Symposium: Women's Voices, Women's Choices: The Challenge of Nutrition and HIV/AIDS

An Education and Counseling Program for Preventing Breast-Feeding–Associated HIV Transmission in Zimbabwe: Design and Impact on Maternal Knowledge and Behavior[1,2]

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ABSTRACT International guidance on HIV and infant feeding has evolved over the last decade. In response to these changes, we designed, implemented, and evaluated an education and counseling program for new mothers in Harare, Zimbabwe. The program was implemented within the ZVITAMBO trial, in which 14,110 mother–baby pairs were enrolled within 96 h of delivery and were followed at 6 wk, 3 mo, and 3-mo intervals. Mothers were tested for HIV at delivery but were not required to learn their test results. Infant feeding patterns were determined using data provided up to 3 mo. Formative research was undertaken to guide the design of the program that included group education, individual counseling, videos, and brochures. The program was introduced over a 2-mo period: 11,362, 1311, and 1437 women were enrolled into the trial before, during, and after this period. Exclusive breast-feeding was recommended for mothers of unknown or negative HIV status, and for HIV-positive mothers who chose to breast-feed. A questionnaire assessing HIV knowledge and exposure to the program was administered to 1996 mothers enrolling after the program was initiated. HIV knowledge improved with increasing exposure to the program. Mothers who enrolled when the program was being fully implemented were 70% more likely to learn their HIV status early (<3 mo) and 8.4 times more likely to exclusively breast-feed than mothers who enrolled before the program began. Formative research aided in the design of a culturally sensitive intervention. The intervention increased relevant knowledge and improved feeding practices among women who primarily did not know their HIV status. J. Nutr. 135: 950–955, 2005.

KEY WORDS: • *breast-feeding* • *HIV* • *exclusive breast-feeding* • *mother to child transmission* • *Zimbabwe*

An estimated 630,000 infants and young children are infected with HIV each year through mother-to-child transmission, and the vast majority of cases occur in sub-Saharan Africa (1). Breast-feeding is an important route of transmission, causing about 280,000 to 300,000 infections annually, or about 42% of pediatric infections (2). This has created one of the most poignant dilemmas of the HIV pandemic, because breast-feeding also protects infants from diarrhea and other

[1] Presented as part of the symposium "Women's Voices, Women's Choices: The Challenge of Nutrition and HIV/AIDS" given at the 2004 Experimental Biology meeting on April 20, 2004, Washington, DC. The symposium was sponsored by the American Society for Nutritional Sciences and in part by the Society for International Nutrition Research. The proceedings are published as a supplement to *The Journal of Nutrition*. This supplement is the responsibility of the Guest Editors to whom the Editor of *The Journal of Nutrition* has delegated supervision of both technical conformity to the published regulations of *The Journal of Nutrition* and general oversight of the scientific merit of each article. The opinions expressed in this publication are those of the authors and are not attributable to the sponsors or the publisher, editor, or editorial board of *The Journal of Nutrition*. The Guest Editors for the symposium publication are Margaret E. Bentley, University of North Carolina, Chapel Hill, NC, and Ellen Piwoz, Academy for Educational Development, Washington, DC.

[2] The ZVITAMBO project was supported by the Canadian International Development Agency (CIDA) (R/C Project 690/M3688), United States Agency for International Development (USAID) (cooperative agreement number HRN-A-00–97-00015–00 between Johns Hopkins University and USAID's Office of Health and Nutrition), and a grant from the Bill and Melinda Gates Foundation, Seattle, WA, with supplemental funding from the Rockefeller Foundation (New York City, NY) and BASF (Ludwigshafen, Germany). Additional funding for the infant feeding work was provided by the Support for Analysis and Research in Africa (SARA) and LINKAGES Projects, operated by the Academy for Educational Development, Washington, DC. The SARA Project is funded by USAID's Bureau for Africa, Office of Sustainable Development under the terms of Contract AOT-C-00–99-00237–00. The LINKAGES Project is funded by USAID's Bureau for Global Health, GH/HIDN, under Cooperative Agreement No. HRN-A-00–97-000007–00.

