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Orapuh Journal

ORIGINAL ARTICLE

*Journal of Oral & Public Health*

# Factors explaining failure to suppress viral load in pregnant women living with HIV in Mbandaka, Equateur Province (Democratic Republic of Congo)

Likulu, J. C. E.[1,2], Kangite, J. M.[3], Adikaka, F. A.[2], Bosako, T. M.[2], Mundembe, P. B.[1,2], Bikoko, G. B.[1,2], Betoko, R. B.[1,2], Mawunu, M.[4,7], Ngbolua, K. N.[4,5], Tshimungu, F. K.[1], & Elongi, J. P. M.[6]

[1]*Doctoral School in Health Sciences, Higher Institute of Medical Techniques of Kinshasa, Kinshasa, Democratic Republic of the Congo*
[2]*Higher Institute of Medical Techniques of Mbandaka, Mbandaka, Democratic Republic of the Congo*
[3]*Health Organizations Management Section, Higher Institute of Medical Techniques of Kinshasa, Kinshasa, Democratic Republic of the Congo*
[4]*Department of Biology, Faculty of Science and Technology, University of Kinshasa, Kinshasa, Democratic Republic of the Congo*
[5]*Center for Research in Pharmacopoeia and Traditional Medicine, Higher Institute of Medical Techniques, Kinshasa, Democratic Republic of the Congo*
[6]*Faculty of Medicine, University of Mbandaka, Équateur, Democratic Republic of the Congo*
[7]*Polytechnic Institute of Kimpa University, Angola*

**ARTICLE INFO**

***Received:*** *10 February 2025*
***Accepted:*** *06 March 2025*
***Published:*** *24 April 2025*

***Keywords:***
HIV, Vertical transmission, antiretroviral prophylaxis, Logistic regression, Mother and child health

***Peer-Review:*** *Externally peer-reviewed*



***Correspondence to:***
Prof. Jean-Paul Koto-Te-Nyiwa Ngbolua
jpngbolua@unikin.ac.cd

***To cite:***
Likulu, J. C. E., Kangite, J. M., Adikaka, F. A., Bosako, T. M., Mundembe, P. B., Bikoko, G. B., Betoko, R. B., Mawunu, M., Ngbolua, K. N., Tshimungu, F. K., & Elongi, J. P. M. (2025). Factors explaining failure to suppress viral load in pregnant women living with HIV in Mbandaka, Equateur Province (Democratic Republic of Congo). *Orapuh Journal*, *6*(4), e1233 https://dx.doi.org/10.4314/orapj.v6i4.33

***ISSN:*** *2644-3740*

*Published by Orapuh, Inc. (info@orapuh.org)*

Editor-in-Chief: Prof. V. E. Adamu
Orapuh, Inc., UMTG PMB 405, Serrekunda, The Gambia, editor@orapuh.org.

## ABSTRACT

### Introduction

Mother-to-child transmission (MTCT) of HIV remains a persistent public health issue, especially in high-burden regions like sub-Saharan Africa. Suppressing maternal viral load through antiretroviral therapy (ART) is central to the prevention of vertical transmission. However, the effectiveness of this strategy is compromised by multiple factors.

### Purpose

The primary aim is to identify the factors associated with virologic non-suppression in HIV-positive pregnant women and assess how these contribute to MTCT, thereby informing strategies to reduce perinatal HIV transmission.

### Methods

A mixed-methods, longitudinal case-control design was adopted. The study population included 438 HIV-positive pregnant women, divided into 146 cases (non-suppressed viral load) and 292 controls (suppressed viral load). Data collection integrated retrospective chart reviews and prospective interviews. Statistical analysis, including logistic regression, was conducted using SPSS version 22.0.

### Results

Key risk factors for virologic failure included poor adherence to ART (OR = 4.983; 95% CI [2.744–9.047]), previous ARV use (OR = 4.458; 95% CI [2.263–8.781]), and HIV-positive status at baseline (OR = 4.374; 95% CI [0.012–9.269]). Conversely, protective factors were prophylaxis initiation by the second month of pregnancy (OR = 0.446; 95% CI [0.202–0.983]), being married (OR = 0.298; 95% CI [0.126–0.705]), and symptomatic HIV status (OR = 0.057; 95% CI [0.012–9.269]).

### Conclusion

Viral suppression failure in pregnant women is largely driven by modifiable factors such as treatment adherence and timing of prophylaxis. Strengthening adherence counselling, promoting early ART initiation, and enhancing social support systems—particularly through marital or community frameworks—are crucial for reducing MTCT. Routine viral load monitoring and personalised interventions remain key to improving outcomes. Further research is warranted to tailor ART delivery models to the socio-cultural context of Mbandaka and similar settings.

## INTRODUCTION

HIV infection is a global pandemic, with developing countries experiencing the most severe impacts in terms of prevalence and healthcare burden (Musanhu et al., 2022; Huynh et al., 2024). The number of HIV-infected children reaching adolescence continues to rise. The failure to suppress viral load may result from poor treatment adherence, pre-existing or acquired drug resistance, or pharmacokinetic factors leading to insufficient plasma drug levels. It is therefore necessary to include other classes of antiretroviral drugs in combination treatments. If treatment regimens fail, patients risk deterioration in their clinical condition (UNAIDS, 2020, 2021; Swinkels et al., 2024). According to WHO guidelines, an HIV-positive pregnant woman whose viral load is suppressed in the four weeks prior to delivery has a low risk of transmitting HIV to her child (Hailu et al., 2025). In addition, breastfeeding is encouraged for women undergoing antiretroviral treatment. However, this risk becomes virtually nil if antiretroviral treatment is initiated before pregnancy and if the viral load remains below 50 copies/mL from conception to delivery (Pollock & Levison, 2023).

Suppression of viral load to an undetectable level in previously treated patients has become an achievable goal with the use of two or more active agents, as shown by the results of the RESIST clinical trials. Vertical transmission remains the main route of HIV infection in children. An infected woman can transmit the virus to her child during pregnancy, childbirth, or breastfeeding. The implementation of prevention of mother-to-child transmission (PMTCT) methods could prevent the majority of pediatric infections. In the absence of intervention, the combined risk of transmission in utero and during childbirth is 15-30%, rising to 20-45% in breastfed children.

The Option B+ approach considerably reduces the risk of mother-to-child transmission of HIV, while preserving the mother's health and reducing the risk of transmission to uninfected partners in the case of discordant couples. To successfully eliminate mother-to-child transmission (e-MTCT), it is essential to integrate PMTCT services into antenatal care in order to identify pregnant women living with HIV as early as possible and preserve their health while preventing vertical transmission. When a person has a viral load exceeding 100,000 copies/mL of blood, the virus is considered highly active, which increases the risk of rapid immune system deterioration.

Despite ongoing efforts, the rate of new vertical HIV transmissions remains high in several regions, with significant variation between countries (UNAIDS, 2020, 2021; Mills et al., 2021). The latest UNAIDS report shows a persistent gap in access to treatment: 74% of adults aged 15 and over living with HIV are receiving treatment, compared with just 54% of children aged 0-14. In the Democratic Republic of the Congo (DRC), the gap is wider, due in particular to limited implementation of screening for children at risk and a lack of follow-up in the maternal and child health system. Viral suppression among people living with HIV on treatment is also among the lowest: only 41% have access to a viral load test, and of those who are tested, 87% achieve viral suppression. As a result, the DRC is struggling to meet the target for viral suppression, primarily due to limited viral load testing capacity.

