International Journal of Development Mathematics Vol 2 Issue 1 Page No. 244 - 250

INTERNATIONAL JOURNAL OF DEVELOPMENT MATHEMATICS

ISSN: 3026-8656 (Print) | 3026-8699 (Online)

journal homepage: https://ijdm.org.ng/index.php/Journals

Impact of Maternal Factors on Vertical HIV Transmission in Jigawa State, Nigeria: A Multilevel Analysis of Antenatal Care and Knowledge of HIV Status

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ARTICLE INFO

Article history:
Received 01 January 2025
Received in revised form 15 March 2025
Accepted 20 March 2025

Keywords:
ANC, MTCT, intra class correlation, hierarchical regression, paediatrics

MSC 2020 Subject classification:
34A30, 34A34, 92B05, 92-10

ABSTRACT

Human immunodeficiency virus (HIV) transmission from mother to child is responsible for over 90% of paediatric acquired immunodeficiency syndrome (AIDS), with Nigerian infants being the most susceptible in the global prevalence ladder. This is due to the prevalence of factors such as late enrolment to the follow-up clinic, rural residence, absence of maternal preventive measures for vertical transmission, and mixed infant feeding practices among HIV positive mothers. This study assessed the impact of mothers' knowledge of their status, mode of infants feeding at birth, and their uptake of antenatal care (ANC) on Mother-to-child-Transmission (MTCT) of HIV; using data from five General hospitals and one specialist hospital in Jigawa State. A two-level hierarchical model is fitted and the intraclass correlation coefficient (ICC) computed for three (3) key predictor variables namely: Location, number of antenatal care visits, and mothers' knowledge of their HIV/AIDS status so as to assess clustering structure. The study findings reveal that there exist a 63.4% correlation between the individual level factors and "Location"; ANC visits accounted for 25.9%, while Knowledge of HIV status returns an ICC of 73.8%. These findings show that the likelihood of a vertical transmission in the population is very much influenced by these clustering variables. Hence, proper understanding of MTCT should take into cognisance the impact of mothers' knowledge of their statuses and other personal characteristics such as their place of residence and ANC uptake.

1. Introduction

Nigeria has the second largest human immunodeficiency virus (HIV) epidemic in the world; accounting for 24% of pregnant women living with HIV worldwide who are not on antiretroviral therapy and is also the largest contributor among the seven countries that account for half of all new HIV infections among children globally. One in every seven babies born with HIV in the world is a Nigerian baby (UNAIDS, 2021), and accounts for about half of all HIV incidence in sub-Saharan Africa annually (UNAIDS, 2017). HIV prevalence is highest in Nigeria's southern states, and this stands at 5.5%; it is lowest in the southeast (the South East Zone) - where there is a prevalence of 1.8%. There are higher rates of HIV in rural areas (4%) than in urban ones (3%). HIV is transmitted basically in four ways: Sexual intercourse, blood transfusion (and other body fluids), Mother-to-child, and sharing contaminated skin piercing instruments. (National Agency for the Control of Aids [NACA], 2024)

Mother-to-child transmission (MTCT) is the spread of HIV from a woman living with HIV to her child during pregnancy, childbirth, or breastfeeding; it is also called perinatal or vertical transmission (NACA, 2024). Besides the dominant heterosexual transmission, vertical HIV transmission from mother to child accounts for more than 90% of paediatric acquired immunodeficiency syndrome (AIDS), influenced by factors such as late enrolment to the follow up clinic, rural residence, home delivery, absence of Preventive Mother-to-Child-Transmission (PMTCT) interventions, and adoption of mixed infant feeding practices among HIV positive mothers (Koye & Zeleke, 2013). According to Terefe et al. (2024), more than 90% of babies acquire HIV/AIDS through vertical transmission, primarily due to low maternal comprehensive knowledge about MTCT of HIV/AIDS and its

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https://doi.org/10.62054/ijdm/0201.19

prevention, which is a cornerstone for eliminating MTCT of HIV/AIDS. A world health organization (WHO, 2018) report shows that without treatment, the likelihood of the virus passing from mother-to-child is 15% to 45%; which is an alarming rate in the Nigerian context.

