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**EXAMINING CHILD MALARIA DIAGNOSIS AND TREATMENT PRACTICES AT AN  
OUTPATIENT CLINIC IN SOUTHWEST NIGERIA**

**A Dissertation in**  
**Biobehavioral Health and Demography**  
**by**  
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## Abstract

Funded by the Eunice Shriver National Institute of Child Health and Human Development, this dissertation examined factors that influence the diagnosis and treatment of child malaria in a clinical setting in southwest Nigeria. If Millennium Development Goal 6—to halt and reverse malaria incidence by 2015 particularly among children—is to be achieved, all factors that affect malaria reduction among children living in endemic countries must be identified. These factors are individual (maternal or physician characteristics), sociocultural (perceptions and beliefs) and contextual (availability of antimalaria drugs and malaria rapid diagnostic tests). Moreover, a firm understanding of the impact of these factors on diagnosis and treatment practices will substantially contribute to the success of malaria control in sub-Saharan Africa. A mixed method of qualitative and quantitative research methods were used in this study. They included: observations, semi-structured interviews, informal discussions, field notes, and the collection of finger prick blood samples for malaria rapid diagnostic tests.

Paper 1 describes a study involving the use of the PEN-3 cultural model to identify mothers' positive health beliefs and practices associated with treatment-seeking for child febrile illness, to examine existential (unique) practices indigenous to mothers that have no harmful health consequences, and to explore negative beliefs and practices that limit recommended responses to febrile illness in children. The study presented in Paper 2 examined the concordance among physician's diagnosis of malaria, mother's perception of child malaria, and the results of malaria rapid diagnostic tests. In Paper 3, the Health Access Livelihood Framework was used to explore how

services provided at an outpatient clinic in southwest Nigeria enabled and/or discouraged effective diagnosis and treatment of child malaria.

Despite more than 100 years of control and eradication efforts, malaria remains one of the primary health problems encountered by children in sub-Saharan Africa. While there is increasing optimism about new opportunities for improved malaria control and possibly elimination, the success of such strategies is based on an understanding of the individual, socio-cultural, and contextual factors that influence effective case-management of malaria among children. Simply put, promising advances in malaria rapid diagnostic tests, or new drugs and vaccines to combat parasite resistance as well as other interventions, may have no effect if the same vigor is not applied to understanding the contexts in which human behaviors occur. Study findings illustrate the importance of understanding the multiple factors that influence diagnosis and treatment of malaria in children at an outpatient clinic. Incorporating knowledge of these factors into efforts aimed at controlling malaria is fundamental to effective case management of child malaria in sub-Saharan Africa.

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### **List of Abbreviations**

ACT	Artemisinin Combination Therapies
AIDS	Acquired Immune Deficiency Syndrome
CQ	Chloroquine
HIV	Human Immunodeficiency Syndrome
FMOH	Federal Ministry of Health
GMAP	Global Malaria Action Plan
MDG	Millennium Development Goals
NDHS	Nigerian Demographic Health Survey
NMCP	National Malaria Control Program
<i>P. falciparum</i>	<i>Plasmodium falciparum</i>
RDT	Rapid Diagnostic Tests
SSA	Sub-Saharan Africa
WHO	World Health Organization

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## Chapter I

### Introduction

This chapter defines the disease known as “malaria.” It highlights the need to explore malaria both on a global level and in sub-Saharan Africa where over 90% of cases occur. The criteria used to define effective case management of malaria are outlined. Also, the multiple factors that enable and/or act as barriers to effective case-management of malaria are examined. Finally, the research objectives and a brief overview of the chapters in this dissertation are presented.

#### 1. What is Malaria?

Malaria is primarily a parasitic disease caused by infection of any parasites from the genus *Plasmodium* (Greenwood et al., 2005). Of the four malaria parasite species (*Plasmodium falciparum*, *Plasmodium vivax*, *Plasmodium malariae*, *Plasmodium ovale*) known to infect humans, *Plasmodium falciparum* is the most common and a devastating cause of severe illness and fatality (Breman, 2001; Greenwood, et al. 2005; Suh et al. 2004). It is also found throughout the tropics and sub-tropic areas (Carter & Mendis, 2002). Malaria life cycle involves transmission of parasites both from mosquito to man and man to mosquito (Marten et al., 1995). It begins through exposure to the bites of an infected female mosquito of the genus *Anopheles* (Greenwood et al., 2005). The infected mosquito feeds on humans and injects the parasite in the form of sporozoites into the blood stream (NIAID, 2010). Sporozoites travel to the liver and invade the liver cells and over a couple of days they grow and rupture into merozoites which exit the liver into the blood stream (NIAID, 2010). Available evidence suggests



that some malaria parasite species may remain dormant for extended periods in the liver causing relapse weeks, months or even years later (NIAID, 2010). Once in the blood stream, the merozoites invade the red blood cells, undergo asexual replication, and release newly formed merozoites into the red blood cells over 72 hours (NIAID, 2010).

The multiplication of thousands of merozoite-infected cells in the blood stream of the host leads to the characteristic illness and complications of malaria (NIAID, 2010). In addition, some merozoite-infected blood cells leave the cycle of replication and develop into sexual forms of the parasite known as male and female gametocytes. These gametocytes circulate in the blood stream and are ingested when mosquitoes bite an infected human (NIAID, 2010). Once inside the mosquito, the infected human blood cells burst, releasing the gametocytes which develop further into mature sex cells known as male and female gametes (NIAID, 2010). These mature sex cells join together to form zygotes which in turn develop into actively moving ookinetes that invade the midgut wall of the mosquito and form oocysts (NIAID, 2010). The oocysts grow, rupture and release sporozites which travel to the mosquito salivary gland and malaria life cycle restarts when infected mosquito injects the sporozites into the blood stream of a human (NIAID, 2010).

Clinical features of malaria vary with factors such as the immune status of the infected individual, geographical location, urban/rural place of residence, high parasite burdens in endemic regions, rainy season, socioeconomic status, access to health care services, among other factors (Gemperli, et al., 2004; Hetzel et al., 2008; Mockenhaupt, et al. 2004; Somi et al., 2008; Uzochukwu et al., 2008; Stauffer & Fischer, 2003). The

characteristic febrile episodes with regular chills, headaches, nausea, aches, body pains, general weakness and sweating are common features of malaria infection (Carter & Mendis, 2002). Greenwood (1997 pg. 764-765) noted that 'the severity of a clinical attack can vary from an illness characterized by only a few hours of fever to one that kills within 24 hours of the first appearance of the symptoms.' If left untreated, malaria infections can result in severe anaemia, enlargement of the spleen, dysfunction of vital organs such as the lungs, kidney, liver and the brain with cerebral malaria (Carter & Mendis, 2002).

Young children under five years of age and pregnant women are particularly vulnerable to malaria (Guinovart et al. 2006; Suh et al., 2004); however, the severity of malaria illness can also overwhelm vulnerable individuals, households, and communities in endemic areas (Bates et al. 2004). While considerable efforts have been made to explore malaria burden in numerous households and communities, limited efforts have however been devoted to understanding the individual, sociocultural and structural (or contextual) factors that influence decision-making processes surrounding effective child malaria diagnosis and treatment practices particularly in settings where health care services are free. Although, there is overwhelming evidence that 'malaria disproportionately affects the poorest of the poor populations in resource-poor settings' (Barat et al. 2004, pg. 174), the pertinent question to address, is what underlying individual, socio-cultural and structural factors in these settings are perceived to be either supportive of or barriers towards effective malaria management and control strategies. Thus, an in-depth understanding of the multiple factors that influence effective malaria management and control particularly among children is needed so as

to eliminate the 'intolerable' burden of malaria globally (Breman, 2001).

## 2. The need to explore malaria burden

Globally, it is estimated that malaria is responsible for up to 1 million deaths and 500 million clinical cases each year (Greenwood et al., 2005). More than 50% of the world's population resides in areas at risk of malaria infection (Breman et al. 2004). Malaria disproportionately affects the poor as it imposes significant burden on patients and families in resource-poor settings (Barat et al., 2004; Worrall et al., 2005). It undermines health systems and slows the economic growth of families and local communities (Bates et al. 2004; Okeke et al. 2006). It decreases school attendance and labor productivity while weakening intellectual development (Greenwood et al. 2005). Malaria burden is further complicated by the fact that most malaria-related morbidities are treated at home and within the community in informal health services and networks with limited resources to effectively combat malaria (Agyepong & Kangeya-Kayonda, 2004).

Despite major global advances in economic development, recent global economic problems notwithstanding, malaria risk and disease burden remains inequitably distributed not only on a global level, but also on a regional level (Opiyo et al. 2007). Also, more people die from malaria today than 40 years ago (Guerin et al., 2002) and in the absence of effective intervention strategies and the rapid spread of drug resistance, the number of malaria cases might double by 2020 (Sachs & Malaney, 2002; Breman, 2001). Tanner and Vlassoff (1998) suggest that attempts to reduce the burden of malaria globally have been unsuccessful due to failure to integrate an interdisciplinary perspective in the design of malaria control strategies, resulting in a

lack of understanding of the social, behavioral, and cultural contexts that influence malaria. Also, recent global economic problems may very well exacerbate malaria cases as more families resort to home treatment of malaria incidence.

In response, many now call for interdisciplinary research pertaining to the multiple factors that influence malaria burden as well as the use and effectiveness of control strategies (Ngalame et al., 2004; Tanner et al., 1998). There has been a renewed optimism in malaria research and control strategies (Breman et al., 2004) as major efforts are underway to develop effective drugs and vaccines, improve vector control strategies, and strengthen malaria diagnosis efforts using malaria rapid diagnostic tests (Crawley et al., 2010). However, these efforts will only achieve maximum potential if knowledge of the multiple contexts (i.e., individual, family, socio-cultural, and structural) that influence effective case-management of malaria particularly among children is available.

### 3. Malaria burden in Sub-Saharan Africa

Sub-Saharan Africa (SSA) bears the heaviest burden of malaria (Snow and Marsh, 2010). While malaria remains a significant health problem in some parts of Asia and South America, its greatest impact is in sub-Saharan Africa where at least 90% of deaths and 60–70% of malaria cases occur (Deressa et al., 2008; Greenwood & Mutabingwa, 2002). Previous studies on malaria transmission and disease burden indicate that malaria accounts for roughly 40% of public health expenditures, 30–50% of inpatient admissions and up to 50% of outpatient visits (Hays et al. 2005). In addition to its health toll, malaria imposes significant economic burden and financial hardship on

households and communities in malaria endemic countries and it is estimated to cost \$12 billion annually in lost GDP in Africa alone (Breman et al, 2004; Gallup & Sachs, 2001).

Young children under five and pregnant women bear the greatest burden of malaria in SSA (Greenwood & Mutabingwa, 2002). According to Sachs and Malaney (2002 pg. 680), 'every 40 seconds a child dies of malaria, resulting in a daily loss of more than 2,000 young lives globally.' In Uganda, studies indicate that malaria is the leading cause of childhood morbidity and mortality—it is responsible for an estimated 11–23% of all deaths in children under five (Njama et al., 2003). Among children in Sierra Leone, severe malaria was the principal cause of morbidity, accounting for 54.3% of hospital admissions (Gerstl et al., 2010). In Tanzania, every year, 70,000–80,000 deaths due to malaria occur among children less than five years of age (de Castro et al. 2004). In Nigeria, malaria is responsible for 25% of infant mortality and 30% of childhood mortality (Uzochukwu et al., 2009).

Malaria control efforts in SSA have been unsuccessful for several reasons. First, the *Plasmodium falciparum* parasite is widely resistant to chloroquine (CQ), the most commonly used anti-malarial drug in past decades (GMAP, 2008; Winch et al. 2007). *Plasmodium falciparum* causes the majority of malaria infections in Africa and is responsible for the most severe disease and mortality impacts (Greenwood et al. 2005). In addition to widespread resistance, control efforts have also been hampered by incomplete understanding of the multiple factors that influence antimalaria drug use both at home and at healthcare facilities, inadequate healthcare infrastructure coupled with limited access to laboratories for accurate diagnosis, and a lack of financial

resources for effective malaria-control interventions (Ahorlu et al. 2006; Amexo et al. 2004; Barat et al., 2005; Hopkins et al., 2007; William and Jones, 2004; Worrall et al. 2005). Indeed, as Webb (2009, p. 1883) suggested, “the problem of malaria is complex both because of what we know and what we don’t know.” Also, the burden of the HIV/AIDS pandemic in SSA as well as numerous other complex emergency situations over the past decades have contributed to the difficulty in controlling the malaria burden in the region (Herrero et al., 2007; Laufer & Plowe, 2007).

Given the burden of malaria in sub-Saharan Africa, effective management and control remains a major challenge in many endemic countries. Efforts to reduce the burden of malaria often emphasize early diagnosis and prompt treatment with effective antimalarial drugs (GMAP, 2008). Yet, despite over 100 years of malaria eradication and control efforts, the goal of reducing, eliminating and subsequently eradicating the burden of malaria in Sub-Saharan Africa continues through effective case management remains elusive. Malaria remains a complex public health problem in much of Sub-Saharan Africa and as de Savigny et al. (2004) pointed out:

*‘the consequence is not just an intolerable burden for individuals, their families, and national health systems, it is also a devastating and continuing impediment to the socio-economic development of the continent.’*

#### 4. Defining effective case management of malaria

Although malaria is influenced by a myriad of factors (i.e. factors related to prevention and the environment), to sharpen the focus of research and to ensure feasibility, the

scope of this dissertation was limited to effective case management of malaria in children. In this study, effective case management is defined as: [1) access to accurate and reliable diagnosis of malaria based on parasitological confirmation of malaria parasites using microscopy or malaria rapid diagnostic tests (RDTs); and (2) prompt treatment of uncomplicated malaria at health care clinics using artemisinin combination therapies (ACT).] This definition is based on the World Health Organization (2010a) re-established guidelines for effective case management of malaria and it included the following recommendations:

Diagnosis: All patients with suspected malaria should receive prompt parasitological confirmation by microscopy or RDTs before treatment is started (WHO, 2010a). This has the advantage of improving care in parasite-positive patients, while allowing for alternative diagnosis to be made in parasite-negative patients. It also prevents unnecessary over-treatment with antimalarials, reduces exposure to adverse side effects especially in parasite-negative patients, while decreasing the possibility of drug resistance (WHO, 2010a). Although the WHO (2010a) recommends that treatment solely on the basis of presumptive diagnosis may be considered in settings where parasitological diagnosis is not accessible, this recommendation is applicable for low-to moderate/or unstable malaria transmission settings. In countries like Nigeria with a hyper-endemic malaria pattern, WHO (2010a) recommends parasitological confirmation of malaria with microscopy or RDTs in all suspected cases of malaria, particularly when slide positivity rate for children under 5 years of age is more than 5%. This is the case in Nigeria, as previous studies conducted in Kano, Nigeria estimates slide positivity rates

of 32.9% in children clinically diagnosed with malaria (Adeleke, 2007) and 27.1% among infants attending an urban hospital in Lagos, Nigeria (Afolabi et al., 2001).

Treatment: Due to resistance to chloroquine (an inexpensive but once safe and efficacious drug for the treatment of malaria), the WHO (2010a) recommends that artemisinin-based combination therapies (ACT) should be used for the treatment of uncomplicated *P. falciparum* malaria. The World Health Organization (2010a p. 13) defines “uncomplicated malaria as symptomatic malaria without signs of severity or evidence (clinical or laboratory) of vital organ dysfunction.” Although, the signs and symptoms are nonspecific and may overlap with other illness (i.e. pneumonia), malaria is presumptively diagnosed on the basis or history of febrile illness (WHO, 2010a). The benefits of presumptive diagnosis of uncomplicated malaria includes promptness of therapy, reduced cost in time and money for the patient and caretaker to attend health care facilities, and lack of expenditure to equip or improve laboratory facilities (Koram et al., 2007). The disadvantages of this method include, the potential for over diagnosis of malaria and/or misdiagnosis of alternative causes of febrile illness, over-exposure to side-effects and the risks of drug toxicity, distrust of antimalarial drugs, as well as the evolution or spread of drug resistance (Koram et al., 2007). Nonetheless, the rationale for the combination of two or more antimalaria medicines is that: 1) combinations are more effective and they enable prevention or delay in the emergence of resistance; 2) in the event of parasite resistance to one of the drugs, the parasite will be killed by the other antimalaria medicine (WHO, 2010a). Three-day courses of ACTs are often required to eliminate 90% of parasitemia and the following combinations are



recommended by the WHO: artemether plus lumefantrine, artesunate plus amodiaquine, artesunate plus mefloquine, artesunate plus sulfadoxine-pyrimethamine, and dihydroartemisinin plus piperaquine (WHO, 2010a). Maximum benefit from ACTs, will be derived if patients can access these combination therapies within 24-48 hours of the onset of malaria symptoms (WHO, 2010a)

### 5. Examining the multiple factors that influence effective management and control of malaria?

In 1989, Deborah Glik and colleagues observed that, individual, sociocultural and structural factors are important in predicting child malaria treatment-seeking practices among mothers in Guinea. Individual factors are factors which increase readiness to take action and they include: maternal age, maternal occupation, child's age and gender, and presence of items such as a radio in the household (Glik et al., 1989). Sociocultural factors refer to shared knowledge based on both traditional and modern health care systems that are linked to the recognition of symptoms of illness and prescribed courses of action and they include; perceptions of illness severity, familiarity with medications and ethnicity (Glik et al., 1989). Structural factors are those features of the health care system (i.e distance to center, affordability and availability of medications) which enable or discourage use of recommended treatment (Glik et al., 1989).

According to Glik (1989), the factors that significantly predicted the probability that a mother would seek health care treatment for her child during an episode of febrile illness include: whether she received medications from a hospital, health care worker or

from a pharmacy, proximity to health care facility, perceived affordability of CQ, presence of a radio in the house and having a child between 12 and 23 months (Glik et al., 1989). Also, the use of chloroquine was associated with affordability and availability of CQ in a health center or pharmacy, maternal age, perceptions of child's fever as severe, and distance to health center (Glik et al., 1989).

Over the past two decades since the study by Glik and colleagues (1989), studies have been published on the individual, sociocultural and structural factors that influence child malaria incidence and treatment seeking practices in endemic countries. For example, in Ethiopia, Peterson et al. (2009) found that age (specifically children in the age group 5-9) was significantly associated with malaria incidence. Relative to sociocultural factors, Beiersmann et al. (2007) found that in rural Burkina Faso, the condition known as *Sumaya* which resembles the biomedical definition of malaria is perceived to be caused by natural factors such as dirty environment, climate (cold and wind), or certain kinds of food. The authors also found that another condition known as *Kono* which closely resembles cerebral malaria and is characterized by convulsions and coma was described by mothers as the bird-illness mainly because the movement of the child's arms during an attack resembles the movement of bird wings (Beiersmann et al., 2007). In describing the influence of structural factors, in Nigeria, the presence of health care facility in the community was predictive of household ownership of insecticide-treated bed nets (Oresanya, Horshen & Sofola, 2008). Also, in Kenya, medicine sellers who sell in drug shops and kiosks are generally closer to where people live (87% of rural households live within 1km of a shop) than formal health care centers (Goodman et al. 2007; Molyneux et al. 1999). As a result, medicine sellers form an

important alternative, and most often the primary supplier of anti-malarial drugs for patients despite concerns surrounding the appropriateness of drugs they provide (Goodman et al. 2007).

Together, these studies emphasize the multiple factors that influence efforts aimed at reducing the incidence of malaria in endemic countries. In general, it is agreed that reduction in malaria related morbidity and mortality rates is influenced by a complex array of determinants operating on individual, socio-cultural and structural levels. Emphasis on one determinant may be insufficient, if efforts are not made to equally address the role they all play in influencing effective diagnosis and treatment of child malaria. Moreover, factors that are inextricably linked with decision-making processes surrounding malaria management and control not only at the household level, but also among physicians in health care settings are also influenced by these determinants (Williams & Jones, 2004). For example, it remains unclear which structural (or contextual) level determinants (such as free health care services or antimalaria drugs versus laboratory testing) play an active role in reducing malaria burden in Sub-Saharan Africa. These questions have important implications for improving effective case-management of child malaria management particularly among the poor who are often deterred from seeking care at most clinics.

