# Provision of Services and Care for HIV-Exposed Infants: A Comparison of Maternal and Child Health Clinic and HIV Comprehensive Care Clinic Models

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**Objective:** Prevention of Mother-to-Child Transmission of HIV programs require follow-up of HIV-exposed infants (HEI) for infant feeding support, prophylactic medicines, and HIV diagnosis for at least 18 months. Retention in care and receipt of HIV services are challenging in resource-limited settings. This study compared infant follow-up results when HEI services were provided within Maternal and Child Health (MCH) clinics or in specialized HIV Comprehensive Care Clinics (CCCs) in Kenya.

**Methods:** This observational prospective cohort study enrolled HEI at 6–8 weeks of age in 2 purposively selected hospitals with similar characteristics but different models of service delivery. In the CCC model, HEI received immunization and growth monitoring in MCH but cotrimoxazole prophylaxis and infant HIV testing in the CCC. In the MCH model, all services were provided in the MCH. Data were collected at enrollment, 14 weeks, and 6, 9, and 12 months.

**Results:** From April 2008 to April 2009, 184 HEI were enrolled in the CCC cohort and 179 in the MCH cohort. Infants in MCH were 1.14, 1.42, 1.95, and 1.29 times more likely to attend 14-week, 6-, 9-, and 12-month postnatal visits, respectively, and 2.24 times (95% confidence interval: 1.57 to 3.18) more likely to attend all 4 visits. Although infants in MCH were 1.33 times (95% confidence interval: 1.10 to 1.62) more likely to have HIV antibody testing at 1 year than CCC, there were no differences for polymerase chain reaction test or cotrimoxazole initiation at 6–8 weeks.

**Conclusions:** HIV services integrated in MCH yield better follow-up of HEI than CCC.

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## INTRODUCTION

More than 90% of pediatric HIV infections are found in sub-Saharan Africa, primarily through mother-to-child transmission of HIV.[1] Although globally, 53% of HIV-infected women received antiretroviral drugs (ARV) for Prevention of Mother-to-Child Transmission of HIV (PMTCT) in 2009, coverage of key services for the HIV-exposed infants (HEI) born to these women were considerably lower.[1] Only 35% of HEI received ARV prophylaxis, 15% were tested for HIV in the first 2 months of life, and 14% were initiated on cotrimoxazole (CTX) prophylaxis in the first 2 months of life. Rates for maternal and infant ARV prophylaxis in sub-Saharan Africa were similar to the global rates (54% and 35%, respectively); however, rates in eastern and southern Africa were significantly higher (68% and 45%) than western and central Africa (23% and 12%).[1] Development of parallel PMTCT and HIV care and treatment programs in many low- and middle-income countries often results in suboptimal provision of longitudinal HIV management and care for HEI.[2–7] Lack of integration of PMTCT and Maternal and Child Health (MCH) staff and services, particularly postnatal services (even when colocated in MCH clinics), along with poor systems to identify and follow-up HIV-infected women and their children after delivery have been major challenges to successful PMTCT program implementation.[6,8–11] The World Health Organization (WHO) defines integration of health services as "the organization and management of health services so that people get the care they need, when they need it, in ways that are user-friendly, achieve the desired results and provide value for money."[12] Achieving worldwide elimination of pediatric HIV infection will require identification of models of service integration that maximize the provision of and uptake and retention in PMTCT services.

National programs have focused efforts and resources toward systematizing methods of identifying and following up HIV-exposed children to improve the delivery of services and improve infant outcomes.[5] This is important for early identification of HIV infection, to avoid postnatal HIV acquisition, to prevent increased risk of mortality from other infectious

diseases, and to provide infant feeding counseling and support. Development and use of coded child health cards, rollout of early infant diagnosis (EID) testing using specimens collected on dried blood spots (DBS), development of psychosocial support groups as a means of ensuring the follow-up of HEI, and utilization of the MCH clinic to provide HIV care and treatment services have contributed to improvements in HEI care.[2–4,10,11]