Studies indicate that efforts to eliminate mother-to-child transmission of HIV are not progressing significantly, despite a high rate of antenatal consultation coverage. However, a relatively low proportion of pregnant women living with HIV receive antiretroviral treatment to prevent mother-to-child transmission. The gap between these two interventions highlights the inadequate integration of HIV care into maternal and child health services (Shah et al., 2022).

In the DRC, the participation rate of women in HIV screening remains below the national target set by the WHO. Two main obstacles prevent universal access to services aimed at eliminating mother-to-child transmission of HIV. First, there is a limited availability of services, which fail to reach a significant portion of pregnant women due to a lack of resources and trained staff. Second, many HIV-positive pregnant women do not receive antiretroviral treatment; a large number disappear after screening, and a significant portion of those who begin treatment do not continue follow-up during the first year. These high dropout rates reflect broader issues in the DRC's healthcare system, particularly in maternal and


https://dx.doi.org/10.4314/orapj.v6i4.33

child health. Access to antiretroviral treatment remains a critical challenge, with many HIV-positive women not receiving the necessary treatment to prevent mother-to-child transmission and being unaware of their HIV status. Since the introduction of prevention of mother-to-child transmission (PMTCT) services, challenges persist in implementing comprehensive antiretroviral protocols. In certain regions, a significant number of children under 15 years old continue to live with HIV, highlighting the ongoing struggle to address pediatric HIV effectively (Mudji et al., 2023).

To improve the predictive value of this theory, other variables from Donabedian's quality of care assessment model, including structural aspects, processes, and outcomes, are incorporated into the main conceptual model to identify organizational factors related to the quality of counseling, testing, and care services. With regard to the factors explaining the lack of viral load suppression among pregnant women in Mbandaka, and the degree of relationship between individual characteristics and viral load suppression, it is postulated that the lack of viral load suppression among women living with HIV in Mbandaka is linked to poor organization of HIV services, a lack of prophylaxis for HIV-positive women, and a lack of follow-up of antiretroviral treatment before and during pregnancy.

## METHODS

This study employed a mixed-methods design, integrating both quantitative and qualitative approaches to examine the factors contributing to viral load non-suppression in pregnant women living with HIV. The quantitative component was a case-control, descriptive, longitudinal cohort study, while the qualitative component consisted of semi-structured face-to-face interviews.

### *Study Population and Sampling Method*

Data were collected from pregnant women who attended the DREAM Centre of Excellence between 2021 and 2023. Participants were randomly selected using a probabilistic sampling method, where women were listed, and participants were selected until the required sample size was reached. The study included women who were HIV-positive, had been on ARV treatment for more than six months, and had undergone viral load testing during both their initial antenatal consultation (ANC) and the second half of their treatment. Pregnant women who had not completed at least six months of ARV treatment were excluded from the study.

The study groups were divided as follows:

- **Cases (146)**: Women whose viral load had not been suppressed after 6-12 months of ARV treatment.
- **Controls (292)**: Women whose viral load had become undetectable after 6-12 months of ARV treatment.

The case-to-control ratio was set at 1:2 to optimize the statistical power of the analysis.

### *Sample Size Calculation*

The sample size was calculated using the Schwartz formula: $N = (eZ^2\ pq)/i^2$

Where:

- e=0.95 (confidence level, typically 95%)
- Z=1.96 (Z-score corresponding to 95% confidence)
- p=0.5 (estimated population proportion, assuming maximum variability)
- q=1−p=0.5
- i=0.05 (desired margin of error, 5%)

This formula yielded a final sample size of 438 participants, including 146 cases and 292 controls. The sample size calculation was based on the UNAIDS 2030 target of 95% viral suppression (UNAIDS, 2020).

### *Data Collection*

Data were collected through a combination of semi-structured face-to-face interviews and a review of participant records. The interviews aimed to gather detailed information on the participants' experiences with ARV treatment, adherence, healthcare access, and other factors potentially affecting viral load suppression.

- **Interview Method**: The semi-structured interviews were conducted using a set of open-ended questions designed to explore social, behavioral, and healthcare-related factors that might influence viral load suppression. Interviewers were trained to ensure consistency in data collection and to minimize interviewer bias.

- **Record Review**: In addition to interviews, participants' medical records were reviewed to extract relevant clinical data, including viral load measurements and treatment history.

Both the qualitative and quantitative data were collected following strict standards of confidentiality and anonymity. All participants provided free and informed consent before participating in the study.

### *Qualitative Data Analysis*

The qualitative data collected through the interviews were analyzed using thematic analysis. This approach involved identifying recurring themes related to factors influencing viral load suppression or non-suppression. The results of the thematic analysis were compared and integrated with the quantitative data to provide a comprehensive understanding of the underlying causes of viral load non-suppression.

### *Quantitative Data Analysis*

The quantitative data were analyzed using descriptive and inferential statistical tools:

- **Descriptive analysis** was performed to summarize the characteristics of the participants, including their demographic information, treatment history, and viral load status. This analysis provided frequencies, averages, and percentages to characterize the study population.
- **Inferential analysis** aimed to assess the relationships between various factors and viral load suppression. Chi-square tests and regression models were used to determine significant associations between demographic, clinical, and treatment-related variables.

### *Ethical Considerations*

This study adhered to strict ethical guidelines, ensuring the privacy and confidentiality of all participant data. In addition to informed consent, participants were assured that their participation was voluntary and that they could withdraw at any time without consequence. To mitigate potential social desirability bias, participants were encouraged to provide honest answers by emphasizing the confidentiality and non-judgmental nature of the study.

## RESULTS

Table 1 presents the demographic and socio-economic characteristics of a sample of 438 HIV-positive pregnant women followed up at the DREAM Centre of Excellence. The majority of participants (94.5%) belong to the 33-37 age group, with smaller percentages in the other age groups. In terms of education level, most participants have secondary education (88.1%), followed by those with primary education (7.3%) and university education (4.1%). Regarding profession, the majority (92.7%) work as housekeepers, while 1.4% are civil servants, and 5.9% are engaged in other occupations. As for marital status, most participants are married (88.6%), while 11.4% are single. Finally, regarding spouses' occupations, 52.3% of participants report that their spouse works in the informal sector, 33.6% are civil servants, and small proportions are engaged in agriculture (0.7%), student (0.2%), or other professional activities (0.5%). A few spouses are unemployed (0.5%) or have no profession (0.7%).

