

High Rates of Exclusive Breastfeeding in Both Arms of a Peer Counseling Study Promoting EBF Among HIV-Infected Kenyan Women

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Abstract

Background: Exclusive breastfeeding (EBF) is recommended for 6 months after delivery as the optimal infant feeding method and is especially important for prevention of mother-to-child HIV transmission (PMTCT). However, EBF promotion efforts among HIV-infected mothers in sub-Saharan Africa have achieved mixed success and require context-specific interventions.

Methods: HIV-positive, pregnant women from six clinics in Nairobi were enrolled into a clinic-level, before-after counseling intervention study. All women received standard perinatal and HIV care. Women in the intervention arm were offered three counseling sessions that promoted EBF, described its benefits, and explained breastfeeding techniques. Mother-infant pairs were followed until 14 weeks postpartum, with infant HIV testing at 6 weeks. EBF prevalence at 14 weeks postpartum was compared between study arms using log-binomial regression. Proportions of 6-week HIV-free survival and 14-week infant survival were assessed using Cox regression. Risk estimates were adjusted for clinic, relationship status, and antiretroviral therapy.

Results: Between 2009 and 2013, 833 women were enrolled of whom 94% planned to practice EBF for 6 months and 95% were taking therapeutic or prophylactic antiretrovirals. Median age was 27 years; median CD4 count was 403 cells/ μ L. EBF prevalence at 14 weeks postpartum was 86% in the control and 81% in the intervention group ($p=0.19$). No differences were observed between groups for 6-week HIV-free survival and 14-week infant survival.

Conclusion: Women who received breastfeeding counseling were not more likely to breastfeed exclusively, in part due to high overall EBF prevalence in this study population. The high EBF prevalence is an important finding, given recent efforts to promote EBF in Kenya.

Introduction

THE WORLD HEALTH ORGANIZATION (WHO) currently recommends exclusive breastfeeding (EBF), defined as feeding no other liquids or solids but breastmilk, oral rehydration salts, and medicinal syrups for the first 6 months of an infant's life.^{1,2} Breastmilk is superior to formula in provision of adequate nutrition for infants during the first 6 months of life, and EBF is associated with reduced infant morbidity and

mortality.^{3,4} Compared with formula feeding, EBF has been associated with decreased risk of respiratory and gastrointestinal infections, and lower infant mortality.^{2,4-9} While this survival benefit is most pronounced in the developing world where risk from contaminated water is high, it has also been observed in high-income settings.^{5,9}

Although breastmilk can be a vehicle for mother-to-child HIV transmission (MTCT), EBF is the preferred infant feeding option for HIV-infected mothers in developing

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countries. With antiretroviral therapy (ART), the risk of MTCT can be reduced to <5% among HIV-exposed breastfed infants,^{10–15} a risk less substantial than the infant mortality risk associated with formula feeding in resource-limited settings.^{15,16} In addition, EBF is associated with diminished risk of MTCT relative to mixed feeding infant formula, animal milk, or food in addition to breastmilk.^{12,17–19}

The duration and prevalence of EBF remain inadequate in settings such as Kenya with limited sanitation and high HIV prevalence. In the 2008–2009 Kenya Demographic and Health Survey (KDHS), 42% of infants <3 months and 32% <6 months were breastfed exclusively, although both estimates had nearly doubled by 2014.^{20,21} Recent improvements in EBF are promising, but Kenya's high HIV prevalence (6.9%) among women of reproductive age and high infant mortality make continued EBF promotion efforts vital.^{22,23}

No single intervention exists to promote EBF, but multi-component counseling interventions that identify and address barriers to EBF have achieved success in a variety of settings. A systematic review in high-income settings indicated that successful counseling-based EBF interventions respond in real time to breastfeeding difficulties encountered during feeding, offer peer support, consist a long duration of follow-up after delivery, and maintain frequent contact with mothers.²⁴ These suggestions are supported by recent studies in Kenya,^{25,26} Ghana,²⁷ and South Africa,²⁸ where peer mentorship and frequent counseling sessions over a long duration were required to influence EBF. EBF promotion efforts among HIV-infected women in sub-Saharan Africa feature additional barriers and challenges. These include stigma associated with any exclusive feeding methods, traditional practices of mixed feeding, divergent messages between counsellors and clinics from whom subjects receive care, and lack of human resources and physical space to deliver sensitive EBF promotion messages.^{29,30}

Materials and Methods

Study design and setting

A clinic-level, before–after study design was utilized to investigate the effect of a counseling intervention on EBF among HIV-positive pregnant women at six Kenyan government maternal and child health clinics in Nairobi: Kangemi, Riruta, Baba Dogo, Dandora II, Kayole II, and Mathare North. These clinics generally serve low-income clients in densely populated, urban regions.

