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Botswana's Program for Preventing Mother-to-Child HIV Transmission

In spring 2008, six years after starting to reinvigorate the underperforming prevention of mother-to-child HIV transmission (PMTCT) program in Francistown, Botswana's second largest city, Dr. Tracy Creek reflected on the program from her office in Atlanta, Georgia. A pediatrician by training, Creek was also the medical epidemiologist for the PMTCT team at the Global AIDS Program of the United States Centers for Disease Control and Prevention (CDC).

The CDC had worked in Botswana since 1996, and when Creek arrived in 2002, it was expanding its PMTCT efforts through a joint program known as BOTUSA. Botswana's PMTCT program was three years old in 2002 but was reaching precious few pregnant women — in spite of what seemed to be sound policy, sufficient resources, and ample political will. Creek worked hard over the next six years to help the Government of Botswana (GoB) implement changes that would reduce rates of mother-to-child transmission to less than 4%.

As Creek drafted the conclusions of the Report on Botswana's National Program for Early Infant Diagnosis of HIV, one of the key evaluations of PMTCT program performance between November 2006 and March 2008, she had to suggest further improvements to help the Ministry of Health move toward its goal of *eradicating* pediatric HIV.

Overview of Botswana

Botswana is a landlocked country bordered by South Africa to the south, by Namibia to the north and west, and Zimbabwe to the north and east (see **Exhibit 1** for map of Africa). In 1885 Northern Bechuanaland — present-day Botswana — came under British control. Rather than making Botswana a full Commonwealth colony, which would have required the input of resources, the British deemed Botswana a Protectorate. The British literally "protected" Botswana for the sake of British rail and road traffic between South Africa and Rhodesia (now Zimbabwe) and the interior of Africa.[1]

Erin Sullivan, Peter Drobac, Katherine Thompson, and William Rodriguez prepared this case for the purposes of classroom discussion rather than to illustrate either effective or ineffective health care delivery practice.

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Botswana gained a peaceful independence from Britain in 1966. One year later, geologists from the De Beers company discovered diamonds. By 1975, the Government of Botswana had negotiated an agreement to share profits with De Beers through a joint venture, Debswana. Debswana became the world's largest diamond producer, accounting for 22% of global output. Diamond mining catapulted Botswana from one of the poorest countries in the world in 1966 to a middle-income country, helping Botswana log 4.7% gross domestic product (GDP) growth in 2007 (see **Exhibit 2** for charts of real GDP and per capita GDP in Botswana and Africa over time). Diamond revenue accounted for about half of all government revenue by that time. Botswana sought to decrease its dependence on diamonds by expanding its manufacturing, construction, financial, service, and safari-based tourism industries. Beef exports were Botswana's second-largest income generator, and tourism, the third-largest sector at the time, was growing quickly. Botswana managed and spent revenue prudently on education, infrastructure, and health care.[2]

After 1966, paved highways linked the major towns. While the roads located in major population centers were generally good, traveling by car outside of large towns could be dangerous due to long, tedious stretches of two-lane highways without shoulders, high speed limits, and poor lighting.[3]

Demographics

About half of Botswana's sparse population lived in urban areas; 200,000 of them in its largest city, Gaborone.[4] While Botswana was a relatively rich country by African standards, the top 10% of the population earned 77 times more than the bottom 10% in 2005,[5] and unemployment was at 23.8%.[6] Diamond mining employed only 4% of the labor force.

There were eight principal tribes, the largest of which were the Tswana (79%), the Kalanga (11%), and the Basarwa (3%).[6] Seven of the eight ethnic groups spoke Setswana. Food security remained a problem in Botswana, exacerbated by its desert location and by the decline in agricultural output due to the government's focus on diamond mining.

Basic Socioeconomic and Demographic Indicators

INDICATOR		YEAR
UN Human Development Index ranking	125 (out of 182)	2007
Population (thousands)	1,839	2005
Urban population (%)	60	2008
Drinking water coverage (%)	95	2008
Poverty rate (% living under USD 1.25 per day)	42	2005
Gini index	37	2005
GDP per capita in PPP (constant 2005 international dollar)	12,900	2008
GDP per capita in constant 2000 USD	6,054	2008
Literacy (total, female, male)	83.3, 83.5, 82.9	2008

Health in Botswana

Life expectancy reached about 65 years in the early 1990s,[7] but with the emergence of the HIV/AIDS epidemic, it plummeted to 36 years by 2002 before improving again (see **Exhibit 3** for more on life

expectancy over time).[8] The under-five mortality rate similarly declined and then increased over time.[9] Ninety percent of pregnant women in Botswana were unmarried.

The incidence of tuberculosis (TB) in Botswana was one of the highest in the world,[10] but only 0.9% of new TB cases were known to be multidrug-resistant, and treatment coverage was reported to be 100%, with 65% treatment success.[11]

Health System and Epidemiologic Indicators

INDICATOR		YEAR
Average life expectancy at birth (total, female, male)	52, 52, 51	2006
Maternal mortality ratio (per 100,000 live births)	380	2005
Under five mortality rate (per 1,000 live births)	59	2008
Infant mortality rate (per 1,000 live births)	44	2008
Vaccination rates (% of DTP3 coverage)	96	2008
Undernourished (%)	26	2005
Adult (15-49 years) HIV prevalence	23.6%	2005
HIV antiretroviral therapy coverage (%)	79	2007
Tuberculosis prevalence (per 100,000)	560	2008
DOTS coverage (%)	100	2007
Malaria cases (per 1,000)	3.6	2006
Government expenditure on health as a % of total government expenditure	17.3	2007
Government expenditure on health per capita (international dollar, USD)	568, 278	2007
Total health expenditure per capita (international dollar, USD)	762, 372	2007
Physician density (per 10,000)	4	2004
Nursing and midwifery density (per 10,000)	27	2004
Number of hospital beds (per 10,000)	18	2008

Health System

The national Ministry of Health (MOH) served as the central governing body for Botswana's health system, overseeing 24 health districts. Botswana had three national referral hospitals; 13 district hospitals; and 17 primary, or first-level, hospitals. These 33 hospitals fell under the purview of the MOH. The Ministry of Local Government provided oversight of the infrastructure and manpower required to provide health care at the local level, in health posts, and clinics. Local health facilities included approximately 222 clinics, 330 health posts, and 740 mobile stops. The maximum distance any Motswana (singular for Batswana) had to travel to the nearest health facility was 15 to 25 kilometers. The MOH retained the ability to enforce policy issues as well as create standards for care.

Botswana had more doctors per 100,000 population than many other African countries (see **Exhibit 4** for comparison of the number of doctors per capita among select African countries), but there was still a shortage of health care professionals.[12] There were several nursing schools, but no medical school[i]; as a

[i] Botswana was building a medical school, which was expected to open in early 2009.

result, approximately 85% of Botswana's doctors were expatriates and did not speak Setswana. Specialists, including pediatricians and obstetricians, were in short supply, with most deliveries attended by midwives. This shortage of health professionals plagued Botswana's health system. To address serious staffing shortages throughout the country, from 2003 on, Botswana relied even more heavily on expatriate doctors. By 2007, Botswana was beginning to move toward a more nurse-centered HIV care model. This required increasing the number of tasks nurses were allowed to perform and developing an accompanying training model. Dr. Ndwapi Ndwapi, director of operations for Botswana's National AIDS Program, explained:

> What we're trying to do is shift all tasks traditionally done by doctors or pharmacists to the nursing cadre because we have a very good supply of nurses here, which has a lot to do with the fact that we have three or four nursing schools inside the country. Our bottleneck at the moment is pharmacists, believe it or not … And sometimes in the smaller clinics you do have issues with doctors; some of them are responsible for three or four clinics and cannot be places full-time. So the idea was that we'd shift some of the consultation, but only of stable patients… to the nurses. At any time in our system, 90% of people showing up to our facilities are stable patients who are just on what we call a well-patient visit… We consulted widely with the nursing organizations; we came to agreement; and then we issued a directive from the director of health services that this was now allowed.

HIV/AIDS in Botswana

The first case of AIDS in Botswana was diagnosed in 1985. By the end of 2003, an estimated 350,000 adults and children in Botswana were living with HIV/AIDS. Affecting more than 37% of pregnant women, the 2003 HIV prevalence was estimated to be the second highest in the world, behind only Swaziland.[6] Updated HIV prevalence data based on 2008 surveillance indicated that prevalence was stabilizing at 17.6%.[13] Still, one in three pregnant women aged 15 to 49 years was HIV positive, and in the most affected age group, the 40 to 44 year olds, prevalence was 40.6% (see **Exhibit 5** for adjusted HIV prevalence trends among pregnant women 2001-2007).[13] By 2007 an estimated 275,773 persons were living with HIV in Botswana, including 163,630 women and 112,143 men.[14] The principal mode of HIV transmission was heterosexual sex.

Factors impacting the HIV/AIDS epidemic in Botswana included poverty and geographic mobility, stigma, gender inequality, high prevalence of herpes infection,[15] and low rates of male circumcision. Income inequality forced people to migrate to areas of greater economic opportunity, spreading HIV through expanded networks of new sexual relationships. Mining areas, such as Selebi Phikwe, had the highest HIV prevalence rates in the country, with over 50% of adults HIV positive.[16] This association between the mining industry and HIV was not unique to Botswana; roughly 45% of South Africa's mine workers were HIV positive compared to 11.5% of South Africa's general workforce.[17] Botswana's 2007 Second Generation ANC HIV/AIDS Sentinel Surveillance demonstrated that, with high population mobility and good roads, HIV prevalence in the rural areas (36.7 %) was even higher than in urban areas (34.0 %; see **Exhibit 6** for map of HIV prevalence among pregnant women per district).

