Willingness to use and pay for a new diagnostic test for syphilis screening in pregnant women: 
Results from Benin, Peru, and Tanzania

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CENTER FOR HUMAN SERVICES
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Center for Human Services: The CHS mission is to help clients meet today’s challenges and take advantage of tomorrow’s opportunities by providing a comprehensive array of education, training, advocacy, and health-related programs and services.

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ABBREVIATIONS

ANC  Antenatal care
AIDS  Acquired immune deficiency syndrome
ALRI  Acute lower respiratory infection
ANOVA Analysis of variance
CFA  Communauté Financière Africaine/African Financial Community (Benin currency)
CHS  Center for Human Services
DHS  Demographic and Health Survey
DPM  Directorate of Pharmacies and Medicines (Benin)
ESSALUD  Social security system (Peru)
FBO  Faith-based organization
GNI  Gross national income
HBM  Health Belief Model
HIV  Human immunodeficiency virus
JICA  Japanese International Cooperation Agency
MHSW  Ministry of Health and Social Welfare
MINSA  Ministerio de Salud / Ministry of Health
MOH  Ministry of Health
MSD  Medical Stores Department
NACP  National AIDS Control Program
NGO  Nongovernmental organization
OLS  Ordinary least squares
PNLS  Programme Nationale de Lutte contre le SIDA/ National AIDS Control Program
RDT  Rapid diagnostic test
RPR  Rapid plasma reagin
RST  Rapid syphilis test
S/.  Peruvian nuevos soles
SDI  Sexually Transmitted Diseases Diagnostics Initiative
STI  Sexually transmitted infection
TB  Tuberculosis
TPHA  Treponema pallidum hemagglutination assay
Tsh.  Tanzanian shilling
UNFPA  United Nations Population Fund
VDRL  Venereal Disease Research Laboratory
WHO  World Health Organization
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. 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. 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.

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 sexually transmitted infections.

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 syphilis diagnostics 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) is different from that 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 are satisfied with the current diagnostic standard or see 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 website: http://www.gatesfoundation.org.
EXECUTIVE SUMMARY

The purpose of this study was to determine the potential market in developing countries for a new syphilis diagnostic test for pregnant women. Syphilis is caused by the spirochete *Treponema pallidum* and is transmitted through sexual contact or through transplacental infection of the fetus when a pregnant woman has the infection. If left untreated, syphilis can severely damage the heart and nervous system. Syphilis-caused genital sores also have been associated with a two- to five-fold increase in risk of transmitting and acquiring HIV. Accurate global statistics on syphilis rates during pregnancy are scarce, but estimates suggest that syphilis affects one million pregnancies every year and is responsible for about a third of all stillbirths in sub-Saharan Africa. Like many sexually transmitted infections (STIs) in resource-poor settings, syphilis is often diagnosed and treated syndromically. In pregnant women, however, syphilis is often asymptomatic, so effective population-based screening requires a serological test. Currently, appropriate testing and treatment options are not easily accessible or available, and are often not practical to administer in developing-country settings. However, effective diagnostic tools do exist and with sound public health strategies for prevention, testing, and treatment, syphilis can be successfully controlled and cured.

The specific objectives of this study included assessing health system interest in and perception of need for a new diagnostic tool and potential consumer willingness to pay (WTP) for same. In addition, the study explored desired characteristics for a new diagnostic among consumers and health care providers. To fulfill these objectives, the Center for Human Services (CHS) performed extensive field work in Benin, Tanzania, and Peru. Field work is underway in India; results from that research will be analyzed and reported separately.

The study employed three principle methods: in-depth interviews with health care providers and program managers, a consumer willingness to pay survey in three regions of each country, and consumer focus groups to further explore survey findings and factors likely to influence consumer willingness to pay for and use a new syphilis diagnostic. During interviews with providers, study team members asked about disease priorities, current diagnostic approaches, the perceived need for a new diagnostic test, and the desired characteristics of such a test. Interviewees included program managers at the national and district levels as well as front-line clinicians. CHS recruited participants from the public, private for-profit, and private non-profit sectors in both rural and urban areas. The consumer WTP survey included questions on each respondent’s socio-economic background, health-seeking behavior, and willingness to pay for a new diagnostic test for syphilis. Contingent valuation was used to determine the maximum amount consumers would be willing to pay in each country. Focus group discussions explored consumer perceptions of the most important health problems in their community; concerns about syphilis and other diseases included in the overall study; perceptions about severity, susceptibility, contagiousness; and perceived motivators and barriers to syphilis diagnosis. Focus group participants also helped clarify some survey results, for instance why survey respondents may have expressed a willingness to pay more for one diagnostic than another or geographic differentials in WTP. Focus groups were designed using the Health Belief Model (Appendix B) as a theoretical framework.

**Consumer Perceptions Related to Syphilis**

Focus group participants in all three countries tended to discuss syphilis as part of a general category of STIs. Although a few participants perceived syphilis as a serious illness, most did not recognize that untreated syphilis can have serious consequences for the unborn child. Rather, most were concerned that syphilis infection could lead to infertility. This misperception may be due to the lack of differentiation between STIs.

Most participants said that syphilis could be avoided by having few sexual partners, though only some mentioned condoms for preventing infection. Most respondents considered syphilis easily identifiable by its symptoms and easily treatable; few realized that it can be asymptomatic. This might pose a barrier to
syphilis screening in antenatal care since pregnant women may be unwilling to use and pay for an improved syphilis diagnostic if they believe that an absence of symptoms indicates lack of infection.

Participants considered syphilis and other STIs highly stigmatizing illnesses, associated with promiscuity and infidelity. Stigma may pose another barrier to diagnostic testing. Stigma plus a perception of syphilis as easy to recognize and treat may lead consumers to seek treatment for symptomatic syphilis from private pharmacies and health shops. Since most pharmacists lack access to STI diagnostics, they make treatment recommendations based on patients’ self-reported symptoms. Self-administered or at-home tests might improve diagnosis and treatment of symptomatic syphilis, but would do little to improve screening among asymptomatic pregnant women. Stigma may also pose a problem in terms of partner notification: Pregnant women testing positive for syphilis are usually encouraged to bring their partners for treatment, but stigma and fear of partner reaction, including violence, may make many reluctant to do so. Such women would be at risk of re-infection during their pregnancy, undermining successful diagnosis and treatment efforts.

Present and Future Diagnostic Tests for Syphilis

Most health providers in Benin and Peru did not identify improved syphilis diagnostics as a high priority, preferring development of better TB and pediatric HIV tests. However, a few providers in these countries said that they must rely on clinical diagnosis and would value better and more accessible STI tests. Compared to the two other countries, providers in Tanzania, where syphilis rates are much higher, ranked improved syphilis tests as a higher priority. They suggested that rapid tests that require minimal health worker training and need neither refrigeration nor additional equipment would increase treatment rates.

In terms of sample preference, respondents generally agreed that urine was the easiest and least uncomfortable sample medium; they characterized blood samples being painful and invasive. Beyond that, sample preferences differed by country. While many respondents in Benin and Peru asserted that blood is the most accurate sample and may be used simultaneously to diagnose other illnesses, Tanzanian focus group participants rejected blood as an STI-testing medium: They said urine was best for all STI tests, particularly for pregnant women who routinely provide urine samples during antenatal care.

Willingness to Pay for a New Syphilis Diagnostic Test

As shown in Table 1, nearly all survey respondents in Benin and Peru said they were willing to pay something for new diagnostic test for syphilis. In Tanzania, data were available only for those who reported being willing to pay some amount. As a result, it is not possible to calculate the percentage of Tanzanian respondents willing to pay, though it is reasonable to assume that it would be similar to that of the other study countries.

<table>
<thead>
<tr>
<th>Country</th>
<th>Total Surveyed</th>
<th>Total WTP</th>
<th>% WTP</th>
<th>% WTP Urban</th>
<th>% WTP Rural</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benin</td>
<td>292</td>
<td>275</td>
<td>94.2%</td>
<td>96.1%</td>
<td>91.1%</td>
</tr>
<tr>
<td>Tanzania</td>
<td>NA</td>
<td>347</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Peru</td>
<td>261</td>
<td>242</td>
<td>92.7%</td>
<td>92.5%</td>
<td>93.7%</td>
</tr>
<tr>
<td>Total*</td>
<td>553</td>
<td>517</td>
<td>93.5%</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

* Totals include only Benin and Peru. In Tanzania, data were available only for respondents willing to pay some amount, not for those unwilling or unable to pay anything.
While most survey respondents expressed interest in improved diagnostics, this alone does not provide a meaningful indication of appropriate pricing for such tests. As shown in Table 2, participants’ stated willingness to pay covered a wide range:

**Table 2: Willingness to pay price range in all three countries**

<table>
<thead>
<tr>
<th>Country</th>
<th>Local currency</th>
<th>US $ equivalent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benin</td>
<td>CFA 100–10,000</td>
<td>$ 0.09–8.50</td>
</tr>
<tr>
<td>Tanzania</td>
<td>Tsh. 300–20,000</td>
<td>$ 0.71–47.51</td>
</tr>
<tr>
<td>Peru</td>
<td>S/. 2.50–100</td>
<td>$ 0.92–36.76</td>
</tr>
</tbody>
</table>

As shown in Figure 1, almost all respondents in all three countries were willing to pay the lowest level price. After that, the percentage of those willing to pay drops off with each price increment, more sharply in Tanzania than in Benin and Peru.

**Figure 1. Percentage of consumers willing to pay at each price interval**

In general, a greater percentage of people in Benin were willing to accept higher prices than in the other two countries. One important conclusion from this is that one price will not fit all countries, and the market for a new syphilis diagnosis will be stronger in some countries than others. Factors that influenced client willingness to pay are region of origin and urban versus rural residence. In Peru, for example, urban dwellers were willing to pay more for a syphilis test than their rural counterparts.

In determining pricing levels, it is important to consider whether a highly priced diagnostic would act as a deterrent to testing. As one provider explained, “If the price for a diagnostic test were low, people might be encouraged to use it, but if the price were high, they might well forego diagnosis and spend their limited resources on treatment.”

**Impact of the Structure of Syphilis Services**

Syphilis screening is mandated as part of routine ANC in all three study countries, and most women attend at least one ANC visit. This offers an opportunity for screening, but actual screening rates remain
low. In Benin, responsibility for managing and supervising antenatal screening is not clearly assigned. Screening also is more likely to occur in hospitals than in health centers and in urban rather than rural areas. In Tanzania, syphilis screening is part of two different public health programs, but one recommends syndromic management while the other often faces stock-outs of tests or reagents. Moreover, many facilities lack the necessary equipment and infrastructure to perform currently available tests. As in Benin, most screening occurs in hospitals or private clinics.

Study results indicate that syphilis is a relatively low priority for most health providers and developing-country health systems. Increasing consumer awareness of syphilis and its potential sequelae, particularly among asymptomatic pregnant women, would require a renewed commitment by providers, local governments, and bilateral and multilateral organizations and donors. Systemic issues, such as cumbersome procurement processes and poor supply chain management also would need to be addressed.

**The Market for a New Syphilis Diagnostic Test**

Given the relatively low level of importance that health providers place on syphilis diagnosis and treatment, the fact that consumers do not view syphilis as uniquely dangerous among STIs, and the asymptomatic nature of syphilis among pregnant women, the current market for a new syphilis diagnostic tool for pregnant women is weak. Efforts to improve syphilis screening rates during ANC could lead to a stronger market. Communications campaigns emphasizing the potential health threats to mother and child could also increase the demand for syphilis testing during antenatal visits. However, the potential public market is limited by competing priorities for limited resources within the public sector. Even health systems highly motivated to offer universal screening may be unable to pay for a new diagnostic without external financial support.

**Recommendations**

Neither health care providers nor consumers expressed a strong demand for a new syphilis diagnostic test. Consumer interest could be increased with communications efforts particularly targeting pregnant women. Should a new test be introduced, pricing schemes would need to take into account the significant between-country and within-country variation in willingness to pay. Stigma around syphilis has a considerable effect on health seeking behaviors and this might be addressed by making at-home self-administered tests available. However, such a test would not address the need for accurate diagnosis among asymptomatic pregnant women. Antenatal care visits will continue to be the primary location for syphilis testing among pregnant women, but to impact infection rates, programs providing these services would need strengthening.
INTRODUCTION

Syphilis is a sexually transmitted infection (STI) caused by the spirochete Treponema pallidum. An understanding of syphilis in pregnancy requires an understanding of the natural history of syphilis infection, its global disease burden, and challenges in collecting data on sexually transmitted infections.

