

Breast Health Problems Are Rare in Both HIV-Infected and HIV-Uninfected Women Who Receive Counseling and Support for Breast-Feeding in South Africa

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Background. Breast problems, including mastitis, can interfere with the duration and exclusivity of breast-feeding. However, there are no large prospective studies documenting the prevalence, duration, and timing of such problems in breast-feeding women, particularly those who are infected with human immunodeficiency virus (HIV).

Methods. Women enrolled prenatally underwent a breast-feeding counseling intervention until 6 months after delivery. Breast health problems were documented per breast for 180 days after delivery, with 14-day recall histories.

Results. Breast health problems were rare, and there were no significant differences between HIV-infected and HIV-uninfected women for any of the following conditions: engorgement, 39 HIV-infected women (3.5%) versus 33 HIV-uninfected women (2.7%; $P = .30$); breast thrush, 17 (1.5%) versus 12 (1.0%; $P = .25$); bleeding nipple, 6 (0.5%) versus 4 (0.3%; $P = .45$); and mastitis/abscess, 11 (1.0%) versus 6 (0.5%; $P = .17$). Most problems occurred during the first month after birth, with few additional mothers experiencing problems after this point: at 1 and 6 months, 13% and 17% of all mothers, respectively, had experienced a minor or major breast health problem, including sore nipples. Women who had not exclusively breast-fed their infants were more likely to experience any of the breast health problems than were women who had exclusively breast-fed their infants (time-dependent variable; adjusted odds ratio, 1.46; 95% confidence interval, 1.13–1.87; $P = .003$). HIV-infected women who experienced any serious breast health problem (i.e., bleeding nipple, pus oozing from a nipple or breast, or mastitis/abscess) were 3.55 times (95% confidence interval, 0.86–14.78 times; $P = .08$) more likely to transmit HIV postnatally to their infant.

Conclusions. With encouragement to exclusively breast-feed, women experienced few breast health problems. When those problems did occur, HIV-infected women with bleeding nipple, pus oozing from a nipple or breast, or mastitis/abscess were more likely to transmit HIV to their infants.

Mastitis and other breast health problems are commonly reported in breast-feeding women [1]. Although much is known about the clinical management of these problems [2, 3], there are limited reports about the expected prevalence of (or interventions to prevent) such conditions [1]. The reported incidence of mastitis and breast abscess ranges from 2% [4, 5] to 33% [6] of lactating women, depending on study design, methods of data collection, and selection of participants [1]. There are no large prospective cohort studies documenting the prevalence of breast pathologies in breast-feeding women.

Serious breast pathologies causing inflammation and bleeding, as well as subclinical mastitis, have been associated with postnatal HIV transmission [7–10]. In addition, conditions such as mastitis are known to interfere with the success and duration of optimal breast-feeding practice in the first 6 months after birth (i.e., exclusive breast-feeding) [2–5]. On the other hand, exclusive breast-feeding decreases both mother-to-child transmission of HIV [11, 12] and breast health problems [2–5]. It is therefore necessary to understand the interactions between these 3 elements of infant feeding: breast health problems, exclusivity of breast-feeding, and postnatal HIV transmission through breast-feeding. Breast problems in 2 cohorts of HIV-infected African women were reported to be high, with rates of mastitis during breast-feeding ranging from 11% [8] to 16% [9]. Therefore, it is critically important to prevent such breast health problems, both to sustain exclusive breast-feeding and to reduce postnatal HIV transmission.

We report the prevalence, duration, timing, and determinants

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Table 1. Definitions of breast health conditions.

