Is Breast Not Best? Feeding Babies Born to HIV-Positive Mothers: Bringing Balance to a Complex Issue
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Breastfeeding prevents millions of infant deaths each year throughout the world but causes at least one-third of all pediatric HIV infections. The first randomized trial of breastfeeding versus formula feeding, reported from Nairobi in March 2000, demonstrated an improved outcome for babies of highly selected HIV-positive mothers assigned to formula feed. However, several conditions must be in place and accepted before such replacement feeding can increase HIV-free survival. The proportion of sub-Saharan African women who have access to and will accept these conditions is small. In the short term, efforts to make breastfeeding safer will probably benefit a greater number of African babies.

Introduction

Surely one of the most poignant tragedies of the HIV pandemic is this: whereas breastfeeding prevents an estimated 6 million infant deaths each year throughout the world, it also results in 200,000–300,000 infant HIV infections. (An estimated 620,000 children became infected with HIV in 1999 and of these, 1/3–1/2 are estimated to have been infected during breastfeeding.) Furthermore, the first 6 months of life, when breastfeeding is most critical to preventing infant deaths and breastfeeding is associated with a two- to tenfold higher risk of infant death in many developing countries, is the same period when the majority of breastfeeding-associated HIV transmission probably occurs.

This paper will review the paradigm shift regarding infant feeding in the context of the HIV epidemic from 1985—when the first case of breastfeeding-associated transmission was reported—up to and focusing on the first published randomized breastfeeding versus formula feeding trial from Kenya in 2000, which confirmed that mother-to-child transmission (MTCT) of HIV during breastfeeding can be substantial. We will then examine the delicate balance between the life-saving benefits and the HIV infection risks of breastfeeding for babies born to HIV-positive women in Africa. The factors that are likely to determine the net balance of these opposing risks for an individual baby will be explored. Finally, we will estimate the number of HIV-positive African women for whom the Kenyan study results are likely to be applicable.

Chronology of the Breastfeeding Transmission of HIV Problem

The first case of MTCT of HIV during breastfeeding was reported in 1985. This report, based on a breastfeeding mother who had been infected with HIV soon after delivery by way of an infected blood transfusion, established that it is biologically possible for HIV to be transmitted from mother to baby via breastfeeding. This was quickly confirmed by other case reports mostly of breastfeeding mothers who were at low risk for HIV infection and who were presumed HIV-negative until they received an infected blood transfusion soon after delivery. Many authors suggested that breastfeeding shortly after maternal seroconversion may represent a special high-risk situation; this is because the viral load in milk probably parallels the peak viremia associated with primary infection. It was therefore thought that this risk should not be extrapolated to lactating women with previously established HIV infection, who, globally, made up the vast majority of HIV-positive breastfeeding women. Because these cases demonstrated a theoretical risk for previously infected women, however, the U.S. Centers for Disease Control and Prevention immediately recommended that known HIV-positive women avoid breastfeeding. Other industrialized countries soon followed suit.

From the late 1980s to the mid-1990s, data steadily accumulated from studies comparing infection rates of babies born to HIV-positive mothers who had self-selected breastfeeding or formula feeding. Though two studies reported similar rates of MTCT for breastfed and formula-fed infants, the majority observed excess rates of in-
fection ranging from 12% to 46% among the breastfed compared with the formula-fed babies.23-31 Six of these studies were included in a meta-analysis published in 1992 that estimated the average excess risk of MTCT attributable to breastfeeding by women with established HIV infection to be 14%.32 Among women seroconverting during lactation, the estimated risk was twice that, namely 29%. These figures became the most frequently cited estimates on this issue for the remainder of the decade.

In 1987 and 1992, the World Health Organization published consensus statements recommending that, "where the primary causes of infant deaths are infectious diseases and malnutrition...breastfeeding should remain the standard advice to pregnant women, including those known to be HIV infected." The recommendation continued, however, that, "where infectious diseases are not the primary causes of death during infancy, pregnant women known to be infected with HIV should be advised not to breastfeed but to use a safe feeding alternative for their babies."