Natural History of Syphilis

In the primary stage of syphilis, a single sore (called a chancre) or multiple sores appear near the genitals where syphilis entered the body. The time between syphilis infection and the appearance of the chancre can range from 10–90 days. Without treatment, the infection progresses to the secondary stage, characterized by skin rash and mucous membrane lesions. This stage is followed by a latent stage, during which the infected person does not manifest symptoms. The latent stage can last for years, after which about 15% of untreated people will develop symptoms of the late stage of syphilis, such as difficulty coordinating muscle movements, paralysis, blindness, dementia, and death.4

Syphilis in Pregnancy: Consequences and Global Burden

Syphilis infection during pregnancy can lead to multiple complications. Approximately 30% of affected pregnancies end in stillbirth. Another 30% of infected mothers give birth to a child with congenital syphilis, which can result in deformities, developmental delays, seizures, and a mortality rate of up to 50%. Some infants with congenital syphilis show symptoms at birth or in the first few months of life; others develop late congenital syphilis, manifesting after the child’s second year.4,5

Global Disease Burden of Syphilis

Despite effective strategies for prevention, diagnosis, and treatment, syphilis remains a global problem: An estimated 12 million people are infected each year.6 Syphilis prevalence rates are highest in sub-Saharan Africa and in South and Southeast Asia. Populations in developing countries and disadvantaged subpopulations in developed countries are most at risk of syphilis infection.7 Syphilis is of particular public health concern in southern Africa because of its association with the transmission of HIV/AIDS. Syphilis-caused genital sores have been associated with a two- to five-fold increase in risk of transmitting and acquiring HIV.8

Syphilis affects about a million pregnancies globally each year and contributes to about a third of the stillbirths in sub-Saharan Africa.6 Congenital syphilis can be prevented by screening early in pregnancy, treating seropositive pregnant women, and preventing re-infection.9

Challenges to STI Data Collection

While sexually transmitted infections such as syphilis pose a significant public health problem for developing countries, accurate data about infection rates are scarce. In part, this is because no single organization is responsible for collating global STI statistics, and different countries have different types of reporting systems. Also, existing data are believed to substantially underestimate the number of new STI cases because of social stigma and other factors that might prevent people from seeking health care.10

Syphilis can be successfully controlled with sound public health prevention, testing, and treatment measures, and effective diagnostic tests do exist. However, they are not easily accessible or available, and they are not always practical to administer in developing-country settings.
Diagnostic Testing for Syphilis

Like many STIs in resource-poor settings, syphilis is often diagnosed and treated syndromically. However, given that syphilis symptoms are non-specific and that many infected individuals are asymptomatic, effective universal screening of a population subgroup (such as pregnant women) requires a serological test. There are two basic types of serological tests for syphilis: treponemal and non-treponemal. Treponemal tests detect the presence of an antigen or antibody specific to *T. pallidum*. These tests can distinguish syphilis from other infections, but since the antigens or antibodies to which they react remain in the bloodstream for years after an infection is treated, they cannot distinguish between an active and a past infection.

Non-treponemal tests detect the presence of reagin, an antibody that reacts to substances released by cells when they are damaged by *T. pallidum*. However, these tests are not specific to *T. pallidum*, so while more accurate than treponemal tests at distinguishing an active from a past infection, they can result in false-positives among patients with certain types of non-syphilitic infections.11

In ideal circumstances, a patient thought to have syphilis is first screened using a non-treponemal test like a rapid plasma reagin (RPR) or Venereal Disease Research Laboratory (VDRL) test to detect active infection. A treponemal test is then used to confirm that the infection is due to syphilis. Use of a treponemal test alone can result in overtreatment, but in settings where scarce resources preclude two-stage testing, overtreatment is less dangerous than leaving infected patients untreated in the absence of a confirmatory test.12

VDRL tests may be done on a blood serum sample or cerebrospinal fluid (to check for neurosyphilis). The test requires a 7 ml venous blood sample. To obtain serum, the patient’s blood is centrifuged for about 10 minutes or must sit for 20 minutes to allow the serum to separate from blood cells. The serum must then be heat-inactivated at 56 °C for 30 minutes using a hot-water bath. The heated serum is mixed with reagent on a glass slide, and the mixture is read microscopically to detect clumping, indicating a positive result.

RPR tests work on the same principle as the VDRL, but can be performed on unheated plasma or serum and do not require a microscope. A drop of serum or plasma is deposited on an 18 mm circle card test, followed by a drop of reagent, which is kept refrigerated and brought to room temperature before use. The test card is then rotated manually or in a mechanical rotator for eight minutes and inspected for clumping, indicating a positive result. Most test cards include negative and positive control wells for comparison.

The RPR’s reliance on electricity, refrigeration, a rotator machine, and personnel with significant training to interpret test results and the VDRL’s reliance on this plus a microscope make these tests impractical in many rural health facilities. Rapid syphilis tests (RSTs), on the other hand, can function effectively in settings with minimal infrastructure and have numerous advantages over diagnostics like RPR or VDRL. First, RST are self-contained units requiring no additional equipment. Second, they do not require refrigeration. Third, while RPR results are open to subjective interpretation, RSTs are simpler to interpret and require less health worker training.13 Many RSTs rely on finger stick whole blood samples, eliminating the need for a venous blood draw and time-consuming serum separation. Finally, RSTs provide results in about 15 minutes, enabling immediate treatment.13,14 A major disadvantage of RSTs is that, like other treponemal tests, they do not distinguish between current and past infection.
DATA COLLECTION METHODS

The study was carried out in Benin, Peru, and Tanzania from March 2007 to April 2009. In addition to literature reviews, study team members made two extended field visits to each country. During these visits, team members collected data on both health provider and consumer perspectives on perceived need for, willingness to use, and willingness to pay (WTP) for the six included diagnostics. Field work in India will be completed by the end of July 2009, with results published in September. Specific approaches to collecting data on health system and consumer perspectives are described below.

Health System Perspective

In each country, the Center for Human Services (CHS) conducted semi-structured, in-depth interviews with public and private sector health personnel – including 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 testing approaches and unmet diagnostic needs, as well as past experiences with adopting new diagnostic tools. The study conducted 29 health provider interviews in two regions of Benin, 42 interviews in three regions of Peru, and 59 interviews in three regions of Tanzania. Those interviewed included national and district-level managers as well as front-line clinicians. To the extent possible, CHS interviewed directors of key national programs relevant to the included diseases: AIDS, tuberculosis, malaria, STIs, and maternal and child health. Interviews also included private for-profit and non-profit program managers and clinicians. Appendix A has a list of those interviewed for this component of the study, along with their affiliations and interview dates.

Consumer perspective

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 WTP surveys and to adapt the survey instruments to local circumstances. In these focus groups, which included providers or consumers, 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 to determine mean willingness to pay in the survey. The facilitator also asked participants to explain local terms used for diagnostic tests so that survey questions would be understandable to those surveyed. In Peru, CHS conducted interviews with health providers familiar with the local economy and care-seeking behaviors, rather than focus group discussions.

In Benin, CHS set the starting prices at 1,000 Communauté Financière Africaine (African Financial Community or CFA) 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 500 Tanzanian shillings (Tsh) and at 200 Tsh for malaria and pneumonia. In Peru, the base price was set at five Peruvian nuevos soles (S/. 5.00) for all diagnostics.

Willingness to pay surveys

CHS then conducted surveys to assess consumer WTP for improved diagnostic tests. Each survey had about 40 questions, including sections to collect socio-demographic information, ask
about previous health-seeking behavior that might shed light on WTP, and (then) ask about WTP itself.

To assess respondent willingness to pay, the surveys used a process called contingent valuation (Figure 1). 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, the interviewer suggests the base price determined in the preliminary focus group discussions. If the respondent is willing to pay this base price, the interviewer then asks about a higher price, increasing the initial amount by a specific increment. This process continues until the respondent says that he or she would not be willing to pay the price reached. For respondents unwilling or unable to pay the starting 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. Contingent valuation approach to measuring willingness to pay**

Totals shown for Tanzania include only those respondents willing to pay some amount. No information was available about respondents not willing or able to pay anything, but it is reasonable to assume that the percentage is probably similar to that of the other two countries.

**Sampling approach**

CHS used purposive sampling to recruit participants for the survey. This means that participants were identified based on the likelihood that they will 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 or acute lower respiratory infection (ALRI) in children under five than would a single adult or an adult whose children are grown. For this reason, surveys about ALRI and malaria diagnostics were performed in health facilities that provide services for young children, recruiting adults with young children to participate. For similar reasons, we recruited pregnant women receiving antenatal care as participants for the syphilis and HIV diagnostics surveys. Adults in curative care were surveyed about TB and STI tests. We had initially hoped to recruit participants for the STI survey solely from STI clinics and participants for the TB survey solely from among TB patients or their family members, but we
were unable to identify specialized health facilities for these conditions in each health sector (public, private for-profit, private non-profit). As a result, we carried out STI surveys with adults seeking curative care (but not necessarily STI testing or treatment) at facilities that provided STI services. Similarly, we recruited participants for the TB survey from among adults seeking curative care (but not necessarily for tuberculosis) at facilities that provided TB services.

The total Peru survey sample included 1478 respondents from Lima, Iquitos, and Arequipa, interviewed between late August and December 2007. The Tanzania sample, collected during April 2007 and April 2008, included 1735 respondents from Tanga and Dar es Salaam. CHS surveyed 1118 people from three regions of Benin (Cotonou, Bohicon, and Parakou) from January to February, 2008. However in Benin, one group of participants (n=287) was asked about both malaria and ALRI while a second group (n=292) was asked about both HIV and syphilis, so the effective sample size was 1697. The sample size of 250 individuals per diagnostic test was calculated to obtain a study power of 80% with a 95% confidence interval. The sampling frame was designed to include participants from both urban and rural facilities at different levels of care as well as a mix of participants attending public, private for-profit, and private not-for-profit facilities. Table 1 describes the sampling frame used in each country.

Table 1. Sampling frame for willingness to pay surveys

<table>
<thead>
<tr>
<th>Diagnostic</th>
<th>Urban Public</th>
<th>Urban For-profit</th>
<th>Urban Not-for-profit</th>
<th>Rural Public</th>
<th>Rural For-profit</th>
<th>Rural Not-for-profit</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malaria</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>252</td>
</tr>
<tr>
<td>HIV</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>252</td>
</tr>
<tr>
<td>ALRI</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>252</td>
</tr>
<tr>
<td>Syphilis</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>252</td>
</tr>
<tr>
<td>Chlamydia and gonorrhea</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>252</td>
</tr>
<tr>
<td>Tuberculosis</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>252</td>
</tr>
<tr>
<td>Total</td>
<td>252</td>
<td>252</td>
<td>252</td>
<td>252</td>
<td>252</td>
<td>252</td>
<td>1512</td>
</tr>
</tbody>
</table>

Analysis

Several studies have measured consumer WTP for health care or goods in developing countries. These studies found that demographic and socio-economic factors, costs of obtaining health care, and facility characteristics influence consumer WTP for health care. Thus, CHS considered how socio-economic variables affect WTP for the six diagnostic tests.

CHS calculated a wealth index for each individual, based on the Demographic and Health Survey methodology. 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. Based on the survey results, CHS estimated the mean, median, and mode of consumer WTP for each of the new diagnostics. 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 a respondent was willing to pay.

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. The log regression coefficients were adjusted using the smearing technique to account for the bias caused by the transformation.

**Follow-up focus group discussions**

CHS conducted follow-up focus group discussions to explore factors influencing consumers’ 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 the focus groups included discussion of 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. CHS will conduct 24 focus groups in India once preliminary WTP survey data become available.