**Table 1**:
Individual Characteristics of Respondents

| Variables | Modalities | n (438) | % |
|---|---|---|---|
| **Age Groups** | 18 - 22 Years | 4 | 0.9 |
| | 23 - 27 Years | 8 | 1.8 |
| | 28 - 32 Years | 4 | 0.9 |
| | 33 - 37 Years | 414 | 94.5 |
| | 38 Years and Older | 8 | 1.8 |
| **Education Level** | Primary | 32 | 7.3 |
| | Secondary | 386 | 88.1 |
| | University | 18 | 4.1 |
| **Profession** | Housekeeper | 406 | 92.7 |
| | Civil Servant | 6 | 1.4 |
| | Others | 26 | 5.9 |
| **Marital Status** | Single | 50 | 11.4 |
| | Married | 388 | 88.6 |
| **Spouse's Occupation** | No Profession | 3 | 0.7 |
| | Small Farmer | 3 | 0.7 |
| | Civil Servant | 147 | 33.6 |
| | Student | 1 | 0.2 |
| | Resourcefulness | 2 | 0.5 |
| | Informal | 229 | 52.3 |
| | Not Applicable | 51 | 11.6 |
| | Unemployed | 2 | 0.5 |

Table 2 presents the distribution of respondents by gestational history in the sample of 438 HIV-positive pregnant women. The majority of participants have had multiple pregnancies, with 41.8% having six or more pregnancies, followed by 36.5% who have had five pregnancies. Smaller proportions have had 4 pregnancies (13%), 3 pregnancies (3.7%), or 2 pregnancies (4.6%), and 0.5% did not report the total number of pregnancies. Regarding miscarriages, most participants (94.1%) did not report any, while 1.8% reported none, 3.7% reported one miscarriage, and 0.5% reported two, with 0.5% not providing this information. As for abortions, the majority (51.8%) did not report any, while 32.6% reported having one abortion, 13.2% reported having two, and 1.8% reported having three abortions, with 0.5% not reporting this information.

**Table 2**:
Breakdown of Respondents by Gestational History

| Variables | Modalities | n (438) | % |
|---|---|---|---|
| **Total Number of Pregnancies** | 2 | 20 | 4.6 |
| | 3 | 16 | 3.7 |
| | 4 | 57 | 13.0 |
| | 5 | 160 | 36.5 |
| | 6 and up | 183 | 41.8 |
| | Not Reported | 2 | 0.5 |
| **Miscarriage** | 0 | 8 | 1.8 |
| | 1 | 16 | 3.7 |
| | 2 | 2 | 0.5 |
| | Not Reported | 412 | 94.1 |
| **Abortion** | 0 | 2 | 0.5 |
| | 1 | 143 | 32.6 |
| | 2 | 58 | 13.2 |
| | 3 | 8 | 1.8 |
| | Not Reported | 227 | 51.8 |

Table 3 shows the distribution of respondents according to gestational age, focusing on specific indicators relating to premature infants, in utero deaths, and deceased infants. Regarding the total number of premature babies, 7.8% of participants reported having one premature baby, and 0.9% reported having two, while 91.3% did not report this information. For the total number of deaths in utero, 0.5% of participants reported one death, another 0.5% reported one death, and 99.1% did not provide this information. Concerning the total number of children who died, the majority (56.6%) reported having one child who died, while 5.9% reported having two, and 37.4% did not report this information.

Table 3 provides a breakdown of respondents by gestation-related characteristics. Regarding premature births, 7.8% of participants reported having one premature baby, while 0.9% had two. A large majority (91.3%) did not report this information. For deaths in utero, 0.5% of participants reported one death, and another 0.5% also reported one death, with 99.1% not providing this information. As for children who died, 56.6% reported one child's death, 5.9% reported two, and 37.4% did not provide this information.

**Table 3**
Breakdown of Respondents by Gestational Characteristics

| Variables | Modalities | n (438) | % |
|---|---|---|---|
| **Total number of premature babies** | 1 | 34 | 7.8 |
| | 2 | 4 | 0.9 |
| | No reported | 400 | 91.3 |
| **Gestation/Total number of deaths in utero** | 0 | 2 | 0.5 |
| | 1 | 2 | 0.5 |
| | No reported | 434 | 99.1 |
| **Total number of children who died** | 1 | 248 | 56.6 |
| | 2 | 26 | 5.9 |
| | No reported | 164 | 37.4 |

Table 4 shows the distribution of respondents by parity. The majority of participants were multiparous (76.2%), followed by large multiparous women (19.2%), and a small percentage were primiparous (4.6%).

**Table 4**
Breakdown of Respondents by Parity

| Variables | Modalities | n (438) | % |
|---|---|---|---|
| **Parity** | Primiparous | 20 | 4.6 |
| | Large multiparous | 84 | 19.2 |
| | Multiparous | 334 | 76.2 |

Table 5 shows how the women surveyed participated in antenatal consultations (ANC). Most participants (94.5%) sought ANC during the first trimester (>T1), while 5.5% did not receive any antenatal care.

**Table 5**
Respondents' Membership of the NPC

| Variables | Modalities | n (438) | % |
|---|---|---|---|
| Period of first ANC | >T1 | 414 | 94.5 |
| | None | 24 | 5.5 |

Table 6 shows how pregnant women were screened and their HIV+ status. All participants (100%) accepted HIV testing and retrieved their results. Most diagnoses were made through CDV (84%), while 16% were diagnosed through ANC. Regarding the timing of serological diagnosis, 20.8% were diagnosed before pregnancy, 26.3% during pregnancy, and 0.5% during breastfeeding. The majority (52.5%) did not report the timing of the diagnosis. Among those diagnosed during pregnancy, 44.5% were in the second trimester, 6.4% in the third trimester, and 45.9% did not report the trimester. Regarding HIV status, 21.9% of respondents were HIV-positive (AC), while 78.1% were HIV-negative (NC). Most participants (98.2%) were diagnosed with HIV1, 0.9% with both HIV1 and HIV2, and 0.9% had no virological typing performed. Among the HIV-positive women, 17.8% were symptomatic, with 9.6% having no symptoms applicable, and 72.4% did not report symptoms. The most common symptoms included fever and weight loss (11.2%), weight loss alone (6.4%), and a few cases of vaginal candidiasis or herpes (0.5%).

**Table 6**
Screening Methods and HIV+ Status of Pregnant Women

| Variables | Modalities | n (438) | % |
|---|---|---|---|
| **HIV testing (acceptability)** | Yes | 438 | 100.0 |
| **Withdrawal of result** | Yes | 438 | 100.0 |
| **Circumstances of diagnosis** | CDV | 368 | 84.0 |
| | ANC | 70 | 16.0 |
| **Period of serological diagnosis** | Before pregnancy | 91 | 20.8 |
| | During pregnancy | 115 | 26.3 |
| | During breastfeeding | 2 | 0.5 |
| | Not reported | 230 | 52.5 |
| **If during pregnancy (trimester)** | Second trimester | 195 | 44.5 |
| | Third trimester | 28 | 6.4 |
| | Not reported | 201 | 45.9 |
| | Not applicable | 14 | 3.2 |
| **HIV+ status of the respondent** | AC | 96 | 21.9 |
| | NC | 342 | 78.1 |
| | Not reported | 10 | 2.3 |
| **Virological typing** | HIV1 | 430 | 98.2 |
| | HIV1+HIV2 | 4 | 0.9 |
| | Not performed | 4 | 0.9 |
| **Symptomatic HIV-positive pregnant women** | No | 360 | 82.2 |
| | Yes | 78 | 17.8 |
| **Type of symptoms** | Not applicable | 42 | 9.6 |
| | Not reported | 317 | 72.4 |
| | Fever, weight loss | 49 | 11.2 |
| | Weight loss | 28 | 6.4 |
| | Vaginal candidiasis, vaginal herpes | 2 | 0.5 |

Table 7 provides information on the screening and HIV+ status of pregnant women, highlighting the prevalence of other chronic diseases and the stage of infection at the time of enrollment. The majority (86.1%) reported having no chronic diseases, with 5% not providing this information. Other reported conditions included fever (5.7%), epilepsy (1.4%), hypertension (0.9%), and small percentages reporting diabetes (0.9%) and other diseases. Regarding AIDS stages at enrollment, 82.6% were in stage III, 10% in stage I, and 7.3% in stage II. Most participants (95.9%) received treatment for sexually transmitted infections (STI), while 3.7% did not receive treatment, and 0.5% did not undergo treatment. Regarding spouse screening, 93.6% of participants reported that their spouses were screened, while 2.3% were not, and 0.9% did not have screening done, with 3.2% indicating that it was not applicable. As for HIV results, 64.4% tested positive, 9.6% tested negative, 22.4% did not report their results, and 3.7% indicated not applicable.