Government Response to AIDS

The Government of Botswana (GoB) acknowledged the country's HIV/AIDS epidemic in its earliest stages and mobilized resources to fight the epidemic. In 2002 Dr. Loeto Mazhani served as the director of health services, the country's top health care official. Mazhani was responsible for all clinical departments within the MOH, including the Department of HIV/AIDS Prevention and Care. The GoB had created a separate department for HIV/AIDS in an effort to streamline HIV care and treatment services given the magnitude of the HIV/AIDS epidemic in the country.

Botswana further demonstrated its commitment to HIV/AIDS through the voices of its leaders and its provision of significant HIV/AIDS funding. The government spent about USD 165 million, roughly 6% of the total domestic budget, on HIV/AIDS in 2005, amounting to nearly USD 100 per capita. The international community praised the GoB for its firm financial and political commitment to address HIV/AIDS. William Jimbo, a PMTCT advisor, echoed this sentiment:

> I think Botswana is different from many other countries because the government put a big chunk of its own money in the budget of HIV/AIDS. And I think at one point they were funding almost 60% of the AIDS budget, which I don't think any other [low-income] country has done. So I don't think that the political will or commitment is demonstrated by just words. They are walking the talk.

In 1999 the GoB formed the National AIDS Coordinating Agency (NACA) to coordinate the public and private sector responses and standardize interventions.[7] The Ministry of State President, not the Ministry of Health, oversaw NACA in order to ensure the response to the disease remained a top priority. NACA was responsible for coordinating HIV program finances, tracking expenditures, and making sure that money was distributed in accordance with program priorities. By 2008, under NACA's oversight, Botswana was spending the majority of its AIDS budget on treatment and impact mitigation. It was also beginning to explore ways to decrease costs without compromising quality.

In trying to mitigate HIV's impact on the country's future, the GoB and its international partners did not invest in other programs equally. Dr. Khumo Seipone, director of the Department of HIV/AIDS Prevention and Care, expressed concern:

> HIV programs don't exist in isolation; their overall success depends on the success of related public health programs. As HIV programs have gotten stronger due to relatively increased funding, other public health programs have been left behind due to inadequate funding… With development partners, we continue to advocate for funding for other public health programs.

ART Program

In 2002 Botswana's government launched Africa's first national antiretroviral treatment (ART) program, *Masa* (Setswana for "A New Dawn"). The country developed treatment guidelines in accordance with international standards (see **Exhibit 7** for Botwana's first national treatment guidelines). The free public treatment increased demand for voluntary counseling and testing (VCT).[ii] The program began by offering ART at a single site, Princess Marina Hospital, in Gaborone in 2002.[7]

From the start, the program faced operational challenges, such as maintaining a consistent supply of medicines, according to Dr. William Wester, who helped pilot HIV/AIDS treatment in Botswana.

> There were some stopgaps at the ART program level, probably into the second year. … [The drugs] didn't run out ever, but they had a couple times where thousands of patients would only be able to get a week or two week's supply… But, fortunately, I think from the patient's side, who were all so committed to taking their medicines, it wasn't disastrous. I mean, people would be lined up here at five in the morning to get their medicines.

[ii] About 85% of patients treated received treatment free of charge in the public sector, and about 15% received treatment through the private sector. An increasing number of private companies in Botswana developed workplace programs for people living with HIV/AIDS.

Within three years, by 2005, more than 55,000 people were receiving treatment in Botswana, which exceeded Botswana's UNAIDS and World Health Organization (WHO) "3 by 5"[iii] target of 30,000 people on treatment. By 2007 the number had risen to 84,000. At the time, 32 public sites were providing ART, with at least one ART site in each of the nation's 24 health districts.[8] According to MOH data, 85% of patients enrolled remained in the program.[18]

Routine "Opt Out" HIV Testing

As Botswana successfully increased ART in many parts of the country, it also switched its HIV testing policy. The "opt-in," or VCT, model in which patients initiated the request for an HIV test, was replaced by a provider-initiated, or "opt-out," model in which clinicians could test for HIV unless instructed not to by patients, known in Botswana as routine provider-initiated HIV testing (RHT). President Festus Mogae gave his well-publicized endorsement of changing the testing strategy in his 2003 Christmas message (see **Exhibit 8** for the complete Christmas message). In 2004 Botswana became the first African country to introduce and integrate RHT into routine health care visits. RHT increased HIV testing; during the first year of implementation, health facilities tested more than 69,000 clients. RHT enabled early access to HIV services; reduced the risk of HIV infection as more people became aware of their status and took precautions; and helped destigmatize HIV infection by promoting acceptance of HIV as just another health condition.

Critics, both inside and outside the country, challenged the introduction of RHT. A panel at the 2006 XVI AIDS International Conference in Toronto debated the policy. Grace Sedio, a project officer in Botswana for the International Community of Women Living with HIV/AIDS, shared her thoughts at the conference: "[The] opt-out approach by [the] Botswana government is difficult for women who may not be empowered to refuse a test in order to consult with [their] partner, that is, the father of the unborn child; or simply because they are not psychologically ready to test."[19] Critics worried that poor, less educated women especially would be coerced into testing without fully understanding the ramifications on their relationships and their physical safety. On the other hand, however, a BOTUSA pilot study in Francistown showed that women found RHT acceptable, and a 2006 survey later showed that 81% of adult Batswana were extremely or very much in favor of routine testing.

HIV/AIDS Program Partners

In developing a response to AIDS, the government looked to mobilize funds and welcomed a limited number and type of collaborations from international partners. The ability to partner while maintaining overall authority was an important part of the government's approach.

Financing

The African Comprehensive HIV/AIDS Partnership (ACHAP) provided financial support for Botswana's ART program starting in 2002 and assisted with program coordination. ACHAP was a collaboration between the GoB, the Bill & Melinda Gates Foundation, and the Merck Company Foundation/Merck & Co., Inc. Although the GoB had been able to fund the majority of AIDS-related programs in the country through domestic spending, ACHAP's additional financial support and independent administrative structure facilitated the rapid growth of the ART program. The Gates Foundation pledged USD 50 million over a five-year period; Merck, whose contribution included antiretroviral medicines, matched this amount. ACHAP provided critical human resources and facilitated

[iii] The "3 by 5" initiative, launched by UNAIDS and WHO in 2003, was a global target to provide three million people living with HIV/AIDS in low- and middle-income countries with life-prolonging ART by the end of 2005.

the establishment of a number of treatment sites. It also supported the development of information, education, and communication activities for ART and a system for tracking patients and monitoring the program. After 2003, the United States President's Emergency Plan for AIDS Relief (PEPFAR) also supported Botswana's efforts to combat HIV/AIDS; PEPFAR donated USD 24.4 million in 2004 and approximately USD 51 million in 2005.

In accepting aid from international donors, Botswana faced two major challenges: tracking spending and measuring progress. The Global Fund to Fight AIDS, Tuberculosis, and Malaria had given the GoB money to disburse to more than 130 local non-governmental organizations (NGOs), which provided HIV prevention services and care. However, as William Jimbo, a PMTCT advisor, explained, "NGOs were lacking internal mechanisms for accountability and [for] giving the Global Fund a report about how the money is spent. Giving the money to small, weak NGOs becomes a problem. Most NGOs are community-based, and they don't have structures for accounting." As a result of this lack of accountability, for instance, one Botswana newspaper reported with regard to a donor's grant that "although the full amount for [the] grant was set at more than USD 18.5 million, only USD 9 million has been disbursed because of the country's failure to justify expenditure."[20]

Clinical and Research Partners

The Botswana-Harvard Partnership (BHP) was established in 1996 to focus on locally relevant HIV research. When the MOH realized that laboratory capacity was a major limitation at the start of the national ART program, in 2001 BHP helped build an HIV clinical reference laboratory on the campus of Princess Marina Hospital—the first of its kind in Africa. BHP also collaborated with the MOH to develop the KITSO[iv] AIDS Training Program, which provided multi-disciplinary and standardized training in HIV and AIDS care for Botswana's health professionals.

Other academic NGOs had been active in AIDS care in Botswana. The University of Pennsylvania program in Botswana provided clinical training and support for hospitalized patients. The Botswana–Baylor[v] Children's Clinical Center of Excellence was established in 2004 as a public-private partnership that aimed to catalyze pediatric HIV care and treatment. According to Dr. Elizabeth Lowenthal, associate director of the program, the Baylor model was "we teach you to see your patients better, not we see your patients better for you." Eleven pediatricians were allocated throughout the country, in consultation with MOH. The Baylor program also worked with four medical officers from Botswana who wanted to become pediatricians; the ultimate goal was to phase out the American expatriates and bring Batswana doctors in to deliver pediatric care.

BOTUSA, the partnership between the US CDC and the Botswana government, supported HIV testing and counseling and drove implementation efforts for the PMTCT program. While the GoB, for the most part, paid for Botswana's PMTCT program, PEPFAR, through the CDC and BOTUSA, provided approximately USD 3 million per year for training and infant testing. The MOH provided all of the infant formula and many of the drugs; Boehringer donated nevirapine (NVP). Because PMTCT was integrated with normal health care delivery and maternal-child health (MCH) clinics, the MOH also paid for most of the PMTCT human resource costs, though BOTUSA contributed to staffing costs at the national level.

[iv] Kitso is the Setswana word for "knowledge." KITSO AIDS also stands for "Knowledge, Innovation, and Training Shall Overcome AIDS."

[v] The Botswana-Baylor Children's Clinical Center of Excellence is the product of a partnership between the Baylor International Pediatric AIDS Initiative at Baylor College of Medicine, the Princess Marina Hospital in Gaborone, and the Government of Botswana.