![Table 2. Sampling frame for focus groups](image)

<table>
<thead>
<tr>
<th>Diagnostic</th>
<th>Urban Public</th>
<th>Urban For-profit</th>
<th>Urban Not-for-profit</th>
<th>Rural Public</th>
<th>Rural For-profit</th>
<th>Rural Not-for-profit</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malaria</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>252</td>
</tr>
<tr>
<td>HIV</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>252</td>
</tr>
<tr>
<td>ALRI</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>252</td>
</tr>
<tr>
<td>Syphilis</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>252</td>
</tr>
<tr>
<td>Chlamydia and gonorrhea</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>252</td>
</tr>
<tr>
<td>Tuberculosis</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>252</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>252</strong></td>
<td><strong>252</strong></td>
<td><strong>252</strong></td>
<td><strong>252</strong></td>
<td><strong>252</strong></td>
<td><strong>252</strong></td>
<td><strong>1512</strong></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 participants mentioned 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

Benin

Benin is a small, ethnically diverse country located along the coast of West Africa and having an estimated population of 9 million.22,23 Despite being one of the first African nations to successfully transition from military rule to democratic government since 1960 independence, Benin remains one of the poorer sub-Saharan African nations. At US$ 570, the gross national income (GNI) per capita is much lower than the sub-Saharan African average of US$ 952. More than a third (37%) of the population live in poverty, and 20% are classified as extremely poor. Like many other African nations, Benin has a young population: 46% are under age 15. Levels of education are lower than in other West African nations, particularly in rural areas and among women. Benin has a population growth rate of 3% and a relatively large urbanized population ratio (45%).22,24,25

Overview of the health system

Despite a 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, comprised as follows:

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.22 Benin has 34 health zones, each covering approximately 210,000 persons. Designed to increase access to 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 of medical practitioners with various levels of training, traditional practitioners, pharmacies, laboratories, for-profit and religious nonprofit facilities, medical equipment and pharmaceutical suppliers, private voluntary and mutual health insurance companies, and nongovernmental organizations (NGOs). Religious, nonprofit facilities are well integrated into the national health system and several operate as zonal hospitals and collaborate with the MOH.22

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, Centre d’Achat des Médicaments Essentiels et Consommables Médicaux (Center for the Purchase of Essential Medications and Medical Consumables; CAME), a government-owned enterprise.\textsuperscript{22}

International partners and bilateral donors contribute to the health sector. Compared to other sub-Saharan African countries, the Beninese government invests slightly less of its total public spending in health (9% and 8%, respectively). Private household spending accounts for 51% of total health spending. Despite unit price market regulation of medicines, most household expenditures on health are spent at pharmacies, most of which are privately owned and operated, rather than funneled through the public health sector.\textsuperscript{22}

A relatively small proportion of the population has health insurance coverage. The three main sources of insurance are 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. An Indigent Fund, established through the MOH, subsidizes health facility user-fees for the most impoverished citizens to reduce financial barriers to health services.\textsuperscript{22}

\textbf{Syphilis in Benin}

Syphilis prevalence in Benin’s general population is estimated at 1–2%, with slightly higher rates in urban areas and among men.\textsuperscript{26,27} Data covering 2006 suggest that the overall prevalence is even lower among pregnant women, around 0.6%, estimated at 0.3% in urban areas and 0.8% in rural areas.\textsuperscript{28} The low syphilis rates in Benin may be in part attributable to the success of HIV prevention campaigns promoting condom use.\textsuperscript{29}

\textit{Direction de la Santé Familiale} (Directorate of Family Health) guidelines mandate antenatal screening using VDRL. Positive screening results are confirmed by \textit{Treponema pallidium} hemagglutination assay (TPHA, a treponemal test). According to some Beninese health providers, however, no MOH program is charged with management and supervision of antenatal care (ANC) syphilis-screening guidelines, and these are not widely implemented. National syphilis prevalence is determined during the annual serosurveillance activities of the national AIDS control program, the \textit{Programme Nationale de Lutte contre le SIDA} (PNLS). The PNLS survey uses RPR and TPHA to screen pregnant women for syphilis.\textsuperscript{28}

A relatively large proportion of pregnant women (88%) attends at least one ANC visit during pregnancy.\textsuperscript{30} While no data are available on the proportion of women actually screened for syphilis during ANC, 2006 Demographic and Health Survey (DHS) data indicate that blood samples were taken from only 40%.\textsuperscript{30} Some interview respondents also indicated that regular antenatal screening occurs mostly in hospitals and is less available in health centers or rural areas.

\textbf{Health provider perspective}

Most health providers interviewed in Benin did not identify improved syphilis diagnostics as a high priority, focusing instead on the need for better TB and pediatric HIV diagnostics. Their priorities may reflect the country’s relatively low syphilis prevalence (1%–2%).\textsuperscript{26,27} However, a few providers, especially gynecologists, said that they must often rely on clinical diagnosis and that they would value better and more accessible diagnostics for STI testing:

With clinical [diagnosis], you can’t be 100% sure. I would say that, based on my experience, clients [with syphilis] often present more or less the same symptoms as those with other illnesses. So it’s very likely that it’s syphilis, but it’s always better to have a biological test. That way you are really sure.

Beninese providers also mentioned that some clients prefer to seek STI tests through private sector facilities due to embarrassment and shame around these illnesses.
Providers said that introducing new diagnostics into the health system is uncomplicated, but they first need to undergo a feasibility assessment at the central level. Once a diagnostic is evaluated and approved for adoption, the MOH organizes trainings and seminars to inform health personnel and technicians of the diagnostic methods and protocols that accompany it.

Some health providers thought Beninese policymakers would be more likely to adopt an improved test if the cost were comparable to that of current modes of diagnosis. These providers said that although external funders would be willing to pay for more expensive diagnostics, governments would hesitate to adopt them, since donors could reduce their funding in the future. The thinking is that the Ministry would rather adopt affordable technologies to be better positioned in case of cuts in external funding.

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

More than 90% of consumers interviewed in Benin about the six study diseases indicated that they were interested in using and willing to pay for diagnostic tests. Figure 2 indicates Beninese consumers were willing to pay more for TB, HIV, and STI tests than for syphilis, malaria, and ALRI.

**Figure 2. Benin: Mean respondent willingness to pay for diagnostic tests**

![Figure 2](image)

<table>
<thead>
<tr>
<th>Disease</th>
<th>Mean Price (CFA)</th>
<th>95% Confidence Interval (CFA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TB</td>
<td>2345</td>
<td>(2068, 2621)</td>
</tr>
<tr>
<td>Malaria</td>
<td>1488</td>
<td>(1231, 1745)</td>
</tr>
<tr>
<td>ALRI</td>
<td>1821</td>
<td>(1595, 2024)</td>
</tr>
<tr>
<td>Syphilis</td>
<td>2943</td>
<td>(2625, 3213)</td>
</tr>
<tr>
<td>HIV</td>
<td>2190</td>
<td>(1979, 2379)</td>
</tr>
<tr>
<td>STI</td>
<td>2674</td>
<td>(2394, 2953)</td>
</tr>
</tbody>
</table>

The average age of respondents in the syphilis WTP survey was 26.6 years (Table 3). Of the 292 people interviewed, 62% were Christian and 27% Muslim, with 6.5% reporting a traditional religion. Married respondents accounted for 94% of those interviewed. Survey respondents interviewed at public facilities accounted for 56% of the sample, compared to 28% at mission and
12% at private for-profit facilities. The rural/urban ratio was 38%/62%. About half (53%) had not completed the primary level of education. Health insurance covered 2% of the sample. At the time of the study, 421 CFA were equivalent to US$ 1. On average respondents traveled 23 minutes to reach a health facility and paid 370 for transport.

Table 3. Benin: Sociodemographic characteristics of syphilis survey respondents

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Respondents % (N=292)</th>
<th>Respondent’s Spouse % (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean age (years)</td>
<td>26.6</td>
<td></td>
</tr>
<tr>
<td>Marital status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single</td>
<td>4.1% (12)</td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>93.8% (274)</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>2.1% (6)</td>
<td></td>
</tr>
<tr>
<td>Religion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Traditional</td>
<td>6.5% (19)</td>
<td></td>
</tr>
<tr>
<td>Muslim</td>
<td>27.4% (80)</td>
<td></td>
</tr>
<tr>
<td>Catholic</td>
<td>36.0% (101)</td>
<td></td>
</tr>
<tr>
<td>Protestant</td>
<td>2.7% (8)</td>
<td></td>
</tr>
<tr>
<td>Other Christian</td>
<td>23.6% (69)</td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>3.4% (10)</td>
<td></td>
</tr>
<tr>
<td>Education level</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; Primary</td>
<td>52.7% (154)</td>
<td>25.9% (71)</td>
</tr>
<tr>
<td>Primary</td>
<td>24.7% (72)</td>
<td>20.8% (57)</td>
</tr>
<tr>
<td>Secondary</td>
<td>19.2% (56)</td>
<td>14.2% (39)</td>
</tr>
<tr>
<td>Technical</td>
<td>0.3% (1)</td>
<td>31.8% (87)</td>
</tr>
<tr>
<td>University</td>
<td>3.1% (9)</td>
<td>7.3% (20)</td>
</tr>
<tr>
<td>Zone</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td>61.6% (180)</td>
<td></td>
</tr>
<tr>
<td>Rural</td>
<td>38.4% (112)</td>
<td></td>
</tr>
<tr>
<td>Region</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cotonou</td>
<td>29.8% (87)</td>
<td></td>
</tr>
<tr>
<td>Bohicon</td>
<td>33.6% (98)</td>
<td></td>
</tr>
<tr>
<td>Parakou</td>
<td>36.6% (107)</td>
<td></td>
</tr>
<tr>
<td>Facility type</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public</td>
<td>55.8% (162)</td>
<td></td>
</tr>
<tr>
<td>Mission</td>
<td>27.4% (80)</td>
<td></td>
</tr>
<tr>
<td>Private For-profit</td>
<td>11.6% (34)</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>5.1% (15)</td>
<td></td>
</tr>
<tr>
<td>Have health insurance</td>
<td>2.4%</td>
<td></td>
</tr>
<tr>
<td>Average travel time (minutes)</td>
<td>23.5</td>
<td></td>
</tr>
<tr>
<td>Average travel cost (CFA)</td>
<td>370</td>
<td></td>
</tr>
</tbody>
</table>

*Health-seeking behaviors*

About 15% of respondents suffered an illness episode in the four weeks preceding the survey; of these, 75% reported seeking care in the formal health sector while 4% sought care from a non-biomedical provider such as a traditional healer. Laboratory diagnostic tests were recommended to 71% of the respondents who went to a biomedical facility, of whom 88% reported consenting to at least some of the tests. On average, respondents who consented to diagnostic tests reported
having paid 5483 CFA for diagnostic tests prescribed on the day of the survey. These tests may have been for syphilis or for another condition since participants were recruited from among pregnant women seeking any type of ANC. These respondents reported a willingness to pay an average of 2943 CFA for a syphilis test. While this amount is 47% less than the average amount participants reported actually paying for diagnostic tests on the day of their visit, it is about 600 CFA more than the 2339 CFA Beninese survey respondents reported being willing to pay across all six study diagnostics.

**Willingness to pay for syphilis diagnostic tests**

Based on the initial focus group findings, the WTP bidding for a syphilis test started at 500 CFA and increased or decreased in increments of 500-2000 CFA depending on the respondent’s reply. Due in part to the survey design, the amounts they selected tended to cluster in increments of 500 CFA. Of 292 respondents, 17 (6%) were not willing to pay anything for a syphilis diagnostic. The other 275 expressed willingness to pay amounts ranging from 300—20,000 CFA. Figure 3 shows that WTP declined sharply as the price increased from 1000 to 1500 CFA and then dropped again by about 22% as the price increased to 3500 CFA. WTP then declined more gradually before dropping sharply again as the price rose above 5500 CFA. Viewed from another angle, a syphilis diagnostic priced at 300 CFA (about US$ 0.71 at the time of the study) would exclude only 6% of consumers in Benin, but one priced at 1500 CFA (about US$ 3.56) would exclude 36%, and one priced at 2000 CFA (about US$ 4.75) would exclude 50%.

**Figure 3. Benin: Willingness to pay for a syphilis diagnostic at each price range**

The figure groups respondents into four market segments to categorize consumer willingness to pay for syphilis diagnostics tests within certain price ranges:

- Segment A: Consumers willing to pay no more than 1000 CFA,
- Segment B: Consumers willing to pay 1001–2000 CFA,
- Segment C: Consumers willing to pay 2001–4500 CFA,
- Segment D: Consumers willing to pay more than 4500 CFA.

Market segmentation enabled a determination of which characteristics these groups share and an explanation of the factors driving market response at each price level. The figure highlights these markets, illustrating the proportion of respondents that falls into each segment at a given price range.
The 17 respondents not willing to pay had completed no more than primary education, and more than 60% were in the two lowest wealth quintiles. More than three-quarters lived in Parakou district, and less than one in five attended a private for-profit health facility. The small number of people who reported being unwilling to pay for syphilis diagnostics precludes drawing reliable conclusions about this group’s socio-economic makeup.

Table 4 shows that socio-economic and demographic characteristics differed little across market segments. More than two-thirds of respondents willing to pay 2001 CFA or more, segments C and D, lived in urban areas compared to 50–61% in segments A and B. Most consumers in all four segments attended public health facilities, and fewer than 15% of consumers across the segments attended for-profit facilities. Also, about half of consumers across the segments had not completed primary school. Although wealth was fairly evenly distributed across the segments, there were higher proportions of respondents in segments A and B represented in the two lowest wealth quintiles.