**Table 7**:
Screening method and HIV+ status of pregnant women

| Variables | Modalities | n (438) | % |
|---|---|---|---|
| **Other chronic diseases** | None | 377 | 86.1 |
| | Not reported | 22 | 5.0 |
| | HTA | 4 | 0.9 |
| | Fever | 25 | 5.7 |
| | Diabetes | 4 | 0.9 |
| | Epilepsy | 6 | 1.4 |



https://dx.doi.org/10.4314/orapj.v6i4.33

| Variables | Modalities | n (438) | % |
|---|---|---|---|
| **AIDS stage at membership** | I | 44 | 10.0 |
| | II | 32 | 7.3 |
| | III | 362 | 82.6 |
| **STI and its treatment** | Yes | 420 | 95.9 |
| | No | 16 | 3.7 |
| | Not realized (nr) | 2 | 0.5 |
| **Spouse screening** | Yes | 410 | 93.6 |
| | No | 10 | 2.3 |
| | Not realized (nr) | 4 | 0.9 |
| | Not applicable (na) | 14 | 3.2 |
| **HIV result** | (+) Positive | 282 | 64.4 |
| | (-) Negative | 42 | 9.6 |
| | Not reported (ns) | 98 | 22.4 |
| | Not applicable (na) | 16 | 3.7 |

**Table 8**:
Opportunistic infections and management

| Variables | Modalities | n (438) | % |
|---|---|---|---|
| **Tpi-sp (doses received)** | 3 | 2 | 0.5 |
| | Not reported (ns) | 436 | 99.5 |
| **Putting on ctx** | Yes | 364 | 83.1 |
| | No | 74 | 16.9 |
| **Prevention of OI** | Yes | 364 | 83.1 |
| | No | 74 | 16.9 |
| **Opportunistic infections during pregnancy** | No | 430 | 98.2 |
| | Yes | 8 | 1.8 |
| **Pathology which can increase time during pregnancy** | Genital herpes | 6 | 1.4 |
| | None | 228 | 52.1 |
| | Not reported | 204 | 46.6 |
| **Eclampsia or preeclampsia** | Yes | 4 | 0.9 |
| | No | 434 | 99.1 |
| **Associated breast pathology** | Yes | 4 | 0.9 |
| | No | 434 | 99.1 |
| **VAT coverage** | Yes | 10 | 2.3 |
| | No | 428 | 97.7 |
| **Access to family planning** | Yes | 4 | 0.9 |
| | No | 434 | 99.1 |

Table 8 presents data on opportunistic infections and the management of pregnant women. Regarding the number of doses received for Tpi-sp, 0.5% of participants reported receiving three doses, while 99.5% did not report this information. For the use of cotrimoxazole (ctx) and prevention of opportunistic infections (OI), 83.1% of participants indicated they were using both, while 16.9% did not. The majority of participants (98.2%) did not experience opportunistic infections during pregnancy, while 1.8% did. In terms of conditions that could increase the risk of time to delivery during pregnancy, 1.4% of participants reported genital herpes, 52.1% reported no related pathology, and 46.6% did not report this information. Only 0.9% of participants reported having eclampsia or preeclampsia, and the same percentage reported associated breast pathology. Most participants (97.7%) did not receive VAT coverage, and 99.1% did not have access to family planning, while only 0.9% had access to family planning.

Table 9 shows the frequency and CD4 counts of pregnant women during the study. Regarding CD4 counts, only 0.5% of participants had counts greater than 350 µL/mm³ at the beginning of pregnancy, while 99.5% did not have this measurement performed. No CD4 counts were recorded during or at the end of pregnancy, as 100% of participants did not have these measurements realized.

**Table 9**:
Periodicity and CD4 rate of respondents

| Variables | Modalities | n (438) | % |
|---|---|---|---|
| **CD4 counts at the beginning of pregnancy** | > 350µL/mm³ | 2 | 0.5 |
| | Not realized (nr) | 436 | 99.5 |
| **CD4 counts during pregnancy** | Not realized (nr) | 438 | 100.0 |
| **CD4 counts at the end of pregnancy** | Not realized (nr) | 438 | 100.0 |

Table 10 illustrates the periodicity and viral load of pregnant women in the study, focusing on viral load suppression as well as values measured at the beginning, during and at the end of pregnancy. Regarding viral load



https://dx.doi.org/10.4314/orapj.v6i4.33

suppression, 66.7% of participants achieved suppression, while 33.3% did not. In early pregnancy, 21.0% had a viral load of less than 40 copies/mL, 0.9% had less than 1000 copies/mL, and 3.0% had more than 1000 copies/mL, with 2.0% not achieving a measurable viral load. At the end of pregnancy, 23.2% of participants had a viral load of less than 40 copies/mL, 6.0% had less than 1000 copies/mL, and 5.7% had more than 1000 copies/mL, with 4.1% not achieving a measurable viral load.

**Table 10**:
Periodicity and viral load of pregnant women

| Variables | Modalities | n (438) | % |
|---|---|---|---|
| **Viral load suppression** | Yes | 292 | 66.7 |
| | Not | 146 | 33.3 |
| **Viral load in early pregnancy** | < 40 Copies/mL | 92 | 21.0 |
| | < 1000 Copies/mL | 4 | 0.9 |
| | > 1000 Copies/mL | 13 | 3.0 |
| | Not achieved (NR) | 9 | 2.0 |
| **Viral load in early pregnancy** | < 40 Copies/mL | 98 | 22.3 |
| | < 1000 Copies/mL | 28 | 6.3 |
| | > 1000 Copies/mL | 6 | 1.3 |
| | Not achieved (NR) | 17 | 4.0 |
| **Viral load at the end of pregnancy** | < 40 copies/mL | 102 | 23.2 |
| | < 1000 Copies/mL | 26 | 6.0 |
| | > 1000 Copies/mL | 25 | 5.7 |
| | Not achieved (NR) | 18 | 4.1 |

Table 11 shows the results of the other tests carried out on pregnant women, highlighting the different tests performed before the start of treatment. Regarding other pre-therapeutic assessments, 98.9% of participants underwent these assessments, while 0.2% did not, and 0.9% had it marked as not applicable. For specific tests, 53.9% of participants had a complete blood count (NFS), while 46.1% had it marked as not applicable. All participants (100%) had their creatinine levels tested, 84.5% had GOT-GOPT tests, and 15.5% did not. Sputum tests (X-PERT) were performed for 82.6% of participants, while 16.4% did not, and 0.9% had it marked as not applicable. For TDR/PALU, 94.5% of participants were tested, while 4.1% were not, and 1.4% had it marked as not applicable.

