Kenya Infant Feeding Assessment

Eastern and Western Provinces

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Infant & Young Child Nutrition Project

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1800 K Street NW, Suite 800
Washington, DC 20006 USA
Tel: (202) 822-0033
Fax: (202) 457-1466
www.path.org
www.iycn.org

Contact Information

Kiersten Israel-Ballard, DrPH
Study Principal Investigator
Senior Program Officer
Maternal and Child Health/Nutrition Global Program
PATH
1455 NW Leary Way
Seattle, WA 98107
USA
Tel: 206.285.3500 Fax: 206.285.6619
kisrael-ballard@path.org

Margaret Waithaka
Kenya Principal Investigator
Senior Program Officer
PATH
A.C.S. Plaza, 4th floor
Lenana and Galana Road, PO Box 76634
Nairobi 00508
Kenya
Tel: (254-20) 3877.177 Fax: (254-20) 3877.172
mwaithaka@path.org

Ted Greiner, PhD
Study Co-investigator
PATH Research Consultant
Professor of Nutrition
College of Human Ecology
Hanyang University
17 Haengdang-dong, Seongdong-gu
Seoul 133-791
South Korea
tedgreiner@yahoo.com

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Acronyms

AFASS	acceptable, feasible, affordable, sustainable, and safe
AIDS	acquired immunodeficiency syndrome
ANC	antenatal care
APHIA II	AIDS, Population and Health Integrated Assistance Program
ART	antiretroviral therapy
BFHI	Baby Friendly Hospital Initiative
EGPAF	Elizabeth Glaser Pediatric AIDS Foundation
HIV	human immunodeficiency virus
IMCI	integrated management of childhood illnesses
IEC	information, education, and communication
IYCF	infant and young child feeding
MCH	maternal and child health
MTCT	mother-to-child transmission
MUAC	mid-upper arm circumference
PATH	Program for Appropriate Technology in Health
PEPI	post-exposure prophylaxis
PEPFAR	President’s Emergency Plan for AIDS Relief
PMTCT	prevention of mother-to-child transmission
SD	standard deviation
WFA	weight for age
WHO	World Health Organization

Executive Summary

In developing countries, the rate of mother-to-child transmission of HIV can be as high as 40%, with prolonged breastfeeding of up to 24 months accounting for one-third to one-half of these infections. The risk of HIV transmission from breastfeeding must be balanced against the benefits of breast milk's protective immunological and nutritional properties, which are often lifesaving in resource-poor communities lacking in safe water and consistent availability of replacement milk and food. Numerous studies have shown that replacement feeding of HIV-exposed infants results in higher rates of morbidity and mortality in infants from non-HIV causes compared to infants who were breastfed. In light of these findings, the World Health Organization (WHO) recommends that HIV-infected mothers should breastfeed exclusively for 6 months unless replacement feeding is acceptable, feasible, affordable, sustainable, and safe (AFASS), in which case avoidance of all breastfeeding is recommended.

For mothers who choose to breastfeed, the eventual transition to replacement feeding has been shown to be a period of high risk. Recent studies suggest that rapid cessation of breastfeeding at 6 months is associated with increased risk of malnutrition, stunting, and morbidity and mortality from diarrhea. In 2006, WHO revised its guidelines to emphasize that cessation of breastfeeding should occur at 6 months *only* if an assessment shows that the AFASS criteria are met and a nutritionally adequate and safe diet can be provided and maintained. Field reports suggest that in many countries there is a high level of confusion among health care workers regarding appropriate recommendations and counseling practices, resulting in mixed messages being given to mothers.

Although data identify the transition period to replacement feeding to be one of high risk to the infant, little research has been done to adequately evaluate HIV-infected mothers' experiences as they stop breastfeeding and the associated impact on their children. In light of this gap in knowledge, PATH conducted a public health evaluation in the Western and Eastern Provinces of Kenya to assess infant feeding practices and counseling, specifically focusing on this transition period. The objectives of this study were three-fold: (1) to assess the clinic-based counseling practices regarding HIV and infant feeding, (2) to describe the infant feeding practices and infant health of HIV-exposed infants during the time they were stopping breastfeeding (defined as "weaning" for this study), and (3) to identify the experiences of HIV-infected mothers during this transition period.

Methods

This cross-sectional study, launched in May 2008, targeted HIV-infected women at clinics for prevention of mother-to-child transmission (PMTCT) or maternal and child health clinics and included 285 quantitative in-depth interviews (including infant weight and mid-upper arm circumference [MUAC] measurements) with mothers of infants who had stopped breastfeeding, 80 brief post-counseling exit interviews, and 22 observations of PMTCT counseling sessions during antenatal and postnatal clinic visits. We also interviewed 11 local stakeholders, including district and provincial nutritionists and nursing officers from Nairobi and Eastern and Western Provinces, regarding current attitudes toward HIV and infant feeding.

Results

Post-counseling exit interviews: Fifty exit interviews were conducted in Eastern Province and 30 in Western Province, where staffing shortages and a lack of individual counseling services yielded fewer opportunities for exit interviews. Most received counseling from a nurse, and 71% indicated that infant feeding practices were discussed with them. Exclusive breastfeeding was discussed with most mothers. More emphasis was placed on risks associated with HIV transmission from breastfeeding than on risks from replacement feeding. Counseling for nearly half of the mothers included how to stop breastfeeding, although few counselors mentioned manual expression of breast milk as a method to relieve engorgement.

Counseling session observations: All antenatal care (ANC) counseling sessions included discussion around exclusive breastfeeding and some components of an AFASS assessment. Among other AFASS-related topics, hygiene was commonly discussed, while water supply and formula and availability of replacement foods were discussed much more rarely. Interestingly, while ANC sessions largely focused on risks associated with replacement feeding, postnatal sessions focused more on the risk of HIV transmission from breastfeeding. Most counselors discussed how to stop breastfeeding; however, again, few mentioned manual expression of breast milk. Although replacement foods were mentioned, in-depth information was not provided. No written education materials were available for either the counselors or the mothers.

In-depth interviews: More than 84% of mothers planned to breastfeed, most exclusively for the first months, and for a duration of almost 9 months. The actual mean duration of breastfeeding was less than 5 months, however. Although most mothers reported success in weaning the infant off the breast the first time they tried, the majority also indicated they experienced some type of physical or psychosocial problems during this time.

The most common source of drinking water was from a river or a pond. Although 90% of mothers reported feeding their infant some type of animal milk during the weaning period, overall, other liquids and solids were fed more often to infants in Western Province than in Eastern Province. In the 24 hours prior to the interview, nearly 70% of mothers reported feeding some type of animal milk, while less than 10% fed any type of meat to their infants.

Infants in Western Province experienced slightly more overall episodes of morbidity during and after the weaning period than those in Eastern Province. Nineteen percent of the infants in this study population had a weight-for-age (WFA) z-score less than -2, with higher prevalence in Western Province. Mothers indicated that the biggest challenge during and since the weaning period was how to get enough food or money for feeding the baby.

We found several statistically significant associations in multivariate regression models. Overall, WFA scores were higher in Western Province; yet the fact that more of the infants with -2 WFA scores were from Western Province as well suggests that infants at both extremes of development and growth reside in this area. Higher WFA scores were also associated with not having experienced illness or weight loss during weaning, suggesting

that infants who remained healthy during and after the weaning period had improved weight gain. A surprising finding was that younger age at weaning and difficulty during the weaning period were associated with improved infant weight gain. As a cross-sectional survey, we cannot determine causation or reverse-causation; previous studies have shown that poor infant health leads to increased duration of breastfeeding. Our data could simply infer that mothers who experienced challenges during weaning or who had low-weight infants were more attentive to their infant's health, thus compensating for these obstacles.

Additional findings included the following: infants who had lacked food during the weaning period were more likely to have compromised nutritional status at the time of the interview; diarrhea during and after the weaning period was more likely among infants who had experienced illness or weight loss during this time; fevers experienced during and after the weaning period were more likely in Western Province, possibly due to malaria burden, and if their mothers were not employed; and infants whose mothers experienced weaning problems were more likely to have increased visits to health clinics.

Local stakeholders felt that the primary issues facing Kenya regarding infant feeding for HIV-exposed infants were poverty, which impaired mothers' ability to provide high-quality foods and replacement milks, and a lack of training among health care staff, resulting in insufficient nutrition knowledge and mixed messages to mothers.

Conclusion and Recommendations

This study found that among HIV-exposed infants, nutritional status, growth, and morbidities are impacted by the problems encountered during the weaning period. Such infants are particularly vulnerable as they transition away from breastfeeding. If infant health is compromised during this time, then even for those who survive, it can have long-lasting consequences on future growth and development. PMTCT programs should be comprehensive and focus not only on enforcing antiretroviral therapy regimens but also on continually promoting safe infant feeding practices through integrated training programs. Caution should be exercised when counseling HIV-infected mothers on the appropriate time to stop breastfeeding; the safest age could vary, depending on whether mothers indeed have AFASS criteria in place to ensure safe and adequate nutrition for their babies. Appropriate counseling should reflect and clearly present this balance of risks to HIV-infected mothers.

Recommendations:

- Ensure that comprehensive AFASS assessments are conducted to allow mothers to choose the infant feeding option most appropriate for their situation.
- Increase the level of PMTCT infant nutrition education for all clinical personnel, including community health workers.
- Provide comprehensive and continual training, including supportive supervision, follow-up, and monitoring and evaluation to assess effectiveness.
- Ensure that consistent messaging around infant feeding options are presented at ANC and postnatal counseling visits; counselor bias must be avoided.
- Develop a comprehensive counseling strategy, including more intensive health worker counseling as well as dedicated peer counseling.
- Continue to enhance food by prescription programs to not only treat, but also prevent malnourishment in infants and young children.
- Provide information, education, and communication materials for health care workers as well as mothers.
- Develop an infant feeding counseling protocol.
- Include age-appropriate frequency, volume, and hygienic preparation of infant foods during postnatal counseling.
- Educate health care workers on heat treatment of breast milk as one effective option.
- Improve effectiveness of PMTCT counseling using follow-up visits.
- Mobilize at the community level to educate on safe infant feeding practices.
- Improve male involvement in the infant feeding decision-making process.
- Explore the option of grandmothers re-lactating to feed their HIV-exposed grandchildren.
- Implement a mass media campaign to promote safe infant feeding practices.
- Provide physical and psychosocial support to mothers during the weaning period.
- Utilize the Baby Friendly Hospital Initiative system to provide instruction to all mothers on manual expression.
- Increase availability of support groups to promote safe infant feeding.
- Ensure that growth monitoring and promotion are conducted at each visit.
- Improve water safety through water sanitation projects and education.
- Increase the availability of nutritionists to allow for more effective scheduling.
- Revise the current child welfare cards for rapid identification of HIV-exposed infants.

