

# HIV testing and knowledge on mother-to-child transmission among pregnant women attending antenatal care at Vanga Hospital, Democratic Republic of Congo

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## Abstract

**Background.** Human immunodeficiency virus (HIV) causes an infectious disease that can be transmitted from an infected mother to her child. Prevention of Mother-to-Child Transmission (PMTCT) programs provide a range of services to women and children that can reduce the risk of vertical transmission of HIV. Unfortunately, PMTCT programs face many challenges in the rural Democratic Republic of Congo (DRC).

**Methods.** A cross-sectional study was conducted among 460 pregnant women attending antenatal care at Vanga Hospital in the Vanga health zone, DRC from March 11<sup>th</sup> to June 25<sup>th</sup>, 2019. Serological tests were performed and a pre-tested questionnaire regarding HIV knowledge was given to all participants. Data were analyzed with STATA 13.0. Descriptive statistics of key variables were computed and logistic regression was used to assess the association between participant's characteristics and knowledge of MTCT.

**Results.** Among the participants, 95.4% (439/460) reported that they have heard about HIV, 82.4% (378/460) indicated sexual intercourse as one of the routes of HIV transmission but only 30.4% (139/460) mentioned MTCT as one of the routes. In addition, only 10.1% (46/460) had knowledge of the existence of PMTCT. Participants' age (>29 years), education level, previous antenatal care, and previous HIV tests were significantly associated with knowledge of MTCT. Also, age (>29 years) and education level were significantly associated with previous HIV test uptake. Most pregnant women 82.3% (376/460) reported that they have never been tested in the past for HIV infection and the prevalence was at 0.9% (4/460).

**Conclusions.** Knowledge of MTCT of HIV, previous uptake of HIV testing, and prevalence was low. The rural setting of Vanga and insufficient HIV sensitization activities are considered contributors to this. While the low prevalence is a positive finding, much needs to be done to improve the uptake of HIV testing and knowledge of HIV MTCT.

## Introduction

Human Immunodeficient Virus (HIV) may cause an infectious disease that can be transmitted from an infected mother to her child. This may occur during pregnancy, labor, or breastfeeding in the absence of antiviral treatment; approximately 25-50% of HIV-positive mothers will transmit the virus to their newborns.<sup>1</sup>

Prevention of Mother-to-Child Transmission (PMTCT) programs provide a range of services such as counseling and testing, antiretroviral drug therapy, comprehensive antenatal care (ANC), and safer delivery practices, as well as appropriate infant feeding to women and infants to fight HIV MTCT during pregnancy, labor, and breastfeeding. These activities can reduce the risk of vertical transmission of HIV to less than 1%.<sup>1</sup> However, HIV testing before and during pregnancy is critical to initiating antiretroviral therapy and elimination of HIV MTCT.<sup>2</sup>

PMTCT starts with testing pregnant women during the antenatal period. Testing requires some knowledge of HIV transmission and prevention, a positive attitude toward the HIV test, and the availability of the test for pregnant women. Unfortunately, PMTCT programs face many challenges in some regions of the world.<sup>3</sup> These challenges include inadequate resources, stigma, and discrimination,<sup>4</sup> attitudes, and skills of healthcare providers, cost, illiteracy, inability to secure husband's permission, the strategy used for HIV testing,<sup>5</sup> and accessibility to health care.<sup>6</sup> These challenges lead to the low coverage of HIV testing leaving a proportion of pregnant women with no access to these programs and exposing them to transmit the infection to their children. For example, a study in Ethiopia that analyzed the 2016 Ethiopian Demographic and Health Survey dataset, showed that only 35.1% were tested for HIV and received the test results during pregnancy.<sup>7</sup>

Another contributing factor to the low coverage of HIV testing could be the lack of knowledge of PMTCT. Mothers with good knowledge of MTCT, understand the severity of HIV MTCT, can assess their susceptibility correctly, and harness the benefit of testing.<sup>8</sup> For example, in Kumasi, Ghana, decisions by pregnant women to take up HIV testing and counseling were mostly influenced by factors such as lack of information, perceptions of privacy and confidentiality, waiting time, poor relationship with health staff, and fear of being positive,<sup>9</sup> while in Kenya, stigmatization was a major barrier to acceptance of HIV testing.<sup>10</sup>