In Kenya, the initial national model for providing follow-up HIV care to HEI involved referral to an HIV Comprehensive Care Clinic (CCC), where consolidated HIV care and treatment services are provided separately from MCH services (ie, immunization, growth monitoring). However, at the time of the study, the Ministry of Health (MoH) was considering an alternative integrated MCH model, where both HIV and MCH services are provided to the HEI in the MCH clinic. Only services for the HEI were included in the MCH integration model whereas their mothers continued to receive their care in the CCCs. Critical information about infant outcomes was needed to assist the MoH in determining the best method of providing care to HEI in Kenya. Therefore, the Elizabeth Glaser Pediatric AIDS Foundation (EGPAF) conducted an evaluation of the effectiveness of the integrated MCH model compared with the CCC model in 2 hospitals in western Kenya.

**TABLE 1.** Facility Characteristics of the Study Sites

| Facility Data (2008) | Vihiga DH/Mbale* (MCH Model Site) | Bungoma DH (CCC Model site) |
|---|---|---|
| No. first ANC visits† | 3850 | 3948 |
| No. facility deliveries† | 3150 | 3191 |
| Proportion of fully immunized infants† (total HIV exposed and non–HIV exposed) | 69%‡ | 67% |
| HIV seroprevalence in ANC§ | 9% | 7% |
| No. women in PMTCT program per year§ | 240 | 200 |
| Services | | |
| Growth monitoring | MCH | MCH |
| All infant immunizations | MCH | MCH |
| CTX prophylaxis | MCH | CCC |
| HIV DBS collection for PCR | MCH | CCC |
| HIV serology | MCH | CCC |
| Maternal HIV care/ART | CCC | CCC |
| Peer escorts between MCH and CCC | Yes | Yes |
| Immunization register | MCH | MCH |
| HEI postnatal follow-up register | MCH | CCC |

*Vihiga DH includes MCH and CCC services, however for HIV-infected women and their infants in the PMTCT program, all HEI services were provided in MCH.
†Data extracted from routine MoH program data reports.
‡Data available from Mbale Rural Training Centre only.
§Data from routine EGPAF PMTCT program data.
ANC, antenatal care.

## METHODS

### Study Design

An observational prospective cohort study was conducted to compare the effectiveness of provision of routine services and HIV care to HEI in a facility providing the integrated MCH model of service delivery with a facility utilizing the CCC model.

### Study Sites

The study was conducted in 2 EGPAF-supported district hospitals (DHs), Vihiga and Bungoma, in the Western Province of Kenya. These hospitals were purposively selected because they are high-volume sites with similar health services, infrastructure, and human capacity, serving populations with similar HIV prevalence, socioeconomic status and were implementing the 2 different models of service delivery (Table 1). Vihiga DH also incorporates the Mbale Rural Training Centre MCH under the same management and MCH model, where the majority of ANC/MCH services are provided; therefore, study data were collected from both clinics and included together under Vihiga DH. Although the staffs in the CCC generally have more expertise and specialty training in HIV than those in the MCH, the training and capacity of staff in providing HEI services were similar in both the Vihiga MCH and Bungoma CCC. At the time of the study, Vihiga DH was the only facility in western Kenya implementing the integrated MCH model.

### Models

Infants received all routine immunizations and growth monitoring in the MCH clinics in both models (Table 1). Maternal HIV care and treatment in both models were provided in the CCC. The MCH and CCC models differed in the delivery of HIV-related services to the HEI, including collection of DBS for EID by polymerase chain reaction (PCR), provision of CTX prophylaxis, and HIV antibody testing, which were provided in the MCH or infants were escorted to the CCC within the same facility to receive these services. In both models, linkages between MCH and CCC were facilitated by peer counselors, who provided ongoing support to women and escorted them between the 2 clinics. These peers were also responsible for escorting HEI who were seen in MCH to the CCC for HIV services and vice versa.

