Maternal and Pediatric HIV/AIDS

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Vignette

Meet Musisi, is an HIV positive child. When Namatovu was pregnant with Musisi, she was unable to travel to the nearest maternity clinic in Masaka Town. The clinic was too far away. With some goodwill from her neighbors, she was finally able to visit the clinic 8 months into her pregnancy. The clinic attendant found that Namatovu was HIV positive and duly enrolled her in a prevention of mother-to-child-transmission (PMTCT) program according to the established Ministry of Health (MOH) guidelines. After Namatovu had given birth, the PMTCT program, not aware of new recommendations, told her not to breastfeed her baby in order to minimize the risk of transmitting HIV to her child.

Namatovu's neighbors, unaware of her HIV status, expressed their concern about the fact that Namatovu was not breastfeeding Musisi. Namatovu was not ready to disclose her status and soon started breastfeeding to avoid the neighbor's inquiries and comments. Namatovu was unable to return to the clinic for her quarterly dose of antiretroviral drugs (ARV's) and postnatal follow up checks. After 12 months, a visiting non-governmental organization (NGO) in Namatovu's village found that Musisi was also HIV positive. The visiting counselor gave Namatovu a referral letter to visit the maternity clinic in Masaka town for ARV's. This clinic, which was 20 kilometers away, was the same clinic Namatovu had been unable to visit during her pregnancy.

1. Introduction

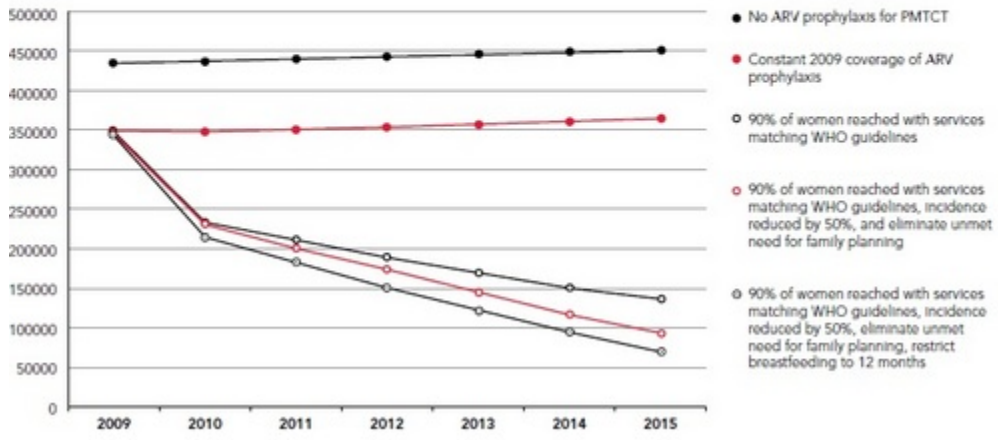
Despite improved antenatal and intra-partum PMTCT services, only a third of HIV-infected mothers adhere to the postnatal PMTCT (PN-PMTCT) programs. With effective and affordable PMTCT programs becoming increasingly available, access to these programs is an issue that needs to be addressed to ensure that mothers living with HIV do not transmit the virus to their babies. The Joint United Nations Programme on HIV/AIDS (UNAIDS) postulates that the virtual elimination of mother-to-child transmission (MTCT) of HIV is possible if current advances in stopping new infections among children are accelerated by integrating services in antenatal care settings (Duff, Kipp, Wild, Rubaale & Okech-Ojony, 2010; United Nations Children's Fund [UNICEF], 2008).

Many mothers who discover they are HIV-positive usually try to hide their status because of widespread discrimination and stigma. However, with supportive families and communities, early initiated antiretroviral visits, continuous antenatal visits and medications, it is possible for all mothers to have healthy babies.

The virtual elimination of mother-to-child transmission of HIV is possible

Estimated New HIV infections among children 0-14: Different scenarios for 25 countries

Source: Mahy M, Stover J, Kiragu K, et al. What will it take to achieve virtual elimination of mother-to-child transmission of HIV? An assessment of current progress and future needs. Sex Trans Infect (Suppl) 2010.



1.1 Background

The Human Immunodeficiency Virus (HIV) and Acquired Immune Deficiency Syndrome (AIDS) present the world with an extraordinary kind of crisis; it is both a medical emergency and a long-term national development issue. Despite increased funding, political commitment, and progress in expanding access to HIV treatment and prevention, the HIV/AIDS epidemic continues to outpace the global response. HIV transmission occurs through the exchange of bodily fluids, mainly through sexual contact and the sharing of needles.

Vertical tranmission (the tranmission of HIV from mother-to-child) is a growing concern. About 90% of MTCT infections occur in Africa where AIDS is beginning to reverse decades of steady progress in child survival (WHO, "MTCT of HIV Data and Statistics", 2010). In high-income countries, MTCT has been virtually eliminated because of effective voluntary testing and counseling programs, increased access to antiretroviral therapy (ART), safer delivery practices, and a more effective and safer Maternal and Pediatric HIV/AIDS (WHO, "MTCT of HIV Data and Statistics", 2010)**.** These interventions to prevent MTCT of HIV are fairly inexpensive. If these interventions were used worldwide, they could save the lives of thousands of children each year.

2. Epidemiology & Etiology

2.1 Background Data

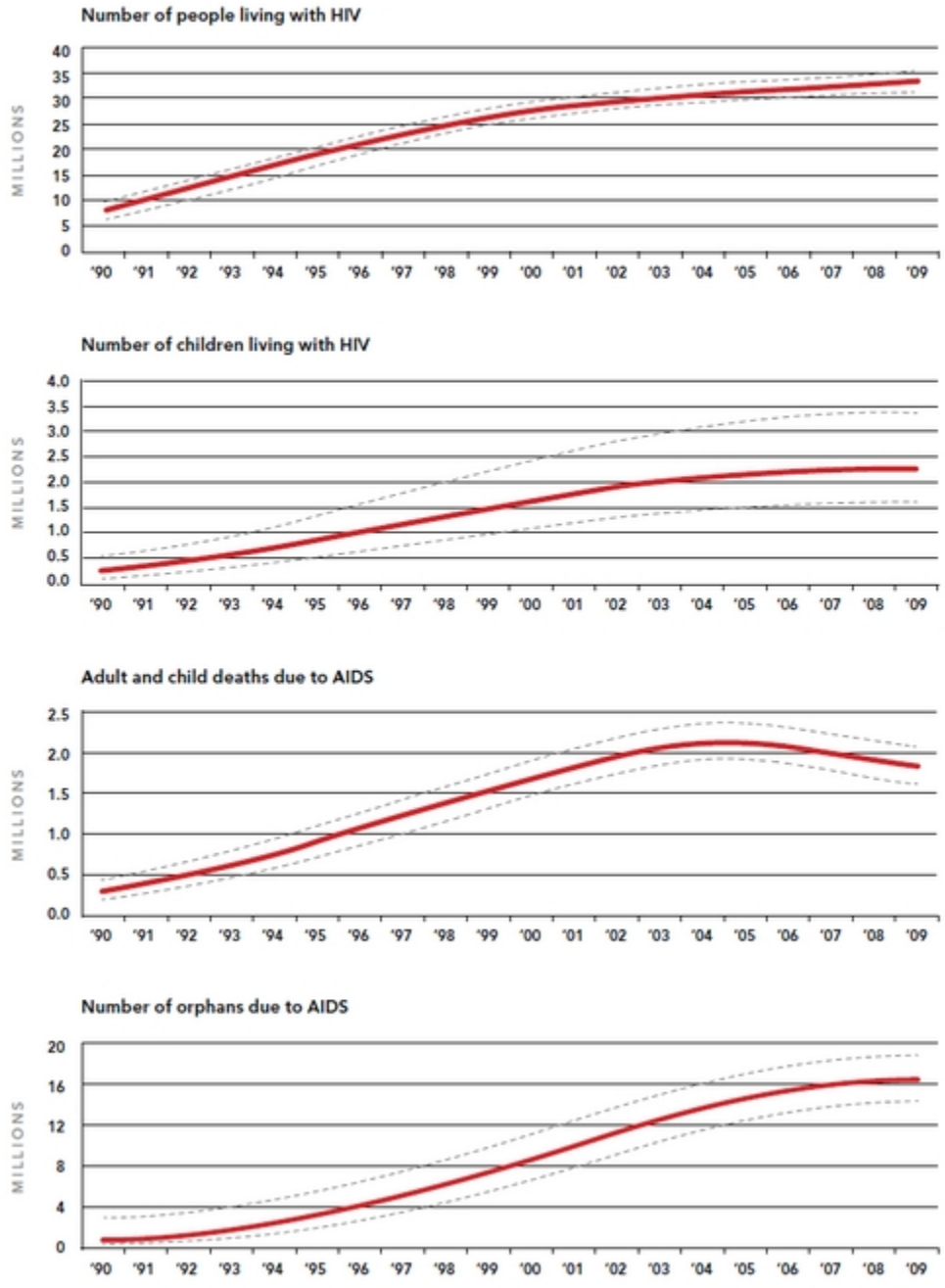
At the end of 2010, UNAIDS estimated that there were 34 [31.6-35.2] million people living with HIV worldwide. The estimated number of children living with HIV increased to 3.4 million [3.0 million–3.8 million] in 2010 while the proportion of women living with HIV has remained stable, at about 50% of the global total. As access to services for preventing the MTCT of HIV has increased, the total number of children born with HIV has decreased (UNAIDS, 2011; GHO, 2012).