According to UNAIDS (2018), PMTCT programmes provide a range of services to women and infants which include preventing HIV infections among women of reproductive age (15–49 years), preventing unwanted pregnancies among women living with HIV (WLHIV), and providing women living with HIV with lifelong ART to maintain their health, and prevent transmission during pregnancy, labour and breastfeeding. They also support safe childbirth practices and appropriate infant feeding strategies, as well as providing infants exposed to HIV with virological testing after birth, and during the breastfeeding period, ART for prevention and effective treatment. Around 1.4 million HIV infections among children were prevented between 2010 and 2018 due to the implementation of PMTCT services. While in 2017, just over half (52%) of the 1.8 million children living with HIV were receiving ART. Among those without access to effective treatment, 110,000 died due to AIDS-related illnesses (UNAIDS, 2018).

Mother's adoption and adherence to recommended feeding alternatives is a problem as, 50% breast milk transmission takes place by 6 weeks, and 75% by 6 months (Guay et al.,2007). In addition, there is early evidence that mixed feeding increases the risk of breast milk transmission of HIV. This poses a serious public health problem since mixed feeding may be riskier for HIV transmission (Terefe *et al.*, 2024). Kassa (2018) in a meta-analysis of Mother-to-child transmission of HIV in Zimbabwe, indicated that home delivery in the Sub-Saharan African countries is significant where more than 80% of children living with HIV are found. Also, WHO (2010), on the relationship between breast feeding and Mother-to-Child Transmission of HIV Infection, indicated that a mother can transmit HIV to her infant during pregnancy and delivery or through breastfeeding. With no intervention, 5–10% of infants will be infected during pregnancy; another 10–20 percent during labour and delivery; and 10–20% through breastfeeding (if breastfed for 18 to 24 months). Cracked nipples, mastitis, and breast abscess are three conditions that have been associated with higher transmission of HIV through breastfeeding. Approximately 13% of HIV-infected women experience one or more of these conditions during breastfeeding, often during the early weeks when the risk of HIV transmission is thought to be greater. Thus, counselling on good breastfeeding techniques at the onset of lactation can help prevent breast problems (UNAIDS, 2018).

Abiodun *et al.* (2015) in a cross-sectional study of 142 traditional birth attendants in Ogun State, Nigeria, by two-staged probability sampling technique found that participants were universally aware of HIV; their ability to correctly identify temporal mode of MTCT of HIV varied from 69.0% for ante-partum and 76.1% during labour and delivery, to 60.6% during breastfeeding. The mean score for knowledge of MTCT and PMTCT of HIV was 16.89. Participants with secondary education or more were three times more likely to know more about MTCT and PMTCT of HIV. Educational status was associated with knowledge of MTCT and PMTCT of HIV ($\chi2$ =11.448, p = 0.001) as well as ($\chi2$ = 5.417, p = 0.020) with PMTCT care practice ($\chi2$ = 5.417, p = 0.020).

The study of Wudineh and Damtew (2016) in Dire Dawa City, Eastern Ethiopia, found there was a 15.7% prevalence of MTCT of HIV with higher female prevalence than males (17.6% versus 13.8%). Fifty percent of infants delivered at home were HIV positive compared to 11.9% among infants delivered at health institutions. The transmission rate was higher among infants who did not receive ARV prophylaxis at birth (45.2%) compared to those who received (7.4%). Bivariate and Multivariate logistic regressions were employed to identify significant determinants. Of the 382 HIV-exposed infants enrolled into care, rural residence, home delivery, infant not receiving ARV prophylaxis at birth, mixed feeding practices, and mother-child pairs neither receiving ARV were significant independent determinants. The study findings suggest additional efforts to intensify scale-up of PMTCT services in rural setting and improve institutional delivery and postnatal care for HIV positive mothers and proper follow-up for HIV-exposed infants.

