Original Research Article

A 10 Year Review of the Impact of Prevention of Mother to Child Transmission of HIV in a Tertiary Health Centre, Makurdi, Benue State, Nigeria

Abstract

Background: Mother-to-child transmission (MTCT) of Human Immunodeficiency Virus (HIV) is the most significant route of HIV infection in children. Over 90% of HIV infections in children are acquired through the mother-to-child transmission route and assessing the impact of prevention is desirable.

Objective: This study aimed at evaluating the impact/effectiveness of interventions to prevent mother to child transmission (PMTCT) of HIV.

Materials and Method: The study employed a retrospective cohort design. Data were collected from the records of HIV-positive pregnant women who registered and received antenatal care at APIN/Sexually Transmitted Infection (STI) Unit of the Federal Medical Centre (FMC), Makurdi, Benue State, Nigeria between January 1st, 2011 and December 31st, 2020. The cohort included HIV-exposed infants born to these mothers who were followed-up for six weeks until their HIV status was determined using DNA Polymerase Chain Reaction (PCR) techniques. The data collected was analyzed using frequency, tables and percentage.

Results: A total of 2,987 pregnant women were HIV positive during the 10 years period. Among these group, only 2,185 (73.15%) with a retrieval rate of 73.15% had their records retrieved and their babies followed up till 6 weeks to determine HIV status by DNA Polymerase Chain Reaction (PCR). There were 2185 exposed infants. The overall MTCT rate was 2.15%, there was reduced mother to child transmission of HIV since maternal and infant ART was introduced. Mode of delivery and infant feeding practice were observed to greatly influence mother to child transmission of HIV.

Conclusion: Though this facility achieved the goal of reducing the rate of HIV mother to child transmission down to less than 3%, there is still need to strengthen service provision and follow up to conform to global plan for the total elimination of new HIV infections among children.

Keywords: Antiretroviral therapy; Impact; Human Immunodeficiency Virus; Mother to child transmission; Prevention of mother to child transmission

Introduction

Human Immunodeficiency Virus (HIV) is a global public health crisis with sub Saharan Africa having a disproportionately high burden of the epidemic[1]. According to UNAIDS, there were 37.9 million People

living with HIV/AIDS across the globe in 2018. Of these, 36.2 million were adults and 1.7 million were children (<15 years old). An estimated 1.7 million individuals worldwide became newly infected with HIV in 2018 of these are 160, 000 infections among children ages 0-14 years[2]. Nigeria has the second largest HIV epidemic in the world[3]. An estimate of 1.9 million people in Nigeria were living with HIV in 2018. Recent drops in prevalence estimates for the country has been attributed to better surveillance[4].
Mother-to-child transmission (MTCT) of Human Immunodeficiency Virus (HIV) is the most significant route of HIV infection in children. Over 90% of HIV infections in children are acquired through the mother-to-child transmission (MTCT) route[5,6]. A woman with HIV who had no prevention of mother to child transmission (PMTCT) intervention has of a 30-45% chance of passing the virus to her baby during pregnancy, labour, delivery as well as during breast feeding[7]. Nigeria contributes over a quarter (26.9%) of all cases of mother-to-child transmission (MTCT) of HIV in the world[8].
To achieve the goal of United Nations of elimination of new HIV infections, a program of prevention of mother-to-child transmission (PMTCT) was launched. With appropriate interventions which include use of antiretroviral (ARV) drugs as maternal ART (with use of HAART-highly active antiretroviral therapy for all pregnant HIV positive mothers) and use of infant ART for all infants born to HIV positive mothers. Obstetric interventions such as delayed rupture of foetal members where possible, elective caesarean section in cases of unsuppressed viral load, caesarean section for obstetric indications, judicial use of operative vaginal delivery and instrumental vaginal delivery as only when indicated. Also, the modification of infant feeding which involve adequate counselling on appropriate infant feeding practices based on AFASS (Available, Feasible, Accessible, Sustainable and Safe), clinical and virologic state of the mother. All these interventions help in reduction of MTCT rates to <2% in some countries[9,-11]. This has significantly reduced the incidence of Paediatric HIV/AIDS and associated morbidity and mortality in those countries [11]. The rate of mother to child transmission of HIV in Nigeria has remained high with an estimate of 22% in 2016[11,12]. As such, reducing mother-to-child transmission remains a major target area.
The national PMTCT programme in Nigeria commenced in 2002 with supports from WHO and UNICEF[12].
The applicability and efficacy of PMTCT programs in Federal Medical Centre, Makurdi, Nigeria, is scarcely known hence this study is instituted to determine the impact/effectiveness of Prevention of Mother to Child Transmission of HIV in Federal Medical Centre, Makurdi, Benue State. Hence, it is informative to review the impact of intervention on MTCT of HIV in our facility and fill in the lacunae where they exist in order to conform to global plan for the total elimination of new HIV infections among children.