### Study Population

All HIV-exposed 6- to 8-week-old infants and their mothers/caregivers presenting for the 6-week immunization visit to the MCH clinics or the 6-week HEI follow-up visit to the CCC at the study facilities were eligible for study participation. MCH immunization nurses identified potential participants in the MCH model through review of the child health card that contains codes identifying HIV exposure status and discussion with the mothers/caregivers. Interested potential participants were referred to the study research clinical officer (RCO) for further information. In the CCC model, CCC nurses identified 6- to 8-week-old HEI presenting to the clinic for follow-up and referred them to the RCO in the CCC. The RCOs verified study eligibility, explained the study, answered any questions, and obtained written consent from mothers/caregivers willing to participate in the

study. The RCOs enrolled infants daily until the desired sample size in each study site was reached.

## Study Procedures

Routine MCH services in Kenya include postnatal visits at 6, 10, 14 weeks and 9 months of age for growth monitoring and immunizations. At the time of the study, Kenya national guidelines for the care of HEI included: postnatal visits at 1–2, 6, 10, 14 weeks, then monthly until 12 months of age, and then every 3 months until 24 months of age. CTX prophylaxis initiation and EID were done at 6 weeks of age, with follow-up HIV antibody testing at 12 and 18 months of age. Study-specific visits were conducted at the 6- to 8-week enrollment visit and then at the time of routinely scheduled 14 weeks, 6 months, 9 months, and 12 months of postnatal visits. All enrolled infants seen in the study clinics were given a return date corresponding to the next immunization visit where applicable or the next study scheduled visit.

Once enrolled, the infants were seen by an RCO posted in either in the MCH or the CCC, who provided HIV services to enrolled participants at all their clinic visits, both routine and study specific. The RCOs in both the MCH clinic and the CCC also provided general services to nonstudy patients when not occupied with study participants. After the study, these clinical officers continued to provide HIV care within routine PMTCT services supported by EGPAF. In the MCH model, the clinical officer interviewed the mother/caretaker and extracted participant data from the existing MoH immunization and HEI postnatal follow-up registers in the MCH (Table 1). In the CCC model, the RCO interviewed the mother/caregiver and extracted data from the HEI postnatal follow-up registers in the CCC but had to go to the MCH clinic to obtain data from the immunization register. Dates of receipt of immunizations were extracted from the infant's child health card and verified in MCH registers whenever possible in both models.

Case report forms were completed by the RCO at each study visit. At study enrollment, sociodemographic and maternal and infant HIV-related information were collected. Data on infant health, immunizations received, and receipt of HIV-related care for the infant (HIV testing, CTX prophylaxis) and mother (staging, CTX, ARV) were collected at enrollment and subsequent visits. At the 12-month visit, the caregivers were also asked if they were satisfied with the services the infants received. Case report forms were sent to the study center in the offices of EGPAF/Kenya for entry into an MS Access 2007 (MicroSoft Corp, Seattle, WA) database. A double data entry system was used with comparison and verification done by the study data manager.

Approval for the research was obtained from the Ethical Review Committee of Kenyatta National Hospital—University of Nairobi. Written informed consent for study participation was obtained from all mothers/caregivers.

## Statistical Analysis

Primary study objectives were to compare rates of attendance at each study visit and receipt of services in the MCH and CCC models of care for: infant DBS-PCR testing and CTX initiation at 6–8 weeks, receipt of immunizations at 14 weeks, continuation of CTX prophylaxis at 6 months, measles immunization at 9 months, and HIV antibody testing at 12 months. The study sample size was estimated using the expected difference in proportions between the 2 groups for each outcome using a 0.05 two-sided significance level and 80% power.

Sociodemographic characteristics of mothers and infants were considered as potential confounders and/or significant covariates in bivariable and multivariable analyses. Pearson $\chi^2$ tests were used to test for significant associations between model of service and each of the sociodemographic characteristics. Fisher exact tests were applied for characteristics having $>20\%$ of the expected cell counts $<5$. Poisson regression with robust error variance estimation was used to examine the relationship between total number of study follow-up visits per infant and model of service adjusting for significant covariates. Generalized estimating equations for binary data were used to test for significant differences in attendance at each follow-up visit between the models of service. The generalized estimating equation assumed a Poisson distribution with the log link and unstructured variance–covariance. The level of statistical significance was set at 0.05. A Bonferroni *P*-value adjustment was applied for multiple comparisons.

