Willingness to use and pay for a new diagnostic test for malaria in children under 5: 
Results from Benin, Peru, and Tanzania

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Abbreviations

ACT Artemisinin combination therapy
ALRI Acute lower respiratory infection
ANOVA Analysis of variance
CAME Central d’Achat des Médicaments Essentiels et Consommables Médicaux (Center for the Purchase of Essential Medications and Medical Consumables, Benin)
CDC US Centers for Disease Control and Prevention
CFA African Financial Community Franc (Francs Communauté Financière Africaine), the currency used in Benin
CHS Center for Human Services
CHWs Community Health Workers
CQ Chloroquine
DPM Directorate of Pharmacies and Medicines
ESSALUD Social security system (Peru)
FBO Faith-based organization
GDF Global Drug Facility
GDP Gross Domestic Product
GNI Gross National Income
HBM Health Belief Model
HIV/AIDS Human immunodeficiency virus/acquired immunodeficiency syndrome
HRP2 Histidine rich protein 2
IHI Ifakara Health Institute
IMALDIA Improving Malaria Diagnosis Project
INS National Institute of Health (Peru)
JICA Japanese International Cooperation Agency
JMP
MOH Ministry of Health
MoHSW Ministry of Health and Social Welfare
MSD Medical Stores Department
NACP National AIDS Control Program
NGO Non-governmental organization
NMCP National Malaria Control Program
OLS Ordinary least squares
PCR Polymerase chain reaction
pLDH Plasmodium Lactate dehydrogenase
PMI US President’s Malaria Initiative
RDT Rapid diagnostic test
S/. Peruvian nuevos soles
SP Sulfadoxine Pyrimethamine
STI Sexually transmitted infection
UNICEF United Nations Children’s Fund
WHO World Health Organization
WTP Willingness-to-pay
ZMCP Zanzibar Malaria Control Program
The spread of infectious diseases is a critical global health concern. Despite recent progress in the availability of powerful drugs, many treatable infectious diseases continue to exact a terrible toll worldwide, particularly in developing countries. The World Health Organization (WHO) estimates respiratory disease to be a leading cause of infant death in countries with high childhood mortality rates. Malaria is estimated to cause 1–3 million deaths and 500 million–5 billion episodes of clinical illness, mostly in Africa.\(^1\) In 2005, an estimated 2.3 million children worldwide were living with HIV/AIDS, 2 million of them in sub-Saharan Africa. About a third of the world’s population is infected with the tuberculosis (TB) bacillus, and as many as 2 million people die of the disease each year. Among people with HIV/AIDS, TB is the leading cause of death. The highest rates of TB are in some of the world’s poorest countries, exacting an enormous economic toll.\(^2,3\) Likewise, sexually transmitted infections (STIs), such as gonorrhea and chlamydia, pose significant health risks, with prevalence rates as high as 40% even in low risk populations in Africa. Syphilis remains a major health problem during pregnancy, with an estimated prevalence rate as high as 18% among pregnant women attending antenatal centers in Africa. Diarrheal diseases affect an estimated 1–4 billion children under age five in developing countries, resulting in about 2.5 million deaths (85% of which occur in the poorest parts of the world); in some countries these diseases account for more than 20% of all deaths in children under age five.\(^1,4\)

To make treatment accessible, it is essential to identify those who require treatment; to administer and monitor appropriate treatment; and, importantly, to prevent overtreatment, which can cause the spread of drug-resistant microbes. At present, the diagnostic tools used in developing countries have many limitations and are largely inadequate for addressing health needs. There is a growing need to develop and test better and more accessible diagnostic tools for several infectious diseases, tools that would be particularly tailored to developing-country realities. In response, the Global Health Diagnostics Forum of the Bill and Melinda Gates Foundation recognized in 2004 the importance of access to appropriate and accurate diagnostic tools to evaluate and improve global health. The forum recommended focusing on six diseases or syndromes that cause among the highest disease burdens in the developing world: acute lower respiratory infections (ALRI), HIV/AIDS, diarrheal diseases, malaria, TB, and STIs.

In 2007 the Gates Foundation awarded a grant to the Center for Human Services (CHS) to research potential demand for diagnostic tests for five of these disease areas: ALRI, HIV, malaria, TB, and STIs. Research on potential demand for diarrheal disease diagnostics was deferred pending further technical and clinical discussion. CHS is advancing the Gates Foundation’s vision of accelerating access to existing vaccines, drugs, and other tools to fight diseases that disproportionately affect developing countries and of identifying new health technologies that would be effective, affordable, and practical in resource-poor settings in the developing world.

CHS conducted research to evaluate potential demand for new diagnostic tests and identify factors that might affect that demand among consumers and within the public, private for-profit, and private non-profit health sectors. This report on malaria diagnostics for children under 5 is one of a series of reports from that research. The research objectives were to:

- Estimate consumer willingness to use and pay for new diagnostic tests,
- Examine the factors that influence consumer willingness to use and pay for these tests,
- Examine the extent to which health care providers and program managers see diagnostic tests for these illnesses as priorities in their countries, and
- Describe a few specific past experiences with the introduction of new diagnostics into specific countries to identify issues that should be considered before introducing new tests in the future.

The research includes six reports, one for each diagnostic included in the study:

- A test to screen for syphilis in pregnant women as a routine part of antenatal care;
- A test for gonorrhea and chlamydia in high risk asymptomatic populations;
• A test for (HIV) in children under 18 months of age;
• A test for active TB in HIV-positive and HIV-negative patients;
• A test for malaria in children under age five; and
• A test for bacterial ALRI in children under age five.

For purposes of this study, syphilis was considered separately from gonorrhea and chlamydia because the target population for syphilis screening (pregnant women) was different from the target population for gonorrhea and chlamydia (high-risk asymptomatic populations such as commercial sex workers).

The project covers four countries: Benin, India, Peru, and Tanzania. Results for Benin, Peru, and Tanzania are presented as part of the report for each diagnostic. Each report provides country demographic and epidemiological profiles along with information on the current standard of diagnosis. Information for the study comes from health worker interviews and consumer surveys and focus groups, as well as from literature. The interviews provide data on the degree to which health professionals at different management and service-provider levels were satisfied with the current diagnostic standard or saw a need for a newer technology. The surveys and focus groups offer perspectives on consumer willingness to pay, factors that influence willingness to pay, and consumer preferences about different types of diagnostic samples (e.g., blood, urine, sputum, etc.). CHS is conducting additional research in India and will publish those results separately.

Case studies examine past experiences with introducing diagnostic tests as a way of smoothing the way for introduction of new diagnostics as they become available. The four case studies being completed as a part of this project include:

• Discussion about the adoption of rapid syphilis tests in Tanzania,
• Development and introduction of microscopic drug susceptibility testing to diagnose TB and test for multi-drug resistant TB in Peru,
• Use of malaria rapid diagnostic tests by volunteer community health workers in remote areas of the Peruvian Amazon, and
• Use of STI diagnostics in the private sector in India.

For more information on the project and for copies of other reports, please contact the Bill & Melinda Gates Foundation or visit its Web site: http://www.gatesfoundation.org.
Executive Summary

Introduction

This report presents the results of a study on the perceived need for a new malaria diagnostic test for children under 5 in Benin, Peru, and Tanzania. The study was designed to assess potential demand for such a test and identify factors that might affect that demand among consumers as well as health care providers and program managers. Study objectives were to:

- Estimate consumer willingness to use and pay for a potential new malaria test;
- Examine the factors that would influence consumer willingness to use and pay for such a test;
- Determine the extent to which health care providers and program managers see a new test of this type as priority in their country both in absolute terms and relative to other health priorities.

The study included in-depth interviews with health care providers in the public, private for-profit, and private non-profit sectors in each country. It also included surveys on consumer willingness to use and pay for a new malaria diagnostic test and focus groups exploring reasons for the results of these surveys.

Methods

Field work for this study occurred in Benin, Peru, and Tanzania between March 2007 and April 2009. During visits to each country, Center for Human Services (CHS) staff collected data on health provider and consumer perspectives about the need for, willingness to use, and willingness to pay for new malaria diagnostic tests. In each country, the study team visited at least three different regions, collecting data from consumers and providers in both urban and rural areas. Thus, though the study is not completely representative of each country’s population, it includes a wide variety of socio-economic, cultural, and geographical perspectives.

In each country, the CHS team conducted semi-structured, in-depth interviews with public and private sector health personnel – physicians, laboratory technicians, program managers, and pharmacists – to explore their perspectives on factors relevant to new malaria diagnostics. CHS asked health providers about their views on current diagnostic approaches and unmet diagnostic needs, as well as past experiences with adopting new diagnostic tools. Interviewees included national and district-level managers as well as frontline clinicians. To the extent possible, CHS interviewed directors of relevant national programs: AIDS, tuberculosis, malaria, sexually transmitted infections, and maternal and child health. Interviews also included donor representatives and private for-profit and non-profit program managers and clinicians.

Consumer willingness to pay was assessed with a survey of about 40 questions covering socio-demographic information, past and present care-seeking behavior, and willingness to pay itself. Surveys also included questions assessing what type of sample (e.g., blood, urine, stool, etc.) respondents considered most appropriate for the diagnostic about which they were being interviewed and why they considered that choice most appropriate.

Based on WTP survey findings, CHS conducted follow-up focus group discussions to explore factors influencing consumer willingness to use and pay for diagnostics. These discussions helped explain why survey respondents said they would be willing to pay more for certain types of diagnostics than others. The groups also helped explain why consumers expressed a preference for one type of sample (e.g., blood, urine, sputum) over another. Finally, the discussions explored consumer perceptions about each illness and the benefits of and barriers to seeking diagnostic testing. CHS designed the focus group discussions using the Health Belief Model (HBM), a theoretical framework developed by the U.S. Public Health Service in the 1950s to explore U.S. consumer behavior related to TB diagnosis. It has since been used in many other contexts in both the U.S. and internationally.
Results

**Benin**

Beninese integrated management of childhood illness (IMCI) and National Malaria Control Program (NMCP) guidelines both stipulate clinical diagnosis of uncomplicated malaria in children under five: fever > 37.5°C or recent history of a fever and other associated signs. No biological tests are done to confirm diagnosis. The country is beginning to use malaria rapid diagnostic tests (RDTs) for patients over age 5 since microscopy is unavailable at most public facilities and NMCP policy reserves ACTs for laboratory confirmed cases. Though defined by the MOH, this policy is made possible through donor support for both RDT procurement and improved microscopy to determine parasite density and provide quality assurance for RDTs.

In both spontaneous listings and card ranking of most-needed new diagnostic tests, Beninese providers usually listed malaria, and more specifically malaria in children under five, as their most pressing priority. At the time of these interviews, malaria RDTs were new to Benin and many providers had only recently become aware of their existence. However, several respondents expressed concern about not treating children with RDT-negative results. Another major theme was the need for a test, in this high prevalence country, that provides parasite density. Respondents were also concerned about the risks of dependence on donor funds when adopting new diagnostic methods.

More than 90% of Beninese consumers surveyed indicated willingness to use and pay for diagnostic tests for all diseases included in the study. However, the amount consumers reported being willing to pay for a malaria diagnostic, 1488 CFA, was less than for any other test. At a price of 500 CFA, 95% of Beninese consumers reported being willing to pay for a malaria diagnostic test. However, WTP dropped by 25% as the price increased from 500–1000 CFA and again as it increased from 1000–1500 CFA and then by another 29% as the price increased from 1500–2000 CFA. As the price rose above 2000 CFA, WTP fell below 10%. Viewed from another angle, a malaria diagnostic priced at 500 CFA (about US $1.19 at the time of the study) would exclude only 5% of consumers in Benin, but one priced at 1000 CFA (about US $2.38) would exclude 30%. At a price of 1500 CFA (about US $3.56) more than half of the population would be unwilling or unable to pay.

Beninese consumers participating in focus groups were divided in their perceptions about the severity of malaria. Some said that malaria is not very severe compared to the other illnesses being discussed; some cited the availability of anti-malarial medication as evidence that the illness is not very serious. Others classified malaria as a very severe illness especially in children. Most Beninese respondents said that they feel highly susceptible to getting malaria, but most feel that malaria does not require a test for diagnosis. Many respondents said that malaria is so common and its symptoms so familiar that diagnostic tests are not required: Doctors can simply recognize the symptoms and prescribe accordingly. Almost all agreed that malaria is easy to treat, either through at-home traditional medicine or by seeking biomedical treatment from a pharmacy or hospital.

**Tanzania**

In 2007 when CHS initiated this study in Tanzania, national norms stipulated presumptive treatment for children under five, as recommended by IMCI guidelines. Although not every public facility had IMCI-trained providers, it was NMCP policy that all fevers in under-fives should be treated presumptively. However RDTs have been used in Tanzania since at least 2003 and became more widespread in 2007, when the US President’s Malaria Initiative (PMI) purchased about 800,000 kits for trial use. In early 2009, the Mainland NMCP began introducing RDTs as the first line diagnostic tool for all age groups at all levels of the public health system. By May, RDTs had been placed in all government hospitals in the Dar es Salaam region, and were scheduled for expansion to the Iringa region in the following months. Approximately 26 million RDTs will be distributed nationally over the next five years, starting in low to
moderate transmission areas. Zanzibar is also considering a shift in their IMCI algorithm for management of fever to one designed for areas of low malaria endemicity.

At the time CHS began to interview Tanzania health professionals in 2007, there was a high perceived need among many respondents for rapid malaria tests for both children and adults. Many interviewees categorized a new diagnostic in children as very high priority due to malaria’s contribution to under 5 morbidity and mortality. However, a number also stated that they would go ahead and treat for malaria regardless of test results; these respondents felt that any test with less than 100% sensitivity would allow some children with malaria to go untreated, which they considered too risky. The need for improved diagnosis was tempered by concern that the government would be unable to sustain the program in the long term without significant donor support.

As in Benin, the amount consumers reported being willing to pay for a malaria diagnostic test, Tsh. 1116, was lower than the amount they reported being willing to pay for any other diagnostic included in the overall study. While 98% of Tanzanians surveyed expressed willingness to pay Tsh 100 (about US $0.10) for a test, less than 75% reported being willing to pay Tsh 500 (US $0.43), and less than 50% Tsh 1000. A price of Tsh. 1500 (about US $1.30) would exclude nearly 80% of consumers.

Tanzanian focus group participants identified malaria as a severe illness, particularly in children, since it can lead to anemic, dehydration and death. They reported that parents often fail to seek treatment for a child until it is too late. While noting that all Tanzanians are susceptible to malaria, focus group participants also classified the disease as easy to treat, especially compared to HIV or TB. Most participants said that because malaria has very obvious symptoms, it does not require a diagnostic test. Others disagreed, saying that testing allows a doctor to make a more specific diagnosis and prescribe more effective treatment.

