MODIFIABLE FACTORS WITHIN THE PREVENTION OF MOTHER TO CHILD TRANSMISSION (PMTCT) PROGRAMME ASSOCIATED WITH FAILURE TO PREVENT HIV TRANSMISSION IN THE ONANDJOKWE DISTRICT OF NAMIBIA.

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THESIS PRESENTED IN FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF PHILOSOPHY (MPHIL) IN FAMILY MEDICINE IN THE FACULTY OF MEDICINE AND HEALTH SCIENCES AT STELLENBOSCH UNIVERSITY.

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DATE OF GRADUATION: DECEMBER 2017

DECLARATION

I, the undersigned, hereby declare that the work contained in this thesis is my original work and that I have not previously submitted it, in its entirety or in part, at any university for a degree. I also declare that ethical approval for the study was obtained from the Health Research Ethics Committee of Stellenbosch University (Reference number: S16/06/109).

Signature: .....……..... Date: ..…….....”

ABSTRACT

Background: Ending new paediatric HIV infections continues to be a global health priority. Cuba and other countries have demonstrated that elimination of mother to child transmission is possible through Prevention of Mother-to-Child Transmission (PMTCT) interventions. As Namibia works on improving PMTCT there is a need to identify the local modifiable factors to achieve zero new HIV infections.

Aim: This study aimed to identify the modifiable factors within the PMTCT programme, which contributed to the acquisition of HIV infection among children in the Onandjokwe District.

Setting: Onandjokwe District, Northern Namibia.

Methods: A descriptive audit of the medical records of mothers and their children under two years, who acquired HIV despite the PMTCT programme.

Results: The study found that 80% of the paediatric HIV infections could be prevented by implementing the existing Namibian PMTCT recommendations. Overall 55% of modifiable factors were related to mothers, 35% to health workers and 10% to the health system. The top three modifiable factors related to health workers were poor HIV viral load monitoring, failure to act on a high HIV viral load and lack of initiative in tracing defaulters. Modifiable factors related to mothers were defaulting anti-retroviral therapy in themselves or their children. Health system related factors were a lack of a recall system to ensure infants came for their medication and HIV tests.

Conclusion: The majority of HIV infections among children under two years could be prevented within the PMTCT programme by addressing the identified modifiable factors in this study.

INTRODUCTION

The elimination of HIV by preventing mother to child transmission continues to be a global health priority.[1] The third United Nations Sustainable Development Goal (SDG) aspires to health and wellbeing for all, and includes a bold commitment to end the AIDS epidemic.[2] One of the major steps in getting to zero new HIV infections is ending paediatric HIV infections. Mother-to-child transmission has been virtually eliminated in high income countries. The science behind this is clear and demonstrates that the use of appropriate antiretroviral (ARV) medication during pregnancy and breastfeeding can reduce the risk of vertical transmission to less than 5%.[3] Cuba, a low income country, has demonstrated that it is possible to eliminate HIV infection in children through the Prevention of Mother-To-Child Transmission (PMTCT) programme, as it became the first country certified by the World Health Organization (WHO) in 2015 to have eliminated paediatric MTCT.[4] To date four more countries have been validated by WHO for elimination of MTCT, which encourages other countries to strive towards achieving this goal and align with the WHO's vision of ending AIDS by the year 2030 [5] As a best practice, therefore, Cuba, Thailand, Belarus, Armenia and Moldova have set an achievable benchmark. Eliminating new HIV infections among children through the PMTCT programme has been shown to be cost-effective as it decreases morbidity and mortality, the psychological burden of HIV, as well as economic costs to both individuals and society.[6]

The PMTCT programme has been proven to effectively reduce the risk of transmitting HIV infection from mothers to their babies, even in high HIV prevalence and low resource settings.[7,8] The benefit of using a short term combination of triple ARVs in pregnant mothers and single-dose Nevirapine in exposed infants had shown a significant decrease in the chance of a mother transmitting HIV to her baby.[9] WHO evidence-based guidelines for PMTCT in 2013 and 2015 recommended starting life-long Highly Active Anti-Retroviral Therapy (HAART) in all HIV positive pregnant and breastfeeding mothers and to offer Nevirapine to their babies throughout the breastfeeding period.[9,10] Adoption of the new 2016 WHO ART guideline recommendations to treat everyone that is tested HIV positive is expected to further reduce the chance that children born to HIV positive mothers will be HIV infected because of earlier initiation of ARV regardless of CD4 count and attainment of viral suppression.[10,11] Prevention of new infections through the PMTCT programme will not only save the life of the baby, but will keep the mother alive by giving her the treatment she needs, and protect other children in the family from being orphaned. Ongoing efforts to stop new HIV infections emphasise the need for frequent monitoring of HIV viral loads among pregnant and breastfeeding mothers, use of dual prophylaxis (AZT and Nevirapine) for infants at higher risk of HIV acquisition and repeated regular HIV testing of HIV negative mothers during the breastfeeding period to close the remaining gaps in PMTCT.[12]

