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Health Outcomes of Infants in a PMTCT Program in Kinshasa

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Abstract

Effective follow-up of mother–infant pairs is critical for ensuring the success of preventing mother-to-child transmission (PMTCT) programs. The objective of this study was to identify factors associated with health outcomes of exposed infants in a PMTCT program in the Democratic Republic of Congo (DRC). Data were collected from January 2005 through December 2008 in 2 maternities in Kinshasa, DRC. The exposed infant's health status was used as outcome. Multiple logistic regressions were used to identify the determinants of infant outcomes. A total of 309 mother–infant pairs were included in this study. Younger maternal age, breast-feeding but weaning before the age of 6 months, and HIV testing of the child and a mother who is not sick were associated with better infant health outcome. The follow-up of mother–infant pairs in PMTCT programs remains critical and challenging. There is a need for innovative and efficient strategies to improve retention of mother–infant pairs in PMTCT programs.

Keywords

HIV, prevention, exposed infant, retention

Introduction

Worldwide, in 2010, a total of 3.4 million children less than the age of 15 were estimated to be living with HIV, with more than 3 million in sub-Saharan Africa.[1] During that same year, only 30% of all pregnant women were tested for HIV globally.[1]

Without any preventive intervention, the risk of HIV transmission from mother-to-child (MTCT) is estimated to be 25% to 40% in developing countries where breast-feeding is recommended to HIV-positive women.[2] The uptake of prevention of mother-to-child transmission (PMTCT) interventions remains low in many countries with a high burden of HIV. According to the Multiple Indicator Clusters Survey (MICS) report published in 2010, the coverage of PMTCT interventions in the Democratic Republic of Congo (DRC) was less than 2%; the antenatal care (ANC) uptake was 87% for the first visit and drastically decreased during the fourth visit to 45%. This low uptake of last ANC services makes follow-up for HIV-positive mothers and their infants challenging, since many of them will not return with their child after delivery.[3] In 2010, the infant mortality rate was 97 of 1000.[3]

Effective follow-up of mother–infant pairs is critical for ensuring the success of PMTCT programs. In the absence of such follow-up, the ultimate health outcome of the infant as well as for the mother will be suboptimal.[4] Antenatal care services are an opportunity to build strong relationships between providers and clients and to reinforce health education of clients.[5] If the follow-up of exposed infants is successful, it serves as an opportunity for mothers to be educated about other health needs such as nutrition and family planning. In addition, it also facilitates early infant diagnosis and the initiation of HIV-infected infants on antiretroviral treatment (ART), which is critical for the infected infants' survival.[6]

If follow-up is not successful, it is a missed opportunity to provide antiretroviral (ARV) medications and cotrimoxazole prophylaxis/treatment to the mother–infants pairs. Inadequate follow-up leads to inaccurate data on HIV infections in exposed infants as well as the proportion of averted infections.[6]

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According to the studies conducted in sub-Saharan Africa, there are numerous reasons why the follow-up of mother–infant pairs is difficult. These include (1) late entry into programs and therefore pregnant women may not have sufficient time to learn about the advantages of PMTCT interventions[7]; (2) health facility–related factors such as not offering PMTCT services[8]; (3) stigma and discrimination against HIV-positive women, and (4) low male and community involvement and poverty.[9]

The objective of this study was to describe the health outcomes of exposed infants in a PMTCT program in DRC and to propose recommendations to improve PMTCT services.

Methods

Study Settings

Data on PMTCT were obtained from the Binza and Kingasani maternities, 2 of the highest volume maternities in Kinshasa, the capital city of DRC. Both institutions are faith-based facilities run by the Catholic Church and provide health services to the general population under the supervision of the DRC Ministry of Health. These were the 2 facilities where the Kinshasa School of Public Health (KSPH) PMTCT program implemented PMTCT activities since 2001.

The first facility, Binza Maternity, is located in the western part of Kinshasa and serves as a general referral hospital for the Binza Health Zone, which serves approximately 250 000 people. Approximately 8 000 deliveries occur each year in this facility. In this maternity, 1 obstetrician and 1 pediatrician work part time and 2 generalist doctors and 25 nurses work full time.

The second facility is Kingasani Maternity located in the eastern part of Kinshasa and serving as a General Referral Hospital for the Kingasani Health Zone, serving approximately 300 000 people. Approximately 10 000 deliveries occur each year at the Kingasani Maternity. In this maternity, 1 obstetrician works part time and 4 generalist doctors and 25 nurses work full time. Both maternities are well equipped for vacuum deliveries; cesarean sections are performed in a nearby hospital. The maternities have incubators but do not have a neonatal intensive care unit or a baby ward.