TABLE 1. TIMING AND SCHEDULE OF SUBJECT ENROLLMENT

	10-month time periods*		
Clinic	1	2	3
Kangemi	C	I	X
Riruta	C	I	X
Baba Dogo	C	I	X
Dandora II	C	I	X
Kayole II	X	C	I
Mathare North	X	C	I

*Approximated.

X, inactive, no data collection; C, control phase; I, intervention phase.

The study was prospective, longitudinal, and quasi-experimental. Clinic-level crossover from control to intervention status was unidirectional (Table 1). Four clinics began enrolling controls in 2009, while the last two clinics began enrolling controls in 2011. Women were continuously enrolled at each clinic during the control period and were provided standard-of-care prevention of mother-to-child HIV transmission (PMTCT) and advocacy for facility delivery. Subjects enrolled during the intervention period were offered standard-of-care^{31–33} plus additional counseling antenatally and postpartum in the clinic.

Recruitment and enrollment procedures

Research staff recruited HIV-infected pregnant women who expressed the intention to breastfeed their infants, and ascertained that standard-of-care counseling had been provided. Eligible women were ≥18 years of age, at gestational age ≥30 weeks, and planning to remain in Nairobi until 14 weeks postpartum. Research staff explained the study to the women, and subjects provided written informed consent before enrollment. Subjects received 100 Kenyan shillings, approximately US\$1, at each visit as compensation.

Control and intervention arms

Standard-of-care counseling offered to all women addressed PMTCT and ART adherence, and encouraged women to practice exclusivity in whatever infant feeding plan they chose. This counseling typically lasted around 15 minutes and was provided by HIV-infected peer counsellors who were trained in PMTCT education but lacked clinical expertise. Counsellors were available via phone to address control and intervention subjects' questions and concerns.

The intervention group received three additional counseling sessions in the clinic: one antenatally at enrollment, and at 1 and 6 weeks postpartum. Counseling sessions lasted between 15 and 30 minutes and were administered by peer counsellors, who previously delivered control procedures but received additional education on PMTCT, EBF, and breastfeeding techniques after the control period was completed in order to avoid contamination of the control.

Intervention messages were developed through formative focus group discussions to obtain information regarding community attitudes toward EBF, barriers, and possible solutions and modeled after WHO infant feeding tools.³⁴ A checklist was utilized to ensure that each message was covered during counseling (Supplementary Data; Supplementary Data are available online at www.liebertpub.com/bfm). Following this standardized approach, peer counsellors explained the benefits of EBF for both the infant and mother, and described PMTCT and the adequacy of breastmilk for infant health, nutrition, growth, and development during the infant's first 6 months of life. In the prenatal session, counsellors recommended early initiation of EBF and expounded its benefits. They introduced the need for frequent and on-demand feeding of infants during the first session, and advised mothers on breastfeeding techniques such as positioning and attachment. These messages were reinforced during postnatal visits, when mothers were also taught to prevent and recognize lactation problems such as sore nipples, engorgement, and mastitis.

Follow-up procedures

Participants in both groups were advised to seek prenatal care weekly until delivery and attend four postpartum follow-up visits at 1, 6, 10, and 14 weeks. Study nurses performed clinical evaluations and administered questionnaires at each follow-up visit to women in both arms to evaluate interval maternal health, including breast pathologies. Questionnaires addressed breastfeeding practices between visits, relationship status, and maternal and infant health.

Maternal blood was obtained from participants at enrollment by venipuncture for CD4 measurement at the research laboratory of the University of Nairobi Department of Paediatrics. Women were referred for ART and prophylaxis per treatment guidelines from the National AIDS and STI Control Programme (NAS COP).^{31–33} Infant dried blood spots were collected by heel prick for HIV-1 DNA polymerase chain reaction (PCR) assays at the national reference laboratory at the Kenya Medical Research Institute (KEMRI) per standard-of-care approximately 6 weeks after delivery, and children found to be HIV-infected received ART per NASCOP guidelines.^{31–33}

Statistical analysis

Data were entered into databases created using CPro v4.0 (U.S. Census Bureau, Washington, DC) and SPSS Data Entry Builder v3.0.3 (IBM Corp., Armonk, NY), and data management and analyses were completed using Stata v12.0 (StataCorp, College Station, TX). Baseline charac-

teristics were analyzed using chi-square and Fisher’s exact tests for categorical variables and *t*-tests for continuous variables. The number and proportion of individuals in each category were listed for categorical variables, while median and interquartile range were reported for continuous variables. The attendance of control and intervention subjects was assessed at each visit using two-sample tests of proportions.