Background

It is estimated that worldwide more than 400,000 children contracted HIV in 2007, the majority of these due to mother-to-child transmission (MTCT).[1] While prevention strategies, such as antiretroviral drugs, elective Caesarean section, and avoidance of breastfeeding, are considered to be adequately safe and available in developed countries, this is often not the case in developing countries, where 90% of MTCT of HIV occurs.[2] In the absence of any interventions, the rate of MTCT in developing countries can be as high as 40%, with prolonged breastfeeding of up to 24 months accounting for one-third to one-half of these infections.[3] Although formula is the recommended infant feeding option for HIV-infected mothers in developed countries, this may not be a feasible or preferred choice for women in resource-poor communities for many reasons: the prohibitive cost,[4] lack of infrastructure to ensure consistent availability,[5] and cultural beliefs about breastfeeding that may pressure mothers to breastfeed.[6, 7] Furthermore, any reduction in breastfeeding in situations where contraceptive availability and use are suboptimal will, by reducing lactational amenorrhea, decrease birth spacing, potentially resulting in an increase in the number of HIV-exposed and infected infants.[5, 8, 9]

Moreover, the risk of HIV transmission must be balanced against the benefits of breast milk's protective immunological and nutritional properties, which are often lifesaving. Replacement feeding results in an increased risk of mortality due to non-HIV infectious diseases, even in developed countries.[10] This is further exaggerated in resource-poor areas, where unsanitary conditions are common. Bahl *et al.* found that non-breastfed infants in Ghana, India, and Peru had a ten-fold higher risk of dying of any cause and a three-fold higher risk of being hospitalized for any cause when compared with those who had been predominantly breastfed.[11] A randomized trial among families with access to safe water and to high-quality health care in Kenya found that HIV-free infant survival over a 2-year period was higher in the replacement feeding group. Cumulative child death rates, however, were not significantly different between formula-fed and breastfed infants; more than half of the deaths in the formula-fed group occurred during the first 6 months of life compared to 36% of the deaths in the breastfeeding group.[12,13] Similarly, in Botswana, replacement feeding was associated with greater mortality at 7 months compared to breastfeeding with 6 months of zidovudine prophylaxis for HIV-exposed children.[14] However, in this Mashi (milk) study, HIV-free survival was similar in both breastfed and replacement-fed infants. In Côte d'Ivoire similar rates of HIV-free survival were seen at 2 years in children replacement fed and those breastfed for 4 months. Formula was provided free for these families.[15] Yet, a recent study in Uganda found that non-breastfed infants born to HIV-infected mothers had a six-fold higher mortality risk compared to those who breastfed.[16] This was the first such study conducted in a rural area of Africa and the first in which the infants were not provided with enhanced health care follow-up (which may bias results since the quality of health care follow-up usually required by ethics committees for longitudinal studies is more likely to prevent deaths due to non-HIV infections than to prevent HIV infection in the breastfeeding arm). These findings emphasize the importance of the World Health Organization (WHO) recommendations that the acceptability, feasibility, affordability, safety, and sustainability of different infant feeding options need to be evaluated at the country and individual level.[17]

Numerous studies have documented that for infants born to HIV-infected mothers exclusive breastfeeding for the first 6 months of life results in significantly less risk of HIV transmission than does mixed feeding (i.e., breastfeeding combined with other liquids or solids).[18–20] In light of these findings, current WHO recommendations state that HIV-infected mothers should breastfeed exclusively for 6 months unless replacement feeding is acceptable, feasible, affordable, sustainable, and safe (AFASS), in which case avoidance of all breastfeeding is recommended. Whether an HIV-infected mother chooses to breastfeed or replacement feed for the first 6 months, it is vital she does so exclusively and avoids the risks associated with mixed feeding. WHO guidance was revised in 2006 to emphasize that if the mother opts to exclusively breastfeed, cessation should occur at 6 months *only* if replacement feeding is AFASS, which means that a nutritionally adequate and safe diet can be provided and maintained.[21]

Discontinuing breastfeeding at 6 months, especially in a rapid manner, is not usual practice for most mothers in developing countries, as breast milk is relied upon as a significant source of nutrition well beyond that age. Recent data have shown that this lack of continued breast milk may negatively impact infant health. For HIV-exposed infants, the transition period from exclusive breastfeeding, or weaning from any breastfeeding, to replacement foods and milks may be one of high risk for malnutrition and stunting.[22, 23]

The risk of morbidity and mortality from diarrhea may also increase during the transition period from breastfeeding to replacement feeding. In a study in Uganda, rates of serious gastroenteritis doubled during this time.[24] The PEPI (post-exposure prophylaxis) trial in Malawi found that gastroenteritis frequency was highest immediately after breastfeeding was discontinued (13.1% at 6 months compared to 7.1% at 3 months), with resulting increases in gastroenteritis-related mortality.[25] The Kisumu Breastfeeding Study in Kenya found that serious diarrhea resulting in hospitalization was 3.6-fold greater at 6 months following weaning compared to another study group that continued breastfeeding.[26] The Mashi Study in Botswana found that at 7 months formula feeding had a higher risk of early mortality (9.3%) compared to breastfeeding for 6 months with zidovudine prophylaxis (4.9%), but lower risk of HIV transmission among formula feeders (5.6%) compared to breastfeeders (9.0%), resulting in similar HIV-free survival rates by 18 months (13.9% compared to 15.1%).[14] Similar findings were observed in a study in Zambia.[27] Additionally, increases in breast milk viral load have been documented during this transition period, suggesting that if a mother breastfeeds during this time, the risk of HIV transmission could substantially increase.[28]

Indeed, the Kenya PEPFAR (President's Emergency Plan for AIDS Relief) programs for prevention of mother-to-child transmission (PMTCT) have noted that infants of HIV-infected mothers who are exclusively fed on breast milk or on infant formula (although very few cases of this are reported) seem to progress well until these infants transition toward complementary foods—a time that is commonly referred to as the "weaning" stage. (This terminology is often confusing, as "weaning" is sometimes used to refer to the period when breastfeeding is discontinued and sometimes used to refer to the period when complementary foods are added. For the purposes of this report, the term weaning is defined as the period of time when breastfeeding is discontinued.) Many programs have anecdotally

noted that if mothers choose exclusive breastfeeding, they do so for 4 to 6 months, but then rapidly stop breastfeeding. After this, many infants begin to get sick and die.

Field reports from several countries indicate that there is a high level of confusion among health care workers regarding appropriate recommendations and counseling practices, resulting in mixed messages being given to mothers. Many health care workers are not aware of the revised WHO recommendations to ensure that the AFASS criteria are met prior to stopping breastfeeding and so are still encouraging mothers to rapidly cease breastfeeding at 6 months or earlier. These anecdotal field reports were recently confirmed in an assessment of PMTCT counseling programs in Botswana, Kenya, Malawi, and Uganda, which found inadequate knowledge among health care workers, resulting in inadequate infant feeding counseling.[29] These studies illustrate the need for comprehensive PMTCT training to include guidance on providing regular assistance with infant feeding practices for 2 years, with particular support given during difficult times such as birth, weaning, and the addition of complementary foods. PMTCT counseling should help the mother assess the availability of safe and nutritious feeding options before breastfeeding stops, as well as provide optimal support during and after the transition from exclusive breastfeeding to complementary foods and replacement milks.

Although data identify the transition to replacement feeding to be one of high risk to the infant, little research has been done to adequately evaluate HIV-infected mothers' experiences as they stop breastfeeding and the associated impact on their children. In light of this gap in knowledge, PATH was awarded funding in 2007 to conduct a public health evaluation in Kenya to assess infant feeding practices and counseling, specifically focusing on this transition period. Despite the fact that exclusive breastfeeding for the first 6 months is considered the gold standard for all breastfed infants, regardless of HIV status, it is rarely practiced in Kenya. The 2003 Demographic and Health Survey found that only 2.6% of infants 4 to 5 months of age were exclusively breastfed and 48% had received solid or semi-solid foods by the time they were 3 months of age. Nearly 30% of women were unaware that HIV could be transmitted by breastfeeding. Almost 30% of all children under 5 are stunted and 20% are underweight.[30] Thus, Kenya has set the improvement of breastfeeding rates as a national priority.

In this context, PATH conducted an assessment of infant feeding among HIV-infected mothers who had recently stopped breastfeeding. This was conducted in two diverse regions in Kenya—Western Province, considered to be food secure, and Eastern Province, considered to be food insecure. The objectives of this study were three-fold: (1) to assess the clinic-based counseling practices regarding HIV and infant feeding, (2) to describe the infant feeding practices and infant health of HIV-exposed infants during the time they were stopping breastfeeding (defined as "weaning" for this study), and (3) to identify the experiences of HIV-infected mothers during the weaning period.

Methods

Study preparation and data collection

Due to the post-election violence that occurred in Kenya in January and February 2008, initiation of this study was postponed from its original start date of January 2008 to May 2008 to ensure the safety of the field team. The study team for Western Province included one field supervisor and four research assistants who were fluent in the local Luhya and Swahili languages. The study team for Eastern Province included one field supervisor and four research assistants who were fluent in Kamba, Swahili, and Kikuyu. A data analyst was also hired to enter and clean data in real time, as well as to assist with data analysis. Study procedural training was held with the entire study team, led by Dr. Kiersten Israel-Ballard and Ms. Margaret Waithaka, May 19–23, 2008. This included pretesting the data collection tools, revising all translations as needed, and piloting them in multiple languages at a local clinic. The study launch was on May 26 for Eastern Province, with field support from Dr. Israel-Ballard, and June 2 for Western Province, with field support from Ms. Waithaka. The data collection tools utilized in this study are available upon request.

Study populations and procedures

This cross-sectional study was designed to collect formative research data in a descriptive manner. This study took place at APHIA II (AIDS, Population and Health Integrated Assistance [USAID-funded program]) affiliated sites in the Kakamega, Vihiga, Hamisi, and Bungoma Districts of Western Province and in the Kitui, Makueni, Kibwezi, Machakos, Mwala, Yatta, Mwingi, and Mbooni Districts of Eastern Province. These regions were selected to include food-secure areas of Western Province and food-insecure areas of Eastern Province. Data collection occurred between May and September 2008. According to the 2007 Kenya AIDS Indicator Survey, Eastern Province had an HIV prevalence of 4.7 and Western Province of 5.1.

This study was composed of a convenience sample of quantitative in-depth interviews, brief post-counseling exit interviews, and counseling session observations. A total of 386 women older than 18 years of age were recruited. In-depth interviews were conducted with 285 women (137 in Eastern Province, 148 in Western Province). Women known to be HIV positive were recruited from PMTCT clinics, comprehensive care centers, and postnatal wards at local clinics and referral hospitals, as well as from support groups affiliated with the health centers. Inclusion criteria included being HIV infected, having an infant <18 months of age, and having stopped breastfeeding between 1 week to 6 months prior to participation. Survey questions focused on the period over which breastfeeding cessation took place, including the age of the infant, liquids and foods fed during this period and their associated costs and availability, infant illness, breast health, general challenges, as well as a 24-hour dietary recall to capture current infant feeding practices and challenges. Infant weight and mid-upper arm circumference (MUAC) were measured to capture current nutritional status.

Post-counseling exit interviews were conducted with 80 women (50 in Eastern Province, 30 in Western Province) who had not participated in the cross-sectional survey. The difference in sample size between provinces was due to clinic staffing shortages, resulting in the lack

of individual postnatal counseling in Western Province; group PMTCT counseling was more commonly practiced. Women known to be HIV positive were recruited upon leaving an antenatal or postnatal PMTCT counseling session at a health facility. Inclusion criteria included being HIV positive, being pregnant, or having an infant <12 months of age.

Counseling session observations occurred 22 times with different women and in various clinics (9 in Eastern Province, 13 in Western Province). Inclusion criteria included being HIV positive, being pregnant, or having an infant <12 months of age. In Eastern Province, four of these observations were antenatal and five were postnatal; in Western Province nine were antenatal and four were postnatal. Antenatal mothers were recruited in the antenatal care (ANC) clinic in the PMTCT section. Postnatal mothers were recruited in the comprehensive care center or in the maternal and child health (MCH) ward. Three observations were of ANC group counseling sessions rather than individual sessions; two in Western, one in Eastern. The observer used a checklist to indicate whether a specified topic had been covered during the session. Although recruitment criteria were inclusive of both antenatal and postnatal mothers with infants under 12 months of age, most (n = 8) of the mothers interviewed postnatally had infants of only 1 month of age, while one mother had a 3-month-old and another had a 9-month-old infant, thus limiting the infant age ranges.