Technical assistance was provided by the Elizabeth Glaser Pediatric AIDS Foundation through the KSPH PMTCT project. These 2 facilities have been used as pilot facilities for the implementation of PMTCT activities in DRC, since 2002. Despite subsequent expansion of PMTCT programs by several implementing partners, the PMTCT coverage remains extremely low in DRC (less than 2% coverage). The facilities of Binza and Kingasani are accredited, by the DRC Ministry of Health, as sero-surveillance sites in Kinshasa. All health care providers working in these facilities have been trained in PMTCT programs and provider-initiated counseling and testing.

In 2001, the DRC Ministry of Health adopted the first PMTCT guidelines. In 2002, the use of single-dose nevirapine (sdNVP) to prevent MTCT was implemented. In 2007, the DRC Ministry of Health adopted the World Health Organization (WHO) 2006 Guidelines for PMTCT, consisting of long course zidovudine (ZDV) for pregnant women, starting at 28 weeks. However, these guidelines were not implemented because of a lack of resources and commodities. Pregnant woman in this study only received 1 tablet of 200 mg NVP at their first ANC visit, with the instruction to take it at the onset of labor. The HIV-positive woman who forgot or lost the NVP tablet was given a new tablet at delivery in the labor room. The new born, HIV-exposed baby received single-dose NVP syrup 2 mg/kg within 72 hours of delivery.

Study Design and Data Collection

We conducted a retrospective analysis of data from routine PMTCT activities in the 2 maternities. Data from January 2005 to December 2008 were included.

The follow-up of exposed infants and their mothers or caregivers was extremely challenging since the beginning of the PMTCT implementation at the 2 facilities. Since the introduction of the PMTCT activities at these 2 maternities, the providers encouraged pregnant women to return to attend postpartum as well as the under-5 clinic with their infants. From 2002 to 2007, however, less than 15% of HIV-positive women used to show up at the clinics, with their infants. In 2007, the KSPH PMTCT team set up a special follow-up system for exposed infants and their mothers. This system consisted of using mobile technology as well as the home visits. Phone numbers (if available) and addresses of all HIV-sero-positive mothers who delivered at the 2 maternities were made available to site counselors. During counseling sessions at the ANC and during labor and delivery, the counselors asked clients whether it was acceptable to contact them later by phone and/or home visit. A follow-up form was developed including information such as the infants' and the mothers' health outcomes, and information regarding whether the infant was tested for HIV if over 12 months old. All counselors were trained how to provide effective counseling and to conduct home visits. Counselors called the caregivers of exposed infants (the mother or another person if mother was dead) by phone to motivate them to return to the health facility with the child. If the exposed infant showed up, their caregivers were interviewed after informed consent was obtained. If a first phone call was not successful, in a second phone call, consent was asked from the caregivers for a home visit. A telephone credit equivalent of US$20 a week was provided to each counselor to facilitate the phone calls. Home visits were performed by the counselor who counseled and tested the client at the health facility. Home visits were conducted from January 2008 to December 2009. Infants who could not be located and whose information was not found 90 days before data collection were classified as lost to follow-up.

Participants

All pregnant women diagnosed with HIV infection attending the 2 facilities between 2005 and 2008 were considered as

potential participants. A total of 12 counselors who were teamed in 6 pairs conducted the home visits. If mother and child were not at home or the counselors could not find the address, another pair of counselors was asked to gather information on the health status of the exposed infant and mother.

If the exposed infant was more than 12 months old and was not yet tested for HIV, the mother or the person in charge was asked to bring the infant to the facility for an HIV test and counseling. A peripheral venous blood sample (~ 1.5 cm^3) was drawn for rapid HIV testing, using the Determine HIV 1/2 (Abbott; Rungis, France), Double Check Gold HIV1&2 (Orgenics; Yavne 70650, Israel), and Unigold HIV (Trinity Bioetech; Bray, Ireland), according to the DRC national HIV test algorithm. All the HIV-positive samples, undetermined, and 20% of the HIV-negative samples were sent to the accredited National HIV/AIDS referral laboratory for quality control (100% of the results were concordant). The result of the HIV test was communicated to the mother or caregiver the same day. HIV-positive infants were referred to an HIV pediatric treatment clinic for a free of charge ART.