Term	Definition
Painful nipple	Mother complains of pain in her nipple
Cracked nipple	A fissure or crack anywhere on the nipple, including the base
Bleeding nipple	Blood coming from the nipple
Engorgement	Painful, edematous breasts, usually bilateral; the skin of the breasts, especially nipples, looks tight and shiny; milk does not flow easily; the mother may experience fever for 24 h
Blocked milk duct	A lump, often tender, sometimes with inflammation of the overlying skin; the woman has no fever and feels well
Breast thrush	Skin of nipple and areola is shiny and flaky (also noted to be red on paler skin); there is itchiness; mother often complains of deep pain that persists between feeds
Nipple oozing pus	Pus coming from the nipple
Breast oozing pus	Pus coming from the breast (as opposed to the nipple)
Mastitis	Part of the breast is swollen and hard, with inflammation of the overlying skin; mother complains of severe pain and fever and feels ill
Abscess	A localized, painful, collection of pus within the breast; mother complains of severe pain, fever and feels ill

NOTE. Data are from [3, 18].

of breast health problems in HIV-infected and HIV-uninfected women in rural and urban Africa who underwent an intervention designed to improve exclusive breast-feeding rates in the first 6 months after birth.

SUBJECTS AND METHODS

HIV-infected and HIV-uninfected pregnant women who attended 9 clinics (8 rural and 1 urban) in KwaZulu Natal, South Africa, were enrolled in a nonrandomized intervention cohort to examine breast-feeding and HIV transmission and to investigate the feasibility of promoting exclusive breast-feeding in a community with a high prevalence of HIV-1 infection.

We previously described our infant feeding counseling and support strategy [11, 13, 14]. In brief, lay HIV counselors provided individual counseling to all pregnant women on infant feeding options, according to World Health Organization (WHO)/UNAIDS recommendations at the prenatal clinic [15–17]. HIV-uninfected women were counseled to exclusively breast-feed for the first 6 months of life (180 days), with sustained breast-feeding to at least 2 years. The option of replacement feeding (commercial formula feeds) or exclusive breast-feeding for the first 6 months of life was discussed with HIV-infected women, and women made decisions based on their home circumstances [13].

Lay breast-feeding counselors, who were blinded to the HIV status of the women, visited all enrolled women at home to discuss feeding practices and study involvement and to meet other family members, if the women agreed. Women choosing to breast-feed were visited regularly at home by breast-feeding counselors for up to 4 visits prenatally, then 4 visits in the first 2 weeks after delivery, followed by a visit once every 2 weeks

up to 6 completed months. At each postnatal visit, the breast-feeding counselors asked mothers to describe any breast health problems they had experienced and documented these for each day between the current and last visit. If the problem was still present, the breast-feeding counselor observed the breast and a breast-feeding session, if the mother was able to feed from the affected side. Breast health problems for each breast were documented separately. The specific problems recorded were painful nipple, cracked nipple, bleeding nipple, engorgement, blocked milk duct, breast thrush, nipple oozing pus, breast oozing pus, and mastitis/abscess. Definitions, diagnosis, and management of these problems were based on the WHO Breast-feeding Counseling Course and materials [3] (table 1).

The breast-feeding counselors were trained on the WHO Breastfeeding Counseling Course [3], with structured support and mentoring thereafter. They received specific training on the diagnosis, management, and appropriate referral of breast health problems. The breast-feeding counselors dealt with painful nipples and breast thrush themselves (they carried nystatin cream on their field visits) but referred all other problems to supervisors for a supervisor visit. The supervisors were chosen and promoted from the pool of breast-feeding counselors and received extra mentoring and clinical practice to enable them to solve more complex problems. A specialized nurse, with training on infant feeding counseling, was responsible for quality control in the field and problem solving. Women with bleeding nipples, pus oozing from the nipple or breast, mastitis, or an abscess were referred immediately to the nearest clinic for assessment, for antibiotic treatment (if necessary), and for appropriate infant feeding counseling; HIV-uninfected women were encouraged to continue to breast-feed, whereas HIV-in-

ected women were advised to stop breast-feeding from the affected breast until the problem resolved but to maintain milk production by hand milk expression [17]. Women with any of the breast health problems were visited daily by the breast-feeding counselors until the problem resolved.