All clients who met the recruitment criteria and consented to join the study during the recruitment period were recruited. To ensure eligibility and guardianship of the infant we required identification documents prior to enrollment.

Additionally, 11 local stakeholders, including district and provincial nutritionists and nursing officers from Nairobi and Eastern and Western Provinces, were informally interviewed to gather their perceptions and attitudes toward infant feeding in the context of HIV in their communities.

This study was approved by the PATH Research Ethics Committee and by the Kenya Medical Research Institute National Ethical Review Committee. Informed consent from all participants was obtained prior to participating in this study.

Statistical analyses

We used a three-stage process to investigate associations between 35 potential predictors and 12 outcomes. We first looked at the 420 bivariate associations between each predictor and outcome. From these results, we selected for each outcome a pool of potential predictors having bivariate probability <0.20, removed from the pool selected variables that had strong correlations with remaining variables, and forced province into the pool. In the second stage, we used backwards stepwise regression to build a multi-predictor model for each outcome, setting .049 as the *p*-value for entering variables from the pool into the equation, and .051 as the *p*-value for removal. Finally, we constructed a regression model for each outcome that included the significant predictors from the stepwise regression, plus adjustment for two socioeconomic status proxies: the mother's education level and her employment status at the time of interview. Only if addition of these adjustment variables suggested confounding with predictors of interest did we retain them in our final model.

Outcomes

Of the 12 outcomes, two were non-normally distributed continuous variables: the weight-for-age (WFA) z-score, and the upper-arm-circumference-for-age z-score, based on WHO normative rates. Infant sex was not recorded at the time of the interview, so non-sex–specific z-scores were calculated using the midpoint z-score values between WHO-defined male and female MUAC and WFA z-scores. Z-scores were calculated using the WHO anthropometry program (v2.04; http://www.who.int/childgrowth/software/en/index.html). A limitation of this program was that it would not calculate MUAC z-scores for infants younger than 2 months of age (n = 22) and for those with potential z-scores less than -3 (n = 5); thus, these were not included in the model investigating MUAC as an outcome.

One outcome was a count of the number of morbidities (0 to 5) the infant experienced during or subsequent to weaning, chosen from a list of five morbidities (respiratory symptoms, diarrhea, dehydration symptoms, fever, and refusal to eat).

The remaining nine outcomes were dichotomies. Five were indicators of whether the infant had experienced each of the morbidities included in the morbidity count outcome. Two were dichotomized versions of the weight and upper-arm-circumference measures, comparing infants with z-scores less than or equal to -2 with a reference group of infants with less extreme weight and arm circumference deficiencies. Two measured high use of medical facilities during the period after cessation of breastfeeding: three or more visits to a health clinic, and three or more visits to hospital—each compared to a reference group of infants with fewer visits.

Predictors

Of the 35 predictors tested, 10 were ordinal or continuous measures: the mother's age at interview, her level of education, CD4 count, total number of children delivered, number of living children, the infant's age at the cessation of breastfeeding, an ordinal rating of the amount of difficulty the mother experienced in weaning the infant, and two counts of weaning problems. Both of the weaning-problem counts included the following five: breast or nipple pain, breast infection, mastitis, cracking or bleeding around the nipple, and fever accompanying any of these problems. One count was limited to those five problems and could range from 0 to 5. The other count, with potential range 0 to10, included five additional problems: infant crying or unhappiness, mother illness, infant illness, disapproval by others, and lack of food for the infant.

One predictor was a categorical variable indicating whether the mother gave the infant water during the time she was stopping breastfeeding, and if so, what water source she used (trichotomized for multivariate regression as piped water in compound, tap in house/bottled water, and all others). The remaining 24 predictors were dichotomies: province; mother's employment status; ten variables measuring whether each of the ten weaning problems noted above had occurred; three variables measuring types of foods provided during the weaning period (non-milk liquids, non-breast milk, solid food); three variables measuring sources of weaning advice (medical or nutrition professionals, family or friends, support groups); four measuring sources of feeding advice (medical professionals, nutritionists,

family or friends, support groups); and two measuring types of food given to the infant (milk, meat/eggs) during the 24-hour period before interview.

Analyses

For bivariate analyses with dichotomous outcomes, we tested associations with Fisher's Exact test when the predictor was dichotomous, Pearson χ^2 when the predictor was a multi-category non-ordinal variable, and the Mann-Whitney Z-approximation when the predictor was ordinal or continuous (comparing the distributions of the predictor on the two categories of the outcome variable). When both the predictor and outcome were ordinal or continuous, we used Spearman's correlations to test the bivariate association. Final models were chosen based upon statistically significant bivariate results and the plausibility of the eligible covariates as potential predictors or confounders. Models were adjusted for infant age at the time of interview where appropriate.

We used Stata to build multi-predictor stepwise regression models. For the two continuous outcomes, we used linear regression with standard errors robust to non-normality. For the count outcome we used a robust Poisson model; because infants varied in the elapsed time since weaning began, thus making them differentially vulnerable for morbidities, we specified the number of days since the start of weaning as the exposure variable. For dichotomous outcomes, we used logistic regression models.

In addition to these primary analyses, we also investigated potential associations between five variables and infants' age at the cessation of breastfeeding: province, mother's employment status and level of education, the weaning difficulty rating, and the number of attempts required to wean the infant. We modeled this outcome first with robust linear regression and then with Cox regression.

All statistical analyses were conducted with the use of Stata software (version 8.2; StataCorp, College Station, TX) and Mplus software (version 4.0; Muthén & Muthén, Los Angeles, CA).[31, 32]

Open-ended questions were categorized according to overarching themes identified by several members of the study team.

Results

Post-counseling exit interviews

Fifty exit interviews were conducted in Eastern Province and 30 in Western Province. This difference was due to staffing shortages, resulting in the lack of individual postnatal counseling in Western Province; group PMTCT counseling was thus more commonly practiced there. Thirty-nine (48.8%) of the women interviewed were pregnant and receiving ANC PMTCT counseling: 22 (27.5%), 13 (16.3%), 3 (3.8%) and 3 (3.8%) had infants aged 3, 6, 9, and 12 months, respectively. Most (61%) reported seeing a nurse for this counseling session, followed by 28.8% seeing a doctor. Only 6.3% reported seeing a nutritionist. The reasons mothers were attending the clinic that day were primarily for antiretroviral therapy (ART) (46.3%), ANC (33.8%), and PMTCT (23.8%), with many attending for multiple

purposes. Many indicated that their counseling session was fairly comprehensive and included questions about the mother's eating habits (52.5%), inquiring about other potential health issues (78.8%), and weighing mother (ANC) and/or baby (postnatal) (82.5%), although few at the postnatal visit (24.4%) said the child welfare card was examined or used. Seventy-one percent of those interviewed indicated that infant feeding practices were discussed with them by the counselor.

Among those who received infant feeding counseling, 69.2% of ANC mothers were told about exclusive breastfeeding, 61.5% of mothers with 6-month-old infants were told about the addition of other milks, and only 23.1% of mothers with 6-month-old infants were told about the use of solid foods. Counselors offered recommendations to exclusively breastfeed to 54.8% of mothers at ANC and 61.5% of mothers with 3-month-old infants. Twenty-nine percent of mothers at ANC were told their infant feeding decision was their choice and no recommendation was given. Nearly 10% of mothers at ANC were given the recommendation to use other milks. Forty percent of mothers were given information on proper hygiene when preparing infant formula/replacement feeds. While 70% of the counseling sessions were reported to have included discussion on the risks of HIV transmission from breastfeeding, only 40% discussed the risks from using infant formula/replacement foods.

How to stop breastfeeding was discussed with 42% of mothers, and primary topics included at what infant age this should occur (82%), starting replacement feeding (77%), over what time period (68%), disclosure (68%), and stigma (50%). Practicing manual expression to relieve engorgement during this period was discussed with only 24% of mothers. Complementary feeding was discussed with 36% of mothers during ANC, increasing to 69% for mothers with infants 6 months of age. Primary topics during these discussions included quality of the foods (63%) and locally available foods (72%), rather than frequency (25%) and quantity (38%). Most common local foods mentioned were bananas (39%), oranges, (39%), milk (39%), pawpaw (35%), avocado (35%), beans (30%), millet (30%) and porridge (22%).

Advice was most offered postnatally for complaints of insufficient breast milk (26%), cracked nipples (20%), stigma (19%), poor positioning (18%), crying baby (18%), and engorged breasts (16%).

Counseling session observations

All (n = 13) of the ANC counseling sessions with different women included discussion of exclusive breastfeeding for the first six months, the majority including the dangers of mixed feeding as well as risks of replacement feeding. Several topics were discussed as part of an AFASS assessment to help guide a mother's decision of how she should feed her infant; however, comprehensive discussions inclusive of all the critical AFASS components were not observed. The major components of an AFASS assessment and the percentage of ANC sessions where these were discussed are presented in Table 1.

Table 1. Percentage of antenatal care counselors who discussed topics related to an AFASS assessment are listed below (n = 13)

AFASS topics	Percentage of counselors who discussed the topic (n = 13)
Water supply	23.1
Refrigerator	7.7
Costs of formula/replacement milks	15.4
Availability of formula/replacement milks	23.1
Family support	38.5
Hygiene	61.5
Stigma from not breastfeeding	30.8

More emphasis during the ANC counseling sessions was placed on the risks associated with replacements feeds rather than the risks from breastfeeding. Eight of the thirteen counselors at ANC mentioned how a mother should transition from breastfeeding. Most postnatal counselors inquired about current feeding practices and provided positive feedback to the mother. Seventy-seven percent of postnatal counselors (n = 9) discussed how a mother should stop breastfeeding, including waiting until the infant is 6 months old, that AFASS criteria should be in place regardless of infant age, how a mother physically stops breastfeeding (i.e., reduce number of breastfeeds per day), and how long the transition should take. Only two of the nine postnatal counselors mentioned manual expression as a strategy to relieve engorgement. Sixty-seven percent of postnatal counselors discussed complementary foods, yet few mentioned that foods should be introduced at 6 months, or discussed critical issues around complementary feeding—including amount of food to give, quality of foods, frequency of meals, or use of locally available foods.

In contrast to the ANC counseling sessions, most postnatal counselors emphasized the risk of HIV transmission from breastfeeding more than risks of replacement foods. Although five of the nine postnatal counselors were observed weighing infants, only three of them actually marked the weight on the child welfare card, and few counselors discussed the infant's growth with the mother.

Only 50% of all the observed counselors introduced themselves to the mother. In order of frequency, mothers sought advice from the counselor on not having enough breast milk, what type of food to feed their infant, engorged breasts, cracked nipples, and stigma. Ninety-one percent of counselors inquired about HIV testing and 62% asked about disclosure. Seventy-one percent used a private room to ensure confidentiality during this session. No written information was given to any of the mothers; information, education, and communication (IEC) materials were not available to guide the counselor nor for distribution to the mothers.

In-depth interviews

Table 2 shows the demographics and characteristics of the 285 mothers and their infants recruited for the in-depth interview.