Furthermore, it is evident from recent studies that new opportunities that hold promise for improving malaria control strategies globally are currently underway (Breman et al. 2004). There have been major advances in malaria research and significant political, strategic, and financial support for malaria management and control (Breman et al. 2004). For example, there are ongoing efforts to develop new drugs and

vaccines, increase provision of insecticide-treated bed-nets, and strengthen diagnostic efforts using malaria rapid diagnostic test (Crawley et al., 2010). One such effort aimed at halting and reversing malaria incidence by 2015 through the accomplishment of specific targets is the Millennium Development Goal 6. Established by world leaders in 2000, the Millennium Development framework of eight goals (MDG) aims to improve human conditions through: 1) eradicating poverty and hunger; 2) achieving universal primary education; 3) promoting gender equality and empowering women; 4) reducing child mortality; 5) improving maternal health; 6) combating HIV/AIDS, malaria, and other diseases; 7) ensuring environmental sustainability; 8) Establishing a global partnership for development (MDG, 2010). Specific MDG 6 targets for halting and reversing malaria incidence in 2015 include; 1) reducing the incidence and deaths rates associated with malaria; 2) increasing the proportion of children under 5 years sleeping under insecticide treated nets; and 3) increasing the proportion of children under 5 years with fever who are treated with appropriate antimalaria medicines (WHO, 2010b).

While these opportunities and goals signal rapidly increasing optimism about improved malaria control and possible elimination, the success of such strategies will rely on an understanding of the individual, socio-cultural, and structural factors that influence effective case-management of malaria among children. Simply put, promising advances in malaria rapid diagnostic tests, or new drugs and vaccines to combat parasite resistance as well as other interventions and targets for reduction might be futile if the same vigor is not applied to understanding the contexts in which human behaviors occur (Mwenesi, 2005). Thus, although available literature continues to demonstrate promising evidence with respect to malaria control in sub-Saharan Africa,

the question of what matters the most (individual, socio-cultural, or structural factors) for effective case-management of child malaria remains. Given the intolerable burden of malaria particularly as related to increasing death and clinical episodes annually among young children, focusing on these multiple determinants is crucial to curbing the burden of malaria globally.

## 6. Research Objectives

Given the definition of effective case management of malaria, the current study set out to examine the extent to which individual, socio-cultural and structural (or contextual) factors influence effective diagnosis and treatment of child malaria in a clinical setting in south-west Nigeria. The term “contextual” will be used in the rest of the study to describe “structural” factors. Also, if the Millennium Development Goal 6 of halting and reversing malaria incidence by 2015 particularly among children is to be achieved, it is necessary to identify all factors including; individual (maternal characteristics), socio-cultural (perceptions and beliefs), and contextual (availability of treatment regimes and diagnostic tests) that are essential to malaria reduction in children living in endemic countries. Thus, the specific objectives of this study are:

1. To elicit malaria illness narratives and treatment decisions among mothers with febrile children attending an out-patient clinic in south-west Nigeria.
2. To utilize the PEN-3 cultural model to identify positive health beliefs and practices held by mothers that are associated with treatment seeking for child febrile illness, examine existential (unique) practices that are indigenous to

mothers and have no harmful health consequences, and explore negative beliefs and practices that limit recommended responses to febrile illness in children.

3. To compare results of the presence of malaria antigens in blood samples collected by finger prick using malaria rapid diagnostic kits (RDTs) against physician's diagnosis of child malaria and maternal interpretation of febrile illness in 135 children attending an out-patient clinic.
4. To examine the role context plays in influencing effective diagnosis and treatment of child malaria at an out-patient clinic in southwest Nigeria where malaria rapid diagnostic tests were available.

These objectives are guided by the following questions:

1. Are there socio-cultural factors that influence treatment seeking decisions for child malaria among mothers attending an outpatient clinic?
2. How does physician diagnosis of malaria and maternal interpretations of child febrile illness compare to the results of malaria RDTs? Is there a degree of concordance between physician's diagnosis, maternal interpretations and the results of RDTs?
3. What contextual factors influence effective case management of child malaria in an outpatient clinical setting in southwest Nigeria?

## 7. Study overview

The present study is divided into seven chapters. The first chapter defined malaria and introduced its burden both globally and in sub-Saharan Africa. Also, this chapter defined effective case management of malaria and examined the multiple factors that influence

diagnosis and treatment practices. In the second chapter, a general overview of the research design, methods and theoretical framework are presented. The third chapter presents findings from paper 1, which utilized the PEN-3 cultural model to identify positive health beliefs and practices held by mothers related to treatment-seeking for child febrile illness, to examine existential (unique) illness-related practices that are important with the management of child febrile illness, and to examine negative beliefs and practices that serve as barriers to appropriate treatment-seeking for child febrile illness. Chapter four presents findings from Paper 2 which examined concordance between physician's diagnosis of malaria, maternal perceptions of child febrile illness and the results of malaria rapid diagnostic tests. In Chapter 5, the findings from Paper 3 are presented. This chapter explored the contextual features of an outpatient clinic in southwest Nigeria that enable and/or discourage effective diagnosis and treatment of child malaria. General discussions of the studies presented in Papers 1, 2 and 3 are discussed in chapter 6 and conclusions of this dissertation as well as limitations, strengths, future directions, and implications for malaria control in Nigeria are presented in chapter 7. Also, since this is a 3 paper dissertation, the reference style required by each journal was preserved for each paper even though the dissertation used APA style.

## Chapter 2

### Methodology

In this chapter, the theoretical framework guiding this study is presented. Also, the setting and location where this study was conducted is discussed. The methods used to recruit participants as well as data collection and analysis conducted in the first and second phase of this study is presented.

#### 1. Theoretical Framework

##### A. THE PEN-3 Cultural Model

This study was informed by the PEN-3 cultural model.

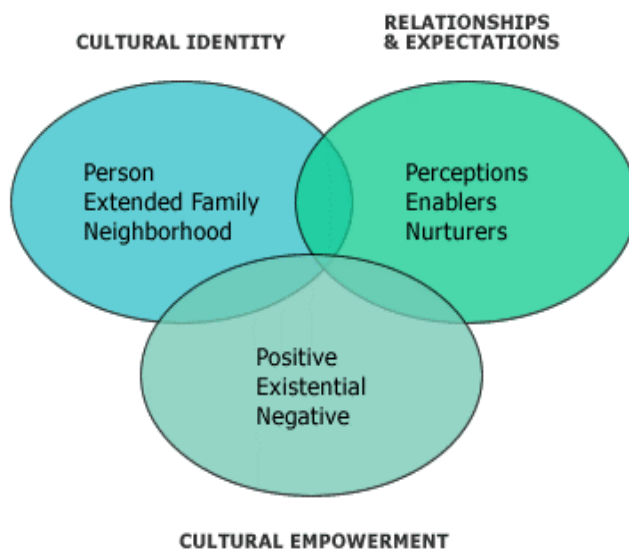


Figure 1: The PEN-3 cultural model

Developed by Airhihenbuwa in 1989 and updated in 1995, 2004 and 2007, the PEN-3 cultural model places culture at the core of understanding beliefs and practices related to health and illness. It incorporates elements of beliefs, knowledge, and



perceptions that are firmly anchored in African ways of knowing that should be encouraged, acknowledged, and/or discouraged. The PEN-3 cultural model serves as a tool for thinking through cultural influences on health behaviors and planning culturally appropriate public health and health promotion/education interventions and programs. It has been used to study stigma, culture, and HIV/AIDS in Western Cape South Africa (Airhihenbuwa et al., 2009), the cultural and racial contexts of “othering” as it relates to HIV and AIDS stigma (Petros et al., 2006), the role of family systems with care and support of people living with HIV/AIDS (Iwelunmor et al., 2007), and why motherhood matters with HIV/AIDS disclosure patterns among women living with HIV/AIDS (Iwelunmor et al., 2010). It has also been utilized to examine the sociocultural factors associated with health and health care-seeking among Latina immigrants (Garces et al., 2006), the sociocultural factors associated with cigarette smoking among women in Brazil (Scarinci et al., 2007), nutritional influences and birth outcomes (Kanan et al., 2008), the prevention of type 2 diabetes (Grace et al., 2008), and to design culturally appropriate breast and cervical cancer screening programs for women (Erwin et al., 2010, 2005) as well as prostate cancer screening for men (Lewis, 2005).

The PEN-3 cultural model (see figure 1) consists of three dynamically related dimensions; 1) relationships and expectations, 2) cultural identity, and 3) cultural empowerment. With the Relationships and Expectations domain, perceptions about treatment seeking for child malaria, the resources and health care services that promote or discourage effective treatment seeking practices, as well as the influence of family and kin in nurturing decisions surrounding effective case-management of

children malaria are examined. With the Cultural Empowerment domain, the child malaria illness narratives and treatment-seeking practices are explored by beginning with and identifying beliefs and practices that are positive- allowing us to examine and acknowledge values and beliefs that are existential and have no harmful health consequences, before identifying negative health practices that serve as barriers. In this way, cultural beliefs and practices that influence treatment seeking practices for child malaria are examined so that aspects that are beneficial are encouraged, those that are harmless are acknowledged, before tackling practices that are harmful and have negative health consequences. Following the identification of these health beliefs and actions, the Cultural Identity domain highlights the intervention points of entry. These may occur at the level of persons (e.g., mothers or physicians), extended family members (grandmothers), or neighborhoods (communities or villages).

To date, the PEN-3 cultural model has not been used to explore treatment-seeking practices related to child malaria in clinical settings. Indeed, it is possible that treatment decisions surrounding child malaria may arise out of unique cultural beliefs and practices that have no harmful health consequences. Thus, there is a need to equally highlight positive health beliefs and practices held by mothers that are beneficial for malaria control—existential (or unique practices that have no harmful health consequences—before focusing on negative perceptions or beliefs related to child malaria treatment decisions and practices. These factors which coincide with the Cultural Empowerment domain are utilized in this study to examine the sociocultural factors that influence treatment-seeking practices for child malaria.

## B. The Health Access Livelihood Framework

The Health Access Livelihood Framework was developed in response to the need to address access to prompt and effective malaria treatment in rural Tanzania (Hetzl et al. 2007; Obrist et al., 2007). It is designed to better align health care resources with people's needs, perceptions, and expectations. It combines issues related to health seeking (why, how, and when individuals seek help for illness) with factors that influence access to health care services (availability, accessibility etc.) to situate the broader context in which effective case management of illness occurs (Obrist et al., 2007). It consists of five dimensions: Availability, Affordability, Accessibility, Adequacy, and Acceptability (Obrist et al., 2007). While availability addresses issues related to the types of services that exist within a health care setting and whether these services correspond with people's needs and expectations, affordability refers to the costs of the services provided (both direct and indirect costs) such as costs of consultations as well as transportation costs and lost time from work (Obrist et al., 2007). Accessibility is concerned with the geographic distance between services and homes of the intended users (Obrist et al., 2007). Adequacy examines whether the organization of the health care settings meets the patient's expectations and acceptability highlights whether or not the information, explanations and treatment protocols provided take the patient's expectations or perceptions into account (Obrist et al., 2007). Although this framework has been used to examine the factors that influence access to malaria treatment in a rural setting with limited resources, in urban settings with access to diagnostic tools such as microscopy or malaria rapid

diagnosis tests, few qualitative attempts have been made to explore how the availability or adequacy of these services align with caretaker's perceptions and expectations of effective diagnosis and treatment of malaria in children. This framework was used in this study to explore how services provided at an outpatient clinic in southwest Nigeria enable and/or discourage effective case management of child malaria.

## 2. Setting: Nigeria



Figure 2: Map of Nigeria

This study took place in Nigeria. With an estimated population of 140 million people, Nigeria is the most populous country in Africa. It is divided into 36 states and a federal capital territory. These states are grouped into six geopolitical regions: North Central, North East, North West, South East, South South, and South West (NDHS, 2003). The three major groups (and languages) in Nigeria are the Hausa, Igbo and Yoruba. In addition to these groups, there are about 250 ethnic groups with distinct languages and customs (Gordon, 2003). Nigerian Pidgin English is a popular lingua franca spoken in most parts of Nigeria. Also, majority of Nigerians live in rural communities and villages. The 2003 Nigerian Demographic Health Survey estimates that approximately 33% of people live in urban areas and Lagos State has the largest urban population in Nigeria, followed by Oyo and Anambra States. The climate in Nigeria is tropical and there are two seasons; the rainy season and the dry season. The rainy season lasts from April to September, with temperatures ranging from 25 and 40° C and rainfall ranges from 2,650 millimeters in the southeast to less than 600 millimeters in some parts of northern states (NDHS, 2003). The dry season lasts from October to March and it is characterized as a relatively cold season with dusty harmattan winds (NDHS, 2003).

Traditional beliefs and customs are central to the identities of the ethnic groups in Nigeria. Okafor and Emeka (1998) loosely classify traditional beliefs in Nigeria into social beliefs and religious beliefs. While social beliefs represent people's view points on human relationships, religious beliefs represent perspectives on supernatural forces and its relationship with humans (Okafor & Emeka, 1995). Culture is often expressed in Nigeria through music, dance, drama, religion, rituals, festivals and ceremonies, marriage, arts, myths and legends, oral stories, sports and games, and food. Also, with

over 444 different languages and major dialects, language is described as an important medium of cultural expression in Nigeria (Okafor & Emeka, 1995)

Nigeria offers a unique opportunity to study the factors that influence effective case-management of child malaria. Indeed, a quarter of all malaria cases in the World Health Organization African region occur in Nigeria (WHO, 2009). While evidence of systematic decline in the number of malaria cases has been reported in others part of Africa, malaria remains a persistent problem in Nigeria (WHO, 2009). According to the Nigerian Federal Ministry of Health (2005), malaria is by far one of the most important public health problems, representing about 60% of outpatient visits to health facilities, 30% of childhood deaths, and 25% of death in children under one year of age. Given the burden of malaria in Nigeria, it is possible that individual, socio-cultural and contextual factors may act in various ways to influence effective case-management of malaria particularly among children. At a time of changes in the burden of malaria, with compelling evidence of dramatic decline in malaria transmission in other parts of sub-Saharan Africa (O'meara et al., 2010), it is important to examine the role individual, socio-cultural, and contextual factors play in influencing effective diagnosis and treatment of malaria among children living in Nigeria.

### 3. Study Location

This study was conducted in two phases; July-September 2009 (pilot phase) and May-August 2010 in Lagos, which is located in the southwest region of Nigeria. With an estimated population of 12 million people (Afolabi et al., 2004), Lagos is also a State and is one of the most populous states in Nigeria and a socio-cultural rainbow of people

from diverse indigenous backgrounds. It is located within the rainforest region of Nigeria and there are two climatic seasons in Lagos-the dry season and the wet season. The dry season lasts from November to March while the wet (or rainy) season lasts from April to October, with the highest rainfalls occurring during May through July. Malaria transmission in Lagos is intense particularly during the rainy season. As a result, this location was ideal for understanding the multiple factors that influence child malaria diagnosis and treatment practices.

This study took place in the pediatric section of an outpatient clinic located in Ikeja, the capital of Lagos. The clinic was visited three-four times a week on average during the rainy season period of 2009 and 2010 to explore child malaria diagnosis and treatment decisions. The first points of contact for the caretakers and their children are the nurses, matrons, and orderlies at the pediatric clinic. They were all women. These women are in charge of ushering the patients from the waiting room outside the clinic to the waiting room inside in the clinic. Depending on the number of physicians on call, patients are often ushered in 10 at a time. Patients are lined in order so that they know when it's their turn to go into the physician's office. The inside waiting area is located outside the physician's office and patients sit in order of their arrival time or the nurse's arrangement. When it's their turn, they go into the physician's room and begin to narrate their child's illness. Although there are five rooms inside the clinic, only two are designated for general outpatient consultations. The overall functions of the outpatient clinic have remained essentially unchanged since its inception. The outpatient clinic was established to provide high-quality healthcare services that are equitable, accessible, and affordable.

In the context of ensuring prompt diagnosis and treatment of child malaria, the clinic provides free services for children, including free antimalaria drugs for those diagnosed with malaria and additional testing with microscopy. Also, nurses provide free health education on health issues (including prevention of malaria with insecticide treated bed nets etc) to parents and guardians in the outpatient waiting room prior to the start of consultations. For these reasons, this clinic was an ideal site for studying perceptions and practices that influence effective case-management of child malaria. Also, due to the lack of space at the clinic, this research was conducted in one of the physician's consultation rooms, in a small corner allotted to the researcher. This location provided ample opportunity for the researcher to observe and interact with physicians on call, asking pertinent questions about their diagnosing and prescription patterns.

#### 4. Participants

During the pilot phase (July-September, 2009), a total of 123 mothers with febrile children with a malaria diagnosis made by physicians were recruited to participate in this study. Participant inclusion criteria were age 18 and above, and child less than five years of age with a recent history of malaria. The purpose of this preliminary fieldwork was to explore mothers' explanatory models of their children acute febrile illness and treatment-seeking practices prior to attendance at the outpatient clinic. Since febrile illness in children is one of the most common symptoms of child malaria, this preliminary work provided a rich opportunity to explore maternal interpretations of a particular febrile illness episode, its perceived causes and severity and expected and/or desired treatment actions. Prior to the commencement of this study, ethical approval



was obtained from Penn State and the Lagos State University Teaching Hospital. Participants were informed of the study's objectives and read and signed an informed consent form.

In the summer of 2010 (May-August), since reliance on clinical examinations alone often results in a high proportion of malaria misdiagnosis or over diagnosis (WHO, 2004), finger prick blood samples were obtained from 135 children with febrile illness attending the outpatient clinic and malaria rapid diagnostic tests were used to detect the presence of malaria antigens in their blood samples. Mothers of these children were sensitized to the study in the outpatient waiting room prior to the commencement of the study and those who provided verbal and written consent were recruited to participate. The children were examined by the physicians prior to enrollment in this study and efforts were made to not interfere with consultations, allowing physicians to diagnose and treat child malaria according to routine. All the children with suspected malaria were diagnosed clinically and treated according to institutional protocol at that clinic. Ethical approval was also obtained from Penn State University prior to commencement of the study and from physicians at the Lagos State University Teaching Hospital.

## 5. Data Collection Methods

### Phase 1 (pilot phase from July-September, 2009)

In-depth interviews were conducted with 123 mothers in the pediatric clinic after their children were examined by the physicians. On a special form, the physicians recorded the child's age, sex, temperature, weight, maternal complaints/symptoms and their clinical diagnosis. During the in-depth interviews, information on maternal age,

ethnicity, educational level, occupation, number of children in the family, any previous loss of child (the cause and circumstances if applicable), and estimated number of clinic visits in the last 6 months were collected from the mothers. Also, using an adapted version of Klienman's explanatory models questionnaire (1980), the individual in-depth interviews elicited maternal interpretations of how their child's febrile illness started (what was happening at the time and noted differences in their child). The in-depth interviews also explored terms commonly used to describe child febrile illness, perceptions of illness causations and severity, illness management practices prior to hospital arrival, kinds of treatment mothers expected their children to receive, the problems their child's illness had caused, and their apprehensions about the illness. Each interview took about 20 minutes to complete and mothers were interviewed alone without any input from family members who had accompanied them to the clinic.

#### Phase 2 (May-August, 2010)

Data collection was carried out through participant observation and semi-structured formal and informal interviews, supplemented with the collection of finger-prick blood samples for malaria RDTs to detect the presence of malaria antigens in samples. Verbal and written consent were obtained from recruited mothers. Also, permission was granted by each physician observed prior to the commencement of the study. Similar to the first phase, children were examined by the physicians prior to enrollment in this study and efforts were made not to interfere with physician's diagnosing and prescriptions patterns. Also, on a special form, the physician's recorded the children's age, gender, and presenting problems. They also applied one of the following

diagnoses: malaria, upper respiratory tract infection, bronchopneumonia, or gastroenteritis. Participant observations focused on interactions between the physicians and mothers as well as daily activities at the clinic. Specifically, using a checklist, the symptoms described by mothers as well as the diagnosis by physicians was recorded. Clinical logic for the diagnosis of malaria and non-malaria cases, as well as the factors that triggered additional testing (using microscopy or malaria rapid diagnostic test), and treatment decisions by physicians were also recorded. Also, the treatment regimes prescribed by the doctors as well as daily activities at the clinic including the roles of nurses and the manner in which patients are ushered into the physician's consultation rooms were also recorded. The informal interviews with physicians explored their diagnostic and treatment decisions with malaria in children observed during the course of this study. Further, after consultations with physicians, in-depth interviews were conducted with recruited mothers. The interviews gathered data on mother's age, ethnicity, education, and occupation as well as information on the length of time it takes to go from their homes to the clinic and their perceptions of the quality of care received at the clinic. In addition, mothers were asked to describe how their children's illness began, what caused the illness and whether it was severe. They also discussed how they managed the illness prior to attendance at the clinic (whether they went to the hospital immediately or to the pharmacy to buy drugs), their reasons for bringing their children to the clinic, the problems the illness had caused for them, their apprehensions about the illness, and what they felt would help them in caring for their children with this illness.