Peru

Malaria transmission in Peru occurs along the northern Pacific coast and throughout the Amazon region. Beginning in the early- to mid-1990s, the health system initiated diagnosis by microscopy, reserving presumptive treatment for areas with limited access to health facilities. But shortages of qualified microscopists and delays in obtaining results led to the search for a more practical alternative. With support from external donors, Ministry of Health and the NMCP have introduced RDTs in some parts of the Amazon region, but uptake has been uneven and supplies unreliable.

For providers in Lima and Arequipa, malaria was a generally a low priority. Practitioners closer to the Amazon recognized a need for improved malaria diagnostic tests and stressed stability and simplicity. The majority of providers mentioned the need for rapid results since getting patients back into facilities to start treatment is difficult.

Consumer survey respondents in Peru reported being willing to pay a mean price of S/. 15.10 (about US $5.55) for a malaria test. This reflects Peru’s relative wealth compared to Benin and Tanzania. However, as in these other countries, this amount was less than reported willingness to pay for any other diagnostic. Moreover, while 92% of Peruvians surveyed reported being willing to pay S/. 5.00, only 41% would pay the mean price of S/. 15.10. At a price of S/. 25.00, less than 25% would pay, and at S/. 30.00, less than 15%.

Peruvian focus group participants familiar with malaria from personal experience saw it as potentially serious, but less serious and less frightening than TB or HIV/AIDS. The frequency with which malaria appears make people perceive it as a greater health problem than more life-threatening diseases such as AIDS and TB to which people consider themselves less susceptible. Participants from endemic areas agreed that malaria treatment is effective and works rapidly. Some said that treatment depends on the stage of the illness: malaria detected early can be treated easily at home, while “advanced” malaria requires a trip to the hospital. So one perceived benefit of diagnosis was early treatment and avoidance of severe disease. According to FGD participants, the low amounts survey respondents were willing to pay for malaria diagnostics may be attributable to the perception that malaria is more common, less
 contagious, and more easily treated. Some respondents said it was natural that people would pay more for an HIV/AIDS diagnostic than one for malaria because treatment for HIV/AIDS was difficult and costly while malaria treatment was readily available and cheap.

Conclusions & recommendations
Health providers in all three study countries agreed that a new malaria test for children under 5 would be useful, but saw it as less critical than tests for some other diseases, particularly tuberculosis and HIV/AIDS. In all three countries, an argument in favor of a new malaria diagnostic was the need to avoid overuse of ACT, both for reasons of cost and for fear of antimalarial resistance. In Benin and Tanzania, where malaria is a major – if not the most important – cause of under 5 mortality, enthusiasm for a new test was tempered by concern about abandoning presumptive treatment and the possibility of false negative cases. Many health professionals in all three countries voiced continued distrust of RDTs, particularly for children under 5. To gain market share on a large scale independent of subsidies or direct procurement by external donors, a new malaria diagnostic would have to achieve high enough specificity under field conditions to allay health worker fears about possible child deaths due to false negative results. External donor support will continue to expand the market for malaria rapid tests worldwide in the near term. But interviewees in all three study countries expressed concern that these markets are unlikely to be sustained absent greatly expanded national government resources or great reductions in manufacturing costs or both.

Consumers from all three study countries see malaria as a disease to which they and their children are highly susceptible, though in Peru this is true only in endemic areas. However several factors militate against individual purchases of malaria diagnostic tests, and would have to be overcome before a significant consumer or caregiver market could develop. First, malaria is a familiar disease perceived as easily treatable. It is less feared than HIV or TB. Consumers believe that malaria symptoms are easily recognized and drugs readily accessible. This makes self-treatment an attractive option and obviates the need for diagnosis prior to treatment. Hence developing a market for home-based malaria RDT use would require convincing potential users that symptoms alone are not enough to diagnose malaria. If consumers can be convinced that a test is a worthwhile expenditure, Benin and Peru at least seem to offer feasible commercial markets. Tanzania presents a more difficult picture: To make RDTs affordable to 90% of Tanzanians, the unit price would have to drop to around US $0.20 or 0.25.

The Market for a New Malaria Diagnostic Test
The current market for malaria RDTs is growing and will likely continue to grow rapidly for the next several years as donors expand their malaria control activities in the run-up to the 2015 Millennium Development Goals deadline. Thus, in the near to medium term, the best approach to estimating market size for malaria diagnostics may be to track grants and work plans of donors like the Global Fund and the President’s Malaria Initiative. There is also a smaller scale demand from private sector facilities, both private for profit and non-profit, where providers and patients seem more interested in and able to pay. There is a negligible individual consumer market for malaria tests at present. Whether such a market can develop will depend in part on drug prices and availability and in part on whether manufacturers or others can overcome the barriers described above. Curiously, a final factor that could play a significant role in determining individual consumer demand for malaria diagnostics is what health systems have to offer patients whose children test negative for malaria. If, as noted earlier, many caregivers see malaria as a familiar disease with recognizable symptoms and easily available effective treatment, the most important incentive for using a malaria test may be to determine that one’s child does not have malaria and thus that some other diagnosis and treatment is required. But such an incentive only works if diagnostics and effective treatments are available for other causes of febrile illness and if parents can expect that their child will receive appropriate care once malaria has been ruled out.
Introduction

This report presents the results of a study on the perceived need for a new malaria diagnostic test for children under 5 in Benin, Peru, and Tanzania. The study was designed to assess potential demand for such a test and identify factors that might affect that demand among both consumers and health care providers and program managers. Study objectives were to:

- Estimate consumer willingness to use and pay for a potential new malaria test;
- Examine the factors that would influence consumer willingness to use and pay for such a test;
- Determine the extent to which health care providers and program managers see a new test for under 5s as priority in their country both in absolute terms and relative to other health priorities.

The study included in-depth interviews with health care providers in the public, private for-profit, and private non-profit sectors in each country. It also included surveys on consumer willingness to use and pay for a new malaria diagnostic test and focus groups exploring reasons for the results of these surveys.

Malaria diagnosis

About half the world’s population is at risk of malaria, and the disease is estimated to cause some 250 million cases of clinical illness and account for between 1-3 million deaths annually. Children under age five in sub-Saharan Africa account for about 90% of these deaths. Pregnant women are also particularly vulnerable. One key to reducing the burden of malaria in Africa and worldwide is a diagnostic test that is sensitive, specific, and practical to use in malaria-endemic areas.

Presumptive diagnosis

In much of Africa, malaria has traditionally been diagnosed and treated presumptively: any patient with fever was presumed to have malaria and treated with antimalarials. Presumptive diagnosis worked well when the most commonly used antimalarials – chloroquine (CQ), sulfadoxine pyrimethamine (SP), and amodiaquine (AQ) – were cheap, effective, safe, and widely available. In settings with limited access to health facilities and laboratories, presumptive diagnosis was cost-effective and, in any case, the only realistic option for health workers at the periphery. The initial response of most patients to a fever was self-treatment and as many as half of all febrile cases never reached a formal health facility. Instead patients and caregivers purchased antimalarials in the private sector.

Parasite-based diagnosis

Growing resistance to CQ and SP, and the concomitant introduction of artemisinin combination therapies (ACT) as first line treatment for uncomplicated malaria, has led to increased pressure for parasite-based diagnosis. There are three principal arguments for parasite-based diagnosis. First, the cost of ACT, though falling as production increases, remains much higher than the cost of CQ or SP. This makes presumptive treatment unaffordable for health systems in many endemic countries. Even when ACT in the public sector is highly subsidized by international donors such as the Clinton Foundation or the Global Fund to Fight AIDS, Tuberculosis and Malaria, the cost to individuals in the private sector remains many times higher than earlier generation antimalarials. Second, widespread unnecessary use of antimalarials contributes to more rapid development of drug resistance. Resistance to ACTs is already beginning to emerge in Southeast Asia. If this emerging resistance becomes widespread, it could leave health systems worldwide with no viable malaria treatment. Finally, there are many causes of febrile illness other than malaria, some of them equally or nearly as deadly. Treating all fevers as if they were malaria effectively denies many patients diagnosis of and treatment for the real cause of their illness.

There are various methods for parasitological diagnosis: light microscopy, polymerase chain reaction (PCR), and rapid diagnostic tests (RDTs). PCR, though highly sensitive and capable of differentiating
between malaria species, is currently too costly and complex for resource-limited settings.\(^7\) Light microscopy is low cost, but requires well trained staff, electricity, well-maintained equipment, and time.\(^7\) Like PCR, microscopy enables identification of different parasite species and can be highly sensitive and specific when carried out properly. However in practice, sensitivity and specificity of microscopy can be quite low.\(^8\) Moreover, even in countries like Peru where it is used successfully, microscopy remains impractical in remote areas far from established health facilities. Because of the need to transport blood slides to where they can be read, then transport results back to the point of care, microscopy results can sometimes take many hours or even days to reach the patient or front-line health worker. This makes opportune treatment impossible and greatly increases the risk of death in vulnerable populations.

**Rapid Diagnostic Tests**

Since their appearance in the mid-1990s, malaria rapid diagnostic tests (RDTs) have offered an increasingly attractive alternative.\(^9\) RDTs detect one of three parasite antigens found in the blood of an infected individual: For falciparum malaria only there is histidine-rich protein 2 (HRP2); for both falciparum and non-falciparum malaria there is plasmodium lactate dehydrogenase (pLDH) or aldolase. All work in similar fashion: A drop of blood is collected from the febrile patient and deposited at one end of a nitrocellulose strip. A small quantity of buffer is added to wash the blood up the strip past a line of dye-labeled antibody. If malaria antigens are present in the patient’s blood, they bind to the dye-labeled antibody, turning it a color (usually red), thus indicating a positive result. If malaria antigens are not present, the blood washes past the antibody line leaving it white and indicating a negative result.\(^10\) RDTs are an attractive option for many resource-limited settings because they can be performed close to home and are relatively simple – beneficial characteristics for patients seeking treatment outside the formal health sector.\(^7,11\)

WHO estimates that there are over 60 brands and over 200 tests available today, but regulatory oversight is weak making procurement of high quality tests a challenge. In addition, sensitivity and specificity vary depending on storage and transport conditions, temperature, humidity, parasite strain, parasite density, and user skill, among other factors.\(^12\) A 2007 WHO-FIND evaluation assessed 41 RDTs from 21 companies using blood panels of cultured *Plasmodium falciparum* parasites, patient-derived *P. falciparum* and *P. vivax* parasites, and parasite-negative panels.\(^12\) Several RDTs demonstrated near 100% sensitivity at 200 parasites/\(\mu\)L for *P. falciparum* and 95% sensitivity for *P. vivax*.\(^13\) However, use has been limited for various reasons. Poor quality assurance data has made some national programs reluctant to support procurement and implementation. One study found that “sensitivity and specificity of RDTs were difficult to assess given the poor quality of routine blood smear staining” by microscopists who were supposed to serve as the reference standard.\(^14\) RDT field trials have been tainted by inadequate handling and storage, poor preparation, and incorrect test interpretation.\(^12\) Implementation has often not been accompanied by sufficient management, training, and community sensitization.\(^12\) Case management guidelines are not always clear about when and with whom providers should use RDTs and what actions providers should take after a positive or negative result. This ambiguity is most troubling with regard to management of fever in children under 5. WHO continues to recommend presumptive treatment with ACT for all children under 5 with a fever, but has modified that recommendation in some cases by adding that parasite-based diagnosis should be used in areas of low transmission. As discussed further on in this report, many governments and health workers are reluctant to abandon presumptive treatment for fear of missing a pediatric case of malaria because of low-level parasitemia.

**Methods**

Field work for this study occurred in Benin, Peru, and Tanzania between March 2007 and April 2009. During visits to each country, Center for Human Services (CHS) staff collected data on health provider and consumer perspectives about the need for, willingness to use, and willingness to pay for new malaria diagnostic tests. In each country, the study team visited at least three different regions. In Benin, these included Cotonou on the coast, Bohicon in the central part of the country, and Parakou in the north. In
Peru, study areas included Lima on the coast, Arequipa in the southern Andes, and Iquitos in the Northern Amazon. In Tanzania, the study team visited Dar es Salaam, Arusha, Mwanza, and Tanga. In each region, the team conducted consumer and provider data in both urban and rural settings. Thus, though the study is not completely representative of each country’s population, it includes a wide variety of socio-economic, cultural, and geographical perspectives. Specific data collection approaches are described below.

Health Systems Perspectives

In each country, the CHS team conducted semi-structured, in-depth interviews with public and private sector health personnel – physicians, laboratory technicians, program managers, and pharmacists – to explore their perspectives on factors relevant to new diagnostics tests. CHS asked health providers about their views on current diagnostic approaches and unmet diagnostic needs, as well as past experiences with adopting new diagnostic tools. In some interviews, participants were asked to create a spontaneous list of what they considered the highest priorities for new diagnostic tests in their setting. These same participants were then asked to rank the six study diagnostics in order of priority and explain the rationale for their rankings. The study team carried out 29 health provider interviews in Benin, 42 in Peru, and 59 in Tanzania. Interviewees included national and district-level managers as well as front-line clinicians. To the extent possible, CHS interviewed directors of relevant national programs: AIDS, tuberculosis, malaria, sexually transmitted infections, and maternal and child health. Interviews also included donor representatives and private for-profit and non-profit program managers and clinicians. Appendix A lists interviewee names, affiliations and dates interviewed.

Consumer Perspectives

CHS evaluated consumer willingness to use and pay for new diagnostic tests in three phases: (1) preliminary focus group discussions, (2) willingness to pay surveys, and (3) follow-up focus group discussions.

Preliminary Focus Group Discussions

CHS conducted two to three preliminary focus group discussions in each country to establish base prices for the willingness to pay (WTP) surveys and to adapt the survey instruments to the local context. In these focus groups, a trained facilitator explained the purpose of the study and then asked participants to discuss what amounts people might typically pay for a diagnostic test. These amounts served as starting points for the iterative bidding process used in the survey to determine the price consumers were willing to pay for each test as described below. The facilitator also asked participants to explain local terms used for diagnostic tests so that survey questions would use language familiar to those surveyed. In Peru, rather than focus group discussions, CHS conducted interviews with health providers familiar with the local economy and care-seeking behaviors.

Willingness to Pay Surveys

Consumer willingness to pay was assessed with a survey of about 40 questions covering socio-demographic information, past and present care-seeking behavior, and willingness to pay itself. Surveys also included questions assessing what type of sample (e.g., blood, urine, stool, etc.) respondents considered most appropriate for the diagnostic about which they were being interviewed and why they considered that choice most appropriate.