Table 4. Benin: Selected socio-economic characteristics of respondents willing to pay within different price ranges for a syphilis diagnostic

<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Education level</strong></td>
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<tr>
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<td>50% (30)</td>
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<tr>
<td>1 (lowest)</td>
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<td>30% (23)</td>
<td>23% (16)</td>
<td>11% (7)</td>
<td>9% (6)</td>
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<td>2</td>
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<td>11% (8)</td>
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<tr>
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<td>63% (48)</td>
<td>61% (38)</td>
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<td>61% (40)</td>
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<td>22.5% (17)</td>
<td>25% (18)</td>
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<td>33% (20)</td>
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<td>10% (6)</td>
<td>14% (9)</td>
<td>9% (6)</td>
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<tr>
<td><strong>Region</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cotignou</td>
<td>18% (3)</td>
<td>23% (18)</td>
<td>36% (25)</td>
<td>40% (24)</td>
<td>41% (28)</td>
</tr>
<tr>
<td>Dahomey</td>
<td>6% (1)</td>
<td>35% (27)</td>
<td>38% (27)</td>
<td>27% (16)</td>
<td>24% (16)</td>
</tr>
<tr>
<td>Parakou</td>
<td>76% (13)</td>
<td>42% (32)</td>
<td>26% (18)</td>
<td>33% (20)</td>
<td>35% (24)</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 facility type is “all other facility types.”

Significant influences on willingness to pay

Bivariate analysis revealed statistically significant differences in consumer WTP by wealth quintile and spousal level of education. On average, consumers in the highest wealth quintile...
were willing to pay 3279 CFA, 74% more than those in the lowest (ANOVA p=0.05). Respondents whose spouses were university educated were willing to pay 3775 CFA, 65% more than those whose spouses had not completed primary school (ANOVA p=0.05).

Willingness to pay also differed significantly by geographic region. Cotonou residents were willing to pay an average of 3516 CFA: 26% more than those in Parakou and 46% more than those in Bohicon (ANOVA p=0.05).

Although the average amounts consumers were willing to pay differed significantly between certain socio-economic and demographic strata, after controlling for other factors, a significant difference remained between spousal education level only. For each additional level of education respondents’ spouses had completed, respondents were willing to pay an additional 557 CFA (OLS p=0.01). Figure 4 illustrates that a far lesser proportion of respondents whose spouse had less than primary education were willing to pay for syphilis diagnostics even at 1000 CFA. The gap between the proportion of respondents willing to pay narrows as the price rises above 6000 CFA, suggesting that at very high prices spousal education has less impact on willingness to pay. Also, the difference in willingness to pay between respondents whose spouses had completed university versus secondary education may be smaller than it appears, since only 20 respondents had partners who had completed university.

Figure 4. Benin: Willingness to pay for syphilis diagnostic, by spousal education

Illness concepts
Severity
Many Beninese focus group participants perceived syphilis in pregnant women as severe. Some recognized that untreated syphilis can have serious consequences for the unborn child, but most said syphilis is serious because it can lead to infertility. This misconception may be due, in part, to the fact that participants frequently grouped syphilis with other STIs, such as gonorrhea and chlamydia, in their discussions. Since these other STIs can cause infertility, participants may wrongly assume that syphilis has similar sequelae.
Susceptibility

Most participants said that syphilis and other STIs are easy to avoid if one is “careful” or “controls oneself.” Participants frequently cited abstinence and fidelity as ways to avoid syphilis and other STIs, and a few mentioned condoms. Participants frequently compared susceptibility to syphilis and other STIs to other illnesses like TB and malaria, over which, they said, one has less agency. A male participant in Cotonou typified participants’ differentiation between non-sexually transmitted infections like malaria versus STIs, including syphilis, by saying:

Malaria [is the easiest to catch] because … [it] doesn’t spare anyone, whatever you do – you can sleep under a mosquito net and still get malaria. Whereas with [an STI], you have to want to get it. If you don’t go out looking for it, you won’t get it… Sometimes you see a woman that [you want to have sex with] and you can be with that woman without anything happening, if you know how to protect yourself. But if you don’t want to eat the banana with the skin on [wear a condom] – if you eat it without the skin [have unprotected sex] – well, then you’ve gone out looking for an STI.

In contrast to most respondents, a few focus group participants said syphilis is easily transmitted and blamed unfaithful partners and early sexual debut among youth for increasing syphilis prevalence in their communities. Other respondents who said they felt at risk of contracting syphilis cited poor hygiene as a possible cause.

Benefits of testing

While a few participants characterized all STIs as “stubborn” and difficult to treat, most said syphilis is relatively easy to treat if identified early. Some contrasted syphilis and other STIs with diseases like TB and HIV, which they considered difficult to treat or incurable.

Few participants viewed syphilis testing as necessary or beneficial; many said it is unnecessary in diagnosing STIs because the symptoms are obvious. As a male participant from Bohicon explained:

For syphilis, as well as gonorrhea, you don’t need a test, because the signs are obvious and everyone – even eight-year-old children – knows what they are, thanks to awareness-raising activities. STIs don’t need a test because as soon as you get one, you know…. When you notice a sore or bump on your genitals, [you know] it’s an STI and you should go to the hospital.

Most participants seemed unaware that syphilis infection may be asymptomatic. Only a few said that syphilis requires a diagnostic or recognized that STIs can be asymptomatic. This lack of awareness may signal less interest in and less willingness to pay for new diagnostics for STIs.

Barriers to testing

Almost all focus group participants identified syphilis and other STIs as stigmatizing. A male participant in Bohicon described the shame attached to syphilis thusly:

Syphilis and gonorrhea, in general, are illnesses that are embarrassing to talk about – especially STIs among women. If you have [an STI], it’s a secret you guard with your life. It’s only if [the illness] gets worse that you talk about it. But malaria is not an embarrassing illness; anyone can get it. If you’re sick with malaria, you don’t hesitate to talk about it.

In some cases, the high level of stigma attached to syphilis may be due to the disease’s perceived link to promiscuity. Participants often said that contracting STIs results from having many partners or infidelity. A male participant from Cotonou commented:

No woman can tell her husband that she has syphilis. He will stay far away from her, fearing that he’ll get infected. If she tells him [that she’s infected], he’ll say that she’s promiscuous, that she’s a prostitute.
Some respondents said that people are embarrassed to seek care out of fear of being seen as promiscuous or unfaithful. Such stigmatization may occur both at the health facility, by providers, and at home, among friends and family, and may serve as a serious barrier to seeking a syphilis test.

Preferred sample type

Many participants said that for women, vaginal discharge was the most suitable sample type for detecting syphilis and STIs, since unusual or excess vaginal discharge can be a symptom of STIs. One commented, “[It’s best to use] vaginal discharge because that’s one of the ways [syphilis] shows itself, through vaginal discharge. So that’s where you can get the best sample, and it will be the most efficient.”

Several participants said that urine was effective for syphilis-screening tests. Some suggested urine as appropriate because pregnant women are commonly asked for urine samples. Only a few participants suggested blood as an appropriate sample type for syphilis testing, saying it produced the fastest and most accurate test results.

Factors influencing willingness to pay

Focus group participants were asked why survey respondents said they would pay more for a syphilis-screening test for pregnant women than for an HIV test for infants under 18 months. In response, some participants pointed out that while syphilis screening in pregnant women can prevent congenital syphilis, HIV testing in infants would not prevent HIV infection. One said:

It makes sense [that one would pay more for the syphilis test than the HIV test for infants] because the [HIV-positive] baby – you already know what’s going to happen to him. But the unborn baby [of a mother with syphilis] is not yet infected, so it’s better to do the test for the pregnant woman.

A few people said that survey respondents may be unwilling to pay much for an HIV test for infants because they know that HIV testing is generally free in Benin. Finally, many participants said that survey respondents’ willingness to pay a higher amount for the syphilis test illustrates that women’s health and reproductive capacity is highly valued.

Tanzania

Located along the east coast of Africa, the United Republic of Tanzania transitioned from independence in 1961 to a socialist state, then to a multiparty democracy with a level of stability that has eluded its neighbors. Despite political stability and economic growth, high disease burdens and low education levels pose challenges to development in Tanzania. The GNI per capita of US$ 400 is much lower than the sub-Saharan African average of US$ 952. Approximately 36% of the population of about 40 million live below the poverty line. The annual growth rate is 2%, and the population is both young (44% are below age 15) and rural (36% live in urban areas).

Overview of the health system

Tanzania’s health system comprises a public sector, a private sector (of NGOs, for-profit groups, and faith-based organizations [FBOs]), and parastatal organizations. Tanzania has a large public health system: More than 80% of health facilities are owned by the government. The system 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. When Tanzania was a socialist state, all health care was provided by the government, and private practice was banned, although the government did maintain a relationship with FBOs. As the country moved toward a more market-oriented economy and the state could provide more than half of health care needs, choice of facility type was opened to consumers. The eventual recognition of the private sector by the public health system after 2002 led to improved health outcomes, including higher vaccination rates.

The geographic distribution of facilities is almost even throughout the country: More than half (52%) of registered health centers are in rural areas. Decentralization has helped meet the needs of the mostly rural population, but the generally poor state of rural roads limits access to referral services.

Public institutions and FBOs and NGOs registered with the Ministry of Health and Social Welfare (MHSW) procure diagnostics centrally through the Ministry’s Medical Stores Department (MSD). Private facilities buy diagnostics directly from individual pharmacies in small quantities at very high prices.

The government, donors, NGOs, private organizations, and households provide health care financing: At 47%, households contribute the greatest proportion, while donors and the government provide nearly equal proportions, 22% and 23%, respectively. Compared to other sub-Saharan African nations, Tanzania is more dependent on external funding for health. The government expends approximately 4% of its GDP on health, slightly less than the regional average of 5%. About 13% of Tanzania’s total spending is on health.

Formal sector employees receive social health insurance through the National Health Insurance Scheme, which provides coverage to approximately 3% of the population. Community-based insurance provides the option of health coverage to 48 primarily rural districts. Micro-insurance schemes are for people employed in the informal sector, and a limited amount of private health insurance is available to those who can afford it.

**Syphilis among pregnant women in Tanzania**

The Tanzanian National AIDS Control Program (NACP) estimated that overall syphilis prevalence among pregnant women in mainland Tanzania in 2003–2004 was 6.7%, ranging from 0.4% in Kilimanjaro region to 32% in Tabora. A 2002 study of pregnant women in Mwanza attributed 51% of stillbirths, 24% of preterm live births, and 17% of adverse pregnancy outcomes to maternal syphilis.

As noted, syphilis is of particular public health concern in southern Africa due to its association with the transmission of HIV/AIDS. In Tanzania, overall HIV prevalence among adults aged 15–49 is estimated at 7%, slightly higher among women than men.

Two programs address syphilis in Tanzania using different diagnostic approaches. The first is the Safe Motherhood Initiative housed within the MHSW Reproductive and Child Health (RCH) program. The initiative mandates syphilis screening for all pregnant women. Most health facilities that provide syphilis screening use the RPR test, though some use the VDRL. Most facilities do not use a confirmatory test. The second program addressing syphilis is the NACP. NACP guidelines do not stipulate the use of diagnostic tests to screen for syphilis among patients attending STI clinics. Instead, they recommend syndromic management.

Despite Safe Motherhood Initiative guidelines and a very high ANC attendance rate (94% of pregnant women have at least one ANC visit), many ANC attendees are not tested for syphilis.
A 2002 study of 342 ANC attendees found that only 39% were screened or booked for future screening. A 2006 service provision survey found that only 19% of Tanzanian health facilities routinely screened ANC clients for syphilis. Most of the sites that did provide screening were hospitals and private, for-profit institutions.

In light of the operational challenges and limits posed by RPR testing in Tanzania, RSTs may offer significant opportunities to achieve universal screening for pregnant women. The Sexually Transmitted Disease Diagnostics Initiative (SDI), whose mission is to “promote the development, evaluation, and application of diagnostic tests for sexually transmitted infections appropriate for use in primary health care settings in developing countries,” has been active in advocating RSTs in Tanzania. While the introduction of rapid syphilis diagnostics has been a slow process (please refer to CHS’s case study, “Rapid Syphilis Tests in Tanzania: A Long Road to Adoption” for more details), the Tanzania MHSW plans to adopt RSTs at the national level if the pilot, district-level roll-out in Geita District is successful.

Health provider perspective
Diagnostic priorities
Many health providers and policymakers agreed on general criteria that would make diagnostics useful in Tanzanian health facilities: Diagnostics should require neither refrigeration nor additional equipment; be simple to interpret; require less health worker training when possible; and, when possible, use finger stick whole blood samples, reducing the need for time-consuming serum separation. Many respondents said that rapid tests would increase treatment rates among patients who would otherwise fail to return for test results and treatment.