An estimated 390,000 [340,000 – 450,000] children were newly infected with HIV in 2010. According to UNAIDS, AIDS has killed more than 27 million people since it was first recognized in 1981, making it one of the most destructive epidemics in recorded history. In 2010 alone, UNAIDS estimated that the AIDS epidemic claimed 1.8 million lives, 161,000 of which were in children under 5 (UNAIDS, 2011).

Global prevalence has remained static over the past seven years, but the number of people living with HIV/AIDS is increasing because new infections add to the existing population of HIV infected people who are living longer lives with antiretroviral treatment (ART). There has been a global increase of ART coverage from 7% in 2003 to 47% in 2010. In low to middle-income countries, ARV coverage for infants is 42%, while ARV coverage for pregnant mothers is 48%. Although there has been significant improvement in access to ART since 2003, there is still an unmet need of treatment for more than half of people in developing countries (UNAIDS, Data Tables 2011).

Global HIV trends, 1990 to 2009

Source: UNAIDS.



One of the most disconcerting repercussions of the AIDS pandemic is the number of children that have been orphaned. Currently, the UN estimates that there are 16.6 million AIDS orphans in the world, of

which 84% are in sub-Saharan Africa, (UNAIDS, 2010).

2.2 Modes of Transmission

HIV transmission requires piercing the skin or mucous membrane and infection through bodily fluids. Routes include intravenous injections, direct contact between blood and/or other bodily fluids, any action or activity that leads to a break in the skin and direct blood-to-blood contact, and sexual contact. HIV can be transmitted through blood, semen, vaginal fluid or breast milk. Bodily fluids which are not infectious include: saliva, tears, sweat, feces and urine.

Intravenous transmission occurs primarily through use of contaminated needles or syringes by injecting drug users, transfusions of HIV infected blood and blood products, and procedures utilizing contaminated equipment. The risk of infection through needle sharing is 1 in 150, while it is 95 in 100 for those who receive transfusions of HIV infected blood (Galvin & Cohen, 2004).

Sexual transmission of HIV occurs primarily through unprotected sexual intercourse (vaginal or anal) with an HIV infected individual. The risk of infection through unprotected vaginal intercourse varies depending on the infected partner, but ranges from 1 in 200 to 1 in 3000. The risk of infection during intercourse between men is 1 in 10 to 1 in 1600 (Galvin & Cohen, 2004).

Mother-to-Child Transmission (MTCT) can occur during pregnancy (transplacental), during birth, or through breastfeeding (perinatal). The risk of infection without the use of ART is 1 in 4, but can be cut by more than half to <1 in 10, if the mother receives ART during pregnancy and birth, as well as providing the child with ART prophylaxis (Galvin & Cohen, 2004).

Transplacental transmission occurs during pregnancy; 1.5-2% of infants are infected this way (Soilleux & Coleman, 2003). An infant is at higher risk for transplacental transmission if the mother is anemic, malnourished, has other infections or if the HIV progresses to AIDS during pregnancy (Colton, 2006).

Perinatal transmission occurs during birth or breastfeeding. The risk of perinatal transmission in the absence of any intervention is between 20% and 45% (WHO, 2008). The risks of MTCT within different stages of perinatal transmission will vary depending on the breastfeeding practices of the local culture. In populations practicing prolonged breastfeeding and exclusive breastfeeding for 6 months, the rates of transmission are 39% and 18%, respectively (Kourtis, Lee, Abrams, Jamieson & Bulterys, 2006).

Factors that increase the risk of MTCT are high maternal viral load, advanced disease (AIDS), exposure to maternal fluids during labor and delivery, and vaginal versus Caesarian section (although a Caesarian section is only warranted in situations where the mother has advanced disease and is not already on any treatment) (AVERT, "Prevention of Mother-to-Child Tranmission of HIV", 2010).

2.3 Clinical Presentation

Once an individual is infected with HIV, the virus travels through the host's blood stream to the lymph tissue. The virus binds itself to the cluster designation four positive T lymphocytes (CD4) which have a key role in the immune system. HIV infects these CD4 cells and when the CD4 cells multiply to fight off the infection, they also subsequently produce more copies of HIV as well. Within the first two weeks of infection, the body launches its immune response, which is known as seroconversion (Merck Manual Professional, 2010).

The body begins to produce antibodies, typically six to twelve weeks after primary infection, the individual develops acute HIV infection. During this time individuals are highly infectious, with elevated levels of the virus in the blood and genital secretions, and the antibodies can be detected by an HIV test.

Watch the video below to view a simulation of how HIV affects the immune system and how HIV progresses to AIDS in the body.

VIDEO LINK http://youtu.be/eOCKOcbr0Os

2.3.1 Clinical Presentation in Adults and Adolescents

Infection with HIV results in the progressive deterioration of the immune system, as described in the stages below.

Primary Infection

The time from HIV exposure to symptom development usually takes two to six weeks. The most common symptoms of acute HIV infection are flu-like: fever, fatigue, arthralgia or myalgia, lymphadenopathy, pharingitis, erythematous rash, diarrhea, nausea or vomiting, weight loss, night sweats, and headaches (Merck Manual Professional, 2010). However, many people's symptoms are not serious enough for them to see a physician and they therefore may go undiagnosed.

Clinically Asymptomatic Stage

The acute infection phase is typically followed by an asymptomatic period of an equilibrium between viral replication and the host immune response. Individuals may not have any clinical manifestations of this infection during this time. This phase, known as clinical latency, is similar in men and women and may last for up to ten years even in the absence of a treatment.

Symptomatic HIV Infection

Symptomatic HIV infection is caused by the deterioration of the lymph nodes and tissues from years of activity, as well as the inability of the body to maintain a supply of T helper cells. It is characterized by the emergence of opportunistic infections and cancers that the immune system would normally prevent. It is in this stage of HIV infection that many infected individuals begin to develop multi-system diseases. While treatment for the specific infection or cancer can be carried out, the symptoms of immune suppression will only worsen as the action of

HIV erodes the immune system, unless HIV itself can be slowed down (AVERT, "Stages of HIV infection", 2010).