Study Objectives

The overall objective is to evaluate the impact/effectiveness of prevention of mother to child transmission (PMTCT) of HIV interventions.

Specific objectives include

- To determine the rate of mother to child transmission of HIV
- To determine the effect of ART (maternal and infant) on MTCT of HIV

 To determine the effect of delivery mode on MTCT of HIV

 The determine the effect of infant feeding type on MTCT of HIV

Material and methods

This study was a retrospective longitudinal study targeting mother-infant pair seeking care at APIN/Sexually Transmitted Infection (STI) Unit of the FMC, Makurdi, Benue State, Nigeria.

Study Population

The study covered HIV positive pregnant women who registered and received ANC between January 1st 2011 and December 31st 2020 in APIN/Sexually Transmitted Infection (STI) Unit of the FMC, Makurdi, Benue State and infants followed-up for 6 weeks until HIV status was determined**.**

Method of data collection

Records of HIV positive pregnant women who registered and had antenatal care (ANC) in the period of January 1st, 2011 to December 31st, 2020, delivered in or outside hospital and whose HIV-exposed babies were followed-up to 6 weeks of age when HIV status was determined by DNA Polymerase Chain Reaction Techniques were collected and analyze. Mother-infant pair data was extracted from PMTCT registers and patients' medical files.

The variables collected include total number of HIV positive pregnant women registered in the 10 years of the study, maternal age, employment status, type of ARV regimen, time of commencement, mode of delivery, infant feeding practice and infant HIV status.

Method of Data Analysis

Data was entered and processed using SPSS version 25. Descriptive statistics using frequency and percentages were also used to determine the effect of various interventions on MTCT of HIV.

Confidentiality of Data

Confidentiality of information gotten was maintained as clients' names and personal details were excluded. Data collected was used for research purpose only.

Non-Maleficence to Participants

This study was not detrimental to the clients in any way.

Results

During the period under review, there was a total of 11,879 patients with HIV infection who were assessing care at APIN/Sexually Transmitted Infection (STI) Unit of the FMC, Makurdi. Among these, 6,573 were women (55.33%) of which, 4965 (41.80%) were between the ages of 15 and 40years during the period of study. Out of a total number of 2,987 pregnant HIV positive women, 2,185 (73.15%) who presented in the facility during the period of study, their records were retrieved with complete information and this form the basis of data analysis. The retrieval rate of the case record was 73.15%. Table 1 revealed that majority of pregnant HIV positive mothers were between 25 and 34 (52.77%) years of age with mean age of 29±5. They were predominantly farmers and traders (80.41%) who were mostly married

(63.57%) with either primary or secondary education (69.43%). Majority were Christians (63.43%) and in a monogamous setting (67.69%). Of total of 2185 HIV positive pregnant mothers, 1594 (72.95%) were on ART before pregnancy and continued thereafter, while 302 (13.82%) started ART during pregnancy and continued after pregnancy. Only 152 (6.96%) of the mothers commenced their ART in labour and continued after delivery whereas 137 (6.27%) started ART after delivery (Table 2). As shown in Table 3, none of the infant of the mothers who started ART before pregnancy, continued during pregnancy and after delivery was HIV positive. Four (1.32%)of the infants of mothers who started ART during pregnancy and continued ART after delivery were HIV positive. For mothers who started ART during labour and continued after delivery, 17(11.18%) of their infants were positive to HIV while 26 (18.98%) of the infants whose mothers only started ART after delivery were positive to HIV. The overall rate of MTCT of HIV was 2.15% as indicated in Table 5 and that none of the infants of mothers who had elective caesarean section was HIV positive. However, 2.14% of those whose mothers had spontaneous vagina delivery and 3.28% whose mothers had emergency caesarean section were HIV positive (Table 7). Of the total of 2185 mothers, 1748 practiced exclusive breastfeeding and out of these 15 (0.86%) of their infants were HIV positive. Of the 332 mothers that practice infant formula feeding in the first six month of birth, only 11(3.31%) of their infant were HIV positive whereas 84 women practiced mixed feeding and 21 (20.00%) of their infants were HIV positive.