In terms of prioritizing diagnostics for specific illnesses, many health personnel said that the current approach to syphilis screening, using the RPR test, is unsatisfactory as it requires electricity, refrigeration, a rotator machine, and personnel with significant training to interpret test results. In locations with frequent electricity outages or where there is no rotator machine, ANC nurses must rotate test cards by hand for eight minutes, diverting attention from patients and slowing care. Health care workers must be trained to interpret RPR titers, but one evaluation found that only 11 of 100 Tanzania staff participating in prenatal assessments had received this training. Screening services in many facilities were also hindered by the absence and turnover of the few RPR-trained staff.

In contrast, several health providers said it was more important to develop new diagnostics for illnesses lacking diagnostic tests than to improve existing ones. For instance, one said that developing effective diagnostics for ALRI and malaria in children should be prioritized over improving syphilis tests.

Some health providers said that many Tanzanians prefer to seek STI care through private sector pharmacies to avoid being seen at public STI clinics. Some providers speculated that since many patients are embarrassed to seek care for STIs, self-administered tests might improve testing and treatment rates. Other respondents were uneasy with the idea of non-medical personnel administering diagnostic tests.

Procurement and supply chain management considerations
Several Tanzanian providers mentioned that procurement and supply-chain management problems in the public sector impede diagnostic testing. Procurement was cited as a major barrier to effective diagnosis: Some providers attributed procurement difficulties to the multiplicity of programs delivering supplies to different health facilities. They felt the multiplicity causes confusion over which source provides which commodity.
Although in general the MSD was described as very inefficient, the private sector in Tanzania faces specific barriers to procurement. One respondent believed that the inability of private providers to purchase in bulk through MSD compromises the quality of products available for patients. This person explained that prices are much higher outside the MSD network, prompting providers who want to make a profit to buy less expensive, lower quality products.

Many providers complained that RPR and reagent stock-outs delay screening during women’s initial ANC visit. This is a problem since many women do not return for a second visit and thus are never tested. Respondents also said that stock-outs reflect poorly on the health system, particularly when women have sought testing in response to sensitization campaigns and then learn the tests aren’t available.

The Tanzanian respondents issued further comments on the private health sector. One cited three reasons why people choose this sector despite out-of-pocket costs: shorter waiting times, more attention from health workers, and more reliable drugs and supplies.

However, these providers also described the numerous challenges private facilities face. One explained that cost sharing is causing a shift away from FBO facilities, which charge user fees to cover salaries; faith-based facilities are also losing health workers to government-operated facilities where salaries are higher. The respondent said this compromises the care of patients, who had anticipated superior care from that in the public sector. These patients continue to visit private facilities, but are now seen by less qualified staff. This is particularly problematic in rural areas where FBOs provide more than 50% of health services, and hospitals tend to be faith based. Another provider explained that although all facilities can participate in national health insurance schemes, FBOs are reluctant to do so because reimbursement is often delayed and the process “cumbersome.” This respondent added that facilities are often refunded at a lower rate if the insurers claim that services were not provided according to standards.

When considering introducing new diagnostics into the Tanzanian health system, one health provider suggested that their per-unit cost be contingent on the disease burden: This respondent said that it would reasonable for a pediatric TB test to cost more than a malaria test because Tanzania has comparatively few cases of childhood TB. Other providers speculated that cost has a direct bearing on patients’ decisions whether to seek professional diagnosis. The participant asserted that if a test is inexpensive, clients are more likely to seek a diagnosis to avoid paying for unnecessary treatments. On the other hand, the provider said, if diagnostics are more expensive than treatment, clients will likely go to a pharmacist.

Donors fund much of the limited syphilis testing that occurs in Tanzania, but both health officials and donor representatives interviewed for this case study reported that syphilis – and STI diagnosis in general – is low on the donors’ priorities lists. One interviewee reported that Japanese International Cooperation Agency (JICA), which has provided support for limited syphilis testing over many years, is anxious to end this component of its assistance.

Some health providers also broached the subject of sustainability in introducing new diagnostics, stating that if the international health community determines that a diagnostic is important and the national health system agrees to introduce it, the government has a moral obligation to ensure supplies. Should governments abandon older technologies, manufacturers of these products may cease to exist, and if the government cannot afford new technologies absent donor assistance, it will face a major challenge to future diagnoses.

**Willingness to purchase and use a diagnostic test**

Of consumers interviewed in Tanzania about the six study diseases, 94–97% indicated that they were interested in using and willing to pay for diagnostic tests. Figure 5 indicates that Tanzanian consumers were willing to pay more for STI and TB tests than for the other four.
Respondents in the syphilis WTP survey averaged 27 years of age (Table 5). Married respondents accounted for 72% of those interviewed. Nearly a third self-identified as Muslim and another third as Christian. Slightly over 15% had less than a complete primary education while 59% had completed primary school. The urban/rural ratio of the population surveyed was 57%/43%. Those interviewed at public facilities accounted for 76% of the sample. Respondents paid an average of Tsh 394 for transport to reach the health facility (median Tsh 200). At the time of the study, USS 1 was equivalent to Tsh 1176.
Table 5. Tanzania: Socio-demographic characteristics of WTP survey respondents

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<td>Tanga</td>
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<td>76.1% (264)</td>
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<td>Average travel time (minutes)</td>
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<td>Average travel cost (Tsh)</td>
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Willingness to pay for syphilis diagnostic tests

Based on the initial focus group findings, the WTP bidding for a syphilis test started at 500 Tsh and increased and decreased in increments of 200–500 Tsh depending on the reply. Due partly to survey design, the amounts respondents selected tended to cluster in increments of 500 Tsh. Of 364 respondents, data on 347 who were willing to pay for syphilis diagnostics are available: Flawed data precludes the presentation of data on respondents not willing to pay and 5% of those willing to pay some amount. The 347 consumers on whom data are available expressed willingness to pay amounts ranging from 100–10,000 Tsh. Figure 6 shows that their willingness to pay dropped by a third as the price increased from 500 to 1000 Tsh and then declined sharply as the price rose to 1500 Tsh. WTP then declined gradually, between 0–15% for each 500 Tsh increase.
Figure 6. Tanzania: Willingness to pay for a syphilis diagnostic at each price range

The figure groups respondents into four market segments to categorize consumer willingness to pay for syphilis diagnostics tests within certain price ranges:

- **Segment A**: Consumers willing to pay no more than Tsh 500,
- **Segment B**: Consumers willing to pay Tsh 501–1000,
- **Segment C**: Consumers willing to pay Tsh 1001–2000,
- **Segment D**: Consumers willing to pay more than Tsh 2000.

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 falls into each segment at a given price range.

Table 6 shows that with the exception of facility type, socio-economic and demographic characteristics differed little across market segments. Across all segments 66–90% of consumers had completed no more than primary education; 8–10% more of those in segment D had completed tertiary education. Overall, the distribution of wealth was fairly even across the segments, although there were 50% more consumers in segment D who fell into the top two wealth quintiles than there were in segment A. There was no readily discernable pattern by geographic region. Only about 20–40% of consumers in segments A, B, and C were Tanga residents as compared to 72% of those in segment D. In segment D, 74% of consumers attended private for-profit facilities as compared to 36%, 12%, and 6% in segments C, B, and A, respectively.
Table 6. Tanzania: Selected socio-economic characteristics of respondents willing to pay for a syphilis diagnostic within different price ranges

<table>
<thead>
<tr>
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<tr>
<td>&gt;Primary</td>
<td>N/A</td>
<td>31% (32)</td>
<td>13% (15)</td>
<td>3% (6)</td>
<td>12% (9)</td>
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<tr>
<td>Primary</td>
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<td>61% (64)</td>
<td>55% (68)</td>
<td>63% (45)</td>
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<td>22% (26)</td>
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</tr>
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<td>2.2% (2)</td>
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<tr>
<td>Wealth quintile***</td>
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<td></td>
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</tr>
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<td>1 (lowest)</td>
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<td>10% (5)</td>
<td>11% (15)</td>
</tr>
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<td>2</td>
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<td>17% (29)</td>
</tr>
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<td>3</td>
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<td>22% (16)</td>
<td>22% (11)</td>
<td>15% (26)</td>
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<td>31% (33)</td>
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<tr>
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<td>17% (13)</td>
<td>32% (16)</td>
<td>30% (24)</td>
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<td>36% (26)</td>
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<td></td>
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<td>57% (41)</td>
<td>28% (14)</td>
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<tr>
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<td>23% (25)</td>
<td>22% (29)</td>
<td>43% (31)</td>
<td>72% (26)</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, the poorest 20% of the population.

Significant influences on willingness to pay

Bivariate analysis revealed statistically significant differences in consumer WTP by wealth quintile and education level. On average, consumers in the highest wealth quintile were willing to pay Tsh 2297, more than 2.5 times as much as those in the lowest (ANOVA p=0.01). Respondents who were university educated were willing to pay Tsh 2769, more than twice as much as those who had not completed primary education (ANOVA p=0.05).

Willingness to pay also differed significantly by geographic region and facility type. Tanga residents were willing to pay Tsh 2228 for a syphilis test, twice as much as those in the capital (t-test p=0.01). Consumers seeking care at private facilities were willing to pay an average of Tsh 2973, nearly three times as much as those at public facilities.

Although the average amounts consumers were willing to pay differed significantly between certain socio-economic and demographic strata, some of these differences disappeared after controlling for other factors. However, significant differences remained between facility type and wealth level. Consumers seeking care at public facilities were willing to pay Tsh 562 less than those at private facilities (OLS p=0.01). Figure 7 shows that willingness to pay at public facilities drops very sharply as the price increases to Tsh 2000, while the decline at private facilities is more gradual. For each increase in wealth level, consumers were willing to pay an additional Tsh 337 (OLS p=0.01). There were also significant differences according to religious group and
transportation costs: Muslim respondents were willing to pay Tsh 143 less than those in other religious groups (OLS p=0.10). For each additional Tsh 250 spent on travel to a health facility, consumers were willing to pay Tsh 143 less for a syphilis test.

**Figure 7. Tanzania: Willingness to pay for a syphilis test, by facility type**

![Willingness to pay for a syphilis test, by facility type](image)

### Illness concepts

#### Severity

In Tanzania, some participants viewed syphilis as a severe illness, particularly as it affects pregnant women and their unborn children. As in Benin, some participants thought syphilis could result in infertility in women and said it is severe because of this possible consequence. As discussed above, the misconception that syphilis can cause infertility may be due to the fact that most participants didn’t differentiate between syphilis and other STIs, and other STIs can lead to fertility problems.

A few participants said that the severity of syphilis and other STIs depended on how quickly it was diagnosed and treated:

> If STIs are diagnosed in time, they are not severe. But in some cases, people get STIs and they have them for some time without knowing, and when they come to realize it, it is too late. In some cases it causes damage to their health. [STIs] can open the door to HIV infections.

However, many participants did not view syphilis and other STIs as severe. Respondents’ perceptions of the minimal severity of syphilis seemed closely linked to their views that it is easily avoided and also easily treated.

#### Susceptibility

Many respondents cited promiscuous behavior as the main source of syphilis infection, asserting that women who are faithful to their partners will not get syphilis. A young woman said, “A woman who has no affairs outside her marriage cannot get syphilis.” This quotation exemplifies some of the stigma associated with this disease, discussed below. However, other participants
mentioned other perceived sources of syphilis infection, including shared clothing and unclean water. While these etiological explanations are not accurate from a biomedical perspective, they may reduce syphilis-associated stigma by providing alternative explanations for the origin of someone’s syphilis infection.

Benefits of testing

Most Tanzanian participants said that the symptoms of syphilis, along with other STIs, are very obvious, and therefore require no diagnostic testing by a doctor and enable effective treatment:

There are some illnesses [for which], when the doctor hears the symptoms, he/she can prescribe without diagnostic testing… Like some STIs – a doctor can give you medicine for those without testing.

Some participants stated that the symptoms of syphilis are so obvious that it may not be necessary to see a doctor and that simply telling your symptoms to a pharmacist may be sufficient to receive effective treatment:

You can go to a pharmacy… You will look around and if there is no one else nearby, you will explain to the pharmacist the way you are feeling – that you have pain in your genitals and discharge. Because he has some experience, he can prescribe medicine or tell you to go to hospital for further investigations.

As in Benin, many focus group participants in Tanzania seemed unaware that syphilis and other STIs can be asymptomatic. Some participants did acknowledge this possibility, however, and said that women were less likely to show syphilis symptoms.