Preventing Mother-to-Child Transmission of HIV

HIV could be transmitted from mothers to infants in three ways: across the placenta during pregnancy; during the trauma of labor and delivery; and through breast milk during the months of breastfeeding. Unchecked, each of these phases carried roughly a 10% to 15% risk of transmission. By six months of age, in the absence of interventions, more than 30% of babies born to HIV-positive mothers were themselves infected. In 2007, 420,000 children worldwide were newly infected with HIV, and 330,000 died of AIDS. [21]

Preventing Infant Transmission in High-Income Countries

Drugs to prevent transmission from mothers to infants were first used in 1994 when a US clinical trial demonstrated that administering the antiretroviral drug zidovudine (ZDV or AZT) to pregnant women in the third trimester of pregnancy, as well as during the peripartum and early postpartum periods, reduced risk of HIV transmission to infants from 30% to about 10%.[22] Delivery by Caesarean section, which shielded the baby from prolonged, direct contact with infected maternal blood, could also reduce the number of transmissions, even if the mother had not received ART. Three-drug combination therapy, known as highly active antiretroviral therapy (HAART), was even more effective than ZDV or NVP alone and became the standard of care in the US, where 99% of American women gave birth attended by a health provider and almost all of these births occurred in hospitals. Infant formula in lieu of breastfeeding could eliminate transmissions via breast milk if used exclusively. Thus, by the late 1990s, most US hospitals caring for HIV-infected pregnant women had an aggressive PMTCT program, including three-drug ART beginning during pregnancy plus infant formula. In less than a decade, transmission in the US dropped from over 30% to under 2%. By 2007, fewer than 200 infants were born in the US with HIV annually (see **Exhibits 9a** and **9b** for WHO PMTCT guidelines and transmission rates with select regimens).[23]

Preventing Infant Transmission in Resource-limited Countries

In resource-limited settings such as sub-Saharan Africa, where 46% of women were attended to during childbirth by a health care worker and only 36% of women gave birth in a health care facility,[24] PMTCT care evolved differently. A 1999 study conducted in Uganda[vi] demonstrated that administration of a single dose of nevirapine (SD-NVP) to both mother and infant at the time of labor and delivery as a sole intervention reduced HIV transmission to 15%. Since SD-NVP could be delivered for less than USD 4, it became widely promoted as the best means to reduce HIV transmission to infants in developing countries. Beginning in 2003, the growing international focus on global health led to more intensive PMTCT programs in sub-Saharan Africa; however, the quality of these PMTCT programs and their willingness to take on more complex but more effective interventions varied widely. In 2007 only 1 in 10 HIV-positive pregnant women in low- or middle-income countries was receiving any antiretroviral medications to prevent mother-to-child transmission of HIV. About 90% of the 420,000 cases per year of infant HIV transmission worldwide occurred in Africa;[25] 50% of infants infected with HIV died by the age of two. In Zimbabwe, 100 babies were infected every day.[26] Worldwide, 200 babies were infected every five hours.

[vi] HIVNET 012.

PMTCT in Botswana

History

In Botswana more than 95% of women received antenatal care and had attended births in a health facility. Botswana piloted its PMTCT program in the two largest cities, Francistown and Gaborone, in 1999 and 2000 respectively (see **Exhibit 10** for chronology of Botswana's PMTCT program starting in 2002). The initial PMTCT program offered women voluntary HIV testing during pregnancy, with pre-test counseling provided by midwives during routine antenatal visits; a short course of ZDV (starting at 34 weeks) for mothers and infants; and infant formula for 12 months. The MOH provided expectant mothers access to all the services in one place by integrating PMTCT into routine maternal-child health services. Due to the program's perceived benefits, the PMTCT program was rolled out across the entire country by 2002. However, despite the fact that nearly 100% of pregnant women in Botswana received antenatal care (ANC) and most delivered in a health facility, the PMTCT program itself had relatively poor uptake during its first years. An audit of Francistown records in 2002 found only 30% of pregnant women were tested for HIV, and only 4% of HIV-positive pregnant women received all of the recommended interventions.

As a first step toward increasing the uptake of HIV testing in ANC, the MOH sought guidance from Uganda's program. Uganda had successfully engaged lay HIV counselors to unburden health professionals from the time-consuming demands of counseling. Lay counseling improved the quality of counseling in Uganda, as training was standardized and lay counselors had no other duties. Lay counseling also ensured proper patient education and better adherence. Following a six-week training program in Botswana, lay counselors (secondary school graduates) began performing HIV counseling and testing services for pregnant women in 2002. Uptake of testing and drugs for PMTCT improved only slightly, however.

While the program struggled to test pregnant women, PMTCT treatment protocols evolved based on findings from major international research trials, including some from Botswana. Initially, women received ZDV alone starting at 34 weeks of pregnancy. Beginning in 2003, single-dose NVP for mother and infant was added to the protocol. The use of SD-NVP enabled a woman to receive a partially effective regimen, even if she had not taken any ZDV antenatally. Together, SD-NVP and ZDV prevented twice the infections of ZDV alone (see **Exhibit 11** for timeline of PMTCT protocols)**.**

To understand the very low uptake of HIV testing and PMTCT drugs, in 2003 Creek conducted a survey on women's attitudes toward PMTCT; the survey polled 500 women and 50 health workers. Dr. Molly Smit, Medical Officer at the PMTCT Operational Research site in Francistown for BOTUSA, commented on the survey results:

> Many didn't want to test because of fear… We knew fear was there, but we didn't know to what extent. They were afraid to know [their] status, and they were asked a lot of personal questions before testing, which they weren't used to. Usually [in Botswana], a doctor does things and explains after. So the mentality had to change. HIV testing gets into your personal life and Batswana are not used to talking about personal problems. They didn't feel comfortable with that, except they were more comfortable talking to a doctor because they were used to that. There was a lot of emphasis on pre-test counseling and that may have made it worse for them. [It] reinforced stigma because the process for counseling was so different than a normal visit to a doctor.

The survey also revealed that more than 90% of women thought HIV testing should be a routine part of antenatal care and that the higher a woman's knowledge of PMTCT, the more likely she was to test.

Additionally, while the PMTCT drugs benefited the child, routine HIV treatment was not available to infected women beyond their pregnancy. Until the advent of the national ART program in 2002, women testing positive for HIV during pregnancy did not have access to ART after they delivered. Once the ART

program began, the PMTCT program saw a rapid uptake in testing, presumably because "the ARV program gave women hope," as noted by Dr. Khumo Seipone, director of the Department of HIV/AIDS Prevention and Care.

From the 2003 survey data, Creek helped implement various changes to Francistown's PMTCT program. One of the key findings from the survey was that health workers were overloaded with individual pre-test counseling. So, in 2003 the Francistown clinic helped pilot and evaluate a PMTCT flip chart for group education and peer counseling. Testing was preceded by standardized, group education that focused on HIV transmission, PMTCT, ART, and recommended testing for all mothers and infants. This was followed by testing and individual post-test counseling. After a successful pilot in Francistown, group pre-test counseling for expectant mothers was introduced in each of Botswana's 24 health districts in 2004.

Despite these evolutions in program design, the near-universal use of health facilities for prenatal care and delivery, and the free testing and PMTCT treatment services, program uptake remained suboptimal, at only 30-40%. A significant number of women were either not being tested for HIV or not returning to the health center to receive test results when they became available.

As a result, the PMTCT program introduced three important programmatic innovations. The CDC and members of the MOH had discussed the merits of opt-out, routine HIV testing for some time. In late 2003, Creek proposed to pilot opt-out HIV testing in Francistown. Despite President Mogae addressing the nation and calling on all citizens to learn their HIV status, effectively introducing the new opt-out testing policy that year, there was no delivery method in place to support the opt-out testing policy. According to Creek, "The government came out and said they wanted this [RHT] done in December 2003, but did not have an actual paradigm or protocol to make it happen." Francistown, however, had the protocol developed and was able to host district staff from all over the country and rapidly train providers on RHT. Beginning in 2004, all pregnant women attending a health facility were routinely tested for HIV unless they declined (see **Exhibit 12** for routine HIV testing flowchart for ANC). Mothers found to be HIV positive received immediate counseling, were prescribed a course of ZDV at 34 weeks, and were given a single dose of nevirapine during labor. The infant received a single dose of nevirapine and four weeks of ZDV.

In another development, rapid HIV testing, which provided same-day test results, became available for use by health care workers and lay counselors. Dr. Carolyn Wester, a BHP research associate, summarized it as follows:

> Before the advent of rapid testing, antenatal clients undergoing HIV testing would be scheduled to return for their test results one to two weeks later. Because of the turn-around time, about 30% of women tested ended up not returning for their results (having either changed their mind or changed location). Rapid testing improved post-test counseling rates and also enabled eligible women to start PMTCT without any delays.

The final programmatic innovation involved CD4 cell count testing for HIV-positive pregnant women and subsequent referral to ART clinics. The CD4 cell count was an important indicator of when to start ART. Therefore, linking CD4 testing to HIV diagnosis improved access to ART. Only one-third of health centers offering PMTCT, however, had the capacity to perform CD4 testing for pregnant women diagnosed with HIV. Thus, women often had to travel to multiple clinics to get a CD4 count and then wait up to several weeks for the results to return from the national reference lab. CD4 test results often did not get back to women before labor and delivery. As Creek described it, it was a problem of "too many steps" — logistical challenges and a narrow time window for action given the length of a pregnancy. This was further reinforced by the fact that Botswana had only 35 centers where all of the key operations — HIV testing and counseling, dispensing of ART, and antenatal counseling — were done under one roof. Beyond these 35 centers, women had to travel to multiple sites to receive the full complement of services.