## 6. Data Analysis

### Phase 1

The in-depth interviews were analyzed using the principles of content analysis described by Morse and Field (1995). Each interview question was reviewed so as to identify different salient themes in the content of the interview. Specifically, following the initial review, the interview questions were segmented into several important topics which then became the primary categories. Data were then sorted into each category until saturation was reached or until no new category emerged. Once the categories had ample data, the PEN-3 cultural model was used as a guide to organize the categories into themes by looking for relationships between and within each category that identified aspects of maternal responses to child febrile illness subsequently diagnosed as malaria by physicians that represented positive, existential (unique), or negative response to treatment-seeking practices.

### Phase 2

#### Quantitative Analysis

The key quantifiable data collected were analyzed with standard descriptive statistics (i.e. frequencies and means). Sensitivity, specificity, positive predictive values, negative predictive values and 95% confidence intervals were calculated to assess the concordance between physician's diagnosis of malaria, maternal perceptions of child malaria and the results of malaria rapid diagnostic tests. While sensitivity calculates the proportion of children with malaria who test positive for malaria parasites based on the results of malaria rapid diagnostic tests, specificity calculates the proportion of children

without malaria who test negative for malaria parasites based on malaria rapid diagnostic tests. The positive predictive value estimates the proportion of children with positive test results who are correctly diagnosed by their mothers and physicians, while the negative predictive values estimates the proportion of children with negative tests results who are correctly diagnosed by mothers and physicians (Altman & Bland, 1994). Also, Cohen's kappa ( $\kappa$ ) which is used to assess the level of agreement between two tests (Blackman & Koval, 2000), with  $\kappa=0.81-1$  representing almost perfect agreement and  $\kappa<0$  representing poor agreement (Landis & Koch, 1977) was calculated to determine the degree of concordance between physician's diagnosis of malaria in febrile children and the results malaria rapid diagnostic tests as well as mother's perception of malaria in their children and the results of malaria RDTs. All analyses were conducted using SPSS (version 18).

### Qualitative Analysis

Transcripts of the in-depth interviews, as well as checklists of participant observations, informal discussions and field notes were analyzed using the content analysis techniques described by Morse and Field (1995). Using the Health Access Livelihood Framework as a guide, responses from the in-depth interviews, informal discussions, as well as checklists of participant observations, and field notes were organized and categorized into perceptions related to effective diagnosis and treatment of child malaria and the resources that enhance and/or create barriers with effectively managing child malaria at the outpatient clinic. An audit trail of the researcher's decisions and insights were also summarized. Credibility of the data was maintained through triangulation of

the multiple sources of data. Also, the data were read in their entirety several times and repeatedly examined so as to obtain a general sense of the information gathered as well as to categorize the material until saturation was reached, that is, until no new themes emerged.

## 7. Conclusion

In summary, the purpose of this chapter was to highlight the theoretical frameworks guiding this study as well as the methods used for data collection and analysis. The PEN-3 cultural model offers the opportunity to examine the socio-cultural factors that influence treatment seeking practices for child febrile illness. The Health Access Livelihood Framework allows for an examination of the contextual features of the outpatient clinic that influence case-management of malaria in children. The setting and the location where this study was conducted is discussed in this chapter as well as methods used to recruit participants. This dissertation utilized a mixed method of qualitative, quantitative, and clinical research methods (i.e. observations, semi-structured interviews, informal discussions, field notes, and the collection of finger prick blood samples for malaria rapid diagnostic tests) to examine child malaria diagnosis and treatment practices in 135 febrile children attending an outpatient clinic in southwest Nigeria.

### Chapter 3

#### **Paper 1: Child malaria treatment decisions by mothers of children less than five years of age attending an outpatient clinic in south-west Nigeria: an application of the PEN-3 cultural model**

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## **Abstract**

### **Background**

Using the PEN-3 cultural model, this study sought to understand treatment decisions about their child febrile illness by examining positive health beliefs and practices held by mothers, examine existential (unique) practices that are indigenous to mothers and have no harmful health consequences, and explore negative beliefs and practices that limit recommended responses to febrile illness in children.

### **Methods**

This qualitative study was conducted in the paediatric section of an outpatient clinic in south-west Nigeria. A total of 123 mothers with children less than five years of age with febrile illness diagnosed as malaria by physicians were individually interviewed on their treatment-seeking practices prior to visiting the clinic and their reasons for attendance at the clinic.

### **Results**

For some mothers interviewed, effective treatment from the clinic for their child's febrile illness, coupled with physician's approach with malaria diagnosis and treatment practices was important in generating positive maternal treatment-seeking responses to child febrile illness. In addition, beliefs related to a child teething highlighted existential decisions with treatment-seeking for child febrile illness in this setting. Finally, the belief that febrile illness is not all that severe despite noticeable signs and symptoms was a concerning negative perception shared by some mothers in this study.



## Conclusion

The findings highlight the need to consider not only the responses that may serve as barriers to effective treatment, but also an acknowledgment of the positive and existential responses that are equally critical in influencing mothers' management of malaria in their children.

## Introduction

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A particularly important question that malaria control programmes continue to ask is: *"why do some mothers continue to delay seeking help for their child's febrile illness, while others take their children promptly to health care centers within 24 hours after the onset of fever?"* [1]. As a result, empirical data from several malaria endemic countries [2-8] have supported the need for a deeper exploration of maternal perceptions and responses with child febrile illness presumed to be malaria as they are critical with the success of increasing treatment seeking for child malaria at health clinics. Indeed, it has been suggested that "mothers, regardless of their sociodemographic characteristics, make the first diagnosis of their child's febrile illness by defining and interpreting changes in their child's behaviour and temperature [7] Also, mothers are generally seen as the "first source of treatment"[3] as they often identify various treatment modalities and where to seek treatment for child malaria. While treatment costs and access to health clinics may influence patterns of treatment-seeking behaviour for child febrile illness [9-13], few qualitative studies have been conducted to explore how mothers respond to fever in their children, particularly in situations in which health care services are free. It is possible that features of the health care systems may encourage maternal use of recommended treatments for child febrile illness; however, relatively little

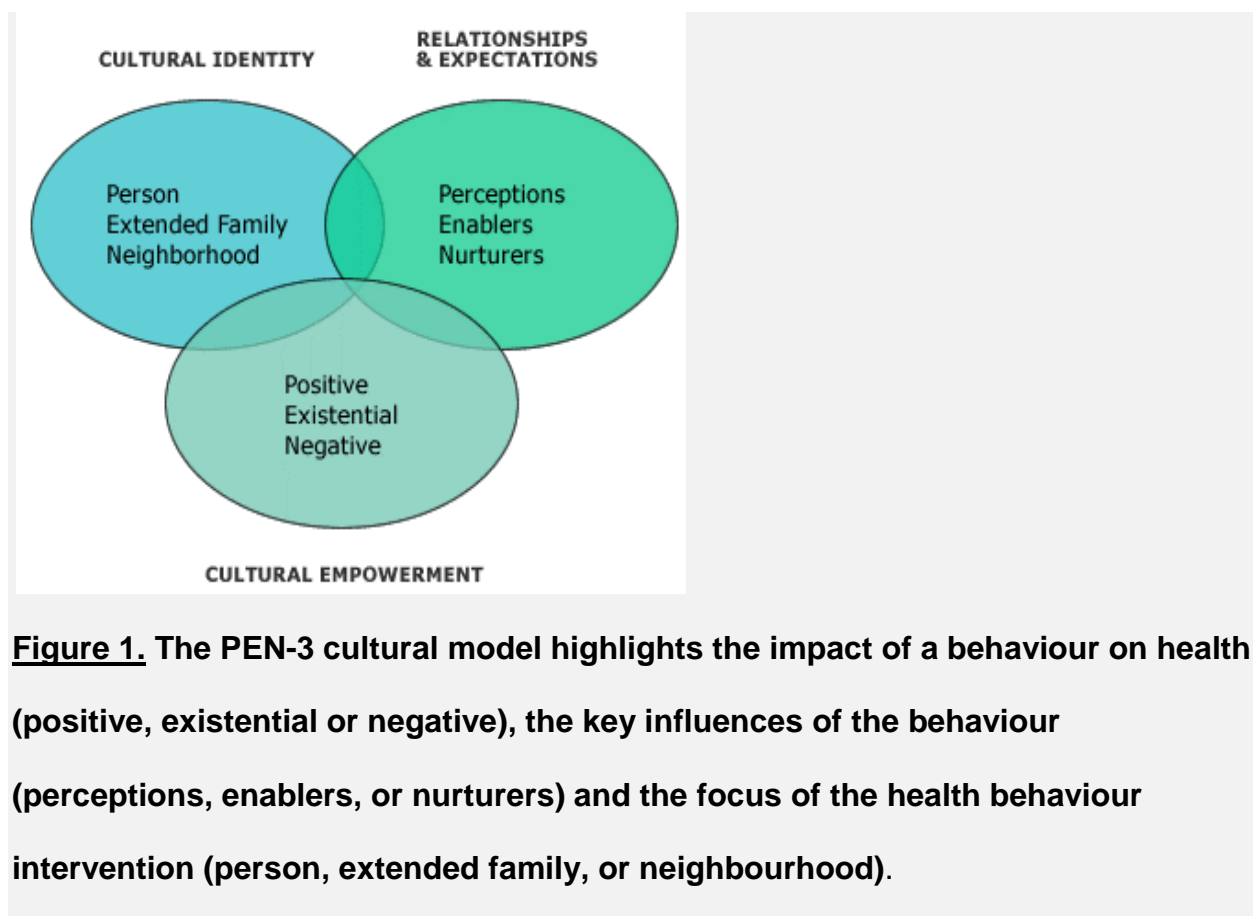
attention has been given to understanding positive or unique decisions made by mothers about their child's febrile illness in the context of free health care services.

Alongside the calls for increased understanding of maternal practices that may improve the quality of malaria case management [14], there is a need to also highlight positive health beliefs and practices held by mothers that are beneficial for malaria control-existential (or unique) practices that have no harmful health consequences-rather than focusing only on negative perceptions or beliefs related to child malaria. Also, in the context of treatment-seeking behaviours, there is recognition that treatment decisions reflect shared knowledge and experiences that are embedded in local culture [14-17]. As a result, in many malaria-endemic countries particularly in sub-Saharan Africa, it is not uncommon for people to engage in multiple patterns of treatment that are customary and may or may not correspond with biomedical standards [18,19]. For some mothers, it is possible that treatment decisions may arise out of unique cultural beliefs and practices that have no harmful health consequences. As noted by Williams and Jones [18], *"instead of trying to provide an answer to the question how can we get them to ..., we should be pressing to find ways to increase people's capacity to access and complete effective treatments"*. The need to improve people's capacity is critical with the success of malaria control initiatives. In this paper, such efforts are presented using the PEN-3 cultural model.

### **Theoretical framework: The PEN-3 cultural model**

Developed by Airhihenbuwa [17,20,21], the PEN-3 cultural model aims to address the complexity of health issues by addressing cultural beliefs and practices that are critical to health behaviours and should either be encouraged, acknowledged, and/or

discouraged. The PEN-3 cultural model (see Figure 1) contextualizes the role of culture in shaping understanding of and actions towards health and illness. It consists of three dimensions that are dynamically interrelated and interdependent: Relationships and Expectations, Cultural Empowerment, and Cultural Identity [20].



Of particular interest to this study is the cultural empowerment domain, which explores the positive, existential, and negative aspects of behaviours of interest. While the positive aspects include values and relationships that promote the health behaviour of interest, the existential examines the qualities of behaviour that make it unique [17,20,21]. The negative aspects include health beliefs and actions that are harmful to health and should be changed [17,20,21]. In utilizing the cultural empowerment domain,

this study identified mothers' positive decisions and practices related to treatment-seeking for their child's febrile illness, existential (unique) illness-related decisions that are important with the management of child febrile illness, and negative decisions that serve as barriers to appropriate treatment practices.

## **Methods**

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### **Setting**

This study was conducted from July to September 2009, in an outpatient clinic in Lagos, located in the south-west region of Nigeria. This region is highly endemic for malaria, particularly during the rainy season (April-October) and an ideal location for understanding the factors that influence mother's perceptions of child malaria and patterns of treatment in the event of malaria. The outpatient clinic also provides free health services and antimalaria drugs for children less than five years of age.

### **Data collection**

Qualitative data collection methods consisting of individual in-depth interviews were conducted with mothers of children less than five years of age attending the clinic. A purposive sampling approach was used to recruit only mothers of children with febrile illness diagnosed by physicians as malaria. A total of 123 consenting mothers participated in this study and they were individually interviewed on their treatment-seeking practices prior to visiting the clinic. Participants were informed of the objectives of the study prior to the start of the interviews. Each interview took about 20-30 minutes to complete and mothers were interviewed alone without any input from family members

who had accompanied them to the clinic. Ethics approval was granted by Penn State and the Lagos State University Teaching Hospital.

### **Data analysis**

The in-depth interviews were analyzed using the principles of content analysis described by Morse and Field [22]. Each interview question was reviewed so as to identify different salient themes in the content of the interview. Specifically, following the initial review, the interview questions were segmented into several important topics, which became the primary categories. Data were then sorted into each category until saturation was reached or until no new category emerged. Once the categories had ample data, the PEN-3 cultural model was used as a guide to organize the categories into themes by looking for relationships between and within each category that identified aspects of maternal responses to child febrile illness subsequently diagnosed as malaria by physicians that represented positive, existential (unique), or negative response to treatment-seeking practices.

### **Results**

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Table 3.1 summarizes the demographics of the participants in the study. Also, using the PEN-3 cultural model, the results were grouped into three main themes that emerged from the in-depth interviews. The themes were labelled as: my child will get well (positive responses to child malaria), teething caused my child's fever (existential responses to child malaria), my child's illness is not severe (negative responses to child malaria).

<b>Table 3.1: Characteristics of study population</b>	
<b>Characteristic</b>	<b>Number (%)</b>
<b>Ethnicity</b>	
Yoruba	69 (56.1)
Igbo	38(30.9)
Hausa	3(2.4)
Other	13(10.6)
<b>Mean number of children</b>	2.04
<b>Age (y)</b>	
Mean (range)	30.7 (20–43)
<b>Education</b>	
None	1(.8)
Primary	8(6.6)
Secondary	49(40.2)
Higher	64(52.5)

### **"My child will get well": Positive responses to child malaria**

Even though malaria remains a major cause of child morbidity and mortality among children and its signs and symptoms are critical in recognizing the onset of malaria, almost all of the mothers interviewed in this study believed that *"their children will get better after they see a doctor."* Although some of the mothers had given some form of treatment to their children prior to visiting the clinic as observed in other studies conducted in Nigeria [23,24], several statements, such as *"doctors' treatment will make child better,"* and *"my child will be okay after medicine from clinic,"* highlight some of the positive responses to treatment-seeking for child malaria at the clinic. Two important notions reflected in these responses are; the role of appropriate malaria treatment and the role of physician's in strengthening maternal capacity to positively respond to child malaria.

Mothers appeared to be well aware that proper malaria treatment at health clinics is critical to their children getting well. This was expressed by statements such as, *"by*

*bringing child to hospital, I will receive something good to stop symptom."* Several mothers noted that although the *"persistence of symptoms"* was one of the chief reasons for bringing their children to the clinic, *"it was better to come so that the doctor will tell me why my child is ill,"* and *"prescribe drugs that will make my child better,"* and *"stop the symptoms."*

The notion that physician's treatment will *"help the child to get better"* was a sentiment shared by a several mothers interviewed in this study. Some mothers believed that physicians have the *"final say"* on treatments that will make a child better as they are *"specialized on children's illness,"* and *"anything they give will be the best."* Also, mothers expressed that they did not *"mind waiting long hours to see a doctor,"* as their *"services are the excellent,"* and the *"drugs written by the doctor's are the best."* Nearly all the mothers interviewed valued the antimalaria drugs prescribed by the physician's rather than those bought from pharmacies. Many believed that the drugs prescribed by doctors are *"the right drugs"* needed to treat malaria as oppose to *"fake drugs"* found in many pharmacies in this setting and that these drugs will help their children's *"illness to go away,"* Also, our findings indicated that *"doctor's approach"* to mothers was also critical in generating positive responses to child malaria, as one mother noted that *"they have the ability to put mothers at ease by explaining what is wrong"* and by giving *"the right drugs"* to *" help child to become better."*

### **"Teething caused my child's fever": Existential (unique) responses to child malaria**

To understand the cultural context of child febrile illness, mothers were asked to describe in their own words what they believed triggered their child's illness. The

findings indicated that mother's perceptions of their child's febrile illness differed from those of the physicians in several existential ways. For example, when mothers were asked questions about what caused their children's febrile illness, regardless of the malaria diagnosis by physicians, to some of the mothers (34%), their children's illness was caused by teething. In aligning with the existential principles of the cultural empowerment domain, febrile illness perceptions related to teething are values and beliefs held by mothers in this setting that have no harmful health consequences in that they did not deter decisions to seek effective treatment at the clinic. Follow-up questioning revealed some of the reasons why mothers associated their child illness to teething. For example, one mother stated that she noticed that her child had "*swollen gums*" and another stated that her child was "*biting her gums*" and as a result the illness was triggered by teething. Also, the presence of child fever (high body temperature) was widely understood to be caused by teething, a view that arose largely through interactions with other family members who told some of the mothers that "*the eruption of a child's tooth triggers the child's temperature.*" Others stated that "*teething is responsible for a host of symptoms.*" For example, one mother explained that "*high temperature and diarrhea, particularly blood in stool and loss of appetite*" were associated with teething. The belief that teething is responsible for high temperatures (fevers) prompted mothers to seek help at the health clinic (existential decisions) as they were of the opinion that treatment from the clinic would enable children to become better.



### **"My child's illness is not severe": Negative responses to child malaria**

Since malaria is often viewed as an "*ordinary illness*" in many endemic countries [1,9], of particular interest in this study was the way in which mothers perceived the severity of their child's illness. Evidence from this study indicated that 61 (52.1%) mothers did not consider their child's illness to be severe. This was particularly evident in responses such as "*my child's illness is mild*," and "*my child's illness is not all that severe*." Even in situations in which mothers stated that their children's illness was caused by "*malaria*" or "*exposure to mosquito bites*" and their children were experiencing noticeable signs and symptoms such as "*high temperature*," some still stated that their children's illness was "*not too severe*" and that it was "*manageable*." A similar phenomenon was found in Kenya [3,25] and Tanzania [1] where child febrile illness is often not perceived as severe but rather as a mild, ordinary illness. These perceptions have implications for malaria treatment practices as it often leads to delay in seeking prompt diagnosis and appropriate treatment at health facilities. In elaborating perceptions of perceived severity of illness, follow-up questioning revealed that some mothers believed that since their children were still "*active*" and "*playing around*", their children's illness were not severe. Indeed, studies have shown that caregivers have their own way of categorizing child fever into mild and severe illness [3,26]. For example, in describing the predictors of health-seeking behaviour relating to child fever among caretakers in Malawi, Chibwana and colleagues [26] found that caregivers believed that children with fever who were able to play were classified as having mild fever, while children with fever who could not play were considered as having severe fever. Mother's perceptions about the severity of their child's fever dictated their course of action with treatment as those who

perceived the illness to be mild or not severe only sought effective treatment because the "*symptoms persisted*" and they wanted "*proper treatment*" that will make their "*child feel better*."

## Discussion

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This study represents the first application of the PEN-3 cultural model with malaria treatment practices in endemic countries. The findings indicate that appropriate treatment from the clinic coupled with physician's approach with child malaria diagnosis and treatment were important in generating positive maternal responses to treatment seeking for child febrile illness. In addition, beliefs related to teething patterns were critical in revealing existential decision-making towards treatment seeking for child febrile illness in this setting. For example, even though some mothers were of the opinion that their child's febrile illness was caused by teething, they still utilized health care facilities for diagnosing and appropriate case management of illness. The notion that teething is part of a child's development process is an existential belief held by mothers in this setting that has no harmful consequence particularly as it posed no threat to maternal treatment seeking for child febrile illness. Also, there are negative responses that should be taken into consideration in formulating malaria control strategies. Consistent with previous studies [1,3,25], the belief that febrile illness is not severe was a common perception shared by some mothers in this study. This perception often underestimates the potential harm of child febrile illness and may invariably contribute to the estimated increase in child morbidity and mortality rates due to malaria in many endemic countries. Ultimately, the decision to seek prompt diagnosis and effective treatment may be influenced by whether mothers perceived the illness to

be mild or severe. In cases in which child febrile illness was perceived as mild, or not severe, it was not uncommon for mothers to delay seeking treatment. As signs and symptoms became more prominent, mothers then sought care from health care facilities for proper treatment of their children's illness.