To assess respondent willingness to pay, the surveys used a process called contingent valuation. In this approach, the interviewer briefly explains the benefits of a hypothetical new diagnostic test; asks whether the respondent would be interested in using such a test if it were available; and if so, whether he or she would be willing to pay something for the test. If the respondent indicates a willingness to pay some amount, the interviewer suggests the base price determined in the preliminary focus group discussions. If the respondent expresses willingness to pay the base price, the interviewer then asks about a higher price,
increasing the base price by a specific increment. This process continues until the respondent says that he or she would not be willing to pay the price suggested. For respondents who say they are unwilling or unable to pay the base price, the interviewer uses the same process, but asks about a lower amount. This information is then used to calculate mean and median willingness to pay. Figure 1 illustrates the contingent valuation process.

Based on focus group results, CHS set the base prices in Benin at 1000 CFA (Francs Communauté Financière Africaine, the Beninese currency) for the pneumonia, syphilis, HIV, and STI diagnostics and at 500 CFA for the malaria and TB diagnostics. In Tanzania, the starting prices for the syphilis, HIV, TB, and STI diagnostics were Tsh 500 (500 Tanzanian shillings) and at Tsh 200 for malaria and pneumonia. In Peru, the base price was S/. 5.00 (five Peruvian nuevos soles) for all diagnostics. At the time of the surveys, the US dollar was worth about 421 CFA, about Tsh 1176, and about S/. 2.72.

**Figure 1. The contingent valuation approach to measuring consumer willingness to pay**

<table>
<thead>
<tr>
<th>Would you be willing to pay something to use this diagnostic?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
</tr>
<tr>
<td>No</td>
</tr>
<tr>
<td>End interview</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Would you be willing to pay $5 for this diagnostic?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
</tr>
<tr>
<td>No</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Would you be willing to pay $10 for this diagnostic?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
</tr>
<tr>
<td>No</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Would you be willing to pay $15 for this diagnostic?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
</tr>
<tr>
<td>No</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>What is the most you would you be willing to pay for this diagnostic?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Record price and end the interview.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Would you be willing to pay $2.50 for this diagnostic?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
</tr>
<tr>
<td>No</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>What is the maximum you would be willing to pay for this diagnostic?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Record price and end the interview.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>What is the maximum you would be willing to pay for this diagnostic?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Record price and end the interview.</td>
</tr>
</tbody>
</table>

**Sampling approach**

CHS used purposive sampling to recruit participants for the survey. Participants were selected based on the likelihood that they would have useful opinions or knowledge about the question of interest. For instance, the parent of a young child is more likely to have an opinion about the value of a diagnostic for malaria in children under five than would a single adult or an adult whose children are grown. For this reason, we carried out malaria WTP surveys in health facilities that provide services for young children, recruiting adults with young children to participate.

A sample size of 250 individuals per diagnostic test was calculated to obtain a study power of 80% with a 95% confidence interval. Table 1 illustrates the basic sampling frame used in each country. The sampling frame was designed to include participants from both urban and rural facilities at different levels of care as well as a roughly even mix of participants attending public, private for-profit, and private not-
for-profit facilities. In addition, in each country, a roughly equal number of participants were to be recruited from each of the three regions included in the study. The one exception to this pattern was in Peru. Of the three study regions included from Peru, malaria is endemic only in and around Iquitos. As a result, CHS carried out WTP surveys for malaria diagnostics only in and around Iquitos since it seemed unlikely that consumers would be interested in using or paying for a malaria diagnostic in areas where malaria transmission does not occur. Despite this fact, interviews with health providers included discussion of malaria in all three regions since these interviews were partially intended to assess providers’ relative priorities of health in terms of the need for new diagnostics. For similar reasons, consumer focus groups included discussion of malaria: while the WTP surveys were designed to ask any one respondent about willingness to pay for a single diagnostic, the focus groups were designed to help understand relative consumer priorities, specifically why consumers seem to be interested in using and paying for some diagnostics more than others.

### Table 1. Sampling frame for willingness to pay surveys

<table>
<thead>
<tr>
<th>Health Sector</th>
<th>Urban</th>
<th>Rural</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public</td>
<td>42</td>
<td>42</td>
<td>84</td>
</tr>
<tr>
<td>For-profit</td>
<td>42</td>
<td>42</td>
<td>84</td>
</tr>
<tr>
<td>Not-for-profit</td>
<td>42</td>
<td>42</td>
<td>84</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>126</td>
<td>126</td>
<td>252</td>
</tr>
</tbody>
</table>

#### Analysis

Several studies have found that demographic and socio-economic factors, costs of obtaining health care, and facility characteristics influence such WTP.\(^{15,16,17}\) Thus, CHS considered how socio-economic variables affected WTP for the malaria diagnostic test.

CHS calculated a wealth index for each individual, based on the Demographic and Health Survey methodology.\(^{18}\) This approach uses information on ownership of assets, numbers of persons per bedroom, building materials used in the home, toilet facilities, and water source to generate a weighted wealth index. The variable weights are generated using factor analysis. In this study, the variable weights are taken from World Bank studies on socio-economic differences within each study country.\(^{19}\)

From survey results, CHS estimated the mean, median, and mode of consumer WTP for the new diagnostic described in the survey. These amounts were then disaggregated by wealth levels, educational levels, rural/urban location, gender, type of facility, and region. CHS used analysis of variance (ANOVA) to test for statistically significant differences in WTP based on respondent demographic characteristics. Ordinary least squares (OLS) regression was used to identify factors that influenced the amount respondents were willing to pay controlling for all other factors.

In the OLS regression analysis, the dependent variable (WTP for the diagnostics) was transformed logarithmically since the data were skewed. Log transformation is widely used to improve precision and diminish the effect of outliers.\(^{20}\) The log regression coefficients were adjusted using the smearing technique to account for the bias caused by the transformation.\(^{21}\)

#### Follow-up Focus Group Discussions

Based on WTP survey findings, CHS conducted follow-up focus group discussions to explore factors influencing consumer willingness to use and pay for diagnostic tests. These discussions helped explain why survey respondents said they would be willing to pay more for certain types of diagnostics than others. The groups also helped explain why consumers expressed a preference for one type of sample (e.g., blood, urine, sputum) over another. Finally, the discussions explored consumer perceptions about each illness and the benefits of and barriers to seeking diagnostic testing. CHS designed the focus group
discussions using the Health Belief Model (HBM), a theoretical framework developed by the U.S. Public Health Service in the 1950s to explore U.S. consumer behavior related to TB diagnosis. It has since been used in many other contexts in both the U.S. and internationally. Appendix B describes the HBM and its applicability to this study.

**Sampling approach**

Table 2 contains the target sampling frame for focus groups. In November 2008, CHS conducted 12 focus group discussions with 8 to 11 members per group in Cotonou, Bohicon, and Parakou in Benin. In March 2009, CHS conducted 9 focus group discussions with 7 to 9 members per group in Dar es Salaam and Tanga, Tanzania. In March and April 2009, CHS conducted 10 focus group discussions with 8 to 10 members per group in Lima, Arequipa, and Iquitos, Peru. Since these discussions touched on all six diseases addressed by the project, including STIs, CHS organized each group as either exclusively male or exclusively female. Female facilitators led the groups of women, and male facilitators those of men.

<table>
<thead>
<tr>
<th>Country</th>
<th>Urban Male</th>
<th>Urban Female</th>
<th>Rural Male</th>
<th>Rural Female</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benin</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>Peru</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>Tanzania</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>24</td>
</tr>
</tbody>
</table>

**Analysis**

All focus groups were digitally recorded and the recordings transcribed. Focus groups in Benin were conducted in Fon, then transcribed into and analyzed in French. Focus groups in Tanzania were conducted in Swahili, then transcribed into and analyzed in English. Focus groups in Peru were conducted, transcribed into, and analyzed in Spanish. All transcripts were imported into ATLAS.ti®, a qualitative data analysis software package. The HBM informed the analysis process. CHS developed codes for each illness, for each HBM component, and for specific factors mentioned by participants as influencing WTP. Study team members then applied the codes to each transcript and developed reports that allowed them to summarize relevant themes for each country. These summaries then served as the basis for the relevant sections of this report.

**Results: Study Countries Profiles and Research Findings**

This section presents findings on health provider and consumer perspectives within each country’s geographic, socio-demographic, and epidemiological context. Background information is followed by a brief description of the health system, malaria epidemiology, current approaches to malaria diagnosis, and views of health care providers and consumers on the need for a new malaria diagnostic test. Health Belief Model constructs help elucidate consumer care-seeking practices related to malaria, particularly consumers’ reported beliefs about the importance of malaria diagnostic tests for children under 5.

**Benin**

Benin is a small, ethnically diverse country located along the coast of West Africa with an estimated population of 9 million. Despite being one of the first post-independence African nations to transition from military rule to democratic government, Benin remains one of the poorer countries in sub-Saharan African. Per capita gross national income (GNI) is US $570, slightly less than 60% of the regional average of US $952. More than a third (37%) of the population live in poverty, and 20% are classified as
extremely poor; 46% are under age 15. Education levels are lower than in other West African nations, particularly in rural areas and among women. The population growth rate is 3% and 45% of the population live in urban areas.²²,²³,²⁴

**Overview of the health system**

Despite a relatively functional and increasingly decentralized health system, health regulations are not uniformly enforced, creating disparities in the quality of care available to different sectors of the population. With 86% of the population living within five kilometers of a health facility, geographic access to health services is relatively high; however, many facilities lack the infrastructure, equipment, and staff necessary to provide priority services. Resource disparities are particularly common in rural areas.²² Benin’s public health system has three levels:

1. Central: the Ministry of Health (MOH), central directorates, and the National Referral Hospital;
2. Intermediate: departmental directorates for health and departmental referral hospitals; and
3. Peripheral: health zones, including zonal referral hospitals, commune health centers, arrondissement health centers, private health facilities, and village health units.

Benin has 34 health zones, each providing coverage for approximately 260,000 persons. Designed to increase access of care, enhance community participation, and advance decentralization of health services, health zones encompass both public and private providers.

Benin has a diverse, largely unregulated, private health sector comprised of biomedical practitioners, traditional practitioners, pharmacies, laboratories, for-profit and religious nonprofit facilities, medical equipment and pharmaceutical suppliers, private voluntary and mutual health insurance companies, and non-governmental organizations (NGOs). Religious, nonprofit facilities are fairly well integrated into the national health system and several operate as zonal hospitals and collaborate with the MOH.

The private pharmaceutical sector is under the purview of the MOH Directorate of Pharmacies and Medicines (DPM), but regulations governing this sector are essentially unenforced. DPM supervises most public, and some private, procurement and distribution through the parastatal central procurement agency, *Central d’Achat des Médicaments Essentiels et Consommables Médicaux* (Center for the Purchase of Essential Medications and Medical Consumables; CAME), a government-owned enterprise. Procurement and distribution of medicines needed for AIDS, TB, malaria, and vaccine programs are partially managed through Global Fund-supported programs.²²

International partners and bilateral donors contribute heavily to the health sector. The Beninese government invests 8% of its total public spending in health, compared to an average of 9% for sub-Saharan Africa as a whole. The Global Fund, the US Government, and the World Bank are major contributors to the purchase of malaria tests and drugs. According to the 20007 MOH budget, the Government of Benin pays mostly for NMCP salaries, whereas donors provide most of the budget for equipment, drugs, training, per diems, fuel, and so on.²⁵

Private household spending accounts for 51% of total health spending. Despite unit price market regulation of medicines, most household health expenditures occur at pharmacies, most of them privately owned and operated, rather than in the public health sector.

A small proportion of the population has health insurance coverage. There are three main sources of insurance: the Beninese Social Security Fund, which offers formal sector employees and their families partial coverage for health care costs; private insurance firms, which offer more comprehensive coverage packages; and community-based health insurance schemes. Additionally, an Indigent Fund, established through the MOH, is supposed to subsidize health facility user-fees for the most impoverished citizens to reduce financial barriers to health services.²²
Malaria in Children under 5

Malaria in children under five is addressed by several programs within the Ministry of Health, primarily the National Malaria Control Program (NMCP) and the Directorate of Family Health, in charge of maternal and child health, specifically the Integrated Management of Childhood Illness (IMCI) program. The Ministry’s Directorate of Pharmacies and Medications and the Directorate of Diagnostics and Blood Transfusion are also involved in policies and support for diagnosis, prevention and treatment of malaria.

Malaria is a leading cause of morbidity and mortality among children under five in Benin. The national health and management information system stated that in 2006, malaria (based on clinical diagnosis) was the primary cause of outpatient visits at health facilities and hospitalizations, accounting for 44% of outpatient visits and for 40% of hospitalizations of children under age five. Malaria is endemic throughout Benin with stable transmission everywhere, peaking in May and in October during the two main rainy seasons. About a quarter of deaths of children under five in 2000 were attributable to malaria.

Overall malaria incidence and prevalence are difficult to estimate, as only facility-based data are available. A project tracking RDT use in one region found that between 60-77% of febrile patients tested positive for malaria during the rainy season, whereas only around 40% tested positive during the dry season.

Current approach to diagnosis

Beninese IMCI and NMCP guidelines both stipulate clinical diagnosis of uncomplicated malaria in children under five: fever > 37.5°C or recent history of a fever and other associated signs. No biological tests are done to confirm diagnosis. The country is beginning to use RDTs for patients over age 5 since microscopy is unavailable at most public facilities and NMCP policy reserves ACTs for laboratory confirmed cases. Though defined by the MOH, this policy is made possible through donor support for both RDT procurement and improved microscopy to determine parasite density and provide quality assurance for RDTs. Recently pan-Plasmodium RDTs have been procured, a change from the *P. falciparum*-only tests used initially. The rationale for this change is unclear, but implementing it will necessitate additional staff training and development of new job aids.

Patient cost

Since children under 5 with uncomplicated malaria are treated presumptively, there is no cost associated with diagnosis. In public health facilities, rapid tests are free. Microscopy is highly subsidized by the NMCP so blood smears or hemoglobin levels carried out for severe malaria cost 300-500 CFA in health centers, and 1500-2500 in hospitals. However obtaining results is slow, so patients are treated presumptively.

RDTs (and ACTs) are provided free to NGO and religious hospitals integrated into the MOH system, and these facilities in term provide these supplies at no cost to patients. In private centers that outside the MOH system, patients must pay. The private clinics get their RDTs from wholesalers, and sell to patients from 500 to 1000 francs.

Perceived need for new diagnostic:

In both spontaneous listings and card ranking of most-needed new diagnostic tests, Beninese providers usually listed malaria, and more specifically malaria in children under five, as their most pressing priority. At the time of these interviews, malaria RDTs were new to Benin and many providers had only recently become aware of their existence. One respondent familiar with RDTs characterized the need in this way:

We are currently treating all fevers in children as malaria, but we are overtreating like this. We can't use ACTs like we used CQ. Now we have to be sure about the diagnosis…. and the rapid test helps us save money. And slides don't give immediate results, whereas RDTs do. You really need the rapid result for children.
However, several respondents expressed concern about not treating children with negative results. “If rapid tests were reliable,” said one, “they would be good, because currently we are giving ACTs to everyone with a fever. For children, though, we should treat anyway.” Another major theme was the need for a test, in this high prevalence country, that gives parasite density. As one provider explained, “we like the specificity of the new RDTs that identify *P. falciparum*. But we need parasite density, which would tell us that the fever is due to malaria….” A second interviewee emphasized the value of a quantitative rather than a qualitative test:

The fact that malaria is all over here doesn't make a test for it desirable, everyone will be positive for malaria. If it [parasite density] is below 500, it's not that important, especially in adults. What we need is a test that can talk about parasite density.