In addition, field monitors visited all mothers weekly to document all feeds (milk and solids) and fluids for each day of the preceding week [11]. WHO definitions of infant feeding were used throughout the study [16]. Being exclusively breast-fed at a given age meant having been fed with breast milk only since birth (i.e., no water, other fluids, or foods).

Women enrolled from the urban clinic received all their breast-feeding support and monitoring visits at the clinic, because it was not deemed safe for field workers to conduct home visits in this area. The study was approved by Biomedical Research Ethics Committee of the University of KwaZulu Natal.

Women who delivered a live birth and initiated breast-feeding in the first 2 days after delivery were included in the analysis. Analysis was based on data from a database created on 30 January 2007.

Baseline characteristics were compared between HIV-infected and HIV-uninfected women using the Pearson χ^2 test or Fisher's exact test to compare categorical variables and using the Mann-Whitney *U* test to compare continuous variables. The primary outcome was the occurrence of breast health problems during the first 6 months after delivery, documented individually and then grouped together in 3 different ways: any of the breast health problems detailed in table 1, any of these breast health problems excluding sore nipples, or any of the following problems: bleeding nipple, pus oozing from the nipple or breast, mastitis, or breast abscess. The latter events were grouped together, because they are considered to be the most painful and serious of the breast health problems during breast-feeding and have also been associated with postnatal HIV transmission [19].

The 6-month probability of remaining free from breast health problems (using the 3 categories mentioned above) was assessed with the Kaplan-Meier method, and its association with baseline maternal variables was quantified in univariate and multivariate stepwise Cox regression analyses [20, 21]. Only variables with a *P* value <.20 in univariate analysis were included in multivariate analysis. In particular, we examined whether women had exclusively breast-fed or engaged in "mixed" breast-feeding before to the occurrence of the breast health problem. If an infant received any other liquid or food other than breast milk, they were removed from the exclusive breast-feeding category and considered to have undergone mixed breast-feeding from that time onward. Women who remained free from breast health problems were censored on the day when they completely ceased breast-feeding.

The effect of breast health problems on the risk of postnatal

transmission of HIV was assessed in a Cox regression model. Children born to HIV-infected mothers with a negative RNA PCR result from a sample obtained at the age of ≥ 1 month and who later became HIV infected were considered to have acquired HIV infection postnatally [11]. The adjusted and unadjusted hazard ratios of occurrence of breast health problems on the risk of postnatal HIV transmission were calculated. This variable was time dependent, taking into account whether the breast health problem occurred before the acquisition of HIV infection by the infant. Adjustment was made for baseline maternal CD4 cell count (<200 cells/ μ L vs. ≥ 200 cells/ μ L), maternal level of education (secondary school vs. primary school or none), and maternal employment in the formal economic sector. All statistical analyses were performed using SAS software, version 8.2 (SAS Institute).

RESULTS

A total of 2755 women with a known HIV status delivered a live infant, of whom 429 were excluded from the study (40 were excluded because the infant died in the first week, 152 moved from the area or withdrew in the first week, 47 had unknown feeding data during the first 2 days, and 190 did not breast-feed during the first 2 days). Therefore, data for 2326 women (1119 HIV-infected women and 1207 HIV-uninfected women) are included in the analysis. There were no significant differences in basic sociodemographic characteristics between women who were included and those who were excluded from the analyses.

Table 2 shows the baseline characteristics of women and children, and table 3 presents the frequency, duration, and timing of breast health problems in the first 6 months after delivery, according to maternal HIV status. Overall, serious breast problems were rare among HIV-infected and HIV-uninfected women. Although 16.9% of HIV-infected women and 15.0% of HIV-uninfected women experienced a breast health problem (including sore nipples), only 1.8% of HIV-infected women and 0.9% of uninfected women experienced a serious breast health problem (i.e., bleeding nipple, pus oozing from the nipple or breast, mastitis, or abscess).

Table 4 shows the 6-month probability of remaining free from breast health problems, according to maternal HIV status. Most breast health problems occurred during the first month, with few additional mothers experiencing problems during months 2–6; by 1 and 6 months, an estimated 13% and 17% of women would ever experience any minor or major breast health problem, including sore nipples, respectively.