Though this policy was meant to recommend the feeding option that would result in the greatest probability of HIV infection-free survival for babies in each environment based on evidence available at that time, it was often viewed by developing country authorities as a "double standard" and the issue became highly emotive and polarized. One breastfeeding expert wrote in The New England Journal of Medicine in 1992, "The role of breastfeeding in the transmission of HIV-1 remains doubtful and at worst minuscule,"33 whereas in the same year an HIV expert pointed out that, "...nine cases that strongly suggest transmission of HIV-1 through breastfeeding have been described...careful, large-scale, prospective cohort studies...are of the utmost priority."34 Between 1994 and 1997, four carefully analyzed prospective cohort studies were published. All estimated the excess risk of HIV transmission attributable to breastfeeding as ranging from a minimum of 4% to a maximum of 22%, depending on how infants were classified.35-38 This stronger evidence led to a major shift in policy of the relevant United Nations organizations (WHO, UNICEF, and UNAIDS), who jointly published revised recommendations in 1997 and 1998.39-42 These recommendations acknowledged that more than one-third of all pediatric HIV infections were acquired during breastfeeding and that if (but only if) babies of HIV-positive mothers could be ensured uninterrupted access to nutritionally adequate, safely prepared breast milk substitutes, they would be at less risk of illness and death. The reports recommended that women have access to testing and counseling and "be empowered to make fully informed decisions about infant feeding."

Over the past couple of years, formula feeding has become the standard for babies of HIV-positive women in some intermediate-economy countries (Thailand, Brazil, and some parts of South Africa). This is not the case in the rest of sub-Saharan Africa, however, which is home to more than 10.6 million HIV-infected women of reproductive age (two-thirds of the global total). These women experience a gross national product of $US375 (roughly equivalent to the cost of a 6-month supply of infant formula), an infant mortality rate of 100/1000 live births, and 45% do not have access to safe water. Most of these women have not had access to HIV testing, let alone information or resources enabling them to make and implement "fully informed decisions about infant feeding."

### The Role of "Exclusive" Breastfeeding, Breast Pathology, and Other Practices

In 1999, a seemingly paradoxical study was published from Durban, South Africa.43 HIV-positive women who chose to breastfeed were counseled to do so exclusively—giving nothing at all except breast milk for up to 6 months, at which point they were counseled to wean rapidly. Transmission rates at 3 months of age among infants who received exclusively breast milk, exclusively formula, and mixed feedings were 14.6%, 18.8%, and 24.1%, respectively. The rates for exclusively breastfed and exclusively formula-fed infants were not statistically different, but the difference between exclusive breastfeeding and mixed feeding was large (a 48% reduction in risk of transmission after adjustment for potential confounders) and significant (p

* These estimates are based on gross national product (GNP), infant mortality rate (IMR), and access to safe water data reported in The State of the World's Children, 2000, UNICEF, and the estimated number of HIV-positive women by country reported in UNAIDS 2000.2 To approximate the average GNP relevant to all HIV-positive women in the region, the number of HIV-positive women living in each of the 44 countries was multiplied by the GNP for that country; these products were summed across all 44 countries and divided by the total number of HIV-positive women in the region. Roughly approximate an average IMR, which would be relevant to the children of all HIV-positive women in the region, the number of HIV-positive women living in each country was multiplied by the IMR for that country; these products were summed across all 44 countries and divided by the total number of HIV-positive women in the region. To estimate the proportion of HIV-positive women in the region with access to safe water, the number of HIV-positive women was multiplied by the percentage of the population with access to safe water. The products were summed and divided by the total number of HIV-positive women in the region. The values reported in the text exclude South Africa because its relatively high GNP and low IMR reflect bimodal distributions rather than being representative of the average person in the population. Including South Africa, the estimates were that 12.94 million HIV-positive women living in sub-Saharan Africa (82% of the global total) have an average GNP of $US879 and an average IMR of 93/1000, and 45% do not have access to safe water.
was associated with higher viral loads in breast milk and high sodium content in breast milk, first suggested to be a risk factor for breastfeeding-associated transmission. All of these women showed that sodium content of breast milk can be minimized by practicing good lactation management, which reduces engorgement, mastitis, and nipple disease.50 This corroborated an earlier case report of a breastfed infant who became infected soon after his HIV-positive mother developed a breast abscess.49 These findings suggested that breast pathology may be an important risk factor for breastfeeding-associated HIV transmission. A more recent study among HIV-negative Bangladeshi women showed that sodium content of breast milk can be reduced by practicing good lactation management, which minimizes engorgement, mastitis, and nipple disease.50 This intervention has not yet been formally evaluated among HIV-positive lactating women. Sembä’s work was also the first to document that high viral load of breast milk is associated with higher transmission rates.44 Because we know that unprotected sex can reinfect HIV-positive women and increase plasma viral load, it makes sense that practicing safe sex during the breastfeeding period may limit milk viral concentrations, and thereby reduce breastfeeding-associated transmission. All of these studies44-50 indicated that we could no longer think only about “ever” versus “never” breastfed babies when considering the risk of postnatal MTCT transmission of HIV. Weaning patterns, breast pathology, latching and positioning during breastfeeding, and maternal sexual practices may all influence this risk.