Table 1a: Socio-demographic characteristics of study population by year (2011-2020)

Variables	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Percentage (%)
Education:											
No formal Education	58	63	41	35	31	24	15	9	11	13	13.73
Primary	117	121	89	78	81	63	32	23	16	9	28.79
Secondary	132	142	119	133	101	70	45	45	47	54	40.64
Tertiary	67	71	52	57	44	35	21	12	7	2	16.84
Occupation:											
Civil servant	42	53	34	40	31	27	21	12	3	5	12.27
Farming	147	134	141	103	98	61	47	24	41	32	37.89
Trading	152	169	103	139	112	91	37	48	37	41	42.52
Dependent/ student	33	41	23	21	16	13	8	5	0	0	7.32
Religion:											
Christianity	180	262	224	213	198	141	84	71	69	75	69.43
Muslim	91	74	43	41	32	35	26	18	12	3	17.16
Traditional	103	61	34	49	27	16	3	0	0	0	13.41
Parity:											
0	107	143	55	69	36	27	23	17	20	13	23.34
1-4	225	195	209	194	199	153	83	64	51	58	65.49
≥5	42	59	37	40	27	12	7	8	10	7	11.17
Age (years):											
15-19	41	47	32	30	23	17	12	7	4	6	10.02
20-24	67	72	46	51	39	25	19	12	9	9	15.97

	25-39	89	96	79	73	61	47	29	27	21	32	24.76
	30-34	88	91	83	81	79	53	33	35	37	32	28.01
	35-39	73	78	54	59	44	41	15	8	9	11	17.94
	≥40	16	13	7	9	11	9	5	0	1	21	3.30
Marital status:												
	Single	51	67	40	33	35	22	17	8	5	7	13.04
	Married	235	227	191	204	169	127	68	61	55	52	63.57
	Divorced	63	71	53	45	41	34	23	17	21	19	17.71
	Widow	25	32	17	21	12	9	5	3	0	0	5.68
Marital setting:												
	Monogamic	247	241	208	203	180	130	67	69	67	67	67.69
	Polygamy	76	89	53	67	42	40	29	12	9	4	19.27
	Single mother	51	67	40	33	35	22	17	8	5	7	15.04

Table 1b: Socio-demographic characteristics of study population

Education:	**Total Number of Patients**	**Percentage (%)**	**Cumulative %**
No formal	300	13.73	13.73
Primary	629	28.79	42.52
Secondary	888	40.64	83.16
Tertiary	368	16.84	100.00
Occupation:			
Civil servant	268	12.27	12.27
Farming	828	37.89	50.16
Trading	929	42.52	92,68
Students	160	7.32	100.00
Religion:			
Christianity	1517	69.43	69.43
Islamic	375	17.16	86.59
Traditionalist	293	13.41	100.00
Parity:			
0	510	23.34	23.34
1-4	1431	65.49	88.83
≥5	244	11.17	100.00
Age:			
15-19	219	10.02	10.02
20-24	349	15.97	25.99
25-29	541	24.76	50.75
30-34	612	28.01	78.76
35-39	392	17.94	96.70
≥40	72	3.30	100.00
Marital Status:			
Single	285	13.04	13.04
Married	1389	63.57	76.61
Divorced	387	17.71	94.32
Widow	124	5.68	100.00
Marriage setting:			
Monogamy	1479	67.69	67.69
Polygamy	421	19.27	84.96

Single mothers	285	15.04	100.00

Table 1 revealed that majority of pregnant HIV positive mothers were between 25 and 34 (52.77%) years of age with mean age of 29±5. They were predominantly farmers and traders (80.41%) who were mostly married (63.57%) with either primary or secondary education (69.43%). Majority were Christians (63.43%) and in a monogamous setting (67.69%).

