

# Predictors of HIV Testing Positive Result Among Pregnant Women Attending Prenatal Clinics in the Democratic Republic of Congo

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**Abstract:** Since it began in 2003, HIV/AIDS surveillance in Democratic Republic of the Congo has been mainly carried out among pregnant women attending antenatal clinics. In addition to screening for syphilis and HIV, some demographic, behavioral, and obstetrical data are also collected. This work aimed to identify the factors associated with a positive HIV test result from the demographic and medico-obstetrical data collected at the time of surveillance-based HIV testing among pregnant women attending sentinel sites in DRC. The HIV surveillance database among pregnant women was obtained from the National AIDS Control Program of DRC. The association between the HIV test result and the factors studied was assessed by the adjusted Odds Ratio (AOR), through a logistic regression of HIV serology on these potential factors. From 2003 to 2013, 109,553 pregnant women were screened for HIV in the DRC surveillance sites. The regression of the HIV test result on the possible factors showed among others that: (i) primary or secondary education was associated with a higher odd of test positivity (AOR: 1.51, 95% CI: 1.13 - 2.03 and 1.41, 95% CI 1.05 - 1.89 respectively) compared to the higher/university level of education; (ii) the sexual debut before age 15 (AOR: 1.33, 95% CI: 1.21 - 1.46) or between 15 and 17 years of age (AOR: 1.18, 95% CI: 1.09 - 1.28) was associated with a positive test result in comparison to age 18 and older; and (iii) the presence of an active syphilis infection was associated with a twofold increase in HIV positive test result odd (AOR: 2.01, 95% CI: 1, 77-2.29). Primary prevention efforts against HIV infection in DRC should include delaying sexual debut, encouraging complete formal education of women, and preventing and adequately managing sexually transmissible infections.

**Keywords:** HIV Test Positive Result, Pregnant Women, DRC, Predictors

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## 1. Introduction

In the DRC, data on the HIV / AIDS epidemic across the country are rather limited. The most regular are those obtained from successive sentinel surveillance activities among pregnant women attending Ante-Natal Clinics (ANC). Other sources of data include: the Demographic and Health Surveys with HIV testing component (DHS +, 2007 and 2013), some reports from field interventions and control programs and projects, and national science days on HIV/AIDS in the DRC, which allow researchers and stakeholders to actively discuss various research findings on the subject.

After fifteen years of continuous sentinel surveillance, current thinking is to use more and more programmatic data, especially PMTCT sites data, for surveillance purposes. The difficulty in doing this is that the screening test is performed on an agreed basis on PMTCT settings, whereas it is anonymous and unrelated on surveillance sites. The requirement of consent may exclude some women on PMTCT sites, and selectively those who fear a positive test result. The prevalence of HIV on PMTCT sites would therefore be lower than that of sentinel sites, or that of the general population. This is what other authors have already found elsewhere [1]. In addition to some problems in data

reporting, PMTCT sites regularly experience breaks in inputs or other resources, leading them to discontinue screening, or at least to rationalize it, targeting women considered to be at higher risk of HIV infection [2]. Hence, one of the pillars of the fight against HIV/AIDS, and particularly the elimination of mother-to-child transmission of HIV in the DRC, is the prevention of HIV in future birth mothers. Around the world, researchers have studied the factors associated with HIV infection, in the general population as with pregnant women, in order to contribute to a prevention battle based on evidence [3-4]. This research was carried out to identify, at the individual level, the factors associated with HIV positive serology in pregnant women attending ANC in the DRC, in order to better guide prevention interventions and, on the other hand, to focus screening programs, in a context of insufficient resources [5].

## 2. Methodology

Databases of HIV sentinel surveillance on pregnant women attending ANC in the DRC from 2003 to 2013 were used for this research. Annually, teams of central supervisors are sent to sentinel HIV surveillance sites and, with provincial support, oversee the implementation of surveillance activities. This ensures compliance with a single, validated protocol, which makes the data comparable. From 2003 to 2013, seven annual rounds collected the information, including:

- Sociodemographic and behavioral data: on the basis of a short two-page questionnaire, data such as age of the woman, marital status, education level, age at sexual debut, age of current sexual partner, number of pregnancies already carried, number of blood transfusions received, are collected.
- Biological data: in accordance with standardized procedures, aliquots obtained from the systematic samples

taken for syphilis screening are used, separated from any information that could link them to the person, and then tested for HIV algorithm. The positive samples and 10% of the negative samples are confirmed at the national reference laboratory on HIV and STI in Kinshasa. This disposal guarantees the validity of the diagnosis. As recently as 2013, protocol modifications have been made to match the surveillance sites with those of PMTCT and to allow access to the results of the test by participants. As the Protocol changed, the information collected that year forward could be different from that collected previously. To obtain comparable information for 2013, in order to properly merge this year's data to those previous, the 17,211 blood samples collected that year were re-screened for HIV in accordance with the protocol and algorithm used the years before (2003 to 2011).