**Nairobi Randomized Trial of Feeding Method**

The cohort studies followed women who self-selected their infant feeding method. Though care was taken to control for baseline differences in all studies, and the consistency between them strengthened their conclusions, several writers suggested over the years that only a randomized controlled trial of breastfeeding versus formula feeding would provide an unbiased estimate of the risk of transmission through breastfeeding. In 1992, Dr. Ruth Nduati and colleagues in Nairobi, Kenya started such a trial. It was completed in 1998 and the long-awaited results were published in March 2000.8 A total of 16,529 pregnant women were screened for HIV and 2315 (14%) were identified as HIV-positive. Of these, 425 (18% of the HIV-positive women identified) returned for their test results and agreed to join the trial. The two major reasons for women declining to join were unwillingness to be randomized to formula feeding and plans to leave Nairobi after delivery.

The authors did an impressive job of successfully meeting the many ethical challenges of such a study. One of the ways they did this was by setting stringent criteria that would limit the risk of infant illness owing to not breastfeeding among those randomized to formula feeding. For example, only women with access to municipal water were enrolled. The study population was therefore “highly selected,” of ethical necessity. All women received extensive counseling by a study physician on MTCT and the relative risks and benefits of breastfeeding and formula feeding. Participants were described as being of lower socioeconomic status, but were relatively well educated (mean 8 years schooling). They were enrolled and randomly allocated to formula feeding or breastfeeding at approximately 32 weeks gestation.

Women in the formula feeding arm were instructed in safe formula preparation, and in a subsequent visit were asked to demonstrate their skills. Key tasks included use of boiled water in mixing formula and feeding by cup rather than by bottle. Free dried milk commercial infant formula was provided for the first 6 months of life. The authors reported no special feeding instructions for the mothers in the breastfeeding group. Home visits were conducted at 2 weeks postpartum and then as needed. Mother-baby pairs were followed up monthly for the first year and quarterly for the second year, and given free clinical care. HIV

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*There is some support for the South African findings in a preliminary report from Kenya.*46 In this study, infants born to HIV-positive mothers who started mixed feeding before 30 days had an incidence rate of HIV infection twice that of those who started after 30 days. The significant reduction in breastfeeding-associated HIV infection rate was also found in those who delayed mixed feeding until after 120 days as compared with those who started mixed feeds before that age. These authors addressed the question of reverse causality by relating maternal CD4 counts (as a measure of mother’s stage of HIV disease) to the age at which mixed feeding was started, and found there was no relationship.
was diagnosed in infants by DNA–polymerase chain reaction on blood taken at birth, 6 weeks, 14 weeks, and every 3 months thereafter until 24 months of age. Intention to treat analyses were carried out to calculate MTCT rates, timing of transmission, mortality rates, and infection-free survival rates using a sophisticated method for estimating joint distribution of death and HIV-1 infection.

The key findings of this study were:

(1) At 24 months, 36.7% of breastfed compared with 20.5% of formula-fed infants were HIV-infected, representing a 16.2% excess risk of transmission in the breastfeeding arm. Most of this excess transmission occurred early. Sixty-three percent, 75%, and 87% of the overall difference had already occurred at 6 weeks, 6 months, and 12 months, respectively. Thus, this study confirmed the findings of many observational studies: breastfeeding can nearly double the risk of MTCT and early breastfeeding carries the greatest risk.