Respondents were also concerned about the risks of dependence on donor funds when adopting new diagnostic methods:

If you are going to implement something in the field, it has to be for long-term. So if it’s too expensive, we won’t decide to use it. Even if it’s supported by the Global Fund, it can be for 2 years….in the long term we can’t base ourselves on that…because we would rapidly be in the position of not being able to pay.

**Consumer willingness to purchase and use a diagnostic test**

More than 90% of Beninese consumers surveyed indicated willingness to use and pay for diagnostic tests for all diseases included in the study. However, as shown in Figure 2, consumers were willing to pay less for a malaria diagnostic than for any other test.

**Figure 2. Mean consumer willingness to pay for 6 diagnostic tests, Benin**
The average age of survey respondents was 27.3 years; the average age of the accompanying child was 11.2 months. Respondents interviewed at public facilities accounted for 55% of the sample, compared to 25% at mission and 13% at private for-profit facilities. In addition, 40% lived in rural areas, and almost half of the sample had less than a full primary education. A mere 4.2% had some form of health insurance. At the time of the study, 421 CFA equaled US $1. On average respondents traveled 23 minutes to reach a health facility and paid 250 CFA for transport. Table 3 presents complete sociodemographic characteristics.

Table 3. Sociodemographic characteristics of malaria survey respondents in Benin

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Respondents % (n=287)</th>
<th>Respondents’ spouse %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Age of Respondent (yrs)</td>
<td>27.3</td>
<td></td>
</tr>
<tr>
<td>Average Age of Child (months)</td>
<td>11.1</td>
<td></td>
</tr>
<tr>
<td>Gender of Child</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>59.5% (169)</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>40.9% (117)</td>
<td></td>
</tr>
<tr>
<td>Marital Status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single</td>
<td>2.5% (7)</td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>95.8% (274)</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>1.8% (5)</td>
<td></td>
</tr>
<tr>
<td>Religion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Traditional</td>
<td>8.4% (24)</td>
<td></td>
</tr>
<tr>
<td>Muslim</td>
<td>22.7% (65)</td>
<td></td>
</tr>
<tr>
<td>Catholic</td>
<td>38.5% (110)</td>
<td></td>
</tr>
<tr>
<td>Protestant</td>
<td>3.9% (11)</td>
<td></td>
</tr>
<tr>
<td>Other Christian</td>
<td>23.1% (66)</td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>3.2% (9)</td>
<td></td>
</tr>
<tr>
<td>Education Level</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; Primary</td>
<td>49.0% (140)</td>
<td>28.5% (78)</td>
</tr>
<tr>
<td>Primary</td>
<td>24.1% (69)</td>
<td>14.6% (40)</td>
</tr>
<tr>
<td>Secondary</td>
<td>22.4% (64)</td>
<td>25.6% (70)</td>
</tr>
<tr>
<td>Technical</td>
<td>0</td>
<td>1.8% (5)</td>
</tr>
<tr>
<td>University</td>
<td>4.6% (13)</td>
<td>1.8% (5)</td>
</tr>
<tr>
<td>Don’t know</td>
<td>0</td>
<td>17.5% (48)</td>
</tr>
<tr>
<td>Urban</td>
<td>60.0% (172)</td>
<td></td>
</tr>
<tr>
<td>Rural</td>
<td>40.0% (115)</td>
<td></td>
</tr>
<tr>
<td>Region</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cotonou</td>
<td>34.5% (99)</td>
<td></td>
</tr>
<tr>
<td>Bohicon</td>
<td>30.0% (86)</td>
<td></td>
</tr>
<tr>
<td>Parakou</td>
<td>35.5% (102)</td>
<td></td>
</tr>
<tr>
<td>Facility Type</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public</td>
<td>54.9% (146)</td>
<td></td>
</tr>
<tr>
<td>Mission</td>
<td>24.8% (66)</td>
<td></td>
</tr>
<tr>
<td>Private For-profit</td>
<td>12.8% (23)</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>11.7% (31)</td>
<td></td>
</tr>
<tr>
<td>Have Health Insurance</td>
<td>4.2% (12)</td>
<td></td>
</tr>
<tr>
<td>Average travel time (minutes)</td>
<td>23</td>
<td></td>
</tr>
<tr>
<td>Average travel cost (CFA)</td>
<td>250</td>
<td></td>
</tr>
</tbody>
</table>
Health-seeking behaviors

About 23% of Beninese survey respondents had a child who experienced an illness episode in the four weeks preceding the survey. Of these, 80% reported seeking care in the formal health sector while 8% visited a non-biomedical provider, such as a traditional healer. Laboratory diagnostic tests were recommended to 42% of respondents’ who took their child to a biomedical facility, and 82% reported consenting to the tests. On average, respondents reported having paid 2497 CFA (US $5.93) for diagnostic tests prescribed on the day of the survey. These tests may have been for malaria or another illness, since participants were recruited from among adults seeking any type of health care for their young child. Respondents reported being willing to pay an average of 1488 CFA (US $3.53) for a malaria test for their child; 40% less than the average they reported actually paying for diagnostic tests on the day of their visit and 36% less than the 2339 CFA they reported being willing to pay across all six diagnostics.

Willingness to pay for malaria diagnostic tests

Based on the initial focus group findings, the WTP bidding for a malaria test started at 500 CFA and increased or decreased in increments of 250 CFA depending on the respondent’s reply. Probably due to the survey design (iterative bidding in 250 CFA steps), the amounts mentioned by respondents tended to cluster in increments of 500 CFA. Of 287 respondents, 6 (2%) were not willing to pay anything for a malaria diagnostic. The other 281 expressed willingness to pay amounts ranging from 200–30,000 CFA. However, only two respondents mentioned prices above 5000 CFA, and this can probably be dismissed as the wishful but unrealistic thinking on the part of a mother considering the lengths to which she would go to care for a sick child. Figure 3 shows that WTP dropped by 25% as the price increased from 500–1000 CFA and again as it increased from 1000–1500 CFA and then by another 29% as the price increased from 1500–2000 CFA. As the price rose above 2000 CFA willingness to pay fell below 10% and declined very gradually. The decline in willingness to pay for malaria diagnostics in Benin is much steeper than for any of the other tests.

Figure 3. WTP for malaria diagnostics at different price points, Benin 2008

Viewed from another angle, a malaria diagnostic priced at 500 CFA (about US $1.19 at the time of the study) would exclude only 5% of consumers in Benin, but one priced at 1000 CFA (about US $2.38) would exclude 30%. At a price of 1500 CFA (about US $3.56) more than half of the population would be unwilling or unable to pay.
The figure groups respondents into four market segments to categorize consumer willingness to pay for malaria diagnostics by price range:

- **Segment A**: Consumers willing to pay no more than 800 CFA,
- **Segment B**: Consumers willing to pay 801–1200 CFA,
- **Segment C**: Consumers willing to pay 1201–1500 CFA, and
- **Segment D**: Consumers willing to pay more than 1500 CFA.

Table 4 shows that socio-economic and demographic characteristics differ among market segments. Education levels tended to increase across market segments; however most of this increase was restricted to secondary school graduates with little increase among those with post-secondary education.

**Table 4. Selected socioeconomic characteristics of respondents willing to pay within different price ranges (CFA) for a malaria diagnostic in Benin**

<table>
<thead>
<tr>
<th>Population Characteristics</th>
<th>Segment A: WTP 200–800 (n=77)</th>
<th>Segment B: WTP 801–1200 (n=71)</th>
<th>Segment C: WTP 1201–1500 (n=87)</th>
<th>Segment D: WTP +1500 (n=46)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Education Level</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; Primary</td>
<td>53% (41)</td>
<td>46% (33)</td>
<td>49% (43)</td>
<td>39% (18)</td>
</tr>
<tr>
<td>Primary</td>
<td>26% (20)</td>
<td>27% (19)</td>
<td>23% (20)</td>
<td>22% (10)</td>
</tr>
<tr>
<td>Secondary</td>
<td>17% (13)</td>
<td>24% (17)</td>
<td>21% (18)</td>
<td>35% (16)</td>
</tr>
<tr>
<td>University</td>
<td>4% (3)</td>
<td>3% (2)</td>
<td>7% (6)</td>
<td>4% (2)</td>
</tr>
<tr>
<td><strong>Wealth Quintile</strong>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 (lowest)</td>
<td>21% (16)</td>
<td>23% (16)</td>
<td>22% (19)</td>
<td>11% (5)</td>
</tr>
<tr>
<td>2</td>
<td>22% (17)</td>
<td>28% (20)</td>
<td>13% (11)</td>
<td>13% (6)</td>
</tr>
<tr>
<td>3</td>
<td>22% (17)</td>
<td>13% (9)</td>
<td>24% (21)</td>
<td>24% (11)</td>
</tr>
<tr>
<td>4</td>
<td>17% (13)</td>
<td>25% (18)</td>
<td>17% (15)</td>
<td>22% (10)</td>
</tr>
<tr>
<td>5 (highest)</td>
<td>18% (14)</td>
<td>11% (8)</td>
<td>24% (21)</td>
<td>30% (14)</td>
</tr>
<tr>
<td><strong>Zone</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td>40% (31)</td>
<td>49% (35)</td>
<td>38% (33)</td>
<td>30% (14)</td>
</tr>
<tr>
<td>Rural</td>
<td>60% (46)</td>
<td>51% (36)</td>
<td>62% (54)</td>
<td>70% (32)</td>
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<td><strong>Facility Type</strong></td>
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<tr>
<td>Public</td>
<td>56% (43)</td>
<td>63% (45)</td>
<td>39% (34)</td>
<td>43% (20)</td>
</tr>
<tr>
<td>Mission</td>
<td>22% (17)</td>
<td>15% (11)</td>
<td>26% (23)</td>
<td>30% (14)</td>
</tr>
<tr>
<td>Private for-profit</td>
<td>19% (15)</td>
<td>14% (10)</td>
<td>22% (19)</td>
<td>20% (9)</td>
</tr>
<tr>
<td>Not available</td>
<td>3% (2)</td>
<td>7% (5)</td>
<td>13% (11)</td>
<td>7% (3)</td>
</tr>
<tr>
<td><strong>Region</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cotonou</td>
<td>29% (22)</td>
<td>30% (21)</td>
<td>34% (30)</td>
<td>52% (24)</td>
</tr>
<tr>
<td>Bohicon</td>
<td>43% (33)</td>
<td>27% (19)</td>
<td>26% (23)</td>
<td>24% (11)</td>
</tr>
<tr>
<td>Parakou</td>
<td>29% (22)</td>
<td>44% (31)</td>
<td>39% (34)</td>
<td>24% (11)</td>
</tr>
</tbody>
</table>

*Difference statistically significant (by OLS) at the 0.10 level. ** Difference statistically significant at the 0.05 level. *** Difference statistically significant at the 0.01 level.

Note: Reference category for wealth quintile is 1 (lowest 20% of the population).

Unsurprisingly, wealthier participants were willing to pay more. Over 40% of those in segments A and B were in the bottom two wealth quintiles compared to only around 20% in segment D. Individuals living in Cotonou reported higher WTP: More than half of segment D lived in that region. No clear trends were observed for facility types and urban versus rural areas. Only 6 respondents said they were unwilling to pay anything, so no reliable conclusions can be drawn about this group.
Significant influences on willingness to pay

Bivariate analysis indicated statistically significant differences in willingness to pay by education level and geographic region. Respondents who had completed secondary education were willing to pay 2109 CFA, 67% more than those who had not completed primary education (ANOVA p=0.07). Willingness to pay also differed significantly by geographic region: On average, Cotonou residents were willing to pay 2011 CFA, 61% more than those in Parakou and 71% more than those in Bohicon (ANOVA p=0.01). After controlling for other factors, however, significant differences remained only by wealth quintile with respondents willing to pay 285 CFA more for each additional level of wealth (OLS p=0.01).

Illness concepts

Severity

Beninese FGD participants were divided in their perceptions about the severity of malaria. Some said that malaria is not very severe compared to the other illnesses being discussed: Some cited the availability of anti-malarial medication as evidence that the illness is not very serious. Other participants, however, said that malaria is a very severe illness because it can be fatal, especially in children, and because it can attack suddenly. A few participants asserted that malaria is severe because it “triggers” other illnesses.

Susceptibility

Most Beninese respondents said that they feel highly susceptible to getting malaria. FGD participants frequently stated that “Malaria spares no one,” noting that the illness attacks people of all ages, and that one can contract malaria despite taking protective measures. As one participant put it, “Even if we sleep under a mosquito net, we stay in the fields until nightfall, so the mosquitoes bite us and we get malaria.” Only a few participants said that malaria can be avoided; they mentioned sleeping under a mosquito net and keeping one’s house free of standing water as effective strategies for avoiding malaria.

Need for Diagnostic Test

According to most Beninese FGD participants, malaria does not require a test for diagnosis. Many respondents said that malaria is so common and its symptoms so familiar that diagnostic tests are not required: Doctors can simply recognize the symptoms and prescribe accordingly.

Stigma

Participants unanimously agreed that malaria is not a stigmatizing illness. According to respondents, malaria is “the illness that everyone gets,” making it less embarrassing. Also, several respondents noted that malaria is a public illness; that is, everyone knows and can see that someone is sick with malaria, while other illnesses, like STIs and HIV, are more hidden.

Sample type

Most Beninese FGD participants agreed that blood is the best sample type for malaria tests. They expressed great confidence in the accuracy of blood samples because blood comes into contact with all pathogens. As one male participant from Bohicon put it, “blood circulates throughout the whole body and can reach wherever the disease is found in the body. It scans everything that is in the body. So in the blood you can detect all diseases.” Another participant compared blood to a river that “flows and collects everything in its path” and asserted that “this is how the blood drains all waste from the body. So in the blood, we can quickly detect diseases.” Focus group participants also alluded to the ready availability of blood as an advantage over stool or urine samples, which patients may not be able to provide as easily. Some did prefer a urine sample, citing as reasons that urine is easier and less painful to give than blood,
that sick people lack adequate blood supply, and that with a blood sample you cannot be sure the needle used is clean. A few participants also noted that the color of urine can change in someone with malaria, suggesting that it would be easy to detect malaria through a urine sample.