Additionally, the study was designed to determine whether there were significant differences in rates of uptake of services at the study visits in the MCH model as compared with the CCC model. The site/service (MCH or CCC), which was the variable of interest, was included as a fixed effect in the models; thus, the results are specific to these 2 sites only. Services included PCR and CTX initiation at 6–8 weeks, oral polio vaccine and diphtheria, pertussis, tetanus (DPT) vaccine at 14 weeks (visit 2), CTX use at 6 months (visit 3), measles vaccine at 9 months (visit 4), and complete vaccinations and HIV antibody test at 12 months (visit 5). Poisson regression with robust error variance estimation was used to test for significant differences in these outcomes between the models of service adjusting for significant covariates. Probability ratios and corresponding 95% confidence intervals (CIs) were reported. All statistical analyses for this article were generated using SAS/STAT software, Version 9.1, of the SAS System for Windows (SAS Institute, Inc, Cary, NC).[13]

# RESULTS

From April 2008 to April 2010, 363 HEI were enrolled in the study and followed up to 12 months of age. In the MCH model, 179 of 183 eligible HEI were enrolled, and 184 of 190 eligible HEI were enrolled in the CCC model. At enrollment, more mothers in the CCC model were married, employed, had a parity of at least 5, had higher WHO stage, and were receiving CTX and antiretroviral therapy (ART) (Table 2).

After enrollment at 6–8 weeks, the overall attendance rate dropped to 82.6% (88.3% in MCH vs 77.2% in CCC; $P = 0.005$) for the first study visit corresponding with the 14-week immunization visit (Fig. 1). Attendance declined more rapidly in the CCC model compared with the MCH model, with a slight increase in attendance in the CCC model at the 12-month visit. Overall, the infant attendance rate at the MCH remained significantly higher than that at the CCC model. Infants in the MCH were 1.14 times (95% CI: 1.04 to 1.26)

more likely to attend the 14-week immunization visit, 1.42 times (95% CI: 1.23 to 1.65) more likely to attend the 6-month postnatal follow-up visit, 1.95 times (95% CI: 1.57 to 2.42) more likely to attend the 9-month postnatal follow-up visit, and 1.29 times (95% CI: 1.07 to 1.56) more likely to attend the 12-month postnatal follow-up visit than infants in the CCC.

In unadjusted Poisson regression models, model of service delivery, level of education, marital status, and employment status were significantly associated with the average number of infant study follow-up visits at or less than the 0.20 level and thus were considered for inclusion in the adjusted model (Table 2). In the adjusted model, model of service delivery ($P < 0.0001$) and employment status ($P = 0.006$) were the only predictors significant at the 0.05 level. The average number of study follow-up visits for infants in the MCH model was 1.30 times (95% CI: 1.16 to 1.46) the number of study follow-up visits for infants in the CCC model after adjusting for employment status. The average number of follow-up visits for infants with unemployed

**TABLE 2.** Comparison of Infant and Caregiver Demographic Characteristics and Average Number of Study Visits to a Health Facility in a 12-Month Follow-up Period