Barriers to testing

Many participants described syphilis and other STIs as embarrassing. Most said that these illnesses are shameful because they indicate promiscuity or infidelity. One participant explained, “Syphilis and STIs are shameful illnesses because if you get them, it’s an indicator that you weren’t faithful to your spouse. It suggests that a woman had an affair with another man, and that creates problems.”

The perceived association between STIs and promiscuity was cited as a barrier to care seeking by several participants who said, “If I go [to the clinic],... [the doctor] will know I am promiscuous and that I have unsafe sex.” Another woman echoed these fears of being labeled as promiscuous by health providers and said that these concerns would motivate her to seek care from a pharmacist instead of at a hospital or clinic.

Focus group participants’ care-seeking preferences echo Tanzanian health providers’ assertion that clients prefer to seek STI care from medicine shops. Pharmacists there lack access to STI diagnostics and make treatment recommendations based on patients’ self-reported symptoms. Self-administered STI tests may improve diagnosis and treatment of syphilis and other STIs for patients seeking advice from pharmacists and health shops. However, at-home syphilis diagnostics would not likely improve diagnosis among pregnant women since they are frequently asymptomatic and would not be seeking care based on symptoms. Targeted health communication campaigns around the need for syphilis screening during pregnancy (including for a woman who is asymptomatic) would be required if self-administered syphilis tests were to be integrated into routine ANC syphilis screening programs.

Preferred sample type

Tanzanian participants unanimously agreed that urine is the most suitable sample type for syphilis diagnosis and said that blood was not a good sample type for syphilis tests. Interestingly, many women in the focus groups had children and so may have been screened for syphilis during pregnancy. Such screenings, if they occurred, would have been done
using RPR, which requires a blood sample. So in theory, some of the women who said that blood is unsuitable for syphilis testing may in fact have had a syphilis test using a blood sample. Participants’ unawareness that blood is currently used to test for syphilis may reflect doctors’ tendency to order blood draws without explaining why to patients.

Factors influencing willingness to pay

Focus group participants were asked why survey respondents were willing to pay less for syphilis and malaria tests than for the other illnesses. Some responded that survey respondents would be unwilling to pay a lot for syphilis screening tests and malaria tests for children because these tests are free in public sector hospitals. Others said that these illnesses don’t require diagnostic tests because the symptoms are obvious, rendering many unwilling to purchase such tests.

Peru

Located on the western coast of South America, Peru is geographically and ethnically diverse. Its 27.5 million population is growing at 1% per year. Thirty-one percent of Peruvians are under age 15. A third of Peruvians lives in or near the capital, Lima, with 73% in urban areas. The World Bank classifies this country as a lower middle-income country; 11% of the population lives below the poverty line. The 2007 GNI per capita, US$ 3450, was lower than the US $ 5540 average for Latin America and the Caribbean. With income disparities among the highest in the world, Peru’s per capita income masks great differences in wealth. The wealthiest 20% of the population accounted for 57% of national income or expenditures in 2003, while the poorest 20% accounted for only 4%. At 93% in 2000, literacy among those over age 15 was high.

Overview of the health system

Despite services for the poor, numerous barriers limit access to public services, including direct costs and opportunity costs. Health services are also not sufficiently decentralized to the poorest areas, and inadequate referral systems pose another barrier to care.

The Peruvian public health system is composed of:

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.

Peru’s public health sector is large and includes 51% of the hospitals, 69% of the health centers, and 99% of the health posts. The public laboratory network includes 16 regional laboratories and the national reference center, the National Institute of Health. 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.

Approximately 8% of total government spending is on health, and external aid accounts for 2% of total health spending. Households were the primary source of health financing in 2000, accounting for 37% of spending. The formal economy, through ESSALUD, accounted for 35%. The government pays 24% of health expenditures, and other sources, including international donors, cover about 4%.

The government created the Comprehensive Health Insurance program in 2001 to provide coverage for those under 18 years of age, 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.
Syphilis in Peru

Syphilis prevalence in Peru is estimated at 1.0% in men and 0.9% in women. Syphilis is reportedly expanding into indigenous communities in the Peruvian Amazon: A 2008 study there estimated the syphilis prevalence rate at 3.2% (3.7% and 2.7% for men and women, respectively). Another study found even higher rates of syphilis, around 6.3%, among an indigenous Amazonian community.

A high percentage of pregnant women (92%) attends at least one ANC visit. No data are available on syphilis prevalence among pregnant women in Peru, but a 2003–2004 study estimated syphilis prevalence there among male partners of pregnant women attending prenatal and post-partum visits to be 1.5%.

Health system perspective

In terms of priorities for new diagnostics, most Peruvian health providers articulated similar views. They said that diagnostics should be sufficiently simple that low-level health providers could implement them without additional equipment, which can break and delay services. Most said that diagnostic tests should be free or very cheap, as most patients cannot pay more than S/. 5.00–10.00. Most providers said tests must have sensitivity and specificity above 95%. A few suggested that tests using saliva or other bodily fluids instead of blood would be more appealing to clients.

Most Peruvian health providers did not cite syphilis as a priority issue, though they said that syphilis prevalence is much higher in the public sector facilities than private ones and those covered by social security. They indicated that free syphilis screening using RPR or VDRL is provided during routine ANC, which mostly occurs in hospitals. Only a few providers mentioned confirmatory testing such as fluorescent treponemal antibody absorption.

Few providers identified a need for improved diagnostics for syphilis, though one referred to broken equipment and attendant delays associated with RPR tests. The provider noted that a test that doesn’t require equipment would minimize such delays.

Consumer willingness to purchase and use a diagnostic test

Of consumers interviewed in Peru about the six study diseases, 90% indicated an interest in using and a willingness to purchase diagnostic tests. As Figure 8 indicates, Peruvian consumers were willing to pay more for TB, HIV and STI tests than for syphilis, and still less for malaria and ALRI.
Peruvian survey respondents who were questioned about syphilis averaged 27 years in age (Table 7). More than half were married, and nearly half (49%) lived in rural areas. Almost 95% had completed secondary education or higher. A larger proportion had health insurance, 20%, than in other study countries. Half sought care at public facilities. At the time of the study, US$ 1 equaled S/. 2.72. On average respondents traveled 27 minutes and spent S/.1.50 in travel costs to reach the health facility on the day of the focus group discussion.
Table 7. Peru: Socio-demographic characteristics of WTP survey respondents

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Respondents (N=260)</th>
<th>Respondent’s Spouse % (N)</th>
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<td>Other</td>
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<tr>
<td>Education level</td>
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<td>5.0% (11)</td>
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<tr>
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<td>26.6% (59)</td>
</tr>
<tr>
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<td>25.7% (57)</td>
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<tr>
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<tr>
<td>Urban</td>
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<tr>
<td>Rural</td>
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<tr>
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<tr>
<td>Lima</td>
<td>38.1% (99)</td>
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<td>Arequipa</td>
<td>27.7% (72)</td>
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<td>Iquitos</td>
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</tr>
<tr>
<td>Facility type</td>
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<td>NGO</td>
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<td>Average travel time (minutes)</td>
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</tr>
<tr>
<td>Average travel cost (S/)</td>
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Health-seeking behaviors

About 38% of respondents reported suffering an illness episode or injury in the four weeks preceding the survey; of these, 55% reported seeking care in the formal health sector while 3% sought it from a non-biomedical provider such as a shaman. Laboratory diagnostic tests were recommended to 20% of those who went to a biomedical facility, and 81% reported consenting to at least some of the tests. Respondents reported having paid an average of S/.40.40 for diagnostic tests prescribed on the day of the survey. These tests may have been for syphilis or another condition, since participants were recruited from among pregnant women seeking any type of ANC. The same respondents reported willingness to pay an average of S/.23.10 for a syphilis test, almost as much as the average S/.26.00 all Peruvian respondents reported being willing to pay for any study diagnostics.

Willingness to pay for syphilis diagnostic tests

Based on the initial focus group findings, the WTP bidding for a syphilis test started at S/.5.00 and increased or decreased in increments of S/.2.50–10.00 depending on the reply. Due in part to the survey design, the amounts respondents selected tended to cluster in increments of S/.5.00. Of 260 respondents, 18 (7%) were not willing to pay anything for a syphilis diagnostic. The other 242 expressed willingness to pay amounts ranging from S/.2.50–100.00. Figure 9 shows that WTP declined sharply as the price increased from S/10.00–15.00 and then dropped 10–15% for every S/.5.00 increase up to S/.35.00. WTP then declined more gradually before dropping by 7% as the price rose above S/.55.00. In terms of market exclusion, a syphilis diagnostic priced at S/.5.00 (about US $1.84 at the time of the study) would exclude 10% of consumers in
Peru, but one priced at S/.15.00 (about US $5.51) would exclude 35% and one at S/. 25.00 (about US $9.19) would exclude almost two-thirds.

**Figure 9. Peru: Willingness to pay for a syphilis diagnostic at each price range**

The figure groups respondents into four market segments to categorize consumer willingness to pay for syphilis diagnostics within certain price ranges:

- Segment A: Consumers willing to pay no more than S/.10.00,
- Segment B: Consumers willing to pay S/.11.00–20.00,
- Segment C: Consumers willing to pay S/.21.00–30.00,
- Segment D: Consumers willing to pay more than S/.30.00.

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

Slightly more than half of the 18 respondents not willing to pay had completed secondary education, and only 1 in 5 was represented in the top two wealth quintiles. About half (50%–61%) lived in urban areas, attended public facilities, and had some form of health insurance. The small number of people who reported being unwilling to pay for syphilis diagnostics precludes drawing reliable conclusions about this group’s socio-economic makeup.

Table 8 shows that socio-economic and demographic characteristics differed across the market segments. More than a third of respondents willing to pay more than S/. 21.00, segments C and D, completed tertiary education, while 6% or 16% did so in segments A and B, respectively. About 40% of those in segments C and D fell into the highest wealth quintile, compared to less than 10% of those in segments A and B. Health insurance was fairly evenly distributed across the market segments. Three-quarters of respondents in segment A attended a public facility, and a third in segment D did. A slightly higher percentage of those in segment D attended NGO facilities and 40% of those in segment D attended private for-profit facilities as compared to a mere 7% in segment A. Higher proportions of consumers in segments C and D lived in urban areas than in segments A and B. Higher proportions of consumers lived in Lima for each increasing market segment, with 55% of those in segment D residing in the Peruvian capital.
Table 8. Peru: Selected socio-economic characteristics of pregnant women willing to pay within different price ranges for a syphilis diagnostic

<table>
<thead>
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<tr>
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<td>Technical</td>
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<td>19% (14)</td>
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<td>18% (6)</td>
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<td>16% (12)</td>
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<td>43% (13)</td>
</tr>
<tr>
<td><strong>Wealth quintile</strong>*</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 (lowest)</td>
<td>22% (4)</td>
<td>36% (26)</td>
<td>22% (16)</td>
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<td>28% (5)</td>
<td>27% (19)</td>
<td>22% (16)</td>
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<tr>
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<td>28% (5)</td>
<td>18% (13)</td>
<td>22% (16)</td>
<td>22% (14)</td>
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<tr>
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<td>13% (9)</td>
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<td>18% (12)</td>
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<tr>
<td>5 (highest)</td>
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<tr>
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<td>45% (33)</td>
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<td>NGO</td>
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<td>29% (21)</td>
<td>23% (15)</td>
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<tr>
<td>Private for-profit**</td>
<td>17% (3)</td>
<td>7% (5)</td>
<td>26% (19)</td>
<td>31% (20)</td>
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<tr>
<td>Lima</td>
<td>33% (6)</td>
<td>28% (20)</td>
<td>42% (31)</td>
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<td>Arequipa</td>
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<td>29% (21)</td>
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<tr>
<td>Iquitos</td>
<td>6% (1)</td>
<td>43% (32)</td>
<td>29% (21)</td>
<td>40% (26)</td>
<td>27% (9)</td>
</tr>
<tr>
<td>Have health insurance</td>
<td>61% (11)</td>
<td>64% (41)</td>
<td>72% (47)</td>
<td>67% (49)</td>
<td>78% (54)</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 facility type is "all other facility types." Reference category for wealth quintile is "lowest 20%.”

**Significant influences on willingness to pay**

As with the bivariate analyses in both Benin and Tanzania, statistically significant differences existed in consumer willingness to pay by wealth quintile and education level. On average, consumers in the highest wealth quintile were willing to pay S/. 35.20, more than twice as much as those in the lowest (ANOVA p=0.01). University-educated respondents were willing to pay S/. 31.80, 47% more than those who had completed only primary education (ANOVA p=0.01).