Treatability

Almost all Beninese participants agreed that malaria is easy to treat, and usually named it the “easiest to treat” among the six illnesses discussed. Many participants said that malaria is familiar in the community (“We are used to it”) and that people “know how to manage” malaria, either through at-home traditional medicine or by seeking biomedical treatment from the pharmacy or hospital.

Tanzania

Located along the east coast of Africa, the United Republic of Tanzania transitioned from independence in 1961 to a socialist state, then a multiparty democracy with a level of stability that has eluded its neighbors.38 Despite political stability and economic growth, high disease burdens and low levels of education pose challenges to development. The per capita GNI of US $400 is much lower than the sub-Saharan African average of US $952. Approximately 36% of the country’s 40 million inhabitants live below the poverty line. The annual growth rate is 2%, and 44% of the population is below age 15.24,39

Overview of the health system

The Tanzanian health system includes a public sector, parastatal organizations, and a private sector comprised of for-profit groups, NGOs, and faith-based organizations (FBOs). The public system, run by the Ministry of Health and Social Welfare (MoHSW) has five levels:

1. National referral hospitals
2. Regional general hospitals
3. District hospitals
4. Health centers, and
5. Dispensaries

The private sector provides about a third of health services, and private shops and kiosks distribute drugs widely throughout the country.40,41 During Tanzania’s socialist years, all health care was provided by the government. Although private practice was banned, the government did maintain a relationship with FBOs, and FBO clinics and hospitals continue to serve as quasi-public facilities not reached by the government. As the country moved toward a more market-oriented economy, consumers began to have a choice between public and private facilities. Recognition of the private sector after 2002 led to improved health outcomes, including higher vaccination rates.

Health facilities are somewhat more abundant in cities than elsewhere: While 64% of the population is rural, only 52% of registered health centers are in rural areas. Decentralization has brought more basic care to the rural population, but the poor state of rural roads limits access to referral services.41,42

The government, donors, NGOs, private organizations, and households provide health financing: Households contribute the greatest proportion of total health care financing, 47%, while donors and the government provide nearly equal proportions, 22% and 23%, respectively.43 Government health care spending accounts for approximately 13% of the total budget or about 4% of overall GDP, slightly less than the regional average of 5%.39,41,44

Public sector employees receive social health insurance through the National Health Insurance Scheme, which provides coverage to approximately 3–5% of the population. Community-based insurance
provides the option of pre-paid health coverage to 48 primarily rural districts, but CHS could find no information about how many people or what percentage of the population was covered under these funds. Micro-insurance schemes exist for people employed in the informal sector, but again, CHS could not find any coverage statistics beyond small-scale studies of individual districts or communities. There is also a limited amount of private health insurance available to those who can afford it.

**Malaria in Tanzania**

Tanzania has the third largest population at risk of malaria in Africa after Nigeria and the Democratic Republic of Congo. In many parts of the country, including the uplands, transmission occurs year-round, though more frequently during and after the rainy season in April and May. Malaria is Tanzania’s number one cause of morbidity and mortality, with an estimated 16-18 million cases per year resulting in about 100,000 deaths, 70,000 of them children under 5. It is estimated that Tanzania loses 3.4% of its GDP ($121 million) as a direct result of malaria. Malaria accounts for up to 44% of all outpatient visits and 42% of inpatient deaths by under fives. Malaria is also the main source of work for Tanzania’s understaffed laboratories: Over 4 million blood smears were processed on the mainland in 2006, 35% of all lab investigations carried out that year.

The Tanzania HIV and Malaria Indicator Survey (THMIS) for 2007–2008 found that 19% of children under age five on the mainland and 24% in Zanzibar had a fever during the two weeks preceding the survey. These reported cases of fever contrast with the findings of blood tests done during the THMIS: malaria parasites were detected in 18% of children 6–59 months on the mainland, compared with less than 1% in Zanzibar. Dar es Salaam region also has a malaria prevalence around 1%. This and other studies confirm that between 41% and 95% of fevers are not in fact due to malaria. This complex and changing epidemiological picture contributes to the difficulty of defining a one-size-fits-all national diagnosis and treatment policy.

**Evolving diagnosis and treatment policies for children under five**

In 2007 when CHS initiated this study in Tanzania, national norms stipulated presumptive treatment for children under five, as recommended by IMCI guidelines. Although not every public facility had IMCI-trained providers, it was NMCP policy that all fevers in under-fives should be treated presumptively with the first line anti-malarial, which was switched to ACT in early 2007.

**Introduction of Rapid Diagnostics**

Malaria rapid diagnostic tests have been used in Tanzania since at least 2003 and on a larger scale starting in early 2007, when the US President’s Malaria Initiative (PMI) purchased about 800,000 Paracheck® and Parahit® kits for trial use by several large-scale research projects. In early 2009, the Mainland NMCP began introducing RDTs as the first line diagnostic tool for all age groups at all levels of the public health system. By May, RDTs had been placed in all government hospitals in the Dar es Salaam region, and were scheduled for expansion to the Iringa region in the following months. Approximately 26 million RDTs will be distributed nationally over the next five years, starting in low to moderate transmission areas. Zanzibar is also considering a shift in their IMCI algorithm for management of fever to one designed for areas of low malaria endemicity.

This switch to RDTs is happening because only about 17% of public health facilities currently provide laboratory services. This means that only 12–20% of the 12 million malaria cases reported annually are
confirmed parasitologically. Microscopy, where available, is only about 70% sensitive and 60% specific. The MoHSW plans to improve the quality of microscopy in higher level facilities so it can be used in special situations as needed. The Mainland NMCP aims to go from 20% to 80% lab confirmation of malaria cases, with a hoped-for reduction of 40% in anti-malarial wastage.\textsuperscript{54}

\textit{Cost to patients}

Blood smears for children under age five are free (though rarely performed), whereas they cost a few hundred shillings for those over five. RDTs for children under five, where they are being used in public facilities, are provided free of charge.\textsuperscript{55} In private for-profit clinics or pharmacies, they are sometimes provided for around one dollar or more, which exceeds many people’s ability to pay.\textsuperscript{56,57}

\textit{Current source of supply}

Public institutions as well as FBOs and NGOs registered with the MoHSW obtain diagnostics centrally through the Ministry’s Medical Stores Department (MSD). MSD procures and manages logistics for most drugs and health products for the public sector and its NGO and FBO affiliates. It issues tenders and proposals at the national and international levels. It distributes stock from the central to the zonal, regional, and district levels. MSD charges organizations using its services 8, 6, 2, and 3% respectively for procurement, clearing, storage and distribution.\textsuperscript{54}

There are several ways in which RDTs enter the country and are distributed: through private importers, the MSD, and directly by donors. As of March 2007, almost 200 private wholesalers were registered with the Tanzanian Food and Drug Administration. These wholesalers procure drugs and medical supplies both internationally and locally and sell them to more than 350 registered pharmacies and over 6000 registered drug shops.\textsuperscript{48} As of 2007, two major importers were bringing in the majority of malaria RDTs used in public and private facilities.\textsuperscript{58} There was reportedly a huge market for malaria RDTs in private sector pharmacies.\textsuperscript{59} The Tanzanian government provides some funding for supplies to the National Malaria Control Programme (NMCP), but most comes from donors. Private for-profit facilities buy diagnostics from wholesalers or from pharmacies in relatively small quantities at high costs. MSD will procure the approximately 26 million RDTs being financed by Tanzania’s Round 7 Global Fund Grant.

\textit{Current spending on malaria diagnostics}

Spending by households and government on malaria in Tanzania is very high: one 10-year old study estimated that total expenditures of malaria represented an estimated 1% of total GDP.\textsuperscript{60} That percentage may have increased considerably in recent years with the tremendous increase in donor funding for malaria control in the country. According to one report, government facilities devote almost one-third of their resources to the disease. Private expenditures on items such as drugs, coils, sprays and bed nets, accounted for an estimated 71% of total expenditures on malaria in the country in 1998.\textsuperscript{50} That percentage has probably decreased significantly as donor funds have grown, but still amounts to an important burden on households and contributes to the continuing cycle of poverty.\textsuperscript{61}

In a 2007 interview, NMCP Director Dr. Alex Mwita stated that it was not possible to accurately calculate current spending on malaria diagnostics. This is partially due to the fact that malaria microscopy costs are hard to distinguish from other microscopy costs, but mainly due to the fact that most money for RDTs and microscopy is coming from donors. Donor support to the NMCP for case
management is a mixture of cash and in-kind, and the amount for diagnosis is sometimes not stated separately. Discussions with NMCP, PMI and Global Fund management staff in 2007 estimated that donor spending on malaria diagnosis had increased over the last 5 years as new funding became available. However, the magnitude of that funding was not possible to determine.55,56,62,63

The principal external donors for malaria control in Tanzania are the Global Fund, PMI and the World Bank. UNICEF, WHO and others (the European Union, Japan) provide relatively small amounts of support. The Japanese International Cooperation Agency (JICA) has provided some support for improving quality of malaria diagnosis using specialized microscopes. The advantages and disadvantages of this method were described by the JICA advisor: “The Acrydine orange test only costs about 30 cents (for the reagent, slide, and cover slip) but the problem is you need a special microscope for it which costs $4,000, and only one company in Japan manufactures it.”64

The previous mentioned Round 7 Global Fund grant contains $15.5 million (out of a total of $52.5 million) for procurement and quality assurance of both RDTs and microscopy. Tanzania’s Round 7 proposal estimated a cost of about $4 million per year to carry out malaria diagnosis using RDTs. It was not if that estimate was based on procurement and distribution alone or also included funds for the necessary supervision and training to scale up and sustain the program.54

**Perceived need**

At the time interviews were carried out in 2007, there was a high perceived need among many respondents for rapid malaria tests for both children and adults. NMCP director Mwita explained this need in the following terms:

> Diagnostic tests in the public sector can’t be offered widely because our health system isn’t good enough. We don’t have microscopy everywhere…Probably only about 20% of fever cases get a blood smear, and probably only about 20% of those are positive.56

Many health professionals interviewed by CHS categorized a new diagnostic technology for malaria in children as very high priority due to its contribution to morbidity and mortality. However, a number of them also stated that, although they would very much like to be able to test children under five for malaria using RDTs, they would go ahead and treat for malaria anyway.

In some cases, this was due simply to the then-current MoHSW policy of presumptive treatment for malaria for all fevers in children under five, and in some cases because respondents felt that any test with less than 100% sensitivity would allow some children with malaria to go untreated, which they considered too risky. There was concern that RDTs needed to pick up low levels of parasitemia.

Additionally, some respondents saw need for better diagnostic capacity for malaria because it helps them “know what else they were dealing with,” and some noted that that better differential diagnosis of fevers can help bring down overall mortality from other causes such as pneumonia.65 A recent study in Tanzania showed that in cases of severe febrile illness, a higher case fatality rate was found in the group of patients without malaria (but with possible bacterial infections that were left untreated) than in the group having documented malaria.66

However, the need for improved diagnosis was tempered by recognition of the high and potentially unsustainable cost.56 “It’s quite difficult to continue to procure RDTs for developing countries,” one
donor representative commented. “In this country, around 70% come from donor funds; the government could not afford to keep procuring RDTs on its own.”

**Consumer willingness to purchase and use a diagnostic test**

Between 94%–97% of Tanzania consumers surveyed indicated willingness to use and pay for diagnostic tests for all diseases included in the study. However, as shown in Figure 4, consumers were willing to pay less for a malaria diagnostic than for any other test.

**Figure 4. Mean consumer willingness to pay for 6 diagnostic tests, Tanzania**

The average age of malaria survey respondents was 28.5 years; the average age of the accompanying child was just under 2 years. About half (53%) of accompanying children were male. Respondents interviewed at public facilities accounted for about 75% of the sample, as did respondents at urban facilities. Most (77%) of the respondents were married. Nearly 70% of respondents had not continued beyond primary education. At the time of the study, US $1 was equal to 1176 Tanzanian shillings (Tsh 1176). On average, respondents paid Tsh 778 in travel costs to reach a health facility. Table 5 presents sociodemographic characteristics.
### Table 5. Sociodemographic characteristics of malaria survey respondents in Tanzania

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Respondent % (n=523)</th>
<th>Respondent’s spouse</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Average age of respondent</strong></td>
<td>28.5</td>
<td></td>
</tr>
<tr>
<td><strong>Average age of child</strong></td>
<td>1.9</td>
<td></td>
</tr>
<tr>
<td><strong>Gender of child</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>53.0% (221)</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>47.0% (187)</td>
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</tr>
<tr>
<td><strong>Marital status</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single</td>
<td>16.6% (87)</td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>77.3% (404)</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>1.0% (5)</td>
<td></td>
</tr>
<tr>
<td>Not available</td>
<td>5.2% (27)</td>
<td></td>
</tr>
<tr>
<td><strong>Education level</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;Primary</td>
<td>15.1% (79)</td>
<td>5.6% (29)</td>
</tr>
<tr>
<td>Primary</td>
<td>54.9% (287)</td>
<td>35.0% (183)</td>
</tr>
<tr>
<td>Secondary</td>
<td>24.1% (126)</td>
<td>27.3% (143)</td>
</tr>
<tr>
<td>Tertiary</td>
<td>4.0% (21)</td>
<td>9.6% (50)</td>
</tr>
<tr>
<td>Vocational</td>
<td>1.3% (7)</td>
<td>3.3% (17)</td>
</tr>
<tr>
<td>Not available</td>
<td>0.6% (3)</td>
<td>18.3% (101)</td>
</tr>
<tr>
<td><strong>Religion</strong></td>
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<td></td>
</tr>
<tr>
<td>Muslim</td>
<td>59.3% (310)</td>
<td></td>
</tr>
<tr>
<td>Christian</td>
<td>37.7% (197)</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>0.6% (3)</td>
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</tr>
<tr>
<td>Not available</td>
<td>2.5% (13)</td>
<td></td>
</tr>
<tr>
<td><strong>Zone</strong></td>
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</tr>
<tr>
<td>Urban</td>
<td>74.8% (391)</td>
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</tr>
<tr>
<td>Rural</td>
<td>25.2% (132)</td>
<td></td>
</tr>
<tr>
<td><strong>Region</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dar es Salaam</td>
<td>64.2% (336)</td>
<td></td>
</tr>
<tr>
<td>Tanga</td>
<td>35.8% (187)</td>
<td></td>
</tr>
<tr>
<td><strong>Facility Type</strong></td>
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<td></td>
</tr>
<tr>
<td>Public</td>
<td>75.1% (393)</td>
<td></td>
</tr>
<tr>
<td>Private</td>
<td>24.9% (130)</td>
<td></td>
</tr>
<tr>
<td><strong>Average travel cost (Tsh)</strong></td>
<td>778</td>
<td></td>
</tr>
</tbody>
</table>

Figure 5 groups respondents into four market segments to categorize consumer willingness to pay for malaria diagnostics tests by price range:

- **Segment A**: Consumers willing to pay no more than Tsh 400,
- **Segment B**: Consumers willing to pay Tsh 401–800,
- **Segment C**: Consumers willing to pay Tsh 801–1000
- **Segment D**: Consumers willing to pay more than Tsh 1000.