| Characteristics | Model of Service Delivery | | | Unadjusted Mean No. Visits (95% CI)† | |
|---|---|---|---|---|---|
| | MCH (N = 179), n (%) or Median (IQR) | CCC (N = 184), n (%) or Median (IQR) | P* | | P‡ |
| Service | | | | | |
| MCH | 179 (100) | — | | 3.01 (2.83 to 3.21) | <0.0001 |
| CCC | — | 184 (100) | | 2.18 (2.00 to 2.37) | |
| Caregiver age, yr | 27 (24, 31) | 28 (23, 31) | 0.39 | | 0.99 |
| Caregiver level of education§ | | | | | |
| Less than secondary | 113 (63.1) | 113 (61.4) | 0.78 | 2.69 (2.53 to 2.87) | 0.10 |
| Secondary + | 62 (34.6) | 66 (35.9) | | 2.44 (2.20 to 2.70) | |
| Caregiver marital status | | | | | |
| Married | 138 (77.1) | 157 (85.3) | 0.04 | 2.54 (2.39 to 2.69) | 0.15 |
| Not married | 41 (22.9) | 27 (14.7) | | 2.81 (2.48 to 3.18) | |
| Maternal parity§ | | | | | |
| 1 | 55 (30.7) | 36 (19.6) | <0.01 | 2.56 (2.29 to 2.86) | 0.81 |
| 2–4 | 112 (62.6) | 120 (65.2) | | 2.58 (2.42 to 2.76) | |
| 5+ | 12 (6.7) | 27 (14.7) | | 2.72 (2.33 to 3.17) | |
| Caregiver employment status§ | | | | | |
| Employed | 85 (47.5) | 128 (69.6) | <0.01 | 2.38 (2.20 to 2.56) | 0.0002 |
| Not employed | 94 (52.5) | 54 (29.3) | | 2.91 (2.71 to 3.12) | |
| Caregiver counseled and tested for HIV during most recent pregnancy§ | | | | | |
| Yes | 172 (96.1) | 177 (96.2) | 0.97 | 2.62 (2.48 to 2.76) | 0.56 |
| No | 4 (2.2) | 4 (2.2) | | 2.25 (1.36 to 3.73) | |
| Infant place of delivery§ | | | | | |
| In a health facility | 95 (53.1) | 83 (45.1) | 0.22 | 2.66 (2.46 to 2.88) | 0.40 |
| At home | 82 (45.8) | 93 (50.5) | | 2.54 (2.36 to 2.74) | |
| Mother WHO staging§ | | | | | |
| I | 130 (72.6) | 109 (59.2) | 0.01 | 2.69 (2.53 to 2.86) | 0.25 |
| II | 32 (17.9) | 43 (23.4) | | 2.40 (2.10 to 2.74) | |
| III | 13 (7.3) | 28 (15.2) | | 2.49 (2.11 to 2.94) | |
| Mother currently on CTX§ | | | | | |
| Yes | 145 (81.0) | 179 (97.3) | <0.01 | 2.58 (2.44 to 2.73) | 0.65 |
| No | 31 (17.3) | 5 (2.7) | | 2.69 (2.26 to 3.21) | |
| Mother currently on ARVs§ | | | | | |
| Yes | 42 (23.5) | 71 (38.6) | <0.01 | 2.68 (2.45 to 2.93) | 0.41 |
| No | 134 (74.9) | 110 (59.8) | | 2.56 (2.39 to 2.73) | |
| Infant gender | | | | | |
| Male | 89 (49.7) | 84 (45.6) | 0.44 | 2.65 (2.46 to 2.85) | 0.43 |
| Female | 90 (50.3) | 100 (54.4) | | 2.54 (2.35 to 2.74) | |

*Generated from Pearson chi-square and Fisher exact tests.
†Estimated from unadjusted Poisson regression models with robust variance estimation.
‡Generated from unadjusted Poisson regression models with robust variance estimation.
§Percentages do not add to 100 due to missing values.

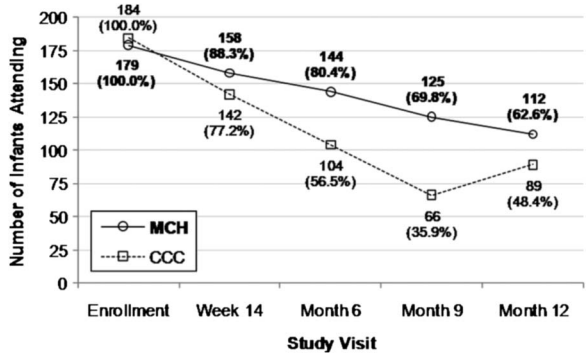


**FIGURE 1.** Frequency distribution [expressed in n (%)] of HEI at enrollment and at each of the study follow-up visits.

caregivers was 1.16 times (95% CI: 1.04 to 1.30) the number of follow-up visits for infants with employed caregivers after adjusting for model of service.

In the MCH model, 96 infants (53.6%) attended all 4 study follow-up visits, whereas only 35 infants (19.0%) in the CCC model attended all 4 visits ($P < 0.0001$) (Fig. 2). After controlling for caregiver's age, marital status, education level, employment status, counseling, maternal parity, staging, mother on CTX, mother on ARV, place of delivery, and infant gender, the adjusted probability of attending all 4 study follow-up visits for an infant in the MCH model was 2.24 times (95% CI: 1.57 to 3.18) greater than that for an infant in the CCC model.