Although it remains unclear why some mothers underestimate the potential severity of child febrile illness, one might expect that if mothers have the ability to recognize signs and symptoms of malaria, they will act accordingly by providing appropriate anti-malarial treatment or by seeking a health care facility for prompt clinical examination. This was generally not the case in this study, for even in situations in which mothers perceived that their children's illness was caused by mosquito bites, they also stated that the illness was not severe. These negative responses suggest that knowledge of the causes of malaria or even signs and symptoms alone may be insufficient if efforts are not equally made to address perceptions related to illness severity for some mothers. Thus, the assumption that changing knowledge may lead to behavior change may be severely limiting if it fails to also consider other factors, including positive or existential factors that might influence treatment-seeking behaviours for child malaria. The PEN-3 cultural model offers an opportunity to explore not only the responses that may serve as barriers to effective treatment of malaria, but also positive and existential responses that are critical in influencing mothers' management of malaria in their children. Also, the findings clearly illustrate the importance of highlighting responses that promote treatment-seeking behaviours as well as responses that have no harmful consequences prior to identifying responses that may have negative health consequences. In this way, rather than dismissing the values and practices that mothers may have towards malaria

treatment strategies, the PEN-3 cultural model affirms the possibilities of their lived experiences by encouraging responses that are positive, acknowledging unique responses while discouraging responses known to be harmful to health.

The implications of these findings are important for malaria control strategies.

Specifically, as mothers adapt to the new and expensive artemisinin-based combination therapies with their multiday/dosage regimes [27], attempts to conceptualize the positive, existential, and negative factors that influence patterns of treatment-seeking for child fever are critical to framing a comprehensive approach to malaria treatment in endemic regions. The findings from this study should be considered in light of several limitations. First, the in-depth interviews were conducted among mothers who were recruited from a health care facility and the information obtained was based on interview responses that may be prone to bias. Second, the findings cannot be generalized to other mothers as the sample for this study was not randomly selected. Indeed, the degree of representation is unknown, particularly as we did not conduct interviews with mothers who did not bring their children to the outpatient clinic. Despite these limitations, the findings provide a better understanding of the influence of cultural values and practices with malaria treatment strategies in that it illuminates maternal response to child febrile illness that are positive, existential, or negative. Although the potential for sampling bias exists in this study, the use of purposive sampling ensured that only mothers with child febrile illness diagnosed as malaria were interviewed. Also, the similarities between maternal responses from one in-depth interview to another, coupled with consistency of findings with published studies on maternal perceptions and treatment-seeking practices for malaria, permits confidence in the validity and analysis

of the data [28]. However, more research is necessary to assess other beliefs and values that influence decision-making for treatment seeking practices at clinic settings, the resources and institutional arrangements that promote or discourage prompt and effective treatment of malaria, coupled with the role of family, kin, and friends in influencing decisions related to patterns of treatment-seeking. These factors, which coincide with the relationship and expectations domain of the PEN-3 cultural model, should be explored further in order to achieve a deeper understanding of not only the social and cultural factors, but also the structural factors that might influence positive, unique, or negative responses to patterns of treatment-seeking for child febrile illness in malaria-endemic countries.

### **Competing interests**

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The authors declare that they have no competing interests.

### **Authors' contributions**

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Jl designed the study, collected and analyzed the data and wrote the paper. OO and AA collected and analyzed some of the data and commented on the findings. COA analyzed some of the data, discussed the findings, and commented on the written paper. All authors read and approved the final manuscript.

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## Chapter 4

### **Paper 2: Examination of concordance between physician's diagnosis, maternal perceptions and rapid diagnostic tests for malaria in children attending an outpatient clinic in Nigeria.**

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## Abstract

Child malaria continues to remain a major public health problem in Nigeria. Recent research in other malaria endemic countries in sub-Saharan Africa suggests that malaria rapid diagnostic tests (RDTs) may enhance effective case-management of malaria in children over and beyond reliance on presumptive diagnosis. In southwest Nigeria, information on the use of malaria rapid diagnostic tests with case management of malaria in children is limited. The purpose of this study was to examine the diagnosis and treatment of malaria in 135 febrile children attending an outpatient clinic in southwest Nigeria where malaria rapid diagnostic tests were available. Specifically, we sought to determine the degree of concordance between physician's diagnosis of malaria, maternal perceptions of child febrile illness, and the results of malaria rapid diagnostic tests. The results indicate poor concordance in the diagnosis of malaria by physicians and the results of malaria RDTs ( $\kappa=0.030$ ,  $p\text{-value}=0.269$ ) as well as between mother's perception of malaria in their children and malaria RDTs ( $\kappa=0.071$ ,  $p\text{-value}=0.369$ ). While physicians can correctly identify children that have malaria according to the RDT test [Sensitivity=95.23%], they were poor identifiers of children who do not have malaria [Specificity= 13.15]. On the other hand, while mothers are poor identifiers of children that have malaria according to the malaria RDT test [Sensitivity=38.1%], they are better at identifying children who do not have malaria [Specificity=71.1%]. The findings demonstrate the importance of exploring the contextual factors that influence case management of child malaria in outpatient clinics. Indeed, simply deploying RDT's may not translate into better diagnosis for children with

febrile illness if efforts are not made to equally address the broader context in which diagnosis occurs.

## **Introduction**

Despite more than 100 years of control and eradication efforts, malaria remains one of the main health problems encountered by children in Sub-Saharan Africa (SSA). It is estimated to account for 7% of global deaths in children and majority of these deaths are in SSA where approximately 1 in every 6 child death is due to malaria (WHO, 2009). The importance of prompt and accurate diagnosis and treatment of child malaria is often stressed in the literature. The assumption is that if implemented well, accurate diagnosis and prompt treatment could ensure effective case management of malaria, while reducing mortality from the disease (Talisuna et al., 2007). However, it has been found in many studies that efforts to ensure early and reliable diagnosis and treatment of child malaria in clinical settings have been hindered in one of three ways. First, most malaria illness among children is self-diagnosed and treatment seeking behaviors occur at home with drugs bought from local pharmacies (Amexo et al., 2006). Second, access to effective treatment is problematic in endemic countries. This problem is compounded by the spread of drug resistance to chloroquine (CQ), the cheapest and most commonly used anti-malarial drug (Hemingway & Bates, 2003). Third, when children are brought to clinical settings, limited access to effective diagnostic tools coupled with lack of laboratory infrastructure and the technical expertise it requires, results in diagnostic inaccuracy (mis – or over-diagnosis), over-prescription of antimalarials, and delays in the diagnosis and treatment of alternative causes of disease (Rafael et al., 2006;

Schellenberg et al., 2010; Uzochukwu et al., 2009).

Although, unprecedented surge in political commitment and international funding has led to a remarkable rise in access to early treatment with new and expensive artemisinin-based combination therapies currently in the market, diagnosing malaria accurately remains a major challenge in many endemic countries. Presumptive diagnosis of malaria based on a combination of clinical features (i.e. febrile illness) and without confirmation with diagnostic tools (Rafael et al., 2006) has been the protocol for management of malaria in many clinical settings in SSA. Indeed, previous studies document that among children who reach outpatient clinics in SSA, a presumptive diagnosis is made in 30%-40% of them (Chima et al., 2003). Unfortunately, the clinical features of malaria overlap with other common illness, including pneumonia (Perkins & Bell, 2008; Kallander et al., 2004). Thus, it is possible that patients clinically diagnosed with malaria may have illnesses attributable to some other cause (Uzochukwu et al., 2009). Moreover, this may result in significant mis-diagnosis of malaria, over-prescription of antimalaria drugs and inappropriate treatment of alternative causes of febrile illness (Uzochukwu et al., 2009). It may also create favorable conditions for the emergence of resistant strains, leaving non-malaria patients without the drugs they need, while aggravating their symptoms (Rolland et al., 2006). Given the potential for poor health outcomes due to exposure to unnecessary medication as well as wastage of valuable/expensive drugs (Amexo et al., 2006; Chandler et al., 2008), improving diagnostic behavior is critical for the control and possibly elimination of malaria in SSA.

In light of this problem, universal access to diagnostic tests for malaria particularly with reference to scaling up the use of malaria rapid diagnostic tests (RDTs)

are among the most commonly proposed solution to long term success of malaria control efforts in endemic countries. The underlying hypothesis is that increasing the use of malaria RDTs in clinical settings may reverse the long entrenched practice of treating all cases of fever as malaria, thereby reducing overuse of artemisinin combination therapies, while providing appropriate care for people with other febrile condition. In 2009, the World Health Organization (WHO), therefore, recommended the use of diagnostic testing in all cases of suspected malaria before treatment (WHO, 2009). Yet, although, the case for this policy change is clear and compelling, most children do not undergo any form of diagnostic testing to confirm diagnosis by a physician. As mentioned earlier, physicians presumptively diagnose and make treatment decisions based on observable signs and symptoms and it is common for caretakers to self-evaluate their children's illnesses and medicate them with malaria drugs before presenting to the hospital or clinic.

Furthermore, while microscopy continues to remain the gold standard for malaria diagnosis and it is valuable when performed correctly in well-resourced settings (Chlander et al., 2010), a vast body of evidence has shown consistently that there are several challenges with using this tool in settings with limited resources (Salwa et al., 2009; Perkins et al., 2008; Reyburn 2007; Amexo et al., 2004). For example, Perkins and colleagues (2008) noted that the accuracy of microscopy services is poor in low-income settings due to sub-standard training of technicians, poor equipments, and limited supply of reagents. Contrarily, RDTs are easy to use and do not require sophisticated technology unlike microscopy (Salwa et al., 2009; Moonasar et al., 2007; Moody, 2001). The results which are based on the detection of parasite antigens in

blood samples (Salwa et al., 2009; Amexo et al., 2004) have been shown to perform well, detecting over 90% of malaria cases (Perkins et al., 2008). It is also possible that RDTs will improve effective case management of malaria by enabling healthcare workers to treat malaria with ACTs only those individuals with a positive parasitological diagnosis. Further, the use of RDTs is critical given that presumptive diagnosis alone may contribute to potential mistrust on the real efficacy of ACTs while prolonging child illness by creating missed opportunities to treat diseases other than malaria (D'Acremont et al., 2009; WHO, 2004).

While the empirical support for a paradigm shift in the management of febrile illness in children using malaria RDTs is extensive (Bjorkman et al., 2010; D' Acremont et al., 2009), in endemic countries like Nigeria, the use of RDTs in clinical settings is sparse. Other studies conducted elsewhere have shown positive results in efforts to introduce RDTs in clinical settings. For example, in Uganda, Kyabayinze et al. (2010) found that the use of RDTs resulted in a 2-fold reduction in antimalaria drug prescription at low level health care facilities. In Ghana, Ansah and colleagues (2010) found that the use of RDTs led to better targeting of antimalarials and antibiotics by physicians in the clinical settings among children and adults without any evidence of clinical harm. Taken together, these studies highlight the usefulness of incorporating RDTs in integrated management of child febrile illness. Although RDTs are very useful with effective diagnosis of malaria in poor resource countries, concordance with its results and physician's diagnosis of malaria as well as with mother's interpretation of febrile illness warrants research investigation. The main aim of this study was to expand on previous findings with RDTs by examining physician-mothers-RDT concordance in an outpatient

clinic in southwest Nigeria. Specifically, we sought to determine the extent to which physician's diagnosis of malaria and maternal perceptions of child febrile illness correspond with the results of malaria rapid diagnostic tests.

## **Methods**

### Setting

This study was conducted from June-July 2010, in an outpatient pediatric clinic in Lagos which is located in the southwest region of Nigeria. With an estimated population of over 12 million people (Afolabi et al., 2004), this setting is an ideal location for several reasons. First, it is located in an urban area highly endemic for malaria with a sporozoite rate of 9.9% (Okwa et al., 2009). The rainy season period in Lagos is intense with heaviest rains occurring during the months of June and July and malaria transmission is at its peak during this period. The entomological inoculation rates are highest in this rain forest region of Nigeria, indicating that in this setting, about 24 infective *Anopheles* could transmit malaria parasite successfully in the rainy season (Okwa et al., 2009). Second, the clinic was chosen because it provides free services to everyone including additional testing with microscopy and free antimalaria drugs (when available) to all children less than five years attending the clinic. As a primary aim of this study, additional testing with malaria rapid diagnostic tests was provided for free to children clinical diagnosed with malaria by physicians.

### Participants

A purposive sampling approach was used to recruit mothers with febrile children



attending the clinic. Inclusion criteria were as follows: mothers aged 18 years and above with febrile children (main complaint) from 2 months to 12 years of age. The selection of mothers was based on previous studies which indicate that “mothers, regardless of their sociodemographic characteristics, make the first diagnosis of their child’s febrile illness by defining and interpreting changes in their child’s behavior and temperature (Heggenhougen et al., 2003). Mothers were sensitized to the study in the outpatient waiting room prior to the commencement of the study and those who provided verbal and written consent were recruited to participate. Children with severe illnesses requiring urgent care or admission at the clinic were excluded from the study. Permission was also taken from each physician observed prior to the commencement of the study.

### Data Collection

Data collection consisted of semi-structured formal and informal interviews, participant observations, and the collection of finger-prick blood samples from recruited febrile children for malaria RDTs. Consenting mothers presented their febrile child to 1 of 3 physicians for diagnosis at the pediatric outpatient unit. These children were initially examined by an attending physician. Clinical observations focused on interactions between the physicians and mothers as well as daily activities at the clinic. Specifically, using a checklist, the symptoms described by mothers as well as the diagnosis provided by physicians was recorded. Clinical logic for the diagnosis of malaria and non-malaria cases, treatment decisions and factors that triggered additional testing (using microscopy or malaria rapid diagnostic test) was also recorded. Febrile children

diagnosed with malaria (and a few non-malaria cases) were referred to the researcher for malaria RDT test. Each child provided finger prick blood samples for malaria rapid diagnostic tests. The blood samples are applied to a test strip and reagents are added to the samples. After 15 minutes, the results are interpreted based on the presence or absence of visually detectable pink-to-purple colored lines on the test strips classified as test line and control lines. Negative results produce only one line in the control portion of the test strip, while positive results produce two or three lines depending on the type of malaria parasite detected. Further, after consultations, in-depth interviews using a structured questionnaire were conducted with recruited mothers. These interviews gathered sociodemographic data including; mother's age, ethnicity, education, and occupation. Information on the length of time it takes to go from their homes to the clinic as well as perceptions of the quality of care received at the clinic was also collected. In addition, mothers were asked to describe how their children's illness began, what caused the illness and whether it was severe. They also discussed how they managed the illness prior to attendance at the clinic (whether they went to the hospital immediately or to the pharmacy to buy drugs), their reasons for bringing their children to the clinic, the problems the illness had caused for them, their apprehensions about the illness, and what they felt would help them in caring for their children with this illness.

### Data Analysis

The key quantifiable data collected were analyzed with standard descriptive statistics (i.e. frequencies and means). Sensitivity, specificity, positive predictive values, negative predictive values and 95% confidence intervals were calculated to assess the

concordance between maternal perceptions of child malaria, physician's diagnosis of malaria and the results of malaria rapid diagnostic tests. While sensitivity calculates the percentage of children who test positive for malaria parasite, specificity calculates the percentage of children who test negative for malaria parasites. The positive predictive value estimates the proportion of patients with positive test results who are correctly diagnosed by their mothers and physicians, while the negative predictive values estimates the proportion of patients with negative tests results who are correctly diagnosed by mothers and physicians (Altman & Bland, 1994). Also, Cohen's kappa ( $\kappa$ ) which is used to assess the level of agreement between two tests (Blackman & Koval, 2000), with  $\kappa=0.81-1$  representing almost perfect agreement and  $\kappa<0$  representing poor agreement (Landis & Koch, 1977) was calculated to determine the degree of concordance between physician's diagnosis of malaria in febrile children and the results malaria RDTs as well as mother's perception of malaria in their children and the results of malaria rapid diagnostics. All analyses were conducted using SPSS (version 18).

## **Results**

Table 1.4 summarizes the socio-demographic characteristics of the study participants. A total of 135 mothers/children who met the eligibility criteria were recruited in this study. Sixty nine children were males (51.1%), while 66 (48.9%) were females. Child age ranged from 3 months to 12 years and the mean age was 27.6 months. Maternal age range was 20–65 and the mean age was 33.2. Most of the mothers had post secondary education (52.6%) and 51.9% belonged to the Yoruba ethnic group of Nigeria.

Table 4.1: Socio-demographics of study population

<b>Variable (N=135)</b>	<b>Number (%)</b>
<b>Maternal Age</b>	
20-30	44(32.6)
31-40	79(58.5)
40+	12(8.9)
<b>Child age (yrs)</b>	
0-2	92(68.1)
2-4	25(18.5)
4+	18(13.3)
<b>Child Gender</b>	
Male	69 (51.1)
Female	66(48.9)
<b>Maternal Education</b>	
None-primary	15 (11.1)
Secondary	49(36.3)
Post Secondary	71(52.6)
<b>Ethnicity</b>	
Yoruba	70(51.9)
Igbo	38(28.1)
Other	27(20)
<b>Perceptions of illness severity</b>	
Severe	88(65.2)
Not Severe	44(32.6)
<b>Duration of Child Illness (days)</b>	
0-1	37 (27.4)
2-3	36 (26.7)
4-5	18 (13.3)
6-7	22 (16.3)
8+	18 (13.3)
<b>Initial Contact for Child's Illness</b>	
Health Care Center	58 (43)
Pharmacy	43 (31.9)
Home Treatment	32 (23.7)
<b>Length of time from house to clinic</b>	
0-30 minutes	56 (41.5)
1-2hours	58(43.3)
3 hours+	20(14.8)
<b>Quality of clinic</b>	
Excellent	70(51.9)
Good	48(35.6)

Average	14(10.4)
Poor	1(.7)
<b>Availability of antimalaria</b>	
Buy	104(77)
Free	19(14.1)
Other	10(7.4)

The diagnoses for febrile illness made by physicians during the course of this study are presented in Table 4.2. Based on illness narratives by mothers and physical examination of children, malaria was diagnosed in 88.1% of the febrile children attending this clinic. Also, a small number of children (11.9%) were diagnosed with conditions other than malaria.

Table 4.2: Physician's diagnosis of child febrile illness

<b>Physician's diagnosis</b>	<b>Frequency (%) (N=135)</b>
Malaria	119(88.1)
Other Conditions	16(11.9)

Table 4.3 displays the sensitivity and specificity estimates for physicians versus the results of the malaria RDT. Of the 135 febrile children who participated in this study, malaria RDTs confirmed the presence of malaria antigens in 21 (15.6%) children. As a result, the level of agreement between the results of the malaria rapid diagnostic tests and physician's diagnosis of malaria in febrile children was poor (Cohen's kappa, 0.030,  $P=0.269$ ). High sensitivity of 95.23% (95% CI: 77.3%-99.2%) indicates that physicians can correctly identify children that have malaria according to the RDT test. However, physicians are poor identifiers of children who do not have malaria [Specificity= 13.15 (95% CI: (8.1%-20.6%))]. Indeed, physicians diagnosed children's illness as malaria in

numerous cases when the children did not have malaria. This has the tendency to over diagnosis or to err on the side of diagnosis/treatment as opposed to non-treatment. Furthermore, the low positive predictive value indicates that physicians could correctly predict the actual presence of malaria antigens in blood samples for malaria RDTs only 17% of the time. This means that when physicians diagnose a child with malaria at this outpatient clinic, their diagnosis is confirmed by the results of the malaria RDTs about 17% of the time. The high negative predictive value indicates that when a physician states that a child has no malaria, this diagnosis is confirmed by the malaria RDTs 94% of the time.

Table 4.3: Comparisons of Physician's diagnosis of malaria by malaria RDT results

		Malaria RDT results (N=135)		
		Positive	Negative	Totals
Physician's diagnosis of Malaria	Positive	20	99	119
	Negative	1	15	16
	Totals	21	114	135

Cohen's kappa (P-value): 0.030 (0.269)

Sensitivity (95%CI): 95.2% (77.3%-99.2%)

Specificity (95%CI): 13.2% (8.1%-20.6%)

PPV (95%CI): 17% (11.2%-24.5%)

NPV (95%CI): 94% (71.1%-98.8%)

When mothers were asked about the perceived cause of their child's febrile illness (Table 4.4), majority (47%) did not know the cause of fever in their children. About 30% of the mothers suspected malaria, while 53% stated that their child's illness was caused by common cold. Some mothers mentioned teething (19.3), while others stated vomiting (34.8%) and diarrhea (17.8%).