Market segmentation enabled a determination of which characteristics these groups share and an understanding of the factors driving market response at each price level. The figure highlights these markets and illustrates the proportion of the population that fall into each segment at a given price range.
Table 6 shows that socio-economic and demographic characteristics differ among market segments. Education levels tended to increase across market segments. However most of this growth was restricted to secondary school graduates with little increase among those with post-secondary education.

There was no clear association between wealth and willingness to pay more for diagnostics. Rural respondents appear willing to pay more, but this was not a statistically significant difference. However, respondents living in Tanga and those attending private clinics were willing to pay more.

In summary, data indicate that consumers willing to pay more for malaria diagnostics were likely to have graduated from secondary school, attend private clinics, and live in Tanga.

**Significant Influences on Willingness to Pay**

In bivariate analysis, there were statistically significant differences in consumer willingness to pay by wealth quintile and mother’s education level. On average, consumers in the highest wealth quintile were willing to pay Tsh 1405, 51% more those in the lowest (ANOVA p=0.01). Respondents who were university educated were willing to pay Tsh 1850, more than three times the amount of those who had not completed primary education (ANOVA p=0.01). Willingness to pay also differed significantly by facility type and the amount of time to reach a facility. Consumers seeking care at private facilities were willing to pay an average of Tsh 1591, 67% more than those at public facilities (ANOVA p=0.01). Figure 6 shows the difference in willingness to pay at each price level between consumers attending public facilities and those attending private facilities.

Respondents who traveled for more than 30 minutes to reach a facility were willing to pay Tsh 1389, 55% more than those who traveled less than 15 minutes (ANOVA p=0.01). Although the amounts consumers were willing to pay differed significantly between certain socioeconomic and demographic strata, after controlling for other factors significant differences remained by mother’s education level, wealth quintile, religion, time to reach a facility and facility type. Consumers seeking care at a hospital were willing to pay Tsh 89 less than those at either health centers of dispensaries (OLS p=0.01) and consumers at public
facilities were willing to pay Tsh 89 less than those at private facilities (OLS p=0.01). For each step up in mother’s education level mothers were willing to pay an additional Tsh 138 (OLS p=0.05) and for each additional level of wealth consumers were willing to pay an additional Tsh 58 (OLS p=0.05).

Table 6. Selected socioeconomic characteristics of respondents willing to pay within different price ranges (Tsh) for a malaria diagnostic in Tanzania

<table>
<thead>
<tr>
<th>Population characteristics (n=523)</th>
<th>Segment A: WTP 0–400 (n=144)</th>
<th>Segment B: WTP 401–800 (n=130)</th>
<th>Segment C: WTP 801–1000 (n=131)</th>
<th>Segment D: WTP +1000 (n=118)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mother’s education level***</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;Primary</td>
<td>24% (34)</td>
<td>16% (21)</td>
<td>11% (14)</td>
<td>8% (9)</td>
</tr>
<tr>
<td>Primary</td>
<td>60% (86)</td>
<td>60% (78)</td>
<td>56% (73)</td>
<td>42% (50)</td>
</tr>
<tr>
<td>Secondary</td>
<td>16% (23)</td>
<td>18% (24)</td>
<td>26% (34)</td>
<td>38% (45)</td>
</tr>
<tr>
<td>Tertiary</td>
<td>0</td>
<td>2% (3)</td>
<td>5% (7)</td>
<td>9% (11)</td>
</tr>
<tr>
<td>Other</td>
<td>1% (1)</td>
<td>3% (4)</td>
<td>2% (2)</td>
<td>3% (3)</td>
</tr>
<tr>
<td>Wealth Quintile**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 (lowest)</td>
<td>22% (31)</td>
<td>17% (22)</td>
<td>24% (31)</td>
<td>14% (17)</td>
</tr>
<tr>
<td>2</td>
<td>21% (30)</td>
<td>15% (19)</td>
<td>21% (27)</td>
<td>15% (18)</td>
</tr>
<tr>
<td>3</td>
<td>23% (33)</td>
<td>19% (25)</td>
<td>15% (20)</td>
<td>19% (23)</td>
</tr>
<tr>
<td>4</td>
<td>17% (24)</td>
<td>22% (28)</td>
<td>24% (31)</td>
<td>20% (24)</td>
</tr>
<tr>
<td>5 (highest)</td>
<td>15% (21)</td>
<td>25% (33)</td>
<td>15% (19)</td>
<td>25% (29)</td>
</tr>
<tr>
<td>Not available</td>
<td>3% (5)</td>
<td>2% (3)</td>
<td>2% (3)</td>
<td>6% (7)</td>
</tr>
<tr>
<td>Zone</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td>81% (117)</td>
<td>75% (97)</td>
<td>73% (95)</td>
<td>69% (82)</td>
</tr>
<tr>
<td>Rural</td>
<td>19% (27)</td>
<td>25% (33)</td>
<td>27% (36)</td>
<td>31% (36)</td>
</tr>
<tr>
<td>Facility Type</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public***</td>
<td>92% (133)</td>
<td>84% (109)</td>
<td>69% (91)</td>
<td>51% (60)</td>
</tr>
<tr>
<td>Private for-profit</td>
<td>8% (11)</td>
<td>16% (21)</td>
<td>31% (40)</td>
<td>49% (58)</td>
</tr>
<tr>
<td>Region</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dar es Salaam</td>
<td>83% (119)</td>
<td>78% (101)</td>
<td>60% (78)</td>
<td>32% (38)</td>
</tr>
<tr>
<td>Tanga</td>
<td>17% (25)</td>
<td>22% (29)</td>
<td>40% (53)</td>
<td>68% (80)</td>
</tr>
</tbody>
</table>

* Difference statistically significant (by OLS) at the 0.10 level.
** Difference statistically significant at the 0.05 level.
*** Difference statistically significant at the 0.01 level

Notes: Reference category for wealth quintile is 1, the poorest 20% of the population. Reference category for education level is below primary education

Illness Concepts

Severity

Many Tanzanian participants identified malaria as a severe illness; respondents said that malaria in children is particularly serious, as it can make children anemic or dehydrated and can be fatal. Some participants noted that when a child falls ill with malaria, it affects the whole family, since “he can spend many days in the hospital, and the mother can’t work in the fields or do other things.” Others said that malaria is especially serious because it can be misleading: its symptoms can mimic other illnesses and parents may fail to recognize that their child has malaria, or, even when they do recognize malaria, they not consider it a condition requiring urgent medical attention. Participants said that parents often fail to seek treatment for a child with malaria until the illness is more acute, at which point it is often too late.
Susceptibility

Tanzanian FGD participants viewed malaria as an illness to which they are very susceptible. Respondents said that a number of factors make malaria a serious risk in their communities: First, they cited many water ditches and other uncovered water sources where mosquitoes breed. Second, participants said that many people do not have mosquito nets, or those that have them do not use them or do not regularly treat them with insecticide. Participants said that while children are particularly vulnerable to malaria infection because they have lower immunity and play near water ditches, “Everyone can get malaria: adults, children, women, men, all can get it.”

Figure 6. Tanzania: Willingness to pay for a malaria test by facility type

<table>
<thead>
<tr>
<th>Maximum Price (Tanzanian Shilling)</th>
<th>Percentage of Respondents WTP</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>200</td>
<td>80%</td>
</tr>
<tr>
<td>400</td>
<td>60%</td>
</tr>
<tr>
<td>600</td>
<td>40%</td>
</tr>
<tr>
<td>800</td>
<td>20%</td>
</tr>
<tr>
<td>1000</td>
<td>0%</td>
</tr>
<tr>
<td>1200</td>
<td></td>
</tr>
<tr>
<td>1400</td>
<td></td>
</tr>
<tr>
<td>1600</td>
<td></td>
</tr>
<tr>
<td>1800</td>
<td></td>
</tr>
<tr>
<td>2000</td>
<td></td>
</tr>
<tr>
<td>&lt;2000</td>
<td></td>
</tr>
</tbody>
</table>

Public (n=393) — Private (n=130)

Treatability

Most participants said that malaria is easy to treat. They compared malaria treatment to that of other illnesses like TB and HIV, saying that anti-malarials are relatively quick and easy to take, and usually effective. A few said that the treatability of malaria depends on how early the illness is diagnosed: the more quickly one starts treatment, the more likely that the treatment is successful. Some pointed out that the symptoms of malaria are apparent, enabling early treatment, while many other illnesses can be asymptomatic.
Stigma

According to Tanzanian respondents, malaria is not a stigmatizing illness. Participants said the lack of stigma is due to the illness being “common,” and because its mode of transmission is not associated with promiscuity or any other shameful behavior. As one respondent put it, “There is no one at our age who can claim never to have had malaria, so it’s easy to see it as normal illness.”

Need for Diagnostic Test

Most participants said that because malaria has very obvious symptoms, it does not require a diagnostic test. As one male participant from Lushoto explained, “[Before], I used to go to hospital and I would tell them how I feel and they tested my blood, but nowadays if I see certain symptoms, I know it is malaria and I don’t test—I buy medicine at a nearby drug store. I don’t do the diagnostic test anymore because I know all symptoms.” But some participants disagreed, saying that testing is useful to know exactly what type of malaria one has. They said that diagnostic testing allows a doctor to make a more specific diagnosis and prescribe more effective treatment.

Sample Type

All the FGD respondents in Tanzania agreed that blood is the best sample type for malaria diagnostics. A few differentiated between “small blood” (taken from the finger tip) and “big blood” (taken from the arm), saying that “small blood” is usually used for malaria testing.

Peru

Located along South America’s Pacific coast, Peru has three geographically and culturally distinct regions: the coastal desert, the Andean highlands, and the Amazonian rainforest. Data for this study were collected in Lima, representing the coastal region, Arequipa representing the highlands, and Iquitos, representing the Amazon. Peru’s population of about 27.5 million is growing by 1% per year. Thirty-one percent is under age 15.44 A third of Peruvians live in or near the capital, Lima, and 73% live in urban areas. The World Bank classifies Peru as lower middle-income; 11% of Peruvians live below the poverty line. At US $3450, the 2007 per capita GNI was lower than the US $5540 average for Latin America and the Caribbean and masks great disparities in wealth.24,67 In 2003 the richest fifth of the population accounted for 57% of national income, while the poorest fifth accounted for only 4%.68 Literacy among those over age 15 was reported at 93% in 2000.69

Overview of the health system

Despite the existence of health programs for the poor, numerous barriers limit access to services, including both direct and opportunity costs.69 Health services are limited in the poorest areas of the country and inadequate referral systems pose another hurdle.44,69,70

The Peruvian public health system includes:

1. The Ministry of Health (Ministerio de Salud or MINSA);
2. Services for salaried personnel provided by the social security system, ESSALUD; and
3. Services for the armed and public forces.67,70

Peru’s public sector includes 51% of the country’s hospitals, 69% of its health centers, and 99% of its health posts. The public laboratory network includes 16 regional labs and the national reference center, the National Institute of Health (INS).69 Private sector services are primarily used by those with higher incomes, and the largest portion is based in Lima, where 70% of the overall health market resides.67,70,71
According to 2004 reports, household spending and employer contributions through ESSALUD account for 37% and 35% of health financing, respectively. The government pays 24% of health costs, equal to about 8% of overall government spending. External donors cover an estimated 2–4%.

In 2001, the Comprehensive Health Insurance program was created to provide coverage for those under age 18 years, pregnant women, and some impoverished populations. As of 2004, 32% of the population used this health insurance. ESSALUD is mandatory for salaried workers; in 2004 it insured 18% of the population. Private sector insurance is also available.

The General Office of Medications, Supplies, and Drugs is the authority on medications, reagents, and medical equipment.

**Malaria in Peru**

Malaria transmission in Peru occurs along the northern Pacific coast and throughout the Amazon region. There is no transmission in Lima or Arequipa, though occasional imported cases occur among patients who have visited an endemic region. Even in endemic regions, malaria transmission is unstable and seasonal. Incidence fluctuates widely from year to year. Most years, *P. vivax* accounts for about 2/3 of all cases and *P. falciparum* for 1/3, but occasionally *P. falciparum* cases equal or exceed *P. vivax*. Beginning in the early- to mid-1990s when malaria reemerged as a significant public health problem in Peru, the health system initiated diagnosis by microscopy with presumptive treatment in areas with limited access to health facilities. But shortages of qualified microscopists and the delay in obtaining microscopy results became problematic almost immediately. Further, pockets of resistance to CQ and SP began to appear as early as 1998. The NMCP implemented ACT (mefloquine and artesunate) as first line treatment in areas of high resistance starting in 2002. With support from external donors, MINSA and the NMCP have introduced RDTs in some parts of the Amazon region, but uptake has been uneven and supplies unreliable. A CHS-prepared case study on malaria diagnosis in Peru provides more detailed information.

**Health system perspective**

Provider and practitioner responses on malaria diagnostics varied depending on location and specialty. For providers in Lima and Arequipa, malaria was a generally a low priority. However, one provider noted malaria as a high priority, specifically in comparison to STIs, since it is a disease that can rapidly prove fatal if not diagnosed and treated in an opportune manner. Some providers knew that RDTs were in use, but were unsure if they were available in sufficient quantities. Practitioners closer to the Amazon recognized a need for improved malaria diagnostic tests and stressed stability and simplicity. The majority of providers mentioned the need for rapid results since getting patients back into facilities to start treatment is difficult.

**Diagnostic Priorities**

Generally, providers indicated that new tests should be easy to use for both clinicians and technicians. One suggested that a widely available self-test would be ideal, particularly in the Amazon where lab facilities are limited. In addition, tests should be easy to transport, small, and have a minimum two-year shelf-life. One provider stated that tests should come in self-contained a kit with all required instructions and supplies. In addition, the results should also be easily interpretable and even color-coded. Additional desirable characteristics included stability in high heat and humidity, high sensitivity and specificity, easy transportability, and possible to use without access to electricity or refrigeration. Results should be available rapidly enough that the patient does not need to make a return visit. A number of currently
available RDTs meet all or almost all of these criteria. Some providers also suggested that, ideally, a new test would be non-invasive (i.e., not blood-based). Finally, some interviewees said that successful widespread implementation of RDTs would require changes to make the health system bureaucracy more responsive and efficient. This point also emerged from the aforementioned case study.\textsuperscript{72}

**Consumer willingness to purchase and use diagnostic tests**

Of the consumers interviewed in Peru about TB, malaria, ALRIs, HIV, syphilis, and other STIs, 90% indicated that they were interested in using and willing to pay for diagnostic tests. Figure 7 indicates that, as in Benin and Tanzania, Peruvian consumers said they were willing to pay less for a malaria test than for any other diagnostic included in the study.