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infections, and is an important birth-spacing method for millions of families. A recent review noted that breast-feeding promotion programs could directly prevent 1.3 million child deaths each year and that breast-feeding promotion and support is one of the most feasible child survival interventions to implement (3).

Although it has been known since the mid-1980s that HIV can be transmitted through breast milk, the public health community remains divided about how to address this issue in developing countries. Initially, in statements issued in 1987 and 1992, the United Nations agencies continued to recommend breast-feeding for all infants of HIV-positive mothers living in resource-poor countries, believing that the benefits of breast-feeding outweighed the risk of HIV transmission in all areas where infectious disease was the leading cause of infant death (4,5).

In June 1998, growing evidence about the risk of HIV transmission through breast-feeding culminated in revised recommendations urging countries to make counseling and HIV-testing accessible to antenatal women and stating that women should be "empowered to make fully informed decisions about infant feeding" and "suitably supported in carrying them out" (6). Later, in 2001, international guidelines were further modified to state that "when replacement feeding is acceptable, feasible, affordable, sustainable, and safe, avoidance of all breastfeeding by HIV-infected mothers is recommended" (7).

Programmatically, these recommendations challenge health care services to move from a general message that can be delivered to all women unequivocally promoting exclusive breast-feeding (EBF)[5] to the need for individualized counseling, wherein HIV test results and infant feeding options are discussed, and an array of risks, benefits, costs, and psychological factors are weighed with each HIV-positive mother.

In addition to helping HIV-positive mothers decide whether to breast-feed at all, counseling must also address ways in which the risk of breast-feeding–associated transmission can be reduced. Two reports published in 1999 suggested that the HIV-risk imposed by breast-feeding might be modifiable. In South Africa, Coutsoudis and colleagues (8) observed a 48% reduction in HIV transmission by 3 mo among mothers who breast-fed exclusively (feeding breast milk only and no other milks, liquids, or solid foods) when compared with transmission risks by mothers who practiced early mixed feeding (feeding breast milk plus other solids, milks, or liquid foods). In Malawi, subclinical mastitis was associated with higher breast milk viral loads and transmission (9), suggesting that good lactation management to minimize engorgement, mastitis, and nipple disease may reduce transmission. This concept, that breast-feeding could be made safer, is particularly promising for women and infants living in settings where clean water is unavailable, where replacement feeding is unaffordable, and where many HIV-positive women are choosing to breast-feed even knowing the risks.

We developed an education and counseling program to inform and to support new mothers about infant feeding in the context of HIV. We evaluated the program's impact on maternal knowledge, feeding practices, and postnatal HIV transmission. The work was done within the ZVITAMBO trial, a randomized clinical trial testing the impact of postpartum vitamin A supplementation on several health outcomes. ZVITAMBO enrolled 14,110 mother–infant pairs from November 1997 through January 2000, covering the time period when the 1998 HIV and infant-feeding guidance was issued, but before the introduction of antenatal HIV counseling and testing in Harare.

This paper describes the steps taken to develop the intervention and its impact on maternal knowledge, timely receipt of HIV test results, and infant-feeding practices. The impact of the program on postnatal HIV transmission and HIV-free survival will be reported elsewhere.

METHODS

ZVITAMBO trial data collection

The ZVITAMBO trial has been described previously (10). Briefly, mother–baby pairs were enrolled, following written consent, within 96 h of delivery at one of 14 maternity clinics in greater Harare, being eligible if neither had an acutely life-threatening condition, the baby was a singleton with birth weight > 1500 g, and the mother planned to stay in Harare after delivery. Written informed consent included permission to test mothers for HIV. Mothers could learn their results at any time during the study with appropriate pre- and post-test counseling, but they were not required to do so. This feature makes ZVITAMBO unique. All other studies of infant feeding and HIV have been conducted among mothers who knew their HIV status.

Socioeconomic, demographic, breast-feeding initiation, and prelacteal feeding data were collected by interview at enrollment. Details of the pregnancy and the delivery were transcribed from hospital records. At delivery, 32% of the mothers were HIV positive (10). Follow-up visits at 6 wk, 3 mo, and at 3-mo intervals for up to 24 mo included maternal and infant blood collection. Detailed infant feeding information, including breast-feeding status and whether or not any of 22 nonmilk liquids, nonhuman milks (animal milks and commercial formula), medicines (traditional fluids, oral rehydration salts, other prescribed), or solid foods had ever been given to the infant were collected at enrollment, 6 wk, 3 mo, and 6 mo after delivery.