Progression from HIV to AIDS

AIDS is a surveillance term which applies to the most advanced stages of HIV infection, defined by the occurrence of any of more than 20 opportunistic infections or HIV-related cancers, or when an HIV positive individual's CD4 count drops below 200 (WHO, "HIV/AIDS", 2010). As the virus breaks down the immune system, people living with AIDS are increasingly susceptible to diseases that healthy individuals can easily fight off. People with AIDS also experience significant declines in body weight, leading to what is commonly referred to as "wasting syndrome" (Bartlett, 2008).

2.3.2 Clinical Presentation in Infants and Children

Infants infected with HIV usually develop symptoms by the time they are six months old, with clinical presentations such as diarrhea and/or failure to thrive. Many children die before they reach their second birthday. Clinical experience indicates that perinatally HIV-infected children fit into one of 3 categories:

- *Rapid progressors*, most of whom die before their first birthday and are thought to acquire infection *in-utero* or during the early postnatal period (about 25-30%).
- *Early symptomatic* children, who develop symptoms early in life then follow a downhill course and die by three to five years (50 - 60%).
- *Long-term survivors,* who live beyond eight years (5-25%). They tend to be small for age and possibly stunted. (See children in opening video whose ages ranged from 5 – 15 years) (WHO, 2011)

Opportunistic Infections and Co-Infections

There are certain illnesses that are rarely seen in people other than those diagnosed with HIV – these are known as opportunistic infections. Some of these infections can spread to a number of organs, at which point they become a systemic disease. When infections reach this stage, they are often fatal (Bartlett, 2008).

Tuberculosis and HIV

In addressing the HIV/AIDS pandemic, Tuberculosis (TB) is far too often ignored or viewed as just one of many opportunistic infections. In fact, TB is the leading killer of people with HIV/AIDS and the first presenting sign in the majority of AIDS patients. It is estimated that

one-third of people with HIV/AIDS are also infected with TB. Today, almost 70% of those co-infected with TB and HIV live in Africa (Abdool Karim, Churchyard, Abdool Karim & Lawn, 2009). New concerns have emerged as Multi-drug Resistant TB (MDR-TB) and Extreme Drug Resistant TB (XDR-TB) are on the rise. Drug-resistant TB poses a grave public health threat that could have a severe impact on mortality of those living with HIV worldwide.

2.4 Economic and Social Impacts

"Our fields are idle because there is nobody to work them. We don't have machinery for farming, we only have manpower - if we are sick, or spend our time looking after family members who are sick, we have no time to spend working in the fields." Toby Solomon, commissioner for the Nsanje district, Malawi

The HIV/AIDS epidemic affects the economy by depleting the work force in a number of ways:
- Healthy individuals are made sick
- Families need time off from work to care for sick family members
- Life expectancy is reduced
- School enrollment is reduced leading to a less educated workforce
- Higher infant and child mortality

Since HIV/AIDS typically impacts people of working age, the household burden is placed on the shoulders of the children and elderly. In poor countries, households face high adult morbidity, mortality, funeral costs, and often high health expenditures associated with HIV/AIDS (Cohen, 1992). These costs and challenges prevent households from being able to meet basic needs such as food and schooling.

Despite international efforts to decrease HIV treatment drug prices, the cost of HIV treatment exceeds many people's ability to pay for them. The median price in 2008 for first line antiretroviral (ARV) treatment cost between $100 to $293 per person per year. Fortunately, many of these drugs are subsidised by donors and governments for the people in low-income countries. However, if the HIV-infected patient develops resistance to the first-line drugs, they have to take a more expensive second line drug, which cost between $819 to $1105 per person per year in 2008 in low-income countries (WHO, 2009).

2.4.2 Women and AIDS

Women continue to be disproportionately affected by HIV/AIDS. In 2010, 17 million women were living with HIV (UNAIDS, 2011). UNAIDS

estimates that 59% of women living with HIV live in Sub-Saharan Africa (UNAIDS, 2011). The widening impact on women is apparent also in Asia and Eastern Europe. In addition to physiological predisposition, women tend to be disproportionately affected by HIV/AIDS because of factors such as inequalities within the family, violence against women, and lack of women's inheritance and property rights. This lack of power makes women more vulnerable to infection and less able to protect themselves (AVERT, "Women, HIV and AIDS", 2010).

Click here to see a 6 minute short version of Raising Voices's documentary film that tells two women's personal stories of violence and HIV/AIDS.

2.4.3 Children and AIDS

An overwhelming proportion (90%) of 3.4million children living with HIV resides in developing nations. Over 90% of these children were infected through mother-to-child transmission (MTCT) during pregnancy, delivery, or perinatally during through breastfeeding. More than half of these children born with HIV will not live to see their second birthday (UNICEF, 2011).

Prevention of mother-to-child transmission is important for several reasons. Treatment of children can be difficult because many drugs are not available in pediatric formulas and those that are in liquid form often require large volumes to be taken, have short shelf-life, and require refrigeration. Furthermore, because children grow quickly, dosing by weight and surface area may lead to underdosing when the child grows. Some of the contributing factors to the increased mortality of HIV positive children include
higher rates of other infections, micronutrient deficiencies and malnutrition (Mphatswe, Blackenberg, Tudor-Williams, Prendergast, Thobakgale & Mkhwanazi, 2007).

2.4.3.1 HIV/AIDS Orphans

About 17.1 million (15.4 million–19.1 million) children under the age of 18 are considered orphans, that is have lost one or both parents to AIDS. Orphans face not only the health issues brought on by the virus, but other problems which exacerbate their vulnerability. These problems include:

- Emotional impacts: Orphans face the emotional trauma that comes with the loss of a parent in addition to potential psychological distress. In addition, they are likely to have to deal with a new living situation which may offer little or no support and could put them in potentially abusive situations. A study in Uganda showed that AIDS orphans were more likely to be more anxious, depressed or angry than other children (Avert, *AIDS Orphans)*
- Household impacts: An orphan's ability to have his/her basic needs met may be challenged without parental assistance.
- Education challenges: In order to earn an income or care for surviving family members, orphans may be forced to withdraw from school. Orphans may also miss out on learning that occurs from parent to child.

Click here to hear from children in Uganda about their experience of becoming orphaned because of HIV/AIDS.

2.4.4 Fighting HIV Related Stigma

HIV/AIDS continues to be marked by discrimination and stigma. AIDS-related stigma refers to the "prejudice and discrimination directed at people living with HIV/AIDS and the groups or communities they are associated with." The stigma of HIV/AIDS is often a result of the fear of the community or individual not knowing how the disease is actually transmitted or treated. This discrimination can often result in the

individual being rejected, shunned, or even physically hurt by their family or community. This negatively affects their lives and treatment of the disease. It also jeopardizes equitable access to HIV-related services and tools for prevention and care, fueling the epidemic.

3. Prevention and Diagnosis of HIV

3.1 Prevention of HIV Transmission

Preventing the transmission of HIV has been the focus of many non-governmental organizations and health ministries around the world. WHO supports a "combination of approaches to prevent the sexual
transmission of HIV, including correct and consistent condom use, reduction in the number of sexual partners, HIV testing and counseling, delaying sexual debut, treatment for STIs, and male circumcision" (WHO, Prevention). Although there are other methods of transmission (mother to child, blood transfusions, sharing tainted needles, etc.), sexual contact is the primary mode, and thus it remains the focus of many prevention campaigns.

3.1.1 Condom Promotion

According to the WHO, UNAIDS, and UNFPA, the male latex condom is the single, most efficient, available technology to reduce the sexual transmission of HIV and sexually transmitted infection (STI). Even with typical use in the general population, condoms are at least 80% effective in preventing transmission.

The World Health Organization recommends incorporating condom promotion into all comprehensive HIV prevention campaigns (WHO, Prevention). The female condom which was introduced in 1995, was a relatively new product that offered another option for a barrier method. It could help prevent the transmission of HIV and was more controlled by women.