Waruru *et al.* (2018) during pre-Option B+ in western Kenya, conducted Spatial–temporal analyses to understand coverage and trends in elimination of mother-to-child transmission of HIV (e-MTCT) and efforts that may be helpful in ensuring timely services are delivered to the right place. The extended Cochran–Mantel–Haenszel stratified test and logistic regression models were used to examine trends and associations of infant HIV status at first diagnosis with: early diagnosis (<8 weeks after birth), age at specimen collection, infant ever having breastfed, use of single dose nevirapine, and maternal antiretroviral therapy status. The study fitted both spatial and spatial–temporal semi-parametric Poisson regression models to explain HIV infection rates using R integrated nested Laplace approximation package. They also calculated new infections per 100,000 live births and used Quantum GIS to map

fitted MTCT estimates for each district in Nyanza region. Uptake of testing 8 weeks after birth was under 50% in 2007 and increased to 64.1% by 2013, ($p < 0.01$). By 2013, the overall standardized MTCT rate was 447 infections per 100,000 live births.

Terefe et al. (2024) researched on the knowledge and PMTCT of HIV/AIDS among women, as well as the associated factors. The study showed that more than 90% of HIV/AIDS in babies were through vertical transmission, largely due to poor maternal knowledge about Mother-To-Child Transmission (MTCT) of HIV/AIDS and its prevention. The study relied on data obtained from the most recent DHS conducted in ten (10) East African countries between 2011 and 2022; a total weighted sample of 133,724 women. A generalized linear model (GLM) with a log link and binomial family to directly estimate prevalence ratios (PR) and 95% confidence intervals (CI) for the association between the independent variables, and the outcome variable was adopted. Study factors with p-values ≤ 0.2 for univariate logistic regression and < 0.05 were considered as statistically significant factors of HIV/AIDS knowledge and prevention in the final model. The study findings reveal that 59.41% (95% CI: 59.15–59.67) of respondents had a comprehensive knowledge about MTCT of HIV/AIDS and its prevention among reproductive-age women in East Africa; being in the older age group, better education level, being from a rich household, employment status, having ANC follow up, institutional delivery, and modern contraception usage were associated with higher prevalence ratios of comprehensive knowledge about MTCT of HIV/AIDS and its prevention. However, being single in marital status, rural women, and traditional contraception utilization were associated with lower ratios of comprehensive knowledge about MTCT of HIV/AIDS and its prevention.

Summarily, available studies present inconsistent and inconclusive findings. Thus, this study explores the impact of mothers' knowledge of their status, mode of infants feeding at birth, and their uptake of antenatal care (ANC) on MTCT of HIV. The study findings will be useful in the design and implementation of proper strategies to reduce the high rate of MTCT of HIV. Likewise, monitoring the progress of PMTCT programs geared toward achieving the Sustainable development goal (SDG-3), target 3.1, 3.2, and 3.3, which is to ensure healthy lives, end preventable deaths of new-born, and the epidemics of AIDS by 2030 will be enhanced.

2. Methods

Data for this study was drawn from the registers at MTCT and ANC clinics in five purposively selected facilities that offer Comprehensive ART services: General hospitals (Ringim, Kazaure, Gumel, Hadejia and Dutse) and one specialist hospital (Dan-Masara) in Jigawa State. The predictor variables considered include Mode of delivery, model of feeding (mixed or exclusive), Mother's age, level of education, Mother location, number of ANC visits, Mother's knowledge of HIV status, Mother Health history, and parity; while the outcome variable is baby's HIV outcome at birth.

For this study, a two-level hierarchical model is fitted where:

$$y_{ij} = \begin{cases} 1 \; if \; vertical \; transmission \; occurs \\ 0 \; if \; otherwise \end{cases}$$

The model is given as, $log\left(\frac{\pi_{ij}}{1-\pi_{ij}}\right) = \beta_{0j} + \beta_{1j}X_{ij} + e_{ij}$ (1)

The regression coefficients vary across the level 2. The level 2 models are also referred to a between-unit models as they describe the variability across the clustering factors (Knowledge of HIV status either before, or at delivery).

$$\beta_{0j} = \gamma_{00} + \gamma_{01}z_j + u_{0j}$$
$$\beta_{1j} = \gamma_{10} + \gamma_{11}z_j + u_{1j} \quad (2)$$