**Figure 7. Mean consumer willingness to pay for 6 diagnostic tests, Peru**

![Figure 7: Mean consumer willingness to pay for 6 diagnostic tests, Peru](image)

The mean age of Peruvian malaria survey respondents was 28.3 years. On average, accompanying children were just over 1 year old and 58% male. Married respondents accounted for 93% of the sample. All malaria interviews were conducted around Iquitos because there is no malaria transmission in Lima or Arequipa. Table 7 reports the sociodemographic characteristics of survey respondents. At the time of the study, US $1 was equivalent to 2.72 Peruvian nuevos soles (S/. 2.72). On average respondents traveled 21 minutes and spent S/.1.70 in travel costs to reach a health facility.
Table 7. Sociodemographic characteristics of malaria survey respondents in Peru

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Respondent (n=241)</th>
<th>Respondents’ spouse</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean age (years)</td>
<td>28.3</td>
<td></td>
</tr>
<tr>
<td>Child’s mean age (years)</td>
<td>1.3</td>
<td></td>
</tr>
<tr>
<td>Gender of Child</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>57.7% (139)</td>
<td>42.3% (102)</td>
</tr>
<tr>
<td>Female</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marital Status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single</td>
<td>5.8% (14)</td>
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</tr>
<tr>
<td>Married</td>
<td>93.0% (224)</td>
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</tr>
<tr>
<td>Other</td>
<td>1.2% (3)</td>
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</tr>
<tr>
<td>Education Level</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;Primary</td>
<td>0.8% (2)</td>
<td>0.4% (1)</td>
</tr>
<tr>
<td>Primary</td>
<td>13.2% (32)</td>
<td>7.5% (18)</td>
</tr>
<tr>
<td>Secondary</td>
<td>51.9% (125)</td>
<td>46.9% (113)</td>
</tr>
<tr>
<td>Technical</td>
<td>22.0% (53)</td>
<td>18.7% (45)</td>
</tr>
<tr>
<td>University</td>
<td>12.0% (29)</td>
<td>19.1% (46)</td>
</tr>
<tr>
<td>Zone</td>
<td></td>
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</tr>
<tr>
<td>Urban</td>
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<tr>
<td>Rural</td>
<td>50.1% (122)</td>
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<td>Facility Type</td>
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</tr>
<tr>
<td>Public</td>
<td>33.6% (81)</td>
<td></td>
</tr>
<tr>
<td>NGO</td>
<td>16.6% (17)</td>
<td></td>
</tr>
<tr>
<td>Private for-profit</td>
<td>49.8% (120)</td>
<td></td>
</tr>
<tr>
<td>Have Health Insurance</td>
<td>26.1% (63)</td>
<td></td>
</tr>
<tr>
<td>Average travel time (minutes)</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>Average travel cost (S./)</td>
<td>1.7</td>
<td></td>
</tr>
</tbody>
</table>

Health-seeking behaviors

Slightly more than half the respondents reported that their child had suffered an illness episode in the four weeks preceding the survey; of these, 93% reported seeking care in the formal health sector while 4% sought care from a non-biomedical provider such as a shaman. Laboratory diagnostic tests were recommended to 26% of the respondents who went to a biomedical facility, and all patients reported consenting to the tests. Respondents whose child underwent diagnostic tests reported having paid an average of S/. 42.80 for these tests on the day of the survey. These tests may have been for malaria or some other illness, since participants were recruited from among adults seeking any type of health care for their young child. The same respondents reported willingness to pay an average of S/. 15.10 for a malaria test.

Willingness to pay for malaria diagnostic tests

Based on the initial focus group findings, the WTP bidding for a malaria test started at S/. 5.00 (US $1.83) and increased or decreased in increments of S/. 2.50–10.00 depending on the respondent’s reply. Due in part to the survey design, the amounts respondents selected tended to cluster in increments of S/.
5.00. All of the 241 respondents expressed willingness to pay some amount ranging from S/. 0.50-70.00. Figure 8 shows that WTP declined by just 8% as the price increased from S/. 0.50–5.00, but then dropped by nearly an additional 30% at S/. 10.00 (US $3.68). A price of S/. 15.00 (US $5.51) excluded nearly 60% of consumers, and a price of S/. 30.00 (US $11.03) nearly 85%.

**Figure 8. WTP for malaria diagnostics at different price points, Peru 2007**

![Figure 8](image)

Figure 8 groups respondents into four market segments to categorize consumer willingness to pay for malaria diagnostics by price range:

- **Segment A**: Consumers willing to pay no more than S/. 5.00;
- **Segment B**: Consumers willing to pay S/. 6.00–10.00;
- **Segment C**: Consumers willing to pay S/. 11.00–20.00;
- **Segment D**: Consumers willing to pay more than S/. 20.00.

Market segmentation also enabled a determination of which characteristics these groups share and an understanding of the factors driving market response at each price level. The figure highlights these markets and illustrates the proportion of the population that fall into each segment at a given price range.

Table 8 shows that socio-economic and demographic characteristics of consumers differ across market segments, but wealth is clearly associated with willingness to pay higher prices. Respondents in market segments C and D tended to be better educated, with substantially higher representation in technical schools and universities. Half or more had attended either technical school or university. As willingness to pay increased across the market segments so did attendance at private facilities. Respondents from Segment A were predominantly from rural areas; those in Segment D were overwhelmingly urban. Respondents willing to pay more also tended to have health insurance.

**Significant influences on willingness to pay**

According to bivariate analysis, there were statistically significant differences in the consumer willingness to pay by wealth quintile and education level. University educated consumers were willing to pay an average of S/. 22.10 for a malaria test, 2.6 times as much as those who had completed only a primary education (ANOVA p=0.01). Similarly, consumers in the highest wealth quintile were willing to pay S/. 25.80 for a test, nearly 4 times as much as the poorest 20% of the population (ANOVA p=0.01).
There were significant differences by geographic zone, facility type and the cost of transport to the nearest facility. On average, urban residents were willing to pay S/. 18.20, 49% more than their rural counterparts (ANOVA p=0.01). Consumers at private facilities were willing to pay S/. 22.10, 6% more than those at NGO facilities and almost twice as much as those at public facilities (ANOVA p=0.01). Respondents who spent more than S/. 2.00 to reach a health facility were willing to pay S/. 21.20 for a test, 59% more than those who spent nothing (ANOVA p=0.01).

In regression analysis, after adjusting for other factors, significant differences remained by wealth quintile (or its proxy, education level) and insurance status. Wealth quintile was the most consistent predictor of increased WTP for all diagnostic tests in Peru. Respondents were willing to pay an increase of S/. 5.04 for each additional level of education completed (OLS p=0.01). Those with private or employee health insurance were willing to pay S/. 5.60 more than their uninsured counterparts (OLS p=0.10).

Table 8. Selected socioeconomic characteristics of consumers willing to pay within different price ranges (S./) for a malaria diagnostic in Peru

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Education Level</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; Primary</td>
<td>1% (1)</td>
<td>0</td>
<td>2% (1)</td>
<td>0</td>
</tr>
<tr>
<td>Primary</td>
<td>23% (16)</td>
<td>17% (11)</td>
<td>9% (4)</td>
<td>2% (1)</td>
</tr>
<tr>
<td>Secondary</td>
<td>67% (46)</td>
<td>59% (39)</td>
<td>39% (18)</td>
<td>37% (22)</td>
</tr>
<tr>
<td>University</td>
<td>9% (6)</td>
<td>17% (11)</td>
<td>28% (13)</td>
<td>39% (23)</td>
</tr>
<tr>
<td>Tertiary</td>
<td>0</td>
<td>8% (5)</td>
<td>23% (11)</td>
<td>22% (13)</td>
</tr>
<tr>
<td>Wealth Quintile**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 (lowest)</td>
<td>54% (37)</td>
<td>32% (21)</td>
<td>9% (4)</td>
<td>2% (1)</td>
</tr>
<tr>
<td>2</td>
<td>30% (21)</td>
<td>21% (14)</td>
<td>15% (7)</td>
<td>14% (8)</td>
</tr>
<tr>
<td>3</td>
<td>7% (5)</td>
<td>24% (16)</td>
<td>21% (10)</td>
<td>10% (6)</td>
</tr>
<tr>
<td>4</td>
<td>7% (5)</td>
<td>15% (10)</td>
<td>34% (16)</td>
<td>24% (14)</td>
</tr>
<tr>
<td>5 (highest)</td>
<td>1% (1)</td>
<td>8% (5)</td>
<td>21% (10)</td>
<td>49% (29)</td>
</tr>
<tr>
<td>Zone</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td>28% (19)</td>
<td>53% (35)</td>
<td>49% (23)</td>
<td>71% (42)</td>
</tr>
<tr>
<td>Rural</td>
<td>73% (50)</td>
<td>47% (31)</td>
<td>51% (24)</td>
<td>29% (17)</td>
</tr>
<tr>
<td>Facility Type</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public</td>
<td>39% (27)</td>
<td>47% (31)</td>
<td>28% (13)</td>
<td>17% (10)</td>
</tr>
<tr>
<td>NGO</td>
<td>4% (3)</td>
<td>14% (9)</td>
<td>32% (15)</td>
<td>22% (13)</td>
</tr>
<tr>
<td>Private for-profit</td>
<td>57% (39)</td>
<td>39% (26)</td>
<td>40% (19)</td>
<td>61% (36)</td>
</tr>
<tr>
<td>Region</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iquitos</td>
<td>100% (69)</td>
<td>100% (66)</td>
<td>100% (47)</td>
<td>100% (59)</td>
</tr>
<tr>
<td>Have Health Insurance*</td>
<td>4% (3)</td>
<td>17% (11)</td>
<td>34% (16)</td>
<td>56% (33)</td>
</tr>
</tbody>
</table>

*Difference statistically significant (by OLS) at the 0.10 level.
**Difference statistically significant at the 0.05 level.
***Difference statistically significant at the 0.01 level

Notes: Reference category for wealth quintile is “lowest 20%”

Illness concepts

Severity

Understandably, focus group participants from regions outside Iquitos had little to say about the severity of malaria. Those familiar with the disease from personal experience saw it as potentially serious, but less serious and less frightening than TB or HIV/AIDS both of which are perceived as more life
threatening, difficult to treat, and more stigmatizing. In general, residents of endemic areas tend to see malaria as severe in the sense of producing serious illness that makes it impossible to carry on with daily activities and can contribute to impoverishment when those infected cannot carry on working. The frequency with which it appears make people perceive it as a more important health problem than some life-threatening diseases to which people consider themselves less susceptible (e.g., HIV/AIDS and TB).

Susceptibility

Peruvian FGD participants knew that malaria is transmitted through mosquitoes, and (not entirely correctly) identified poor sanitation and standing water in one’s environment as risk factors for malaria. Iquitos FGD participants had more familiarity with malaria and often recounted their own past illness episodes or those of family members. Urban residents of Iquitos tend to be more concerned about dengue than malaria, since there is little malaria transmission within the city limits while dengue is ubiquitous. The opposite is the case for rural residents: people consider themselves highly susceptible to malaria infection and less concerned about dengue.

Benefits of diagnostic testing

Iquitos participants agreed that malaria treatment is effective and works rapidly compared to treatment for other illnesses; respondents also said it is more affordable than many other medications. Some participants said that the treatment for malaria depends on the stage of the illness: malaria detected early can be treated easily at home, while “advanced” malaria requires a trip to the hospital. So one perceived benefit of diagnosis was early treatment and avoidance of severe disease. Over the 15 or so years since malaria has reemerged as a significant public health problem in Peru, those living in endemic areas have become accustomed to getting blood tests for the disease and, if questioned, will often say that blood tests are the only way to determine if one has malaria.

Barriers to diagnostic testing

Malaria was not identified as a stigmatizing illness. Participants said that unlike STIs, malaria is not something that can be controlled or avoided, and therefore one is not held responsible or made to feel embarrassed if he contracts malaria. As one participant from Lima said, “The patient is more responsible [for getting an STI]. As for malaria, maybe you know how to watch out for [standing water] and that stuff, but a mosquito bites you once and infects you— it’s beyond [your control] you know?” Ready availability of effective treatment was mentioned by some as a disincentive to pay for a diagnostic. Focus group participants never mentioned the ready availability of free testing as a disincentive to purchasing a diagnostic test, but it would likely be a factor, especially among the rural poor who experience frequent malaria episodes.

Factors affecting Willingness to Pay

According to FGD participants, the low amounts survey respondents were willing to pay for malaria diagnostics may be attributable to the perception that malaria is more common, less contagious, and more easily treated, people would be less willing to pay for diagnostics for malaria than for illnesses considered more severe, more dangerous, and having more complicated treatment. For instance, some respondents said it was natural that people would pay more for an HIV/AIDS diagnostic than one for malaria because treatment for HIV/AIDS was difficult and costly while malaria treatment was readily available and cheap.

Conclusions and Recommendations

Health system perspective

Health providers in all three study countries agreed that a new malaria test for children under 5 would be useful, but saw it as less critical than tests for some other diseases, particularly tuberculosis and HIV/AIDS. In all three countries, an argument in favor of a new malaria diagnostic was the need to avoid
overuse of ACT, both for reasons of cost and for fear of antimalarial resistance. In Benin and Tanzania, where malaria is a major – if not the most important – cause of under 5 mortality, enthusiasm for a new test was tempered by concern about abandoning presumptive treatment and the possibility of false negative cases. Many health professionals in all three countries voiced continued distrust of RDTs, particularly for children under 5. To gain market share on a large scale independent of subsidies or direct procurement by external donors, a new malaria diagnostic would have to achieve high enough specificity under field conditions to allay health worker fears about possible child deaths due to false negative results. Other studies have demonstrated that doctors and nurses are also often skeptical of lower level health workers’ and care givers’ ability to use a diagnostic test correctly. This skepticism does not necessarily preclude marketing RDTs directly to CHWs or individual caregivers, but it would impede widespread individual or household level use.

Only Beninese providers mentioned the need for a quantitative rather than a qualitative test, noting that in an area of high stable transmission, nearly all patients will test positive if the criteria is any discernible level of blood parasitemia, even though their clinical signs (fever) may be caused by something else. A quantitative test may be a less pressing need for children under 5, however, since even low levels of parasitemia may cause clinical disease and progress to cerebral malaria or death if not treated rapidly.

Regardless of what happens in the retail sector, external donor support will significantly expand the market for malaria rapid tests worldwide in the near future whether or not the technical quality of tests improves. The 26 million units slated for purchase in mainland Tanzania and Zanzibar over the next 5 years with Global Fund support will be repeated in many other settings. But interviewees in all three study countries are understandably skeptical of programs built entirely or almost entirely on the basis of donor support – these large markets are unlikely to be sustained absent greatly expanded national government resources or great reductions in manufacturing costs or both.