Despite initial optimism, the female condom has been underutilized. Studies have shown that it is not commonly proposed method of preventing STIs, especially HIV/AIDS. A carefully planned re-introduction can help to ensure its acceptance by policy makers, service providers, and potential

users. (Hoffman, Mantell, Theresa, and Stein)

3.1.2 Syndromic Management of Sexually Transmitted Infections

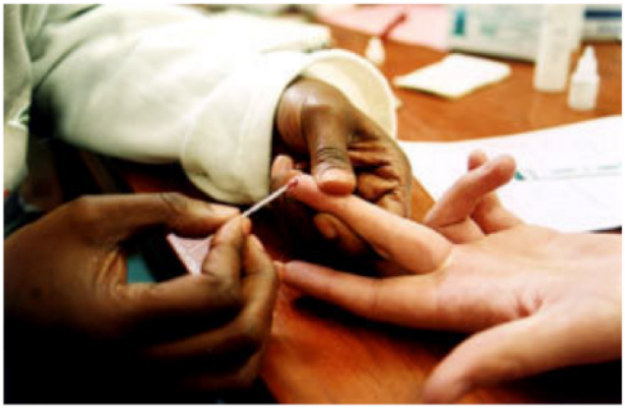
In developing countries where diagnostic tests are limited, it is difficult to diagnose specific STIs. Thus, WHO currently recommends implementation of the syndromic method for managing STIs, where people with symptoms that could be attributed to STIs are treated without diagnosis. There has been unclear evidence as to whether or not reducing STIs also helps to reduce the transmission of HIV (WHO, Prevention). However, primary STI prevention targeting individual, groups, or the entire community can reduce genital lesions caused by many STIs in women, possibly leading to reduced HIV infection in women.

3.1.3 Microbicides

Microbicides are anti-infective products such as gels, creams, impregnated sponges, and similar devices that women apply before sexual intercourse to prevent HIV transmission and other sexually transmitted infections. Many women have no control over when, with whom, and what degree of protection is used in sexual relationships. However, the use of microbicides is controlled by women, which allows for more options to protect themselves. More than sixty microbicides are being researched or in development (International Maternal and Pediatric HIV/AIDS Partnership for Microbicides, About Microbicides). One microbicide, Tenofovir gel, has seen some promising results. One study found that women who were highly adherent to using the gel were 54% less likely to be infected with HIV than those in the control group (Karim, et al., 2010). The gel is currently being piloted with limited production. Though microbicides are a good short-term method for allowing women to prevent their own infection, the bigger social problem of male control over sexual relationships will need to be addressed in the long-term for women to truly reduce their risk of HIV infection.

Here is a link to the microbicide study: http://www.mtnstopshiv.org/

3.2 Diagnosis of HIV



HIV testing and diagnosis is the doorway to HIV care and treatment. Client initiated HIV testing (VCT) was the standard of care for many years, but now, there is growing interest in provider-initiated testing. Promising provider-initiated strategies include opt out policies in PMTCT and community based testing with door-to-door or mobile clinics (WHO, 2010). HIV infection is usually diagnosed by testing serum for antibodies to HIV using a commercially available enzyme-linked immunosorbent assay (ELISA). Because the ELISA test is not entirely specific, positive results are confirmed with a Western blot assay, which identifies antibodies to specific components of HIV. Both of these methods require appropriate laboratory settings and take time to get results. (Hare, 2009) Newer, less resource intensive diagnostic techniques are developing. For example, OraQuick tests antibodies in saliva and urine specimens and produces results in 20 minutes. Other options include home testing and rapid HIV resume testing methods. These tools can increase access to early diagnosis as well as referral for treatment and prevention services in high-HIV prevalence settings.

3.2.1 Voluntary Counseling and Testing

Voluntary Counseling and Testing (VCT), a client initiated testing, is a combination of pre-test counseling, HIV testing, and post-test counseling. According to the UNAIDS recommendations, VCT services should be provided in a voluntary and confidential manner. Figure 3 outlines the VCT process.

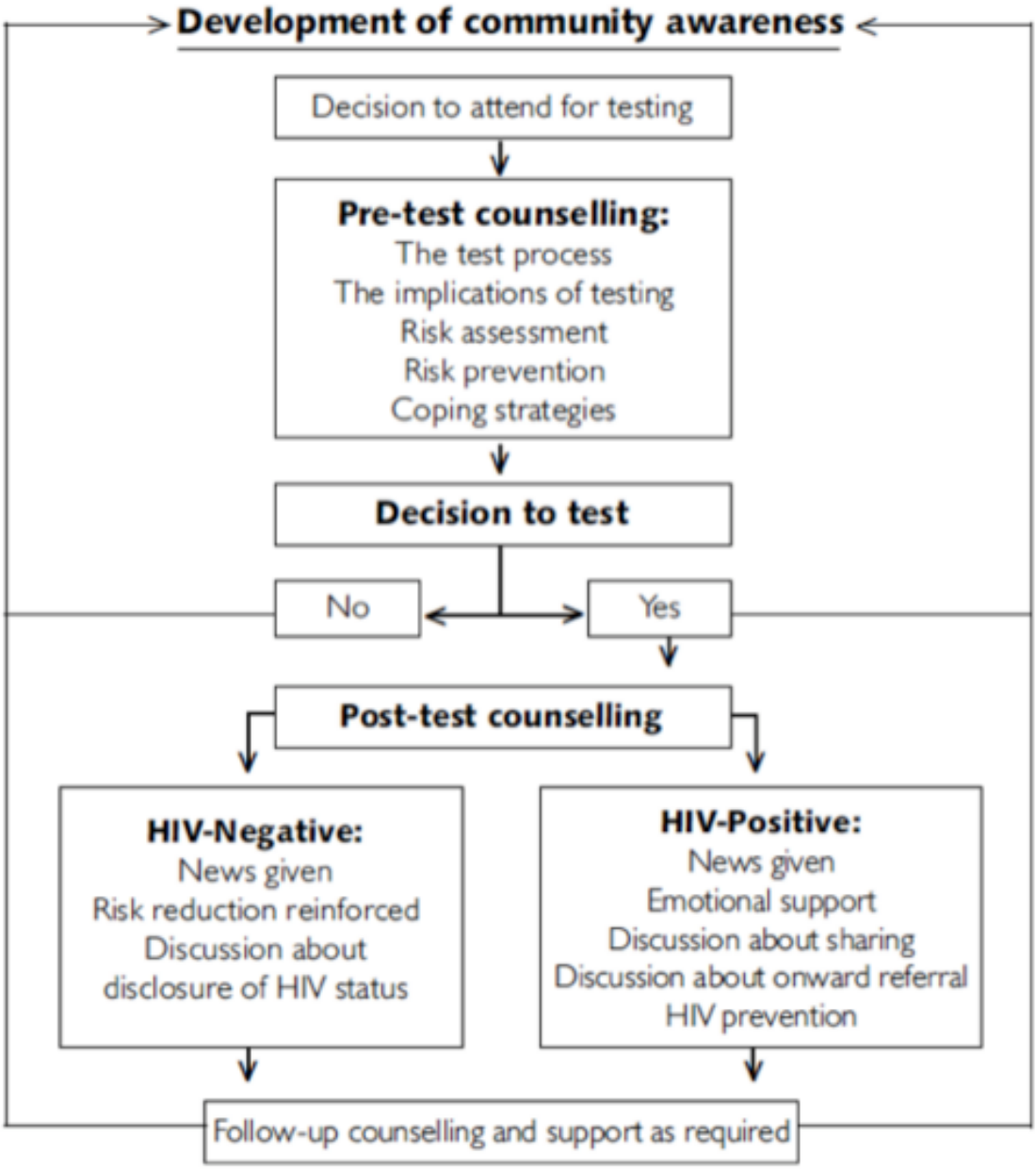


Figure 3. Pathway Through VCT (UNAIDS, 2000)

3.2.2 Opt Out Testing for Pregnant Women

Opt out testing is a provider-initiated testing, where women are told that an HIV test will be included in the standard group of prenatal tests, but they have the option to decline testing. By making counseling and testing routine, HIV-related stigma is reduced with seemingly everyone participating. The opt out approach has shown significant results. For example, Botswana saw 15% increase to 90.5% in testing when they

switched over from the old practice of letting the patient choose whether to get tested to the opt out approach. Implementing opt out does put an additional strain on human resources but has an increased uptake of counseling and testing. Creating peer training systems, lay counselors, and task-shifting can help meet the demand of increased services. (Kasenga, Byass, Emmelin, & Hurtig, 2009).