Francistown often served as the test pilot for new PMTCT interventions. Once changes proved successful in the Francistown PMTCT project, they were rapidly scaled up throughout the country. According to Creek, "Once we had something going that was worthwhile [in Francistown], we worked with the government [to expand it.]" In practice, this meant that Francistown was not distinctly ahead in PMTCT treatment.

Overall, the programmatic advances in 2004 — RHT, rapid HIV testing, attempts to increase access to CD4 cell count testing, and improvements in counseling education[vii]— coupled with the expanding national roll-out of ART resulted in a significant increase in HIV test acceptance and PMTCT program uptake. Data reported by all 24 health districts to the national PMTCT program indicated that the percentage of women delivering in health facilities who knew their HIV status increased from 52% in 2003 to 69% during the first six months of 2004.

In 2005 BOTUSA leaders went to the MOH with another PMTCT treatment recommendation: start ZDV treatment at week 28, as opposed to week 34, of gestation. HIV-positive pregnant women were supposed to start ZDV at week 34 and take it until week 40 for a total of six weeks of treatment before delivery. Creek and her Francistown colleagues had observed, however, that most women started ZDV at 36 or 37 weeks and delivered at weeks 38 or 39; women were getting about two weeks of ZDV instead of six.[viii] The MOH agreed with BOTUSA's proposal and implemented ZDV treatment at 28 weeks. This meant that most women ended up receiving at least one month of ZDV treatment, more effectively reducing HIV transmission to the infant.

Advances and Challenges in PMTCT

Infant Testing

In 2005 Francistown piloted DNA polymerase chain reaction (PCR) testing of infants at six weeks of age using dried blood spots (DBS), a relatively new technology at the time. DBS involved collecting blood from a skin prick of HIV-exposed infants using filter paper. Before DBS, PCR could only be done from venipuncture, which was very difficult to collect from toddlers and required refrigeration and testing within eight hours. The DBS method made it possible to collect samples at a clinic anywhere in the country and transport them to the central laboratory in Gaborone without time sensitivity or refrigerated transport. It was easy to train health workers at any clinic to prick an infants' heel, toe, or finger in order to obtain a sample. DBS was a cheaper, simpler way to test infants and made early infant diagnosis possible. Because DBS provided positive feedback for health workers and mothers who had worked hard at PMTCT, clinics clamored to get DBS capability up and running. A short time after the Francistown pilot, the government adopted DBS testing as part of the national PMTCT program.

According to Creek, widespread DBS testing demonstrated the success of the PMTCT program; among infants who were tested in 2007-2008 at six weeks of age (most of whom had received numerous interventions for PMTCT), the MTCT rate was only 4%.

[vii] PMTCT education for health care providers was also revised. PMTCT was incorporated into the pre-service training curriculum for midwives and nurses, and the in-service training was strengthened.

[viii] The decision to start ZDV earlier was also, in part, based on: Lallemant M, Jourdain G, Le Coeur S, et al. A trial of shortened zidovudine regimens to prevent mother-to-child transmission of HIV type 1. N Engl J Med 2000; 343: 982–91.

Infant Feeding

As part of the PMTCT program, all babies born to HIV-positive mothers were given free infant formula until their first birthday to prevent transmission related to breastfeeding. Joe Makhema, co-director of HBP, noted:

> Culturally, breast has always been "best," but the risk of [HIV] transmission basically deterred the policy from advocating, in any way, breastfeeding. And therefore, we went with formula feeding. So with PMTCT…not only did we take the protocols initially from the West, but we took some of the guidelines, which basically from our environmental and cultural context, obviously we are now re-visiting and hope to be informed from studies we are now undertaking on how to make breastfeeding safe in the HIV era by the use of HAART.

Formula feeding was considered the best strategy for HIV-positive mothers in Botswana because the government believed its citizens had universal access to clean water and could prepare infant formula from powder safely. Little consideration was given to hygienic practices and conditions or to access to refrigeration and electricity. PMTCT lay counselors and midwives advised all HIV-positive mothers to formula feed starting in 1999.

> WHO recommended formula feeding only if it was affordable, feasible, acceptable, sustainable, and safe (also known as AFASS criteria), and in most situations WHO advocated for individual counseling so women could make an informed choice about the best feeding method for their infant. Botswana's government decided that formula feeding was best for all HIV-infected women and instructed them to use only formula starting in 1999. Botswana was extremely proud of its ability to provide 10 tins of formula per month to every HIV-positive mother free of charge.

Botswana conducted a number of studies to establish its formula feeding strategy. In 2002 the MOH and a UNICEF team published a study of formula use in the pilot districts where PMTCT had first started. This study identified problems with the quality of counseling and patient education; mothers were not using formula correctly. A 2004 study of 1,200 breastfeeding mothers in Botswana, the Mashi study, showed that formula feeding protected infants against HIV infection, but it was associated with higher mortality in the first six months of life than the combination of breastfeeding and infant ZDV. Unfortunately, the study also indicated that ZDV was not effective at preventing breastfeeding-related MTCT and did not provide an encouraging alternative to formula feeding.[27] Despite the UNICEF and Mashi studies, the MOH decided to stick with the formula feeding strategy and work on improving patient education. In 2006 a BOTUSA study revealed that improper feeding practices — storage of formula at room temperature, inadequate cleaning of utensils, use of bottles with hard-to-clean nipples, and frequent formula shortages — were still very common.

Later that year, following a period of heavy rains and flooding, Botswana experienced an outbreak of severe diarrheal disease. The outbreak primarily affected infants and young children, resulting in 430 infant deaths in Botswana's northern, rural areas. Creek led the CDC's investigation of the diarrhea outbreak which determined that the most vulnerable children were formula-fed; they were dying of both diarrhea (often with multiple pathogens, but primarily *Cryptosporidium* and enteropathogenic *E. coli*) and malnutrition after a prolonged period of diarrhea. Lowenthal reported, "A lot of the kids…who become sick in these outbreaks… are those who have just weaned. So if you've just weaned from breastfeeding, you're more vulnerable. So in 2006 there was clear data that those [formula-fed kids] were the kids who were getting in trouble first."

Because nearly all of the hospitalizations and deaths occurred in non-breastfed infants, the disaster immediately became associated with the PMTCT program's formula feeding policy. Nonetheless, Creek's investigation of the outbreak determined that rainy season flooding in rural areas had caused contamination between pit latrines and clean water sources. The contamination led to diarrhea in children throughout the

affected area but only caused severe diarrhea in children who were not breastfeeding. Even though 35% of the deaths occurred among non-breastfeeding children of HIV-negative women, the findings ignited a major controversy with respect to PMTCT protocols.

The bigger issue may have been about clean water. As Dr. Molly Smit described:

> At that point, it was very difficult for Botswana to accept that the water wasn't safe. They had been proud that they had safe water. And to suddenly be told you don't have safe water … But now, they've really grasped it and addressed a weak system, with weak maintenance and weak supervision. But those things were not good. And the water in the peripheral areas was not good. So there has been a lot of education. But at the time, [the response was] "this cannot be."

The infant formula program struggled to maintain a consistent formula supply, and reviews of data from 2006, 2007, and 2008 indicated that infants were getting an average of 60% of the formula they needed over the course of their first year.

PEPFAR-supported supply chain experts determined that the problem stemmed from a lack of effective systems for tendering, managing inventory, distributing, and re-ordering. The program made plans to strengthen the infant formula supply chain beginning in 2007. Additionally, some infants who lacked additional sources of food needed more than the "average" amount of formula that national PMTCT guidelines suggested for each child based on age. Families without access to refrigeration tended to waste formula, as any formula that was mixed but not consumed by the infant had to be discarded rather than left unrefrigerated. Dr. Elizabeth Lowenthal, associate director of the Botswana-Baylor Children's Centre of Excellence explained:

> And women would come in and say that they needed more formula and would be told they already got their 10 tins, "You're not getting anymore." If you're following the guidelines and don't have refrigeration, you have to make formula fresh every time, and you'll go through formula much faster, especially if your child is a grazer[ix]… there is a big range of what kids need. People were saying, "Oh you're selling the formula, you're not going to get more." We did see cases where women would come in with malnourished children, even though they were getting their formula.

Results

Overall, the PMTCT interventions put in place after 2002 reduced HIV transmission to infants markedly. In 2007 the MOH suggested that Botswana had lowered the rate of MTCT to less than 4%. More than 90% of babies received appropriate post-exposure interventions; among the small number of infants being diagnosed with HIV, 25% were on ART. PMTCT interventions were available in every district, and uptake of ZDV or ART was 85%. Dr. William Wester reported, "The women believe in the [PMTCT] program… It's no wonder that 65% to 70% of all the people on HAART are women. I think they've been in the system the longest, and they believe in it."

HIV-Positive Mothers

The Report from Botswana's National Program for Early Infant Diagnosis of HIV that Creek was working on identified two groups that were contributing substantially to the pediatric HIV problem: (1) approximately 11% of women were not receiving any PMTCT despite a known HIV diagnosis; and (2) women who acquired HIV late in their pregnancy after their HIV test or while they were breastfeeding

[ix] A child who eats frequent small amounts rather than larger meals less frequently.

accounted for approximately half of all pediatric HIV cases in Botswana. The data, collected between November 2006 and March 2008, indicated that 1.3% of women who were HIV negative at the time of their antenatal test were HIV positive at delivery, and that 2.7% of women who were HIV negative at their antenatal test were HIV positive when their child was about one year old. Creek explained that these two groups were characteristic of a mature PMTCT program:

> …if you're in a young PMTCT program that is not functioning very well, you don't think about these women. They are so insignificant in the face of the 5,000 cases that we were having at the peak of the epidemic, those 450 babies were not important. But now that we're down to 1,100 infections a year, those 450 babies suddenly become very important. So these are the challenges of a mature program — you've got to keep maturing. So repeat testing of women who are negative is the next priority.