Namibia has a long history of implementing PMTCT since 2005, at both public and private clinics, and is now using the fifth edition of the ART and PMTCT guidelines. Of note the latest Namibian ART guideline adopts the 2016 WHO recommendations, with a clear commitment to the elimination of mother-to-child transmission.[13] Identifying avoidable factors related to HIV transmission during the PMTCT period can help the health services to achieve this goal. Some of the known modifiable risk factors in the PMTCT programme in Sub-Saharan countries are poor access to maternal care and/or PMTCT services due to geographic factors, non-availability of medication, economic barriers such as transport costs, and unacceptable services due to negative staff attitudes.[14,15] The quality of care may also be impaired due to a failure to offer PMTCT and /or a lack of knowledge amongst health care proffesionals[16] The modifiable factors may differ between countries and even districts within countries and therefore specific local modifiable factors must be identified and local solutions developed to prevent new HIV infections in children.[17–19] This type of research has yet to be conducted in Namibia.

A study done at Onandjokwe Hospital, Namibia in 2013 showed that 13% of mothers of children less than five years old, who were admitted and died, were not given an HIV test during pregnancy and 15% of the children that died were confirmed HIV positive for the first time when admitted to the ward and some mothers delivered at home.[20,21] From February 2014 until January 2016 a total of 67 children under two years of age acquired HIV despite the PMTCT programme at Onandjokwe Hospital. This study in the Onandjokwe District will bring an understanding of the modifiable factors within the PMTCT programme, which might be targeted to reduce the number of children who acquire HIV through MTCT. The identified modifiable factors will be used by PMTCT stakeholders to design local solutions and strategies to close the gaps and prevent new paediatric HIV infection.

AIM AND OBJECTIVES

The study aim was to identify the modifiable factors within the PMTCT programme, which contributed to the acquisition of HIV infection among children in the Onandjokwe District. The objectives were:

- To describe the profile of mothers and children who acquired HIV infection within the PMTCT programme
- To identify the modifiable factors related to the health care workers.
- To identify the modifiable factors related to the health care system.
- To identify the modifiable factors related to the mothers

METHODS

Study design

The study design was descriptive(an audit) of the medical records of mothers and their children under two years, who acquired HIV despite the PMTCT programme's existence in the period 2014-2016.

Study setting

The study was conducted at Onandjokwe District in northern Namibia, located 750km from the capital city of Windhoek. Onandjokwe District covers approximately 25,000 km^2 with a catchment population of 147,000. The majority of patients live in rural villages and walk to nearby health facilities. The district has one referral hospital (Onandjokwe), three health centres (Okankolo, Onyaanya and Onayena), and eight primary care clinics (Olukonda, Onakazizi, Omuntele, Ndamono, Oshigambo, Elombe, Ontananga and Ontunda).

All facilities were implementing PMTCT option B+ since 2014 according to WHO recommendations adopted by the national ART guideline and continue to offered antenatal care (ANC) services. The PMTCT option B+, which offers all pregnant and breastfeeding women HAART as soon as they are diagnosed, is continued for life regardless of CD4 count. Onandjokwe District Hospital offers the PMTCT services via antenatal and intrapartum care and has ARVs easily available. Onandjokwe ART clinic (Shanamutango CDC Clinic) is the third largest ART clinic in the country by patient volume and serves as the referral centre for the rest of the eleven health care facilities in the district that offer HIV services.

Exposed infants received Nevirapine at their respective clinics and were followed up until the age of six weeks when their first DNA Polymerase Chain Reaction test was performed; those who tested HIV positive were referred to Onandjokwe for confirmation and prepared for ART initiation. All children who tested DNA PCR negative at 6 weeks continued with breastfeeding up to 12 months while getting Nevirapine. A second diagnostic Rapid Test (Determine) was performed at nine months and repeated 4 weeks after stopping breast milk exposure. Any child who tested positive by HIV rapid test was referred to Onandjokwe Hospital for an HIV confirmatory test and was then started on ART. All paediatric patients were initiated on ART at Onandjokwe Hospital and monitored for at least six months or until the first viral load result was reviewed. Those with suppressed viral load and who were clinically stable were then referred, with their mothers, to a nearby health facility for continued care.