**Table 11**:
Other assessments carried out

| Variables | Modalities | n (438) | % |
|---|---|---|---|
| **Other pre-therapeutic assessments** | Yes | 433 | 98.9 |
| | No | 1 | 0.2 |
| | Not applicable (NA) | 4 | 0.9 |
| **NFS** | Yes | 236 | 53.9 |
| | Not applicable (NA) | 202 | 46.1 |
| **Creatinine** | Yes | 438 | 100.0 |
| **GOT-GOPT** | Yes | 370 | 84.5 |
| | No | 68 | 15.5 |
| **X-PERT (Sputum)** | Yes | 362 | 82.6 |
| | No | 72 | 16.4 |
| | Not applicable (NA) | 4 | 0.9 |
| **TDR/PALU** | Yes | 414 | 94.5 |
| | No | 18 | 4.1 |
| | Not applicable (NA) | 6 | 1.4 |

Table 12 shows the screening and HIV+ status of pregnant women, with particular emphasis on their antiretroviral (ARV) treatment or prophylaxis and the reasons for their induction. Regarding treatment or prophylaxis with ARVs, 81.7% of participants received treatment more than three months before delivery, and 18.3% received it two months before delivery. Most ARV inductions occurred in 2021 (53.9%), followed by 2022 (40.6%), with a smaller number in 2023 (1.8%). The primary reason for ARV induction was for health purposes (64.8%), followed by pregnancy-related reasons (33.8%). In terms of timing, 55.7% of inductions occurred before pregnancy, 29.7% during pregnancy, and 14.6% after delivery. The therapeutic line during pregnancy was predominantly line I (99.1%), with 0.9% on line II. All participants (100%) received the TLD therapeutic scheme. ARV interruption was reported by 28.8% of participants and 77.6% had normal adherence to the treatment, while 22.4% had poor compliance. Poor adherence was mostly attributed to ART interruption (19.2%), alcohol intake (14.6%), or loss to follow-up (0.9%), with 51.4% of cases being unreported or not applicable.

**Table 12**:
Screening method and HIV+ status of pregnant women

| Variables | Modalities | n (438) | % |
|---|---|---|---|
| **Treatment or prophylaxis with ARVs** | 2 months before delivery | 80 | 18.3 |
| | > 3 months before delivery | 358 | 81.7 |
| | Not reported (NS) | 6 | 1.4 |
| **Year of ARV induction** | 2021 | 236 | 53.9 |
| | 2022 | 178 | 40.6 |
| | 2023 | 8 | 1.8 |
| | Not reported | 16 | 3.7 |
| **Reason for ARV induction** | For own health | 284 | 64.8 |
| | For pregnancy (ANC/PMTCT) | 148 | 33.8 |
| | Not reported | 6 | 1.4 |
| **Period of induction** | Before pregnancy | 244 | 55.7 |
| | During pregnancy | 130 | 29.7 |
| | After delivery | 64 | 14.6 |
| **Therapeutic line during pregnancy** | I | 434 | 99.1 |
| | II | 4 | 0.9 |
| **Therapeutic scheme** | TLD | 438 | 100.0 |
| **Historic ARV interruption** | No | 312 | 71.2 |
| | Yes | 126 | 28.8 |
| **Concept of observance** | Normal | 340 | 77.6 |
| | Poor | 98 | 22.4 |
| **If poor compliance** | ART interruption | 84 | 19.2 |
| | Alcohol intake | 64 | 14.6 |
| | Lost to follow-up | 4 | 0.9 |
| | Distance | 5 | 1.1 |
| | Not reported (NS) | 225 | 51.4 |
| | Not applicable (NA) | 56 | 12.8 |

Table 13 presents the care provided during and after childbirth for the pregnant women in the study. Regarding gestational age, the vast majority of pregnancies were at more than 37 weeks of gestation (98.9%), while only 1.1% was under 37 weeks. During childbirth, 88.6% of the cases were not reported or not applicable, and 1.4% did not receive care. Vaginal disinfection was not applicable for 11.0% of the cases, and for 89.0% it was not reported. Compliance with the membrane rupture deadline was not applicable for 11.0% of cases, with 89.0% of cases not reported. The limitation of invasive procedures was not applicable for 10.0% and not reported for 90.0%. Washing the newborn was not performed in 0.9% of cases, while 10.0% were not applicable. Eye cleaning was not applicable for 96.3% of newborns, and 3.7% of cases were not reported.

**Table 13**:
Care provided during and after childbirth

| Variables | Modalities | n (438) | % |
|---|---|---|---|
| **Gestational age (known)** | >37 SA | 433 | 98.9 |
| | < 37 SA | 5 | 1.1 |
| **Care provided during childbirth** | No | 6 | 1.4 |
| | Not applicable (NA) | 44 | 10.0 |
| | Not reported (NS) | 388 | 88.6 |
| **Disinfection of the vagina** | Not applicable (NA) | 48 | 11.0 |
| | Not reported (NS) | 390 | 89.0 |
| **Compliance with membrane rupture deadline** | Non applicable (NA) | 48 | 11.0 |
| | Not reported (NS) | 390 | 89.0 |
| **Limit of invasive procedures** | Not applicable (NA) | 44 | 10.0 |
| | Not reported (NS) | 394 | 90.0 |
| **Washing the newborn** | No | 4 | 0.9 |
| | Not applicable (NA) | 44 | 10.0 |
| | Not reported (NS) | 390 | 89.0 |
| **Eye cleaning** | Not applicable (NA) | 422 | 96.3 |
| | Not reported (NS) | 16 | 3.7 |

Table 14 looks at antiretroviral therapy (ART) adherence among pregnant women. The concept of observance was considered normal for 77.6% of patients, while 20.5% had poor compliance, and 1.8% had no reported data. In cases of poor compliance, 19.2% experienced ART interruptions, 14.6% had alcohol intake issues, and 0.9% were lost to follow-up. 1.1% reported distance as a factor, while 51.4% had no reported data, and 12.8% had not applicable data. All deliveries took place in the maternity ward (100%), and premature rupture of water had no reported data (100%). Traumatic obstetric procedures during childbirth were absent in 94.1% of cases, with 5.9% not reported. Regarding breast pathology during pregnancy and/or breastfeeding, 0.5% experienced cracks, 98.6% had no issues, and 0.9% had other conditions.