(2) Mortality at 24 months was high in both groups: 244/1000 and 200/1000 in the breastfeeding and formula feeding group, respectively. In the first 6 weeks of life, mortality among all children was four times greater among the formula-fed children compared with the breastfed children ($p = 0.06$). The point estimates for cumulative mortality continued to be higher in the formula-fed group compared with the breastfed group (though not statistically different) until 12 months of age, when mortality among the breastfed babies began to exceed that of the formula-fed babies (differences were again not statistically significant). A recent analysis showed that among children who were HIV-negative, those in the formula group were six times more likely to die in the first 6 months of life compared with those in the breastfeeding group (5% of the formula-fed babies versus 0.8% of the breastfed babies died). Thus, this study also confirmed decades of work demonstrating that not breastfeeding is associated with substantial risk of death, especially for the youngest babies.

(3) HIV-free survival was greater at 24 months in the formula-fed group compared with the breastfed group (70% versus 58%). This calculation shows that, in this study population the balance of risks favored those in the formula group.

(4) Compliance with the formula arm of intervention (defined as complete avoidance of breast milk) was 70%. Compliance with the breastfeeding intervention (defined as any use of breast milk) was 96%.

Under the conditions of this study, therefore, formula feeding nearly halved MTCT of HIV and increased HIV infection–free survival by 12%. These benefits are substantial and immediately beg these questions: Will formula feeding, or more generally, replacement feeding, result in a better outcome for all HIV-positive women in developing countries (more than 80% of whom live in sub-Saharan Africa)? How stable is the risk-benefit ratio observed in Kenya when applied to other diverse circumstances prevailing in sub-Saharan Africa?

Factors Important in the Balance of Risks and Benefits

Unquestionably, the risk of MTCT of HIV through breastfeeding is zero if HIV-positive mothers strictly avoid breastfeeding. The dilemma is that replacement feeding places babies at greater risk of dying from other infections even though it protects them from HIV infection. Several mathematic models have been developed in attempts to estimate these opposing risks. Whereas their assumptions vary, the models show that whether replacement feeding will increase or decrease HIV infection–free survival among infants of HIV-positive mothers is sensitive to the following key variables:

R: Relative Risk of Death Attributable to Not Breastfeeding

In a recent meta-analysis of data from three countries, $R$ was calculated as the pooled odds ratio for the relative risk of death among infants not breastfed compared with those breastfed. In this study, infants who were not breastfed were 1.9, 3.2, and 7.9 times more likely to die during infancy in the Philippines, Brazil, and Pakistan, respectively. $R$ is sensitive to infant age, maternal education, and access to safe water. In the meta-analysis, $R$ declined steadily with age: it was 5.8, 4.1, 2.5, 1.8, and 1.4 for <2 months, 2–3 months, 4–5 months, 6–8 months, and 9–11 months, respectively. Maternal education was also highly associated: for mothers in the lowest tertile of maternal education (roughly equivalent to 0–5 years of schooling), $R$ was more than twice that of mothers in the second and third tertiles. Earlier research in Malaysia showed that $R$ is doubled for households without access to tap water and toilet facilities compared with those with access to these facilities.

As $R$ increases, the relative risk of replacement feeding and the relative benefit of breastfeeding increase. Fac-
tors that reduce, or are likely to reduce $R$ include access to safe water, uninterrupted supply of infant formula or animal milk, intensive counseling and skills training with follow-up in the home regarding preparation and delivery of replacement feedings, good hygiene, a supportive home environment, and frequent, conscientious, and affordable clinical follow-up with early intervention for growth faltering and illness.

**IMR: Infant Mortality Rate**

In the models, the factor $R$ is multiplied by IMR. Accordingly, for a given $R$ the absolute number of deaths owing to not breastfeeding increases as IMR increases. Thus, the $R$ that will shift the net balance toward favoring breastfeeding will be lower in countries with a high IMR compared with countries with a low IMR. Kenya has a moderate IMR ($\approx 75$ deaths/1000 live births), which is one-third to one-half that of many African countries.