The probability of a woman having any breast health problem was associated with characteristics possibly indicating the intensity of support available (i.e., no home visits in urban areas and receipt of fewer prenatal visits), and women who were not exclusively breast-feeding immediately before the breast health

Table 2. Baseline characteristics of women and children, according to maternal HIV status.

Characteristic	HIV-infected women (n = 1119)	HIV-uninfected women (n = 1207)	P
Maternal age, median years (IQR)	25 (21–29)	22 (19–28)	<.001
Residence			
Urban	195 (17.4)	185 (15.3)	<.001
Peri-urban	413 (36.9)	347 (28.8)	
Rural	511 (45.7)	675 (55.9)	
Highest education achieved			
Secondary	621 (50.5)	728 (60.3)	.06
Primary	422 (37.7)	407 (33.7)	
None	76 (6.8)	72 (6.0)	
Mother currently at school ^a			
Yes	43 (3.9)	103 (8.6)	<.001
No	1070 (96.1)	1100 (91.4)	
Source of water ^a			
Piped water inside home	81 (7.3)	91 (7.6)	.58
Piped water outside	673 (60.5)	748 (62.2)	
Other source of water	359 (32.2)	364 (30.2)	
Toilet available ^a			
Flush toilet	186 (15.5)	191 (17.2)	.32
Other form sanitation	712 (59.2)	665 (59.7)	
No toilet	305 (25.3)	257 (23.1)	
Mother is main income provider ^a			
Yes	116 (10.4)	73 (6.1)	<.001
No	997 (89.6)	1130 (93.9)	
Prenatal maternal CD4 cell count, median ×10 ⁶ cells/mL (IQR) ^b	467 (318–637)	...	
Prenatal maternal plasma HIV RNA load, median log ₁₀ copies/mL (IQR) ^b	4.0 (3.3–4.6)	...	
Median no. of previous live-born children (IQR) ^a	1 (0–2)	0 (0–2)	.03
Previous breast-feeding experience			
Women with previous live-born child	732 (65.4)	599 (49.6)	<.001
Women who breast-fed prior live-born child	732 (100)	599 (100)	1.0
Duration of previous breast-feeding, median months (IQR) ^c	18 (12–24)	18 (12–24)	.27
Mode of delivery ^a			
Caesarean section	131 (11.8)	145 (12.0)	.86
Vaginal delivery	978 (88.2)	1059 (88.0)	
Place of delivery ^a			
Facility (hospital or clinic)	949 (85.8)	1051 (87.5)	.22
Home	157 (14.2)	150 (12.5)	
Child's sex			
Male	566 (50.6)	601 (49.8)	.70
Female	553 (49.4)	606 (50.2)	
Child's birthweight, median g (IQR) ^d	3100 (2750–3500)	3200 (2900–3600)	<.001
Child still breast-fed at 180 days of age	666 (59.5)	877 (72.7)	<.001
Child exclusively breast-fed from birth to 180 days of age	472 (42.2)	540 (45.7)	.21

NOTE. Data are no. (%) of women, unless otherwise indicated. IQR, interquartile range.

^a Data were missing for <20 women.

^b Data were missing for 70 women.

^c Data were missing for 102 women (50 HIV-uninfected women and 52 HIV-infected women).

^d Data were missing for 218 women (126 HIV-uninfected women and 92 HIV-infected women).

Table 3. Frequency and duration of breast health problems in the first 6 months after delivery, according to maternal HIV status.