Table 4.4: Mother's perceived causes of fever in their children

<b>Perceived Cause</b>	<b>Frequency (%)</b>
<b>Malaria</b>	41(30.4)
<b>Common cold</b>	54(53)
<b>Teething</b>	26(19.3)
<b>Diarrhea</b>	24(17.8)
<b>Vomiting</b>	47(34.8)
<b>Don't Know</b>	63(47)

\*95 out of 135 mothers gave more than one response

Similar to physicians diagnosis, maternal perceptions of malaria in their children were compared to the results of malaria rapid diagnostic test. As shown in Table 4.5, the degree of concordance between maternal perceptions and the results of RDTs was poor (Cohen's kappa, 0.071,  $P=0.369$ ). Also, a low sensitivity of 38.1% (95% CI: 20.8%-59.1%) indicates that mothers are poor identifiers of children that have malaria according to the malaria RDT test. However, the moderate specificity of 71.1% (95% CI: 62.1%-78.6%) indicates that mothers are better at identifying children who do not have malaria. This may be the result of some mothers having tried malaria treatment unsuccessfully before presenting their child to the clinic thus the tendency of mothers to be more willing to ascribe malaria-like symptoms to other conditions (i.e. common cold and teething). The low positive predictive value indicates that mothers could correctly predict the actual presence of malaria antigens in blood samples in 19.5% of the time, while their high negative predictive value indicates that when a mothers perceives that other conditions (i.e. teething, vomiting, diarrhea) are the cause of their child's illness, this is confirmed by malaria RDTs 86.2% of the time.

Table 4.5: Comparisons of maternal perceptions of malaria by malaria RDTs

		Malaria RDT results( N=135)		
		Positive	Negative	Totals
Maternal Perception of Malaria	Positive	8	33	41
	Negative	13	81	94
	Totals	21	114	135

Cohen's kappa (P-value): 0.071 (0.369)

Sensitivity (95%CI): 38.1% (20.8%-59.1%)

Specificity (95%CI):71.1% (62.1%-78.6%)

PPV (95%CI):19.5% (10.2%-34%)

NPV (95%CI):86.2% (77.8%-91.7%)

## Discussion

Diagnostic accuracy for a condition like malaria whose symptoms mimic other conditions depends on availability of diagnostic tools to confirm physician's diagnosis of suspected cause of an illness. The use of a diagnostic testing in clinical settings during routine consultations is necessary and should be made available. Such tools for diagnostic confirmation of child illness should be seen as a fundamental right for all children in malaria endemic countries as it ensures that only those with malaria infection will be accurately diagnosed and treated with antimalarial. It also ensures that children will receive accurate diagnosis for non-malaria conditions responsible for their fever symptom.

New malaria rapid diagnostics tests offer the possibility for accurate and accessible detection of malaria antigens in blood samples and they have an important role in limiting the potential for malaria mis-diagnosis and over-diagnosis (Zikusooka et al., 2008). Most literature to date on rapid diagnostic tests has focused on its utility with improving case management of malaria particularly as related to its sensitivity and specificity for detecting malaria parasites. Invariably, the assumption is that if universally



available, RDTs will aid in diagnostic decisions, reduce presumptive treatment, while targeting antimalaria drugs to those who need them. However, despite its many benefits of RDTs, the use of RDTs during routine case management of child malaria in clinical settings has not been extensively studied. This study offers some insights into the use of RDTs in low resource clinic with well trained and dedicated physicians but with no adequate test for confirming diagnosis. It also offers insights into degree of concordance between physician's diagnosis of malaria, maternal perceptions of child febrile illness and the results of malaria RDTs.

The results corroborate findings from a previous study on the importance of context in malaria diagnosis (Chandler et al., 2008). By context, we refer to institutional and structural impediments (i.e. inadequate facilities and diagnostic equipments and trained laboratory personnel) to physician diagnostic practices as recommended by the World Health Organization (2009). These impediments limit accurate and reliable confirmation of malaria in children attending outpatient clinics. Indeed, if antimalarials are to be better targeted to children who need them the most, this study demonstrates that physician's need supporting tools and trained personnel to make accurate diagnosis rather than relying on presumptive diagnosis. This means that simply deploying RDTs may not translate into better diagnosis for children with febrile illness if efforts are not made to equally address the broader context in which diagnosis occurs. For example, maternal interpretations of child febrile illness, caused by other conditions (i.e. teething, vomiting, and diarrhea) rather than malaria are less likely to receive attention by physicians in the absence of confirmatory test like RDT. Yet as the findings indicate, mother's belief that cause of their child's illness is attributable to other causes

is confirmed by malaria RDTs 86.2% of the time. Since mothers are critical with regards to ensuring prompt diagnosis and treatment for their child's illness (Mwenesi et al., 1995), ignoring their concerns may result in repeat visits to clinics for the same problem, thus putting strain on already constrained and under-resourced health care systems (Amexo et al., 2006). Moreover, it may also encourage home treatment of any fever such as malaria (Salwa et al., 2009).

Also, since presumptive diagnosis is the norm in many clinical settings, identifying the contextual factors driving this clinical behavior is critical for RDTs to achieve its maximum potential in clinical settings. For example, the findings of this study indicate that physician's diagnosis of malaria was confirmed by the results of the malaria RDTs only 15.6% of the time. In light of these findings, there are a number of contextual features of this outpatient clinic that should be taken into account. First, physicians had large queues of patients and so consultations lasted 4-5 minutes to ensure that all waiting patients were seen during the scheduled hours of operation. Also, although microscopy is available in a limited capacity at this clinic, physicians preferred to treat patients for malaria based on their observable diagnosis rather than recommend a lab test. Physicians stated that malaria tests with microscopy are cumbersome, particularly as the results are available within two days and given the sheer volume of patients, it is necessary to begin treatment rather than waiting for test results. Thus, one can assume that the introduction of RDTs in this clinical setting may undoubtedly improve case management and treatment of child malaria (should RDTs become a normal protocol in hospitals) if efforts are not made to equally address the contextual features of the clinic that enable and/or act as barriers to effective diagnosis

and treatment practices. In this study site, having RDTs did not result in immediate change in diagnostic behavior but it led to physicians asking more questions and becoming increasingly interested in the results by the end of the study. The readiness to change was evident but it is likely to be a longer term process that requires changes in institutional and contextual supports and expectations.

This study has several limitations that are worth mentioning. First, all semi-structured interviews were conducted face-to-face in a setting with little or no privacy. However, the use and triangulation of multiple research methods (i.e. semi-structured interviews, participant observations, informal discussions and field notes) allowed the research to develop a better understanding of the clinical logic and reasons underlying diagnosis and treatment decisions for child malaria at this outpatient clinic. Second, the potential for selection bias exists as this study was conducted in one clinical setting in Southwest Nigeria and participants recruited from any clinical setting are likely not to be representative of the entire population of children with malaria. Moreover, the results may not be generalized to other clinical settings in different parts of Nigeria or in other malaria endemic countries. The fact that this study was conducted during routine clinical consultations may contribute to bias in reporting some of the observational findings. Also, it is possible that some mothers may exaggerate or underreport their children's conditions. The use of probes or symptom lists in future studies may reduce the potential for over-reporting or underreporting of morbidity by mothers.

## **Conclusion**

Given that malaria rapid diagnostic tests are critical for improving the targeting of

antimalaria drugs, while reducing the widespread practice of treating any non-specific febrile illness as malaria (Lubell et al., 2007), it is important to examine how they are used during routine clinical consultations. Indeed, if RDTs are to achieve significant impact with reducing malaria morbidity and mortality rates among children, understanding the broader contextual factors that drive physicians to presumptively diagnosis all patients with acute febrile illness with malaria is essential. Simply put, introducing RDT's in clinical settings in malaria endemic countries might be futile if the same vigor is not applied to understanding the institutional contexts in which diagnosis occurs. These factors include availability of trained personnel, like nurses, to administer RDTs without having to rely on physicians to do so. Another factor to consider is to increase the number of physicians so that workload can allow for adequate time to spend with each patient instead of 5 minutes or less and to ensure that artemisinin combination malaria drugs are available always at the clinic. The diagnostic result may be in question, what is not in question is the level of commitment, sensitivity, and care that these physicians displayed toward their patients. Thus, the high physician/RDT discordance in malaria diagnosis is a function of institutional and other contextual factors than individual physician skills or commitment to caring for their patients. Given the importance of identifying contextual factors that influence effective case-management of malaria in the context of RDTs, more studies (i.e. multi-level modeling) are needed to explore diagnostic decisions during routine clinical practices, taking variables such as patient load on a typical working day as well as other clinic characteristics such as urban or rural location, public, private- or government-owned into account, and physician characteristics (age, gender, etc.) into account.

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## Chapter 5

### **Paper 3: Contextualizing child malaria diagnosis and treatment practices at an outpatient clinic in southwest Nigeria.**

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**Keywords:** malaria, diagnosis, treatment practices, contextual factors, outpatient clinics



**Abstract**

Effective case management of malaria remains a major challenge in many endemic countries. Moreover, there is increased interest in factors that influence mis- and over-diagnosis of malaria among children attending clinics. This study explored the contextual features of an outpatient clinic in southwest Nigeria that enable and/or discourage effective diagnosis and treatment of child malaria. We conducted in-depth interviews with mothers of 135 febrile children attending the clinic as well as participant observations and in-formal discussions with physicians. The findings demonstrate that availability and affordability of antimalaria and laboratory testing, access to the clinic and pediatricians, adequacy and acceptability of services provided at the clinic were key factors that influence effective case management of malaria in children. Implications for malaria rapid diagnostic tests as well as malaria mis- and over-diagnosis are discussed.

## Introduction

One of the central goals of malaria control programs is to provide effective diagnosis and treatment of malaria particularly in children less than five years of age. To this end, efforts have been made to encourage caretakers to seek prompt diagnosis and treatment at health care settings within 24 hours of illness onset. However, despite these efforts, over the past several years, malaria mis- and over-diagnosis has increased dramatically. This is evidenced by the proliferation of published articles which addressed; “the effects of malaria misdiagnosis on the poor and vulnerable,” (Amexo et al., 2004) “the role of patient pressure in influencing malaria over-diagnosis,” (Chandler et al., 2008a) “household costs of malaria over-diagnosis,” (Hume et al., 2008) and “the reasons why clinical staff over-diagnose malaria (Chandler et al., 2008b). Although the World Health Organization (2009, p,3) currently recommends “*prompt parasitological confirmation by microscopy or alternatively by rapid diagnostic tests (RDTs) for all patients with suspected malaria before treatment is started*, in settings where these tools are available, few qualitative evidence exists about the contextual features of health care clinics that influence effective diagnosis and treatment of malaria.

Contextual factors are those features of the health care systems which enable and/or discourage effective case-management of child malaria (Glik et al., 1989). These factors have important implications for reducing the morbidity and mortality from malaria among children. Ignoring the context in which child malaria diagnosis and treatment practices occur may impede renewed optimism towards improved malaria control and possibly elimination in many endemic countries.

The importance attributed to contextual factors is also underscored by empirical

evidence indicating a need to go beyond presumptive (or clinical) diagnosis of malaria in children (Bjorkman & Martesson, 2010; Endeshaw et al., 2008; Kyabayinze et al., 2010). Presumptive diagnosis based on clinical signs and symptoms has been the primary means of diagnosing and treating malaria in many malaria endemic countries (D'Acremont et al., 2009; Hopkins et al., 2008; Talisuna & Meya, 2007). It refers to how the disease is understood in the absence of a laboratory confirmation of blood analysis and the course of treatment to be taken. Indeed, in many malaria endemic countries, malaria microscopy which remains the gold standard for laboratory diagnosis remains inaccessible to patients because of poor laboratory infrastructure and under-staffing of technical expertise it requires (Hopkins et al., 2008). Even in settings where microscopy is available, referrals for laboratory test rarely happen because in many instances, aspects of such a test (i.e. drawing blood from patients) may also be performed by a physician (as was the case in this study site). Further, when they do happen, they are time consuming and physicians often mistrust the laboratory results and continue to treat those who test negative with antimalarials (Rafael et al., 2006). For these reasons, knowledge of the contextual factors that influences effective diagnosis and treatment of malaria in children is important for efforts aimed at halting and reversing the incidence of malaria in endemic countries.

In Nigeria, malaria follows a hyper-endemic pattern, with peak transmission occurring during the rainy season period (June-July). Nigeria offers a unique opportunity to study the contextual factors that influence effective case-management of child malaria for several reasons. First, a quarter of all malaria cases in the World Health Organization African region occur in Nigeria (WHO, 2009). Also, while evidence of

systematic decline in malaria cases have been reported in others parts of Africa, malaria remains a persistent problem in Nigeria (WHO, 2009). According to the National Malaria Control Program in Nigeria (2005), malaria is by far, one of the most important public health problems, representing about 60% of outpatient visits to health facilities, 30% of childhood deaths, and 25% of death in children under one year. Given the burden of malaria in Nigeria, it is possible that contextual features of health care clinics may act in various ways to enable and/or discourage effective case-management of malaria in children. At a time of changes in the burden of malaria, with compelling evidence of dramatic decline in malaria transmission in other parts of sub-Saharan Africa (O'meara et al., 2010), it is important to examine the role context plays in influencing effective diagnosis and treatment of malaria. In this paper, we apply the health access livelihood framework to contextualize child malaria diagnosis and treatment practices at an outpatient clinic in southwest Nigeria.

### **Theoretical Framework: The Health Access Livelihood Framework**

The Health Access Livelihood Framework was developed in response to the need to address access to prompt and effective malaria treatment in rural Tanzania (Hetzl et al. 2007; Obrist et al., 2007). It is designed to better align health care resources with people's needs, perceptions, and expectations (Obrist et al., 2007). It combines issues related to health seeking (why, how, and when individuals seek help for illness) with factors that influence access to health care services (availability, accessibility etc.) to situate the broader context in which effective case management of illness occurs (Obrist et al., 2007). It consists of five dimensions: Availability, Affordability, Accessibility,

Adequacy, and Acceptability (Obrist et al., 2007). While availability address issues related to the types of services that exist within a health care setting and whether these services correspond with people's needs and expectations, affordability refers to the costs of the services provided (both direct and indirect costs) such as costs of consultations as well as transportation costs and lost time from work (Obrist et al., 2007). Accessibility is concerned with the geographic distance between services and homes of the intended users (Obrist et al., 2007). Adequacy examines whether the organization of the health care settings meets the patient's expectations and acceptability highlights whether or not the information, explanations and treatment protocols provided take the patient's expectations or perceptions into account (Obrist et al., 2007). Although this framework has been used to examine the factors that influence access to malaria treatment in a rural setting with limited resources, in urban settings with access to diagnostic tools such as microscopy or malaria rapid diagnosis test, few qualitative attempts have been made to explore how these services align with caretaker's perceptions and expectations. This framework was used in this study to contextualize how services provided at an outpatient clinic in southwest Nigeria align with caretaker's perceptions and expectations of effective diagnosis and treatment of malaria in children.

## **Methods**

### Setting

This study was conducted in Lagos, one of the largest urban metropolis located in the southwest region of Nigeria. With an estimated population of 12 million people (Afolabi

et al., 2004), Lagos is also a State and is one of the most populous states in Nigeria and a socio-cultural rainbow of people from diverse indigenous backgrounds. It is located within the rainforest region of southwest Nigeria and there are two climatic seasons in Lagos-the dry season and the wet season. The dry season lasts from November to March while the wet (or rainy) season lasts from April to October, with the highest rainfalls occurring during May through July. Malaria transmission in Lagos is intense particularly during the rainy season. This study took place in the pediatric section of an outpatient clinic located in Ikeja, the capital of Lagos. Three times a week on average, the researchers conducted this study at the clinic during the rainy season of June and July, 2010, to explore the mechanisms that guide child malaria diagnosis and treatment decisions at the clinic.

#### Study design and participants

In-depth interviews, participant observations, informal-discussions, and field notes were used to collect data with a purposive sample of mothers with febrile children attending the outpatient clinic and the physicians providing care. Mothers were sensitized to the study in the outpatient waiting room prior to the commencement of the study and those who provided verbal and written consent were recruited to participate. A total of 135 mothers with febrile children participated in this study. The age range of the mothers was 20-65, while the children ranged in age from 3 months to 12 years. Majority of the mothers belonged to the Yoruba (59.1%) and Igbo (28.1%) ethnic groups in Nigeria. Ethics approval for this study was granted by Penn State and the Lagos State University Teaching Hospital.

Verbal consent was also obtained from each physician observed prior to the commencement of the study. Data collection took place in the consultation rooms at the outpatient clinic after routine consultations of mothers with febrile children by physicians. In-depth interviews with mothers focused on perceptions and treatment seeking practices for child's febrile illness prior to clinic attendance. Specifically, mothers were asked to describe how the illness began, what caused the illness and whether it was severe. They also described their reasons for bringing the child to the clinic, as well as their expectations of the services provided at the clinic. Participant observation focused on interactions between the physicians and mothers. Specifically, using a checklist, the symptoms described by mothers as well as the diagnosis by physicians was recorded. Clinical logic for malaria diagnosis or diagnosis of non-malaria cases and treatment decisions by physicians were also recorded. Informal discussions with physicians explored their criteria and decision logics for diagnosing malaria in children, their treatment choices as well as the potential for malaria mis- and over-diagnosis at this clinical setting.

### Data analysis

Transcripts of the in-depth interviews, as well as checklists of participant observations, informal discussions and fieldnotes were analyzed using the content analysis techniques described by Morse and Field (1995). Using the Health Access Livelihood Framework as a guide, responses from the in-depth interviews, informal discussions, as well as checklists of participant observations, and field notes were organized and categorized into expectations about effective diagnosis or child malaria and the

resources that enhance or create barriers with effectively managing child malaria at this outpatient clinic. An audit trail of the researcher's decisions and insights were also summarized. Credibility of the data was maintained through triangulation of the multiple sources of data. Also, the data were read in their entirety several times and repeatedly examined so as to obtain a general sense of the information gathered as well as to categorize the material until saturation was reached, that is, until no new themes emerged.

## **Results**

As stated earlier, the contextual factors are those features of the health care system which either promote or lessen the ability to effectively manage child malaria. In this study, these factors include; the availability of drugs and laboratory testing for malaria, affordability of antimalaria drugs, access to the clinic (particularly access to pediatricians), adequacy of clinic, and acceptability of services provided at the clinic.

### Availability of drugs and laboratory testing

This outpatient clinic is known to provide free antimalaria medication for all children less than 5 years of age diagnosed with malaria. Unfortunately, during the course of this study, access to free anti-malaria drugs was problematic as the drugs were not always available at the dispensary. Most mothers remarked that the lack of free anti-malaria drugs at the dispensary was a hindrance to effectively treating malaria diagnosed in their children. One mother stating the following:



I came to this clinic because I thought that they give free antimalaria drugs that were of good quality, but they don't have any and I am not sure if I would trust the ones that they have at the market.

In addition to the lack of free antimalaria drugs, although laboratory testing with microscopy is free for children attending this clinic, referrals are rare. While some mothers were of the opinion that *"it is better to run tests to know the exact problem causing the child's illness,"* physicians did not recommend it because of time factor, absence of personnel to perform laboratory tasks and finally, delay in receiving lab results. In this setting, giving antimalaria treatments to all children with febrile illness was deemed to be necessary by physicians particularly as malaria transmission is hyper-endemic in this region of Nigeria. One physician stated the following:

If I referred a patient for microscopy, it will take at least 2 days before results are available, by then malaria may have worsened, so it's better to treat immediately due to the volume of patients we see in any given day. Moreover, the microscopy laboratories are small, understaffed and overworked and they lack the equipments to handle the sheer volume of tests needed by patients.

#### Affordability of antimalaria drugs

One of the key elements for malaria control in Sub-Saharan Africa is prompt treatment with effective anti-malarial drugs. Although, major efforts are underway to strengthen and promote appropriate utilization of effective anti-malarial drugs, barriers imposed by the cost of the new and expensive artemisinin combination therapies may constrain malaria control efforts in multiple ways. For example, findings from the in-depth

interviews indicate that affordability of antimalaria drugs can delay prompt treatment of child malaria as evidenced in the following comments:

I cannot afford to buy meds that the doctor just prescribed because of the cost. I don't have any job or money to buy it now for my child.