Study population

The population included all children who were confirmed HIV positive in the chronic care ART register, were under the age of two years, and registered between 1 April 2014 and 30 March 2016 at Onandjokwe District Hospital. The register showed a total of 67 children for this period.

Data collection

A standardised data collection tool was used to collect data from each individual record on adherence to the key recommendations of the PMTCT guidelines during pregnancy, delivery and postpartum care. Due to the fact that some patients who were pregnant in 2013 received PMTCT Option A based on the 2010 Namibia ART guideline recommendations, in contrast to those who became pregnant after March 2014, who received PMTCT Option B+, based on the 2014 ART guideline, the tool was designed to include appropriate questions regarding both options. (PMTCT option A included stat dose of AZT at week 14 pregnancy, single dose 200mg Nevirapine at onset of labour then AZT and 3TC stat then 12 hourly during labour and delivery, then AZT and 3TC twice daily continued till 7th day postnatal then stopped. Breastfeeding exposed infant received NVP throughout breastfeeding and stopped 4 week after stopping breastfeeding, but non-breastfeeding infants received daily Nevirapine for 6 weeks only. Option A was given to pregnant mothers who did not quality for ART.[22] Option A was given to pregnant mothers who did not quality for ART.[22] The adherence to ART was assessed by health care workers using pill counts, whereby patients who consumed more than 95% of the recommended doses supplied in last visit were regarded as having good adherence, between 85-95% regarded as having fair adherence and less than 85% was classified as having poor adherence. Any patient who misses his/her clinic visit and interrupts ART treatment is defined as " Defaulter'' and should receive counselling to avoid further interruptions. Any patient who interrupts ART for consecutive 90 days or more is defined as "Lost to follow up'' should be traced, brought to care and reasons explored to prevent future instance. [13]

The design of the tool was based on another study at Onandjokwe Hospital on the causes of mortality and associated modifiable health care factors for children (< 5-years).[20] The tool was submitted to a panel of experts to validate its content and construct and was piloted on six test cases to ensure it was practical to collect data and the questionnaire consisted of the following information; demographic information of the mother/infant pair ,PMTCT option of the mother and the infants, breastfeeding option of the mother and practices ,Time when mother initiated Triple ARV therapy, Overall adherence to ARVS of the mother, Time when was the child confirm HIV+,HIV viral load of the mother, the reasons of the viral load not done, description of modifiable cause identified during ANC, labour and delivery, during postpartum and breastfeeding and lastly the overall assessment of process of care whether if different care was provided the infant HIV infection be prevented.

Data were extracted by the principal investigator. The medical records reviewed included the ANC registers; labour and delivery register books, maternity delivery clinical notes, postnatal clinical notes, mother-baby care follow up register (MBCFR), and ART patient care booklets.

Data captured in the tool was then analysed by a review team who reached a consensus on any reason(s) why the PMTCT programme failed to prevent transmission. The review team included the principal investigator, HIV doctor (HIV Clinical Mentor for HIV Care in Onandjokwe District) and the District HIV Clinical Mentor. This team also referred to the records themselves if necessary to clarify issues.

Data analysis

Data was captured on an Excel spread sheet and checked for any missing, incomplete or inconsistent data before analysis. The data were analysed by a statistician using the Statistical Package for the Social Sciences version 16.0. Descriptive statistics were used to determine frequencies and percentages or means and standard deviations.

ETHICAL CONSIDERATIONS

The research was conducted according to the ethical principals in the Helsinki Declaration version 2013 and approved by the Health Research Ethics Committee of Stellenbosch University S16/06/109 and second approval was granted by Onandjokwe district research committee.

RESULTS

The study included 59 children out of the possible 67 due to 8 missing records. The record review at Onandjokwe indicated that a total of 19,898 deliveries were conducted during the study period, among them 3358 pregnant mothers were HIV positive (16.9%) and the transmission rate was therefore 2%. Out of the 59 children, 64% were female (Table 1) and 48% were diagnosed HIV positive within six months of birth. The majority had a normal birth weight (75%; mean birth weight 2.9 kg (SD 0.8)), 81% delivered in a health facility and 92% were delivered by normal vertex delivery. The majority of the mothers had completed primary school and attended some secondary school education (64%). Almost half of the mothers (48%) were diagnosed with HIV before pregnancy and the majority of the mothers (56%) started lifelong ART before the third trimester.