Outcomes

The primary outcome of the analysis was the health status of the exposed infant. Exposed infants who were alive, did not develop any HIV-related clinical event, and remained HIV negative were classified as having a favorable outcome. Those who developed an HIV-related event or were severely malnourished and bedridden (very sick) either at home or in the hospital were classified as having an unfavorable outcome.

Data Analysis

Epi-info software 2000 (Ear Information [TM] 3.4.3; Centers for Disease Control and Prevention) was used for the analysis. Descriptive statistics were performed. The mean with standard deviation and median with quartiles were used for quantitative variables. Categorical variables were summarized using proportions.

Unadjusted analyses were performed to assess the association between the variables and the outcome: odds ratios were used to estimate the effect sizes. Chi-square test with a P value $<.05$ was used to test the differences in proportions.

Multiple logistic regressions were used to identify determinants of infant outcomes (including infants' and maternal characteristics). Variables found to be significant in bivariate analysis ($P < .10$) were included in the multivariate model. The final model was obtained by stepwise backward elimination, and the interaction terms were tested.

Results

From 2005 to December 2008, the KSPH PMTCT program provided ANC services to 71 088 pregnant women, and 64 298 were tested for HIV at the 2 health facilities. A total of 1512 (2.1%) pregnant women were HIV positive, of these only 954 (63%) delivered at the health facility. Three hundred nine mother–infant pairs were reached and were included in this study.

Sociodemographic Characteristics

The mean age of the included children was 31 months. The mean birth weight was 3014 g; 54.7% (169) were male; 297 (96.2%) of 309 were born vaginally and 10 (3.8%) of 309 by cesarean section. Episiotomy was performed for 9 (2.9%) mothers, 30 (10%) infants were born after prolonged labor, and 9 (2.9%) were preterm babies. Premature rupture of membranes occurred in 51 (16.5%) deliveries and 10 (3.2%) infants were twins. Single-dose NVP prophylaxis was given to 229 (74%) children. Other details related to the exposed infants are included in Table 1.

The average age of pregnant women included was 27.7 years; 236 received NVP around the delivery. Characteristics of the mothers are included in Table 1.

Health Outcomes of Mother and Children. A total of 40 (12.9%) of 309 infants were reported to have died. Also, 25 (8.1%) of 309 mothers were reported dead. In 10 mother–infant pairs, both mothers and children died, and in 30 pairs only the infant died and in 15 pairs only the mother died. HIV-positive women were referred to the closest HIV clinic for care and treatment. In all, 244 (78.9%) children did not have a clinical problem at the time of the visit and 11 (3.9) children were bedridden (very sick), either at home or in hospital; 66 children were less than 9 months of age at the time of data collection and not eligible for HIV antibody testing. Thus, 203 exposed infants eligible for HIV testing got tested, 33 (16.3%) of 203 were identified as HIV positive (Table 2). Concerning the HIV-positive women, 208 (67.3%) of 309 had no complaints or clinical problems, and 10 of 309 (3.2%) were bedridden (Table 2).

Determinants of the Infant's Outcome

Infants born to older mothers or to mothers who were not in good health, who were weaned after 6 months, who received mixed feeding before 6 months, and who were not tested for HIV were more likely to experience an unfavorable outcome during univariate analysis. These factors remained significant during multivariable analysis (Table 3).

Discussion

Five factors were found to be associated with favorable children outcome: (1) maternal younger age, (2) time of weaning at 6 months, (3) type of infant feeding: exclusive breastfeeding, (4) HIV testing of the infant and counseling of the caregivers, and (5) the mother's health status: healthy.

Younger maternal age was associated with positive child outcomes. In the study conducted in South Africa, low infant morbidity was associated with younger mother age.[10] However, a study conducted in Uganda reported that in women

Table 1. Sociodemographics Characteristics.