Table 2a: Maternal ART Status by Year (2011-2020)

Maternal ART status	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
ART started before pregnancy	211	231	193	232	215	162	109	86	80	75
ART started during pregnancy	87	73	55	41	20	23	3	0	0	0
ART started during labour/delivery	41	54	32	17	7	1	0	0	0	0
ART after delivery	35	39	21	13	15	6	1	3	1	3

Table 2b: Maternal ART Status

Maternal ART Status	**Total Number of Patients**	**Percentage (%)**	**Cumulative Percentage**
ART started before pregnancy	1594	72.95	72.95
ART started during pregnancy	302	13.82	86.77
ART started during labour	152	6.96	93.73
ART started after delivery	137	6.27	100.00

Table 2 shows that of total of 2185 HIV positive pregnant mothers, 1594 (72.95%) were on ART before pregnancy and continued thereafter, while 302 (13.82%) started ART during pregnancy and continued after pregnancy. Only 152 (6.96%) of the mothers commenced their ART in labour and continued after delivery whereas 137 (6.27%) started ART after delivery.

Table 3: Effect of Maternal ART on MTCT of HIV

	Infant HIV Status		Total	Percentage (%)
	Negative	Positive		
ART started before pregnancy	1594	0	1594	0.00
ART started during pregnancy	298	4	302	1.32
ART started during labour	135	17	152	11.18
ART started after delivery	111	26	137	18.98

The table above shows the effect of maternal ART on the rate of mother to child transmission of HIV. None of the infant of mothers who started ART before pregnancy, continued during pregnancy and after delivery was positive. Four of the infants of mothers who started ART during pregnancy and continued ART after delivery were HIV positive. For mother who started ART during labour and continued after delivery, 17 of their infants were positive to HIV while 26 of the infants whose mothers only started ART after delivery were positive to HIV.

Table 4: Time of Maternal ART commencement and Infant HIV status

Maternal ART Status	Total Number of Infants with HIV Positive Report	Percentage (%)
ART before pregnancy, during/after pregnancy	0	0.00
ART during pregnancy/after pregnancy	4	1.32
ART during labour/ after delivery	17	11.18
ART after delivery	26	18.98

The above table shows that of the total 1594 women who commenced ART before pregnancy, none of their infants were determined HIV positive with PCR testing but of 302 who commenced ART during pregnancy, 4 (1.32%) tested HIV positive. Those HIV positive pregnant women who commenced ART during labour were 152 and 17 (11.18%) of their infants were HIV positive while of 137 pregnant HIV positive mothers, 26 (18.98%) of their infants were HIV positive using PCR testing at 6 weeks follow up postpartum.

Table 5: Rate of MTCT of HIV

HIV Status of Infants	Total Number of Infants	Percentage (%)
Negative	2138	**97.85**
Positive	47	**2.15**
Total	2185	**100.00**

Table 5 above shows that of the total 2185 infants who were followed up 6 weeks postpartum until HIV status was determined by DNA PCR test, a total of 47 were HIV positive with MTCT rate of 2.15%.

Table 6: Effect of Paediatric ART on MTCT of HIV Year by Year (2011-2020)

YEARS	Yes ART	NO ART	Negative	Positive	Percentage (%)
2011	374	0	365	9	2.41
2012	397	0	382	15	3.78
2013	301	0	295	6	1.99
2014	301	0	295	6	1.99
2015	303	0	295	8	2.64
2016	257	0	254	3	1.17
2017	113	0	113	0	0.00
2018	89	0	89	0	0.00
2019	81	0	81	0	0.00
2020	78	0	78	0	0.00

The table above shows that all the infants received ART prophylaxis and the rate of MTCT of HIV was less than 5% year by year. The rate of MTCT of HIV became less than 1% in the last 4 years of review.