The proportion of pregnant women accepting HIV testing depends on the country as well as if the region within the country is rural or urban. While HIV testing is obligatory for pregnant women in some countries, it is not in other countries. This can explain the disparities observed in Africa. For example, only 6.1% of pregnant women were tested in Chad compared to 98.1% in Rwanda.<sup>11</sup>

Regarding HIV knowledge, several studies in Africa have shown some good knowledge of PMTCT among pregnant women.<sup>12-14</sup> In DRC, the data available on HIV testing in the rural region is particularly limited except in cities like Lumbumbashi.<sup>12</sup> In addition, little is known about the prevalence of HIV and knowledge of PMTCT among pregnant women in rural settings. For this reason, we conducted a study to assess the knowledge of MTCT of HIV, HIV testing uptake, and HIV prevalence among pregnant women attending ANC at Vanga Hospital, DRC.

## Materials and Methods

### Study design and setting

This was a cross-sectional, descriptive study. The study was conducted at the Vanga Evangelical Hospital. It is located in Kwilu province, in the Vanga health zone 530 km east of Kinshasa, 35 km from Bulungu Hospital, and 60 km from Djuma Hospital. The hospital has 479 beds and serves a health zone with a population of over 300,000 persons as well as patients from neighboring health zones. The hospital organizes ANC every Thursday for pregnant women with consultations from midwives and nurses.

### Sample size determination

We used an online calculator ([www.openepi.com](http://www.openepi.com)) to calculate the required sample size. The HIV prevalence rate among pregnant women in DRC is uncertain, so we assumed a 50% prevalence rate, which was to be measured with a 5% precision and an alpha error of 5%. This gave a minimum sample size of 385 patients. We recruited 460 participants for this study.

### Study participants

The study population comprised all pregnant women who visited the Vanga Hospital for their antenatal (booking) visit during the study period. They come from Vanga and the surrounding villages to receive ANC from Vanga Hospital. Since screening for malaria was performed systematically in the hospital for pregnant women during the first ANC visit, we included HIV serological tests during the study period from March to June 2019.

### Sampling technique

A simple random sampling technique was adopted for the study. The study population consisted of all pregnant women who visited the Vanga Hospital for their antenatal (booking) visit during the study period and data was collected from March 11<sup>th</sup> to June 25<sup>th</sup>, 2019.

Two midwives and a laboratory technician were recruited for the purpose of this study. During the study period, the midwives identified pregnant women attending ANC at the Vanga Hospital for the first time for inclusion in the study. After the ANC consultations, the pregnant women were directed to the physician, who presented the study purpose and procedure and obtained written informed consent from the participants.

### Inclusion and exclusion criteria

We included those who attended the ANC for the first time for the ongoing pregnancy. Those who didn't attend for the first time were excluded.

### Data collection

An interviewer-administered structured questionnaire regarding HIV knowledge was elaborated from the model found in a literature review.<sup>15</sup> The questionnaires were translated into the French language, pretested, and adapted before administration to the study participants. Five milliliters (ml) of blood samples were collected from each study participant. The serum was separated and immediately used for the HIV serological test. Participant's socio-demographic and obstetric information, as well as medico-surgical history, were collected from their antenatal care chart.

### Laboratory analysis

Alere HIV Combo to detect the HIV serology status was used. This test detects antibodies to HIV-1 and HIV-2 and the detection of non-immunocomplexes (free) HIV-1 P24 antigen in human venous serum. We further confirmed all positive tests by further analysis with Inegol and Vikia test.

### Operational definition

The knowledge outcome was defined based on the knowledge of the transmission of the infection from mother to child.

A pregnant woman was considered positive for HIV after a positive result of the analysis with the Alere HIV Combo to detect HIV serology status and confirmation with the Inegol and Vikia tests.

## Ethical consideration

The research proposal was submitted to the Comité National d'éthique de la santé and received the approval number 100/CNES/BN/PMMF/2019. To participate, pregnant women were clearly informed about the HIV test and had to sign a written informed consent form after an explanation of the purpose, benefits, and risks of participation. Investigations were performed following normal medical examinations. Participants who tested positive were taken provided care following the national HIV guidelines for pregnant women.<sup>16</sup>

## Data analysis

Data were analyzed with STATA 13.0. The descriptive statistics of the key variables were computed and presented as frequencies and percentages in Tables 1-4. Logistic regression was used to assess the association between the participant's characteristics and knowledge of MTCT as well as the association of the participants' characteristics with previous HIV test uptake. Only variables with significant values ( $p < 0.05$ ) in univariate analysis were included in multivariate logistic regression analysis.