In part, the success of the PMTCT program could be attributed to the phenomenon of better upstream testing — more women were now getting pregnant after starting ART, reducing the transmission risk to their infants even more than PMTCT regimens. Disinhibition was one concern, as HIV-infected pregnant women had, on average, more pregnancies than non-HIV-infected women. Eighty percent of HIV-infected women had more than two pregnancies, and 26% had more than four.[28] In a country where 65% of pregnancies were unplanned and 35% unwanted, family planning was a key challenge.

Infants[x]

Creek was finding the results of the infant diagnosis program, covering the entire country by April 2007, both interesting and encouraging. All health facilities providing MCH care, ART, or inpatient care were able to collect blood for early infant testing. Access to infant testing was excellent. The PMTCT program aimed to test all infants at six weeks, and the infant diagnosis study showed a median testing age of 11 weeks. Further, the two- to three-month turnaround time for infant testing, which occurred as the testing program scaled up in early 2007, had been solved; turnaround time was currently at three weeks. The following issues, however, needed to be addressed by the program:

- Weak links to routine child health care: the PMTCT program had many challenges in getting ART to the infants who became HIV infected. Once diagnosed, infants needed to be referred to other sites to receive treatment. PCR tests took about four weeks to return to sites; not all families returned for the results; and not all families who received results took their infants to ART clinics. As a result, the data showed a very low rate of ART initiation among infants diagnosed with HIV at less than one year of age.
- Poor infant follow-up: a small BOTUSA study in Francistown had shown that of 78 infants diagnosed with HIV, 19 were alive and on ART in Francistown; 25 had died (13 before starting treatment and 12 while on treatment); 10 were referred for ART but never appeared in the clinic; and 24 could not be located.[29]
- Lack of a medical record system: there was no way to track HIV-exposed infants over time and document mortality rates. Further, it was difficult to estimate the country's MTCT rate accurately. As the result of the infant diagnosis study, Creek estimated a much higher MTCT rate than the previously reported 4%, which applied only to women who brought their infants for a six-week test. These women were largely those who received good PMTCT or ART.

[x] This section is based on information from "Report from Botswana's National Program for Early Infant Diagnosis for HIV," by Tracy Creek, Leu Leu, and Ant Snyman (June 5, 2008).

Combining the "known" HIV cases and the incident HIV cases, Creek estimated a 7.8% MTCT rate in 2007.[xi]

- Optimal infant feeding strategies: in light of the 2006 diarrhea outbreak, the MOH was working to define the best feeding strategy for HIV-positive mothers. Simply providing clean water for formula could not make formula feeding safe. It was clear that infants contracted diarrhea from other sources. Moreover, much of the excess mortality in formula-fed children in the Mashi study was from pneumonia, against which breast milk offered some protection.

Creek struggled with the future of Botswana's PMTCT program and the number of challenges that had to be overcome to achieve the eradication of pediatric HIV. Botswana's children were also facing problems beyond HIV. There were increasing rates of malnutrition in the under-five population and unresolved formula feeding safety issues.

The overarching PMTCT goal — to greatly reduce transmission of HIV — had been successful. As Lowenthal reported, the Baylor clinic had seen a huge decline in the number of patients testing positive for HIV at six weeks old; the clinic was focusing increasingly on the care and treatment of an aging population of children and adolescents with HIV, and Creek hoped that other metrics for success could be considered. As she explained:

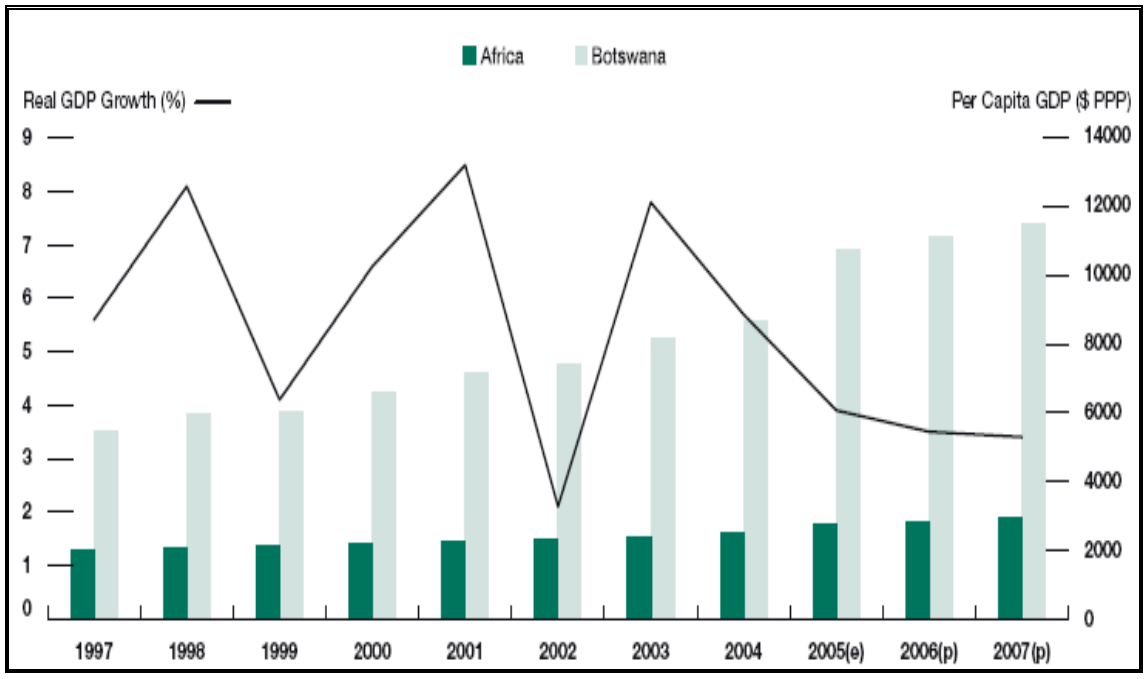
> The goal, or success point, of the PMTCT program should be 18 to 24 months of HIV-free survival for infants. Just an HIV test at six weeks is not sufficient to prove that your program has succeeded. We want better monitoring of HIV-free survival at 18 or 24 months, that means the child is HIV negative and alive. It is not hard to report how many babies test or how many babies are HIV-positive. Reporting the number of babies alive is much more difficult because no one goes back to the clinic and informs someone that their baby has died.

[xi] The higher estimated rate included women who received no PMTCT despite a known HIV diagnosis and the women who acquired HIV after being tested during ANC. These women also transmitted HIV, and at higher rates than women with established HIV infections. Under the current testing system at the time, these women were almost never identified because pregnant women were not routinely re-tested.

Exhibit 1 ***Map of Africa***

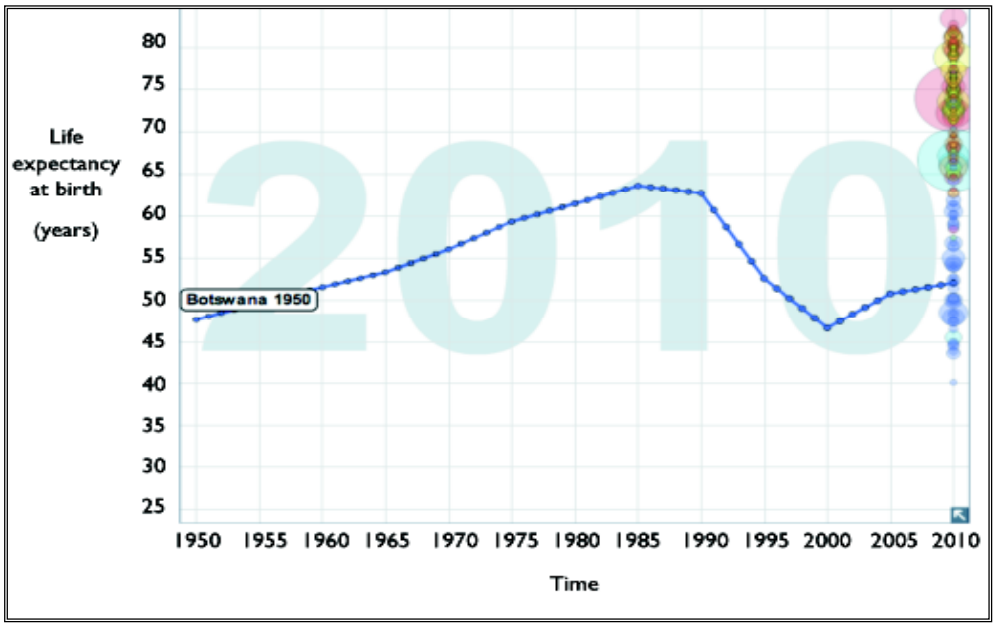
Source: Adapted from public domain.