Infants who provided infant-feeding information at enrollment, 6 wk, and 3 mo were classified into 1 of 3 early breast-feeding patterns: *1*) EBF—only breast milk, vitamins, or prescribed medicines at all 3 time points, or at 2 of 3 time points. One lapse in exclusivity of EBF at 1 of the 3 time points was allowed only if the nonbreast milk item consumed was a nonmilk liquid; *2*) predominant breast-feeding—breast milk plus nonmilk liquids; *3*) mixed breast-feeding—breast milk plus nonhuman milks and/or solid foods at one or more time points. Classification was limited to the first 3 mo, because 93% of study infants were mixed breast-feeding by 6 mo.

Psychosocial counseling was available throughout the study. The date and reason for each individual counseling session, and whether HIV test results were obtained, was documented.

Formative research to design the education and counseling program

The first public-sector HIV-testing facility in Zimbabwe opened in March 1999. Before this, very few antenatal women or any other Zimbabweans had the opportunity to know their HIV status, other than women participating in our trial. Hence, there was little experience to inform us about how to implement new HIV infant-feeding guidance, or how mothers and their families would respond. To address this gap, we carried out a formative research study from April to July 1999 to help us to design a locally appropriate education and counseling intervention.

Focus groups were used to assess knowledge, beliefs, and attitudes in the community about mother-to-child transmission (MTCT) of HIV, breast-feeding and replacement feeding, and HIV testing and status disclosure. A purposeful sample of 48 fathers, 53 lactating women, and 47 pregnant women participated in one of 24 discussions (8 for each type of person). In-depth interviews were conducted with postpartum women participating in the ZVITAMBO trial to learn how they had made the decisions of whether to receive and to disclose their HIV results and how to feed their baby. Eleven women who knew they were HIV positive and 7 women who knew they were

[5] Abbreviations used: EBF, exclusive breast-feeding; KE, knowledge/exposure; MTCT, mother-to-child transmission of HIV.

HIV negative were enrolled on a rolling basis as they came for post-test counseling; an additional 19 women who chose not to know their HIV status were selected, matched to the HIV status-known women on infant age and family income.

All discussions and interviews were conducted in Shona by 1 of 4 trained interviewers using field guides, and were tape recorded, transcribed, and translated. Participants provided written informed consent.

Formative research analysis

Textual data were read to identify recurrent patterns, and summaries were written about each case. Codes were created and assigned to text so that it could be systematically searched (11). Data were computerized and analyzed using the software NUDIST (12).

Formative research: key findings

The majority of respondents believed that all babies of HIV-positive mothers would become HIV infected and that there was nothing that could be done to prevent transmission. Few Zimbabweans can afford replacement feeding, and it was felt that mothers who do not breast-feed may face negative social consequences. People may believe that she is a witch, stole the child, has a bad omen or spirit, has been promiscuous so that this child is not her husband's, or that she is HIV positive. Some people held the misconception that mixed feeding is a good way to reduce the risk of HIV transmission, because smaller volumes of infected milk are consumed. Both wives and husbands agreed that husbands have the final say in whether and how long their babies are breast-fed.

Learning one's HIV test results was perceived as an extremely negative and fearful experience. Mothers who tested for HIV before their husbands were tested were worried that they would be accused of bringing HIV into the home. Understanding that maternal HIV seroconversion during breast-feeding places babies at especially high risk of breast-feeding–associated transmission was the key point that helped married men to understand their role in MTCT and to accept responsibility to be tested and to take preventive measures. Married men wanted to be informed about MTCT issues directly rather than through their wives so they could assume a leadership role in the discussion. Wives wanted to be relieved of the responsibility of informing their husbands.

Development of the education and counseling program

The education and counseling program ("the intervention") was developed from June to August, 1999 and included the following components.