Table 1: Characteristics of study children and their mothers (N=59)

Characteristics	N	%
Child gender		
Male	21	35.6
Female	38	64.4
Mode of delivery		
Normal vaginal delivery	54	91.5
Caesarean section	5	8.5
Place of delivery		
Health facility	48	81.4
Home	8	13.6
In transit	3	5.1
Level of education of mothers		
Primary	18	0.5
Secondary	38	64.4
College	1	1.7
Not education	2	3.4
Time of HIV diagnosis of mothers		
Before pregnancy	29	49.2
During first trimester	3	5.1
During second trimester	5	8.5
During third trimester	5	8.5
During labour and delivery	2	3.4
During postnatal and breastfeeding	15	25.4
Time of ART initiation for mothers		

Before pregnancy	25	42.4
1st trimester	3	5.1
2nd trimester	5	8.5
3rd trimester	3	5.1
Labour and delivery	1	1.7
Postnatal and breast feeding period	22	37.3

Table 2 presents the PMTCT options used and infant feeding practices. The table indicates that the majority of the mothers received PMTCT option B+ (74.6%) and chose to breastfeed their babies (97%). Despite the high number of breastfeed infants, only 54% of the children were exclusively breastfed and 19% of children took Nevirapine from birth throughout the breastfeeding period.

Table 2: Mother and the children PMTCT and feeding options (N=59)

Variables	**N**	**%**
Mother's PMTCT options		
PMTCT Option A	1	1.7
PMTCT Option B+	44	74.6
Missed PMTCT	1	1.7
No PMTCT	13	22.0
Children PMTCT options		
Children received nevirapine during delivery only	18	30.8
Children received nevirapine during delivery and breastfeeding	11	18.6
Children never received nevirapine	30	50.8
Mother's choice of feeding option after delivery		
Breastfeeding	57	96.6
Formula milk feeding	2	3.4
Infant feeding practices		
Exclusive breastfeeding until 6 months	32	54.2
Mixed feeding	26	44.1
Formula milk	1	1.7

Table 3 presents the key characteristics of follow up care after delivery. The Table indicates that 63% of mothers, who had been on ART for six months or more, had poor adherence as shown by regularly missing clinic appointments. This also contributed to 80% of them missing their date for viral load assessment.

Table 3: Mothers follow up care characteristics

Variables	**N**	**%**
Mother active on ART for six months or more (N=59)		
Yes	30	50.8
No	29	49.2
Adherence (N=59)		
Good	5	8.5
Fair	6	10.2
Poor	19	32.2
Not on ART more than six month	29	49.1
Viral load monitoring among eligible patients (N=30)		
<40	2	6.7
40-1000	1	3.3
>1000	7	23.3
Viral load not done	20	66.7
Reasons for the viral load not done (N=20)		
Unknown	4	20.0
Missed follow ups	16	80.0

Overall 327 modifiable factors were identified and of these 55% were related to the mother, 35% to the health workers and 10% to the health system. The key modifiable factors related to the health care system (Table 4), which might have contributed to HIV transmission, were a failure

of the system for tracing the mothers who defaulted from postnatal care, failure to provide a facility-based delivery and lack of stock of Nevirapine for infant prophylaxis.

Table 4: Modifiable factors related to health care system (N= 59)

Variable	n	%
No system in place for PHC clinics to know and follow up of postnatal mothers expected to come for follow up for DBS and NVP supply	25	42.4
Home delivery	7	11.9
Nevirapine out of stock	2	3.4

The top five modifiable factors related to the health care professionals (Table 5) were a failure to intervene when a patient was virologically failing on the first line ART regimen, failure to check the viral load, failure to trace the patient who did not attend, and not offering the mother an HIV test.

Table 5: Modifiable factors related to health care professionals (N=59)

Variable	N	%
Patient was failing first line ART regimen with no intervention	36	61.0
Health care professionals failed to check viral load	20	33.9
Health care professionals failed to trace the patients who defaulted ART	14	23.7
Mother not offered HIV test	10	16.9
The new born was not given NVP until follow up at 6 weeks	8	13.6
Pregnant mother tested HIV positive, but ART not initiated until child diagnosed with HIV	6	10.1
Pregnant mother tested HIV positive, but ART only initiated later in pregnancy	4	6.8
Health care professionals offered HIV test very late in pregnancy	1	1.7

The key five modifiable factors related to the mother (Table 6) were defaulting taking ARVs to ART themselves , mixed feeding before infant reaching 6 months , mothers with high viral load before pregnancy , mothers/ care takers not turning to clinics to collect prophylactic Nevirapine and mothers seroconverting during pregnancy.