Exhibit 2 *Real GDP Growth and Per Capita GDP (in $ PPP at current prices)*



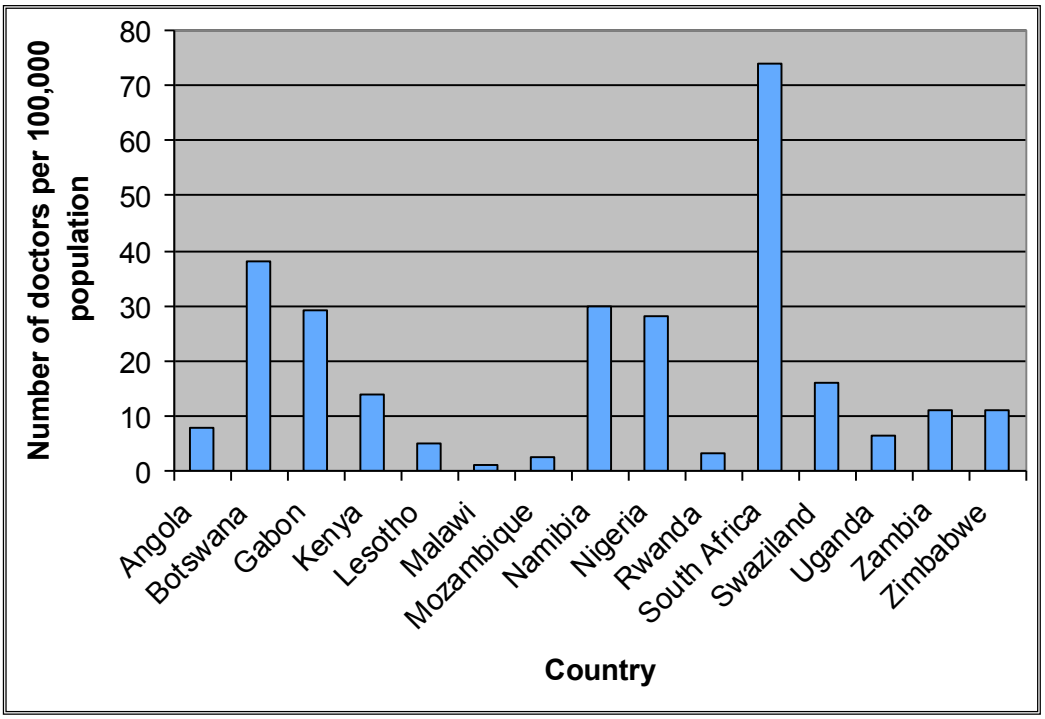
Source: Bank of Botswana and IMF data.

Exhibit 3 *Life Expectancy at Birth in Botswana, 1950-present*



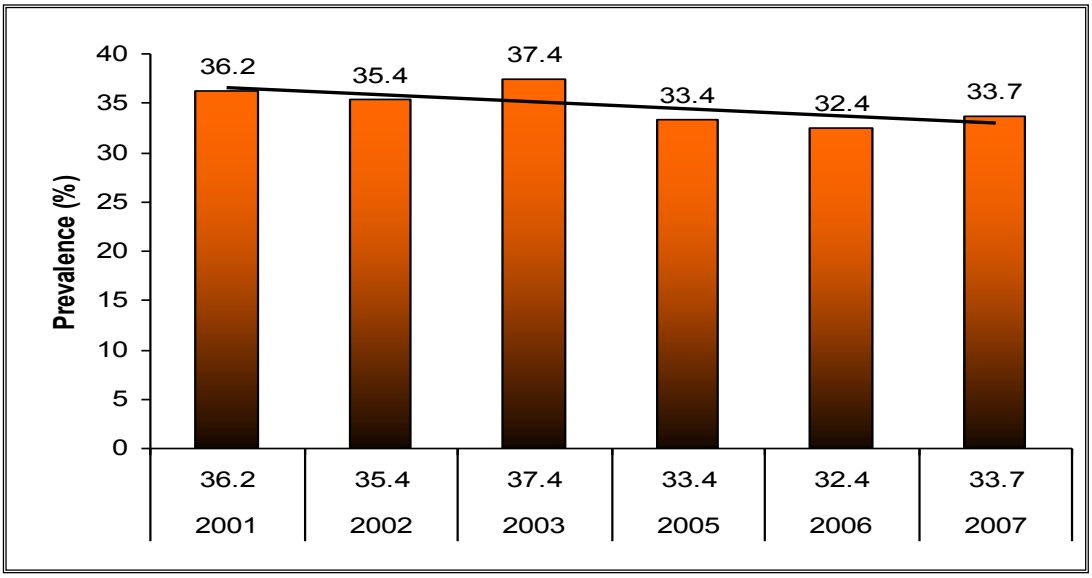
Source: www.gapminder.org.

Exhibit 4 *Doctors in Select African Countries*



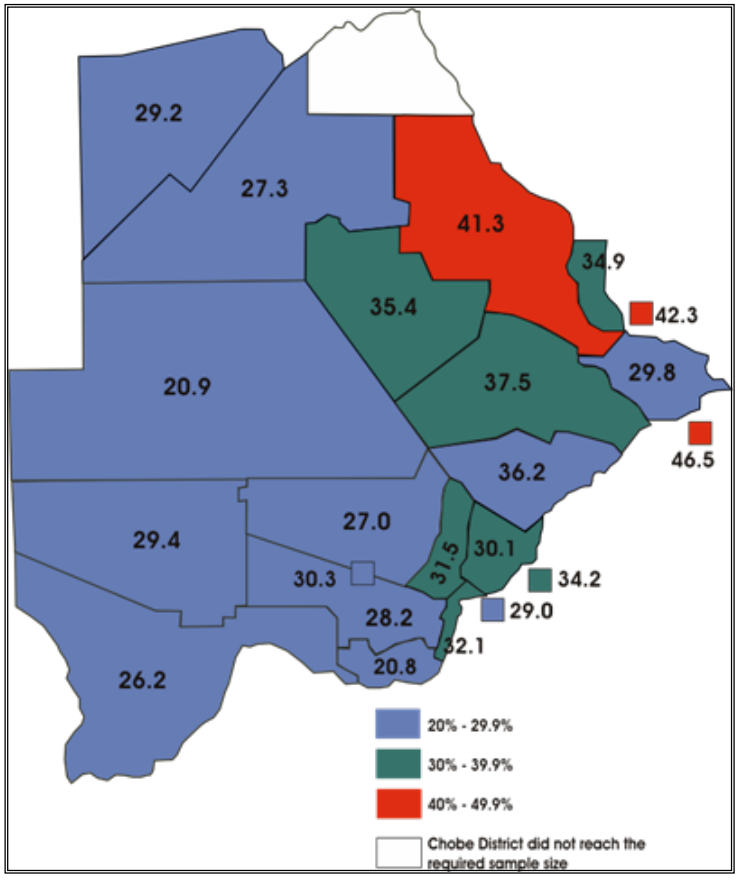
Source: Adapted from www.gapminder.org.

Exhibit 5 *Adjusted HIV Prevalence Trends Among Pregnant Women, 2001 - 2007*



Source: Botswana Sentinel Surveillance.

Exhibit 6 *HIV Prevalence per Health District among Pregnant Women, Botswana 2005*



Source: Ministry of Health, Botswana.

Exhibit 7 *Botswana's First National Treatment Guidelines*

In order to be eligible for ARV therapy, patients must be HIV positive with:
♦ A CD4 cell count less than 200;
♦ And/or presence of an AIDS-defining illness;
♦ Or a child under the age of 13 years.
Further, priority groups for ARV treatment were divided into the following categories:
♦ Pregnant women with CD4<200 and/or AIDS defining illnesses and qualifying partners who fulfilled the same criteria;
♦ All HIV-infected children older than 6 months of age who are inpatients;
♦ All HIV-infected TB patients with CD4 <200;
♦ All adult inpatients with CD4<200 and or AIDS defining illness.

Source: Ministry of Health, Botswana.

Exhibit 8 *President Festus Mogae's Christmas Message, 2003*

Dailynews No 243 Tuesday December 23, 2003 Page 6

Republic of Botswana

CHRISTMAS AND NEW YEAR MESSAGE TO THE NATION
BY
H.E. MR. FESTUS G. MOGAE
PRESIDENT OF THE REPUBLIC OF BOTSWANA
DECEMBER, 2003.

1. Batswana betsho! Once again, the festive season is upon us. It has now become our tradition and practice for the President to wish the Nation a happy Christmas and a prosperous New Year. I wish to assure you that every hour of the day, every day of the week, every week of the month and every month of the year, my thoughts and efforts are devoted to working for the happiness and prosperity of each and everyone of you. I am therefore delighted to have this opportunity to express my goodwill and best wishes to you during this joyous season.

2. There is cause for festivity and happiness. This is a period for friends, family and community reunions. This is the period of the year which succeeds in bringing together the largest number of people who were separated from each other over time and by distance. There is also another important sense in which you deserve to be in a festive mood.

3. As I stated in my State of the Nation Address, this year alone Botswana received several accolades for good performance and achievements in a variety of fields. This could not have been possible without your unity of purpose, hard work and determination to reach greater heights. You therefore deserve these holidays and I encourage you to use them to rest, and to reflect on the challenges of the year ahead.

4. Let us also remember the importance of acting responsibly throughout the festive season. Failure to do so can turn the festive season into a walk through the valley of the shadow of death. The carnage on our roads due to substance abuse, over speeding, negligence and driving under the influence of alcohol are a major source of pain, suffering and the loss of young precious lives. It is a double tragedy when a moment of happiness suddenly turns into grief and sorrow.

5. These unhappy incidents occur every year, and every year I warn the Nation that speed kills, and not to drive under the influence of alcohol. I find the apparent failure to learn from the mistakes of the past very disturbing and surprising. However, let me remind you that it is memory that made humanity to rise above the beast.

6. If humanity did not develop memory, which its compass enabled it to avoid mistakes of the past, modern civilization would not have flourished. Without memory the ancestors of modern man could have foundered and even been destroyed over time. Alternatively, we could still be swinging on trees and rocks as

President Mogae

animals of the wild. Surely our compass of memory may be imperfect but we have much greater knowledge about the cause of the carnage on our roads and what needs to be done to stop it. We have the capacity to deal with this unfortunate failure of memory which brings deep pain and sorrow in its train by rudely interrupting our moments of happiness during this period.

7. There is another factor which is the chief enemy of our happiness. HIV/AIDS stands on the way of our desire to attain our full measure of happiness. Once again, it is essential to learn from past mistakes. Government has provided detailed information on the virus that causes AIDS. Government has provided substantial information on how to prevent infection. Government has provided full information on how the virus that causes AIDS is transmitted from one person to another. And, above all, we have put in place programmes to prevent and mitigate the impact of the HIV/AIDS epidemic.