Characteristics	Kingasani Maternity, n (%)	Binza Maternity, n (%)	Total, n (%)
Age, months			
Mean (SD)	30.8 (15.4)	31.8 (14.6)	31.3 (15)
Birth weight			
Mean (SD)	3004 (488)	3028.9 (451.8)	3014 (473.5)
Sex			
Male	105 (57.0)	64 (51.2)	169 (54.7)
Female	79 (43.0)	61 (48.8)	140 (45.3)
Delivery way[a]			
Vaginal	173 (96.6)	120 (95.3)	297 (96.2)
C-section	5 (3.3)	5 (4.6)	10 (3.8)
Delivery event[b]			
Episiotomy	6 (3.3)	3 (2.4)	9 (2.9)
Other	14 (7.8)	14 (11.2)	28 (9.5)
Prolonged labor	8 (4.4)	22 (17.7)	30 (9.2)
Prematurity	6 (3.3)	3 (2.4)	9 (2.9)
None	145 (81.0)	82 (66.1)	227 (74.9)
Premature rupture of membranes			
Yes	17 (9.2)	34 (27.2)	51 (16.5)
No	131 (71.1)	88 (70.4)	219 (70.8)
Not sure	36 (19.5)	3 (2.4)	39 (12.6)
Twins			
Yes	7 (3.3)	3 (3.1)	10 (3.2)
No	177 (96.7)	122 (96.9)	299 (96.8)
Infant received NVP			
Yes	137 (74.5)	92 (73.6)	229 (74.1)
No	34 (18.5)	17 (13.6)	51 (16.5)
Not sure	13 (7.0)	16 (12.8)	29 (9.4)
Breast-feeding			
Yes	171 (92.9)	114 (91.2)	285 (92.2)
No	13 (7.0)	11 (8.8)	24 (7.8)
Age of mother, Years			
Mean (SD)	26.9 (5.6)	28.9 (5.5)	27.7 (5.6)
Mother received NVP			
Yes	136 (73.9)	100 (80)	236 (76.4)
No	36 (19.6)	15 (12)	51 (16.5)
Not sure	12 (6.5)	10 (8)	22 (7.1)

Abbreviations: SD, standard deviation; C-section, cesarean section; NVP, nevirapine.
[a] Six missing data in Kingasani Maternity.
[b] Five missing data in Kingasani Maternity and 1 missing in Binza Maternity.

Table 2. Current Outcomes.

Outcomes	Kingasani Maternity, n (%)	Binza Maternity, n (%)	Total, n (%)
Infant current outcome			
Healthy	130 (77.4)	114 (80.8)	244 (78.9)
Very sick	8 (4.8)	3 (2.1)	11 (3.6)
Dead	23 (13.7)	17 (12.1)	40 (12.9)
Hospitalized	0 (0.0)	1 (0.8)	1 (0.4)
Under HAART	2 (1.2)	3 (2.1)	5 (1.6)
Not fund	5 (2.9)	3 (2.1)	8 (2.6)
Infant tested			
Yes	102 (55.5)	101 (80.2)	203 (65.6)
No	82 (44.5)	24 (19.8)	106 (34.4)
HIV test result			
Positive	16 (15.2)	17 (16.8)	33 (16.3)
Negative	86 (84.8)	84 (83.2)	170 (83.7)
Mother current outcome			
Healthy	117 (63.6)	91 (72.8)	208 (67.3)
Very sick	8 (4.3)	2 (1.6)	10 (3.2)
Dead	20 (10.9)	5 (4)	25 (8.1)
Hospitalized	6 (3.3)	1 (0.8)	7 (2.3)
Under HAART	24 (13)	22 (17.6)	46 (14.9)
Not fund	9 (4.9)	4 (3.2)	13 (4.2)

Abbreviation: HAART, highly active antiretroviral therapy.

older age was significantly associated with better uptake of early infant diagnosis.[11]

Our study also confirms the well-known beneficial effects of exclusive breast-feeding in HIV-exposed children. Single-dose NVP, mixed feeding, and lack of ARV prophylaxis covering the breast-feeding period are associated with unfavorable infant's outcome, such as risk of MTCT. The current evidence shows that continuous ARV prophylaxis during infant's breast-feeding period improves infant survival.[12] This reinforces the current WHO recommendations that breast-feeding should be provided for at least 12 months, along with ARV prophylaxis for the infant or ART of the mother to reduce the risk of MTCT.[13]

The fact that infants tested for HIV had a better health outcome than those not tested could be explained by the counseling and health education during the HIV testing. Health education regarding HIV and PMTCT in the context of testing and counseling is essential for improving retention, HIV care for both mother and child, and the initiation of ART.[14,15]

Similar to other studies, healthier HIV-positive mothers were associated with better infants' health outcome.[11] This is likely because healthier mothers are in a better position to take care of their HIV-exposed infants.