The prevalence of EBF at 10 and 14 weeks postpartum was analyzed by study arm using binomial regression with a log-link, while adjusting for clinic, relationship status, and self-reported ART prescription. A mother was considered to be exclusively breastfeeding when the infant was fed nothing but breastmilk and approved medicinal substances per the WHO definition.^{1,2} Proportions were calculated out of the number of women who attended each visit in order to avoid assumptions about the breastfeeding practices of women who missed visits.

Cox regression and Kaplan–Meier plots were utilized to assess both 6-week infant HIV-free survival and 14-week infant survival, while adjusting for clinic, relationship status, and self-reported ART prescription. The former outcome incorporated all deaths that were recorded within 6 weeks after delivery and HIV infections identified by HIV PCR tests from routine testing at 6 weeks postpartum. Time to seroconversion was defined as the midpoint between delivery and testing. The 14-week survival included all infant deaths that occurred within 14 weeks after delivery.

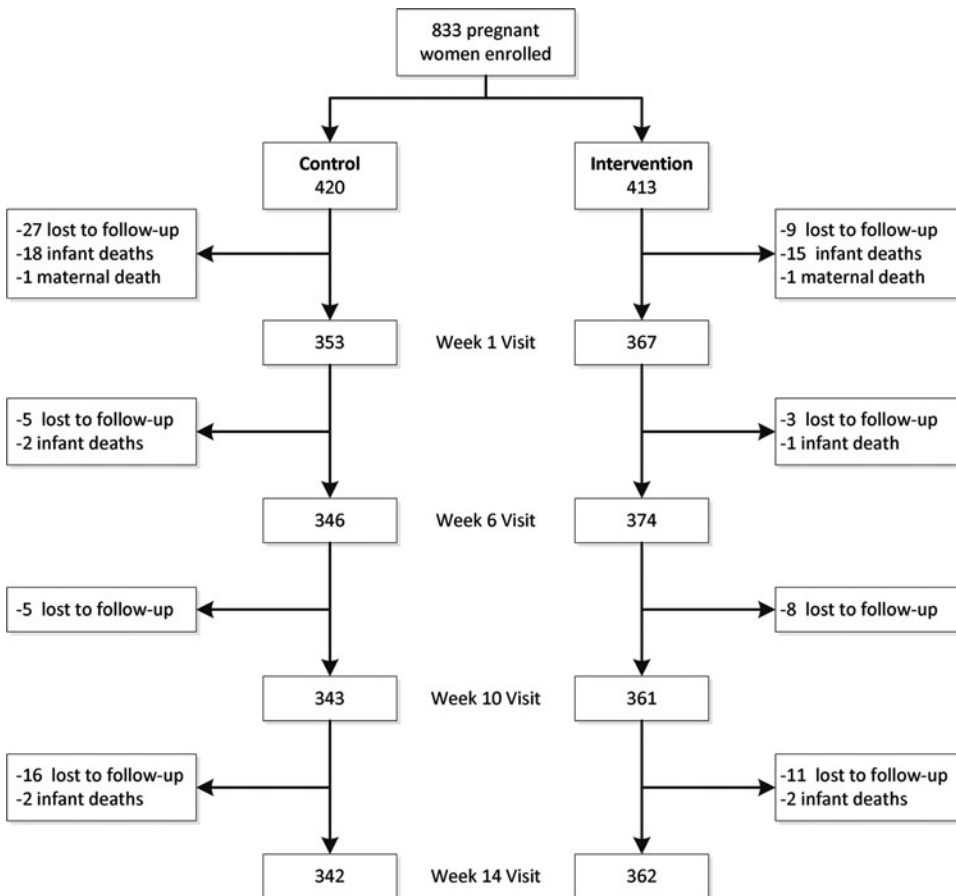


FIG. 1. Study enrollment, retention, and loss to follow-up.

Counts of breast pathologies, both self-reported and clinically diagnosed, were analyzed using Poisson regression adjusted for clinic, relationship status, and self-reported ART, offset by the number of postnatal visits a woman attended.

Human subjects

Human subjects approval was granted by the KEMRI/National Ethical Review Committee and the Stockholm Regional Ethics Committee.

Results

Description of study population

Between March 2009 and April 2013, 420 and 413 women were enrolled into the control group and the intervention group, respectively (Fig. 1). All clinics achieved the pre-determined recruitment sample size (70 women per clinic,

per arm) except for Kayole II, which enrolled 63 women in the intervention group.

Women in the control and intervention groups were similar at baseline (Table 2). Median age of women was 27 years (interquartile range [IQR] 23–31), and median CD4 count was 403 cells/ μ L (IQR 287–571). Overall, 458 (55.1%) women had a primary-level education or less, while only 60 (7.2%) had a post-secondary education. At baseline, 610 (73.6%) women were unemployed, and 643 (77.5%) reported living in a single-room house. In the control group, 389 (92.6%) women were receiving therapeutic or prophylactic antiretrovirals compared with 400 (96.9%) women in the intervention group ($p=0.01$).