8. The HIV Voluntary Counselling and Testing Centres, the Prevention of Mother to Child Transmission (PMTCT), condom distribution and Anti Retroviral Therapy are examples of our sterling efforts to combat HIV/AIDS. But if Batswana do not heed the messages, and take advantage of these programmes to stop new infections, to receive treatment and live positively with the virus, but instead pursue risky sexual practices, that would be a great pity and tragedy beyond description. It would be a great pity, because it would be as if we have no memory compass. It would be as if we are still in the jungle stage of existence tearing one another to pieces by continuing to transmit the virus with seeming reckless abandon!

9. Bagaetsho, we have accumulated knowledge and wisdom about the HIV/AIDS epidemic. We have the strong support of the international community in combating it. Our compass of memory is still fresh and should enable us to remember the pain, wounds and bruises inflicted on us by the epidemic not to repeat the mistakes of the past. It is the responsibility of each and everyone of us to ensure that, during this holiday season, you do not engage in activities which you will live to regret, or place the lives of friends, family members and compatriots in grave danger.

10. It is for these and many other reasons that Government decided that with effect from January 2004, HIV testing will be routine but not compulsory. Next year when you visit a health facility and it becomes necessary to conduct a medical test, the test will include testing for HIV. Health Workers will test for HIV unless you decline to be tested. The onus will therefore be upon you to say I do not wish to be tested for HIV. I encourage you to accept being tested. It is in your interest to know. Knowledge of your HIV status will empower you to take care of your destiny.

11. We are intensifying efforts to combat stigma by making HIV testing to be as simple and as accessible as checking blood pressure. We are encouraging as many people as possible to test, to know their HIV status. In doing so, we are saying being HIV positive is no longer a death sentence. Help is available! You can live a healthy and productive life for 15 to 20 years. In the process you can bring up your children, an important part of your memory and heritage.

12. I therefore reiterate my appeal to each and everyone of you to exercise the right to leave the darkness of ignorance and take the upward climb to the light of knowledge. Ignorance and a repetition of the mistakes of the past have been the chief cause of death and unhappiness. HIV/AIDS thrives, and is more virulent under conditions of inaction, ignorance, stigma and resistance to change behaviour.

13. Bagaetsho, let me conclude by expressing the hope that the heavens will smile upon us and break the severe drought spell. We should maintain our hope that it will rain, and prepare ourselves to plough and plant crops that can be a source of food and income for families across the country. On that note, it gives me great pleasure, as always, to wish you a happy Christmas and a Prosperous New Year. P U L A

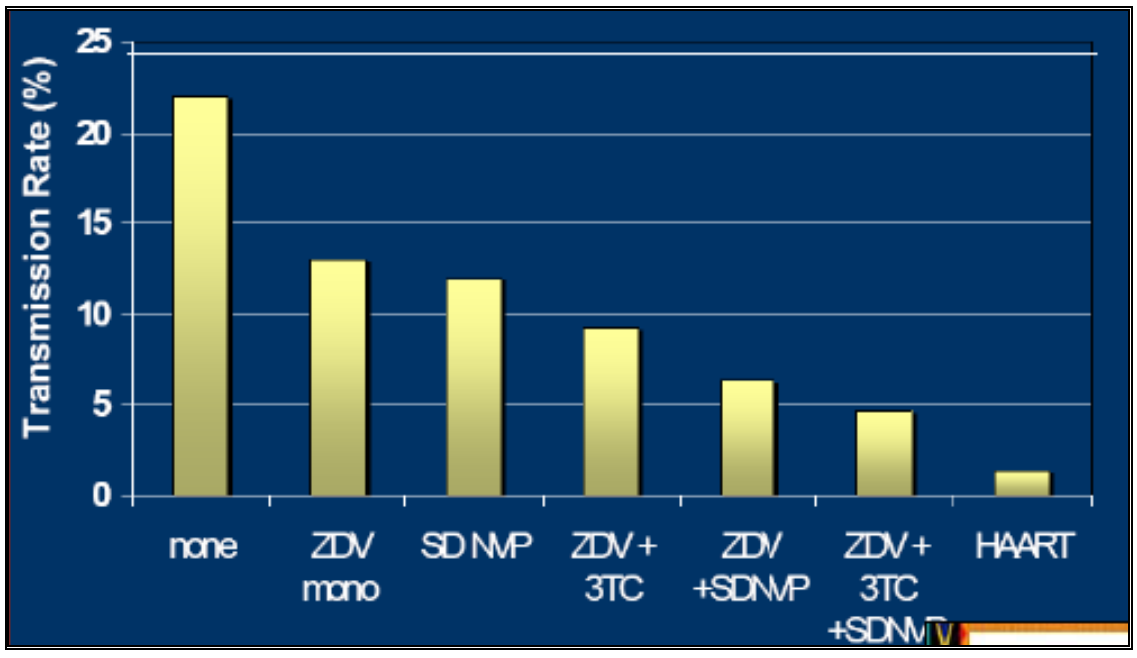
Source: The Dailynews, December 22, 2003.

Exhibit 9a *WHO Guidelines for PMTCT, 2006*

1. HAART for symptomatic women with WHO Clinical Stage 4 AIDS or with CD4 counts less than 200/mm^3
2. Consideration of HAART for women with WHO Stage 3 disease and CD4 counts between 200 and 350/mm^3
3. Simpler regimen of Zidovudine from 28 weeks gestation, plus SD-NVP added in labor for mom and baby, plus 7 days of ZDV+3TC after delivery to prevent resistance to NVP
In emergency settings or where nothing else is available, give single dose NVP.

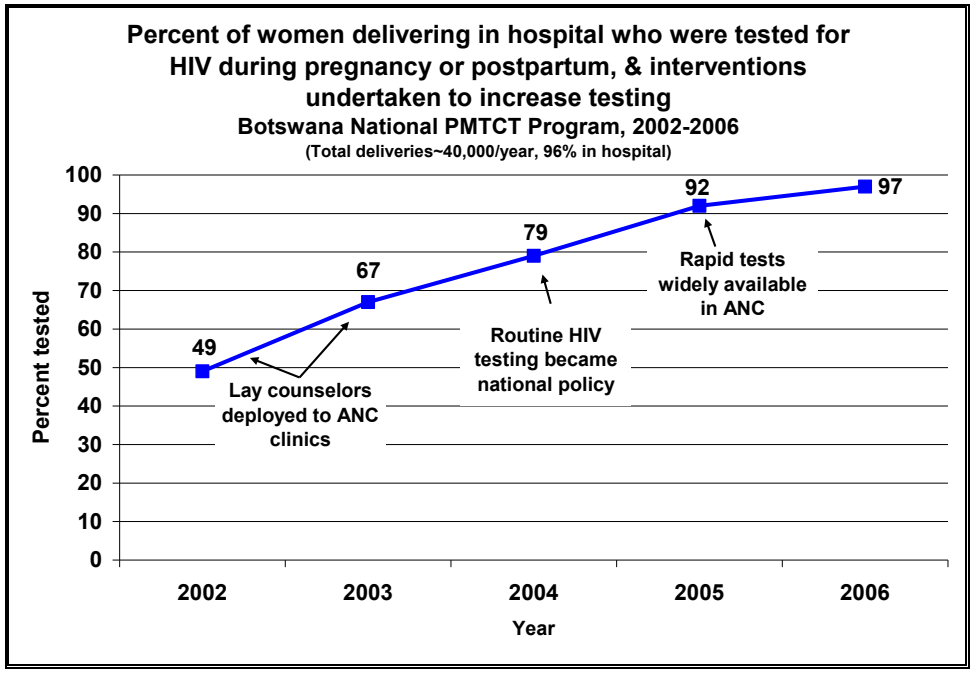
Source: World Health Organization.

Exhibit 9b *Perinatal Transmission Rates with Select PMTCT Regimens*



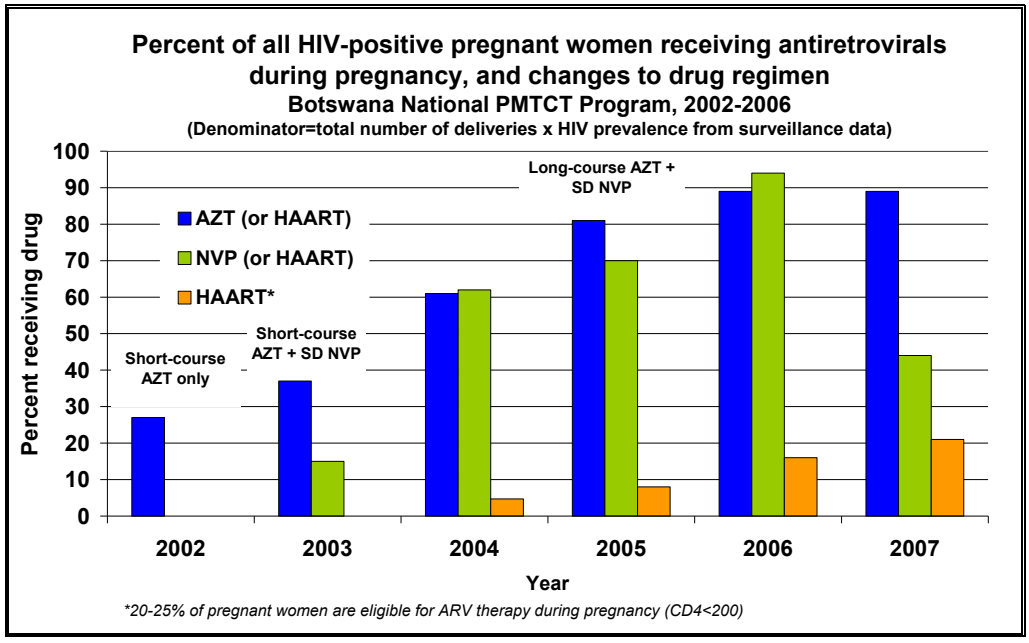
Source: Adapted from public sources.