Almost all infants received PCR testing (99%) or were initiated on CTX prophylaxis (98%–100%) by enrollment, with no significant differences between MCH and CCC models of service (Table 3). Overall, infants in the MCH model were significantly more likely to receive oral polio vaccine at 14 weeks, CTX at 6 months, measles vaccine at 9 months, and complete vaccinations and have an HIV antibody test at 12 months compared with infants in the CCC model. Receipt of DPT vaccination was much lower than polio vaccination at 14 weeks in both models (MCH: 34.6% vs 82.1%; CCC: 39.7% vs 65.8%) due to national vaccine stock outs that occurred during the study period. However, when including only the HEI who attended the specified clinic visit, there were significant differences in the proportion of infants who received the desired service in MCH compared with CCC, respectively, for some (DPT: 39% vs 51.4%; polio: 93% vs 85%; CTX: 93.8% vs 99.0%) but not all endpoints (Table 3).

Caretakers in both models were asked whether they were satisfied with the services that they received for their infant and what they liked or disliked. At the final 12-month study visit, there was no difference between the models, with only one caretaker in the MCH model indicating lack of satisfaction due to long waiting time before being seen. The majority of comments were positive noting that they were well treated by staff, they appreciated the information and advice that they received, their babies received good care, the baby's health improved, and particularly that the baby was HIV negative because of the care they received.

## DISCUSSION

This study demonstrates that in Western Province, Kenya, one DH with an integrated PMTCT–MCH model of postnatal care for HEI performed significantly better than a similar DH using an HIV CCC model. With the significant loss to follow-up seen in the HIV CCC model, the delivery of HIV-related and routine services is compromised, which will negatively impact child survival. However, the overall high rate of postnatal loss to follow-up in both models is a major concern as Kenya and other African countries roll out the new WHO guidelines for PMTCT that include the extended use of ARV throughout the full breastfeeding period.

The relatively better performance for the MCH clinic model in the study sites may be attributed to the integration of some HIV-related services in the MCH, allowing HEI to be seen in a single visit with the same service providers. This approach to service delivery seems more patient-friendly and may be less stigmatizing.[10] HIV CCC model involved receiving immunizations and growth monitoring in the MCH clinic with one set of providers followed by navigating the system to a separately located HIV CCC to receive the DNA PCR, CTX, or HIV antibody test provided by another set of health care workers. The use of peer counselors to support women in the process may have mitigated some of the challenges with this model. Visits to the CCC may be seen as more stigmatizing, particularly for HIV-infected women who appear well and are not yet on ART. These women may be less motivated to return to the CCC regularly for their own care and thus return less for their infant care as well.