Diagnosis of breast health problem	HIV-infected women (n = 1119)	HIV-uninfected women (n = 1207)	P
Sore nipples			
No. (%) of women who experienced this problem	99 (8.9)	101 (8.4)	.68
Duration of problem, median days (IQR)	2 (1–4)	2 (2–4)	.38
Time of first occurrence, median no. of days after delivery (IQR)	3 (1–16)	3 (2–7)	.44
Engorgement			
No. (%) of women who experienced this problem	39 (3.5)	33 (2.7)	.30
Duration of problem, median days (IQR)	1 (1–3)	2 (1–2)	.29
Time of first occurrence, median no. of days after delivery (IQR)	5 (3–29)	3 (3–5)	.005
Breast thrush			
No. (%) of women who experienced this problem	17 (1.5)	12 (1.0)	.25
Duration of problem, median days (IQR)	5 (3–8)	12 (7–17)	.16
Time of first occurrence, median no. of days after delivery (IQR)	99 (50–116)	70 (51–127)	.87
Blocked duct			
No. (%) of women who experienced this problem	23 (2.1)	24 (2.0)	.91
Duration of problem, median days (IQR)	3 (2–7)	3 (2–3)	.12
Time of first occurrence, median no. of days after delivery (IQR)	20 (11–57)	21 (4–47)	.79
Cracked nipple			
No. (%) of women who experienced this problem	38 (3.4)	33 (2.7)	.35
Duration of problem, median days (IQR)	4 (2–7)	3 (2–6)	.23
Time of first occurrence, median no. of days after delivery (IQR)	13 (3–62)	7 (3–25)	.47
Bleeding nipple			
No. (%) of women who experienced this problem	6 (0.5)	4 (0.3)	.45
Duration of problem, median days (IQR)	2 (1–2)	1 (1–2)	.24
Time of first occurrence, median no. of days after delivery (IQR)	6 (2–28)	8 (2–26)	.47
Nipple oozing pus			
No. (%) of women who experienced this problem	2 (0.2)	0	.23
Duration of problem, median days (IQR)	... ^a	...	
Time of first occurrence, median no. of days after delivery (IQR)	... ^a	...	
Breast oozing pus			
No. (%) of women who experienced this problem	2 (0.2)	1 (0.1)	.36
Duration of problem, median days (IQR)	... ^b	... ^c	
Time of first occurrence, median no. of days after delivery (IQR)	... ^b	... ^c	
Mastitis or abscess			
No. (%) of women who experienced this problem	11 (1.0)	6 (0.5)	.17
Duration of problem, median days (IQR)	7 (5–14)	8 (7–13)	.49
Time of first occurrence, median no. of days after delivery (IQR)	17 (7–23)	5 (24–54)	.32
No. (%) of women who experienced any of these problems	189 (16.9)	181 (15.0)	.21
No. (%) of women who experienced any of these problems, excluding sore nipples	114 (10.1)	102 (8.5)	.15
No. (%) of women who experienced bleeding nipple, pus oozing from a nipple or breast, mastitis, and/or abscess	20 (1.8)	11 (0.9)	.07

NOTE. IQR, interquartile range.

^a For one woman, the problem started on day 1 and lasted for 2 days; for the other, the problem started on day 15 and lasted for 5 days.

^b For one woman, the problem started on day 68 and lasted for 1 day; for the other, the problem started on day 80 and lasted for 10 days.

^c The problem started on day 156 and lasted for 8 days.

Table 4. Kaplan-Meier probability of remaining free from breast health problems, according to maternal HIV status

Condition, subject group	Probability (95% CI) of remaining free from condition			P ^a
	1 Month after delivery	3 Months after delivery	6 Months after delivery	
Any breast health problem				
HIV-uninfected mothers	0.87 (0.85–0.89)	0.85 (0.83–0.87)	0.84 (0.82–0.86)	.13
HIV-infected mothers	0.87 (0.85–0.89)	0.84 (0.82–0.86)	0.81 (0.79–0.84)	
Any breast health problem, excluding sore nipples				
HIV-uninfected mothers	0.94 (0.92–0.95)	0.92 (0.90–0.93)	0.91 (0.89–0.93)	.08
HIV-infected mothers	0.93 (0.91–0.94)	0.91 (0.89–0.92)	0.88 (0.86–0.90)	
Bleeding nipple, pus oozing from nipple or breast, mastitis or abscess				
HIV-uninfected mothers	0.99 (0.99–1.00)	0.99 (0.98–1.00)	0.99 (0.98–0.99)	.05
HIV-infected mothers	0.98 (0.97–0.99)	0.98 (0.97–0.99)	0.98 (0.97–0.99)	

^a Determined using the log rank test.

problem were more likely to have any breast health problem (table 5). HIV-infected women were twice as likely to experience a serious pathology than HIV-uninfected women, and again, nonexclusive breast-feeding was significantly associated with a more than doubling of the risk of the serious breast pathology.