Where z_j is the value on the level 2 predictor; γ_{00} is the overall mean intercept adjusted for z. γ_{11} is the regression coefficient associated with z relative to level 1 slope. u_{0j} is the random effect of the j[th] level 2 unit adjusted for z on the intercept while u_{1j} is that adjusted on the slope. Hence, we have:

$$logit\left(\frac{\pi_{ij}}{1-\pi_{ij}}\right) = \gamma_{00} + \gamma_{10}X_{ij} + \gamma_{01}z_j + \gamma_{11}z_jX_{ij} + u_{ij}X_{ij} + u_{0j} + e_{ij} \quad (3)$$

The intra-class correlation (ICC), "ρ", which is the proportion of variance in the population attributive to the hierarchical structure can be derived from the null (intercept-only) model. The null model is given by:

$$logit\left(\frac{\pi_{ij}}{1-\pi_{ij}}\right) = \gamma_{00} + u_{0j} + e_{ij} \text{ while the ICC, } \rho = \frac{\sigma_{uo}^2}{\sigma_{uo}^2 + \frac{\pi^2}{3}} \quad (4)$$

3.0 Results and Discussion

This study is based on the mother-to-child transmission of HIV/AIDS. The dependent variable for this study is Mother to child transmission (MTCT) while the independent variables are Type of Breast Feeding, Ante-natal care visit (ANC), mode of delivery (home and hospital), Mother- HIV Status.

Table 1: Associations between Factor variables and Study Outcome (MTCT)

		MTCT						MTCT			
Factor		No	Yes	Chi	p-value	Factor		No	Yes	Chi	p-value
	None	377	55	7.86	0.0001*						
CoMorbidity	Non_sexual	105	40			**HIV Status**	After	2	63	329.91	<0.001*
	Sexual	49	13				Previously	529	45		
Parity	1st	108	25	0.44	0.8036	**ANC Visits**	<4	215	74	63.63	<0.001*
	2nd-3rd	222	44				4 - 7.	302	20		
	Others	201	39				8+	14	14		
Age	15-19	14	4	21.95	0.0012*	**Location**	DANMASARA	0	68	400.52	<0.001*
	20-24	78	24				DUTSE	73	6		
	25-29	148	45				GUMEL	88	0		
	30-34	130	21				HADEJIA	90	13		
	35-39	90	14				KAZAURE	79	21		
	40-44	50	0				RINGIM	201	0		
	45-49	6	0								
Education						**Mode**	Exclusive	433	59	37.25	<0.001*
	None	364	54	19.53	0.0002*		Mixed	97	49		
	Pry	80	17								
	Sec	64	27			**Delivery**	HOME	177	59	17.47	<0.001*
	Higher	23	10				HOSPITAL	354	49		

Table 1 presents the result of descriptive summary statistics on the study variables. Table 1 gives the frequency and percentage distributions of study participants across the study variables. The distribution reveals the prevalence of comorbidity issues as follows: 67.6% (432) of the study patients had no prior illnesses, 9.7% (62) reported other sexually Transmitted illnesses, while 22.7% (145) reported cases of other ailments. On Parity, 133 (20.8%) reported that the child at hand is their first child, 266 (41.6%) were with their 2nd or 3rd child while 240 (37.6%) were the fourth or greater.

The study grouped the women according to their reproductive ages and found the following: 18 (2.9%) of the mothers were within their teen ages (15 – 19 years); another 102 (16.35%) aged between 20 - 24 years. 193 (30.93%) women were aged 25 – 29 years while 151 (24.2%) were between 30 – 34 years. Age groups 35 – 39, 40 – 44 and 45 – 49 had frequencies of 104 (16.7%), 50 (8.0%) and 6 (0.96%), respectively.