**Table 14**:
ART adherence

| Variables | Modalities | n (438) | % |
|---|---|---|---|
| **Concept of observance** | Normal | 340 | 77.6 |
| | Poor | 98 | 22.4 |
| **If poor compliance** | ART interruption | 84 | 19.2 |
| | Alcohol intake | 64 | 14.6 |
| | Lost to follow-up | 4 | 0.9 |
| | Distance | 5 | 1.1 |
| | Not reported (NS) | 225 | 51.4 |
| | Not applicable (NA) | 56 | 12.8 |

| Variables | Modalities | n (438) | % |
|---|---|---|---|
| **Deliveries in maternity ward** | Yes | 438 | 100.0 |
| **Premature rupture of water** | Not reported | 438 | 100.0 |
| **Traumatic obstetric procedures during childbirth** | No | 412 | 94.1 |
| | Not reported (NS) | 26 | 5.9 |
| **Breast pathology during pregnancy/breastfeeding** | Cracks | 2 | 0.5 |
| | No issues | 432 | 98.6 |

Table 15 examines the notions of sharing information about test results and health decisions between couples. The concept of observance was considered normal for 77.6% of patients, while 20.5% had poor compliance, and 1.8% had no reported data. In cases of poor compliance, 19.2% experienced ART interruptions, 14.6% had alcohol intake issues, and 0.9% were lost to follow-up. 1.1% reported distance as a factor, while 51.4% had no reported data, and 12.8% had not applicable data. All deliveries took place in the maternity ward (100%), and premature rupture of water had no reported data (100%). Traumatic obstetric procedures during childbirth were absent in 94.1% of cases, with 5.9% not reported. Regarding breast pathology during pregnancy and/or breastfeeding, 0.5% experienced cracks, 98.6% had no issues, and 0.9% had other conditions.

**Table 15**:
Notions of information sharing

| Variables | Modalities | n (438) | % |
|---|---|---|---|
| **Result information between the couple** | Yes | 348 | 79.5 |
| | No | 90 | 20.5 |
| | Not reported | 6 | 1.4 |
| | Not applicable | 4 | 0.9 |
| **Information of result towards another confidant** | Yes | 36 | 8.2 |
| | No | 390 | 89.0 |
| | Not reported | 12 | 2.7 |
| **Reason for lack of information sharing** | Fear of spouse | 6 | 1.4 |
| | Discrimination | 111 | 25.3 |
| | Less importance | 210 | 47.9 |
| | Low awareness | 2 | 0.5 |
| | Ignorance | 30 | 6.8 |
| | Not reported | 79 | 18.0 |

Table 16 presents an analysis of the variables associated with viral load suppression in HIV-positive pregnant women. The results show that several factors are significantly associated with viral load suppression in HIV-positive pregnant women. Women without symptomatic HIV have better viral load suppression (98.6% vs. 74% in those with symptoms), with a statistically significant difference ($\chi^2 = 40.431$, $p = 0.000$). Respondents with an active HIV+ status also showed better viral load suppression (29.1% vs. 7.5% for non-carriers, $\chi^2 = 26.475$, $p = 0.000$). Having a history of antiretroviral (ARV) treatment or ARV prophylaxis before pregnancy also impacts viral suppression, with women without prior treatment showing higher rates of suppression (86.6% vs. 40.4%, $\chi^2 = 101.52$, $p = 0.000$). Women who received ARV prophylaxis more than 3 months before delivery also showed better results (89% vs. 11%, $\chi^2 = 31.321$, $p = 0.000$). Furthermore, the concept of good treatment adherence is crucial, with higher suppression rates among women with normal adherence (76.5% vs. 32.7% for poor adherence, $\chi^2 = 65.726$, $p = 0.000$). In contrast, factors such as marital status, gestational age, opportunistic infections, and result sharing between couples did not show significant differences regarding viral load suppression.

**Table 16**:
Relationship between respondents' individual characteristics, service organisation, ANC, treatment, and sero-virological follow-up

| Variables | Modalities | VIRAL LOAD SUPPRESSION | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Oui (292) | % | Non (146) | % | $\chi^2$ | RR | P | IC95% |
| **Marital status** | Married | 254 | 87.0 | 134 | 91.8 | 2.213 | 1.439 | 0.137 | (0.862-2.401) |
| | Single | 38 | 13.0 | 12 | 8.2 | | | | |
| **Pregnant woman sero+ symptoms** | No | 216 | 74 | 144 | 98.6 | 40.431 | 15.6 | 0.000 | (3.949-61.629) |
| | Yes | 76 | 26 | 2 | 1.4 | | | | |
| **HIV+ status of the respondent** | AC | 85 | 29.1 | 11 | 7.5 | 26.475 | 1.463 | 0.000 | (1.308-1.636) |
| | NC | 205 | 70.9 | 137 | 92.5 | | | | |
| **Gestational age (known)** | >37 SA | 287 | 98.3 | 146 | 100.0 | 2.529 | 0.663 | 0.112 | (0.620-0.709) |
| | < 37 SA | 5 | 1.7 | 0 | 0.0 | | | | |
| **Opportunistic infections** | NO | 285 | 97.6 | 145 | 99.3 | 1.592 | 0.757 | 0.207 | (0.578-0.993) |
| | YES | 7 | 2.4 | 1 | 0.7 | | | | |
| **History of ARVs** | NO | 253 | 86.6 | 59 | 40.4 | 101.52 | 2.620 | 0.000 | (2.007-3.419) |
| | YES | 39 | 13.4 | 87 | 59.6 | | | | |
| **ARV prophylaxis** | 2 months before delivery | 32 | 11.0 | 48 | 32.9 | 31.321 | 0.551 | 0.000 | (0.428-0.728) |
| | > 3 months before delivery | 260 | 89.0 | 98 | 67.1 | | | | |
| **Result information between the couple** | Yes | 234 | 67.2 | 114 | 32.8 | 0.252 | 1.043 | 0.616 | (0.880-1.237) |
| | No | 58 | 64.4 | 32 | 35.6 | | | | |
| **Notion of compliance** | Normal | 260 | 76.5 | 80 | 23.5 | 65.726 | 0.349 | 0.000 | (0.276-0.442) |
| | Bad | 32 | 32.7 | 66 | 67.3 | | | | |

Table 17 analyses the relationship between respondents' individual characteristics and the probability of not suppressing their viral load. The analysis reveals



https://dx.doi.org/10.4314/orapj.v6i4.33

significant associations between various factors and viral load suppression in HIV-positive pregnant women. Women with symptomatic HIV are significantly less likely to achieve viral load suppression compared to those without symptoms (26% vs. 74%, OR = 0.39, p = 0.000). Respondents with an active HIV+ status (AC) showed a much higher likelihood of achieving viral suppression compared to non-carriers (NC) (29.1% vs. 7.5%, OR = 5.040, p = 0.000). A history of antiretroviral (ARV) treatment is also crucial for viral load suppression, as women without a history of ARVs have a significantly lower rate of suppression (86.6% vs. 40.4%, OR = 9.566, p = 0.000). Prophylactic ARV use more than 3 months before delivery also increased the likelihood of suppression (89% vs. 11%, OR = 0.251, p = 0.000). Compliance with ARV treatment plays a critical role, with normal adherence being associated with significantly higher suppression rates (76.5% vs. 32.7% for poor adherence, OR = 6.703, p = 0.000). In contrast, marital status, opportunistic infections, and result sharing between couples did not show significant effects on viral load suppression.