Table 2. Demographics and characteristics of mothers and infants recruited for in-depth interviews

Characteristics	**Eastern Province** ***(n = 137)***	**Western Province** ***(n = 148)***
Maternal age (years) mean (SD)	30.1 (5.3)	29.8 (5.5)
Level of education – n (%)		
None	6 (4.4)	9 (6.1)
Some primary / Completed primary	99 (72.3)	99 (66.9)
Post-primary	32 (23.3)	40 (27.0)
Occupation – n (%)		
Housewife / not employed outside home	71 (51.8)	74 (50.0)
Other employment	66 (48.2)	74 (50.0)
Parity (mean) (SD)	3.4 (1.7)	3.9 (2.3)
Water source – n (%)		
No water source specified	26 (18.9)	22 (14.9)
River, dam, or open pond	53 (38.7)	68 (46.0)
Community water system	17 (12.4)	25 (16.9)
Piped water in compound	8 (5.8)	17 (11.5)
Borehole	16 (11.7)	9 (6.1)
Rain water / well	10 (7.3)	6 (4.0)
Tap in house / bottled water	7 (5.1)	1 (0.7)
Maternal CD4+ count (cells/mm^3) mean (SD) (n = 68, 64)	404.7 (283.0)	484.8 (270.7)
Infant age (months) mean (SD)	8.7 (4.3)	9.0 (4.8)
Infant weight at time of survey (kg) mean (SD) (n = 136, 148)	7.7 (1.8)	8.0 (1.8)
Infant mid-upper arm circumference at time of survey (cm) mean (SD) (n = 134,148)	13.5 (2.4)	13.8 (1.8)
Infant age when stopped breastfeeding (weeks) mean (SD)	19.5 (12.6)	17.7 (10.8)
Estimated number of days since infant stopped breastfeeding (SD)	144.0 (96.1)	165.3 (121.1)

SD: standard deviation

Prior to delivery, 84.2% of mothers had planned to breastfeed, the majority of these (69.8%) planning to do so exclusively for a mean period of 3.3 months, and 12.6% had planned to feed cow's milk from birth. The mean planned duration of any breastfeeding was 8.8 months. Mothers reported, however, a much lower mean age of 4.6 months (standard deviation [SD] 2.9 months) when they actually stopped breastfeeding. Nearly 70% of mothers had received some type of advice on how to stop breastfeeding, mostly from health care professionals as well as HIV support groups and family members. The majority of mothers reported physical or psychosocial problems while they were trying to stop breastfeeding (Table 3). Eighty-one percent of mothers said they were successful in stopping breastfeeding the first time they tried. Sixteen percent indicated that during the time they were weaning they would still breastfeed at night. An average of 6.20 days was taken to stop breastfeeding. For the 18.5% who indicated they had to try more than one time to stop breastfeeding, a mean of 3.04 attempts were needed. Seventy-four percent of mothers experienced breast pain during this time and 42% reported manually expressing their breast milk, mostly to relieve pain and engorgement.

Table 3. Problems experienced by mothers while attempting to stop breastfeeding

Problem	Percentage
Difficulty in stopping breastfeeding	
Not very difficult	31.23
Less difficult	21.05
More difficult	18.95
Very difficult	28.77
Number of problems experienced while stopping breastfeeding*	
0	6.32
1	16.14
2	24.91
≥ 3	52.63

*Infant fussy, mother ill, infant ill, disapproval from family/community, no food for infant, breast pain, infection, mastitis, cracked/bleeding nipples, fever.

The type of food and liquid fed to the infant during weaning, as well as the associated challenges of acquiring these are presented in Table 5. Forty-three percent obtained their drinking water from a river or pond. Meat was considered the most difficult to obtain; however, most foods and liquids were widely considered to be expensive. Ninety-percent of mothers reported feeding their baby some kind of milk during this period, most of which was boiled animal milk. Overall the majority of infants were fed some type of non-milk liquid, non-breast milk liquid, and solids during the time they were stopping breastfeeding (Table 4). For all liquid or solids categories (e.g., meat [3.0% Eastern, 27.7% Western]), a higher percentage of mothers in Western Province reported feeding these to their infants, except for milk; more mothers in Eastern Province (94.9%) reported feeding this compared to those in Western Province (83.8%).

Table 4. Percentage of respondents who fed liquids and solids to infants during the time they were stopping breastfeeding (Eastern Province n = 137; Western Province n = 148)

Liquid or solids fed	Province	Percentage of Respondents
Fed non-milk liquid (water, juice, tea)	Eastern	83.9
	Western	90.5
Fed non-breast milk liquid (animal milk, formula, powdered)	Eastern	94.9
	Western	83.8
Fed solids	Eastern	81.0
	Western	93.9

Table 5. Percentage of respondents who fed liquids and foods to infants during the time they were stopping breastfeeding and their associated availability and affordability (Eastern Province n = 137, Western Province n = 148)

		Percentage of Respondents									
	Province	**Juice**	**Tea**	**Milk**	**Porridge**	**Ugali**	**Fruit**	**Vegetables**	**Meat**	**Eggs**	**Beans/ Legumes**
Fed to baby	*Eastern*	31.4	16.1	94.9	68.6	18.2	60.6	21.2	13.0	16.1	22.6
	Western	36.5	50.0	83.8	87.8	40.5	66.2	50.0	27.0	24.3	37.2
Difficult to get	*Eastern*	37.2	68.2	43.1	44.7	44.0	43.4	37.9	55.6	31.8	41.9
	Western	37.0	45.9	33.9	43.1	48.3	26.5	36.5	58.5	27.0	34.5
Cheap	*Eastern*	18.6	9.1	17.7	11.7	0.0	19.3	6.9	5.6	0.0	3.2
	Western	14.8	8.1	16.1	7.7	11.7	23.5	18.9	0.0	10.8	1.8
Free	*Eastern*	23.3	4.5	25.4	13.8	20.0	15.7	17.2	0.0	59.1	29.0
	Western	18.5	4.1	15.3	13.8	11.7	20.4	31.1	2.4	37.8	29.1
Expensive	*Eastern*	58.1	86.4	56.9	74.5	80.0	65.1	72.4	94.4	40.9	67.7
	Western	66.7	87.8	68.5	78.5	76.7	56.1	50.0	97.6	51.4	67.3
Available	*Eastern*	44.2	31.8	70.0	61.7	72.0	48.2	44.8	33.3	50.0	41.9
	Western	29.6	41.9	60.5	62.3	60.0	42.9	64.9	2.4	40.5	41.8
Enough for baby	*Eastern*	62.8	27.3	64.6	71.3	88.0	54.2	62.1	38.9	63.6	61.3
	Western	66.7	73.0	71.0	83.1	81.7	74.5	81.1	75.6	83.8	83.6

Infant morbidities experienced during the time they were stopping breastfeeding are presented in Table 6. Infants in Eastern Province reportedly experienced a mean of 1.4 (SD 1.3) overall episodes of morbidities during this period, compared to 1.7 (SD 1.3) in Western Province; this difference between provinces was not statistically significant. During and since the time they were stopping breastfeeding, the mean frequency of visits to a health center and hospital by infants in Eastern Province was 0.82 (SD 1.73) and 0.92 (SD 1.31) times, and in Western 1.09 (SD 1.63) and 0.88 (SD 1.31) times, respectively (Table 7). Forty-one percent of mothers reported having concerns about their infants' growth since they stopped breastfeeding.

Sixty-two percent reported receiving advice on how to feed their baby for the period *after* they stopped breastfeeding, mostly from health care professionals, HIV support groups, nutritionists, and family members. This advice focused on appropriate replacement foods.

In the 24 hours prior to the interview, 67% of mothers reported feeding any kind of animal milks, 54% fed any fruit, 46% fed any vegetables, 9% fed any meat, 12% fed eggs, 23% fed beans/legumes. Although foods were generally considered easy to obtain, the majority felt that all items were expensive.

Table 6. Infant morbidities experienced during the time they were stopping breastfeeding.

Morbidities during and after stopping breastfeeding	**Percentage of respondents**	
	Eastern Province (n = 137)	**Western Province** (n = 148)
Respiratory illness	13.9	20.9
Diarrhea	43.8	42.6
Dehydration symptoms	14.6	16.2
Fever	43.1	65.5
Refused to eat	21.9	22.3
Malnutrition symptoms	7.3	14.2

Table 7. Mean number of infant visits to a health center or hospital

Province	**Mean visits to health center during and after weaning (standard deviation)**	**Mean visits to hospital during and after weaning (standard deviation)**
Western (n = 148)	1.09 (1.63)	0.88 (1.31)
Eastern (n = 137)	0.82 (1.73)	0.92 (1.31)

Mean WFA and MUAC z-scores by age categories are presented in Tables 8 and 9.

Table 8. Mean weight-for-age z-scores, taken at time of interview, by province and age category

Age group in months (n Eastern, Western)	Mean weight-for-age z-score (standard deviation)	
	Eastern Province	Western Province
0–3 (n = 18, 21)	0.32 (1.80)	1.33 (1.78)
4–6 (n = 25, 33)	-0.51 (1.14)	0.78 (1.97)
7–9 (n = 37, 28)	-0.30 (1.18)	-0.23 (1.76)
10–12 (n = 28, 25)	-1.09 (1.33)	-1.10 (1.33)
13–15 (n = 18, 23)	-1.54 (1.18)	-1.11 (2.21)
16–18 (n = 10, 18)	-1.03 (1.65)	-1.89 (1.49)

Table 9. Mean mid-upper arm circumference z-scores, taken at time of interview, by province and age category

Age group in months (n Eastern, Western)	Mean mid-upper arm circumference z-score (standard deviation)	
	Eastern	Western
0–3 (n = 6, 8)	0.56 (1.56)	0.15 (1.52)
4–6 (n = 23, 33)	-0.77 (1.62)	0.37 (1.50)
7–9 (n = 37, 28)	0.10 (1.19)	-0.33 (2.03)
10–12 (n = 27, 25)	0.04 (0.82)	-0.94 (1.62)
13–15 (n = 18, 22)	-0.10 (1.11)	-0.51 (1.22)
16–18 (n = 8, 18)	-0.41 (0.91)	-0.50 (1.17)

Percentages of infants from each province with mean WFA and MUAC z-scores less than -2 are presented in Table 10. It is important to note that 19% of the infants in this study population had a WFA z-score less than -2. Infant birth weights were not collected, however. Although infants with WFA z-scores less than -3 did not significantly differ from

infants with WFA z-scores greater than -3.we did note slight differences in that severely malnourished infants were more likely to be in families with a higher number of children, and to have been sick more often during weaning, with increased severity as suggested by increase in hospital visits, and they were less likely to have been given non-breast milk during weaning or fed meat or eggs within the last 24 hours.

Table 10. Percent of respondents in Eastern and Western Provinces with mid-upper arm circumference and weight-for-age z-scores <-2

	% MUAC z-score <-2	**% weight-for-age z-score <-2**
Western Province	13.4	21.6
Eastern Province	8.4	16.2

Table 11. Characteristics of infants with weight-for-age z-scores <-3 compared to infants with WFA z-scores >-3.