Antenatal education. Basic information about infant feeding in the context of HIV was incorporated into education sessions held for women receiving antenatal care at ZVITAMBO recruitment sites. Key messages included these facts: only some (not all) babies of HIV-positive mothers become infected themselves, breast-feeding is a major mode of HIV transmission and the risk is particularly high for mothers who seroconvert during breast-feeding, and making an informed choice about infant feeding is one reason to learn one's HIV status.

Male outreach and education. Information on MTCT, including infant feeding, was incorporated into ongoing male education programs in Harare, including work-place outreach.

Infant feeding options for HIV-positive mothers. Infant feeding was integrated into HIV counseling for ZVITAMBO women who chose to learn their HIV status. Post-test counseling of HIV-positive women included a full discussion of the risks, benefits, and costs of 4 feeding options: *1*)"safer breastfeeding," consisting of 4 practices (EBF to 6 mo; proper infant positioning and attachment to the breast to minimize breast pathology; seeking medical care quickly for breast problems; and practicing safe sex, especially during the breast-feeding period); *2*) heat-treated expressed breast milk; *3*) replacement feeding with commercial formula; *4*) replacement feeding with homemade formula. HIV-positive mothers were counseled to stop breast-feeding rapidly at 6 mo and to then feed their infants using locally available foods.

Infant feeding options for other mothers. HIV-negative mothers and mothers who chose not to learn their HIV status were educated in "safer breast-feeding." Educational materials were developed, including 2 videos, 3 pamphlets, counseling tools describing the costs, advantages and disadvantages of each feeding option for HIV-positive women, and take-home fact sheets providing step-by-step instructions for implementing each feeding option safely.

Implementation of the intervention

Over a 2-mo period, beginning September 1, 1999, 12 HIV counselors and >50 health educators, all employed by the study, were trained on MTCT and infant feeding, and on how to use the education and counseling materials. The program was considered to be partially operational during the 2-mo period when training was taking place. By November 1, all staff had been trained, and educational materials were available for individual counseling and group education sessions. Thus, women enrolled in ZVITAMBO before September 1, 1999, September 1, 1999 to October 31, 1999, and November 1, 1999 to January 31, 2000, were classified as the "pre-," "partial-," and "full-" enrollment cohorts with respect to the intervention.

Evaluation of the intervention

A questionnaire was administered to 1996 women in the "partial" and "full" cohorts to ascertain sources of information and knowledge about 16 issues regarding HIV, MTCT, risk factors, and ways to reduce breast-feeding–associated transmission. Recall of exposure to any of the 7 educational materials used in the program (3 brochures, 2 videos, group education, individual counseling) at any of 4 time points (antenatal, delivery, 6 wk postpartum, and other times) was also measured. The impact of the intervention on maternal knowledge was compared according to the number of reported exposures to the program, timing of exposure, and whether or not individualized counseling and/or group education was received. The impact of the intervention on early infant-feeding practices and the decision to learn one's HIV status was evaluated by comparing these behaviors between enrollment cohorts (pre, partial, and full) for the total study population and then, among mothers completing the knowledge/exposure (KE) questionnaire, according to the timing, type, and number of reported exposures to the program.

Analysis methods

Statistical analysis was conducted using SAS Version 8.1 (13). Baseline characteristics were compared for mothers in the pre, partial, and full cohorts using ANOVA and chi-square tests for continuous and categorical variables, respectively. Mothers' exposure to the intervention was quantified by summing the total number of reported contacts with the 7 ZVITAMBO educational materials at the 4 time points, for a total of 28 possible exposures. Logistic regression models were used to investigate the effect of exposure to the intervention on knowledge of HIV/AIDS and infant feeding, decisions about HIV testing, and on EBF for at least 3 mo. Models were constructed with and without adjusting for other explanatory variables. Independent factors were retained in the multivariate logistic regression models at the $\alpha = 0.05$ level.

RESULTS

Of the 14,110 mothers enrolled in the trial, 11,362, 1311, and 1437 were enrolled during the pre, partial, and full intervention periods, respectively. Overall, 2323 mothers received individual counseling from the project; 1652, 520, and 151 mothers had 1, 2, and 3 or more individual counseling sessions, respectively. All but 4 mothers initiated breast-feeding. Mothers in the full intervention cohort had slightly higher parity and lower income, and were less likely to have prolonged

membrane rupture during childbirth. Other baseline characteristics did not differ between the enrollment cohorts (**Table 1**).