**Table 17**:
Relationship between respondents' individual characteristics and the probability of not suppressing their viral load

| | | Viral load suppression | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Variables** | **Modalities** | **Yes (292)** | **%** | **No (146)** | **%** | **Or** | **P** | **IC95%** |
| **Marital status** | Married | 254 | 87.0 | 134 | 91.8 | 0.559 | 0.137 | (0.303-1.184) |
| | Single | 38 | 13.0 | 12 | 8.2 | | | |
| **Pregnant women sero+ symptoms** | No | 216 | 74.0 | 144 | 98.6 | 0.39 | 0.000 | (0.010-0.163) |
| | Yes | 76 | 26.0 | 2 | 1.4 | | | |
| **HIV+ status of the respondent** | AC | 85 | 29.1 | 11 | 7.5 | 5.040 | 0.000 | (2.593-9.793) |
| | NC | 205 | 70.9 | 137 | 92.5 | | | |
| **Opportunistic infections** | No | 285 | 97.6 | 145 | 99.3 | 0.281 | 0.207 | (0.034-2.304) |
| | Yes | 7 | 2.4 | 1 | 0.7 | | | |
| **History of ARVs** | No | 253 | 86.6 | 59 | 40.4 | 9.566 | 0.000 | (5.966-15.339) |
| | Yes | 39 | 13.4 | 87 | 59.6 | | | |
| **ARV prophylaxis** | 2 months before delivery | 32 | 11.0 | 48 | 32.9 | 0.251 | 0,000 | (0.152-0.416) |
| | > 3 months before delivery | 260 | 89.0 | 98 | 67.1 | | | |
| **Result information between the couple** | Yes | 234 | 67.2 | 114 | 32.8 | 1.132 | 0,616 | (0.69-1.842) |
| | No | 58 | 64.4 | 32 | 35.6 | | | |
| **Notion of compliance** | Normal | 260 | 76.5 | 80 | 23.5 | 6.703 | 0,000 | (4.103-10.952) |
| | Bad | 32 | 32.7 | 66 | 67.3 | | | |

Table 18 presents Spearman's bivariate correlation between several independent variables and viral load suppression, revealing varied results. The analysis of independent variables associated with viral load suppression in HIV-positive pregnant women shows several significant findings. The presence of HIV symptoms is strongly negatively correlated with viral load suppression (COR = -0.304, p = 0.000), indicating that symptomatic individuals are less likely to achieve suppression. Compliance with antiretroviral therapy (ARVs) is positively associated with viral suppression (COR = 0.387, p = 0.000), emphasizing the importance of adherence to treatment. History of ARV treatment also shows a significant positive correlation (COR = 0.481, p = 0.000), suggesting that prior ARV use contributes to better viral load control. Prophylactic ARV use is negatively correlated with viral suppression (COR = -0.267, p = 0.000), which could imply that earlier initiation may influence suppression. Gestational age and marital status, while factors to consider, did not show significant effects on viral suppression (p = 0.112 and p = 0.138, respectively). The presence of opportunistic infections and sharing information between couples did not show significant effects (p = 0.208 and p = 0.617, respectively).

**Table 18**:
Bivariate correlation of spsearmen

| **Independent variables** | **Viral load suppression** | | | |
|---|---|---|---|---|
| | ***COR (rho)*** | ***SD*** | ***Bias*** | ***p*** |
| HIV positive + symptom | -0.304 | 0.026 | 0.01 | 0.000 |
| status + HIV | 0.246 | 0.38 | -0.01 | 0.38 |
| Gestational age | -0.76 | 0.18 | 0.02 | 0.112 |
| Notion of compliance | 0.387 | 0.049 | 0.01 | 0.000 |
| Opportunistic infections | -0.60 | 0.037 | 0.002 | 0.208 |
| History of ARVs | 0.481 | 0.040 | -0.02 | 0.000 |
| Prophylaxis | -0.267 | 0.51 | 0.001 | 0.000 |
| Marital status | -0.71 | 0.0042 | -0.01 | 0.138 |
| Couple information | 0.024 | 0.048 | -0.002 | 0.617 |

The logistic regression analysis of variables associated with viral load suppression (Table 19) reveals several significant factors. HIV-positive symptomatic individuals were less likely to achieve viral suppression, with an odds ratio (OR) of 0.057 (p = 0.000), indicating a strong negative correlation between symptoms and suppression. HIV status also played a crucial role, as those with an AC status were significantly more likely to experience suppression (OR = 4.374, p = 0.000). The concept of observance was another major determinant, with those adhering well to their ARVs being significantly more likely to achieve suppression (OR = 4.983, p = 0.000). A history of ARV

treatment was strongly associated with better suppression (OR = 4.458, p = 0.000). Interestingly, prophylaxis initiation 2 months before delivery showed a negative effect on suppression (OR = 0.446, p = 0.045), indicating that earlier initiation may not always lead to better outcomes. Finally, marital status showed a significant association, with married individuals less likely to suppress their viral load (OR = 0.298, p = 0.006), possibly reflecting issues such as access to care or support within relationships.

**Table 19**:
Logistic regression and final model for non-suppression of viral load in pregnant women

| Variables | Modalities | N | S.D. | Wald | p | OR | IC 95% |
|---|---|---|---|---|---|---|---|
| **HIV positive + symptomatic** | No | 360 | 0.790 | 13.106 | 0.000 | 0.057 | [0.012-9.269] |
| | Yes | 78 | | | | | |
| **HIV status** | AC | 96 | 0.392 | 14.139 | 0.000 | 4.374 | [2.027-9.438] |
| | NC | 342 | | | | | |
| **Observance** | Normal | 340 | 0.304 | 27.849 | 0.000 | 4.983 | [2.744-9.047] |
| | Bad | 98 | | | | | |
| **ARV history** | No | 430 | 0.346 | 18.672 | 0.000 | 4.458 | [2.263-8.781] |
| | Yes | 8 | | | | | |
| **Prophylaxis** | 2 Months | 80 | 0.403 | 4.007 | 0.045 | 0.446 | [0.202-0.983] |
| | > 3 Months | 358 | | | | | |
| **Marital status** | Married | 388 | 0.439 | 7.608 | 0.006 | 0.298 | [0.126-0.705] |
| | Single | 50 | | | | | |

## DISCUSSION

This study examines the factors influencing the failure to achieve viral load suppression in pregnant women living with HIV. Among the most prominent factors, we identified the serological status of HIV+ women, adherence to antiretroviral therapy (ART), history of previous ARV treatment, prophylactic and immunological follow-up, and marital status. Our findings contribute to existing literature by emphasizing the importance of early HIV testing and ART initiation, adherence to treatment, and supportive interventions, especially in regions with varying access to healthcare.

### *HIV+ Serological Status and ART Initiation*

Our results showed that a significant portion of pregnant women were receiving ART: 68.4% of participants were taking ARVs for their health, with 55.7% beginning treatment before pregnancy, 29.7% during pregnancy, and 14.6% after childbirth. Moreover, 99.1% of participants received first-line treatment during pregnancy. Among the newly diagnosed women, the likelihood of failing to achieve viral load suppression was 4.37 times higher (OR = 4.374; 95% CI [0.012–9.269]). A study by Collinet (2019) also indicated that late HIV diagnosis during pregnancy or illness resulted in poorer outcomes; however, this result did not show statistical significance (p = 0.074), contrasting with our findings, where early ART was linked to better outcomes. This is consistent with the work of Woldesenbet et al. (2020), which highlighted that late antenatal care (ANC) booking and delayed ART initiation were the main contributors to viral non-suppression. They also found that ART initiation before pregnancy did not guarantee viral suppression, as more than one-quarter of women who began treatment before pregnancy still failed to achieve suppression by their third trimester. These findings point to the need for continuous monitoring of viral load and enhanced counselling and adherence support during pregnancy to ensure successful outcomes.