**T: Risk of Transmission Attributable to Breastfeeding**

The Nairobi trial estimated $T$ to be 16.2%. As $T$ increases, the relative benefits of formula feeding and the relative risks of breastfeeding increase for babies of HIV-positive women. Over the past couple of years, more attention has focused on identifying practices that are likely to reduce $T$. These include exclusive breastfeeding, practice of safe sex during the breastfeeding period, good lactation practice, avoidance of breastfeeding during breast disease, and limiting duration of breastfeeding.

Therefore, formula feeding resulted in higher HIV-free survival compared with breastfeeding for the babies in the Nairobi study population of HIV-positive women for whom intensive effort was made to reduce $R$ (e.g., selecting relatively well-educated women who had access to safe water; provision of free, frequent clinical monitoring and intervention when needed; and provision of free formula), and amongst whom IMR was moderate, but for whom few inputs were made to minimize the excess risk of transmission by breastfeeding $T$.

Several models indicate that the balance of risks and benefits of replacement feeding by HIV-positive mothers is sensitive to small changes in $R$, IMR, and $T$. In the highly selected Kenyan study population, we might assume that $R$ was less than 2.0 during the first 12 months of life (the value reported for the Philippines in the multicenter study cited above\(^4\)). Because Kuhn’s model estimates that with an IMR of 75/1000 and a $T$ of 16.2%, replacement feeding would increase net infant mortality for babies of HIV-positive mothers only when $R$ exceeds 3.5,\(^3\) it is not surprising that formula feeding resulted in higher HIV-free survival compared with breastfeeding for the babies in that situation. However, an $R$ greater than 3.5 is common in developing countries (e.g., in Pakistan $R$ was 7.9 during the first 12 months of life). Likewise, as IMR increases, Kuhn’s model indicates that lower $R$s would shift the balance. For example, if IMR is $>100$, the net balance would favor breastfeeding when $R$ exceeds 2.8. Moreover, when IMR is $>160$, $R$ would only have to be 2.1 for the risk of replacement feeding to surpass the risk of breastfeeding by HIV-positive women. Finally, Kuhn’s analysis shows this risk-benefit ratio is sensitive to small changes in $T$. Holding IMR constant at 75/1000, as $T$ decreases from 16.2% to 14% to 7%, the critical $R$ above which replacement feeding increases infant death decreases from 3.5 to 3.1 to 2.1. Thus, if the more recently identified factors to reduce $T$ are effective, babies in fewer and fewer situations would benefit from replacement feeding compared with breastfeeding.

**For How Many Women Are the Nairobi Results Valid?**

As a first step in estimating the number of HIV-positive African women to whom the Nairobi results might be relevant, we estimated the number who are likely have a similarly low $R$ based on access to safe water and literacy. Of the nearly 13 million HIV-positive women of reproductive age living in sub-Saharan Africa, 55% (7.2 million) have access to safe water and nearly the same number (7.1 million) are literate.\(^4\) They are no doubt mostly the same women. Therefore, replacement feeding might be favorable for roughly 7 million babies if factors to minimize $R$ are put in place (as they were carefully implemented in the Nairobi study) and if women accept and comply with these interventions.

The first assumption requires huge resources and ingenuity. The second assumption is more difficult to estimate: what proportion of these 7 million women will be willing to learn their HIV status, disclose it to others, prepare and feed the replacement feeding safely, limit rural travel so they can attend frequent medical care and access replacement feedings, and have husbands and other close family members who will support them in this process? In the Nairobi study, 18% of the identified HIV-positive women agreed to know their HIV results, stay in Nairobi where they could access formula supplies, counseling,

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\(^4\) These estimates are based on access to safe water and female literacy rates reported in The State of the World’s Children, 2000, UNICEF,\(^4\)\(^4\) and the estimated number of HIV-positive women by country from UNAIDS, 2000.\(^2\) For each of the 44 countries in sub-Saharan Africa, the reported number of HIV-positive women was multiplied by the percentage of the population with access to safe water. The products were summed to obtain a rough estimate of the number of HIV-positive women in the region with access to safe water. Similarly, the female literacy rate in each country was multiplied by the number of HIV-positive women in that country and the products were summed to obtain a rough estimate of the number of literate HIV-positive women in the region.
and clinical follow up, and said they would be willing to formula-feed if they were randomized to that arm of the study.