At enrollment, fewer women reported being in a relationship in the control group (86.4%) than in the intervention group (91.0%; $p=0.04$). Among women reporting a relationship, median relationship duration was similar in both groups at 4 years (IQR 2–8 years). Among the 735 women in

TABLE 2. DESCRIPTION OF BASELINE CHARACTERISTICS

Characteristic	Control, N=420	Intervention, N=413	p-Value
Age (years)	27 (23–31)	27 (23–31)	0.63
CD4 count (cells/mm ³)	401 (286–560)	405 (293–576)	0.49
<200	46 (11.0)	32 (7.8)	
200–500	198 (47.3)	186 (45.2)	0.15
>500	175 (41.8)	194 (47.1)	
Prescribed ARVs	389 (92.6)	400 (96.9)	0.01
Prophylactic ARVs	253 (60.3)	252 (61.0)	
Therapeutic ARVs	168 (32.4)	148 (35.8)	0.02
Education level			
Primary or less	251 (59.9)	218 (54.0)	
Secondary	145 (34.6)	157 (38.1)	0.10
Post-secondary	23 (5.5)	37 (9.0)	
Occupation			
Unemployed	318 (76.1)	292 (71.1)	
Salaried	36 (8.6)	50 (12.2)	0.17
Self-employed	64 (15.3)	69 (16.8)	
Number of rooms in home			
1	320 (76.7)	323 (78.4)	
2	64 (15.4)	54 (13.1)	0.64
3+	33 (7.9)	35 (8.5)	
Had an STI previously	10 (2.4)	22 (5.3)	0.03
Used contraception previously	257 (61.3)	287 (69.7)	0.01
Relationship status			
Single, no partner	57 (13.6)	37 (9.0)	
In a relationship	362 (86.4)	373 (91.0)	0.04
Partnership duration (years) ^a	4 (2–8)	4 (2–7)	0.99
Partner known to be HIV infected ^b	90 (38.3)	112 (41.6)	0.45
Disclosed HIV status to partner ^c	250 (69.3)	276 (73.6)	0.19
Discussed PMTCT with partner ^d	172 (48.7)	205 (55.4)	0.07
Number of previous pregnancies	2 (1–3)	2 (1–2)	0.48
Breastfed last child ^e	278 (98.6)	293 (96.4)	0.12
Planned to practice EBF for 6 months	391 (94.0)	384 (93.7)	0.08

Data shown are either *n* (%) or median (IQR).

^aAmong 637 women who reported a relationship and specified its length.

^bAmong 504 women who reported a relationship and responded to question.

^cAmong 736 women who reported a relationship.

^dAmong 723 women who reported a relationship and responded to the question.

^eAmong 586 women who had other children and responded to the question.

IQR, interquartile range; ARVs, antiretrovirals; PMTCT, prevention of mother-to-child HIV transmission; EBF, exclusive breastfeeding; STI, sexually transmitted infection.

relationships, 526 (71.5%) reported disclosing their HIV status to a male partner, and 377 (52.1%) had discussed PMTCT methods with their partner. Parity was similar between groups, and 571 (97.4%) multigravida women reported having breastfed their last child. Overall, 775 (93.8%) women entered the study planning to breastfeed exclusively for at least 6 months.

Follow-up adherence

More women in the intervention arm attended each scheduled postpartum follow-up visit than women in the control group did ($p < 0.05$ at each visit; Fig. 1). Among surviving mother–infant pairs, 342 (86%) women in the control group attended the final visit at 14 weeks postpartum compared with 362 (92%) in the intervention group ($p < 0.01$).

Intervention adherence

In the intervention group, 301 (72.9%) women received all three counseling sessions, and 51 (12.3%) failed to attend any sessions. Overall, 112 (27.1%) women missed at least one visit, including 43 (10.2%) who missed both postnatal interventions and 25 (6.1%) who missed the prenatal intervention.

Prevalence of EBF

High levels of EBF were observed in both groups at each visit (Table 3). At 14 weeks postpartum, 288 (85.7%) women in the control group were practicing EBF compared with 286 (81.0%) in the intervention group. Overall, substantial variation was observed between clinics with EBF prevalence ranging from 73% to 95% ($p < 0.01$). The adjusted relative risk (aRR) of EBF was 0.96 (95% confidence interval [CI] 0.90–1.02) comparing the intervention and control groups, and there was no significant difference in EBF prevalence ($p = 0.15$). Similarly, at 10 weeks postpartum, 566 (88%) of all subjects were breastfeeding exclusively, and no statistically significant difference was observed between the intervention and control groups ($p = 0.58$).