4. WHO Guidelines on Antiretroviral Therapy for PMTCT

In 2010, WHO released a new set of guidelines surrounding the provision of ART to prevent MTCT. Under the guidelines, all HIV positive mothers should receive a course of ARV prior to, during, and after delivery. In comparison to the 2006 guidelines, WHO now recommends earlier initiation of ART to a wider spectrum of HIV-positive, pregnant women. It is structured to benefit the overall, lifelong health of the mother as well as best practice strategy to prevent MTCT. Even if the mother does not require ART for their own health, WHO recommends a choice of two ARV prophylaxis options to prevent MTCT during pregnancy, labor, delivery, postpartum, and the breastfeeding period. It is the first time there is a prophylaxis treatment recommended during breastfeeding period.

The 2010 recommendation is notably more comprehensive compared to 2006 version. It recommends coverage of more people for a longer period of time. However, this produces a challenge for resource and access-poor settings. In such a case, WHO recommends the continued use of the 2006 guidelines. Figure 4 outlines the summary of WHO recommendation as summarized by Avert (WHO Guidelines). For more detailed information, see WHO's "Antiretroviral Drugs for Treating Pregnant Women and Preventing HIV Infection in Infants: Recommendations for a Public Health Approach". 2010 version is available at http://www.who.int/hiv/pub/mtct/antiretroviral2010/en/index.html

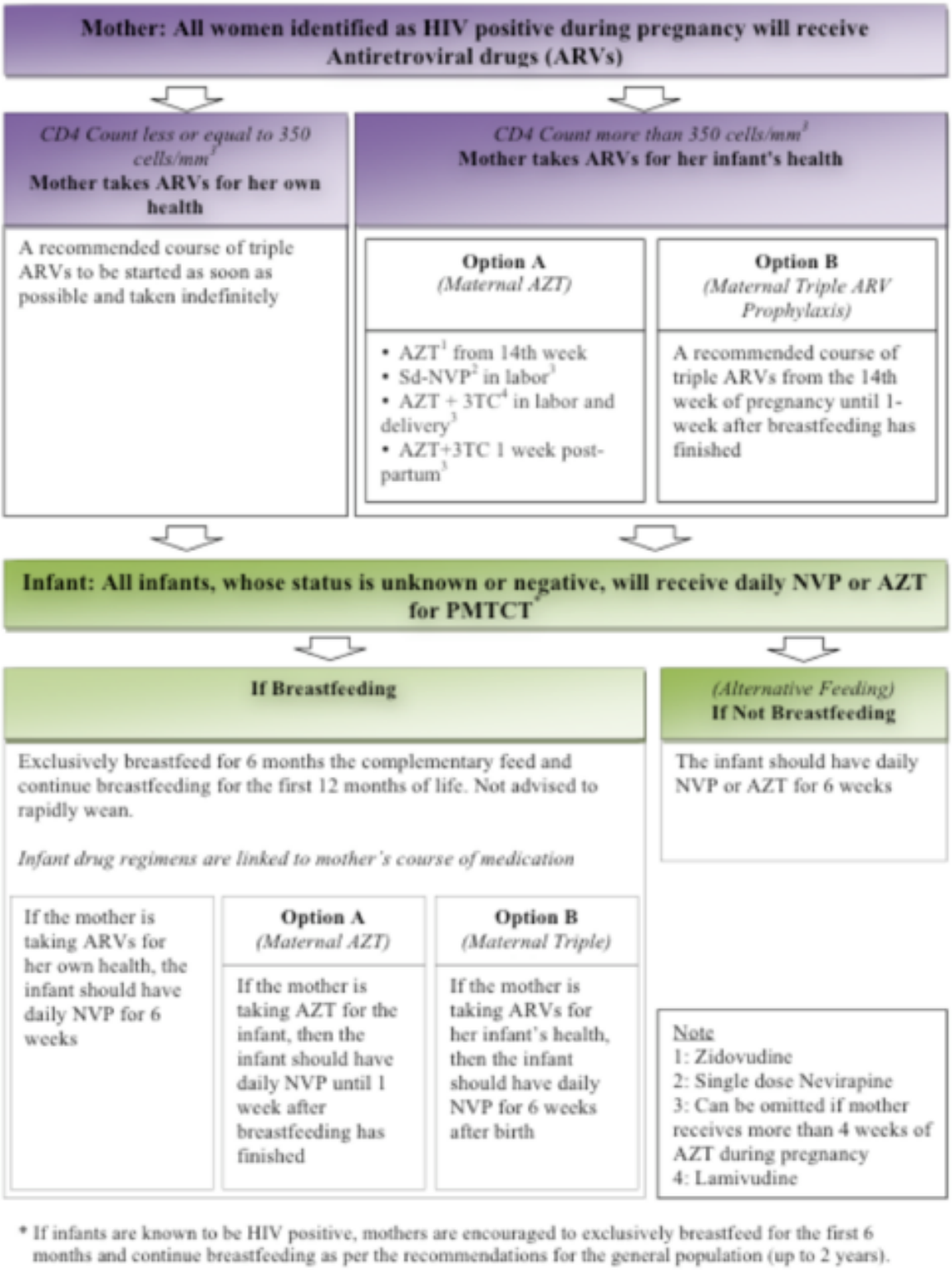


Figure 4. Summary of WHO PMTCT and Breastfeeding Guidelines, 2010 (AVERT, WHO Guidelines)

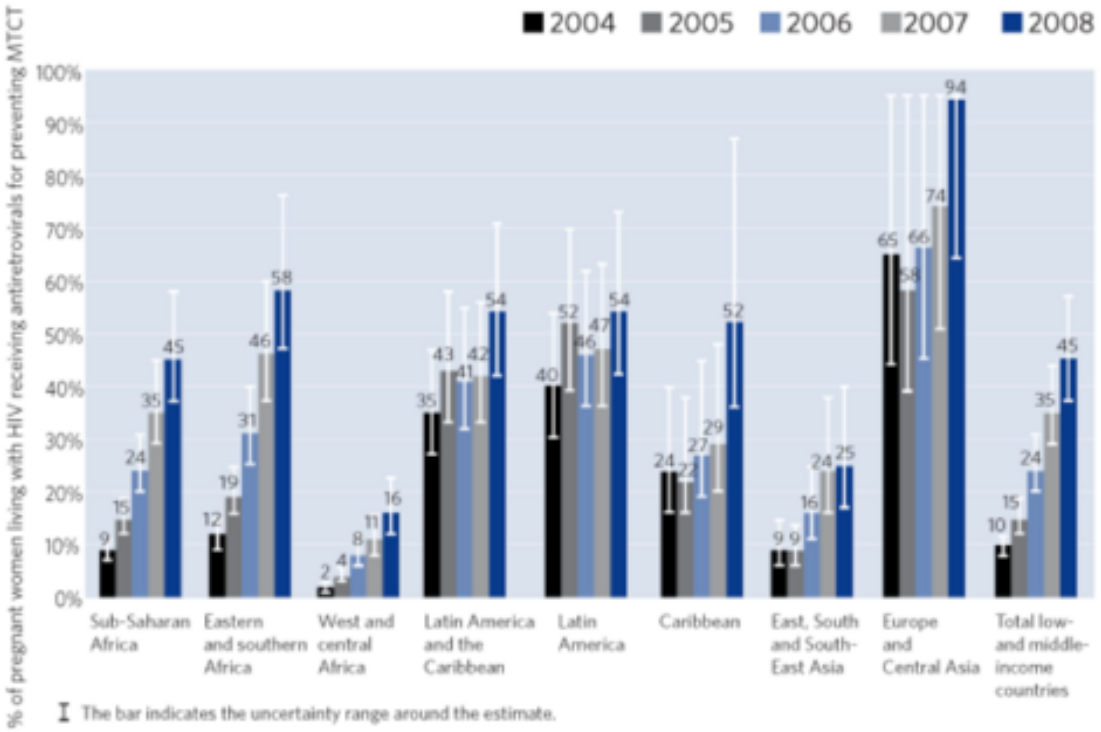


Figure 5. Proportion of Pregnant Women Receiving ART by Region (WHO, MTCT Data and Statistics)