The effect of breast health problems on the risk of postnatal transmission of HIV was assessed among the 860 children born to HIV-infected mothers who were HIV negative during the peripartum period. After adjustment for the baseline characteristics detailed in Subjects and Methods, postnatal transmission subsequent to breast health problems was more likely to occur than in the absence of breast health problems, especially in the case of serious pathology. Although HIV-infected women who experienced any breast health problems or who experienced a breast health problem other than painful nipple were 1.68 (95% CI, 0.97–2.94; $P = .05$) and 1.88 (95% CI, 0.98–3.61; $P = .06$) times more likely to subsequently transmit HIV postnatally, respectively, women with serious breast health problems, including bleeding nipple, pus oozing from the nipple or breast, mastitis, or abscess, were 3.55 (95% CI, 0.86–14.78; $P = .08$) times more likely to transmit HIV than were those without breast health problems.

DISCUSSION

In our study, we found a low prevalence of all breast health problems, particularly the more serious diagnoses (mastitis and abscess), compared with other reports [6, 8, 9] and with findings in our area, where 19% of women complained of a breast-feeding difficulty at some time between birth and 16 weeks after delivery, before the implementation of the breast-feeding intervention [22]. These low rates are most likely associated with the quality of support the women received and the high rates of exclusive breast-feeding achieved. At the prenatal visits, counselors discussed with mothers the importance of giving colostrum to their infant and feeding on demand, with no

restriction on the length or frequency of feeds [1]. They explained the difference between colostrum and later mature milk and how to avoid engorgement by regular feeding and allowing the infant to finish feeding from one breast before offering the second breast [1]. During the early postnatal visits, breast-feeding counselors observed breast-feeds and helped with positioning and attachment of the infant at the breast, and they diagnosed early problems (e.g., sore nipples due to poor attachment) before those problems became more serious (e.g., cracked or bleeding nipple). Most problems occurred during the first month, and it is at this time that breast-feeding women need support and help to establish breast-feeding. Women who partook of fewer of the scheduled prenatal visits were more likely to experience any breast health problems, as were women who had not exclusively breast-fed immediately before the occurrence of the problem. Women who had not breast-fed previously were more likely to experience problems, highlighting the importance of support for primiparous women. There is no clear explanation for the fact that women without piped water were more likely to experience problems. It is possible that these women, who were socioeconomically disadvantaged, lived further from the clinics and had less access to immediate support. Alternatively, these women may have spent significant portions of their day walking to collect water, and this may have interfered with demand breast-feeding, if their infants were left behind, thus leading to milk stasis and breast health problems.

Our study design gave us the opportunity to explore differences in breast health problems in women who received home counseling visits (in the rural and peri-urban areas) and those who received counseling at the clinics (urban area). Although women in the urban area were more likely to experience any breast health problem, they were *not* more likely to experience serious breast health pathology. This has important public health implications, because clinic-based support for infant

Table 5. Determinants of the occurrence of a breast health problems.