Infant outcomes at 6 and 14 weeks postpartum

Overall, of 792 infants, 17 (2.2%) were HIV-infected at 6 weeks, 53 (6.7%) acquired HIV or died by 6 weeks, and 39

(4.9%) died by 14 weeks postpartum. There was also no significant difference between control and intervention groups in 6-week HIV-free infant survival (adjusted hazard rate [aHR]=0.79, 95% CI 0.46–1.36, $p = 0.40$) or 14-week infant survival (aHR=0.77, 95% CI 0.41–1.45, $p = 0.42$; Fig. 2).

Counts of breast pathology

Women in the intervention group were no more likely to experience breast pathology as determined by clinical examination and self-report than those in the control group (aRR=1.37, 95% CI 0.82–2.30, $p = 0.22$). Women in the intervention arm self-reported more pathologies than women in the control group did, but this difference was not statistically significant (aRR=1.55, 95% CI 0.84–2.84, $p = 0.16$).

Discussion

In this clinic-level, before–after study among HIV-infected Kenyan mothers, the counseling intervention was not associated with increased EBF at 14 weeks postpartum, and no statistically significant associations were found for other outcomes, including 6-week infant HIV-free survival, infant survival to 14 weeks, or breast pathology. This was likely due to the prevalence of EBF at 14 weeks postpartum across both arms being substantially higher than the cross-sectional population estimates reported by the Kenya DHS in 2008–2009 (42% of infants <3 months) and 2014 (63% of infants between 2–3 months old).^{20,21}

Reasons for the high prevalence of EBF observed in this study are not fully known but can be partly explained by secular trends, which are patterns of change in an outcome that occur over time in a population. For example, EBF prevalence has been increasing in Kenya since 2003 according to the Kenya DHS.^{20,21,35} This trend is likely stronger among HIV-infected women due to the modification of PMTCT guidelines early during this study to endorse EBF for 6 months following delivery.³² Following the guidelines, NASCOP began an EBF promotion campaign among HIV-infected women, in addition to providing mother and infant with ART. Improved training and peer counseling also coincided with these efforts. The messages of this campaign likely reached our subject population, as a preponderance of subjects (94%) reported at enrollment that they planned to

TABLE 3. RISK OF KEY OUTCOMES BY STUDY ARM

Outcome	Intervention, n (%)	Control, n (%)	Adjusted rate ^a (95% CI)	p-Value
EBF at 14 weeks ^b	286 (81.0)	288 (85.7)	0.96 (0.90–1.02)	0.15
EBF at 10 weeks ^c	283 (86.3)	283 (90.1)	0.99 (0.94–1.03)	0.58
Infant death or HIV infection by 6 weeks ^c	24	29	0.79 (0.46–1.36)	0.40
Infant death	16	20		
HIV infection	8	9		
Infant death by 14 weeks ^d	17	22	0.77 (0.41–1.45)	0.42
Breast pathologies ^e	35	28	1.37 (0.82–2.30)	0.22
Clinically diagnosed	8	9	1.00 (0.37–2.70)	0.80
Self-reported	27	19	1.55 (0.84–2.84)	0.16

^aAll rates were adjusted for clinic, relationship status, and antiretroviral therapy prescription.

^bAmong 353 intervention and 336 control subjects with available data at time point of interest.

^cAmong 328 intervention and 314 control subjects who attended the 10-week visit.

^dAmong 400 intervention and 392 control subjects who were not lost to follow-up before delivery.

^eAmong 387 intervention and 372 control subjects who attended at least one postnatal visit.

CI, confidence interval.

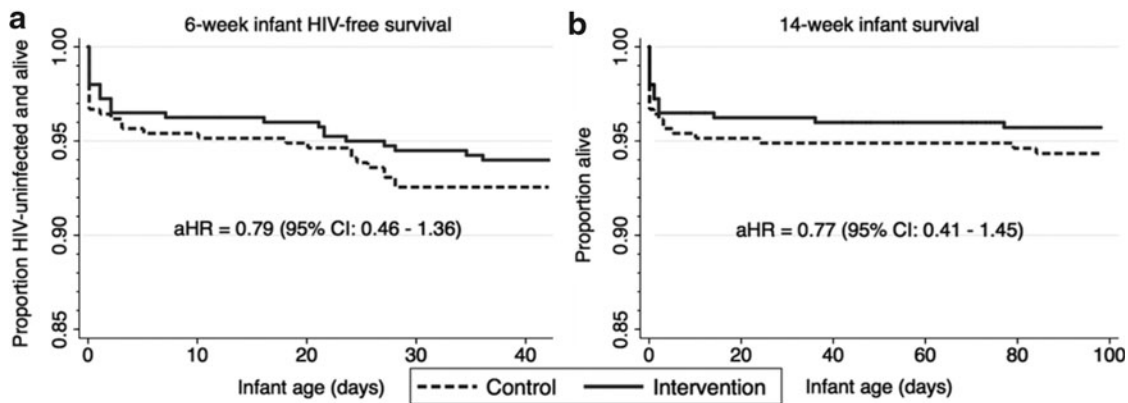


FIG. 2. Kaplan–Meier curves showing (a) time to infant HIV acquisition or death, and (b) time to death, comparing outcomes between the intervention and control groups. Each adjusted hazard rate (aHR) controlled for clinic, relationship status, and antiretroviral therapy prescription.

breastfeed exclusively for at least 6 months as the guidelines recommended.