Once a single database had been established, it was processed to handle missing data, code text responses, and turn some variables into desired categories.

A binary logistic regression of the HIV test result on a group of factors potentially determining the serology was performed. The possible association between HIV serology and any of the factors collected on the record was assessed by the adjusted Odds Ratio and its 95% confidence interval. The NCSS software (version 11) and the DESCRIBE program (version 3.18) of the WINPEPI software were used for these analyzes. Moreover, some graphs were formulated on Microsoft Excel.

## 3. Results

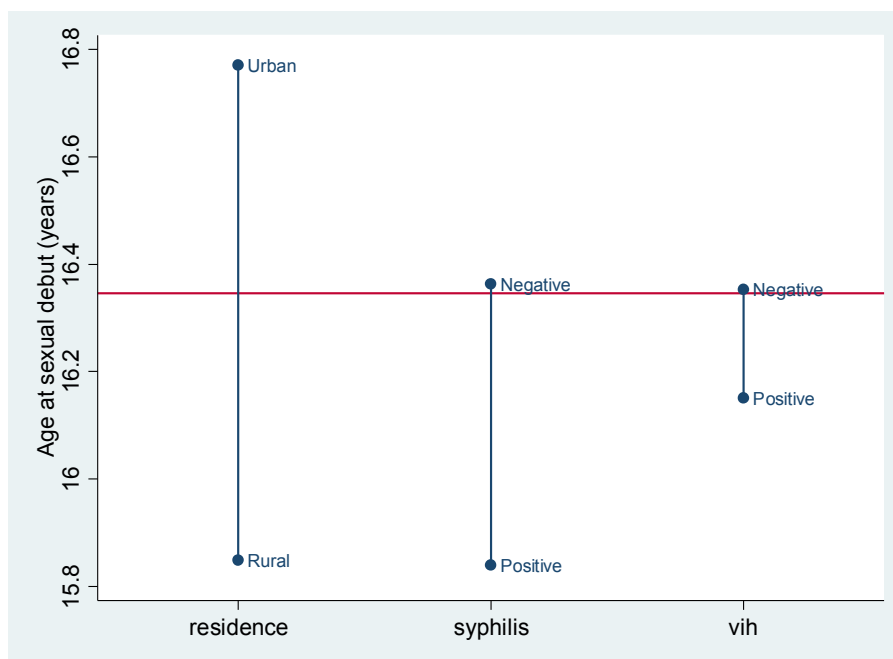
From 2003 to 2013, a total of 109,553 pregnant women were tested for HIV at the sentinel surveillance sites in the DRC. Table 1 shows the principal sociodemographic characteristics of those pregnant women.

**Table 1.** Sociodemographic characteristics of pregnant women screened for HIV in sentinel surveillance sites in DRC from 2003 to 2013, based on the HIV test result.

Characteristic	Modalities	Total screened	HIV Positives	(%)
Age	Adolescent (younger than 18 years old)	9538	284	3,0%
	Young adult (18 to 24 years old)	44196	1544	3,5%
	Adult (25 years and older)	55725	2303	4,1%
	Total	109459	4131	3,8%
Education	No formal instruction	12776	379	3,0%
	Primary level instruction	45965	1753	3,8%
	Secondary level instruction	48601	1938	4,0%
	Higher/University level instruction	1811	49	2,7%
	Total	109153	4119	3,8%
Occupation	Without remuneration	67794	2547	3,8%
	Self-employed/entrepreneur	35750	1378	3,9%
	Employee	3654	149	4,1%
	Small/micro commercial enterprises	2355	59	2,5%
	Total	109553	4133	3,8%
Marital status	Single (never married)	6185	223	3,6%
	Currently married (cohabiting)	102051	3847	3,8%
	Previously married (Separated, divorced, widowed)	1317	63	4,8%
	Total	109553	4133	3,8%
Age at sexual debut	Before age 15	22427	933	4,2%
	At 15 to 17 years	57771	2198	3,8%
	At 18 years and older	29355	1002	3,4%
	Total	109553	4133	3,8%

Table 1 shows that: almost 10% of pregnant women tested for HIV in the DRC ANC from 2003 to 2013 were younger than 18 years of age; less than 2% of these women had reached the highest level of education; and that more than 90% of them cohabited with a male partner. As shown in

Figure 1, the average age at first sexual intercourse is younger for HIV-positive women, and even for syphilis-positive, than negative ones. Considering the living environment, this age is younger for women residing in rural areas compared with those living in cities.