Analysis, variable	No. of women	Univariate analysis		Multivariate analysis	
		Hazard ratio (95% CI)	<i>P</i>	Hazard ratio (95% CI)	<i>P</i>
Analysis 1: occurrence of any breast health problem					
Maternal HIV status					
Uninfected	1207	1	.13	1	.13
Infected	1119	1.17 (0.95–1.43)		1.18 (0.95–1.45)	
No. of prenatal visits					
3 or 4	1452	1	.19	1.25 (1.00–1.55)	.05
0, 1, or 2	874	1.15 (0.93–1.43)			
Residence					
Rural	1186	1	.01	1	.003
Urban or peri-urban	1140	1.29 (1.05–1.58)		1.38 (1.11–1.72)	
Source of water					
Piped water	1593	1	.07	1	.009
Other	723	1.12 (0.99–1.51)		1.35 (1.08–1.69)	
Previous live-born child					
Yes	1331	1	.12	1	.07
No	995	1.17 (0.96–1.44)		1.21 (0.98–1.49)	
Exclusive breast-feeding until the occurrence of the breast problem ^a					
Yes	1247	1	.006	1	.003
No	1079	1.42 (1.10–1.81)		1.46 (1.13–1.87)	
Analysis 2: Occurrence of any breast health problem, excluding sore nipples					
Maternal HIV status					
Uninfected	1207	1	.08	1	.17
Infected	1119	1.27 (0.97–1.66)		1.21 (0.92–1.58)	
Residence					
Rural	1186	1	.05	1	.02
Urban or peri-urban	1140	1.31 (1.00–1.72)		1.38 (1.04–1.84)	
Source of water					
Piped water	1593	1	.09	1	.02
Other	723	1.28 (0.97–1.69)		1.41 (1.06–1.89)	
Exclusive breast-feeding until the occurrence of the breast problem ^a					
Yes	1181	1	.03	1	.02
No	1145	1.40 (1.03–1.91)		1.42 (1.04–1.93)	
Analysis 3: occurrence of bleeding nipple, pus oozing from nipple or breast, mastitis, or abscess (i.e., serious breast pathologies)					
Maternal HIV status					
Uninfected	1207	1	.05	1	.045
Infected	1119	2.06 (0.99–4.31)		2.12 (1.02–4.43)	
Exclusive breast-feeding until the occurrence of the breast problem ^a					
Yes	1119	1	.02	1	.01
No	1207	2.50 (1.19–5.26)		2.58 (1.22–5.43)	

^a Time-dependent variable.

feeding is immediately feasible at a large scale and could be complemented by community health worker home visits where available.

The strengths of this study are the prospective documenta-

tion of breast health problems in a large cohort of HIV-infected and HIV-uninfected women that were documented daily for 180 days with 14-day recall histories, a daily record of infant feeding practices with 7-day recall histories, and use of stan-

standardized WHO infant feeding definitions. Under these stringent conditions, there were no significant differences in the occurrence of any breast health problems between HIV-infected and HIV-uninfected women. This is not surprising, because most breast health problems result from practical difficulties, such as inefficient removal of milk resulting from poor breast-feeding technique, as opposed to bacterial infection [1, 3, 18, 23]. It is perhaps surprising that breast thrush was equally common among HIV-infected and HIV-uninfected women, because one would expect this condition to be associated with immunosuppression.

When the more serious breast conditions were grouped together (i.e., bleeding nipple, pus oozing from the nipple or breast, mastitis, or abscess), there was a significant difference between HIV-infected and HIV-uninfected women, but the prevalences of these conditions were still very low. Despite this and the prompt management of problems by the breast-feeding counselors, HIV-infected women with these problems were significantly more likely to transmit HIV to their infant. It is crucial to prevent these conditions in all women, but it is particularly important to do so for those who are HIV infected. It is also important that health care workers who manage these problems understand the differences in treatment for women who are HIV infected versus those who are not HIV infected: HIV-uninfected women should be encouraged to continue to breast-feed, but HIV-infected women should be encouraged to express and discard milk from the affected side until the problem resolves [16, 24].

Lay breast-feeding counselors with no tertiary education who received practical training on breast feeding, followed by supervision and mentoring, were able not only to support exclusive breast-feeding, but also to reduce the rates of breast health problems. Because these problems cause a considerable burden of disease among breast-feeding women and may involve substantial costs to the health services, prevention and rapid, effective treatment of breast-feeding problems is of great importance.

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