The reasons why, in our study, certain HIV-positive pregnant women chose not to deliver in the health facility they initially attended are not known. Maybe reasons such as the distance to the health facility, fear of discrimination, and stigmatization may have played a role.[16] There is a need for conducting qualitative research in the context of DRC to know the reasons for attrition in the PMTCT programs.

The uptake of NVP prophylaxis by the HIV-positive pregnant women was only 76%. This finding corroborates with other studies conducted in sub-Saharan Africa. In a study conducted in Malawi, the sdNVP uptake was similar among mothers, but the infant ARV prophylaxis uptake was less than that of our findings (ie, 56.2%).[17] However, it has been reported that the ARV prophylaxis uptake was 61% in Rwanda and 86% in Kenya.[8,18] Reasons for low uptake of ARV medications included the weakness of the health system, providers who didn't propose prophylaxis, women who neglected to take their ARV mediations, and nonavailability of ARV medications.[8,18]

Of the exposed infants, 40 (12.9%) died. It is unclear how many of these children died of an HIV-related condition. Indeed postmortem examinations or verbal autopsies were not performed. This mortality rate is only slightly higher than the estimated overall infant mortality rate of 11% in DRC.[19]

Table 3. Factors Associated with Favorable Infant Outcomes.

Factors	Kingasani Maternity, n (%)	Binza Maternity, n (%)	Unadjusted OR	95% CI	Adjusted OR	95% CI	*P* Value
Infant's age, months							
Mean (SD)	30 (15.47)	31 (14.68)	0.98	0.96-1.00	0.98	0.96-1.01	.207
Mother's age, years							
Mean (SD)	27 (5.67)	28 (5.51)	0.90	0.86-0.95	0.90	0.84-0.95	.001
Weaning time							
≤6 months	77 (41.85)	37 (29.84)	1		1		
>6 months	107 (58.15)	87 (70.16)	0.67	0.50-0.90	0.69	0.49-0.96	.031
Exclusive							
No	13 (7.10)	11 (8.80)	1		1		
Yes	171 (92.90)	114 (91.20)	10.31	3.06-34.75	6.04	1.52-23.91	.010
Infant tested							
No	82 (44.57)	24 (19.20)	1		1		
Yes	102 (55.43)	101 (80.20)	4.07	2.24-7.38	3.35	1.74-6.47	<.001
Current mother's outcome							
Not healthy	67 (36.41)	34 (27.20)	1		1		
Healthy	117 (63.59)	91 (72.80)	2.99	1.69-5.30	2.75	1.41-5.36	.002

Abbreviations: CI, confidence interval; SD, standard deviation; OR, odds ratio.

Studies conducted in sub-Saharan Africa have shown that most of the HIV-positive children die before 2 years if they are not treated.[20,21] Therefore, the real proportion of deaths and children who became infected is likely to be much higher than 13% because many children were lost to follow up. Okomo et al have reported in a study conducted in The Gambia that more than 50% of the children lost to follow up died.[20]

The proportion of HIV-infected infants is likely to be more than the observed 16.5% because several of those who died or became lost to follow up were probably also HIV infected. In a similar study from Malawi, the proportion of children tested HIV positive was 13.8%.[17]

World Health Organization is currently promoting the more efficient option B plus strategy.[22] These guidelines, launched in June 2013, consist of initiating lifelong combination ART for HIV-infected pregnant women regardless of her CD4 count and to continue ART during breast-feeding.[22] With such guidelines, good follow-up and retention are critical to avoid resistance to the ARV medications.

The major limitation of our study is the lack of detailed data regarding clients lost to follow up. Since verbal autopsies were not conducted, we do not have information about the causes of death of the children and mothers who died. We also lack information about the exposed infants born to women who didn't return to deliver at the same facility where they were diagnosed with HIV and the mothers whom we were unable to contact by phone or home visits.

In conclusion, the follow-up of mother–infant pairs in PMTCT programs remains critical and challenging. There is a need for innovative and efficient strategies to improve the retention of mother–infants pairs in PMTCT programs. Most importantly, the quality of health services needs to be improved, engaging all stakeholders and policy makers in this process. Qualitative research is needed to determine why some pregnant women do not return to deliver in the same facilities where they first attended ANC services. Communication skills of health providers need to be improved to provide friendly, good-quality services in order to retain mother–child pairs in the program. During ANC services, the focus should be on a delivery plan that includes a discussion between the client and health provider regarding issues such as transportation for next ANC services, venue for delivery, male involvement, early infant diagnosis, and family planning.

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