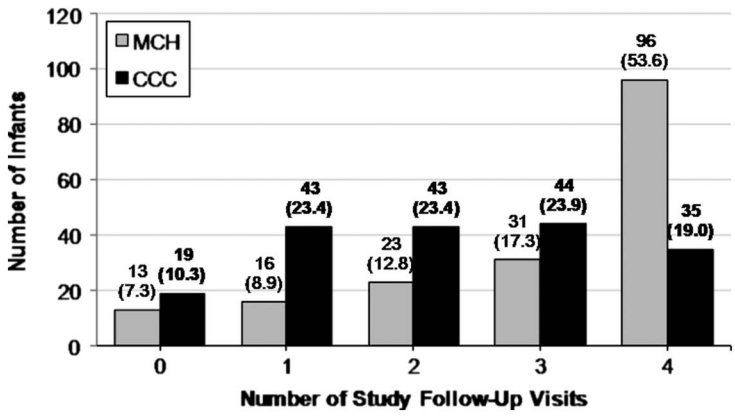


**FIGURE 2.** Frequency distribution [expressed in n (%)] of the total number of study follow-up visits attended by HEI.

**TABLE 3.** Comparison of Unadjusted Rates of Service Uptake by Infants in the MCH and CCC Models of Service

| Outcome Variable | MCH, n (%) | | CCC, n (%) | | Ratio (95% CI)* | P† |
|---|---|---|---|---|---|---|
| | Yes | No | Yes | No | | |
| PCR at 6–8 wk | 177 (98.9) | 1 (0.56) | 182 (98.9) | 0 (0) | 0.99 (0.98 to 1.01) | 0.49 |
| CTX initiation at 6–8 wk | 179 (100) | 0 (0) | 180 (97.8) | 2 (1.09) | 1.01 (0.99 to 1.03) | 0.50 |
| DPT vaccine at 14 wk | 62 (34.6) | 117 (65.4) | 73 (39.7) | 111 (60.3) | 0.87 (0.67 to 1.14) | 0.32 |
| Oral polio vaccine at 14 wk | 147 (82.1) | 32 (17.9) | 121 (65.8) | 63 (34.2) | 1.25 (1.10 to 1.41) | 0.0004 |
| CTX at 6 mo | 135 (75.4) | 44 (24.6) | 103 (56.0) | 81 (44.0) | 1.35 (1.16 to 1.57) | <0.0001 |
| Measles vaccine at 9 mo | 123 (68.7) | 56 (31.3) | 63 (34.2) | 121 (65.8) | 2.01 (1.61 to 2.51) | <0.0001 |
| Complete vaccination by 12 mo‡ | 130 (72.6) | 49 (27.4) | 103 (56.0) | 81 (44.0) | 1.30 (1.11 to 1.52) | 0.0014 |
| HIV antibody test at 12 mo | 109 (60.9) | 70 (39.1) | 84 (45.7) | 100 (54.3) | 1.33 (1.10 to 1.62) | 0.0036 |

*Estimated from Poisson regression models with robust variance estimation, these probability ratios (95% CI) are calculated as the probability that infants in the MCH model receive the service divided by the probability that the infants in the CCC model receive the service.

†Generated from unadjusted Poisson regression models with robust variance estimation.

‡Includes number of infants seen at 12 months who had received complete set of DPT, oral polio vaccine, and measles vaccinations according to child health card.

The 12-month loss to follow-up rate of >40% in both models in this study is consistent with results of a recent program evaluation for HEI retention in care in 9 facilities in Eastern and Central Kenya that reported only 49% retention in care at 12 months and 37% at 18 months.[2] Early experience with an integrated model of PMTCT follow-up in rural MCH clinics in Malawi was also plagued by extremely high rates of loss to follow-up postnatally, with a cumulative loss to follow-up of 68% by delivery, 70% by the first postnatal visit, and 81% by the 6-month visit.[14] In comparing results from this study, it is important to note that the loss to follow-up rates reported here include only those lost after the study enrollment visit at the 6-week follow-up time point and thus do not represent the total lost either from ANC to delivery or from delivery to the first 6-week visit. A more recent evaluation of the integration of PMTCT into routine MCH services in South Africa found poor follow-up of mothers and infants in postnatal care, with poor integration of services, lack of clarity on health care worker roles, and poor record keeping.[10] Lack of return visits to clinic by women and their infants is compounded by lack of provision of services when they do attend caused by deficiencies in the health system.[3,6,11] In the South African study, only 47% of HEI received PCR testing or CTX at the first prenatal care visit, despite high immunization coverage rates.[10]

Reasons for loss to follow-up, such as poor socioeconomic conditions, difficult transport, distance from health facility, competing health needs, fear of results, poor record keeping, and unreported deaths, have all been described.[6,15–17] This study's finding that maternal employment status influences retention is important to investigate further. Being employed may mean that repeated absence from work to attend clinic is an obstacle to receiving care or that women with more resources may follow-up in private facilities. Minimizing the frequency and duration of clinic visits by integrating services in one visit or flexible appointment times to accommodate work schedules may improve visit follow-up. Low DNA test rates have been reported due to lack of availability of EID services (often due to poor transport systems for moving DBS), lack of identification of a child as HIV exposed, reagent or DBS shortages, clinicians forgetting to offer or order the tests, maternal fears of phlebotomy or knowing infant status, or undocumented testing in other sites.[6,9,10,15] Although there were no DNA test stock outs during the study period, the nationwide stock out of DPT vaccine points out the vulnerabilities in the health infrastructure that also affect HIV-related commodities.[15]