Also, it was not uncommon for some mothers to buy chloroquine (despite its known resistance to malaria in this setting) because it was cheap and affordable when compared to the new/expensive artemisinin combination therapies currently in the market. In improving the affordability of antimalaria drugs, one mother stated that *"these drugs need to be provided at subsidized price at this clinic so that even poor people can afford to buy them."*

#### Access to clinic and pediatricians

When mothers were asked to describe the length of time it took to travel from their homes to the clinic, 41.5% stated that it took less than 30 minutes, 43.3% stated it to 1-2 hours depending on the traffic, while 14.8% stated that it took over 3 hours to arrive at the clinic. Some of the mothers said they brought their child to this clinic because it is known to provide *"free services to everyone."* Access to free clinical services was considered to be important, particularly as it addressed the health needs of the poorest who are often deterred from seeking care at most clinics. Some mothers stated that access to the clinic also guaranteed they would receive the *"best decision and treatment"* for their child's illness. Another component of the clinic resources that matter with the mothers interviewed was *"easy access to pediatricians."* Indeed, due to ease with access to pediatricians at the clinic, it was not uncommon for some mothers to

bring their children to the clinic within 24 hours of illness onset. Easy access to pediatricians also played a significant role in influencing many mother' decisions to travel long distances and in some cases wait 2-3 hours before being seen by the physician at the clinic with little or no complaints. Indeed, our findings revealed that what's often viewed as healthcare barrier or constraint in some settings (i.e. long travelling distances or long waiting times), although important, was insignificant when considered alongside other defining characteristics such as easy access to pediatricians at the clinic.

#### *Adequacy of outpatient clinic*

The outpatient clinic caters to the needs of all people residing in the surrounding areas of the clinic as well as people from throughout the country. Although the hours of operation are from 9am to 3pm, most caretakers and their children arrive as early as 6am to ensure that they are seen as soon as the clinic opens. No prerequisites (such as formal referral letters) are needed to access the clinic's services. As a result, the clinic is readily accessible to patients from all social classes with varied health problems. The caretakers and children who arrive as early as 6am begin the task of waiting in an area outside the hospital designated as the outside waiting room. The physicians often arrive a little after 8, and the clinics begin by 9am. The first points of contact for the caretakers and their children are the nurses, matrons, and orderlies at the clinic. They are all women. These women are in charge of ushering the patients from the outside waiting room to the waiting room inside in the clinic. The inside waiting area is located outside the physician's office and patients sit in order of their arrival time or the nurse's

arrangement. When it's their turn, they go into the room and begin to narrate their child's illness. Although there are five rooms inside the clinic, only two are designated for general outpatient consultations and so on many occasions due to lack of space, two physicians share a consultation room, seeing two separate patients at a time. In the context of providing treatment for malaria, as mentioned earlier, the clinic provides free services for children, including free antimalaria drugs for those diagnosed with malaria and free additional testing with microscopy when necessary. Physicians rarely recommended patients for microscopy as they had large queues of patients waiting for consultations. Their priority was to ensure that all waiting patients were seen by a physician during the scheduled hours of operation. Also, unlike in other countries where nurses perform blood work, such task is performed by physicians in this clinic. This means that physicians often have to weigh the time spent drawing blood of one patient (which translates to seeing 3 to 4 patients) or base diagnosis on observation and mothers explanation and history of illness. One physician aptly stated the following:

Malaria tests with microscopy are cumbersome and in the long-run malaria rapid diagnostic tests are not available indefinitely in this clinic. Patients are many and yes when they come with a temperature, before we think of anything, we have to think of malaria.

### Acceptability of health care services

With regards to acceptability of the health care services provided at the clinic, mothers were asked whether they were satisfied with their consultations (as related to the quality of services provided by physicians and other healthcare workers at the clinic), what they

liked best (comments from satisfied mothers), and what the clinic could do to provide better services (comments from dissatisfied mothers)? More than half of the mothers (52.6%) interviewed stated that the quality of care provided at the clinic was excellent. 36.1% stated that the services were good, while 10.5% noted that the care provided at the clinic was average. Among mothers who were satisfied with the care that they received, some were of the opinion that the physicians at the clinic were “*helpful*” and “*attentive to their needs.*” Dissatisfied mothers cited “*lack of additional tests*” prior to prescribing medications and the “*absence of free antimalaria drugs,*” as key potential barriers for adequate case management of child malaria at this clinic.

## **Discussion**

The aim of this study was to illustrate the ways in which contextual factors of an outpatient clinic in southwest Nigeria influence effective diagnosis and treatment of malaria. As child malaria diagnosis remains a major challenge in many endemic countries, the findings indicate that malaria control strategies should take contextual factors into account as they are critical with the effective case management of malaria in children attending health clinics. This is crucial because the success of malaria control strategies does not only depend on the development of effective drugs or vaccines or improved vector control, but also knowledge of aspects of the context that promote and/or act as barriers to effective diagnosis and treatment. The findings of this study suggest that availability of antimalaria drugs and laboratory testing services, affordability of services, access to clinic and physicians, adequacy of clinics and acceptability of

services are important in addressing access to effective case management of malaria in children attending an outpatient clinic.

Contextual features of health care clinics are also important particularly with the recent advent of malaria rapid diagnostic tests (RDTs) in malaria endemic regions settings (D' Acremont et al., 2009; Hopins et al., 2008; Kyabayinze et al., 2010). Although malaria RDTs could also be useful with effective diagnosis of child malaria, contextual factors such as the availability, affordability, access to, adequacy, and acceptability of RDTs may also constrain physician's practice and impoverish their professional judgment. For example, in rural Burkina Faso, Bisoffi and colleagues (2009) found that as many as 85% RDT negative patients were prescribed antimalarials despite knowledge that a negative RDT results excludes presumptive treatment of malaria. Also, in Zambia, Hamer and colleagues (2007) noted that when rapid diagnostic tests were performed and reported as negative, 35% of patients were still prescribed an antimalarial. Simply put, promising advances in malaria rapid diagnostic tests might be futile if the same vigor is not applied to understanding the contexts in which human behaviors occur (Mwenesi, 2005). Moreover, as noted by Chandler and colleagues (2008c, p, 1140) "changing ingrained clinical behaviors (i.e. presumptive diagnosis) may be difficult" if attention is not equally given to the role contextual factors play.

Some potential limitations of this study must be duly acknowledged. There is always the possibility that the physicians may have altered their diagnostic and prescribing behavior to err on the side of diagnosing malaria due to the presence of the research study (e.g. Hawthorne effect). To minimize this effect, efforts were made to

not interfere with consultations, allowing physicians to diagnose and prescribe child malaria treatment according to their routine. The findings of this study may also be limited due to selection bias since we did not compare participants recruited at this outpatient clinic with those who sought care at other clinics. One caution about our population is that it is plausible, for example, that mothers with febrile children in search of answers to their child's illness may amplify the severity and persistent sign and symptoms observed in their children in hopes to receive additional testing so as to accurately pin-point the cause of illness. Future studies with mothers with febrile children outside clinical settings are necessary to determine whether this process occurs. Also, the generalizability of our findings is limited since this outpatient clinic may not be representative of other outpatient clinics in malaria-endemic countries. Further, the constraint of space in which this study was conducted may have contributed to bias in reporting some of the findings of this study. However, such space constraint also enabled observations of mundane actions or events to be recorded, particularly with regard to differences between physicians diagnostic decisions and mothers interpretation of their child's illness.

Study findings have implications for improving effective diagnosis and treatment for child malaria in malaria-endemic countries. If the Millennium Development Goal 6 of reversing malaria incidence by 2015 particularly among children is to be achieved, evidently, it is timely to examine the contextual factors that are essential for effective diagnosis and treatment of child malaria among children in clinical settings. The results presented in this article are timely given the increased interest in factors that influence mis-and over-diagnosis of malaria in clinical setting. However, more research is

necessary to assess whether these findings remain valid in different clinical settings (i.e. rural clinics, private vs. government owned clinic) and with different participants (i.e. mothers in community settings).



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## Chapter 6

### Discussion

In this chapter, an overview of the purpose of this study is presented. Also an overall summary of the study conducted in phase 1 and presented in chapter 3 (Paper 1) as well as the summary of the study conducted in phase 2 and presented in chapters 4 (Paper 2) and Chapter 5 (Paper 3) is discussed.

#### 1. Study Overview

This study was conducted in order to examine factors that influence effective case management of child malaria in a setting where malaria transmission is hyperendemic. Given the increased concern with malaria mis- and over-diagnosis, inappropriate use of antimalaria drugs and delay in the treatment of other potentially fatal causes of febrile illness in children, this study attempted to examine how individual, sociocultural, and contextual factors influence effective diagnosis and treatment of malaria in children attending an outpatient clinic setting in southwest Nigeria. This study was guided by the following questions:

1. Are there socio-cultural factors that influence treatment seeking decisions for child malaria among mothers attending an outpatient clinic?
2. How does physician diagnosis of malaria and maternal interpretations of child febrile illness compare to the results of malaria RDTs? Is there a degree of concordance between physician's diagnosis, maternal interpretations and the results of RDTs?
3. What contextual factors influence effective case management of child malaria in an outpatient clinical setting in southwest Nigeria?

This project builds on previous work that highlighted the importance of maternal perceptions of malaria illness in children versus clinical evidence of the disease (Jackson, 1985), the role of socio-cultural beliefs in influencing local illness concepts among children, recognition of key signs and symptoms, perceptions of illness causations and illness management practices among mothers (Beiersmann et al., 2007; Cropely, 2004; Tarimo et al., 2000), as well as the role of individual, sociocultural, and structural factors in influencing the use of antimalarials for episodes of fever presumed to be malaria (Glik et al., 1989).

Although the studies cited above are important, all were conducted when chloroquine was used as a first line of treatment for malaria. Due to widespread resistance to malaria, artemisinin combination therapies (ACTs) have since replaced chloroquine as first-line treatments in many malaria-endemic regions in sub-Saharan Africa. Thus, as mothers become accustomed to the multi-dosage/multi-day regimens of ACTs (Mwenesi, 2005), the use of this anti-malaria treatment strategy will depend on understanding how maternal perceptions, sociocultural beliefs and contextual factors influence effective case management of child malaria. Without an understanding of the influence of these key factors, the possibility of controlling, eliminating, and ultimately eradicating malaria in endemic countries may not be fully realized.

### Overall Summary of Paper 1

Paper 1 focused on a preliminary study on child malaria treatment decisions among mother's attending the pediatric outpatient clinic in southwest Nigeria. This area is highly endemic for malaria, particularly during the rainy season (April-October), and an

ideal location for understanding the factors that influence treatment-seeking practices of child malaria by mothers in the event of malaria. Also, clinical examinations and medications, particularly antimalarial treatments, are free for children under five who attend the outpatient clinic. For these reasons, this clinic was an ideal site for studying perceptions and practices that influence the effective management of child malaria. The purpose of this preliminary fieldwork was to explore mother's explanatory models of acute febrile illness among under-five children. Since febrile illness in children is one of the most common symptoms of child malaria, this preliminary work provided a rich opportunity to explore maternal interpretations of febrile illness episodes, its causes and perceived severity, as well as expected and/or desired treatment actions.

For this study and with the aid of a physician at the clinic (Dr. Idris of LASUTH), a revised version of Kleinman's (1980) explanatory models questionnaire was prepared and administered to mothers with children under five who had fever as a major complaint at the time of their visit to the hospital. Explanatory models is a term coined by Kleinman (1980) which refers to patient's conceptions of the nature of a particular illness episode, the timing and onset of symptoms, its severity, expected and or desired treatment, as well as apprehensions about the illness episode. Explanatory models are grounded in cultural interpretations, norms, beliefs, practices, and experiences of particular illness within a given society and they have been shown to influence treatment seeking practices as well as health service utilization (Patel, 1995). In the context of malaria, it is essential to understand explanatory models for a number of reasons. First, they play a crucial role in addressing timely and appropriate use of treatment strategies particularly within the 24-48 hour frame recommendation put forth

by the World Health Organization (2010). Second, they address the influence of cultural factors, beliefs and practices with treatment-seeking for malaria. Third explanatory models provide a better understanding of the patient's subjective experience of malaria as it highlights how they perceive, understand, explain and interpret their illness experience.

The revised version of Kleinman's explanatory model questionnaire included open-ended questions that specifically focused on maternal interpretations of how their child's febrile illness started (what was happening at the time and noted differences in their child). In-depth interviews were conducted with mothers in the pediatric clinic after their children were examined by physicians using the revised version of Kleinman's explanatory model questionnaire. The interviews gathered information on maternal age, ethnicity, educational level, occupation, number of children in the family, any previous loss of child (the cause and circumstances if applicable), and estimated number of clinic visits in the last 6 months. The questionnaire also explored terms commonly used to describe child febrile illness, perceptions of illness causations and severity, and illness management practices prior to hospital arrival. Also, the researcher obtained detailed information on the kinds of treatment mothers expected their children to receive, the problems the illness had caused for them, their apprehensions about the illness, and what they felt would help them in caring for their children with this illness. In addition to the interviews, physicians recorded on a special form, the child's age, sex, temperature, weight, maternal complaints/symptoms and their clinical diagnosis.

Results from this study showed that home management and self-medication of child febrile illness symptoms is common. For example, in describing reasons for visiting

the clinic, persistence of symptoms despite prior medications (74%) were commonly cited as a central factor influencing decisions to seek treatment at the outpatient clinic. Mother's clearly stated that they expected to receive the "best doctor's treatment," that will make their will enable their children to recover fast. In describing problems caused by illness as well as concern/fears, some of the mothers reported that "loss of time from work," (45%) and "disturbed sleeping patterns" (28.4%) were among the main problems, while "death" (23.5%) was a common fear.

The findings of this study also highlight the importance of socio-cultural beliefs about febrile illness episodes in influencing treatment-seeking practices. For example, sociocultural beliefs related to teething were commonly cited as the cause of a child's febrile illness. Personal communication with Dr. Idris suggested that it was common for mothers to cite teething as the cause of their child's illness for a couple of reasons. Most mothers with young children (from four months and above) expect their children to start teething and as a result any illness that occurs during this period is attributed to teething. When a tooth starts to appear, mothers believe that it is accompanied with many febrile-like conditions and this perception may interfere with interpretations of malaria-related signs and symptoms. The role of teething patterns in influencing treatment-seeking practices needs further attention with malaria control programs particularly with reference to exploring whether this perception delays prompt treatment of malaria.

In addition, particularly important in mother's assessment of effective case management of their child's febrile illness was laboratory evidence of malaria disease. As indicated earlier, it was common for mothers to initiate treatment for malaria at home

prior to seeking care at the hospital. Persistence of symptoms despite home treatment was the most common reason for turning to the hospital. It is important to note that the majority of the mothers indiscriminately initiated anti-malaria treatments prior to hospital arrival. Although, some of the mothers were of the opinion that laboratory tests were important to ascertain the diagnosis of their children's illness (due to the persistence of anti-malaria treatment failures that they initiated at home), physicians did not offer any laboratory tests. Instead, diagnosis was based on observations of malaria signs and this is similar to what mothers are already doing at home.

Although this study primarily focused on the treatment seeking for febrile illness among urban children, it is important to note that fever is a common symptom for a plethora of different illnesses among children, including malaria. Little qualitative evidence exists on the management of febrile illness particularly as related to perceptions that influence positive treatment seeking practices, existential or negative are important so as to ensure effective case management of malaria in children attending outpatient clinics. While Kleinman's explanatory model was used to guide the questions, to further provide insights into the positive, existential and negative cultural beliefs that might influence treatment seeking practices, the PEN-3 cultural model was used to guide the analysis of the data. The aim of paper 1 was to explore the range of cultural values and practices that influence patterns of treatment seeking for acute febrile illness among mothers attending an outpatient clinic. To my knowledge, this study represents the first application of PEN-3 cultural model with malaria treatment practices in endemic countries.



In this study, maternal treatment seeking decisions were grouped into positive responses, existential responses, and negative responses. We found that the use of appropriate treatment coupled with the role of physicians in health care facilities were important in generating positive responses to treatment seeking for child febrile illness. In addition, existential beliefs related teething did not alter maternal use of health care facilities for diagnosis and appropriate treatment of child febrile illness. Finally, the belief that febrile illness is not all that severe was a common negative perceptions shared by some mothers in this study. This perception often underestimates the potential harm of child febrile illness. Moreover, the decision to seek prompt diagnosis and effective treatment may be influenced by whether mother's perceived the illness to be mild or severe. In cases where child febrile illness was perceived as mild, or not severe, it was not uncommon for mothers to delay seeking treatment. As signs and symptoms become more prominent, mothers then resorted to public health facilities for proper treatment of their children's illness.

The effect of negative responses suggests that knowledge about causes of malaria or even signs and symptoms alone may be insufficient to address perceptions related to severity for some mothers. Thus, the assumption that changing knowledge may lead to behavior change may be severely limiting if it fails to also consider other factors, including positive or existential factors that might influence treatment-seeking behaviours for child malaria. It may, therefore, be more fruitful to adapt messages surrounding effective case management of malaria around responses that are likely to promote or enhance treatment-seeking practices (positive), paying close attention to response that have no harmful consequences (existential), before identifying responses

that may have negative health consequences. Furthermore, rather than focusing exclusively on changing negative treatment-seeking responses that are known to be harmful to a child's health, the PEN-3 cultural model provides an opportunity to also promote positive treatment seeking behavior of mothers. In this way, one is able to examine the totality of the context in which positive, existential and negative treatment seeking practices occur.

### Overall Summary of Paper 2

Many studies have stressed the importance of effective diagnosis and treatment for child malaria in endemic countries. The assumption is that if implemented well, it could ensure effective case management of malaria, while reducing mortality from the disease (Talisuna et al., 2007). However, the fact that most malaria illness are self-diagnosed with people engaging in home treatment using antimalaria drugs bought from local pharmacies have hindered efforts aimed at ensuring early and reliable diagnosis and treatment of child malaria in clinical settings (Amexo et al., 2004). Also, the symptoms of malaria are non-specific and its clinical presentations often overlap with other common illness including pneumonia, making it difficult to accurately self diagnose (Crawley et al., 2010; Perkins et al., 2008; WHO, 2010). Access to effective treatment is problematic in endemic countries particularly as chloroquine (CQ), the cheapest and most commonly used anti-malarial drug (Hemingway & Bates, 2003) is resistant to malaria. Finally, in many malaria endemic countries, limited laboratory facilities and/or trained staff make access to parasitological confirmed diagnosis of malaria impossible (Bjorkman et al., 2010; Gerstl et al., 2010).

Although microscopy is the gold standard technique used in malaria diagnosis, it is valuable when performed correctly in well-resourced settings (Chlander et al., 2010), but unreliable when poorly executed (Salwa et al., 2009). Microscopy entails the examination of thick and thin blood films obtained from finger prick (the most common method), stained with Giemsa or Field's stain and then examined under a microscope. This procedure provides information on both the species of the parasite and the parasite density of infection (Murray & Bennet, 2009). However, reliable microscopy requires trained technicians, electricity, and well-maintained microscopes, resources that are often not available in settings with limited resources (Rafael, et al., 2006). Also, in settings where microscopy is used, it is not uncommon for physicians to have doubts about test results due to substandard equipments and limited supply of reagents and they often treat those who test negative with antimalaria drugs (Perkins et al., 2008; Rafael et al., 2006). In light of the limitations with microscopy, new malaria rapid diagnostic test are increasingly used as strategies to improve malaria diagnosis.

Unlike microscopy, malaria rapid diagnostic tests are easy to use and do not require microscopes, electricity or laboratory staff (Ansah et al., 2010). The results which are based on the detection of parasite antigens in blood samples (Amexo et al., 2004; Salwa et al., 2009) have been shown to perform well, detecting over 90% of malaria cases (Perkins et al., 2008). It is also possible that RDTs will improve effective case management of malaria in children by enabling healthcare workers to treat with ACTs only those children with a positive parasitological diagnosis. Given the scale and importance of targeting antimalarial drugs to children who need them the most, while reducing delay in the treatment of non-malaria cases, it is essential to examine the

potential impact of new malaria rapid diagnostic tests on children in endemic countries particularly as it allows diagnosis to be made even in health care settings lacking laboratory facilities (Bissoffi et al., 2009).

The study presented in paper 2 was designed to explore the factors influencing effective case management of child malaria at an outpatient clinic setting. Since presumptive case management often leads to mis- and over-diagnosis of malaria, RDTs were used in this study to determine the degree of concordance between physicians' diagnosis of malaria and mother's interpretations of child febrile illness. This study was conducted from June through July, 2010 in the same pediatric outpatient clinic where preliminary data from paper 1 was collected. Mothers with febrile children were sensitized to the study in the outpatient waiting room prior to the commencement of the study and those who provided verbal and written consent were recruited to participate.