4.1 When is Single Dose Nevirapine Appropriate?

A major concern about the use of single dose nevirapine is drug resistance. Studies have suggested that single dose nevirapine can make future treatment with nevirapine or efavirenz (a related drug) less effective. This could have serious consequences for mothers who wish to prevent MTCT during subsequent pregnancies, or who later use nevirapine or efavirenz as part of combination therapy to improve their own health. There is also some evidence to suggest that if a mother develops nevirapine resistant HIV, this may be passed through breast milk to her baby.

Because of these concerns, there is now general agreement that single dose nevirapine should be used only when no alternative PMTCT drug regimen is available. Whenever possible, women should receive a combination of drugs to prevent HIV resistance problems and to decrease MTCT rates even further. (AVERT,

PMTCT)

4.2 Breastfeeding and Transmission

WHO and UNICEF recommend initiation of breastfeeding within the first hour of life, followed by exclusive breastfeeding for six months, followed by the introduction of appropriate complimentary foods for up to two years. However, HIV can be transmitted through breast milk. Therefore, HIV positive mothers must be given different recommendations about breastfeeding.

The risk for HIV transmission from breastfeeding, which has been estimated to be between 10 and 20%, increases with a longer duration of breastfeeding. The risk for HIV infection through breastfeeding appears to be greatest in the first few months of life. Thus, WHO initially recommended abrupt weaning to minimize the risk of HIV transmission while not increasing their risk of other causes of morbidity and mortality. However, a study conducted in Zambia has found that there was no benefit to abrupt weaning (Kuhn, et al., 2008). The investigators concluded that the mothers were allowing the baby to be breastfed when the baby chronically cried for the milk. Breastfeeding after a long period of not feeding builds up the

viral load in the milk, increasing the chances of infecting the baby with HIV (Nancy Scott, Personal Conversation). As abrupt weaning is not realistically feasible, WHO no longer advise mothers to rapidly wean (AVERT, WHO Guidelines).

4.3 Barriers and Potential Solutions to PMTCT Programs

There are a significant number of barriers that prevent organizations and governments from successfully conducting a PMTCT program. The majority are resource limitation issues, from human resources to ARVs. There are cultural barriers as well, such as stigma surrounding HIV that inhibits women from accessing clinics for treatment and male acceptance of ARTs for their wives. The table below has summarized several barriers and potential solutions for PMTCT programs.

Obstacles/ Challenges	Solutions
• Inadequate human resources	• Task shifting • Usage of lay counselors • Community Health Workers • Volunteers
• Transportation • Communication	• Email • Text messaging • Decentralized lab facilities
• Low NVP uptake because of home deliveries	• Usage of Traditional Birth Attendants • Distribution of NVP by TBA
• Male partner involvement	• Set incentives by allowing women who bring their partners to move to the front of clinic lines • Radio outreach • Invitations to males directly through mass media and personal communications • Sensitization of Chiefs and Headmen
• Return for results follow-up	• Rapid/ same-day testing

5. Pediatric HIV/AIDS

5.1 Early Infant Diagnosis

"I am very proud that this test now exists in Malawi and that we are saving children's lives...Eighteen months is a long time for a child to not know their status and by then many children have complications and get sick," - Lloyd Nyangulu, Senior laboratory technician

A video about pediatric AIDS: http://www.youtube.com/watch?v=vW2q4fnJOO0

About 30% of children born with HIV will die by their first birthday (WHO/UNICEF 2011), and half will die by their second birthday (World Bank, *AIDS - Data*). About 800 children die every day because they lack access to pediatric treatment and care (WHO/UNICEF 2011). Most will not be diagnosed with the immunosuppressing disease that killed them. About 75% of pediatric deaths by HIV can be prevented if treatment is started in the first 12 weeks of life (World Bank, *AIDS - Data*). In 2011 pediatric ART coverage rose from 456,000 children to 562,000 children, however this increase still only represents about 28% of the children in need of coverage (WHO 2010).

In infants, the diagnosis of HIV infection is complicated by the presence of maternal antibodies passively transmitted through breast milk. Hence, virologic tests (rather than antibody tests) are used. (ICAP) There are a few types of virologic tests (detection of HIV by culture, DNA polymerase chain reaction and RNA assays), that allow the detection of HIV infection in most infected infants by the age of one month and many more that allow detection in almost all infected infants by age 6 months. Initial testing is recommended at 48 hours after birth because about 40% of infected infants can be identified at this time. (World Bank, *AIDS - Data*)

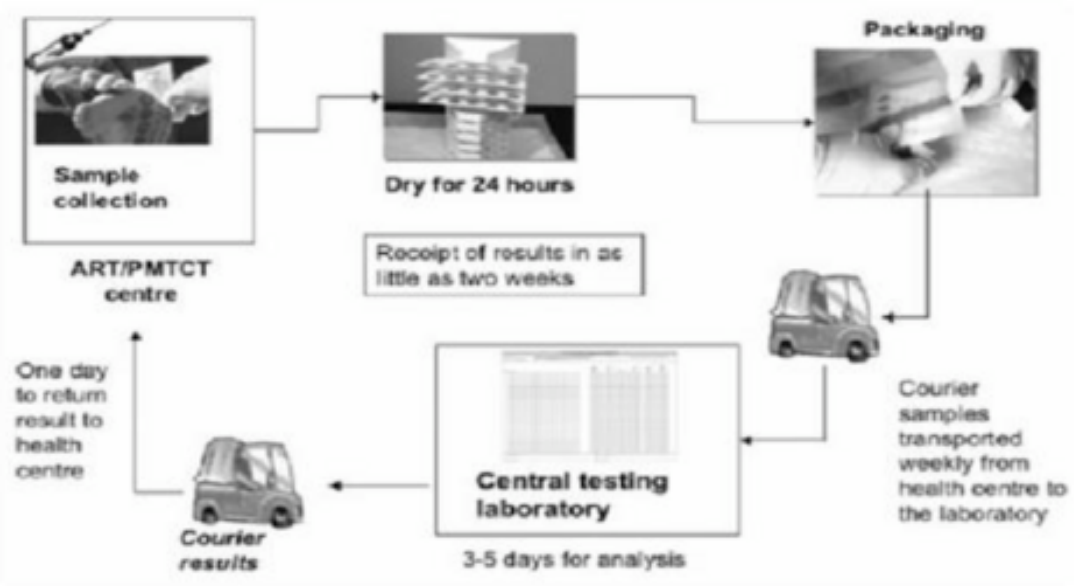


Figure 6. DBS and PCR Process in Kenya study of EID

As antibody testing cannot be used for infants, they receive a heel stick and blood spot test to determine if the virus if present in their blood. UNICEF recommends as a part of routine antenatal care package that infants be tested in the first two months of life. Seamless communication of results is essential to this early diagnosis and treatment but has been very challenging because there is no same day testing option (see Figure 6 for an example of the testing and reporting procedure).