### *Adherence to Antiretroviral Therapy (ART)*

Non-adherence to ART is another critical factor affecting viral load suppression. Our study revealed that poor adherence was significantly associated with a 6.7-fold higher likelihood of non-suppression (OR = 6.703; 95% CI [4.103–10.952]). Factors contributing to non-adherence included forgetfulness, adverse effects, financial constraints, medication stock-outs, and psychological factors such as depression. This finding aligns with research by Musumari et al. (2014), which outlined similar barriers to adherence, including geographical isolation and substance abuse. Despite these challenges, interventions targeting adherence support are crucial. Woldesenbet et al. (2020) suggested that providing enhanced adherence support could improve viral suppression rates, particularly for pregnant women. In contrast, our study found that married women had a significantly lower likelihood of non-suppression (OR = 0.298; CI95% [0.126–0.705]), indicating that marital status could serve as a protective factor. This contrasts with the findings of Zondi et al. (2020), who noted higher odds of non-suppression among married women, potentially due to non-disclosure of HIV status or lack of spousal support. This discrepancy suggests that the influence of marital status on viral suppression may vary depending on local cultural and social dynamics.

*History of Previous ARV Treatment*

The study also identified that 59.6% of participants had a history of ARV treatment, and this history increased the risk of non-suppression 9.56-fold (OR = 9.556; CI 95% [5.966–15.339]). This correlation between previous ARV use and non-suppression may reflect non-adherence, pharmacological resistance, or suboptimal monitoring of ART efficacy, as highlighted by Kamian (2020). These findings underscore the importance of regular monitoring and adjustments to ART protocols to ensure effective treatment and prevent the development of resistance. This is in line with the recommendations from Adeniyi et al. (2020), who stressed the need for enhanced monitoring and support to optimize ART adherence among pregnant women.

*Prophylaxis and Immunological Follow-up*

Prophylaxis initiated after the third month of pregnancy was found to be a protective factor against non-suppression (OR = 0.446; CI95% [0.202–0.983]). However, late initiation of ART can still contribute to transmission risks, as highlighted by Ngwej et al. (2015), who found that delayed screening increased the risk of mother-to-child transmission due to a higher prevalence of opportunistic infections and placental permeability. This underscores the need for early and consistent screening and ART initiation during pregnancy.

*HIV Symptoms and Risk of Non-Suppression*

Our study also found that the presence of HIV-related symptoms during pregnancy significantly increased the risk of failure to suppress viral load (RR = 15.6; CI95% [3.949–61.629]; $p < 0.001$). This is consistent with previous research by Blanche et al. (1994) and Rurahoze (2020), who found higher transmission rates among symptomatic mothers. In Lubumbashi, Mukuku (as cited by Rurahoze, 2020) reported that mothers with opportunistic infections during pregnancy had a transmission rate of 46.9%, compared with 9.2% for those without symptoms.

*Marital Status and Virological Non-Suppression*

In our study, marriage was found to be a protective factor against non-suppression, which differs from the findings of Zondi et al. (2020), who reported high odds of virological non-suppression among married participants. This difference may reflect contextual differences in marital dynamics, where, in our study, marital status could imply better social support for adherence. On the other hand, Zondi et al. (2020) suggested that non-disclosure of HIV status within marriages could hinder adherence to ART.

These findings highlight several critical factors that contribute to the failure to achieve viral suppression in pregnant women living with HIV. Early ART initiation, adherence to treatment, timely prophylaxis, and the absence of HIV-related symptoms are essential to improving viral suppression outcomes. Our study further underscores the importance of addressing barriers to adherence, such as stigma, financial constraints, and non-disclosure within marriages. These findings support the implementation of targeted interventions aimed at improving early ANC booking, promoting adherence, and strengthening counselling services, which are crucial for the elimination of mother-to-child transmission of HIV in our region. Future research should focus on tailored interventions for specific subgroups, such as women with a history of ARV treatment or younger women aged 19 to 30 years, who may face unique challenges in achieving viral load suppression.

### Study Limitations

The study was unable to provide evidence regarding the outcomes of newborns born to HIV-positive mothers, which may limit the generalizability of the findings. Additionally, while the study controlled for several potential biases, recall bias and healthcare access bias could still have influenced the responses. Furthermore, social desirability bias may have affected participants' responses, as some may have provided answers they believed to be more socially acceptable. To address these limitations, future studies could include the triangulation of data sources or member checking to validate the qualitative findings.

## CONCLUSIONS AND RECOMMENDATIONS

This study aimed to explore the factors influencing the failure to reduce viral load among pregnant women living with HIV in Mbandaka, with a focus on contributing to the reduction of HIV transmission, particularly vertical transmission. Through a case-control design, data were collected via semi-structured interviews and medical record analysis. The findings highlight several factors



https://dx.doi.org/10.4314/orapj.v6i4.33

associated with the failure to suppress viral load. Specifically, HIV+ status, poor treatment adherence, and a history of ARV treatment were found to be significant contributors to non-suppression. On the other hand, pre-delivery prophylaxis, being married, and being symptomatic with HIV emerged as protective factors against non-suppression. A significant negative correlation was observed between prophylaxis, HIV-related symptoms, and viral suppression, while factors such as gestational age, marital status, and information exchange between couples showed no significant relationship with viral suppression outcomes.

Given these results, several concrete recommendations can be made for health policymakers. First, it is crucial to raise awareness among patients about the importance of adhering to ARV treatment. This can be achieved through targeted educational campaigns and personalized counseling during antenatal care visits. Additionally, prophylactic coverage during pregnancy should be improved to ensure early and consistent intervention, reducing the risk of non-suppression. Moreover, healthcare providers should focus on closely monitoring married, symptomatic HIV-positive women, as they were found to be at a higher risk for non-suppression, ensuring that they receive the necessary support and treatment adjustments. Finally, strengthening adherence to ARVs, particularly in women with a history of ARV treatment, is essential to optimize therapeutic outcomes. These actions will not only help reduce HIV transmission but also contribute to preventing vertical transmission, improving maternal and child health outcomes in Mbandaka.

**Ethical Approval**: The study protocol received ethical approval from the Higher Institute of Medical Techniques of Kinshasa, Kinshasa, Democratic Republic of the Congo.

**Conflicts of Interest:** None declared.

**ORCID iDs:**

Likulu, J. C. E.[1,2]: Nil identified
Kangite, J. M.[3]: Nil identified
Adikaka, F. A.[2]: Nil identified
Bosako, T. M.[2]: Nil identified
Mundembe, P. B.[1,2]: Nil identified
Bikoko, G. B.[1,2]: Nil identified
Betoko, R. B.[1,2]: Nil identified
Mawunu, M.[4,7]: https://orcid.org/0000-0001-6658-9223
Ngbolua, K. N.[4,5]: https://orcid.org/0000-0002-0066-8153
Tshimungu, F. K.[1]: Nil identified
Elongi, J. P. M.[6]: Nil identified



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