Combined quantitative and qualitative methods were used to collect data on diagnosis and treatment practices for child malaria at the clinical setting. Specifically, semi structured interviews with structured questionnaire was used to elicit information on maternal treatment seeking practices for child malaria prior to attendance at the clinic, observations of physician/caretaker interactions during consultations were recorded and finger-prick blood samples were collected from recruited children for malaria rapid diagnostic test. Data collection took place in the consultation rooms at the outpatient clinic after routine consultations with physicians. Permission was obtained from each of the three physicians observed prior to the commencement of the study. The physicians were asked to record on a special form; the age and gender of the child, maternal complaints, and whether any of the following diagnosis were applied; malaria,

upper respiratory infection, bronchopneumonia, or gastroenteritis. This is consistent with methods used in previous study (Lubanga et al., 1997). The protocol was as follows: mothers present their sick child to 1 of 3 physicians for diagnosis. The physician examines the child and prescribes medication. Efforts were made not to interfere with case management, allowing physicians to diagnose and treat according to routine.

All the children with suspected malaria were diagnosed as such and treated according to institutional protocol at the clinic. Also, diagnosed malaria cases (and a few non-malaria cases) were referred to the researcher for additional testing with RDT. All the mothers were informed about the nature and requirements of the in-depth interviews and RDT test. Each recruited child provided finger prick blood samples for malaria rapid diagnostic tests. As mentioned earlier, RDTs were used in this study because they provide a rapid and reliable way to detect the presence of malaria antigens in the finger prick blood samples. RDTs are easy to use and results are available within 15 minutes. The blood samples are applied to a test strip and reagents are added to the samples. Also, since *Plasmodium falciparum* is the common malaria parasite found in southwest Nigeria, the Binax Now malaria rapid diagnostic test kits were used in this study as they have been found to be sensitive (99.7%) and specific (94.2%) for the diagnosis of *Plasmodium falciparum* (Murray et al., 2008) in blood samples.

A total of 135 mothers with febrile children participated in this study. This sample size was based on the number of available malaria rapid diagnostics tests during the course of this study. Child age ranged from 3 months to 12 years and the mean age was 27.6 months. Maternal age ranged from age range was 20–65 and the mean age was 33.2. Most of the mothers had post secondary education (52.6%) and 51.9%

belonged to the Yoruba ethnic group of Nigeria. When mothers were asked to describe their children's illness, most provided narratives that explained when and how the illness started, the main symptoms they noticed, and what they had done to manage the illness prior to attendance at the clinic. Some mothers recounted their attempts to manage their children's illness by buying medicines recommended by family members, particularly those who worked in health care centers and with drug shop keepers in their areas.

Based on illness narratives by mothers and clinical observations of children, physicians diagnosed malaria in 88.1% of the febrile children attending this clinic. Multiple disease diagnosis (Table 6.1) was also common as majority of the children diagnosed with malaria, were also diagnosed with another form of disease such as malaria and respiratory tract infection (39.3%), or malaria and pneumonia (5.2%), or malaria and sepsis (15.6%).

Table 6.1: Multiple diagnosis of malaria and other forms of diseases

<b>Physician's diagnosis</b>	<b>Frequency (%)</b>
Malaria & Respiratory Tract infection	53(39.3)
Malaria & Pneumonia	7(5.2)
Malaria & Sepsis	21(15.6)
Malaria & Gastroenteritis	13(9.6)

Estimates of the sensitivity, specificity, positive and negative predictive values revealed striking results. For example, low specificity scores (13%) in comparisons between physician's diagnosis of malaria and the results of malaria RDTs indicate that

physicians are poor at identifying children who do not have malaria antigens in their blood samples. However, high sensitivity score (95.23%) indicates that physicians can correctly identify true positives (i.e. children who truly have malaria antigens in their blood samples according to the RDT test). With reference to concordance between mother's interpretation of child febrile illness and the results of malaria rapid diagnostic tests, a low sensitivity of 38.1% indicates that mothers are poor identifiers of children that have malaria according to the malaria RDT test, while a moderate specificity of 71.1% indicates that mothers are better at identifying children who do not have malaria.

In summary, the findings presented in paper 2 underscore the importance of confirming physician's malaria diagnosis with RDTs so as to prevent the potential for malaria over-diagnosis at this outpatient clinic. As noted by Hopkins (2009), most febrile illnesses among children are not due to malaria and significant portions of mortality are due to other causes of illness. Presumptive diagnosis may contribute to inappropriate treatment of potentially fatal non-malaria febrile illness as well as over-prescription of antimalaria drugs. Indeed, Amexo and colleagues (2004, p. 1896), writing about malaria mis-diagnosis, noted "individuals wrongly diagnosed with malaria will be exposed to unnecessary side effects of drugs and the true cause of their illness may not be recognized or treated." Ansah and colleagues (2010, p. 1) suggested that "over-diagnosis can lead to overuse of antimalarial drugs, potentially increasing the risk of spread of drug resistant malaria." If the Millennium Development Goal 6 of reversing malaria incidence by 2015 particularly among children is to be achieved, evidently, it is timely to examine all factors, including contextual factors that influence effective diagnosis and treatment of child malaria in clinical settings.

### Overall Summary of Paper 3

Although the study conducted in phase 2 initially began by exploring child malaria diagnosis and treatment practices in a clinical setting where malaria rapid diagnostic tests were available, during the course of data collection, we observed a high rate of discordance between physician's diagnosis of child malaria and the results of the malaria RDT. While febrile illness was the chief symptom used to recruit mothers and their children, 88% of the children were wrongly diagnosed with malaria by physicians. Specifically, malaria RDT's confirmed the presence of malaria antigens in 15.6% of the febrile children diagnosed by physicians to have malaria. Results of the malaria RDT's had limited immediate impact on diagnostic patterns and antimalaria prescriptions as physicians continued to diagnose most of the febrile children with malaria and prescribe antimalarial drugs regardless of negative test results. The discordance in diagnosis between physicians and malaria RDT prompted further exploration of the contextual features of the outpatient clinic that enable and/or act as barriers towards effective child malaria diagnosis and treatment. This is particularly important because we had no evidence or reason to question the competency, skill, or training of physicians or their commitment to their patients. We therefore relied on data obtained in the qualitative component of the study conducted in phase 2 particularly the participant observations of mother-physicians interactions during routine consultations, in-depth interviews with recruited mothers, field notes and informal-discussions with physicians.

The overarching argument offered in this paper is that most discussions surrounding the need for effective diagnosis and treatment of child malaria appear to have strayed from exploring the contextual factors in clinical settings that are likely



influence the ability to change current practices related to presumptive diagnosis of malaria or the adoptions of new malaria rapid diagnostic tests currently being introduced to health care facilities. In this paper, therefore, we focused on the process of diagnosing child malaria in a clinical setting in southwest Nigeria in an attempt to understand the role of contextual factors. Given the potential for researcher bias in the recording of observations and information, field notes enabled reflexivity by allowing the researcher to actively engage in critical self-reflection about potential predisposition (Johnson et al., 1997) of appropriate case management of child malaria. Extended field work at the outpatient clinic allowed sufficient amount of time for studying the mechanisms that guide malaria diagnosis during a period where malaria transmission is at its peak. Also, the triangulation of multiple research methods and data sources also improved the internal validity (Johnson et al., 1997) of this study by allowing a better understanding of the reasons underlying diagnosis and treatment decisions for child malaria in this clinical setting.

To contextualize the key factors that influence effective case management of malaria in febrile children attending this outpatient clinic, we began by exploring the process involved with diagnosing malaria in children. Two main mechanisms guide physicians' approach to diagnosing child malaria at this clinic - sequencing and pragmatism. Gross (2009, p. 1823) defines sequencing as the process of relying upon "a set of temporal factors to account for diagnostic changes" in the course of illness. Sequencing allows the initial diagnosis to remain valid despite the fact that symptoms may accumulate and aggravate and their response to medication may decrease over time (Gross, 2009). This is exemplified in consultations where mother's stated that their

child's illness began *'during the previous night' with 'high temperatures' or 'hot bodies,' "coughing," "headache," "loss of appetite," and "vomiting."* Evidence from the checklists from participant observations indicate that sequential factors (i.e. illness beginning at night with characteristic symptoms) guide the diagnostic process with physicians stating directly that the child's febrile illness as interpreted by mothers and the presence of signs and symptoms (i.e. high temperature, headache, coughing) was indeed malaria. Follow-up discussion with one of the physicians revealed that:

Since most malaria transmission with *Anopheles* mosquitoes occurs during the night, most cases at the clinic the following day during high rainy season will indeed be malaria. Also, if mothers state that their children's temperatures were very high during the night, creating sleepless nights for them, I would most likely conclude that their child's illness is indeed malaria.

In describing pragmatism, Gross (2009, p. 1819) stated that it involves "using information only as far as it provides sufficient grounds for treatment decision, leaving ambiguities unresolved." In practice, physicians in this study favored limited use of confirmatory diagnostic protocol (i.e. microscopy since RDT was only available at the clinic for this research), but rather relied on the information provided by mothers as well as visual observation of child for their decisions. While some of the mothers interviewed did not know the specific cause of their child's illness, subsequent malaria diagnosis from physicians facilitated the process of re-defining their child's febrile illness as malaria. In some cases, physician's diagnosis legitimated maternal concerns thereby

creating a sense of hope and trust in the subsequent treatment prescribed. For some mothers, there was a general feeling that the *“doctor’s diagnosis is the best and they will prescribe drugs or injections that will make the child’s symptoms go away.”*

Interestingly, in cases where physician’s diagnosis did not confirm mother’s belief, not having lab tests contributed to difficulties for some mothers with (re)defining their child febrile illness as malaria. Indeed, in-depth interviews following consultations revealed that these mothers felt that their concerns with their child’s febrile illness were minimized or ignored in physician’s quest for definite diagnosis of malaria in their children. For example, despite the physician’s malaria diagnosis and prescribed course of anti-malaria treatment, during the in-depth interview one mother insisted that her son’s illness might still be due to teething as evident in the following statement:

I went to the pharmacy and I bought different types of medicines. I have used tepid sponge on my child to reduce his temperature and I still don’t know what to make of his illness. I am not sure he has malaria as I have tried everything. Even my neighbors say it might be teething since he is 7 months old.

This comment by this mother illustrates the potential pitfalls of presumptive diagnosis as this child may very well be suffering from alternative conditions (such as respiratory infection) that are just as fatal as malaria. The absence of microscopy or RDT makes it impossible to confirm the true cause of fever in this child. As a result, presumptive diagnosis of child malaria has far-reaching consequences, particularly in resource-poor areas where the physician’s diagnoses are often not confirmed for malaria.

In summary, the findings of this paper demonstrate that contextual factors in an outpatient clinic may act in various ways to promote and/or discourage effective

diagnosis and treatment of child malaria. As noted in paper 3, the availability and affordability of antimalaria drugs coupled with access to the clinic (particularly access to pediatricians) adequacy and acceptability of services provided at the clinic could directly act as barriers to effective case-management of malaria among children attending outpatient clinics. A closer examination of context in which child malaria diagnosis occurs (particularly as related to the outpatient clinic where this study was conducted) helps to explain the potential for malaria mis-diagnosis or over-diagnosis at clinical settings. For example, even though microscopy services are free, physicians did not recommend it because of time factor, absence of personnel to perform laboratory tasks and finally, delay in receiving lab results. Given the long queue of patients and inadequate maintenance of microscopy related equipments, presumptive diagnosis of malaria ensures that all febrile children are seen and treated within a short time frame rather than delaying treatment while waiting for parasitological confirmation. In this setting, presumptively prescribing antimalaria treatments to all children with febrile illness was deemed to be necessary given the hyper-endemic patterns of malaria transmission in Nigeria. If antimalarial drugs are to be targeted to those who most need them the most while reducing delays in the treatment of non-malaria conditions, it is important to examine the contextual factors that influence effective case management of malaria. Knowledge of these factors is also important given the concern over malaria misdiagnosis, over-diagnosis, and resistance to antimalaria therapies currently on the market.

## Conclusion

The purpose of this chapter was to present overarching summary of the study conducted during phase 1 and presented in paper 1 as well as the studies conducted in phase 2 and presented in paper 2 and 3. The findings of this dissertation illustrate the importance of understanding the individual, socio-cultural and contextual factors that influence effective case management of malaria in children attending an outpatient clinic in southwest Nigeria. Indeed, a firm understanding of the impact of these factors on diagnosis and treatment practices would in all likelihood substantially contribute to improved case management of malaria among children.

## Chapter 7

### Conclusion

In this chapter, a summary of the overall study is presented alongside the limitations, strengths, future directions and implications of findings for malaria control in Nigeria.

#### 1. Summary of Findings

A number of recent studies have suggested that a number of barriers remain in fight against malaria in endemic countries (Newman, 2010; Schellenberg et al., 2010; Wairagala, 2010). From the evolution and emergence of drug resistance parasites, which may undermine the effectiveness of the new combination therapies currently in the market (Schellenberg et al., 2010; Wairagala, 2010), to the need to address the factors influencing effective case management at the household, community, health care, and even political levels (Newman, 2010), the possibility of controlling, eliminating, and ultimately eradicating malaria in many tropical parts of sub-Saharan Africa seems uncertain (Webb, 2009). Also, more people die from malaria today than 40 years ago (Guerin et al., 2002), and in the absence of effective intervention strategies and the rapid spread of drug resistance, the number of malaria cases might double by 2020 (Breman, 2001).

Malaria-related morbidity and mortality rates remains inequitably distributed not only on a global level, but also on a regional level (Opiyo et al., 2007) as 58% of malaria cases occur in the poorest 20% of the world's population (Barat et al., 2004). It disproportionately affects the poor by imposing significant financial burden on patients and families in resource-poor settings (Barat et al., 2004; Breman et al., 2004; Worrall et

al., 2005). Indeed, “poorer household have less access to treatment, they are more vulnerable to deleterious consequences of malaria, including progression to severe diseases and death” (Worrall et al., 2005, p. 1056). These barriers act in various ways to increase negative health outcomes by delaying access to appropriate treatments and effective use of preventive services. Moreover, the poorest households often have limited access to health services and this may potentially serve as obstacles in accessing prevention and treatment services (Teklehaimanot & Mejia, 2008).

In sub-Saharan Africa, over 70% of patients with suspected malaria do not initially attend health facilities for diagnosis and treatment (Amexo et al., 2004). Prior research has shown that most people do not receive adequate medical attention either because of monetary factors such as treatment costs (Dzator et al, 2004) or access problems due to distance to health facilities. As a result, treatment-seeking for malaria usually begin within households as most people engage in home-based treatment using old medications, drugs bought from local pharmacies, or traditional remedies. When symptoms persist and home-based treatment fails, they attend health care centers as evidenced in the findings presented in paper 1, citing the provision of appropriate treatment and care from physicians at the clinic as essential with treatment seeking for child febrile illness. However, previous literature suggests that even when people attend health care facilities, they do not often receive good-quality diagnosis (Amexo et al., 2004).

The findings presented in paper 2 indicate that when febrile children attend the outpatient clinic in southwest Nigeria, they are diagnosed presumptively with malaria and treated accordingly. Although this routine case management of malaria was

recommended in an era when treatment with “chloroquine was known to be safe, efficacious, readily available, and inexpensive, not surprisingly, the malaria situation in many endemic countries has now changed” (Schellenberg et al., 2010, p. 7). Given the emergence of drug resistance-parasites, new and more expensive artemisinin combination therapy (ACT), with their multidosage/multiday regimens have replaced chloroquine as the first line of treatment for malaria (Mwenesi, 2005). In addition, routine case management of malaria in endemic countries has become increasingly problematic because its signs and symptoms overlap with those of other important febrile illness including pneumonia, acute respiratory infection and sepsis (Amexo et al., 2004; Kallander et al., 2004). The potential for mis-diagnosing alternative causes of febrile illness coupled with high rates of over-diagnosing/over-treatment of malaria, and the need to maximize the cost-effectiveness of malaria treatment, while reducing the potential for drug-resistance are without a doubt compelling reasons to improve diagnostic strategies in endemic countries (Amexo et al., 2004; Schellenberg et al., 2010).

Universal access to diagnostic tests for malaria particularly with reference to scaling up the use of malaria rapid diagnostic tests (RDTs) are among the most commonly proposed solution to long term success of malaria control efforts in endemic countries. The underlying hypothesis is that increasing the use of malaria RDTs in clinical settings may reverse the long entrenched practice of treating all cases of fever as malaria, thereby reducing overuse of artemisinin combination therapies, while providing appropriate care for people with other febrile condition. The World Health Organization has responded to this proposition by recommending diagnostic testing in



all cases of suspected malaria before treatment (World Malaria Report, 2009). However, studies on malaria diagnosis suggest that presumptive treatment of all fevers as malaria remains the norm (Rafael et al., 2006; Hopkins et al., 2008) despite being problematic and microscopy, which for decades has been the gold standard for malaria diagnosis remains inaccessible to most patients due to weak laboratory infrastructure and understaffing of the technical expertise it requires (Hopkins et al., 2008).

The introduction of malaria rapid diagnostic tests offers new opportunities to effectively manage malaria even in health care facilities lacking laboratory facilities. RDTs are easy to use and can aid health care workers to rapidly and accurately distinguish between parasitemic and non-parasitemic febrile illness in areas where microscopy are unavailable (Bell et al., 2006). Still, as the data from this study indicates, the widespread introduction of RDTs requires revisiting the context in which diagnosis occurs as simply deploying RDT's may not translate into better diagnosis for children with febrile illness. Although not explored in this study, emphasis on using RDTs may be unsuccessful, if efforts are not equally made to explore adherence of physician's to the diagnostic results as it is possible that they may not change their diagnostic behaviors given their patient load on a typical day or the number of physicians at a clinic (Chandler et al., 2008). Further, although, the case for WHO policy change is clear and compelling, concordance between physicians' diagnosis of malaria, mother's interpretation of child febrile illness and the results of malaria rapid diagnostic tests have not been thoroughly examined.

The findings presented in paper 2 specifically addressed the degree of concordance between physicians' diagnosis, mother's interpretation of child febrile

illness, and confirmation with malaria RDT. In the context of providing effective clinical care, a surprisingly high rate of discordance was found between physician's diagnosis of malaria and the results of the malaria rapid diagnostic tests as physician's diagnosis were confirmed by the results of the malaria RDTs only a dismal 15.6% of the time. The findings underscore the importance of examining the context in which child malaria diagnosis occurs. Simply put, introducing RDT's in clinical settings in malaria endemic countries might be futile if the same vigor is not applied to understanding the contextual features of health care facilities clinic that enable and/or discourage effective diagnosis and treatment of child malaria.

The findings presented in paper 3 are critical for intervention strategies aimed at increasing coverage of improved malaria diagnostics at health care facilities. Evidence related to availability of drugs and additional laboratory testing for malaria, affordability of antimalaria drugs, access to the clinic (particularly access to pediatricians), adequacy and acceptability of services provided at the clinic suggests that contextual factors play a key role in influencing effective case management of child's malaria. For example, although laboratory testing are free for children attending this clinic, physicians did not recommend it because of time factor, absence of technical expertise to perform laboratory tasks and finally, delay in receiving lab results. As a result, presumptively diagnosing and prescribing antimalaria treatments to all children with febrile illness was deemed to be necessary by physicians particularly as malaria transmission is hyper-endemic in this region of Nigeria. Clearly, the minimal use of laboratory support for diagnosis of malaria in children at this outpatient clinic contributes to malaria over diagnosis and leads to a failure to treat or a delay in the treatment of alternative life-

threatening non-malaria diseases such as pneumonia, acute respiratory disease, or sepsis. Also, even when referrals for tests are made, physicians in this setting also performed the task of collecting blood specimens (in most cases the following morning), while mothers transported it to the labs. Indeed, this approach leads to long delays in the collection and testing of blood specimens and it does not guaranteed proper handling or delivery of specimen (Petti et al., 2006). For these reasons, the free laboratory services at this clinic were often underutilized while physicians elected to proceed with treatment based on presumptive diagnosis. The findings of this study highlight the importance of taking into account the context in which diagnostic and treatment practices occurs as malaria is one of the most frequent diagnosis made in sub-Saharan Africa (Chandler et al., 2008). Failure to disentangle the role context plays particularly in relation to physician's decision-making for malaria diagnosis might impede efforts aimed at targeting the new and expensive artemisinin combination therapies to children who need them the most.