	Weight-for-age z-score ≤-3 (n = 17)	**Weight-for-age z-score ≥-3 (n = 268)**
Total number of children mother delivered	1.94 (1.71)	1.50 (1.28)
Total number of morbidities during weaning	4.06 (3.15)	3.63 (1.96)
3+ visits to the hospital during and since weaning	0.18 (0.39)	0.10 (0.30)
Fed non-breast milk during weaning	0.76 (0.44)	0.90 (0.30)
Fed meat or eggs in previous 24 hours	0.06 (0.24)	0.19 (0.39)

Open-ended questions

Several open-ended questions were asked regarding the mother's general experience during the time she was stopping breastfeeding. When asked to describe any concerns or challenges faced *during* the time they were stopping breastfeeding, the most common response was how to get enough food or money for feeding the baby (35%). Additional responses, in order of frequency, included breast pain, concerns about the baby's health, stigma from not breastfeeding, the baby being unhappy or refusing to eat food, concerns about infant HIV status, and that the baby would lose weight and grow slowly.

"I felt bad because I had not planned to stop breastfeeding."

"I knew breast milk was best so replacement milks couldn't be so good."

"The baby looked too small to stop breastfeeding but I felt I had no other option."

- Various mothers who said they stopped breastfeeding at 6 months, Eastern Province

When asked to describe any concerns or challenges they faced *since* they stopped breastfeeding, responses were similar; however, there was an increase in how many felt that getting enough food or money for feeding the baby was a challenge (55%).

"Food is expensive and the rains are unreliable."
- Mother who said she stopped breastfeeding at 6 months, Eastern Province

"Sometimes we sleep hungry and the baby takes black tea."
- Mother who said she stopped breastfeeding at 6 months, Western Province

"I have transport issues going to look for milk."
- Mother who said she stopped breastfeeding at 3 months, Eastern Province

Fifty percent said if they had to do it again, they would stop breastfeeding in a different way from how they did for this infant, although many did not indicate what they would change. Thirty-eight percent said they would not breastfeed at all. In spite of all the problems they reiterated, very few stated that they would breastfeed for a longer duration. For example, only 6% (most of whom breastfed less than 6 months) indicated that if they could do it over again they would breastfeed for 6 months.

Multivariate regression models

The results from multivariate regression models are presented in Table 12 and in detail below.

Table 12. Multivariate regression analyses identifying factors significantly associated with infant health outcomes.

Variables retained in model	ß*	Odds Ratio†	Incidence Rate Ratio‡	95% Confidence Interval	ρ value
WFA z-score (continuous)					
Model 1§					
Eastern Province	-0.513			-0.887, -0.139	0.007
Infant ill or weight loss	-0.632			-1.120, -0.143	0.011
Model 2					
Infant age at weaning	-0.032			-0.051, -0.014	0.001
Weaning difficulty	0.187			0.011, 0.364	0.038
Infant ill or weight loss	-0.858			-1.378, -0.338	0.001
WFA z-score <-2 (dichotomous)§					
Infant ill or weight loss		2.438		1.122, 5.300	0.024
MUAC-for-age z-score (continuous)					
Lack of baby food	-0.497			-0.973, -0.021	0.041
Respiratory problems					
Mother illness during weaning		2.277		1.202, 4.311	0.012
Fed meat or eggs 24 hrs prior		2.358		1.132, 4.910	0.022
Diarrhea§					
Infant ill or weight loss		3.241		1.608, 6.534	0.001
Fever§					
Eastern Province		0.390		0.240, 0.638	<0.001
Mother employed		0.614		0.377, 0.999	0.050
Refusal to eat§					
Mother employed		0.455		0.249, 0.828	0.010
≥3 visits to health clinic§					
Number of weaning problems		1.303		1.071, 1.584	0.008
Age at cessation of breastfeeding					
Weaning difficulty	1.350			0.183, 2.516	0.024

*Continuous variables
†Categorical variables
‡Poisson regression model
§Adjusted for infant age at time of interview
MUAC = mid-upper arm circumference; WFA = weight for age

Weight-for-age z-score. The predictor pool for the continuous measure of weight-for-age z-score included nine variables: province, mother's age at interview, total number of children, infant's age at cessation of breastfeeding, the weaning difficulty rating, infant illness and lack of baby food cited as weaning difficulties, and provision of meat or eggs to the infant during the 24 hours before interview. Infant age at the time of interview was included to control for possible confounding between age and nutritional status. Three were independently associated with weight: province (b=-0.513, *p*=.007) and infant illness or weight loss during the weaning period (b=-.632, *p*=.011). Age-standardized weights were significantly higher for infants from Western Province and those who had not experienced illness or weight loss during the weaning period.

When age at interview was removed to maintain the appropriate number of covariates in the model based on sample size, age at interview and province were replaced with infant age at cessation of breastfeeding (b=-.032, *p*=.001) and the weaning difficulty rating (b=.187, *p*=.038) as predictors of weight-for-age z-score, with infant illness/weight loss during weaning remaining as the third predictor (b=-.858, *p*=.001). In this alternative model, age-standardized weights were significantly higher for infants who were weaned at younger ages (though the effect size was small), those whose mothers rated the weaning process as more difficult, and those who had not experienced illness or weight loss during the weaning process.

When modeled as a dichotomy, comparing infants with extremely low weight scores (-2 or lower) with other infants, the predictor pool included six variables: province, mother's age at interview, infant's age at cessation of breastfeeding, infant illness or weight loss cited as a weaning problem, and provision of non-breast milk to the infant during the weaning period. . Infant age at the time of interview was included to control for possible confounding between age and nutritional status. One predictor had an independent association with low weight: infant illness or weight loss during the weaning period (OR=2.44, *p*=.024). Those who had experienced illness or weight loss during the weaning process were more likely than their counterparts to have extremely low weight. (Addition of mother's education to the model increased the OR for infant illness to 2.86, owing to a significant positive association between mother's education and reports of infant illness during weaning; *p*<.02.)

MUAC-for-age z-score. The pool of predictors for the continuous version of the age-standardized upper-arm circumference measure included three variables: province, the weaning difficulty rating, and infant illness or lack of baby food cited as weaning difficulties. Infant age at the time of interview was included to control for possible confounding between age and nutritional status. Lack of baby food (b=-.497, *p*=.041) had an independent association with the MUAC score. Age-standardized arm circumferences were higher among infants who had not experienced this weaning difficulty.

When upper-arm circumference was modeled as a dichotomy (comparing those with a z-score < -2), the predictor pool included two variables: province and the weaning difficulty rating. Infant age at the time of interview was included to control for possible confounding between age and nutritional status. None of these variables entered the stepwise regression, all having bivariate *p*>.049.

Number and types of morbidities experienced during or after weaning. The Poisson regression model of number of morbidities included a pool of six potential predictors: province, number of weaning problems exclusive of infant illness, infant illness cited as a weaning problem, provision of non-breast milk during the weaning period, provision of milk to the infant during the 24 hours before interview, and the length of time since the beginning of weaning. Infant age at the time of interview was included to control for possible confounding between age and nutritional status. None of the predictors entered the stepwise regression, all having bivariate *p*>.049.

The predictor pool for the dichotomous indicator of respiratory problems included five variables: province, number of weaning problems exclusive of mother illness, mother illness during weaning, feeding of non-breast milk during weaning, and provision of meat or eggs to the infant during the 24 hours before interview. Only two of the predictors had independent associations with respiratory problems: mother illness during weaning (OR=2.28, p=.012) and provision of meat or eggs prior to interview (OR=2.36, p=.022). Mothers who experienced illness during the weaning process and those who had recently provided their children with meat or eggs were more likely to report that their infants had experienced respiratory problems during or subsequent to the weaning process.

We tested eight potential predictors of diarrhea: province, mother's age at interview, total number of children, infant's age at cessation of breastfeeding, mother or infant illness during the weaning period, and provision of non-breast milk during the weaning period. Infant age at the time of interview was included to control for possible confounding between age and nutritional status. One had an independent association with occurrence of diarrhea: infant illness during weaning (OR=3.24, p=.001). Those who had been ill or lost weight during the weaning period were more likely to have experienced diarrhea during or subsequent to the weaning period.

Experience of dehydration symptoms had a pool of four potential predictors: province, number of living children, and infant illness during the weaning period. Infant age at the time of interview was included to control for possible confounding between age and nutritional status. None of the predictors entered the stepwise regression, all having bivariate p>.049.

We tested a pool of seven potential predictors of infants' experience of fevers: province, mother's employment status, the weaning difficulty rating, the number of weaning difficulties exclusive of infant illness and mother having fevers, those two weaning problems considered separately, and provision of milk to the infant during the 24 hours prior to interview. Infant age at the time of interview was included to control for possible confounding between age and nutritional status. Of these, three were independently associated with reports of infant fever: province (OR=0.390, p<.001) and mother's employment status (OR=0.614, p=.050). Infants from Western Province and those whose mothers were not employed were more likely to have experienced fevers during or after weaning.

The pool of predictors for infant refusal to eat included four variables: province, mother's employment status, number of weaning problems exclusive of infant illness, and infant illness cited as a weaning problem. Infant age at the time of interview was included to control for possible confounding between age and nutritional status. Mother's employment status (OR=0.455, p=.010) was independently associated with infant refusal to eat. Infants whose mothers were unemployed were more likely to refuse to eat.

High use of medical facilities. We used a pool of three potential predictors for the dichotomous indicator reflecting occurrence of three or more visits to a health clinic subsequent to the cessation of breastfeeding: province, the number of weaning problems

cited (the 0 to 10 version of this measure), and the provision of milk to the infant during the 24 hours prior to interview. Infant age at the time of interview was included to control for possible confounding between age and nutritional status. The number of weaning problems (OR=1.30, p=.008) was independently associated with high health clinic use. Those for whom there had been more weaning problems were more likely to be high users of health clinics during the period after cessation of breastfeeding.

High hospital use included testing of province in the predictor pool. Infant age at the time of interview was included to control for possible confounding between age and nutritional status. None of the predictors entered the stepwise regression, all having bivariate p>.049.

Age at cessation of breastfeeding. Finally, we investigated potential associations between five variables and infants' age at the cessation of breastfeeding: province, mother's employment status and level of education, the weaning difficulty rating, and the number of attempts required to wean the infant. A linear regression using a robust estimator with all five predictors forced into the model revealed only one association with p<.05: the weaning difficulty rating (b=1.350, p=.024). When run stepwise, only the weaning difficulty rating entered the model (b=1.247, p=.038). These results suggested that increased difficulty in weaning may lead to delays in cessation of breastfeeding.

However, in a Cox regression model using the same predictors, with no censoring required and with age at cessation of breastfeeding used as the time-to-event variable, weaning difficulty was not statistically significant (HR = 0.928, p = .150).

Stakeholder interviews

Eleven district and provincial nutritionists and nursing officers were interviewed regarding their perceptions of health care provider infant feeding recommendations and actual practices among HIV-infected women and in their communities. All agreed that the Kenya policy stated that mothers should make a choice based on meeting the AFASS criteria, and then they should breastfeed or replacement feed *exclusively* for the first 6 months.

When asked about HIV and infant feeding training, numerous mechanisms of training were mentioned, including:

- Seminars with continuing medical education.
- Basic PMTCT training–in Provincial and District hospitals only.
- Infant and young child feeding (IYCF)—has only been carried out in "UNICEF" districts.
- On-the-job training from colleagues.
- Reading the Kenya PMTCT policy.

"I am the DNO and yet have not undergone IYCF training."

- District Nursing Officer
Eastern Province

Most felt, however, that those doing the counseling do not have enough knowledge for the following reasons:

- Only a fraction of health care providers actually receive infant feeding training.