The high EBF prevalence estimates, relative to the Kenya DHS results, are notable because DHS overestimates EBF prevalence relative to the estimates in the current study.^{20,21} DHS used cross-sectional estimates based on 24-hour recall that do not take into account duration of EBF and assess only period prevalence, which includes mothers from a range of time postpartum (e.g., 0– months), while the current study assessed the point prevalence of EBF at 14 weeks and accounted for any deviation from EBF in the 14 weeks following delivery.

Disparities in EBF prevalence between HIV-infected and -uninfected women also suggest that NASCOP's efforts and accompanying training and emphasis on peer counseling may have been influential during this period. A cross-sectional study in Western Kenya found that EBF prevalence from 4–8 weeks postpartum was three times greater among HIV-infected women than women uninfected or unaware of their HIV infection status.³⁶ Another cross-sectional study of HIV-infected and -uninfected women during 2011 at three Kenyan facilities found that EBF prevalence was significantly lower among HIV-uninfected mothers, a population not targeted by NASCOP's EBF promotion efforts, than among HIV-infected mothers of infants aged 3, 4, and 5 months.³⁷ Research in Kenya indicates that HIV-infected women receive more EBF promotion counseling through PMTCT programs than their HIV-uninfected counterparts,^{36,37} and qualitative work suggests that this health-service disparity may be leading to stigmatization of EBF as an indicator of maternal HIV infection, which could limit the effectiveness of future EBF promotion initiatives.³⁶

Recent studies have suggested that long-duration, support-based interventions that feature frequent visits after delivery, often weekly or biweekly, are among the most successful ways to increase EBF.^{24,26,27} However, local barriers must also be addressed with contextualized solutions to promote EBF among HIV-infected women in sub-Saharan Africa where any exclusive feeding method could stigmatize an HIV-infected woman, and healthcare providers have frequently changed feeding recommendations for HIV-exposed infants—or continue to provide incorrect messages despite updated guidelines.^{29,30,36,37}

This intervention did not feature high numbers of frequent visits but was based on current scientific evidence, health policies, and formative research. The intervention addressed local barriers, including common misconceptions about the inadequacy of EBF for infant nutrition, peer pressure to introduce new substances, accurate definitions of “exclusive” breastfeeding, and stigma. The observed prevalence of EBF at 14 weeks postpartum was higher than EBF prevalence at 3 months (61%) among HIV-uninfected women in Nairobi from 2006 to 2008 who received seven counseling sessions on EBF.²⁶ It was also higher than prevalence at 3 months (71%) observed with high-intensity, long-duration interventions in South Africa.²⁷ Differences between studies may stem from a number of factors. The timeline of the present study coincided with major efforts by NASCOP to increase EBF, and differences exist between the current study population of HIV-infected women intending to breastfeed at enrollment, prior study populations,^{26,27} and cross-sectional cohorts.^{20,21,35–37}

The high prevalence of EBF observed in the present study could have been inflated by social desirability bias, as subjects may have felt compelled to over-report EBF in an effort to please the interviewer. This phenomena has been observed in Kenya with mothers reporting higher proportions of EBF when interviewed face-to-face than with audio computer-assisted self-interviewing (ACASI).³⁸ However, the magnitude of this problem in the present study is not clear, and the majority of breastfeeding studies and health surveys in sub-Saharan Africa have utilized face-to-face interviews. Nevertheless, future studies should consider using ACASI to mitigate social desirability bias.

Other concerns with the study include lack of power and potential selection bias associated with the exclusion of women who did not plan to breastfeed. This study was powered to detect a 50% increase in EBF at 14 weeks from a baseline prevalence of 20%, but actual EBF prevalence was four times higher in the control group. The influence of selection bias is likely small, since only a small proportion (5%) of HIV-infected Kenyan mothers report never breastfeeding their infants.²² Differential attendance and loss to follow-up between study arms was also observed at each visit. Although subjects in the intervention arm were more likely to attend visits than controls, which could have led to differential

ascertainment of outcomes by study arm, a large proportion of them failed to attend the very critical week 1 visit, and this may have diluted the effect of the intervention. A sensitivity analysis assessed whether differential attendance could explain the non-significant association between intervention and EBF prevalence but found that its effect was not statistically significant.