## Results

### General characteristics of participants

We recruited 460 pregnant women for the purpose of this study. The majority, 58.6% (268/460) were aged between 18 and 29 years, 69.4% (317/460), had attended secondary school and 92.1% (421/460) were married. 79.1% (362/460) were multigravida while 77.2% (353/460) reported a previous abortion. 13.3% (61/460) reported a history of general surgery and 7.4% (34/460) had received a blood transfusion in the past (Table 1).

**Table 1. Participant's socio-demographic characteristics (N=460).**

Variable	Frequency (N)	Percentages (%)
Age		
18-29	268	58.6
30-39	163	35.7
>39	26	5.7
Education level		
No formal education	51	11.2
Primary school	79	17.3
Secondary school	317	69.4
College/university	10	2.2
Marital status		
Unmarried	35	7.7
Married	421	92.1
Widowed	1	0.2
Gravida		
Primigravida	95	20.9
Multigravida	362	79.1
Past abortions		
Yes	353	77.2
No	104	22.8
Past history of surgery		
Yes	61	13.3
No	396	86.3
Past blood transfusions		
Yes	34	7.4
No	423	92.4

N, sample size. Frequencies and percentages may not add up because of missing responses.

## Knowledge of participants on HIV and mother-to-child transmission

The majority, 95.4% (439/460) of the pregnant women reported that they have heard about HIV and the most common source of information on HIV was from friends 79.3% (363/460). 82.4% (378/460) of the participants indicated sexual intercourse as one of the routes of HIV transmission but only 30.4% (139/460) mentioned MTCT. Only 10.1% (46/460) of the participants reported that infection could be transmitted from mother to child and had knowledge of the existence of PMTCT, respectively. Regarding participants' knowledge of a period of HIV MTCT, 21%, 9%, and 8.1% were reported during pregnancy, labor, and breastfeeding, respectively. 8.1% (37/460) of the participants knew that taking antiretroviral medication during pregnancy could reduce the risk of maternal-fetal transmission.

## HIV testing uptake

Most pregnant women 82.3% (376/460) reported that they have never been tested in the past for HIV infection. 54.5%

**Table 2. Knowledge of participants on HIV and mother-to-child transmission (N=460).**

Variable	Frequency (N)	Percentages (%)
Knowledge		
Yes	439	95.4
No	19	4.1
Source of information		
Previous antenatal care	35	7.6
Radio	74	16.2
Church	21	4.6
Health facilities	176	38.4
Newspaper	10	2.2
Friends	363	79.3
School	34	7.4
Knowledge of route of infection		
Sexual intercourse	378	82.4
Mother-to-child	139	30.4
Blood substance: injections	319	69.7
Spiritual/witchcraft	10	2.2
Reported period of MTCT		
During pregnancy	96	21.0
During labor/delivery	41	9.0
During breastfeeding	45	9.8
Knowledge of existence of PMTCT		
Yes	46	10.1
Knowledge of prevention means		
ARV to mother	37	8.1
ARV to child	13	2.8
Avoid breastfeeding	15	3.3
HIV test in the past		
Yes	79	17.3
No	376	82.3
Don't know	2	0.4
If no test, why?		
I am not at risk	155	33.9
I have not been offered a test	249	54.5
The results may be known by others	13	2.8
My husband refuses	2	0.4
Prevalence of HIV		
Positive	4	0.9
Negative	439	95.9

PMTCT, prevention of mother-to-child transmission. Frequencies and percentages may not add up because of missing responses.

(249/460) indicated that the main reason for not being tested was that they had not been offered a test previously while 33.9% (155/460) reported that they were not at risk and should not be tested. In our study, HIV prevalence was at 0.9% (4/460).

### Logistic regression analysis

Study participants below 29 years of age and secondary level education or less, have a reduction of 9% (95% CI=0.99-6.45,  $p<0.01$ ) and 75% (95% CI=0.12-0.53,  $p<0.01$ ) respectively in the odds of having knowledge of HIV MTCT compared to those aged >29 years with a college or university education. Likewise, participants who had previously attended antenatal visits and had taken HIV tests before had a 4.22 (95% CI=1.85-9.63,  $p<0.01$ ) and 3.21(95% CI=1.78-5.76,  $p<0.01$ ) increased odds of having knowledge of HIV MTCT than those who had not attended respectively.