Table 7a: Route of Delivery and Infant HIV status by year

Year	Delivery Route			Infant HIV status		Percentage (%)
	SVD	Elect C/S	EMC/S	Negative	Positive	
2011	303	23	48	365	9	2.40
2012	313	31	53	382	15	3.78
2013	246	16	39	291	10	4.07
2014	239	21	43	295	8	3.35
2015	223	13	21	252	5	2.24
2016	171	7	14	192	0	0.00
2017	102	2	9	113	0	0.00
2018	102	2	9	113	0	0.00
2019	74	0	7	81	0	0.00
2020	72	1	5	78	0	0.00

Table 7b: Effect of route of delivery on MTCT of HIV

Route of delivery	Infant HIV Status		Total	Percentage
	Negative	Positive		
SVD	1785	39	1824	2.14
Elective CS	117	0	117	0.00
Emergency C/S	236	8	244	3.28

Table 7 above shows that none of the infants of mothers who had elective caesarean section was HIV positive. However, 2.14% of those whose mothers had spontaneous vagina delivery and 3.28% whose mothers had emergency caesarean section were HIV positive.

Table 8: Effect of Infant Feeding Option on MTCT of HIV

Infant Feeding Option	Infant HIV status		Total	Percentage (%)
	Negative	Positive		
Exclusive breast feeding	1733	15	1748	0.86
Infant formula	321	11	332	3.31
Mixed feeding	84	21	105	20.00

The table above shows that of the 2185 women, only 1748 practiced exclusive breastfeeding and out of these 15 (0.86%) of their infants were HIV positive. Of the 332 women that practice infant formula feeding in the first six month of birth, only 11(3.31%) of their infant were HIV positive whereas 84 women practiced mixed feeding and 21 (20.00%)of their infants were HIV positive.

Discussion

Mother-to-child transmission (MTCT) of Human Immunodeficiency Virus (HIV) is the most significant route of HIV infection in children. Over 90% of HIV infections in children are acquired through the mother-to-child transmission (MTCT) route[5]. A woman with HIV who had no prevention of mother to child transmission (PMTCT) intervention has of a 30-45% chance of passing the virus to her baby during pregnancy, labour, delivery as well as during breast feeding[6,7]. The applicability and efficacy of PMTCT programs in Federal Medical Centre, Makurdi, Nigeria, is scarcely known hence this study is instituted to determine the impact/effectiveness of Prevention of Mother to Child Transmission of HIV in Federal Medical Centre, Makurdi, Benue State. Hence, it is informative to review the impact of intervention on MTCT of HIV in our facility and fill in the lacunae where they exist in order to conform to global plan for the total elimination of new HIV infections among children.

During the study period, a total number of 2,987 pregnant HIV positive mothers presented in the facility for antenatal care. A total of 2185 mothers and their infants were followed up until 6 weeks post-delivery when HIV status of their infants was determined by DNA PCR testing. This study revealed a mother to child transmission (MTCT) rate of 2.15% from January 2011 to December 2020. The rate of MTCT of HIV in this study was quite similar to what was reported by Agboghoroma, Audu, Iregbu[14] and in the study in Abuja where the rate of 2.4% was reported but slightly lower than 3.2% rate reported in another study in same location[15] and by Taiwo O.D. et al where the rate of 4.44% was reported[16]. The rate of MTCT of HIV from this study is also lower than what was reported in a study in Angola where the rate of MTCT of HIV was 13.89%[17] and 7.7% MTCT rate in a study in Ethiopia[18]. This could be due to the promotion of PMTCT

options in the hospital, increased level of awareness via media and increased in the number of facilities rendering PMTCT services in the state including rural areas.

In this study, 72.95% of pregnant HIV positive mothers were on ART before pregnancy and continued during and after pregnancy. This was similar to the finding reported by Taiwo O.D. et al[16]. Maternal and infant ART had been reported to greatly reduced mother to child transmission of HIV and as it was observed in this study, none of the infant of mothers who started ART before pregnancy and continued after delivery was positive to HIV since maternal and infant ART were introduced. This finding was similarly observed and reported in different studies[14,15,16] The study further observed that late commencement of ART greatly increased the risk of MTCT of HIV as it was find out that 11.18% of infants, whose mothers started ART during labour and delivery were positive to HIV infection while 18.98% of infants whose mothers started ART only after delivery were positive to HIV infection. This observation was also reported by Taiwo O.D. et al and other studies[14,15] Only four of mothers who started ART during pregnancy and continued after delivery that their infants were positive to HIV. This was comparable to result of a study carried out in North Central Nigeria, where mothers who were on ART were statistically less likely to have HIV-infected infants ($\chi 2=54.71$, $P<0.00$)[19]. According to the report of a study in Nigeria[20], the prevalence of MTCT reduces when both mother and baby received a form of ART for PMTCT. This indicates the importance of identifying HIV status before pregnancy or early in pregnancy so that prompt intervention can be put in place. This is because early ART significantly reduced viral load and greatly lowered the risk of MTCT of HIV[20].