Of the 1996 mothers who completed the KE questionnaire, 930 enrolled during the partial and 1066 enrolled during the full intervention periods. The majority of KE interviews (66%) were carried out at the 3-mo clinic visit. The remaining interviews were carried out at 6 mo (8%), 9 mo (19%), or between 9 and 12 mo after delivery (6%). Among the mothers completing the questionnaire, 278 (13.9%) reported no exposure to the program; 451 (22.6%) reported 1 or 2 exposures to the program, 742 (37.2%) reported 3 or 4 exposures, and the remainder (26.3%) reported 5 or more exposures to the program, respectively. Most often, exposure occurred during enrollment (64.2%) and at the 6-wk visit (38.4%).

Impact of the intervention on knowledge

Among women who reported no exposure to the intervention, about half were able to distinguish between HIV and AIDS, and most knew that a healthy-looking person can be HIV positive, but few could name risk factors for postnatal transmission or could cite ways to reduce this risk (**Table 2**). Exposure to the intervention was a significant determinant of knowledge for 13 of the 16 HIV facts that were measured. The likelihood of knowing these 13 facts rose significantly, by 10% to 39%, with each additional exposure to the intervention, after adjusting for maternal education, parity, timing of the interview, and knowledge of HIV status at the time of the interview. Most of this impact was due to receiving group education (data not shown). Exposure at antenatal care, delivery, and 6-wk postpartum were significantly associated with knowing 11, 10, and 9 of the 16 HIV facts, respectively, after adjusting for maternal characteristics and exposure at the other time points, indicating that all time points were effective teaching times (data not shown).

Impact of the intervention on receiving HIV test results

Among all the women enrolled in ZVITAMBO, only 2182 mothers (15.5%) chose to learn their HIV status at any time during the study. Thus, the educational intervention on safer breast-feeding for women of unknown HIV status was one of the most important aspects of the program. Of those who learned their status, 1022 (46.8%) learned in the first 3 mo (13 wk) after delivery. Early acquisition of test results is important, because it allows mothers the opportunity to make informed decisions about breast-feeding and HIV prevention practices. In final logistic regression models, mothers in the full-intervention cohort were 70% more likely to learn their HIV status in the first 3 mo than mothers in the preintervention cohort, after adjusting for other significant covariates (**Table 3**).

Impact of the intervention on early breast-feeding patterns

Complete data on early feeding patterns were available for 8591 infants. The EBF rate increased and the mixed breast-feeding rate decreased among women enrolled in the full intervention compared with the preintervention cohorts (**Fig. 1**). Predominant breast-feeding rates were similar across en-

TABLE 1

Baseline characteristics of women according to intervention enrollment cohort (n = 14,110)

	Enrollment cohort[1]			
Baseline characteristic	Pre *n* = 11,361	Partial *n* = 1311	Full *n* = 1438	*P*-value
Age, *y*	24.5 (5.3)	24.5 (5.1)	24.8 (5.3)	0.17
Parity	2.05 (1.3)	2.08 (1.3)	2.14 (1.2)	0.04
Household income, *US$/d*	3.87 (4.6)	3.48 (4.7)	3.66 (4.7)	0.02
Employed, %	17.7	18.8	18.8	0.42
Education <8 y, %	18.5	16.9	16.5	0.10
Infant birth weight, *g*	2969.5 (458.0)	2993.1 (441.7)	2980.0 (454.6)	0.17
Infant gender, male, %	51.6	51.9	50.1	0.53
Ruptured membranes >4 h, %	42.4	30.6	29.7	0.0001
HIV positive at delivery, %	32.2	30.8	31.2	0.45

[1] Values are means (SD), except where noted otherwise.