In addition, pregnant women in Vanga below 29 years of age and primary level education or less have a reduction of 7% (95% CI=0.90-0.97,  $p<0.01$ ) and 73% (95% CI=0.10-0.74,  $p=0.01$ ) respectively in the odds of previous HIV test uptake compared to those aged >29 years with a secondary or higher education level.

## Discussion

This study assessed the knowledge of MTCT of HIV, HIV testing uptake, and HIV prevalence among pregnant women attending antenatal care at Vanga Hospital. We found that 82.4% of the participants indicated sexual intercourse as one of the routes of HIV transmission but only 30.4% mentioned MTCT. Most pregnant women (82.3%) reported that they have never been tested in the past for HIV infection and the prevalence was at 0.9%.

In this study, 9.8% of the participants knew that HIV MTCT could occur during breastfeeding and 8.1% knew that antiviral medication reduces the risk. These results are different from the findings of the second DRC demographic and health survey (EDS-RDC II 2013-2014), which found that 59% of women aged 15-49 years were aware that the HIV virus could be transmitted from mother to child during breastfeeding and 32% knew that taking antiretroviral medication during pregnancy, could reduce the risk of MTCT.<sup>17</sup> This difference could be explained by the rural setting of the study, the local presumed HIV prevalence, and education among our study participants. Indeed, Vanga is a rural area with limited opportunities for the population to have access to health

**Table 3. Multivariable logistic regression analysis to assess the association between participant characteristics and knowledge of HIV mother-to-child transmission (N=455).**

Variable	OR	95% CI	P
Age			
18-29	1.00		
>29	0.91	0.89-0.95	<0.01
Education level			
No formal education	1.00		
Primary school	0.59	0.42-8.26	0.69
Secondary school	0.58	0.28-1.21	0.15
College/university	0.25	0.12-0.53	<0.01*
Previous antenatal			
Yes	1.00		
No	4.22	1.85-9.63	<0.0
Previous HIV test			
Yes	1.00		
No	3.21	1.78-5.76	<0.01
Past surgery			
Yes	1.00		
No	1.03	0.51-2.03	0.93

OR, odds ratio; CI, confidence interval.

**Table 4. Multivariable logistic regression analysis to assess the association between participant characteristics and previous HIV test uptake (N=455).**

Variable	OR	95% CI	P
Age			
18-29	1.00		
>29	0.93	0.90-0.97	<0.01
Education level			
No formal education	1.00		
Primary school	0.15	0.01-1.80	0.13
Secondary school	0.27	0.10-0.74	0.01
College/university	0.03	0.06-0.16	<0.01
Previous antenatal			
Yes	1.00		
No	1.68	0.75-3.75	0.21

OR, odds ratio; CI, confidence interval.

education. In addition, the presumed low prevalence of HIV in Kwilu province leads to fewer interventions to fight HIV and the subject of HIV does not seem to be prioritized as a topic during antenatal care.

Only 30.4% of the participants recognized MTCT as a route of HIV transmission. This result can affect processes targeted at preventing MTCT, like screening and management of infected pregnant women. An infected pregnant woman who has accurate knowledge of how HIV is transmitted and of strategies for preventing transmission can reduce the risk of transmission by applying PMTCT. The result of 30.4% is far lower than the reports of two studies conducted in Ethiopia, where 83.5% and 84.5% of pregnant women knew about MTCT. Likewise, it differed from reports from Uganda (more than 60%),<sup>18</sup> Nigeria (76.9%),<sup>19</sup> Kenya (52%),<sup>20</sup> and other sub-Saharan African countries. Again, the rural setting of the study and the low local presumed HIV prevalence could be an explanation for the poor knowledge of MTCT among the participants. Participants' level of education (college or higher) was significantly associated with knowledge of HIV MTCT.