A final barrier to overcome is that of quality assurance along the entire supply chain from manufacturer to end user. Current manufacturers, many of whom are small-scale operations, will have to find a way to maintain high standards of reliability while scaling up production from tens of thousands of units to tens of millions. These reliability standards will have to include stability to withstand transport and storage in conditions of high heat and humidity. In the public sector, logistics systems will need increased capacity to effectively move product from manufacturer to port, through customs clearance, central storage, regional and district storage, on to end users at health facilities or at the community level. Health systems will have to develop management and supervisory capacity sufficient to ensure that end users perform test steps accurately and safely – without such capacity, effective sensitivity and specificity will fall far below quality standards achievable under ideal conditions. In the private sector, manufacturers will have to identify wholesalers capable of playing a similar role while in turn indentifying retail outlets with the economic and human capital necessary to ensure access and adequate use.

**Consumer Perceptions Related to Malaria**

Consumers – parents – from all three study countries see malaria as a disease to which they and their children are highly susceptible, though in Peru this is true only in endemic areas. Consumers from all three countries also coincided in the view that, unlike STIs, HIV, and TB, becoming infected with malaria carries no stigma. These factors militate in favor of a consumer market for a malaria diagnostic test. However several factors militate against individual purchases, and these would have to be overcome before a significant consumer or caregiver market could develop. First, while consumers in all countries acknowledge that malaria can be a severe and even fatal disease in young children, it is a familiar disease perceived as easily treatable and less feared than diseases such as HIV or TB. In Benin and Tanzania, and to a lesser extent in Peru, consumers also see malaria as a disease with easily recognizable symptoms for which drugs are readily accessible. This makes self-treatment an attractive option and obviates the need for diagnosis prior to treatment. Hence developing a market for home-based malaria RDT use would require convincing
potential users that symptoms alone are not enough to diagnose malaria. More research would be needed to
develop specific marketing messages, but possible messages might include:

- symptoms common to malaria are also common to other illnesses;
- other illnesses with malaria-like symptoms can also be life-threatening to young children;
- if your child has some other illness, taking antimalarials won’t cure it;
- treating your child without first getting a diagnosis might increase her/his risk of dying;
- it is important to know what illness your child has so you can get the correct treatment.

If these kinds of messages can convince consumers that a malaria diagnostic test is a worthwhile
investment, Benin and Peru at least seem to offer feasible markets.

Beninese consumers who paid for diagnostics on the day of the survey reported paying 2497 CFA (US
$5.93) and reporting being willing to pay $1488 CFA (US $3.53) for a malaria test. Compared to current
production costs and market prices internationally, this is probably high enough to support selling RDTs
in the private sector in Benin. However, even a price of 1488 CFA, would exclude roughly 55% of
consumers from buying a malaria RDT. A price of 1000 CFA (US $2.38) would exclude only 30%,
while a price of 500 CFA (US $1.19) would exclude only about 5%. Given economies of scale, it is still
probably feasible to manufacture and sell an RDT at this price.

It is important to reiterate, however, that developing a private sector market in a country like Benin
presupposes overcoming the formal health sector’s skepticism about consumer or caregiver use of
diagnostic tests. This would be necessary to win government approval for official direct-to-consumer sales.

In Peru, the mean reported willingness to pay of S/. 15.10 (US $5.55) is more than the current cost of
many RDTs (at least for bulk purchases), but this price would exclude nearly 60% of Peruvian consumers
from the RDT market. A price of S/. 5.00 (US $1.84) would make RDTs accessible to over 90% of
Peruvian consumers. As in Benin, this is probably a feasible price at a moderate level of production.
Survey results suggest that prices could be set somewhat higher in urban areas and at private facilities.

Tanzania presents a more difficult picture. The mean price Tanzanian consumers reported being willing
to pay (Tsh. 1116 or about US $0.95) reflects Tanzania’s greater poverty and would actually exclude over
50% of consumers. To make RDTs accessible to around 90% of Tanzanian consumers – at least based on
the data from this study – the per unit cost would have to drop to somewhere around Tsh 250 or about US
$0.20–0.25. Currently, a typical malaria RDT in a pharmacy in Dar es Salaam sells for about Tsh 3,000.

The fact that only 11% of parents reported consenting to an earlier diagnostic test recommended by their
child’s provider underscores the challenge of this market. A recent study using similar methodology
found that 92% of 265 Tanzanian parents surveyed were willing to pay Tsh 500 for a child’s dose of
ACT, but only 55% were willing to pay more than that amount, even among wealthier respondents.73

The Market for a New Malaria Diagnostic Test

The current market for malaria RDTs is growing and will likely continue to grow rapidly for the next
several years as donors expand their malaria control activities in the run-up to the Millennium
Development Goals deadline in 2015. Thus, in the near to medium term, the best approach to estimating
market size for malaria diagnostics may be to track grants and work plans of donors like the Global Fund
and the President’s Malaria Initiative.

There is a relatively small demand from private sector, both private for profit and non-profit facilities,
where both providers and patients seem more interested in and able to pay for the use of diagnostic tests.
There is a negligible individual consumer market for malaria tests at present. Whether such a market can
develop will depend in part on drug prices and availability and in part on whether manufacturers or others
can overcome the barriers described above. Curiously, a final factor that could play a significant role in
determining individual consumer demand for a malaria diagnostic is what health systems have to offer
patients whose children test negative for malaria. If, as noted earlier, many caregivers see malaria as a familiar disease with recognizable symptoms and easily available effective treatment, the most important incentive for using a malaria diagnostic may be to determine that one’s child does not have malaria and thus that some other diagnosis and treatment is required. But such an incentive only works if diagnostics and effective treatments are available for other causes of febrile illness in children and parents can expect that their child will receive appropriate care once malaria has been ruled out.
Appendix A: Health Providers and Program Managers Interviewed for the Diagnostics Cost Analysis Project

Benin

Dr. Dissou Affolabi, Biologist and Assistant Professor of Microbiology, National Reference Laboratory for Mycobacteria. Cotonou. 8/9/2007 and 3/21/2009.


Dr. Guy Aouanou, Chief of Pediatrics, Hôpital Saint Jean de Dieu. Tanguiesta. 3/16/2009.


Mr. Romain Dahoui, Biotechnologist, Medical Center St. Jean. Cotonou. 8/11/2007.

Dr. Alfred Dansou, Director of Pharmacy and Medications. Cotonou. 8/9/2007.

Dr. Alexandrine L. Dazogbo, Manager of Youth and Adolescent Reproductive Health Program, UNFPA. Cotonou. 3/20/2009.


Dr. Abdel Aziz Fagbemi, Manager of Medical and Reagent Stocks for the National AIDS Control Program. Cotonou. 8/8/2007.


Dr. Fernand Guedou, Director of Health Research. Cotonou. 8/9/2007.


Joseph Essodina Ndayake, Biomedical Analysis Technician and Laboratory Director, Hôpital Saint Jean de Dieu. Tanguiesta. 3/15/2009.

Dr. Elvis Nkounkou, Gynecologist, Centre Nationale Hospitalier Universitaire. Cotonou. 3/19/2009.
Dr. Aguima Tankoano, Director, Health Care Improvement Project. Bohicon. 8/5/2007

Peru
Dr. César Bonilla, Director, National Tuberculosis Strategy. Lima. 4/14/2009
Dr. Juan Cornejo del Carpio, Director, Chagas Program, Regional Directorate of Health. Arequipa.
Dr. Lenin del Cuadro, Director, Reference Laboratory, Iquitos Directorate of Health. Iquitos. 4/3/2009.
Dr. Fredy Delgado, Director, Reference Laboratory. Arequipa. 4/1/2009.
Dr. Javier Ferreyros, Director, Pediatras Asociados. Lima. 3/31/2009.
Dr. Amalfí Gallegos, Former Laboratory Director, Honorio Delgado Hospital. Arequipa. 4/3/2009.
Dr. Lenka Kolevich, Infectologist, Hospital del Nino. Lima. 4/6/2009.
Dr. Aldo Luchetti, Adjunct Director, IMPACTA/IMENSA. Lima. 8/21/2007.
Dr. Carlos Manrique, Director, Regional Directorate of Health. Iquitos. 4/2/2009.
Dr. Juvenal Mendoza, Gynecologist, Hospital San Jose-Callao. Callao. 4/6/2009.
Captain Alejandro Mercado Noriega, Chief, Department of Infectious Diseases, Naval Hospital. Callao.
3/30/2009.
Dr. David Moore, Cayetano Heredia University. Lima. 8/24/2007 and 3/30/09.
Dr. Victor Nuñez, Pulmonologist, Hospital de la Policia, TB Control Program. Lima. 4/7/2009.
Mary Luz Perea Quispe, Biologist, Reference Laboratory. Arequipa. 4/1/2009.
Dr. Willy Pozo, Pediatrician, Hospital del Nino. Lima. 4/7/2009.
Dr. Cesar Ramal Asayag, Chief of HAART (Highly Active Anti Retroviral Therapy). Iquitos Regional
Hospital. Iquitos. 4/2/2009.
Dr. Maria Esther Ramirez, IMPACTA/IMENSA. Lima. 8/21/2007.
Dr. Hugo Rodriguez, Director for Peru, PAMAFRO (Malaria control project, Andean Health
Tanzania

Dr. Aziz Abdallah, Pediatric HIV Care and Treatment Officer, Columbia University, ICAP. Dar es Salaam. 4/03/2007.

Dr. Lakha Al Nur, Managing Director, Oyster Bay Pharmacy. Dar es Salaam. n.d.


Mr. V. Barongo, Warehouse Officer, Medical Stores Department. Mwanza. n.d.


Dr. Chonde, TB Laboratory Director, Ministry of Health and Social Welfare. Dar es Salaam. n.d.
Geert Haverkamp, Program Director, PHARMACESS. Dar es Salaam. n.d.
Dr. Innocent, Chief of Tuberculosis Control, Magu District, Ministry of Health and Social Welfare. Magu. n.d.
Dr. Pastory Kahbi, Acting District Medical Officer and Director, Magu District Hospital. Magu. n.d.
Dr. Amos Kahwa, Researcher, National Institute for Medical Research. Dar es Salaam. n.d.
Dr. Paul Kimanzi, Country Director, AMREF. Dar es Salaam. n.d.
Dr. Lameck Kipilyango, Senior Warehouse Officer and Acting Area Manager, Medical Stores Department. Mwanza. n.d.
Mr. M. Lubisi, Receiving/Dispatch Supervisor, Medical Stores Department. Mwanza. n.d.
Dr. Dominique Luboja, Regional Health Officer, Mwanza. Mwanza. 4/23/2007
Dr. Mfungo Marero, Director Care and Treatment, National Malaria Control Program. Dar es Salaam. 4/03/2007.
Dr. Julius Massaga, Director, Center for Excellence in Malaria Interventions. Dar es Salaam. 4/03/2007.
Dr. Peter McElroy, PMI Advisor, U.S. Centers for Disease Control. Dar es Salaam. n.d.


Mr. Kaisi Mnabukula, District Health Administrator, Ministry of Health and Social Welfare. Magu. n.d.

Dr. Fabrizio Molteni, Malaria Technical Advisor to National Malaria Control Program, Research Triangle International. Dar es Salaam. n.d.

Dr. Suzy Mosha, Physician, Vingunguti Clinic. Dar es Salaam. 3/14/2009.

Dr. Mary Moshana, Sexually Transmitted Infections Program Officer, National AIDS Control Program, Dar es Salaam. n.d.


Dr. Suleiman C. Muttani, Hospital Director, Temekte Municipal Hospital. Dar es Salaam. 4/16/2007.

Dr. Alex Mwita, Program Director, National Malaria Control Program. Dar es Salaam. 4/17/2007.


Lucy Nderimo, Acting Director, Tanzanian Medical Stores Department. Dar es Salaam. 4/20/2007.


Dr. David Ochong, Lab Director, African Medical and Research Foundation (AMREF). Dar es Salaam. n.d.

Dr. Samuel Ogillo, Program Manager, Association of Private Health Facilities of Tanzania (APHFTA). Dar es Salaam. 4/20/2007.


Tim Rosche, Country Director, JSI Deliver. Dar es Salaam. n.d.


Dr. Patrick Swai, Senior Project Management Specialist, HIV, PEPFAR. Dar es Salaam. n.d.


Dr. Joseph Temba, Director, Tanzania Commission for AIDS (TACAIDS). Dar es Salaam. n.d.


Appendix B: The Health Belief Model

The Health Belief Model (HBM) is a widely-used theoretical model focusing on individuals' attitudes and beliefs to predict and explain health behaviors. This study adapted the model to illustrate how clients make decisions around diagnostic testing. The follow-up focus group discussions used the modified HBM as a theoretical framework, and the qualitative analysis also draws on HBM constructs.

Figure 9. Adapted Health Belief Model

According to the modified HBM, an individual’s decision to seek diagnostic testing is informed by the following perceptions:

Perceived Severity: An individual is unlikely to seek diagnosis or treatment of an illness they don’t perceive as serious.

Perceived Susceptibility: An individual is unlikely to seek diagnosis of an illness to which they don’t feel susceptible. For diagnostic testing of an asymptomatic illness, the person must believe that he or she can have the disease without symptoms.

Perceived Benefits and Barriers: An individual is more likely to receive testing if they perceive that the benefits of diagnostic testing outweigh the barriers. Note that since the perceived benefits of testing are linked to treatment, a person must perceive an illness as treatable in order to recognize the benefits of testing.

Understanding consumers’ perceptions of illnesses severity, their susceptibility to the illnesses, and the barriers and benefits to getting tested can help explain some aspects of the WTP survey results. An understanding of consumers’ perceptions can also inform the design of health communication messages around the introduction of new diagnostic tests.
References


Interview with Dr. Dina Gbenou. WHO Programme Officer for Malaria. Cotonou, Benin. (August 10, 2007).

Interview with Joseph Essodina Ndayake. Laboratory Director. Saint Jean de Dieu Hospital. Tanguiesta, Benin. (March 15, 2009).


Interview with Dr. Guy Aouanou Hôpital Saint Jean de Dieu. Tanguiesta, Benin. (March 16).

Interview with Dr. Alban Quenum. Cotonou, Benin. (August 4).


Interview with Dr. Alex Mwita. Director. Tanzania National Malaria Control Program. (April 17th, 2007).

Interview with Mr. Ndege. Program Director. Association of Private Health Facilities of Tanzania. (April 20, 2007).

Interview with Bharat Rajani. Managing Director of Biocare Health Products Ltd. Dar es Salaam, Tanzania. (April 18, 2007).


Harvey, S. Malaria Rapid Diagnostic Tests in the Peruvian Amazon: A promising start and an uncertain future. *Case study.* (Center for Human services, Chevy Chase, 2009).