At a time when individuals, families, and communities adapt to the new and more expensive artemisinin combination therapies being introduced into the market, with their multidosage/multiday regimens (Mwenesi, 2005), "big hurdles remain in sub-Saharan Africa's fight against malaria" (Wairagala et al., 2010, p. 10) as hopes of vaccines remain distant. Also, it's been suggested that malaria is a complex disease both because of what we know and what we don't know (Webb, 2009). While new opportunities that hold promise for improving malaria diagnosis with RDTs are underway, the findings of this study demonstrate that these efforts will only achieve maximum potential if knowledge of the individual, socio-cultural and contextual factors

that influence diagnosis and treatment practices are available. Incorporating knowledge of these factors is fundamental to the success of efforts aimed at controlling, eliminating, and ultimately eradicating malaria in many endemic countries. Study findings also have implications for ensuring that access to effective and improved diagnosis for malaria is achieved in endemic countries while limiting the potential for malaria mis-diagnosis, over-diagnosis and over-prescribing of antimalaria drugs.

## 2. Limitations

There are several limitations of the study. First, the in-depth interviews were conducted among mothers who were recruited from a health care facility and the information obtained was based on interview responses that may be prone to bias. The findings of this study are also limited to selection bias as participants recruited from an outpatient clinic may differ from those who do not go to a clinic for diagnosis and treatment of their child's febrile illness. In fact, it is also possible that mothers who seek care at clinics may be more assertive about their child's presenting problems and this may influence the physician's diagnosis and prescribing pattern. However, this was not the case in this study as the mothers interviewed rarely contested, negotiated, or challenged any diagnostic or treatment decisions of the physician.

Also, one caution about our population is that it is plausible that some mothers with febrile children in search of answers to their child's illness may exaggerate the severity and persistence of sign and symptoms observed in their children in hopes to receive additional testing so as to accurately pin-point the cause of illness. Future studies with mothers with febrile children outside clinical settings are necessary to

determine whether these actions occur. Moreover, the use of probes or symptom lists in future studies may reduce the potential for over-reporting or underreporting of morbidity by mothers.

In addition, there is always the possibility that the physicians may have altered their diagnostic and prescribing behavior to err on the side of diagnosing malaria due to the presence of the research study (e.g. Hawthorne effect). To minimize this effect, efforts were made to not interfere with consultations, allowing physicians to diagnose and prescribe child malaria treatment according to their routine. Indeed, all the children with suspected malaria were diagnosed presumptively by physicians and treated according to institutional protocol at that clinic prior to the collection of blood samples for malaria RDTs and the availability of the results. Also, the generalizability of our findings is limited since this outpatient clinic may not be representative of other outpatient clinics in malaria-endemic countries. Further, the lack of space in which to conduct this study may contribute to bias in reporting some of the findings. However, observations of the diagnostic process as well as the interactions with doctors enabled actions and decisions related to routine consultations to be recorded.

### 3. Strengths

Despite these limitations there are several strengths of this study worth mentioning. First, to my knowledge, this study represents the first application of PEN-3 cultural model with malaria treatment practices in endemic countries. The use of PEN-3 cultural model in this study allowed for an exploration of treatment seeking practices that not only promote effective case management of malaria in children, but also an exploration

of unique practices that have no harmful health consequences as well as practices that act as barriers. Second, the use of malaria rapid diagnosis tests is critical in this study as reliance on presumptive diagnosis alone often results in a high proportion of mis-diagnosis or over-diagnosis which in turn may prolong and worsen child illness as well as create missed opportunities to treat diseases other than malaria (WHO, 2004).

Third, effective case management of malaria in clinical settings where malaria RDTs are available involves understanding the degree of concordance between physician's diagnosis of malaria, maternal perception of malaria in their children and the results of malaria RDTs. By examining this probability of agreement, this dissertation provided valuable insights on the importance of understanding the context in which child malaria diagnosis and treatment practices occurs. Finally, the use and triangulation of multiple research methods (i.e. semi-structured interviews, participant observations, informal discussions, field notes, diagnosis based on RDTs) offered important insights on individual (maternal characteristics), socio-cultural (perceptions and beliefs) and contextual factors (availability of treatment regimes and diagnostic tests) that influence effective case management of child malaria in a clinical setting. It also enabled a better understanding of the clinical logic and reasons underlying diagnosis and treatment decisions for child malaria at this outpatient clinic.

#### 4. Future Directions

Increased interest in malaria diagnosis, particularly as it relates to mis- and over-diagnosis has received considerable attention in available literature. As evidenced in this study, diagnosing malaria has become ever more problematic as its signs and

symptoms overlap with those of other acute febrile illnesses. At a time of growing concern about resistance to new and expensive antimalarial drugs currently on the market (WHO, 2010) and the consequences of mis- and over-diagnosis (Amexo et al, 2004; Ansah et al., 2010) further research is needed to identify micro-and macrolevel factors that influence diagnosis and prescription of antimalarials in multiple clinical settings where malaria rapid diagnostic tests (RDTs) are routinely available. Participants may include caretakers and their children as well as physicians in different clinical settings.

Future studies should also endeavor to use multi-level modeling to examine potential contextual factors essential for understanding child malaria diagnostic and treatment decisions. Measures of appropriate case management of child malaria should also be considered. For example, it is important to examine the following: 1) whether the physicians request malaria tests using available diagnostic tools or continue to engage in presumptive diagnosis; 2) whether they treated children with antimalarials without any form of diagnostic test; and 3) whether they treated children who had negative RDT results with antimalarials. Variables to be collected may include the following: Patient—age and gender of the child, associated symptoms, temperature, weight; Consultation variables such as history taken, examinations performed, any test requested, diagnoses, medications prescribed, results of RDTs; Caretakers—age, education, gender, ethnicity, occupation; Physician characteristic such as—age, gender, year of graduation, date started working at the clinic, patient load on a typical working day, salary bracket; and Clinic variables—urban or rural location, private- or government-owned, primary care vs. secondary care or tertiary care. Since caretakers/children

recruited are nested within particular physicians who in turn are nested in different clinical settings, multi-level modeling will account for the multilevel structure of the data collected as well as to control simultaneously for the possible confounding effects of the different variables collected.

Since malaria is increasingly recognized as a complex disease operating on multiple levels, improving malaria control strategies in Sub-Saharan Africa requires advanced research methodology aimed at understanding the multiple contexts that influence malaria burden. Jones and Williams (2004) suggested that malaria is not an isolated issue in people's lives and so efforts should be made to integrate malaria control interventions within the broader multi-contexts (e.g. structural, behavioral etc) in which malaria occurs. Thus, multi-level modeling may foster the analysis of the complex questions surrounding the multiple factors that influence effective case management of malaria in clinical settings.

#### 4. Implications for malaria control in Nigeria

Unlike other countries experiencing decline in the burden of malaria, little progress has been made in Nigeria with controlling, eliminating, and ultimately eradicating malaria. Existing evidence suggests that malaria remains a major public health problem in Nigeria accounting for 60% of outpatient visit to health facilities and 132 billion naira financial loss to treatment and prevention costs (NMCPN, 2005). Also, although about one-third of children do not receive any anti-malaria drugs with the onset of febrile illness and when they do receive drugs, chloroquine is the most commonly used medications for the treatment despite its known resistance to malaria parasites



(NMCPN, 2005). The findings of this study are significant as caretakers become accustomed to artemisinin combination therapies currently in the market. Indeed, persistence of symptoms despite use of antimalaria drugs sheds lights on why some caretakers continue to delay in seeking treatment for the onset of child's febrile illness promptly at a health care facility. It may be that caretakers engage with home-based treatment using chloroquine. However, in settings where health care services are free, the findings presented in paper 1 demonstrate that appropriate antimalaria treatment coupled with care from physicians were critical in generating positive response to child malaria.

Paper 1 also highlights the need to consider not only positive responses that encourage effective diagnosis and treatment for child malaria, but also an acknowledgement of existential responses (i.e. teething influenced decision to attend clinic) as well as an examination of the negative response that may serve as barriers to effective treatment (i.e. my child's illness is not severe) as they are equally critical in influencing mothers' management of malaria in their children. This is important in the Nigerian context as well as in other endemic countries as emphasis on changing negative perceptions alone may be severely limiting if it fails to also consider other factors, including positive or existential factors that might influence treatment-seeking behaviours for child malaria.

In many clinical settings in Nigeria, microscopy remains the gold standard used to confirm cases of malaria. However, in settings where use of this equipment is limited due to patient load on a typical day (i.e. 0-60 patients a day), as was the case in the outpatient clinic where this study was conducted, presumptive diagnosis of malaria

based on observable signs and symptoms and illness narrative remains the norm. Physicians engage in presumptive diagnosis because it is efficient even though not effective compared to referrals for microscopy and it ensures that all patients are treated within a short time frame. Moreover, as one physician aptly stated;

“90% of cases are indeed malaria or something else. If we conducted tests it will take at least 2 days before results will come out, by then malaria may have worsened, so it’s better to treat immediately due to the massive volume of patients we see in any given day.”

This practice however, is likely to result in erroneous management of millions of non-malaria cases, over-prescribing of antimalarials, and unnecessary exposure to side effects of drugs, while true cause of illness many not be recognized or treated appropriately (Amexo et al., 2006; Zikusooka et al., 2008). Considering the hyper-endemic patterns of malaria transmission in Nigeria, it is therefore important to improve case management during routine clinical practice using reliable, easy-to use, and inexpensive diagnostic tools that are safe and require minimal laboratory infrastructure.

Malaria rapid diagnostic tests offer the opportunity for improved diagnosis of malaria in Nigeria as it allows for reliable detection of malaria antigens in blood samples. Although there is a need to equip health care facilities in Nigeria with RDTs in order to facilitate improvements in case management of malaria, it is essential to also examine whether maternal interpretations of child’s febrile illness and subsequent diagnosis of malaria by physicians during routine clinical consultations correspond to

the results of malaria rapid diagnostic tests. The results presented in paper 2 illustrate a high rate of discordance particularly between physician's diagnosis and the results of the malaria, however there are a number of contextual factors that should be taken into account in light of these findings. The findings presented in paper 3 demonstrates that although RDTs has the opportunity to potentially improve case management of malaria in Nigeria, these tools will only achieve maximum potential if knowledge of the context in which diagnosis occurs is available. Achieving this potential also requires a major paradigm shift in the strategies guiding malaria diagnosis in clinical settings, particularly as failure to address the contextual factors that influence presumptive diagnosis may impede overall efforts to control, eliminate, and ultimately eradicate malaria in Nigeria.

In summary, despite encouraging results of declines in the burden of malaria in many parts of Africa, major challenges remain in the fight against malaria in Nigeria. In 2009, the World Health Organization recommends the confirmation of malaria through parasite based diagnosis prior to the start of treatment, yet this approach remains elusive in many clinical settings in Nigeria with physician's engaging in presumptive diagnosis. Health care systems in Nigeria face increasingly severe resource constraints and this may impede efforts to improve case management of malaria with better diagnostic tools. Thus, although the need to scale up universal access to diagnostic test in Nigeria is important, these efforts might be futile if a detailed situational analysis of the performance of health care systems is not available (Moerman et al., 2003). Also, investing in RDTs without addressing diagnostic attitudes and prescribing behaviors of physicians or even expectations of patients/caretakers is unlikely to improve effective case management of malaria. Developing guidelines which serve to address the long-

standing approach of presumptively diagnosing malaria in Nigeria alongside using RDTs to target antimalarials to children who need them may go a long way towards reducing malaria over-diagnosis and missed diagnosis of non-malaria cases in clinical settings.

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## **Appendix A**

### **Study Recruitment**

**Title of Project:** A biocultural study on child malaria in Southwest Nigeria.

**Introduction:** Hello, my name is Juliet Iwelunmor and I am conducting a study on child malaria and patterns of treatment seeking among mothers living in Southwest Nigeria.

This study is conducted for research purposes and the results from this study will be used for a doctoral dissertation research by a student from Penn State University in the United States.

**Eligibility:** There are several criteria that would exclude you from this study:

Are you at least 18 years old?

Do you have a child under age 5 with a recent history (past 2 weeks) of malaria?

If participant meets eligibility criteria stated above, the study will be explained to them as stated below.

**If participant is interested, the following steps will be explained to them:** “Since you meet our initial eligibility criteria, the next step is to give the informed consent form for you to review, ask questions and sign if you are interested in participating in this study. “ Do note that parental consent is required for individuals under the age of 18 who participate in this study.

**Right to Ask Questions:** If you have any questions about your rights as participants in this research study, or if you do not like what is being done, you can either contact the researcher, Ms. Juliet Iwelunmor, at [jia111@psu.edu](mailto:jia111@psu.edu) or you can contact – anonymously, if you wish – Dr. Oladipo Idris, Family Medicine Doctor at LASUTH at [holladipo@yahoo.com](mailto:holladipo@yahoo.com).

## Appendix B

### Interview Script

#### A biocultural study on child malaria in southwest Nigeria: Questionnaire #:

Name of Mother:                      Age of child:                      Child's Sex:    Number of children:

Age of mother:                      Ethnicity:                      Highest Education: None    P    S    H

Occupation: None    H.WIFE    Trader    Artisan    Civil-Servant

Professional\_\_\_\_\_

Which do you own in your house: Radio TV    Gen    Car    Motorcycle

Do you use public transportation: Yes    No

Where does the water in your house come from: borehole    river    well

other source\_\_\_\_\_

How long does it take to go from you house to the hospital: 30mins    1hr    2hr

3hr-longer

How would you rate the quality of care at the hospital? Excellent    Average    Poor

What do you like best about this hospital?

#### Interview

Please tell me about your child's illness. When did it begin/How did you manage it?

Did you go to the hospital immediately or pharmacy? If pharmacy, what did you buy?

Did your child get better?

What do you call this?

What do you think caused your child's illness?



Why do you think it started when it did?

How severe is your child's illness?

Since it started what have you done or given to help your child?

What are your reasons for bringing your child to the hospital?

What are the problems your child's illness has caused?

What do you worry or fear most about your child's illness?

What do you feel would help you (and your family) in caring for your child with this illness? What as a hospital can we do better?

If your child's illness is malaria (after we run the test), how do you plan to prevent malaria?

What will you need to help you manage your child's malaria?

Will malaria medicines be given to you for free or will you buy them? Where will you buy them from?

Is the price of malaria medicine affordable to you? Yes                      No

(Why)\_\_\_\_\_

## Appendix C

### Checklist for Observation and Participant Enrollment Form

Please record the presence of either fever, cough, diarrhea, vomiting, or convulsions in participant at time of consultation and if diagnosis is malaria, upper respiratory infection, bronchopneumonia, or gastroenteritis.

Child's age: Child's sex: Weight: Temp.

Mother's Compliant: Clinical Diagnosis

- |    |    |
|----|----|
| 1. | 1. |
| 2. | 2. |
| 3. | 3. |
| 4. | 4. |
| 5. | 5. |

**Attending Physician:**

## **Appendix D**

### **Research Protocol**

**Title: A biocultural study on child malaria in southwest Nigeria**

Funding Source: National Institutes of Health, *Eunice Kennedy Shriver National Institute of Child Health and Human Development Predoctoral Fellowship*, The Africana Research Center, The Pennsylvania State University

IRB Approval Number: 33082

IBC Approval Number: 33611

Principal Investigator: Juliet Iwelunmor

### **Protocol**

**Purpose of the study:** The purpose of this study is to explore maternal perception of child malaria and to clinically test the presence of malaria parasites using the malaria rapid diagnostic test kit. This research involves the collection of a finger prick of blood sample to detect the presence of malaria parasites as well as in-depth interviews and focus group discussions on child illness episodes and patterns of treatment seeking for child malaria. The results from this study will be used for a doctoral dissertation research project by a student from Penn State University in the United States. The purpose of the research is to gain a better understanding of maternal perceptions of child malaria and as well as examine patterns of diagnosis and treatment practices in Southwest Nigeria. The data will be used to look at ways to reduce child malaria in Nigeria.

**Study Site:** This study will be conducted in an outpatient pediatric clinic located in southwest Nigeria.

**Target Population:** Participants included mothers with febrile children attending the outpatient clinic.

**Procedures to be followed:** Recruited participants will be asked to answer questions about recent episode of your child's malaria. Also, a finger prick of blood sample will be collected from your child to detect the presence of malaria parasites using the malaria rapid diagnostic test kit. Case history interviews and observations will be conducted with participants whose children are diagnosed by the clinician with malaria. You must be 18 years of age or older to consent for your child to participate in this study as well as to complete the interviews and discussions on child malaria. The blood sample will be collected only once. The interviews and focus group discussions will be audio-recorded.

**Discomforts and risks:** Some of the questions that will be asked will be of a sensitive nature, such as personal barriers and challenges towards treatment seeking for child malaria. Also the potential exists for discomfort during the collection of finger prick of blood samples. However, you have the right to decide whether to answer any questions and to withdraw your consent at any time during the interview without any negative consequences to you.

### **Data Management**

Recruited participants answers to the in-depth interviews and focus group discussions will be kept confidential. The results of the malaria rapid test will also be kept confidential. If you speak about the contents of the focus group outside this group, it is expected that you will not tell others what individual participants said. Any answers

provided and the results of the malaria rapid test will not be connected to any information that would identify you. All completed interview recordings and discussions and the results of the rapid test will be kept in secured files by the researcher. The researcher and her faculty advisor are the only people who will have access to the interviews, discussions and the results of the rapid test. Penn State University's Office for Research Protections, the Institutional Review Board, and the Office for Human Research Protections in the Department of Health and Human Services may review records related to this research study. All records associated with your participation in the study will be subject to the usual confidentiality standards applicable to medical records (e.g., such as the results of the malaria rapid test). In the event of any publication resulting from the research, no personally identifiable information will be disclosed. The data and recordings will be stored and secured at Penn State University in a locked file. The interview recordings, discussions and results of the rapid test will be kept for three years after the project ends in 2011. The researcher administering the survey will keep anything she may know about you confidential. In the event of any publication or presentation resulting from the research, no personally identifiable information will be shared.

**Juliet Iwelunmor**  
Curriculum Vitae

**EDUCATION**

- 2011 Ph.D. in Biobehavioral Health with a minor in Demography,  
Pennsylvania State University, University Park, PA
- 2006 B.S. Human Development and Family Studies with a minor in Sociology,  
Pennsylvania State University, University Park, PA.

**PROFESSIONAL EXPERIENCE**

- 2006-2011 Graduate Research and Teaching Assistant, Department of Biobehavioral  
Health, The Pennsylvania State University, University Park, PA
- 2006 Global InfoBase research Intern at The World Health Organization,  
Geneva, Switzerland.

**TEACHING EXPERIENCE**

- 2010 (Fall) Guest Lecturer: BBH 302: Diversity & Health & BBH 305: Introduction to  
Global Health
- 2010 (Spring) Guest Lecturer-BBH 407: Global Health Equity
- 2009 (Summer) Instructor-BBH 119: Health, Behavior & Disease
- 2007(Fall) Teaching Assistant-BBH 302: Diversity & Health
- 2006(Spring) Teaching Assistant-BBH 310W: Research Strategies
- 2006(Fall) Teaching Assistant-BBH 301: Values & Ethics & BBH 119: Health,  
Behavior & Disease

**PUBLICATIONS**

Iwelunmor, J., Idris, O., Adalokun, A. & Airhihenbuwa, CO (2010) Child malaria treatment decisions by mothers of children less than five years of age attending an outpatient clinic in south-west Nigeria: an application of the PEN-3 cultural model. *Malaria Journal*, 9:354

Iwelunmor, J, Zungu, N, & Airhihenbuwa, CO (2010) Rethinking HIV/AIDS Disclosure among women within the context of Motherhood in South Africa. *American Journal of Public Health*, 100 (8), 1393-1399

Airhihenbuwa CO, Okoror TA, Shefer T, Brown DC, Iwelunmor J, Smith E, et al. (2009). Stigma, Culture, and HIV and AIDS in the Western Cape, South Africa: An Application of the PEN-3 Cultural Model for Community Based Research. *Journal of Black Psychology*, 35(4):407–432.

Iwelunmor, J, Airhihenbuwa, CO, Okoror, TA, Brown, DC & Belue, R. (2007) Family Systems and HIV/AIDS in South Africa, *International Quarterly for Community Health Education*, 27(4), 321-325

**HONORS AND AWARDS**

- 2010-2011 Eunice Shriver National Institute of Child Health and Human Development (NICHD) Predoctoral Fellow
- 2010 Biobehavioral Health Graduate Student Scientific Achievement Award
- 2009-2010: Hintz Graduate Education Enhancement Fellowship Recipient,
- 2009-2010: Albert and Lorraine Kligman Fellow in Health and Human Development
- 2008-2009: Hintz Graduate Education Enhancement Fellowship Recipient,
- 2008-2009: Pennsylvania State Africana Research Center Fellowship Recipient,
- 2006-2010: Bunton Waller Fellowship at Pennsylvania State University.