Table 6: Modifiable factors related to mother and children (N=59)

Variables	n	%
Mother defaulted ART at some point during pregnancy and breastfeeding	34	57.6
Mixed feeding started before infant reached 6 months in	25	42.2
Mother had high viral load before pregnancy	22	37.3
Mother defaulted Nevirapine dose in the infant	21	35.6
Mother seroconverted during pregnancy or breastfeeding	15	25.4
Mother never attended ANC	11	18.6
Mother started ANC very late, HIV test done very late	8	13.6
Mother on pre-ART follow-up and became pregnant before starting ART	8	13.6
Mother tested positive, but refused to be initiated ART	1	1.7

The overall consensus of the review team on whether the HIV infection of the children was avoidable was that 80% of the HIV infection cases could have been prevented by implementing the existing Namibian PMTCT recommendation, 5.0% of infections happened despite following the recommendations and in 15% of children it was difficult to decide whether the infection could have been avoided.

DISCUSSION

The rate of modifiable factors for HIV infection in this study was more than twice that identified in South Africa, where only 34% of transmissions were deemed avoidable.[14] This might be explained by a higher rate of ART uptake in South African mothers (83%), higher rate of HIV exposed infants receiving prophylaxis and the fact that the study did not look at adherence to treatment or duration of ART. The majority of the factors at Onandjokwe were attributed to the mothers (55%) and were related to the mothers not knowing their HIV status, which contributed to missed opportunities for intervention. This was similar to the findings in South Africa whereby almost half of all preventable infections in infants were related to the mother's unawareness of their HIV status.[14] Interestingly twice as many female compared to male infants were infected and there is no clear explanation for this. South Africa reported equal numbers of male and female infected infants.[14]

With regards to health care professional factors, the study showed that 25% of the mothers were diagnosed late, during the postnatal and breastfeeding period, and 17% of the mothers attended ANC, but were not tested for HIV. Late maternal HIV testing puts the infant at higher risk of

HIV transmission and this issue has also been observed in South Africa (32% of mothers) and the USA (26% of mothers).[14,15,20,24] Missed opportunities to provide prophylaxis was seen in 14% of children, almost similar to a reportedly higher rate of 15% in South Africa.[14] A high percentage of pregnant mothers had a delay in the initiation of ART (10%), despite clear Namibian ART guideline recommendations,[25] although higher rates have also been reported in South Africa (23%).[6,9,15] The biggest three challenges among health care professionals were poor HIV viral load monitoring (34%), failure to act on results showing a high HIV viral load (61%) and lack of initiative from health care workers to trace defaulters (14%). Higher rates of poor viral load monitoring have been reported in South Africa (75%) and USA (37%) as well as failure to take action when a high viral load is observed.[15, 22] A failure to respond to virological failure may also expose the infant to resistant HIV strains and negate the value of Nevirapine prophylaxis.

In terms of the mothers, the study found that 36% of their modifiable factors were due to either defaulting ART completely or poor adherence. Defaulting and poor adherence in Malawi appeared to be also high among mothers on PMTCT intervention whereby 20% of patients who were started ART missed appointments and only 40% of them could be traced by defaulter tracing teams.[26] There was a high percentage of mothers who did not come back for Nevirapine, comprising 14% of modifiable factors, and given the fact that 97% of children were breastfeeding, this was high. South Africa showed an even higher percentage (43%) with no evidence of using Nevirapine, although this difference might be due to the study collecting data at an earlier point in the postnatal period.[15] Mixed feeding was common (44%) and appeared much higher than reports from South Africa (6%),[15] Again differences might be due to the earlier data collection, however such high rates may require further study and intervention. A third of mothers (33%) attended ANC late or not at all, which could make it difficult for mothers to test for HIV and receive a timely PMTCT intervention. This rate, however, is lower than South Africa, where approximately half of the mothers had their first ANC visit in the third trimester.[15] In the USA 56% did not receive prenatal care.[15,24]