- No updates or refreshers are provided.
- Basic PMTCT training is inadequate in this area; only 1 of 8 modules focuses on nutrition.
- Those trained in PMTCT have no previous nutrition training.
- Many who attend trainings do not pass on the information to colleagues at their facilities.
- Although the 6-day IYCF training focuses on nutrition, it is not enough time to allow for comprehensive understanding of these issues.

"In this country, infant feeding is the weakest link in PMTCT in terms of how much time is allocated to it."

- Member, National Infant Feeding Committee, Nairobi

Interviewees indicated that infant feeding information is conveyed to mothers at several opportunities. The majority is provided during individual counseling sessions, although due to time constraints and staff shortages, even this is usually limited to the first post-test counseling session or if prompted by questions from the client. In larger facilities with staffing shortages, group counseling sessions are likely, as are health talks that address a variety of health issues. Malezi Bora (meaning "good nurturing" in Kiswahili), which occurs two weeks per year and encourages mothers to bring their infants to the clinics for routine integrated infant care, brings many mothers who would otherwise be missed. Support groups also exist in some areas, although the lack of financial and logistical support for them limits their effectiveness.

Respondents highlighted several challenges to improving the quality of individual counseling on infant feeding, including:

- High staff workload, which limits time available for counseling.
- The nurses focus more on the clinical aspects of health care and less on feeding practices, so mothers may come to the clinic and not receive any counseling on infant feeding/nutrition.
- Most nurses feel they have inadequate knowledge even after attending the PMTCT training and that the training quality could be improved.

However, respondents also indicated there are several potential opportunities for counseling mothers on PMTCT and infant feeding. These included:

- Health talks for clients that are carried out early in the morning at clinics before services begin; mothers/clients who come later in the day are missed as are those who feel the talks are unnecessary and so avoid them.
- Group counseling sessions that currently place more emphasis on medical aspects of PMTCT, such as ART, than on nutrition.
- Developing capacity at the community level, since mothers who deliver at home usually come to the facility after they have already initiated their infant feeding choice.

> **"I feel that those who fully understand/grasp the counseling are most likely to exclusively breastfeed."**
>
> *- District Nursing Officer*
> *Western Province*

> **"If you take a mother through one-on-one counseling, most will then exclusively breastfeed successfully."**
>
> *- District Nursing Officer*
> *Western Province*

There were varied responses when the stakeholders were asked how most HIV-infected mothers in their communities choose to feed their infants. In Eastern Province, some felt that half choose breastfeeding and half choose replacement feeding. Others felt the majority of mothers opt to breastfeed as they cannot afford replacement foods. And still others felt that the majority choose not to breastfeed out of fear of transmitting HIV or because of the stress caused by early cessation. In Western Province, most felt that the majority of mothers mixed fed their infants, with very few exclusively breastfeeding for 6 months. The reasons for mixed feeding include pressure from family and community, the belief that breast milk "is not enough," stigma and the fear of discrimination, and lack of disclosure. In addition, the message from health care workers in the past was *not* to breastfeed because of the risk of transmission; this message is difficult to change and it is difficult to "preach" the newer messages that exclusive breastfeeding could be the safest option. According to respondents, the primary factor in a mother's infant feeding choice was the counseling she received at the health center, which too often reflected the biases of the counselor.

Informants interviewed at all levels felt that infants who were exclusively breastfed had better growth and development compared to those who were replacement fed. A general observation by the health care workers who participated in this study was that infants they see in their communities who were not breastfed have higher risk of morbidity, stunted growth, underweight, and malnutrition.

> **"At least 80% of those mixed fed are emaciated and malnourished."**
>
> *- District Nursing Officer*
> *Western Province*

When asked how mothers feed their babies after they have stopped breastfeeding, regional differences were apparent. In Eastern Province, extreme conditions exist due to drought, especially in the upper north-eastern areas. They estimated that up to 50% of mothers may not have enough food for their baby during the weaning period. Milk is shared among all the household members, and it is diluted, usually with unsafe water. In Western Province, the study staff generally observed adequate availability of food; however, the greatest challenge seemed to be the lack of knowledge among mothers and health care workers regarding what local foods are nutritionally adequate for an infant. In Nairobi, informants felt that most mothers continue breastfeeding after 6 months because they do not have the means to provide a safe and appropriate replacement diet.

When asked what they consider to be the most pressing challenges facing their communities regarding the feeding of HIV-exposed infants, respondents listed the following:

- Household poverty levels.
- Untrained/unequipped health workers who lack confidence and knowledge, thus giving mothers contradicting information.
- Cultural beliefs.
- Stigma.
- Teenage pregnancy and a lack of youth-friendly infant feeding counseling.
- Lack of nutrition expertise among management, resulting in nutrition not receiving adequate funding.
- Lack of resources to train health workers.
- Staff shortages which impact the quality of service.
- Low literacy levels among clients.
- Inadequate availability of maternal nutrition counseling.
- Lack of IEC materials to aid health care workers with counseling and to distribute to mothers.
- Poor systems for identification and follow-up of HIV-exposed children.

Their immediate recommendations included the urgent need for collaboration between the Ministry of Health and the Ministry of Agriculture and Forestry to focus on sustainable agricultural techniques, such as drought resistant crops for both food and cash crops, and to launch a major campaign for promoting male involvement in the infant feeding process.

Study Limitations

This study was designed to describe the current infant feeding practices and counseling among HIV-infected women who had recently stopped breastfeeding in two areas in Kenya. As a cross-sectional survey, causation is particularly difficult to deduct; multivariate analysis removes some but certainly not all confounders; reverse causality can often not be ruled out. Our sample was not “random” but recruited from specific APHIA II affiliated clinics within two provinces, and as such, these data are not generalizable to broader populations. In addition, confounding factors may not have been equally distributed between the groups being compared, and this unequal distribution may have biased our findings. We also acknowledge the recall bias that may exist in the survey responses related to past infant

feeding behaviors and morbidities, as well as in the counseling exit interview responses related to topics discussed during the counseling session. Recall error bias may explain some of the inconsistent ages provided for certain questions, such as when certain foods were introduced. Questions focused on feeding patterns during the weaning period rather than on age at which liquids and foods were first introduced. Infant sex was not collected at the time of interview, so the use of non-sex–specific values increases in effect the normal measurement error in the MUAC and weight-for-age results. Measurement errors tend also to be larger when there are multiple anthropometrists, as in this study. The WHO anthropometry program provides no reference data for MUAC z-scores for infants younger than 2 months of age (n = 22), nor for those with z-scores less than -3 (n = 5), excluding those infants from MUAC analyses, biasing them slightly toward infants who were older at interview, at weaning, or who were weaned at a more distant period of time.

Study Conclusion and Discussion

Post-counseling exit interviews

We found that the majority of counseling was provided by nurses, while very few mothers had access to a nutritionist. Postnatal counseling sessions were rarely done on an individual level, especially in Western Province. We observed that issues concerning an HIV-exposed infant's nutrition were not prioritized. The comprehensive care center personnel assume that a mother has undergone comprehensive PMTCT counseling previously so is already equipped with adequate information; the counseling is not usually offered unless the mother indicates that she had not received PMTCT counseling elsewhere.

Alarmingly, few visits included a review of the infant's child welfare card, which is required to adequately monitor infant health and is especially important in this vulnerable population of HIV-exposed infants. Although most included some type of discussion around infant feeding, few mothers with 6-month-old infants received any counseling on feeding solids. Our counseling observations, however, suggested that the majority of postnatal counselors do discuss complementary foods, albeit few mentioned frequency and quantity, both critical for mothers to understand as they are stopping breastfeeding. AFASS assessments were inadequate, as the majority of counseling did not include discussion of safe water and sanitation or the availability of replacement foods. The counseling observations, however, suggest that hygiene was discussed often, although this may be due to improved counseling while being observed. There seemed to be unequal emphasis placed on risks associated with breastfeeding and risks associated with replacement feeding (though in opposite directions antenatally and postnatally), suggesting that mothers were subjected to provider bias and not given the comprehensive information mothers need in order to make their own fully informed decision. Although stopping breastfeeding was discussed with many mothers, manual expression was not often mentioned as a strategy during this transition. This lack of information could have grave consequences; manual expression can relieve engorgement and subsequently prevent cracked nipples and mastitis. These conditions are often experienced during weaning and known to significantly increase maternal breast milk viral load and the risk of HIV transmission. Also, although many women did report utilizing expression, not all women are able to do it effectively without at least a modicum of training and some support.

These post-counseling exit interview data suggest that although counseling sessions are informative, there are several missed prevention opportunities. Key findings and recommendations included the following:

- Examination of the child welfare card should be conducted at each clinic visit.
- Comprehensive care center staff should provide PMTCT and infant nutrition counseling rather than assume mothers already received adequate information during their initial PMTCT visits.
- Comprehensive AFASS assessments should be conducted to allow a mother to assess her personal situation and decide the choice appropriate for her at the time.
- Bias must be avoided; it is the health care provider's ethical obligation to provide a mother with accurate information on risks and benefits of all infant feeding options.
- Comprehensive and continual training must be in place to ensure that health care providers have accurate and up-to-date knowledge on such risks and benefits.
- Individual counseling, rather than group counseling, is needed to allow for comprehensive and confidential discussion of safe infant feeding.
- Postnatal counseling should include nutritional education on locally available foods and feeding practices such as age-appropriate frequency and volume and preparation practices to improve energy and nutrient density.
- Prevention of breast pathologies is a well documented strategy to reduce postnatal transmission of HIV, especially important during the time a mother is stopping breastfeeding. As such, manual expression of breast milk should be included in counseling sessions as an effective method to reduce engorgement and other pathologies.
- With training, flash-heat treatment of expressed breast milk could be utilized in this population to eliminate the increased risk of HIV transmission that often occurs during the weaning process.[33, 34]

Counseling session observations

Confirming our post-counseling exit interview findings, we observed that few counselors discussed safe water as part of their AFASS assessment. Yet, this is a crucial factor for decision-making in this study population given that the most common water sources cited among mothers interviewed were rivers, dams, or open ponds. We also noted that the costs of replacement feeding were rarely mentioned. Interestingly, we observed more emphasis placed on risks from replacement feeding than on those from breastfeeding during ANC, but the opposite emphasis during postnatal visits, perhaps due to the perceived fear of infecting an otherwise healthy-looking infant. Regardless of when the counseling takes place, an accurate representation of risks and benefits associated with all infant feeding options needs to be conveyed to mothers. It was reassuring to note that most counseling sessions included discussion around how to stop breastfeeding, including mentioning that cessation should not occur until 6 months and that AFASS criteria should be in place, and providing an explanation of how a mother should physically stop breastfeeding (i.e., reduce number of breastfeeds per day) and how long the transition should take. However, as with the exit interviews, few mentioned manual expression to prevent breast pathologies. Although complementary foods were often discussed, mothers needed more detailed information on

timing, frequency, quantity, diversity, and appropriate local foods to be able to optimally feed their infants. Although infants were often weighed, their growth progress was rarely discussed with the mother. Effective growth monitoring should also include growth promotion, which includes dialogue with the mother in order to identify and address problem areas before they lead to growth faltering or malnutrition.

Key findings and recommendations from these observations included:

- Mixed messages around risks associated with replacement feeding or breastfeeding result in confusion.
- Infant growth monitoring and promotion should be discussed with the mother at each clinic visit.
- Comprehensive AFASS assessments were rarely discussed.
- Counseling during ANC and postnatal should share a consistent message based on mothers' needs and national guidelines, rather than counselor bias.
- No IEC materials were used during the counseling session by the counselor nor provided to the mother to take home for her reference; these could serve as a simple guide for explaining risks and benefits accurately as well as describing locally available and nutritious foods.