The most common source of information among participants in this study was friends. People in Vanga resort to information from friends, which is often erroneous or incomplete because there are no standardized sources of good information on health topics like HIV in Vanga. The national prevalence estimates, EDS-RDC II 2013-2014 on HIV is 1.2% and Vanga is located in the Kwilu province, which has one of the lowest HIV prevalence (0.1%) in DRC.<sup>17</sup> The consequence of this presumed low prevalence is that fewer sensitization activities are undertaken on HIV prevention both within the healthcare setting and the community. As a result, fewer resources would be deployed to HIV MTCT-related prevention activities. For HIV testing uptake, only 17.3% of the participants in this study had been tested in the past. This is different from the results of the EDS-RDC II 2013-2014 study,<sup>17</sup> where 13% of pregnant women were counseled about HIV prior to testing, had an HIV test, and were aware of the results. When compared to studies previously conducted in Chad, Rwanda, Uganda and Zambia, the uptake of HIV testing was 6.1%, 98.1%, 92.4%, and 96.9% respectively.<sup>18</sup> The uptake of HIV testing was found to be the highest among women in Southern and Eastern African countries, whereas it was lowest among women in Western and Central African countries.<sup>18</sup> The low number of pregnant women that had previously been tested for HIV in this DRC study as well as in some countries like Chad could be a reflection of each country's national HIV testing mandate. For example, in Rwanda and Uganda, it is mandatory for every pregnant woman who attends ANC to be tested for HIV,<sup>18,21</sup> while in DRC, a pregnant woman can refuse to be tested.

We found an HIV prevalence of 0.9%. This prevalence is lower than the DRC prevalence in the general population (1.2%) and the national prevalence among pregnant women (2.7%) but higher than the prevalence estimate for Kwilu province (0.1%).<sup>17</sup> The low prevalence in the Kwilu province could be explained by the factors like the absence of armed conflict, less accessibility as a remote region, fewer commercial activities compared to the other eastern regions of Congo, and previous HIV awareness campaigns over the past decade. However, this low prevalence could also be due to the reduction of the screening processes due to the lack of HIV test equipment. Compared to other countries, the prevalence is still low probably due to the reasons mentioned above. For instance, the pooled HIV incidence among pregnant women in sub-Saharan Africa and other countries was 2.1 per 100-person/year.<sup>20</sup> In Uganda, it was 2.9 per 100 women/years and 6.9% in western Kenya.<sup>22,23</sup> Rurality has been identified as an HIV protective factor in the Demographic and Health Survey 2007.<sup>24</sup>

## Limitations

This study has some limitations. Firstly, the participants were recruited during ANC visits, thus pregnant women who did not visit the clinic for antenatal care were not assessed. These results are therefore not completely representative of the pregnant women in the Vanga Health Zone.

However, we believe it makes important contributions to a better understanding of the prevalence, knowledge of MTCT, and uptake of HIV testing in Vanga, a potential representation of the situation in other rural regions of DRC.

## Conclusions

In this study, knowledge of HIV MTCT, previous uptake of HIV testing, and prevalence among the participants was low. While the low prevalence is a positive finding, much needs to be done to improve the uptake of HIV testing among pregnant women in Vanga and other rural regions. The rural setting of Vanga and insufficient HIV sensitization activities are considered to be major contributors to these. These gaps can be bridged by deliberate training of health workers to provide health education to pregnant women on MTCT in order to improve knowledge. Rural health workers should be adequately trained to play the key role of HIV counseling and the health authorities should ensure adequate provision of HIV testing materials in Vanga Hospital and other healthcare settings to encourage the uptake of testing. We recommend that similar and better representative studies be conducted to ascertain if the low HIV prevalence (0.9%) reported in our study is representative of other rural zones of DRC.

## References

- Hurst S, Appelgren K, Kourtis A. Prevention of mother-to-child transmission of HIV type 1: The role of neonatal and infant prophylaxis. *Expert Rev Anti Infect Ther* 2015;13:169-81.
- Vrazo A, Sullivan D, Ryan PB. Eliminating mother-to-child transmission of HIV by 2030: 5 strategies to ensure continued progress. *Glob Health Sci Pract* 2018;6:249-56.
- Worku M, Teshale A, Tesema G. Prevalence and associated factors of HIV testing among pregnant women: A multilevel analysis using the recent demographic and health survey data from 11 east African countries. *HIV/AIDS (Auckl)* 2021;13:181-9.
- Mumtaz Z, Merchant N, Levay A. Factors influencing the uptake of HIV testing during antenatal care in rural Uganda. *J Women's Health Care* 2013;2.
- Pai N, Klein M. Rapid testing at labor and delivery to prevent mother-to-child HIV transmission in developing settings: Issues and challenges. *Women's Health* 2009;5:55-62.
- Gunn J, Asaolu I, Center K, et al. Antenatal care and uptake of HIV testing among pregnant women in sub-Saharan Africa: A cross-sectional study. *J Int AIDS Soc* 2016;19:20605.
- Ejigu Y, Tadesse B. HIV testing during pregnancy for prevention of mother-to-child transmission of HIV in Ethiopia. *PLOS ONE* 2018;13:e0201886.
- Alemu Y, Habtewold T, Alemu S. Mother's knowledge on prevention of mother-to-child transmission of HIV, Ethiopia: A cross-sectional study. *PLOS ONE* 2018;13:e0203043.
- Kwapong G, Boateng D, Agyei-Baffour P, Addy E. Health service barriers to HIV testing and counseling among pregnant women attending antenatal clinic; A cross-sectional study.