Mother's educational status revealed the following: 418 (65.41%) women had "No Formal education"; 97 (15.18%) had up to Primary school training; another 91 (14.24%) had up to Secondary school education while the remaining 33 (5.16%) had tertiary level education within the study population. Regarding the timing in knowledge of their HIV/AIDs status, 574 (89.83%) had prior knowledge of their status before delivery while the remaining 65 (10.17%) of the mothers knew their statuses after delivery of their babies. The number of antenatal care visits made by the pregnant mother plays a major role in ascertaining the type of care the mother and the neonate received. The study findings show that 289 (45.23%) women made less than 4 ANC visits which is below the WHO requirement of at least 4 ANC visits; 322 (50.39%) made between 4 – 7 ANC visits while 28 (4.38%) made 8 or more ANC visits.

The distribution of the mothers in this study are situated around the location of their respective health

facilities and the following were obtained: Danmasara 68 (10.64%), Dutse 79 (12.36%), Gumel 88 (13.77%), Hadejia 103 (16.12%), Kazaure 100 (15.65%) and Ringim 201 (31.46%). Mother's mode of feeding revealed that 492 (77.12%) practiced exclusive breastfeeding while 146 (22.88%) practiced mixed mode of feeding their babies. 236 (36.93%) of the mothers reported that their delivery took place at home while 403 (63.07%) had their babies in the hospital.

Table 1 also gives the result of the chi-square test of association between the outcome of interest, MTCT and other predictor variables considered in this study. The study findings reveal that there exists statistically significant associations between MTCT, and co-morbidity ($\chi^2 = 7.86, p - value = 0.0001 < 0.05$); Mother's Age category ($\chi^2 = 21.95, p - value = 0.0012 < 0.05$); Educational status ($\chi^2 = 19.53, p - value = 0.0000 < 0.05$); Knowledge of HIV status ($\chi^2 = 329.91, p - value = 0.0001 < 0.05$); Location/Residence ($\chi^2 = 400.52, p - value = 0.0000 < 0.05$); Mode of feeding ($\chi^2 = 37.25, p - value = 0.0001 < 0.05$); and Place of delivery ($\chi^2 = 17.47, p - value = 0.0001 < 0.05$). the child's parity does not show any statistical association with the outcome variable with ($\chi^2 = 0.44, p - value = 0.8036 > 0.05$). Thus, the significant factors can be used in further analysis on the prevalence of mother to child transmission of HIV/AIDS in Jigawa state.

Table 2: Clustering assessment using the Intra-class correlation coefficient (ICC)

Parameter	ICC	ICC(%)	Std. Err.	[95% Conf.Interval]	
Location	0.634247	63.42	0.092934	0.44159	0.791777
ANC visits	0.259952	25.99	0.169434	0.058832	0.663738
Knowledge of Status	0.737775	73.78	0.20107	0.268432	0.9557

Table 3: Intercept Only model

Model 1: Intercept Only MTCT	Coef.	Std. Err.	z	P>z	[95% Conf.Interval]	
Intercept	0.534423	1.948297	0.27	0.784	-3.28417	4.353014
Knowledge of Status var(cons)	9.256108	9.620051			1.207142	70.97388

The intraclass correlation coefficient is computed for three (3) key predictor variables namely: Location, number of antenatal care visits made and knowledge of their HIV/AIDS status. This is to assess possible clustering structure. Table 2 presents the study findings and reveals that there exist a 63.42% correlation between the individual level factors and "Location" of the mother as a clustering (higher level) variable. ANC visits return an ICC value of 25.99% while Knowledge of HIV status returns an ICC of 73.78%. These findings show that the likelihood of a vertical transmission in the population is very much influenced by these clustering variables. The data exhibits some hierarchical structure, as such, the estimates of model parameter will be biased if the traditional logistic regression is used in model fitting and assessment of the likelihood of vertical transmission, due to a possible violation of the independence assumption. This study thus adopts the multi-level logistic regression for its analysis. "Knowledge of status" - with the highest intra-class correlation (ICC) value, was chosen as the clustering variable, as it accounts for approximately 74% of the variance in MTCT outcome. Table 3 presents the result of the Intercept-only model. This shows that on the average, (without predictor influence), the odds of MTCT occurrence is $2.718\ (= \exp(0.534423))$.