Why was this proportion so low? The proportion of antenatal women willing to be tested and told their HIV status varies greatly across African settings, but is frequently low.7 Frequent travel between rural and urban homes and being away from an urban setting for prolonged periods (e.g., planting or harvesting times) is the norm for most African populations. Finally, breastfeeding is universal in most of Africa; not breastfeeding may label a woman as being HIV-positive, as having an evil spirit, or as being sexually promiscuous and unfaithful to her husband.38 Thus, it is not surprising that only 18% of the screened HIV-positive women in Nairobi agreed to comply with these conditions. Applying the 18% acceptance rate to the 7 million women with adequate education and safe water implies that replacement feeding will increase HIV infection-free survival for 1.3 million babies (approximately 10% of all babies born to the 13 million HIV-positive African women). Of course an 18% acceptance rate for a research study does not necessarily translate into the same figure for a program. This figure could well be increased in the medium to long term by social marketing and other techniques aimed at reducing the stigma associated with being HIV-positive and increasing husbands’ support of their wives and participation in the process of HIV testing, counseling, and decision-making. These interventions must be pursued vigorously so that a greater number of babies of HIV-positive mothers will be in a position to benefit from replacement feeding.

It is critical to understand that this discussion is not just a description of how hard it is to put these programs in place—the answer to that would be to work harder. This is an estimate of how many of these mothers will not be able to comply with the conditions that will make replacement feeding favorable; it is an estimate of the number of babies whose chance of HIV infection-free survival would be better if they were breastfed, even though their mothers are relatively educated and have access to safe water.

Compliance with “Exclusive” Feeding: A Core Issue

The findings from South Africa suggest that mixed feeding is twice as risky as either exclusive replacement feeding or exclusive breastfeeding. If these findings are confirmed, and in situations where minimum maternal education, access to safe water, uninterrupted supply of replacement feeding, and accessible clinical care are in place, counseling sessions with an individual HIV-positive mother should focus on helping her decide with which mode—exclusive replacement feeding or exclusive breastfeeding—she is most likely to comply. Both of these “exclusive” feeding modes have proved difficult to implement. Of the “highly selected” women in the Nairobi study who were randomized to the formula feeding arm, received intensive counseling to avoid breastfeeding, and initially agreed to comply with the study protocol, 30% admitted to partially breastfeeding. Given all the social constraints not to replacement feed in Africa, the pressure to breastfeed, even occasionally or for a short time, can be intense for some women. In our work in Zimbabwe, some women have told us that they formula-feed in private, but breastfeed in public. Anecdotal reports from some of the MTCT pilot projects offering antiretroviral drugs and free infant formula suggest that many women accept the formula, but then also breastfeed.

On the other hand, exclusive breastfeeding is also not the norm in most of the world, including Africa. In 1999, 38.6% of Zimbabwean infants ages 0–3 months and 7.9% of those ages 4–6 months were exclusively breastfed.60 In KwaZulu Natal, nearly half of the mothers in a longitudinal study of infant feeding had supplemented breast milk within 48 hours of delivery, mostly because of perceived “insufficient breast milk.”61 However, programs to promote exclusive breastfeeding have been moderately successful. In a peri-urban community in Mexico, antenatal and postnatal visiting by peer counselors increased exclusive breastfeeding at 3 months from 12% to 67% (p <0.001).61 In Bangladesh, home-based counseling by peer counselors (local mothers who had received 10 days training) increased the prevalence of exclusive breastfeeding at 5 months from 6% to 70%.62

It is perhaps more than a coincidence that the compliance figures for exclusive formula feeding in Nairobi and exclusive breastfeeding in Mexico and Bangladesh are remarkably similar (=70%). Mixed feeding is a hard practice to break. It may be, however, that acceptance of exclusive breastfeeding by African communities will not involve the quantum cultural jump required for exclusive formula feeding.63 Work is underway in several settings to better understand if this is so.