- BMC Health Serv Res 2014;14.
10. Turan J, Bukusi E, Onono M, et al. HIV/AIDS stigma and refusal of HIV testing among pregnant women in rural Kenya: Results from the MAMAS study. *AIDS Behav* 2011;15:1111-20.
  11. Awopegba O, Kalu A, Ahinkorah B, et al. Prenatal care coverage and correlates of HIV testing in sub-Saharan Africa: Insight from demographic and health surveys of 16 countries. *PLOS ONE* 2020;15:e0242001.
  12. Mwembo-Tambwe A, Kalenga M, Donnen P, et al. Dépistage du VIH en salle de travail à Lubumbashi, République démocratique du Congo. Une stratégie de rattrapage dans le cadre de la prévention de la transmission de la mère à l'enfant. *Revue d'Épidémiologie et de Santé Publique* 2013;61:21-7.
  13. Sama C, Fetei V, Tindong M, et al. Prevalence of maternal HIV infection and knowledge on mother-to-child transmission of HIV and its prevention among antenatal care attendees in a rural area in northwest Cameroon. *PLOS ONE* 2017;12:e0172102.
  14. Egbe T, Tazinya R, Halle-Ekane G, et al. Estimating HIV incidence during pregnancy and knowledge of prevention of mother-to-child transmission with an ad hoc analysis of potential cofactors. *J Pregnancy* 2016;2016:1-9.
  15. Abteu S, Awoke W, Asrat A. Knowledge of pregnant women on mother-to-child transmission of HIV, its prevention, and associated factors in Assosa town, Northwest Ethiopia. *HIV/AIDS Res Palliat Care* 2016:101.
  16. Ucopplus.org. 2021 [cited 9 July 2021]. Available from: [https://www.ucopplus.org/media/2019/05/GUIDE-PEC-VIH\\_RDC-1.pdf](https://www.ucopplus.org/media/2019/05/GUIDE-PEC-VIH_RDC-1.pdf)
  17. Unicef.org 2021 [cited 15 June 2021]. Available from: <https://www.unicef.org/drcongo/media/1046/file/EDS-RDC%20II%202013-2014.pdf>
  18. Byamugisha R, Tumwine J, Ndeezi G, et al. Attitudes to routine HIV counselling and testing, and knowledge about prevention of mother to child transmission of HIV in eastern Uganda: A cross-sectional survey among antenatal attendees. *J Int AIDS Soc* 2010;13:52.
  19. Igwegbe A, Ilika A. The willingness and constraints to routine HIV screening among antenatal mothers at Nnamdi Azikiwe University Teaching Hospital, Nnewi. *Tropical J Med Res* 2007;10.
  20. Kei R, Ndwiga T, Okong'o S, Mburu S. Knowledge and attitude on prevention of mother to child transmission of HIV among pregnant women attending antenatal clinic at Kisii Level Five Hospital in Kisii County, Kenya. *Int J Trop Dis Health* 2015;6:44-51.
  21. Binagwaho A, Pegurri E, Drobac P, et al. Prevention of mother-to-child transmission of HIV: Cost-effectiveness of antiretroviral regimens and feeding options in Rwanda. *PLOS ONE* 2013;8:e54180.
  22. Graybill L, Kasaro M, Freeborn K, et al. Incident HIV among pregnant and breast-feeding women in sub-Saharan Africa: a systematic review and meta-analysis. *AIDS* 2020; 34:761-76.
  23. Ndege S, Washington S, Kaaria A, et al. HIV prevalence and antenatal care attendance among pregnant women in a large home-based HIV counseling and testing program in Western Kenya. *PLOS ONE* 2016;11:e0144618.
  24. Dhsprogram.com. 2021 [cited 16 July 2021]. Available from: <https://dhsprogram.com/pubs/pdf/FR208/FR208.pdf>