TABLE 2

Maternal knowledge for mothers with no reported exposure to the education and counseling program, and the relationship between knowledge and exposure to the program (n = 1996)

Knowledge item	% women with zero exposure knowing the fact	Adjusted odds ratio for knowing the fact per each additional reported program exposure (95% CI)[1]
HIV and mother-to-child transmission		
HIV is a virus	42.8	1.17‡ (1.11–1.22)
AIDS is a disease	53.2	1.10‡ (1.05–1.15)
A healthy-looking person can be HIV positive	87.2	1.02 (0.95–1.10)
1 to 3 babies of HIV-positive mothers will be born HIV positive	17.1	1.26‡ (1.19–1.34)
1 to 3 babies of HIV-positive mothers will become HIV infected during breast-feeding	22.3	1.30‡ (1.23–1.36)
Risk factor for postnatal transmission		
Mother becomes HIV positive during breast-feeding	6.8	1.19‡ (1.10–1.28)
Cracked nipples	15.5	1.16‡ (1.11–1.22)
Mastitis or breast abscesses	5.8	1.12** (1.05–1.19)
Infant oral thrush or mouth sores	3.6	1.22‡ (1.14–1.31)
Nonexclusive breast-feeding	1.8	1.22‡ (1.12–1.32)
Mother has AIDS	3.2	1.04 (0.92–1.18)
Possible ways to reduce postnatal transmission		
Learn HIV status; go for counseling	4.0	1.18** (1.08–1.29)
Practice safe sex	7.6	1.19‡ (1.12–1.27)
Breast-feed exclusively up to 6 mo	2.5	1.39‡ (1.30–1.48)
Seek prompt treatment of illness, especially breast pathology	4.7	1.22‡ (1.15–1.30)
Stop breast-feeding or do not breast-feed at all	23.7	0.95 (0.90–1.00)

[1] Models adjusted for maternal education, parity, timing of interview, and knowledge of HIV status by 3 mo after delivery; * $P < 0.05$, † $P < 0.01$, ** $P < 0.001$, ‡ $P < 0.0001$.

TABLE 3

Adjusted odds ratios (95% CI) in final multivariate logistic regression models[1] of the impact of the education and counseling intervention on (a) a mother's decision to learn her HIV status <3 mo (n = 14037) and (b) EBF for at least 3 mo (n = 8591)

	(a) Learned HIV status <3 mo		(b) EBF	
	Adjusted odds ratio	95% CI	Adjusted odds ratio	95% CI
Intervention cohort				
Pre	1.00		1.00	
Partial	1.27	1.04–1.56*	1.75	1.31–2.35**
Full	1.70	1.28–2.25**	8.43	6.13–11.59‡
Maternal HIV status				
Positive	1.00		—	—
Negative	1.18	1.03–1.36*		
Mother employed				
No	1.00		1.00	
Yes	1.29	1.10–1.51†	0.74	0.58–0.94†
Maternal education (years completed)	1.08	1.03–1.12**	1.08	1.03–1.14†
Maternal parity	1.12	1.06–1.17‡	1.28	1.20–1.37‡
Enrollment over Christmas holiday				
No	1.00		1.00	
Yes	0.53	0.43–0.66‡	0.68	0.51–0.91**

[1] Other variables offered but not retained in the model include household income, duration between membrane rupture and delivery, and infant birth weight; * $P < 0.05$, † $P < 0.01$, ** $P < 0.001$, ‡ $P < 0.0001$.

rollment cohorts. The adjusted odds ratio for EBF was 8.43 among women exposed to the full intervention (Table 3). Learning one's HIV status before 3 mo was associated with a relatively small (28%) increase in the likelihood of EBF and was not retained in the final model.

Among women completing the KE questionnaire, EBF rates increased in a dose responsive manner with the number of reported exposures to the intervention (**Fig. 2**). Both group and individual contacts were important (**Table 4**). After adjusting for maternal parity, employment, and education, mothers who received only group education, individual counseling but no group education, and both group education and individual counseling were 2.60 (95% CI: 1.90–3.56), 3.35 (95% CI: 2.22–5.06), and 5.21 (95% CI: 4.04–6.73) times more likely to EBF, respectively, relative to mothers with no program exposure.