In-depth interviews

We found that prior to delivery, on average, mothers had planned to exclusively breastfeed for over 3 months and to continue breastfeeding up to almost 9 months, yet they had stopped breastfeeding completely by 5 months of age. Although rates of exclusive breastfeeding could not be determined from these data, we hypothesize from some of the age data provided for feeding liquids and solids that mixed feeding was common and started at early ages. As has been commonly found in many cultures we believe that there is often pressure from family and community to provide supplemental feeds and liquids at young ages.[35] Complete breastfeeding cessation may have occurred earlier than mothers had originally planned due to pressure from health care providers to stop breastfeeding at an early age (much of which may have been conveyed to the population in earlier years). Although most mothers received advice on how to stop breastfeeding and reported being successful on their first attempt, physical and psychosocial problems during this time were common, suggesting additional support during this time was warranted. Breast care, how to express breast milk, and flash heating are crucial skills for these mothers, neither widely known nor widely included in counseling and training.

With the exception of animal milks (likely to be diluted to an unknown extent),[36] mothers in Western Province reported that during the weaning period they fed more liquid and food items than those in Eastern Province. This difference was expected, given the agricultural constraints in the arid regions of Eastern Province which often lead to a lack of variety of foods in this area. Indeed, during data collection in 2008, this region experienced a severe drought and resulting crop failure. Health care workers feared that significant increases in infant malnutrition would be unavoidable.

Although not statistically significant, we observed a higher mean number of morbidities and visits to a health center among infants in Western Province compared to those in Eastern Province. Eastern Province, however, had slightly more visits to a hospital, suggesting that illness in this area may have been more severe. These findings should be interpreted with caution, however, as infants who were severely ill could have already died and so would not have been included in these survey data. In addition, a large proportion of infants in our sample had been breastfed until quite recently, so their current health and nutritional status might not accurately reflect those of society as a whole.

Mean weight-for-age gradually declined with age in Western Province, but fell more rapidly and at an earlier age by 4 to 6 months in Eastern Province. Similarly, in Eastern Province MUAC dropped to its lowest level already by this early age. In Western Province it dropped more slowly, but also achieved much lower levels at older ages. The overall quality of diet fed in these areas may have been inadequate to sustain growth in settings where breastfeeding ends at such an early age. This implies that AFASS assessments should be more carefully done to ensure that breastfeeding is not stopped before reasonable dietary adequacy for the child can be ensured.

Similarly, we observed a higher percentage of low z-scores ($\leq$-2) of both weight-for-age and MUAC in Western Province than in Eastern Province. However, these data were collected prior to when the full impact of the crop failures in Eastern Province would have been observed.

We found that 19% of the infants in this study were considered to be malnourished and underweight, with WFA z-scores <-2. The nutritional status of these infants was similar to children in this age group in the 2003 Kenya DHS, which found that 14.9% and 25.9% among 6- to 11-month-olds and 12- to 23-month-olds in Eastern and Western Provinces were malnourished.

In our study population, characteristics of severely malnourished infants did not differ significantly from those with good nutritional status. We did note, however, that severely malnourished infants were slightly more likely to have experienced severe illness (as suggested by number of hospital visits) and less likely to have been fed appropriate replacement milks during weaning. Although many received some type of animal milk, the continued lack of appropriate replacement food for this vulnerable group of children is suggested by how few of them received meat or eggs in the 24 hours prior to this survey. These differences, albeit small, are not surprising, as they are often predictors of severe malnourishment. These data, although limited by sample size, do suggest that challenges experienced during the weaning period could have a significant impact on the infant's nutritional status at an older age. Again, this suggests that a stricter interpretation of AFASS may be required in this setting. Some highly vulnerable infants may not be adequately identified during the AFASS assessment process, or perhaps if they are, counselors are not aware of WHO's revised guidance to continue breastfeeding, even beyond 6 months, if cessation does not clearly meet AFASS criteria.

Expense was unanimously noted as a challenge, regardless of province or food item. Since many indicated that their water source during this period was from a river or a pond, the potential for contamination was very high. This highlights the need for improving water sanitation in these areas as well as providing frequent education and counseling for mothers on the importance of proper hygiene and safe water, particularly when conducting AFASS assessments.

Of concern are the nearly 35% of infants who were not fed any type of animal milk in the 24 hours prior to this interview. None of the infants in this study were currently breastfeeding and thus all required animal-milk–based foods to ensure adequate nutrition. However, a comparison to the data on food given during the weaning process, showing that 90% of mothers fed some type of milks during this period, suggests that better quality food was given at that time, but this does not appear to have been a sustainable dietary pattern.

According to 2009 UNICEF projections, 232 hospitals in Kenya (66%) have been designated as "Baby Friendly" and meet the Baby Friendly Hospital Initiative (BFHI) criteria to promote and protect breastfeeding. These criteria include teaching expression of breast milk in order to maintain lactation during periods of separation. In the context of HIV, teaching manual expression is especially important, as it promotes exclusive breastfeeding as well as breast health by helping to reduce complications from engorgement. Although 42% of women who participated in the survey indicated they had manually expressed in the past, we did not observe training or promotion of this practice in the actual counseling sessions. As mandated by BFHI and as a cost-effective, simple prevention strategy to reduce postnatal transmission of HIV,[37] manual expression should be taught to all mothers at ANC to prepare them for safe infant feeding. This knowledge could additionally contribute to empowering mothers to heat treat their breast milk to inactivate HIV during and after the transition from breastfeeding.

We identified several statistically significant associations in multivariate regression models. We investigated two different regression models for continuous WFA z-scores. When controlling for several variables, including infant age at interview, we found significant associations between higher age-standardized weights and being from Western Province and not having experienced illness or weight loss during the weaning period. This finding of overall WFA scores being higher in Western Province, and our previous finding that more of the infants with -2 WFA scores were from Western Province as well, suggests that infants at both extremes of development and growth reside in this area. As would be expected, this model suggests that infants who remained healthy during and after the weaning period had improved weight gain.

In an alternative model, we controlled for other variables as above but also substituted age at interview and province with the infant age at cessation of breastfeeding and weaning difficulty. We found statistically significant associations between higher age-standardized weights and being younger when weaned, the mother having difficulty during weaning, and, as above, not having experienced illness or weight loss during the weaning period. Additionally, when we compared infants with extremely low weight z-scores (-2 or lower)

with their counterparts, we found that infants who did not experience illness or weight loss during the weaning period were more likely to be underweight.

That these data suggest that infants who stopped breastfeeding at younger ages and whose mothers had more difficulty during weaning were more likely to have improved weight status is surprising but should be interpreted with caution. As a cross-sectional survey, we cannot determine causation, and importantly, reverse-causation. Indeed, a previous study that found a negative association between breastfeeding and linear growth demonstrated it to be due to reverse causality.[38] Breastfeeding did not lead to poor growth, but rather poor infant growth led to increased duration of breastfeeding. These data may reflect the same situation; that is, an HIV-infected mother may decide that early cessation makes sense if and only if her child is doing well. As described earlier, the weaning period for HIV-exposed infants has been shown by multiple longitudinal studies to be one of high risk for malnutrition, growth, and morbidity. As such, the WHO revised guidelines for HIV-infected mothers state that cessation should occur at 6 months *only* if the AFASS criteria are met and a nutritionally adequate and safe diet can be provided and maintained. Our data that suggest otherwise are limited by study design and could simply infer that mothers who experienced challenges during weaning or who had low-weight infants were more attentive to their infant's health, thus compensating for these obstacles. Additionally, this somewhat "unexplained" finding could be due to a statistical artifact given the large number of variables included in our analyses.

We found that infants who had experienced illness or weight loss or lacked food during the weaning period were more likely to have compromised nutritional status at the time of the interview. These findings suggest that challenges experienced months earlier, during the critical period when breast milk is no longer consumed, could have long-term impact on infant nutritional status.

Infants were more likely to have experienced respiratory problems during and since the weaning period if their mothers had been ill during this time or if the infant had eaten meat or eggs in the 24 hours prior to the interview. The association with maternal illness could be due to transmission of a respiratory infection from mother to infant, which was made more likely by the fact that the infant was not receiving breast milk's immune protection. The positive association with meat and eggs being fed in the previous 24 hours was surprising but could reflect those mothers who were attentive toward their infants' diets were also more likely to note early signs of possible illness.

We found that diarrhea during and after the weaning period was more likely among infants who had experienced illness or weight loss during this time. This was not surprising as a cycle of illness is often observed among infants; the immune system gets compromised by one affliction, resulting in susceptibility to other subsequent infections, often causing weight loss.

Fevers experienced during and after the weaning period were more likely if infants were from Western Province and if their mothers were not employed. Malaria prevalence is high in Western Province and could be the cause of more fevers reported in this area. Mothers'

unemployment could be a proxy for low socioeconomic status, often associated with increased infant morbidity.

Infants whose mothers were unemployed were also more likely to have refused to eat during and after the weaning period. This is not intuitive, as one would assume that mothers who are home would be more successful in improving eating behavior. However, this finding may simply be due to unemployed mothers being home more often and able to note feeding problems as they arise or that the infant was refusing to eat food from the mother whom they were expecting to breastfeed from instead.

Infants whose mothers experienced weaning problems were more likely to have had more than three visits to health clinics during and after the weaning period, although this was not observed for hospital visits. This suggests that if mothers have challenges stopping breastfeeding this could translate to compromised infant health, which could be compounded by the lack of enhanced immune protection from breast milk as it is replaced by other milks and foods.

It is clear from these data that multiple challenges exist for HIV-infected mothers during the weaning period. The additional costs associated with replacement foods were prohibitive for many, and affordability was the most common challenge cited by mothers during this time. When a mother stops breastfeeding, she may be able to sacrifice for some time to provide high-quality foods for her infant. But, lacking in past experience, she may be unaware that such high expenses are not sustainable for long enough to protect the health of the non-breastfed infant. Local stakeholders felt that the primary issues facing Kenya regarding infant feeding for HIV-exposed infants were poverty, which impaired mothers' ability to provide quality foods and replacement milks, and a lack of training among health care staff, resulting in insufficient nutrition knowledge and mixed messages to mothers.

This study found that challenges experienced during the weaning period, including infant morbidity and difficulty providing an adequate replacement diet, affected the future nutritional status of HIV-exposed infants, who are particularly vulnerable to growth faltering. Mothers require enhanced support during this challenging period in order to minimize physical and psychosocial problems for her and her infant. Caution should be exercised when counseling HIV-infected mothers on the appropriate time to stop breastfeeding; the safest age could vary depending on if mothers indeed have AFASS criteria in place to ensure safe and adequate nutrition for their babies. Appropriate counseling should reflect and clearly present this balance of risks to HIV-infected mothers. In order for this to occur, however, counselors themselves must be adequately trained. PMTCT trainings should prioritize the inclusion of comprehensive education around WHO recommendations for infant feeding, including the continued need for AFASS assessments for infants older than six months and the possibility that for many, continued breastfeeding may be the safest option.