5.2 Routine Care

Infants who are either HIV positive or HIV exposed should be carefully and continuously monitored, as they may not initially present symptoms. Once symptoms develop, infants can quickly deteriorate,

despite a normal CD4 count. Clinicians should bear this in mind and include HIV in every differential analysis. For those utilizing the Integrated Management of Childhood Illness (IMCI), there is a complimentary course which expands upon the existing IMCI training and framework. The objective of the course is to train health workers on pediatric HIV care at first-level health facilities by integrating HIV care with the IMCI clinical guidelines at first level. (WHO, *IMCI Complementary course on HIV/AIDS*) HIV positive or exposed infants should be given all immunizations as per the Expanded Programme for Immunization, including the pneumococcal and *Haemophilus influenzae* type B vaccines. Depending on a child's HIV staging, immunization schedules may have to be modified. (WHO, 2008)

5.3 Nutrition

A proactive approach to nutritional support in HIV-positive children is important. Infants and children infected with HIV will have increased energy needs (10% on average), and those with additional opportunistic infections will have even higher energy needs (25-30%). Energy needs can increase as much as 50-100% for infants and children recovering from weight lost due to co-infections. (WHO, 2009)

Nutritional assessments should be carried out for HIV-exposed and positive children just as they would be for any other child, taking into account weight, weight change and mid-upper arm circumference (MUAC), as compared to national or regional standards (WHO, 2009). Assessments should include access to food, care-giving practices, and possible drug-food interactions if the child is on ART. Those experiencing growth failure will require special support, such as counseling and education about food choices (and where appropriate, access for food programs), diagnosis of underlying illnesses, and evaluation of ART status (i.e. when to begin, the need to switch, etc.). (WHO, 2008)

5.4 Infant feeding, counseling and support

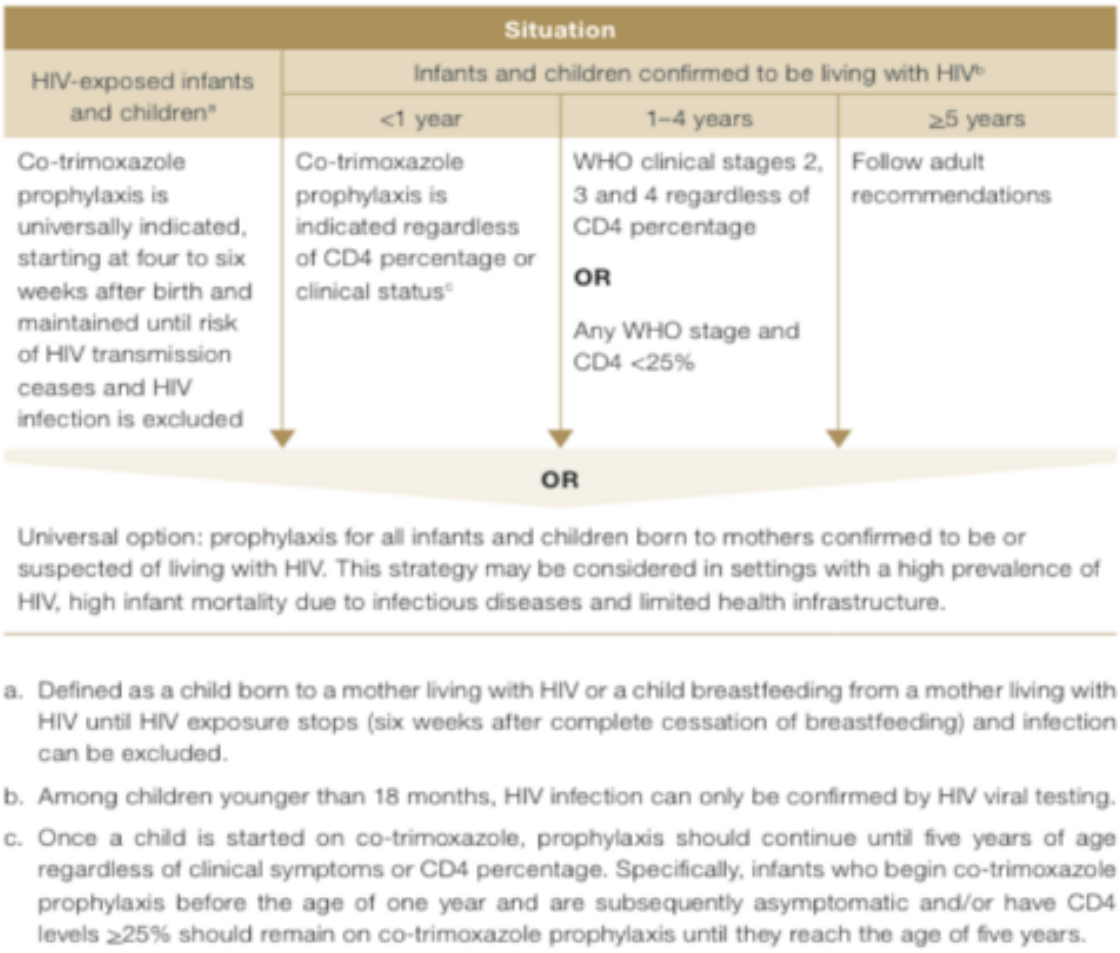
Breastfeeding reduces infant mortality and has health benefits that

extend into each child's adulthood. The best feeding method for an HIV-infected mother will depend on her health and living situation, such as whether she a compromised immune system, whether she is receiving ART, and whether she has reliable and consistent access to baby formula and clean water. The risk of transmission of HIV through breastfeeding increases with advanced maternal imunosupression, low CD4 cell count, high viral load, mixed feeding, and prolonged duration of breastfeeding. The WHO recommendations for breastfeeding are covered in the previous section (refer to Prevention of Mother-to-Child Transmission of HIV, Breastfeeding and Transmission).

5.5 Treatment

5.5.1 Co-trimoxazole Prophylaxis

WHO recommends that in areas with high HIV-prevalence, all HIV-exposed infants and children begin co-trimoxazole prophylaxis within four to six weeks of birth, continuing until at least six weeks after risk of HIV transmission (generally from breastfeeding), or definitive HIV exclusion (WHO, 2009). Figure 7 below illustrates who should receive co-trimoxazone prophylaxis and when it should begin.



a. Defined as a child born to a mother living with HIV or a child breastfeeding from a mother living with HIV until HIV exposure stops (six weeks after complete cessation of breastfeeding) and infection can be excluded.

b. Among children younger than 18 months, HIV infection can only be confirmed by HIV viral testing.

c. Once a child is started on co-trimoxazole, prophylaxis should continue until five years of age regardless of clinical symptoms or CD4 percentage. Specifically, infants who begin co-trimoxazole prophylaxis before the age of one year and are subsequently asymptomatic and/or have CD4 levels ≥25% should remain on co-trimoxazole prophylaxis until they reach the age of five years.

Figure 7. Initiation of Co-trimoxazole prophylaxis in infants and children (WHO, 2009)

5.5.2 Antiretroviral Therapy for Children

Currently, the median age of children beginning ART in developing countries is 5-9 years old. To better address the mortality of infants with HIV, the WHO recommends beginning all HIV-positive infants on ART, regardless of their CD4 count or WHO clinical stage. It also recommends that an infant or child falling into any of the categories below begin ART:

§Any child <18 months given presumptive clinical diagnosis of HIV.

§Any HIV-infected child between 12-24 months, regardless of CD4 count or WHO clinical stage.

§Any infant or child in WHO clinical stage 3 or 4, regardless of CD4 count.

§Any child between 24 and 59 months with a CD4 count of ≤750 cells/mm3 or %CD4+ ≤25, whichever is lower, irrespective of WHO clinical stage.