Exhibit 10 *HIV Testing among Pregnant or Postpartum Women Delivering in Hospitals and Botswana PMTCT Program Chronology*



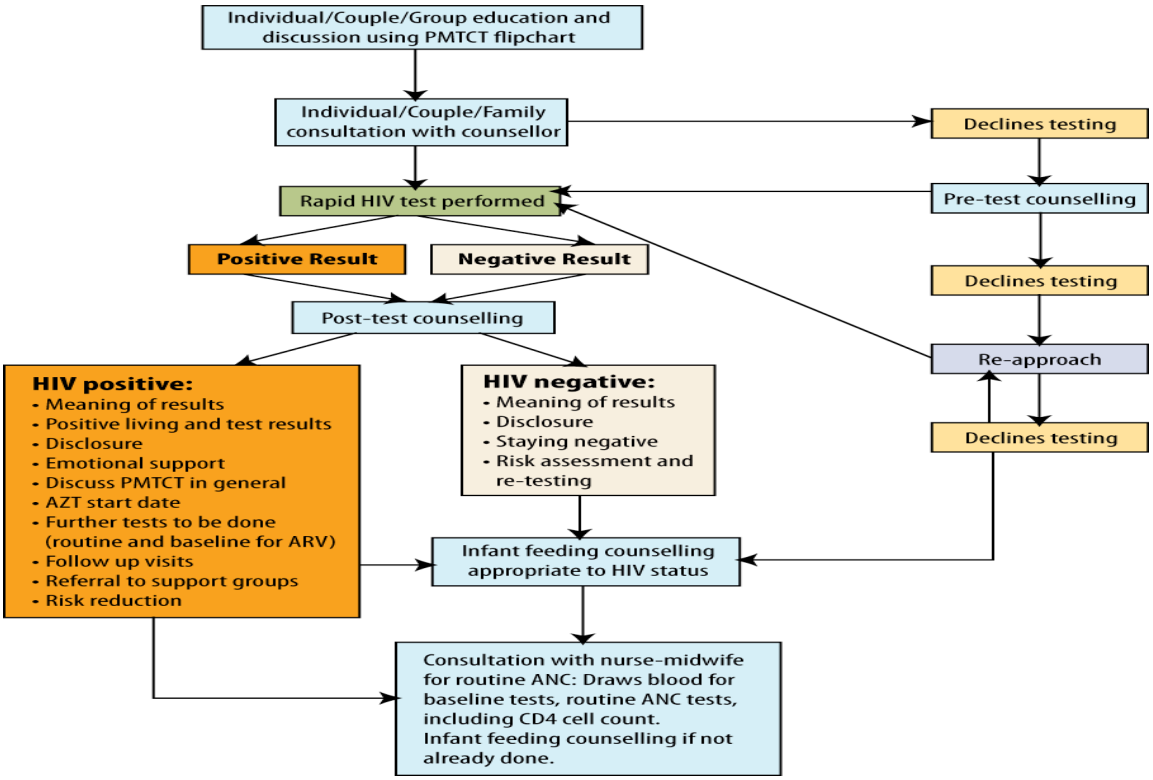
Source: BOTUSA.

Exhibit 11 *Timeline of PMTCT Protocols and Changes in ARVs Used*



Source: BOTUSA.

Exhibit 12 *Routine HIV Testing Flow Chart for ANC*



Source: Ministry of Health, Botswana.

Appendix *Useful Abbreviations*

ACHAP	African Comprehensive HIV/AIDS Partnership
AFASS	affordable, feasible, acceptable, sustainable, and safe
AIDS	acquired immunodeficiency syndrome
ANC	antenatal care
ART	antiretroviral treatment
ARV	antiretroviral
AZT	zidovudine
BHP	Botswana-Harvard Partnership
CDC	US Center for Disease Control and Prevention
DBS	dried blood spots
DOTS	directly observed treatment short course
DTP3	third dose of diphtheria toxoid, tetanus toxoid, and pertussis vaccine
GDP	gross domestic product
GoB	Government of Botswana
HAART	highly active antiretroviral therapy
HIV	human immunodeficiency virus
MCH	maternal-child health
MOH	Ministry of Health
NACA	National AIDS Coordinating Agency
NGO	non-governmental organizations
NVP	nevirapine
PCR	polymerase chain reaction
PEPFAR	US President's Emergency Plan for AIDS Relief
PMTCT	prevention of mother-to-child HIV transmission
PPP	purchasing power parity
RHT	routine provider-initiated HIV testing
SD-NVP	single dose of nevirapine
TB	tuberculosis
UN	United Nations
UNAIDS	Joint United Nations Programme on HIV/AIDS
US	United States
USD	United States' dollars
VCT	voluntary counseling and testing
WHO	World Health Organization
ZDV	zidovudine

References

1. Sillery A. *Botswana: A Short Political History*. London: Methuen & Co, Ltd.; 1974.
2. Warhurst A. How Botswana Leverages Growth. *BusinessWeek.* Vol Online. http://www.businessweek.com/globalbiz/content/apr2008/gb20080430_874526_page_2.htm ed; April 20, 2008.
3. United States Department of State. Botswana. http://travel.state.gov/travel/cis_pa_tw/cis/cis_1071.html. Accessed July 7, 2008.
4. Globalis. Botswana: Urban Population. http://globalis.gvu.unu.edu/indicator_detail.cfm?country=BW&indicatorid=30.
5. Labour Resource and Research Institute (LaRRI). *Wage Bargaining Report 2005.* Windhoek, Namibia September 2006.
6. Central Intelligence Agency. Botswana. *The World Factbook* [http://www.cia.gov/library/publications/the-world-factbook/geos/bc.html.
7. Fredriksson-Bass J, Kanabus A. HIV & AIDS in Botswana. http://www.avert.org/aidsbotswana.html.
8. World Health Organization. *Summary country profile for HIV/AIDS treatment scale-up: Botswana.* Geneva 2005.
9. United Nations Children's Fund. Botswana: Statistics. http://www.unicef.org/infobycountry/botswana_statistics.html.
10. World Health Organization, Joint United Nations Program for HIV/AIDS, United Nations Children's Fund. *Towards Universal Access: scaling up priority HIV/AIDS interventions in the health sector: progress report 2008*. Geneva: WHO; 2008.
11. World Health Organization. TB Country Profile: Botswana.
12. Health Workforce. *Global Atlas of the Health Workforce* [http://www.who.int/whosis/en/.
13. Republic of Botswana. *Preliminary Results: Botswana AIDS Impact Survey III (BAIS III), 2008.* Gaborone: Central Statistics Office; May 2009.
14. Botswana Ministry of Health. *Sentinel Surveillance* 2007.
15. Paz-Bailey Gea. Changes in the etiology of sexually transmitted diseases in Botswana between 1993 and 2002: Implications for the clinical management of genital ulcer disease. *HIV/AIDS.* 2005;41((1 November)):1304-1312.
16. National AIDS Coordinating Agency. Botswana Second Generation HIV/AIDS Surveillance: A Technical Report. Gaborone: The National AIDS Coordinating Agency; 2003.
17. Davies J. The SA Mining Industry Enters the HIV/AIDS War Zone. *Meditari Accountancy Research.* 2002;10.
18. Merck. The Front Line in Botswana: A Public-Private Partnership. www.merck.com/cr/enabling_access/developing_world/hiv/achap_botswana.html.
19. Kaiser. HIV Testing in the Era of Treatment Scale Up. www.kaisernetwork.org/health_cast/hcast_index.cfm?display=detail&hc=1830.
20. Daily News. Botswana Loses Out. August 16, 2006: http://www.gov.bw/cgi-bin/news.cgi?d=20060816&i=Botswana_loses_out.
21. United Nations Children's Fund. Unite for Children, Unite Against AIDS Fact Sheet. http://www.uniteforchildren.org/knowmore/knowmore_30104.htm. Accessed June 23, 2008.
22. Lallemant M, Jourdain G, Le Coeur S, et al. Single-dose perinatal nevirapine plus standard zidovudine to prevent mother-to-child transmission of HIV-1 in Thailand. *New England Journal of Medicine.* Jul 15 2004;351(3):217-228.

23. US Centers for Disease Control and Prevention. Mother-to-Child (Perinatal) HIV Transmission and Prevention. www.cdc.gov/hiv/topics/perinatal/resources/factsheets/perinatal.html.
24. United Nations Children's Fund. Fact of the week. www.unicef.org/factoftheweek/index_36577.html.
25. Avert.org. Preventing Mother-to-Child Transmission of HIV. www.avert.org/motherchild.htm.
26. United Nations Children's Fund. Zimbabwe's orphan crisis: A daily emergency for millions. www.unicef.org/har07/index_37554.htm.
27. Thior I, Lockman S, Smeaton LM, et al. Breastfeeding plus infant zidovudine prophylaxis for 6 months vs formula feeding plus infant zidovudine for 1 month to reduce mother-to-child HIV transmission in Botswana: a randomized trial: the Mashi Study. *Journal of the American Medical Association.* Aug 16 2006;296(7):794-805.
28. Ministry of Health. Botswana 2007 Second Generation ANC HIV/AIDS Sentinel Surveillance: Presentation by F. Gomez: Department of AIDS Prevention and Care; 2008.
29. Motswere C. *Challenges in following up of HIV positive infants in Botswana National PMTCT Program*: BOTUSA; 2007.