Table 4: Multi-level logistic regression analysis of factors associated with MTCT of HIV/AIDS

	Model 2: Individual Level						Model 3: Knowledge (Status) Level					
Predictors	Coef.	Std. Err.	Z	p-value	[95% Conf.Interval]		Coef.	Std. Err.	z	p-value	[95% Conf.Interval]	
Co_Morbidity												
No Sickness	1.141114	0.820876	1.39	0.164	-0.46777	2.750001	0.972714	0.750912	1.3	0.195	-0.49905	2.444475
Non_sex related	2.331142	0.845305	2.76	**0.006**	0.674374	3.98791	2.099898	0.778135	2.7	**0.007**	0.574782	3.625014
Parity												

1st child	0.0825057	0.449296	0.18	0.854	-0.7981	0.96311	0.164115	0.462828	0.35	0.723	-0.74301	1.071242
2nd-3rd child	0.1052857	0.381034	0.28	0.782	-0.64153	0.852099	0.131861	0.399887	0.33	0.742	-0.6519	0.915626
Education												
Pry	0.2854168	0.483609	0.59	0.555	-0.66244	1.233273	0.162326	0.482098	0.34	0.736	-0.78257	1.10722
Sec	1.058197	0.416339	2.54	**0.011**	0.242189	1.874206	1.018352	0.424153	2.4	**0.016**	0.187028	1.849677
Higher	1.715858	0.571652	3	**0.003**	0.59544	2.836276	1.664618	0.57703	2.88	**0.004**	0.533661	2.795576
ANC												
<4	-2.079428	0.524982	-3.96	**<0.001**	-3.10837	-1.05048	-1.94711	0.546531	-3.56	**<0.001**	-3.01829	-0.87593
4-7	-2.387297	0.519575	-4.59	**<0.001**	-3.40565	-1.36895	-2.3338	0.557385	-4.19	**<0.001**	-3.42625	-1.24134
Mode of Feeding												
Mixed	0.2976266	0.443577	0.67	0.502	-0.57177	1.167022	0.546859	0.448221	1.22	0.222	-0.33164	1.425357
_cons	0.8583151	2.316146	0.37	0.711	-3.68125	5.397879	0.898641	1.558405	0.58	0.564	-2.15578	3.953058
Status_Knowledge							Status_Knowledge>Age_Mother					
var(_cons)	11.01415	11.51271			1.419774	85.44417	35.33279				4.265232	292.6936

Table 4 presents the results of fitting the Individual level model which incorporates the predictor variables Co-morbidity (Sex related), Parity/Position at birth (fourth and above), Mothers' Education (No formal education), ANC visits (Reference category is 8+) and Mode of Breastfeeding (Reference category is Exclusive). The findings reveal that the likelihood of MTCT among mothers with non-sex related comorbidities is statistically significant compared with those with sex-related comorbidities with an odds ratio of 10.088 (p-value = 0.006 < 0.05). Comparing the likelihood of MTCT prevalence based on Mothers educational attainment, the study findings reveal a statistically significant effect among mothers with secondary, and tertiary education. These have odds ratios of 2.88 (p-value = 0.011<0.05) and 5.56 (p-value = 0.003<0.05) respectively compared to mothers with no formal education. Assessing the effect of number of mother's ANC visits on during pregnancy on the likelihood of MTCT occurrence, the study found that there is a statistically significant effect. The negative coefficient imply that the prevalence is most critical amongst mothers who made 8+ ANC visits. The odds ratios are 0.125 (p-value = 0.000) and 0.092 (p-value = 0.000) respectively for those with less than four and 4 - 7 ANC visits respectively. This negates expectations but suggests that those with 8+ visits are likely mothers who are HIV+ or other underlying conditions that prompt transmission. Mixed mode of breastfeeding has an odds ratio 1.367 (p-value = 0.502>0.05) thus does not show any statistical significance neither does parity where those experiencing child birth for the first time have an odds ratio of 1.086 (p-value = 0.854) and 2nd – 3rd child has an odds ratio of 1.111 (p-value = 0.782>0.05).