WTP also differed significantly by geographic region, zone, facility type, and the amount respondents spent on transport to the health facility. Lima residents were willing to pay an average of S/. 27.10 for a syphilis test, 37% and 27% more than those in Arequipa and Iquitos, respectively (ANOVA p=0.05). Urban consumers were willing to pay S/. 27.50, nearly 50% more than their rural counterparts (ANOVA p=0.01). Respondents also reported a willingness to pay S/.35.30 if they spent more than S/. 2.00 to reach the facility, 73% more than they were willing to pay if they spent no money on transport (ANOVA p=0.01). Consumers who attended
NGO facilities were willing to pay S/.31.60; 19% more than those at private facilities and 71% more than those at public ones (ANOVA p=0.01).

Although the average amounts consumers were willing to pay differed significantly between certain socio-economic and demographic strata, after adjusting for other factors, significant differences remained between all the same factors except for geographic region and zone. Wealth quintile (or education as a proxy) was the most consistent predictor of more willingness to pay across all diagnostic analyses in Peru. Respondents were willing to pay an additional S/. 5.40 with each increased level of wealth (Figure 10, OLS p=0.01). As the price exceeds S/. 35.00, the proportions of consumers willing to pay in the fourth and fifth wealth quintiles become more similar, as do the proportions in the first three wealth quintiles. Consumers seeking care at public facilities were willing to pay S/. 1.40 less than those at private or NGO facilities (Figure 11, OLS p=0.05). At about S/. 30.00 the gap between the proportion of consumers willing to pay for tests at each facility narrows, suggesting that at higher prices facility type is less important in determining willingness to pay. Pregnant women who spent more than S/. 1.00 on travel were willing to pay an additional S/. 1.60 for a syphilis diagnostic (OLS p=0.05). For each additional child, they were willing to pay S/. 1.41 less (OLS p=0.05).

**Figure 10. Peru: Willingness to pay for a syphilis test, by wealth quintile**
Illness concepts

Severity

Peruvian focus group participants viewed syphilis and other STIs as somewhat severe, ranking them after TB and HIV. Although facilitators distinguished syphilis (for which pregnant women are the target risk group) from gonorrhea and chlamydia (for which the population of interest is high risk asymptomatic women, many of whom are likely to be commercial sex workers), participants did not seem to differentiate among STIs.

Although respondents perceived syphilis as severe, very few were aware of its potential impact during pregnancy. Rather, the severity of all STIs was linked to their symptoms and discomfort.

Susceptibility

Several Peruvians said that STIs were easily avoided by using protection during sex. Some suggested that STIs resulted from carelessness and that, unlike other diseases, one has agency over susceptibility to STIs. As this participant put it:

For example, [let’s say] I’m married and I want to have [extra-marital] sex. I decide independently who I’ll do it with. On the other hand, pneumonia, one doesn’t decide. Same with TB – one doesn’t decide. I go here and there, and I may or may not get TB, even though I’m innocent.

Respondents often discussed differences in STI prevalence among different populations. For instance, participants said that men are at higher risk of contracting syphilis and other STIs than are women because men have more sexual partners. Many participants mentioned higher STI prevalence in urban areas, which they attributed to the fact that people from the countryside lead healthier lifestyles through better eating and a cleaner environment. Respondents also characterized urban residents as more promiscuous, making themselves more susceptible to STIs. The exception to this rural/urban breakdown was that Amazonian populations were described as
highly promiscuous. Also and in general, many respondents blamed early sexual debut among youth for increasing syphilis prevalence in the country. They cited inadequate sex education in schools and irresponsible parenting as contributing to youth’s sexual “liberty.”

Benefits of testing

Most focus group participants said that STI treatment is relatively easy and that STIs are easy to identify due to the visible symptoms; most seemed unaware of asymptomatic syphilis infection. Several participants mentioned that young people buy antibiotics directly from a pharmacist rather than being tested to avoid their parents’ knowing. In the words of one male participant, “Pharmacists are good, too, right? You explain to the pharmacist more or less what symptoms you have, and he says, ‘You’re quemado [burned], take this.’ No going through a doctor.” Similarly, an adult might self-medicate rather than seek testing, fearing that his or her spouse might discover the infection if the spouse visits the health center.

Of those participants who said specific testing was required to diagnose syphilis, most said it was helpful to differentiate between illnesses with similar symptoms – not to identify asymptomatic infections.

I imagine that the analysis is important because a woman doesn’t just have burning during urination because of syphilis, right? It could be a urinary tract infection or [another illness]. One could be confused with this disease, so to find out what [exactly] it is, you need an analysis.

A few participants in several groups and most participants in the male group in Iquitos said that a diagnostic test is necessary for any kind of illness. These statements often appeared to be based on social desirability bias – saying what might be socially acceptable rather than true beliefs. Such bias can make it difficult to assess participants’ true perceptions of the need for diagnostic testing. The best example of such a comment came from a male participant in Lima:

We need a diagnostic test for all illnesses, to know what we have, because otherwise we would be questioning the credibility of medical science – it’s necessary and that’s what we need doctors for… to know what kind of sicknesses we have, and also… they’re the ones… the scientists are the ones, who have classified all these illnesses, and that’s why [a diagnostic is needed] for all illnesses.

Barriers to testing

Focus group participants said that many people avoid diagnostic testing from fear that a blood test might leave a person weak or anemic. Though such concerns might seem strange to someone with even a fairly basic understanding of medicine and human physiology, they are fairly common among people with a limited education who do not know that the body regenerates blood and that the small quantity typically needed for such test would have no effect on a patient’s health.

Some participants mentioned patients’ fear their blood might be sold. A Lima participant explained that mothers “think that [health workers] are going to take a lot [of blood], that [the children] will wind up sick, that [the health workers] will sell the blood.”

Not surprisingly, cost is another important barrier to diagnostic testing. One provider explained why it can be difficult to convince some parents to spend even a small amount on diagnostics for themselves:

Their hands are tied. They tell me, “if I go to the doctor, let’s suppose the office visit costs 5 soles, but with those 5 soles, I make my lunch.” So I say, “but think about the fact that you’re getting sicker. You can eat now, but tomorrow you won’t be able to eat. One day without eating won’t kill you… Get tested – don’t treat yourself, because then you’ll wind up with resistance to [the medicine]. So then they say, “But, no, what am I supposed to do about [feeding] my children?” So for most of them, it’s about lack of money.
Participants cited other reasons for refusing diagnostic tests: long waiting lines, maltreatment by health workers, discrimination, and embarrassment. Some women reported embarrassment at being examined by male doctors, especially for STI tests.

Most Peruvian focus group participants said syphilis and other STIs are stigmatizing, since people associate an STI diagnosis with multiple sexual partners. Several participants said that friends and family members would isolate someone with an STI. Respondents said that people don’t seek diagnosis or treatment for STIs, and once diagnosed, they often don’t tell their partners.

Preferred sample type

Although many participants said that urine was the easiest and least uncomfortable sample type for diagnostic testing, many said blood is more accurate. Participants also said that blood tests permit doctors to diagnose multiple illnesses from a single sample:

Let’s suppose I have disease “X” and the doctor tells me, we can make a diagnosis with any of the four [blood, sputum, urine, stool], right? But I would want the blood test mostly because that way I can find out if I have some other disease apart from the one I already know about, right? It’s not that way with urine: Blood is more complete.

Some Peruvians said that people dislike giving blood samples because they’re afraid of painful needles or that the health worker will not know how to perform the blood draw correctly. They reported that some people faint or experience a drop in blood pressure when they have a blood sample taken. According to providers, some clients also fear becoming infected with a contaminated needle.

Few participants cited vaginal discharge as a preferred sample type, saying that both the position and procedure for collecting a vaginal swab are uncomfortable, particularly if the person performing the swab is male.

Factors affecting willingness to pay

Focus group participants were asked why survey respondents from Lima were willing to pay more for syphilis tests than those from Arequipa and Iquitos. Respondents speculated that the higher WTP reflected higher syphilis prevalence, which they attributed to promiscuity and “more liberal” behavior. Participants were also asked why urban respondents were willing to pay more than rural respondents; their responses cited higher prevalence in urban areas. Additionally, they thought that people from the countryside rely more on traditional medicines and may be less aware of the diagnostic testing services available to them.

**CONCLUSIONS AND RECOMMENDATIONS**

**Health Provider Priorities**

Although syphilis screening is a mandated component of routine ANC services in all three study countries and the majority of women attend at least one antenatal visit, many women are not screened for syphilis during pregnancy. Despite these low rates of screening, most health providers in Benin and Peru did not identify improved syphilis diagnostics as a high priority. These priorities may reflect the relatively low syphilis prevalence rates in Peru and Benin (about 0.9–2.0%). It may also suggest that the current approach to syphilis screening in pregnancy (RPR and VDRL tests) is considered satisfactory, and providers would instead prioritize improved diagnostics for high-burden illnesses for which no effective tests exist.

In Tanzania, on the other hand, providers ranked improved syphilis tests a higher priority than did those in the other countries. This may reflect the much higher syphilis prevalence in the country (around 7%). Tanzanian providers’ prioritization of improved syphilis diagnostics may also
indicate dissatisfaction with the current approach to antenatal syphilis screening (using RPR): They cited many problems with the method and suggested that rapid tests requiring minimal health worker training and needing neither refrigeration nor additional equipment would increase treatment rates. While rapid syphilis tests are under review for use in Tanzania’s antenatal syphilis screening programs, the diagnostics have not yet been adopted into national protocols.

Supply-chain management was noted as an obstacle in all three countries, particularly in terms of procurement and distribution of diagnostics and supplies. Logistics and supply-chain management are particularly problematic in rural areas where access to laboratories is often limited.

**Consumer Market for a New Syphilis Diagnostic Test**

Nearly all of the people surveyed in all three countries said they were willing to pay for new diagnostic test for syphilis, as shown in Table 9.

<table>
<thead>
<tr>
<th>Country</th>
<th>Total Surveyed</th>
<th>Total WTP</th>
<th>% WTP</th>
<th>% WTP Urban</th>
<th>% WTP Rural</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benin</td>
<td>292</td>
<td>275</td>
<td>94.2%</td>
<td>96.1%</td>
<td>91.1%</td>
</tr>
<tr>
<td>Tanzania</td>
<td>NA</td>
<td>347</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Peru</td>
<td>261</td>
<td>242</td>
<td>92.7%</td>
<td>92.5%</td>
<td>93.7%</td>
</tr>
<tr>
<td>Total*</td>
<td>553</td>
<td>517</td>
<td>93.5%</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

* Totals include only Benin and Peru. In Tanzania, data were available only for respondents willing to pay some amount, not for those unwilling or unable to pay anything.

The fact that more than 90% of respondents said they were willing to pay indicates that 5%–10% are either unable or unwilling to pay. In developing countries, there will likely always be at least a small percentage of the population who cannot afford health care.

Table 10 shows the range of respondents’ maximum willingness to pay.

<table>
<thead>
<tr>
<th>Country</th>
<th>Local currency</th>
<th>US $ equivalent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benin</td>
<td>CFA 100–10,000</td>
<td>$ 0.09–8.50</td>
</tr>
<tr>
<td>Tanzania</td>
<td>Tsh. 300–20,000</td>
<td>$ 0.71–47.51</td>
</tr>
<tr>
<td>Peru</td>
<td>S/. 2.50–100</td>
<td>$ 0.92–36.76</td>
</tr>
</tbody>
</table>

A few individuals said that the maximum amount they were willing to pay was less than the initial baseline price, but the vast majority accepted the baseline price or said they would pay a more. The boundaries of these ranges should, however, be considered outliers, particularly on the upper end. Table 11 shows the mean price survey respondents said they were willing to pay.
Table 11. Mean price consumers were willing to pay

<table>
<thead>
<tr>
<th>Country</th>
<th>Local currency</th>
<th>US $ equivalent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benin</td>
<td>CFA 2,943</td>
<td>$ 6.99</td>
</tr>
<tr>
<td>Tanzania</td>
<td>Tsh 1489</td>
<td>$ 1.27</td>
</tr>
<tr>
<td>Peru</td>
<td>S/. 23.10</td>
<td>$ 8.49</td>
</tr>
</tbody>
</table>

These mean amounts, while useful for estimating appropriate pricing schemes, are influenced by the outliers and don’t indicate what percentage of people would actually pay these prices or how many might be excluded from testing if prices were set at these levels. To get a better idea of the impact each price level would have, CHS analyzed the percentage of interviewees willing to pay at each of 14 price intervals, representing the range of prices for each country and providing a general idea of the elasticity of prices. The results are summarized in Figure 12, which illustrates that nearly all respondents in the study countries were willing to pay the lowest level price.\(^1\) After that, with each price increment, the percentage of respondents willing to pay drops off, especially in Tanzania. Thus, for example, at the fourth pricing interval, about half of interviewees in Benin and Peru said they were willing to pay that price, while only about 25% of those in Tanzania were.