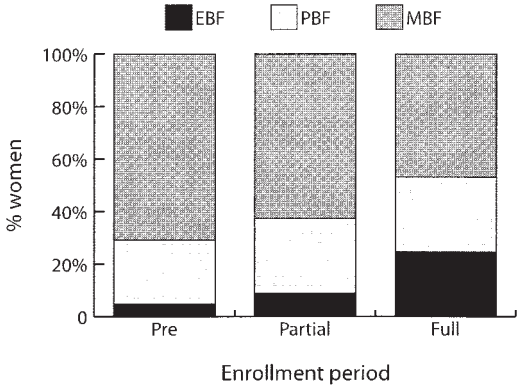

FIGURE 1 Early breast-feeding pattern by exposure to the counseling and education intervention (n = 8591). MBF, mixed breast-feeding; PBF, predominant breast-feeding.

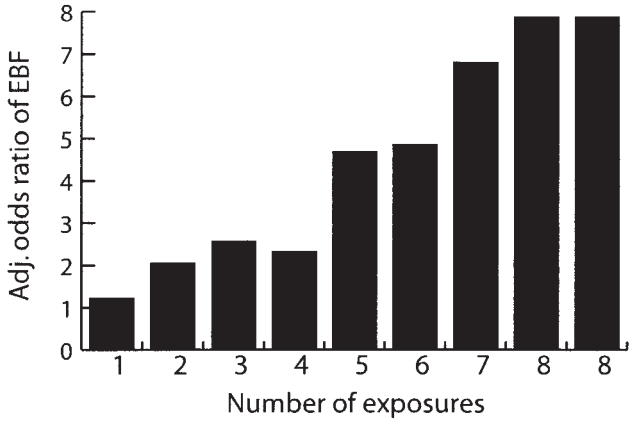

FIGURE 2 Adjusted odds ratio for exclusive breast-feeding to at least 3 mo with each additional exposure to the counseling and education intervention (n = 1996). Model adjusted for maternal parity only. Other variables offered but not retained in the model include maternal education, employment, maternal HIV status, maternal knowledge of HIV status, duration between membrane rupture and delivery, and infant birth weight.

DISCUSSION

We used formative research methods to design a culturally sensitive education and counseling program about infant feeding in the context of HIV and then evaluated its impact on maternal knowledge and behavior. The program was implemented within a large study population in which the prevalence of HIV was high, yet the proportion choosing to know their HIV status was relatively small.

The education and counseling program was effective in improving knowledge about MTCT of HIV, risk factors for HIV transmission during breast-feeding, and ways to prevent breast-feeding–associated HIV transmission. The intervention also increased the likelihood that a mother would learn her HIV status early in the postnatal period and that she would breast-feed exclusively for at least 3 mo, a practice that was associated with a 50% reduction in postnatal HIV transmis-

TABLE 4

Early breast-feeding pattern by type of exposure to the counseling and education intervention (N = 8591)[1]

Type of early feeding pattern	Type of Exposure			
	None	Group only	Individual counseling only	Group + individual
	% (n)			
EBF	5.5 (416)	13.4 (52)	15.9 (29)	23.7 (94)
PBF	24.4 (1859)	30.2 (117)	31.2 (57)	28.0 (111)
MBF	70.2 (5350)	56.3 (218)	53.0 (97)	48.2 (191)
Total (N)	7625	387	183	396

PBF, predominant breastfeeding; MBF, mixed breast-feeding.
[1] Overall χ^2; 6 df; $P < 0.0001$.

sion in this study population (14). The decision to breast-feed exclusively was independent of knowledge of HIV status in this study. The impact of our program on HIV transmission by mothers of known and unknown HIV status is now being analyzed.

In spite of the significant positive impact of exposure to the program, the proportion of mothers in the full-intervention cohort who followed our recommendations was still disappointingly low, leaving much room for improvement: only 7.1% learned their HIV status before 3 mo and only 24.6% breast-fed exclusively for at least 3 mo. In the future, to achieve greater compliance, efforts to sensitize communities about HIV and infant feeding should combine group education with individualized counseling, reaching women (and their partners) frequently during the antenatal and postnatal periods. Group education should cover basic facts about HIV and infant feeding, including safer breast-feeding practices. Individualized counseling is needed to help all mothers safely implement feeding decisions.

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