Mode of delivery was also found to be important as none of the infants of the pregnant HIV positive women who had elective caesarean section was HIV positive. This is similar with findings in Abuja Nigeria[20], where women who were delivered by CS had lowered risk of MTCT of HIV compared with those who had a vaginal delivery. Elective CS was however associated with lower risk of MTCT rates of HIV compared with emergency CS. Also similar to this, is the report of a study in Guangdong province[21], where it was concluded that delivery mode might not be relative to HIV MTCT. This is in contrast to what was reported in a study in Nigeria[22], where the mode of delivery (caesarean section vs SVD) was statistically significant ($P<0.00$).

Of the 2185 HIV positive women from this study, only 1748 mothers practiced exclusive breastfeeding and out of these, only 0.86% (15) of their infants were HIV positive. Of the 332 women that practice formula feeding in the first six month of birth, 3.31% (11) of their infants were HIV positive. A total of 105 mothers practiced mixed feeding and out these, 20.00% (21) of their infants were HIV positive. This finding was similar to what have been reported in different literatures over the years[14-20]. This also agreed to World Health Organization guidelines which recommend the national authorities to promote one infant practice among mothers with HIV, either exclusive breastfeeding while ART drugs are provided or avoiding all breast milk if AFASS (Available, Feasible, Accessible, Sustainable and Safe) are met[23,24]. This reveals a good understanding of the risk of mixed feeding as observed in this study a staggery 20%

of infants whose mothers practiced mixed feeding were HIV positive. The breastfeeding rate (80%) in this study was higher than findings from other African studies[25,26]. This reflects cultural practices supporting breastfeeding in Nigeria. The lower rate of MTCT of HIV (0.86%) associated with exclusive breastfeeding in this study may be due to the possibility that, many of these mothers accept breast feeding as best and affordable option of infant feeding practice. There is therefore need to increase level of awareness of mothers on the concept of exclusive breastfeeding.

Conclusion

The rate of mother to child transmission of HIV in the studied centre from January 2011 to December 2020 is 2.15%. The majority of the infants who were HIV positive were those whose mothers commenced ART late in pregnancy or after delivery, hence it is important to strengthen the implementation of PMTCT program to increase the availability and acceptability of interventions even before pregnancy. Although, this facility achieved the expectant goal of reducing the rate of HIV MTCT down to less than 3% with PMTCT interventions in place, there is still need to strengthen service provision and follow up to conform to global plan for the total elimination of new HIV infections among children and keeping their mothers alive.

Limitation

The current study had some limitations that should be acknowledged.
It was a single-center, hospital-based, descriptive retrospective study. Therefore, selection bias might have existed, and its capability of inferences was limited. Second, data about risk factors that might influenced MTCT of HIV, information about early or late initiation of ART in mothers who practice exclusive breast feeding as well as mothers who had elective caesarean with low MTCT of HIV were lacking. Third, follow-up analysis of inferential statistics of the maternal and neonatal outcomes was not performed.

Recommendation

Although, PMTCT intervention program in the facility achieved a huge success, more is needed such as more advocacy for free HIV counseling and testing as well as early commencement of ART in HIV positive women of reproductive age in order to achieve the global target of total elimination of new HIV in children.

There is a need for more studies that will examine the impact of intervention for MTCT of HIV possibly multicenter studies. Subsequent studies should also implore more robust methodology that will look at risk factors that might influenced MTCT of HIV and information about early or late initiation of ART in HIV positive mothers. Also, further studies should aim at performing inferential statistical analysis in order to examine association of factors such as viral load, CD4 counts, patient's clinical factors as well as obstetrics factors that could positively or otherwise influence the PMTCT intervention program.

Ethical approval

Ethical approval for the study was obtained with the registration number FMR/FMC/MED:108/VOL.1/X from Ethical Review Committee of Federal Medical Centre, Makurdi, Benue State, Nigeria.

Disclaimer (Artificial intelligence)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

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