Figure 12. Percentage of consumers willing to pay at each price interval

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\(^1\) In the case of Tanzania, for reasons related to the formulation of the study, only interviewees indicating willingness to pay and a price were included. While the graph suggests that everyone was willing to pay at the lowest price, in reality, the proportion of Tanzanian respondents willing to pay at each price interval was almost certainly similar to trends seen in the other two countries.
In general, a greater percentage of people in Benin were willing to accept higher prices than in the other two countries; at price interval 10, about 22% were willing to pay CFA 5000 (US$ 11.88). In Peru, a price set at the sixth interval, equivalent to S/. 30.00 (US$ 11.00) would still be within the acceptable range of nearly 30% of the population. In Tanzania, while nearly everyone would accept a price of Tsh. 500 (US$ 0.42), doubling that small amount might exclude 30% of the population for access. Tripling it (Tsh. 1500/ $US$ 1.28) would exclude 65%. These examples recommend against setting a fixed price for syphilis tests across different countries, as the market for a new syphilis diagnostic will be stronger in some countries than others.

To further facilitate our analysis of each country, CHS separated the pricing intervals into four segments (which varied somewhat in accordance with the range of pricing intervals and the responses). In the figure, segment A corresponds approximately to pricing intervals 1 and 2; segment B to intervals 3 and 4; segment C to intervals 5–8; and segment D intervals 9–14. CHS analyzed how respondents’ demographic and socio-economic characteristics within these segments might influence willingness to pay for syphilis diagnostics.

Two statistically significant factors were identified in all three countries: education and wealth quintiles. Respondents with relatively higher education were more likely to correspond to segments C and D, while those with primary education or less/none would likely fall into segments A and B. In Benin, the education of the respondent’s partner was also correlated with the maximum level of payment suggested.

The strongest correlation in terms of the maximum price respondents were willing to pay was wealth quintile. While all the pricing segments included members from each wealth quintile, there were strong tendencies at the upper and lower ends. For example, two-thirds of the respondents from Tanzania falling into segment A (the lowest price segment) came from the lowest two wealth quintiles, and nearly 90% came from the lowest three quintiles. On the other hand, about half of the respondents in segment D (the upper price segment) represented the wealthiest 40% of Tanzanian respondents. Peru and Benin exhibited similar, though less striking, patterns.

**Figure 13: Tanzania: Percentage willing to pay by public versus private sector**

Consumers’ willingness to pay may also be influenced by other factors, such as the health facility where they are seeking services. Note the difference in WTP between people seeking services in the public and private sectors in Tanzania (Figure 13). The survey results show that most Tanzanians were willing to pay a relatively low amount for syphilis diagnostics: Setting the price of a new syphilis diagnostic at Tsh. 1500 (about US$ 1.26) would exclude nearly 80% of clients. However, these results were influenced by the fact that nearly three-fourths of included respondents were interviewed in public sector facilities, where clients stated lower WTP amounts than at private facilities. The
figure suggests that there may well be a market for such a test in the private sector, where respondents were willing to pay much more for a syphilis test: 70% of respondents surveyed at private facilities were willing to pay Tsh. 2000 (about $1.70) and about 30% of them were willing to pay as much as Tsh. 5000 (about US$ 4.21).

The Peru data demonstrates similar trends, though less extreme: 40% of the for-profit private sector and 30% of the non-profit private sector said they were willing to pay a price of S/. 30.00 (about US$ 11.00); and at that price, even 30% of the public sector clients expressed a willingness to pay that price. Dropping the price to S/. 25.00 (about US$ 9.19), would make the test affordable to another 10% of respondents in all three markets.

Surprisingly, in Benin, the private sector patients were willing to pay less than those in the public sector, for reasons yet unclear. Interestingly, patients from religiously affiliated services expressed a willingness to pay 5%–10% more that at either public or for-profit facilities at all price levels.

**Figure 14. Peru: Willingness to pay, by region**

Another factor correlated with willingness to pay was the region where clients sought care. Figure 14 shows the difference in WTP among respondents from different regions in Peru. For example, fewer respondents from Arequipa were willing to pay for the syphilis diagnostic than respondents from the other two regions, and those who were willing to pay something gave lower maximum WTP amounts. On the other hand, 20%–25% of respondents from Lima were willing to pay S/. 20.00 (about US$ 7.35) or more. This example demonstrates the importance of considering within-country price differences. In the case of Peru, one might consider charging S/. 20.00 in Lima and S/. 15.00 (US$ 5.51) in other regions. In Benin, one might consider higher price points in Cotonou, where a greater percentage of respondents were willing to pay at all price levels.

Urban and rural populations were willing to pay different amounts for improved diagnostics. In Peru, there was no difference between rural and urban respondents’ willingness to pay for syphilis diagnostics priced at the lowest price level, but a greater percentage of urban respondents were willing to pay at all other price levels.

At least initially, the primary market for a new diagnostic is probably not the public sector, which generally serves people at the lower end of the economic spectrum and which must remain conscious of its responsibilities to safeguard the public health. Support from international donors is not sustainable, and governments will be hesitant to adopt a new test they cannot afford without subsidies. They could charge a small co-payment for administering such a test without the risk of turning away more than a few people. However, this runs contrary to the policies of governments like Tanzania and Peru, which provide free ANC services to all as a strategy to reduce maternal and neonatal mortality.
The private sector may hold some market potential: The maximum prices suggested in Peru and Benin are encouraging in terms of attracting a substantial market while still charging prices that enable developers to recoup some development, production, and distribution costs and make minimal a profit, particularly if produced in sufficiently large quantities. In Peru and Benin, it appears that as many as 40% of private sector clients might be willing to pay up to about US$11.00 for a new syphilis diagnostic. This percentage, however, might vary considerably both by country and within each country in terms of specific geographic and socio-economic markets. It is also important to keep in mind that the private sector in such countries represents a small percentage of the population. For instance, in our Benin survey sample, slightly less than 12% of respondents were interviewed at private facilities.

**Consumer perceptions related to syphilis**

While some focus group participants perceived syphilis as severe, most participants did not recognize its specific and very dangerous risks during pregnancy. Rather, most were concerned that syphilis could lead to infertility. Additionally, very few participants understood that syphilis can be asymptomatic. This lack of understanding may represent a barrier to syphilis screening in antenatal care: Pregnant women would likely be unwilling to purchase a syphilis diagnostic if they believe that an absence of symptoms indicates lack of infection.

Participants considered syphilis easily treatable, particularly because they perceive the symptoms as obvious (enabling early recognition and treatment). According to the adapted Health Belief Model, in which access to treatment represents a “benefit of diagnostic testing,” the fact that syphilis is seen as “easy to treat” would normally signal greater client interest in testing. However, participants may consider syphilis so “easy to treat” and commonplace that they perceive diagnostic testing as unnecessary. In the case of syphilis, perceived treatability may pose a barrier to formal care seeking and, in turn, diagnostic testing.

Participants considered syphilis and other STIs to be highly stigmatizing illnesses, largely because of their association with promiscuity and infidelity. High stigma associated with STIs may represent a barrier to syphilis diagnostic testing. Clients may be less inclined to seek care through the formal system for symptomatic syphilis infections and may instead seek treatment directly through private pharmacies. Pharmacists do not have access to STI diagnostics and must make treatment recommendations based on patients’ self-reported symptoms. Self-administered or “at-home” STI tests may improve diagnosis and treatment of syphilis and other STIs for patients seeking advice from pharmacists, but such diagnostics would not likely improve syphilis screening among asymptomatic pregnant women.

Another stigma-related problem may involve partner notification: Pregnant women testing positive for syphilis are usually encouraged to bring their partners for treatment, but would likely hesitate to do so. They would also be at risk of re-infection during their pregnancy, undermining diagnosis and treatment efforts.

**Recommendations**

- The market for syphilis diagnostics varies by country. Setting a single price for a new test would be impractical and inappropriate given the cross-country variance in disease burden, health provider priorities, and consumer interest in and willingness to pay for diagnostics.
- Pricing schemes for syphilis diagnostics must also take into account within-country variation in WTP. Diagnostics sold at private facilities or in urban areas might be assigned higher prices than tests sold in public institutions or rural areas. The market segmentation analysis provided above would help determine appropriate price points for
sub-populations. Differentiated pricing schemes would help governments recoup costs and subsidize syphilis diagnostics for poorer segments of the population.

- The amounts respondents from Peru and Benin’s private market were willing to pay suggest that potential producers of a new syphilis diagnostic might look toward the private sector as the most feasible market, at least initially, to recoup development, production, and distribution costs.

- Given the considerable stigma around syphilis, a self-administered syphilis diagnostic could increase diagnosis and treatment rates among patients with syphilis symptoms. However, such a test would have less impact on asymptomatic pregnant women. Antenatal syphilis screening will likely remain a part of facility-based antenatal care where improved diagnostics are required.

- Rapid syphilis tests (designed for use in health facilities) do exist, and some countries, like Tanzania, are considering adopting them into their national ANC protocol. Their main drawback is that they are treponemal, meaning that they cannot distinguish between current and past infection. Diagnostics developers interested in improving RSTs may consider producing a non-treponemal rapid syphilis test.

- Syphilis is a low priority for most health providers, developing-country health systems, and donors than are higher profile diseases like AIDS, malaria, and TB. Few health providers that CHS interviewed identified improved syphilis diagnostics as an urgent need, and ANC screening rates are low, even in facilities with the infrastructure necessary for testing. In Tanzania, where prevalence is high and the impact of syphilis in pregnancy significant, advocacy efforts by SDI to introduce rapid syphilis tests into national screening programs have been slow creating policy change. Donors, multilateral and bilateral organizations, and host country governments will have to work together to increase the profile of syphilis as a key public health issue and convince policymakers to devote increased resources to the problem.

- To increase consumer interest in and willingness to pay for syphilis diagnostics, diagnostics developers should consider implementing health communications campaigns around the risks of syphilis and the importance of testing. Priority messages would include:
  - Syphilis infection during pregnancy poses a threat to the health of the child.
  - Syphilis can be asymptomatic, especially in women. Pregnant women need syphilis screening even if they do not have any symptoms.
  - Different sexually transmitted infections share similar symptoms: Diagnostic testing enables more accurate treatment by identifying the exact source of the infection.

- Stigma reduction campaigns may also increase care-seeking for symptomatic syphilis infection. Such efforts could also increase partner notification among pregnant women, reducing the risk of re-infection during pregnancy.

- Health system issues like cumbersome procurement processes and poor supply chain management impede syphilis diagnosis. While a simple rapid test with fewer required components might simplify logistics, such a test would not eliminate all problems in delivering diagnostics to rural settings. Improvements in procurement and logistics systems would be required in order to make significant inroads in antenatal syphilis screening rates.
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. 4/1/2009.

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. Amalfi 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 Policía, TB Control Program. Lima. 4/7/2009.

Mary Luz Perea Quispe, Biologist, Reference Laboratory. Arequipa. 4/1/2009.

Dr. Willy Pozo, Pediatrician, Hospital del Niño. 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 Rodríguez, Director for Peru, PAMAFRO (Malaria control project, Andean Health Organization). Iquitos. 4/3/2009.


Dr. Angel Rosas Aguirre, PAMAFRO (Malaria control project, Andean Health Organization). Lima. 3/31/2009.

Dr. Zully Ruiz Vargas, Pulmonologist, Maria Auxiliadora Hospital. Lima. 4/8/2009.


Dr. Sixto Sanchez, Director of Epidemiological Investigation, National Institute of Health. Lima. 8/21/2007.

Dr. Pedro Saona Ugarte, Obstetrician/Gynecologist, Cayetano Heredia Hospital and San Felipe Clinic. Lima. 3/31/2009.

Dr. Karina Sebrian, Infectologist, Maria Auxiliadora Hospital. Lima. 4/8/2009.

Dr. Peter Spangenberg, Partner, Pediatras Asociados. Lima. 3/31/2009.

Dr. Eduardo Ticona, Principal Investigator/Former Director of National Malaria Control Program, Dos de Mayo Hospital. Lima. 8/18/2007.

Dr. Antonio Tukumoto, Head of Pulmonology and Infectious Diseases, Peruvian Armed Forces Hospital. Lima. 8/24/2007.

Dr. Julio Valdivia. Chief, Department of Medicine and PROCETS, Goyeneche Hospital. Arequipa. 4/2/2009.


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.


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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 1. 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.
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