The study design has potential limitations. The before-after design should produce balanced participant characteristics, but it is susceptible to confounding by temporal trends and other unmeasured confounders, such as concurrent breastfeeding initiatives. In addition, three study sites have been involved in PMTCT studies for >20 years, so they may be systematically different from other clinics in Nairobi. The duration of follow-up was another limitation, as the WHO recommends EBF for 6 months, and evidence in Kenya indicates that the biggest decline in EBF prevalence occurs between 3 and 6 months postpartum.^{20,21,25,26,35,36} Although the levels of EBF observed at 14 weeks postpartum were promising, it is important that measurements extend to 6 months, the WHO-recommended duration.²

Conclusion

The counseling intervention was not associated with increased EBF prevalence. However, the study showed that high EBF prevalence can be achieved at 14 weeks among HIV-positive women in Nairobi. NASCOP's inclusion of EBF promotion in its PMTCT initiatives during the course of the study may be responsible for the high EBF prevalence, and it is crucial to continue investigating the impacts of these EBF promotion activities and national trends. Such actions would serve to improve PMTCT programs. Future DHS and Kenya AIDS Indicator Survey efforts should incorporate more detailed questions about EBF practice and duration to provide enhanced surveillance data and relevant disaggregation based on maternal serostatus. Further studies are also needed to assess whether high levels of EBF can be sustained to 6 months postpartum, a concern that is particularly salient given declines in EBF between 3 and 6 months postpartum. Efforts to expand EBF promotion activities to all women in Kenya are also critical in order to expand health benefits to all infants and avoid stigmatization of EBF.

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Disclosure Statement

No competing financial interests exist.

References

1. World Health Organization. The optimal duration of exclusive breastfeeding: report of an expert consultation. Geneva, Switzerland, 2001.
2. World Health Organization. WHO recommendations on postnatal care of the mother and newborn. Geneva, Switzerland, 2013.
3. Butte N, Lopez-Alarcon M, Garza C. Nutrient adequacy of exclusive breastfeeding for the term infant during the first six months of life. Geneva, Switzerland, 2002.
4. World Health Organization. Effect of breastfeeding on infant and child mortality due to infectious diseases in less developed countries: a pooled analysis. WHO Collaborative Study Team on the Role of Breastfeeding on the Prevention of Infant Mortality. *Lancet* 2000;355:451–455.
5. Chantry C, Howard C, Auinger P. Full breastfeeding duration and associated decrease in respiratory tract infection in US children. *Pediatrics* 2006;117:425–432.
6. Cesar J, Victoria C, Barros F, et al. Impact of breast feeding on admission for pneumonia during postneonatal period in Brazil: nested case-control study. *BMJ* 1999;318:1316–1320.
7. Ásbjörnsdóttir KH, Slyker JA, Weiss NS, et al. Breastfeeding is associated with decreased pneumonia incidence among HIV-exposed, uninfected Kenyan infants. *AIDS* 2013;27:2809–2815.
8. Victora CG, Smith PG, Vaughan JP, et al. Evidence for protection by breast-feeding against infant deaths from infectious diseases in Brazil. *Lancet* 1987;2:319–322.
9. Kramer MS, Kakuma R. Optimal duration of exclusive breastfeeding. *Cochrane Database Syst Rev* 2012;8:CD003517.
10. Lallemand M, Jourdain G, Le Coeur S, et al. Single-dose perinatal nevirapine plus standard zidovudine to prevent mother-to-child transmission of HIV-1 in Thailand. *N Engl J Med* 2004;351:217–228.
11. Dabis F, Bequet L, Ekouevi D, et al. Field efficacy of zidovudine, lamivudine and single-dose nevirapine to prevent peripartum HIV transmission. *AIDS* 2005;19:309–318.
12. Coovadia H, Rollins N, Bland R, et al. Mother-to-child transmission of HIV-1 infection during exclusive breastfeeding in the first 6 months of life: an intervention cohort study. *Lancet* 2007;369:1107–1116.
13. Natchu UC, Liu E, Duggan C, et al. Exclusive breastfeeding reduces risk of mortality in infants up to 6 mo of age born to HIV-positive Tanzanian women. *Am J Clin Nutr* 2012;96:1071–1078.
14. Coutoudis A, Pillay K, Spooner E, et al. Morbidity in children born to women infected with human immunodeficiency virus in South Africa: does mode of feeding matter? *Acta Paediatr* 2003;92:890–895.
15. World Health Organization. PMTCT Strategic Vision 2010–2015: preventing mother-to-child transmission of HIV to reach the UNGASS and Millennium Development Goals. Geneva, Switzerland, 2010.
16. De Cock KM, Fowler MG, Mercier E, et al. Prevention of mother-to-child HIV transmission in resource-poor countries:

- translating research into policy and practice. *JAMA* 2000;283:1175–1182.
17. Coutsooudis A. Influence of infant feeding patterns on early mother-to-child transmission of HIV-1 in Durban, South Africa. *Ann N Y Acad Sci* 2000;918:136–144.
 18. Iloff P, Piwoz E, Tavengwa N, et al. Early exclusive breastfeeding reduces the risk of postnatal HIV-1 transmission and increases HIV-free survival. *AIDS* 2005;19:699–708.
 19. Coutsooudis A. Method of feeding and transmission of HIV-1 from mothers to children by 15 months of age: prospective cohort study from Durban, South Africa. *AIDS* 2001;15:379–387.
 20. Kenya Ministry of Health, ICF International. Kenya Demographic and Health Survey. Calverton, MD, 2009.
 21. Kenya Ministry of Health, ICF International. Kenya Demographic and Health Survey, Key Indicators 2014. Calverton, Maryland, 2014. <http://dhsprogram.com/pubs/pdf/PR55/PR55.pdf> (accessed April 20, 2015).
 22. Kenya National AIDS and STI Control Programme (NASCOP). Kenya AIDS Indicator Survey 2012: Final Report. Kenya Ministry of Health, Nairobi, 2014.
 23. World Bank. Mortality rate, infant (per 1,000 live births) 2009–2013. [databank.worldbank.org/data/](http://data.worldbank.org/data/) (accessed May 22, 2014).
 24. Skouteris H, Nagle C, Fowler M, et al. Interventions designed to promote exclusive breastfeeding in high-income countries: a systematic review. *Breastfeed Med* 2014;9:113–127.
 25. Okanda J, Borkowf C, Girde S, et al. Exclusive breastfeeding among women taking HAART for PMTCT of HIV-1 in the Kisumu Breastfeeding Study. *BMC Pediatr* 2014;14:280.
 26. Ochola SA, Labadarios D, Nduati RW. Impact of counselling on exclusive breast-feeding practices in a poor urban setting in Kenya: a randomized controlled trial. *Public Health Nutr* 2013;16:1732–1740.
 27. Bland R, Little K, Coovadia H, et al. Intervention to promote exclusive breastfeeding for the first 6 months of life in a high HIV prevalence area. *AIDS* 2008;22:883–891.
 28. Aidam B, Perez-Escamilla R, Lartey A. Lactation counselling increases exclusive breast-feeding rates in Ghana. *J Nutr* 2005;135:691–695.
 29. Tuthill E, McGrath J, Young S. Commonalities and differences in infant feeding attitudes and practices in the context of HIV in sub-Saharan Africa: a metasynthesis. *AIDS Care* 2014;26:214–225.
 30. Tuthill EL, Chan J, Butler LM. Challenges faced by health-care providers offering infant-feeding counseling to HIV-positive women in sub-Saharan Africa: a review of current research. *AIDS Care* 2015;27:17–24.
 31. Kenya National AIDS and STI Control Programme (NASCOP). Guidelines for Antiretroviral Therapy in Kenya. 3rd ed. Kenya Ministry of Health, Nairobi, 2005. www.who.int/hiv/pub/guidelines/kenya_art.pdf (accessed August 6, 2014).
 32. Kenya National AIDS and STI Control Programme (NASCOP). Guidelines for the Prevention of Mother to Child Transmission (PMTCT) of HIV/AIDS in Kenya. 3rd Edition. Kenya Ministry of Health, Nairobi, 2009. nascop.or.ke/library/pmtct/PMTCT%20Guideline-March%202010.pdf (accessed August 6, 2014).
 33. Kenya National AIDS and STI Control Programme (NASCOP). Guidelines for the Prevention of Mother to Child Transmission (PMTCT) of HIV/AIDS in Kenya. 3rd Edition. Kenya Ministry of Health, Nairobi, 2009. nascop.or.ke/library/pmtct/PMTCT%20Guideline-March%202010.pdf (accessed August 6, 2014).
 34. Thomas E, Piwoz E, WHO, UNICEF, USAID. HIV and infant feeding counselling tools. World Health Organization, Geneva, Switzerland, 2005, 2008.
 35. Kenya Ministry of Health, ICF International. Kenya Demographic and Health Survey. Calverton, MD, 2003.
 36. Kagwaini F, Karanja S, Bosire R. Exclusive breastfeeding: is it for HIV-1 positive women only? *Afr J Hlth Sci* 2014;27:57–70.
 37. Onono M, Cohen C, Jerop M, et al. HIV serostatus and disclosure: implications for infant feeding practice in rural south Nyanza, Kenya. *BMC Public Health* 2014;14:390.
 38. Waruru AK, Nduati R, Tylleskär T. Audio computer-assisted self-interviewing (ACASI) may avert socially desirable responses about infant feeding in the context of HIV. *BMC Med Inform Decis Mak* 2005;5:24.

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