Through most of this paper we have considered the risk benefit balance for the 55% (=7 million) of all HIV-positive African women who are literate and have access to safe water, assuming these to be the absolute minimal conditions before replacement feeding could provide benefit. We have shown that for these women, the risk-benefit ratio is very tightly balanced, such that it will vary from one woman to the next, even within the same community. For the remaining 45% (=5.8 million) of HIV-positive women in sub-Saharan Africa who do not have safe water and/or minimal maternal education, it will be the rare woman who will meet the criteria necessary for formula feeding to save lives. This is not to say that these unusual individual women should not be provided with all the information, support, and resources the community, both local and international, can provide. At a public health level, however, inputs to reduce T will probably be more effective in im-
creasing HIV infection–free survival of these women’s babies.

In Zambia and Zimbabwe, a package of four practices called “Safer Breastfeeding” is being taught to HIV-positive women who choose to breastfeed following individual counseling, as well as HIV-negative women and women who choose not to know their HIV status. This package includes education regarding exclusive breastfeeding to 4–6 months followed by rapid weaning, proper positioning and latching during breastfeeding, seeking medical care quickly for breast problems or when infants have oral lesions, avoiding breastfeeding from an affected breast, and practicing safe sex during the breastfeeding period.

Conclusion

It is clear that:

Babies of HIV-positive mothers who are breastfed are substantially more likely to be infected with HIV than those who are replacement-fed.

Even among highly selected African mothers who are relatively well educated, have access to safe water, have access to free, frequent, and careful clinical care, and have access to free medications for illness and free commercial infant formula, the mortality risk associated with replacement feeding is substantial.

The balance of risk versus benefit is finely placed for mothers in sub-Saharan Africa, the area of the world where the HIV epidemic is currently most fierce. As health policy makers and clinicians, we must first clearly acknowledge that none of the available feeding modes for babies of African HIV-positive women are great—none are devoid of risk. With humility we must help each HIV-positive woman to decide which of the available, albeit imperfect options holds the greatest chance of her baby staying HIV-negative and alive. Very importantly, we must then intensively support her as she implements her choice.

It is probable that:

Intense input to support exclusive replacement feeding at community, health service, and individual levels could make it significantly safer for more babies born to HIV-positive African women.

Intense input at the same levels to support “safer breastfeeding” practices could make breastfeeding significantly safer for babies born to HIV-positive African women.

In the short term, efforts to make breastfeeding safer will benefit many more African babies than efforts to make replacement feeding safer.

Countries, ministries of health, clinics, individual health workers, and most importantly, individual mothers will have to decide where the balance of benefit lies. The complexities of the issues are such that the time of simplistic poster messages (“Breast is best” or “Formula for ALL babies of HIV-positive mothers”) is past. Finally, these difficult decisions will have to be reviewed repeatedly as new data are reported.

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* “Abrupt” weaning is still a controversial concept. There is as yet no research to support or refute it. It hinges on the theory that the reason why mixed-feeding is associated with the highest rates of MTCT of HIV is because non-breast milk feedings in some way damage gut epithelium and thus promote the establishment of HIV infection if infected breast milk is ingested during the same period. Thus it appears logical to avoid any “mixing” of feeds, including during the period of weaning. However, the finding in several studies that the majority of breastfeeding-associated transmission occurs in the first 6 weeks of life may mean that it is at this time that mixed-feeding is particularly risky. This is consistent with the pediatric perception that the neonatal gut is more vulnerable than that of an older infant. If this is so, a short period of mixed feeding at approximately 6 months (i.e., "rapid" weaning) may prove to add an insignificant degree of risk.
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32. Daar ES, Moudgil T, Meyer RD, Ho DD. Transient high levels of viremia in patients with primary human immunodeficiency virus type 1 infection. N Engl J Med 1991;324:961-4


40. Ryder RW, Manzila T, Baende E, et al. Evidence from Zaire that breast-feeding by HIV-1-seropositive mothers is not a major route for perinatal HIV-1 transmission but does decrease morbidity. AIDS 1991;5:709-14


45. Bobat R, Moodley D, Coutoʾsoudis A, Coovadia H. Breastfeeding by HIV-1-infected women and outcome in their infants: a cohort study from Durban, South Africa. AIDS 1997;11:1627-33


63. Coutsoudis A. Promotion of exclusive breastfeeding in the face of the HIV pandemic. Lancet 2000;356:1620–1