It is acknowledged that the transition during breastfeeding cessation to replacement feeding can be a period of high risk, especially for HIV-exposed infants. If infant health is compromised during this time, then even for those who survive, it can have long-lasting

consequences on future growth and development. PMTCT programs should be comprehensive and focus not only on enforcing ART regimens through trainings and education but also on safe infant feeding practices. This is a daunting task given the staffing shortages and limited budgets that many sub-Saharan African countries grapple with today, and considering that child malnutrition is common even for mothers who do not cease breastfeeding because of HIV infection. Prioritizing infant nutrition in the context of PMTCT, however, is a cost-effective strategy, since interventions to promote exclusive breastfeeding, safe continued breastfeeding, and appropriate cessation of breastfeeding and transition to replacement feeding could be beneficial to the entire community and impact all children, not only those who are HIV-exposed.

The following is a list of recommendations toward creating a comprehensive strategy, many of which could target both PMTCT and general populations:

- Ensure that comprehensive AFASS assessments are conducted to allow a mother to assess her personal situation and decide the choice appropriate for her both at birth and, when appropriate, postnatally to decide when to stop breastfeeding.
- Increase the level of infant nutrition education for all clinical personnel, focusing both on PMTCT and general populations.
- Provide for comprehensive and continual training to ensure that health care providers have accurate and up-to-date knowledge on infant feeding risks and benefits. However, research shows that training is not enough.[39] Supportive supervision and follow up are crucial,[40] and where possible, monitoring and evaluation should be used to help find ways to improve counseling outcomes.
- Ensure that a consistent message is provided during ANC and postnatal counseling. Bias must be avoided; it is the health care provider's ethical obligation to provide a mother with accurate information on risks and benefits of all infant feeding options based on national guidelines.
- Develop a comprehensive approach to infant feeding counseling. Exclusive breastfeeding is not traditional in Kenya and to support it successfully will take more effort than a brief counseling session, as was found in Botswana.[41] Comprehensive approaches can be highly effective,[42, 43] specifically if they include more intensive health worker counseling as well as dedicated peer counseling.[44–47]
- Continue to enhance food by prescription programs to not only treat, but also prevent malnourishment in infants and young children.
- Provide HIV-specific as well as general IEC materials, such as job aids and counseling checklists, for health care workers as well as mothers on exclusive breastfeeding, continued breastfeeding, safe cessation of breastfeeding, and appropriate complementary and replacement feeding.
- Develop an infant feeding counseling protocol, shown to be very effective in Malawi.[48]

- Include age-appropriate frequency, volume, and hygienic preparation practices of infant foods during postnatal counseling.
- Educate health care workers on heat treatment of breast milk as one effective option to make breast milk safe during the high-risk weaning period.
- Improve effectiveness of PMTCT counseling.
    - Comprehensive counseling that occurs only during the initial post-test counseling visit may not be effective, as she would be overwhelmed at just learning her status. Providing information during follow-up visits as well would ensure improved comprehension when mothers are better equipped to deal with decision-making.
- Mobilize at the community level, including education of community leaders on safe infant feeding practices, as well as grandmothers, fathers, and social workers.
- Improve male involvement in infant feeding decision-making. This strategy was shown to improve compliance with PMTCT regimens in Kenya and most likely could improve adherence to exclusive breastfeeding as well.[49]
- Explore the option of grandmothers re-lactating to feed their HIV-exposed grandchildren. A recent study in Coastal Kenya found that grandmothers of HIV+ mothers could produce breast milk of adequate quantity and quality and that this was an acceptable infant feeding option to the community.[50]
- Implement a mass media campaign to promote safe infant feeding practices for all mothers.
    - Specific education should be provided regarding the risks associated with the unsafe teething practices common to Eastern Province (see Annex A: General Observations). This could include inclusion into any PMTCT and infant nutrition trainings as well as into any ongoing mass media campaigns with radio and dramas.
- Provide physical and psychosocial support, including individual mentoring and peer groups, targeting mothers during the weaning period, as well as increased follow-up for the infant to monitor for growth faltering and morbidities.
- Utilize the BFHI system to provide instruction to all mothers on manual expression of breast milk, especially as a strategy to promote exclusive breastfeeding and to prevent engorgement during weaning.
- Increase the overall availability of support groups to promote breastfeeding and safe infant feeding; these could target mothers, fathers, and grandmothers.
    - We noted that the existing support groups could improve in efficiency and quality; assigning one or several counselors to coordinate and facilitate specific support groups would allow for more in-depth discussions and possibly increase attendance.
- Provide infant nutrition education to community health workers to assist in counseling and providing support, with emphasis on the use of the child health card to assess nutritional status.

- Ensure that growth monitoring and promotion are conducted at each clinic visit.
- Improve water safety by implementing water sanitation projects and providing enhanced education around hygiene.
- Increase the availability of nutritionists to allow for more effective scheduling with clients (see Annex A).
- Revise the current ANC and child welfare cards to be a combined MCH card for rapid identification of HIV-exposed infants and allow for appropriate follow-up for this vulnerable population.
    - This would eliminate many missed opportunities to inquire about infant HIV testing, opportunistic infections, and growth monitoring. In addition, a separate register could be implemented to monitor exposed children. We observed an example of this at the Breastfeeding Club, a support group at Machakos District Hospital in Eastern Province.
- Provide refresher trainings to all counseling personnel, focusing on the ethical obligation as health care providers to ensure complete confidentiality when dealing with clients, especially those who are HIV-infected (see Annex A).

The implementation of such a comprehensive strategy requires the shared vision to prioritize infant nutrition across government and partnering institutions to ensure that a consistent message is delivered, with the ultimate goal of increasing HIV-free survival as well as improving growth and development among infants and young children in Kenya.

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Annex A: General Observations

The field teams made several observations during the data collection process at the clinics. These are worth noting here:

- Recruitment for observations and exit interviews was a challenge in Eastern Province because individual counseling was uncommon. Aside from the post-test counseling session, most PMTCT counseling takes place in groups, limiting the opportunity to discuss infant feeding issues confidentially. In most cases when a mother did have individual time with a provider, it was only for weighing the infant and prescribing medication. Staffing shortages seemed to be responsible for this lack of counseling (e.g., Ikanga Health Center in Eastern Province had only one nurse and one clinic officer to cover all wards). The group health talks, usually held in the mornings, are often used to substitute for individual counseling; however, clients who come later in the day miss this opportunity as well.
- Most of the ANC individual counseling took place during the post-test counseling session when mothers had recently received their test results. Pregnant women appeared to be in shock when learning of their status, and yet this is when comprehensive information on infant feeding, safe sex practices, disclosing status to partner, and general health advice was provided. It is unlikely that mothers would retain this information if only provided during the initial post-test counseling session.
- There was no indication of the mother's HIV status on the child welfare card, resulting in missed opportunities of identifying HIV-exposed infants, especially in the MCH clinic. Despite high turnouts, the field team had to depend on mothers who would volunteer their status or health providers who remembered these clients. Although a few facilities (Mwingi and Machakos District Hospitals in Eastern Province) indicate "EB" (exposed baby) on the cards, the majority have no indication.
- The field team felt that many of the health care providers are willing to counsel and have correct information on infant feeding practices but are overwhelmed by the workload, especially at District Hospitals, where attendance is high and individual counseling is difficult.
- In some health facilities, health care providers seem willing to learn but have either wrong or out-of-date information, resulting in a bias toward not breastfeeding at all or breastfeeding for a short time.

"The more you breastfeed, the higher the chances of infecting the baby. The less you breastfeed, the safer your baby. You should breastfeed only if you're not able to afford food for the baby. By all means, don't exceed 4 months."

- *Student nutritionist counseling mothers in Breastfeeding Club at a District Hospital, Eastern Province*

- We observed very little follow-up for mothers by the providers after counseling. Many mothers had been counseled to stop breastfeeding before the infant was 6 months of age, but then they encountered challenges while trying to stop and so returned to breastfeeding (i.e., mixed feeding). Yet the providers had not inquired about or offered support regarding their infant feeding situation.
- Many mothers seemed to take the infant feeding information they received very seriously and strive to adhere to it, whether they chose to exclusively breast feed or replacement feed. We were impressed by the desire of many mothers, educated or not, who seemed to understand and attempt to adhere to their decision in a very strict manner. In spite of this, mixed feeding was a common practice in both provinces.
- Stigma seems to be a major issue for mothers as they attempt to stop breastfeeding. Even when they have correct information, many mothers are not able to practice it out of fear or pressure from relatives and neighbors, resulting in mixed feeding before 6 months or continued breastfeeding longer than they intended.
- Financial and food availability constraints often impact mothers' ability to follow the feeding method they chose.
- As per advice from their health care provider, many mothers are attempting to stop breastfeeding abruptly out of fear of infecting their baby.
- Some mothers indicated that if an infant tests HIV negative, the infant is no longer at risk and so mixed feeding would then be safe.
- Some cultural practices mandate that mothers not feed meat, eggs or cow's milk to an infant, even when they are older than 6 months.
- Many mothers-in-law were noted to exert substantial negative influence on the mothers' ability to implement her infant feeding choice. Unaware of the HIV status of their daughters-in-law, they would often insist that their grandchild continue to be breastfed—a challenge, given that they usually live in the same compound. Husbands tended to be indifferent to their wives' predicament, possibly because they had not received infant feeding counseling.
- Districts have one nutritionist who is expected to work in all the facilities in the district, and thus has very limited time. As a result, the nutritionist is often not available when needed. We observed one mother with a very weak child who had been referred to the nutritionist and had come to the clinic three times looking for her in vain. We were able to establish contact with the nutritionist and successfully arrange an appointment for the mother.
- Privacy and confidentiality appeared to be issues in some health facilities. On multiple occasions, health care providers were observed talking about clients in the presence of other clients. Several clients acknowledged that they preferred to travel to clinics far from their homes to avoid the clinic in their community because the provider there had exposed their status to others without their consent.
- We observed frequent rotation of support group in-charge nurses. Some mothers complained that there was no continuity, resulting in confusion of topics that had been and were yet to be covered and inefficient scheduling. This also dilutes the impact of PMTCT (and other) training and emphasizes the need to continually repeat training, as new untrained staff continually take up new positions.

- In Eastern Province, we observed a cultural practice called *kukithwa* which involves traditional healers rubbing a teething infant's gums with a mixture of soda ash and a rough substance; often razor blades are used. The belief is that this allows the growing teeth to be exposed. This often results in open wounds in the baby's mouth, however, increasing the risk of HIV transmission if the infant is still breastfeeding or if the traditional healer is HIV infected and there is blood exposure. Although not substantiated, we learned of a case in Makindu of a baby who tested HIV-infected, yet both parents were negative; the infection was suspected in the community to be from the traditional healer practicing *kukithwa*.
- Similarly, in Eastern Province the practice of removing a baby's molar teeth manually with pins, razors, needles, or other sharp objects is common. Although discouraged at the clinic level, this is widely practiced in the community and puts many infants at risk of HIV and other potential infections as well as causing psychological distress.
- General observations of food security were that food availability was a major challenge for most mothers in Eastern Province. Most have to buy the majority of the food both for themselves and for the baby. Some mothers were considering going back to breastfeeding (after they had stopped) because of a lack of food for the baby. Some women indicated that they had money; however, neither milk nor baby food was available where they lived. In Western Province, the region is more diverse. In Kakamega and Bungoma Districts of Western Province, although food seems readily available, it is not adequate for many; most residents have a food crop but also need to supplement from the market, yet low income levels limit this. In Vihiga District, there is little subsistence farming due to difficult terrain, resulting in the need to purchase most food items. Food is known to be expensive in this area, and as a result many cannot afford to buy adequate food on a continual basis.
- Many mothers informally reported stopping breastfeeding before 6 months due to a belief that lack of enough food for the mother prevents her from being able to produce sufficient breast milk.