§Any child over the age of five years whose CD4 count is ≤350 cells/mm3 (as in adults), regardless of WHO clinical stage. (WHO, 2010)

There are many options for ART regimens, which vary by country, price and accessibility. The appendices of the WHO 2010 revision of the publication "Antiretroviral Therapy For HIV Infection In Infants And Children: Towards Universal Access" have 25 different regimens for infants and children, with different medications and combinations. When laying out these regimens, the formulation (liquid versus solid) was taken into account, as well as the use of scored tablets (many tablets have to be divided to provide the correct dose for a child; scoring allows for more accurate division), and it was recommended that morning and evening doses don't differ. (WHO, 2010)

5.6 Areas that need improvement

There are great disparities between pediatric and adult access to ART. About 37% of adults in need of ART in Africa are receiving it, while out of the 1.3 million children that need ART, only 28% of children access it. This is in part due to poor systems for patient retention, inability of health centers to provide pediactric ART, limited access to diagnosis and complicated drug regimens for children (WHO/UNICEF 2011).

6. Monitoring & Evaluation

Monitoring and evaluation are key components of programming to ensure constant program improvement, data collection for decision-making, and future project planning. M&E is especially important in resource poor settings as it can shine light on which programs are more effective than others. This information can lead to better use of donor funds and to increased access to care for those in need. Real world considerations demand that HIV/AIDS programs improve the lives of "beneficiaries" but also have the ability to prove that they have done this. Below are indicators for HIV/AIDS prevention and treatment programming for maternal and child health:

6.1 The UN Millennium Development Goals

Pregnant women
• Total number of ANC attendees
• # of women pretest counseled on PMTCT
• # who received results
• # of pregnant women who received ARV for PMTCT
• # of exposed infants who received ARV for PMTCT
Facility indicators
• Total number of facilities providing PMTCT by district
• Commodities supply chain and back up
Early infant diagnosis outcome/performance
• # of facilities offering early infant diagnosis
• # of exposed infants testing and received results using EID
• # of health workers trained in EID
Communization mobilization
• Sensitization of chief or head men in community
• Usage of media
• # of men tested for HIV
Human resources/training
• Two week National PMTCT training attendance
• PMTCT refresher course attendance
• PMTCT lay counselor training

The MDGs are ambitious agendas for reducing poverty and improving lives by 2015. These ambitious goals serve as an unofficial standard to measure the developmental success on a global scale. MDG #4 aims to reduce the under-five mortality rate by two-thirds, and MDG #6 sets the goal of halting HIV infection and begin to reverse the spread of HIV and AIDS. Current monitoring and evaluation has found that

there are still millions of people newly infected every year, mothers and children getting the blunt of the effect.

The new 201 WHO guidelines on PMTCT and breastfeeding, which were introduced in section 3.3, claims that "even in resource limited settings, with full implementation of the new recommendations and scale-up to universal access, nearly all new pediatric infections from MTCT can be prevented" (WHO, 2010). The truth to this claim is yet to be seen. Since even the simpler 2006 guidelines had difficulties being implemented in resource poor settings, it seems there is still room for better interventions to be introduced.

Some of the challenges of monitoring the progress of programs are the incomplete and inaccurate data collection of low-income and middle-income countries. To help improve the data collection, institutions such as ministries of health utilize communication technologies and enhancing health information systems. With improvements in these technologies systems, the can mean some of these challenges. However, it does not provide all of the solutions.

7. New developments and innovations

In low-income countries, many mothers and children in need of antiretroviral drugs never get them. One reason is that continuous follow-up of patients after an HIV positive test has been unrealistic as many never return to the clinic for subsequent steps of care. While stigma and resource limitations are major underlying reasons, innovative methods have emerged to begin to mitigate these program challenges and minimize the opportunity for loss to follow up. Three are discussed below.

7.1 The Mother-Baby Pack The Mother-Baby pack (MBP) is a take-home box of PMTCT drugs designed

for pregnant mothers who have limited access to conventional,

high-quality preventive care.

MBP aids in stopping the spread of HIV from mother to child. It provides the mother with full course of drugs on schedule, from pregnancy through breastfeed.

The pack combines highly effective antiretroviral drugs and prophylactic antibiotics for a pregnant woman and her newborn child from 14 weeks of pregnancy until six weeks after delivery. Health workers in antenatal clinics distribute the treatment packs to pregnant women who are living with HIV but do not yet need ARV treatment for their own health. The medicines are pre-measured according to WHO guidelines and color-coded packaged for administering the right combination of preventive drugs at the appropriate times. (UNICEF, 2011)

MBPholds high promises of expanding access to MTCT prevention and has been tried in Zambia, Kenya and Cameroon in addition to Lesotho. However, various issues of implementation had arisen prompting the halting of distributions in all the above counties except in Lesotho. During this time, the program is being reviewed to formulate country-specific program requirements for optimal implementation and appropriate monitoring and evaluation methods. For more on the status of MBP, click here.

7.2 SMS technology Mobile phone technology is a thriving tool in HIV/AIDS programs in developing countries. One area of significant importance has been in facilitation of infant HIV test results. In Mozambique, for instance, laboratories now enter test results onto a database that is uploaded to an online server that then transmits results back to health centers using wireless phone SMS technology. At the health centers, dedicated and especially designed printers receive small receipt-like print outs containing the results along with patient identification. (African Press, 2010)

Previously, such tests on average took three weeks, and up to several months. This technology currently allows receipt of results in about three days. The major improvement has allowed

initiation of antiretroviral treatment about 4 months earlier, crucial in maintaining the health of the infant. Similarly, the number of infants starting treatment has increased by 60%. (African Press, 2010)

Another use of SMS technology in PMTCT program improvement has been its use in the work of a network of mentor mothers under the organization Mothers2Mothers (m2m) who provide education and support for pregnant women and new mothers living with HIV/AIDS. The pilot program of active client follow-up completed in Zambia and Malawi worked to support and encourage mothers to keep key PMTCT appointments at health care facilities through pre-appointment SMS along with support through home visits. Mothers who miss important PMTCT appointments were also followed-up using the same methods to help them resume their care. (Maternal Health Task Force, 2011) Click here for a series on the active client follow-up initiative by m2m.

7.3 Point-of-care CD4-count equipment CD4 cell depletion is the hallmark of AIDS and hence CD4 count is crucial information in determining the initiation of antiretroviral treatment. The standard method for CD4 tests requires complex equipment and skilled technicians, often involving off-site transport of specimen or patient referral in resource-limited settings. Many patients are lost to follow-up in this juncture because of time and money constraints or distance to access testing until they fall ill. (Jani, 2011 and NAM)

A simple-to-use, fast, cheap and effective equipment, Alere's PIMA, has

recently been developed and allows for the determination of CD4 cell count at the initial point-of-care when an individual receives an HIV positive test. Watch this video for an illustration of how the PIMA machine works. This makes the initiation of timely treatment possible for those in need. In health clinics in

Mozambique, the utilization of this equipment resulted in decrease of patient loss to follow-up before obtaining CD4 test from 57% to 21%. (Jani, 2011) Such point-of-care CD4 test is being used in Mozambique and in mobile clinics in Southern Africa, with widespread introduction is expected within the next two years. (NAM, 2011).

8. Conclusion

The HIV/AIDS pandemic of the 21st century continues to remain bleak, surpassing its solutions and creating a multi-dimensional challenge that is difficult to grasp. The epidemic remains extremely dynamic; it is continuously changing its attributes just as the virus exploits new opportunities for transmission. Despite the strong political, social, and financial commitments that have generally increased over the course of the epidemic, the number of new infections remains high and still outweighs the number of people who receive treatment. Women and children have disproportionately been affected by the disease. There has been a powerful and collective commitment to battle this disease and support the necessary programs to reduce disease transmission. New treatment and preventive mechanisms, such as microbicides, shows significant promise. However, the behavioral root cause for infection still has many challenges; innovative interventions must be introduced to overcome the many financial, logistical, and cultural barriers to prevention and treatment.

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