The Kenya demographic and health survey found that 85% of infants receive the 9-month measles immunization, much higher than the rate of retention of HEI into care in this study and other PMTCT programs.[18] This indicates the need for special focus on the HEI to address barriers to 18-month postnatal follow-up. These approaches may include innovative active tracking and defaulter tracing systems, mechanisms to increase partner support, peer support for women and synchronizing the clinic visit for the mother and her infant. Provision of services where the mother and child received care and treatment services together eliminates the need to choose between a mother attending clinic for her health or for that of her child.[15] This study only examined integration of services for the HEI into routine MCH services, whereas more recently, programs integrating all PMTCT services, including maternal HIV care and treatment and family planning in MCH, have been implemented as ART services have expanded and policies allowing nurse-led ART prescription have evolved. Another alternative to integrating HIV services in MCH includes providing immunization services in the HIV CCC to eliminate the need for 2 visits; however, this will also require ensuring that all other MCH services, such as family planning, are also provided in the CCC.[15] Creative strategies to overcome barriers to follow-up, such as telephonic reminders, home visits, and transport reimbursement, have been used effectively to maintain high retention in research and clinical trials in Africa and could be translated into more cost-effective measures within routine service delivery.[15–17,19]

This study supports an integrated model for colocated delivery of PMTCT and MCH services. This study utilized a dedicated health care worker (a trained nurse or clinical officer) within the MCH to supplement the MCH workforce to manage the additional PMTCT service delivery requirements, which led to infants receiving the services needed if they came to the visit. This and the use of peer counselors to support HIV-infected women in the clinics are ideal, particularly as the added requirements for maternal ART and extended longer

prophylaxis are incorporated in PMTCT, but may not be feasible in all settings. Adding additional work in an already overburdened MCH system without addressing concomitant health workforce and logistics issues has the potential to increase staff discontent, increase waiting times, negatively impact quality of staff interactions with women, and lead to an overall decrease in delivery of quality services and patient retention. A holistic approach focusing on the health system strengthening is important to achieve a well-integrated program, including capacity building for MCH health care workers and improvement of the health management information system, commodities management, and program leadership.[10]

There are some limitations to this operational research study. This study was conducted in only 2 DHs in western Kenya, limiting the generalizability of results. It did not include the lower level health center or dispensary settings or facilities without an HIV CCC. The majority of the data were collected from registers completed during routine service delivery, based on self-reporting and without active tracing of those lost to follow-up. HEI may have received their HIV services elsewhere, but this was not captured. Having full-time study clinical officers providing HIV-related care during the study likely increased the rates of receipt of services that may not otherwise be seen in routine settings without staff specifically in place. The study training and SOPs likely contributed to the high rate of collection of specimens, provision of necessary care, and adherence to PMTCT program activities compared with gaps in service provision within routine services reported elsewhere due to the multiple competing needs of health care worker that may not allow provision of all HIV services, despite infants' attendance in the MCH clinic.[3,8,15] Because the study sites were not randomized to the service delivery models, there could be other factors that contribute to the differences seen in the 2 study groups, despite attempts made to minimize this, such as the differences in the 2 populations of study women at enrollment.

With more than 4100 health facilities that provide PMTCT services and 1125 health facilities that provide HIV care and treatment services, Kenya has made great progress in addressing its HIV and AIDS epidemic.[20] As of April 2011, 78% of HIV-infected women received ARV and 63% of their HEI received ARV for prophylaxis and EID testing. To reach elimination of pediatric HIV and maximize the survival of HIV-infected woman and children, more than 95% of HIV-infected women and their infants need to receive the full complement of HIV and MCH services. Further research to identify barriers to achieving these targets and practical, efficient, and effective ways of overcoming them is critical. Research documenting the effectiveness of different integration models is needed to identify the most efficient and effective method of delivering PMTCT services.

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