Table 4 also presents the outcome from fitting the multilevel logistic regression with both first and second level predictors. This also reveal significant effects of comorbidity (Non-sex related vs Sex-related); Level of education (Secondary and Tertiary education) and Number of ANC visits during pregnancy. The intra-class correlation ICC coefficient shows that about 74% of the variance in MTCT prevalence is attributive to mothers' knowledge of their HIV status.

4. Conclusion

The study highlights the importance of mother's knowledge of their HIV/AIDS status prior to delivery as well as measures for preventing vertical transmission. This aligns with the findings of Terefe et al (2024) who also emphasised mother's knowledge of PMTCT, though our study explored the timing of mother's knowledge of their HIV/AIDS status. Also, mother's commitment to their antenatal visit schedules whether at the individual level or with the inclusion of the clustering level influence, is vital to regulating the likelihood of mother to child transmission of HIV/AIDS.

References

Abiodun O, Sotunsa J, Ani F, Olaleye, A., Taiwo, A. (2015). Elimination of Mother-To-Child Transmission of HIV in Nigeria: The Roles, Preparedness and Determinants of Successful Involvement of Traditional Birth Attendants. J AIDS Clin Res 6: 481. doi:10.4172/2155-6113.1000481.

Kassa, G.M. (2018). Mother-to-child transmission of HIV infection and its associated factors in Ethiopia: A systematic review and meta-analysis. *BMC Infect Dis*, 10;18(1):216. https://doi.org/10.1186/s12879-018-3126-5.

Koye, D.N. &Zeleke, B. M. (2013). Mother-to-child transmission of HIV and its predictors among HIV-exposed infants at a PMTCT clinic in northwest Ethiopia. *BMC Public Health, 13:398*. http://www.biomedcentral.com/1471-2458/13/398.

NACA (2024). Preventing Mother-to-Child Transmission of HIV - NACA Nigeria

Olagunju, M., Jimoh, R.G. & Juhriyansyah, D. (2011). Predictive Control Model of HIV/AIDS Spread With Emphasis in Nigeria, International Journal of Science and Advanced Technology , (ISSN 2221-8386) Vol.1 No.2, Retrieved March 2 2019 from http://www.ijsat.com

Terefe, B., Jembere M. M & Liyew, B. (2024). Comprehensive knowledge of mother-to child HIV/AIDS transmission, prevention, and associated factors among reproductive age women in East Africa: insights from recent demographic and national health surveys. BMC Women's Health 24:318 https://doi.org/10.1186/s12905-024-03173-1

UNAIDS (2021) Anambra, Nigeria, commits to eliminating vertical transmission of HIV by end of 2022 |UNAIDS

United Nations Programme on HIV/AIDS (UNAIDS) (2018). *90–90-90: An ambitious treatment target to help end the AIDS epidemic Report. Geneva.*

Waruru, A., Thomas N.O. A, Muttai, H, Ng'ang'a, L., Gutierrez, E.Z., Ochanda, B., Katana, B., Young, P.W., Tobias, J.L., Juma, P. , Cock, K.M.D.& Tylleska, T. (2018). Spatial–temporal trend for mother-to-child transmission of HIV up to infancy and during pre-Option B+ in western Kenya.

World Health Organization (2010). New data on the prevention of mother-to-child transmission of HIV and their policy implications. Conclusions and recommendations. WHO technical consultation on behalf of the UNFPA/UNICEF/WHO/ UNAIDS Inter-Agency Task Team on Mother-to-Child Transmission of HIV.

World Health Organization (2018). Mother-to-child transmission of HIV. http://www.who.int/hiv/topics/mtct/about/en/.

World Health Organization (2023) Epidemiological fact sheet: HIV statistics, globally and by WHO region. https://cdn.who.int/media/docs/default-source/hq-hiv-hepatitis-and-stis-library/j0294-who-hiv-epi-factsheet-v7.pdf

Wudineh F. & Damtew, B. (2016). Mother-to-Child Transmission of HIV Infection and Its Determinants among Exposed Infants on Care and Follow-Up in Dire Dawa City, Eastern Ethiopia. Hindawi Publishing Corporation AIDS Research and Treatment Volume 2016, pp. 1 – 6. http://dx.doi.org/10.1155/2016/3262746.