Health care system gaps included a lack of co-ordination of care between district hospitals and primary care facilities (42%), such that the mothers who were expected to come for follow up could not be identified easily and were not traced if they failed to attend. In addition 19% of mothers delivered either at home or on transit to the district hospital and might delay or miss the PMTCT interventions. A study done in Malawi showed that only 77% of women who delivered at home could be traced to get PMTCT interventions and none of their children were taken back to health facilities for Nevirapine prophylaxis..[20]

The study showed that 50% of infants never received Nevirapine and this number can be explained by the fact that 22% of the mother never received any PMTCT intervention hence diagnosed late, 25% of the mothers were diagnosis HIV positive during postnatal and breastfeeding mostly when their children were admitted for sickness and 6% of the infants

documented Nevirapine was out of stock. The results can be compared to 43% of infants that never received Nevirapine in South Africa out of which 26% of the mothers were tested late for HIV.[15]

Limitations of the study

Not all medical records were available and additional factors might have been identified or ranked differently if all records were included in the study. Some of the included records lacked sufficient information to judge whether modifiable factors were present despite the fact that the review team also waited for the mother-child's follow up visit to elicit information from the patient's and child's road-to-health card. The results of this study depend on the analysis and decision making of the review team. In cases where there was no consensus, for example if the factor was primarily related to health care workers or to patients, the decision was made on the opinion of the majority of the panel. The study involved infants who were already diagnosed with HIV and, therefore, HIV positive infants who were not yet diagnosed would be excluded from the study.

Recommendations

The transmission of HIV to an infant should be seen as a critical incident and a review of the records to identify modifiable factors should become institutionalised and not just part of a research study. This will enable ongoing learning and correction of the PMTCT programme's challenges and hopefully realisation of the goal of zero new HIV infections by 2030.

Patient empowerment and engagement is crucial and health education on ART should be provided at different service delivery points such as ANC, ART support counselling teams and through media to reduce mothers defaulting their ART. Comprehensive education on the PMTCT approach should include the importance of infant Nevirapine prophylaxis, early infant diagnostic tests, feeding options, adherence to medication and use of condoms during the breastfeeding period. Namibia has an extensive network of Health Extension Workers in the community, and health facilities should work in collaboration with this cadre to provide community education and sensitization on the importance of attending ANC and if possible to plan to stay near to the health facility when they are due to deliver.

Most of the missed opportunities related to health care professionals could be avoided by providing training on Provider Initiated Testing and Counselling (PITC) at the time the pregnant mother contacts the health facility rather than referring them to another place for testing. This may help reduce delays in testing during pregnancy and breastfeeding period.

Integration of ANC, postnatal care and ART services to all pregnant women at all health delivery points. This may improve access to care, monitoring of viral load in the mothers and early infant diagnosis, additionally it will provide better understanding of mother/infant pair challenges. Mothers unable to access health care facilities due to long distances should be be assisted to

create local support groups with the help of health extension workers where they can receive ART in the community.

To avoid children missing Nevirapine the mothers contacts should be obtained immediately after delivery and a reminder given by phone or health extension worker prior to their follow up date. Each facility should have a standard operating procedures with clear steps on how to offer PMTCT services in national and the local language. Nevirapine supply should be planned and made available at all time, in case of no supply from central medical stores hospitals arrangements should be made for buy-out from private pharmacies.

CONCLUSION

Modifiable factors could have prevented transmission of HIV in 80% of children. Overall 55% of modifiable factors were related to mothers, 35% to health workers and 10% to the health care system. The key modifiable factors related to the mother were poor adherence to ART in themselves or their infant, mixed feeding, seroconverting during pregnancy and poor attendance at antenatal care. The key modifiable factors related to the health care workers were a failure to intervene when a patient was virologically failing on the first line ART regimen, failure to check the viral load, failure to trace the patient who did not attend and not offering the mother an HIV test. The key modifiable factors related to the health care system were a failure of the system to trace mothers who defaulted from postnatal care, failure to provide a facility-based delivery and lack of stock of Nevirapine for infant prophylaxis. Since the major factors contributing to HIV acquisition among exposed infants at Onandjokwe district have been identified, these findings should be presented to all clinic staff and other HIV services stakeholders to develop action plans to close the gaps and achieve the WHO's vision of ending AIDS by 2030.

ACKNOWLEDGEMENTS

To the District HIV Nurse Mentor and Regional Doctor HIV clinical mentor for availing their time and agreeing to be part of review committee to discuss each case and reach consensus.

COMPETING INTERESTS

The researcher has no conflict of interest in this study, her enthusiasm towards accomplishing this work comes from interest in fighting HIV pandemic in Namibia and the whole world.

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