**Figure 1.** Mean age at sexual debut of pregnant women attending ANC services in the DRC, based on HIV and Syphilis serology, and living environment.

A binary logistic regression of HIV test results on the few potentially determining factors collected during the prescreening interview was performed. Only variables that were found to be associated with HIV serology on the basis of a bivariate analysis were introduced into the logistic

model. For some of these factors (such as blood transfusion history, occupation, or marital status) the regression model did not detect any association with HIV serology. Table 2 depicts the results of the factors observed to be associated with HIV serology.

**Table 2.** Some determinants of HIV infection among pregnant women attending the ANC in the DRC.

		p (Wald test)	OR	95 % CI of OR	
				Lower	Upper
Age (p<0.001)	Adolescent (less than 18 years old)		1		
	Young (Age 18 to 24 years)	.001	1.26	1.10	1.43
	Adult (Age 25 or older)	.000	1.54	1.35	1.76
Education (p<0.001)	Superior/Higher/University level instruction		1		
	Secondary level instruction	.006	1.51	1.13	2.03
	Primary level instruction	.024	1.41	1.05	1.89
	No formal instruction	.788	1.04	.77	1.42
Age at sexual debut (p<0.001)	Before age 15		1		
	At 15 to 17 years	.000	1.18	1.09	1.28
	At 18 years and beyond	.000	1.33	1.21	1.46
Syphilis (p<0.001)	Negative		1		
	Positive	.000	2.01	1.77	2.29

The data in this table show that:

- Considering the age of the pregnant women: HIV-positive odd for pregnant women was 26 % and 54% higher for young adults (18-24 years) and adults (25 years and older) respectively, compared with that for adolescent girls (15-17 years of age). A woman's age is therefore a factor associated with the positivity result of an HIV test among pregnant women in the DRC. The older the age is; the higher

the HIV-positive odd.

- Women's level of education is another factor associated with a positive HIV test result among pregnant women. Here the ratio is the opposite: the more highly educated the woman, the lower the positive odd. Women without formal education, with only primary, and secondary education, experienced a 4%, 41%, and 51% increase in positive status, respectively, in comparison with those who reached higher or

university education.

- In terms of age at first sexual intercourse: compared with women whose sexual debut was at age 18 or later, the HIV-positive odds among women who had their first sexual intercourse between the ages of 15 and 17, and those before 15 years, are increased by 18% and 33% respectively.

- In the end, pregnant women with a positive syphilis test result, had an HIV positive test odd double that of pregnant women with a negative syphilis test result.

## 4. Discussion

This research explored sentinel HIV surveillance data among pregnant women in the DRC and sought to identify factors associated with the positivity of the HIV test among these women. It found that the age of a woman, her level of education, her age at first intercourse, and the presence of a sexually transmitted infection (in this case syphilis) are factors associated with HIV infection; while her profession, marital status, and the fact of having-undergone a transfusion, are not associated.

Age is known factor associated with HIV infection. In this study, the age of 25 years and older is more associated with this infection, and less associated with under-25 years olds. In a context of predominantly sexual transmission of HIV, as in the DRC, sexual experience and the number of different sexual partners increases with age, which could explain this difference [6]. Exposure to other routes of contamination is also all the more intense as age advances. In Kenya, Johnson and colleagues found that the 25-29 age group for women, and the 35 to 44 age group for men, were associated with a high positive HIV test score [7]. In India, G. Alvarez-Uria and his team found that, in rural areas, the age range of 25 to 45 year olds was associated with a high HIV positive status [8].

Low educational attainment is also a known risk factor for HIV infection [4]. The acquisition of certain skills necessary for preventive action depends on education. Our study has shown that the higher the level of education, the lower is the odd of HIV positivity. Education is therefore a significant protective factor against HIV infection. Other researchers have described this elsewhere. In point is a Tanzanian study in which E. Mmboma describes education as being associated with HIV infection in rural settings, and mostly educated women as having a lower likelihood of infection [9]. Another Tanzanian study in point conducted by G. Todd and his team found that people who have at least completed primary education have a lower probability of contracting HIV than those who have not received any formal education [10]. In one more study in point, Alvarez-Uria and his team made the same observation of men as aforementioned [8]; and likewise U. Thamattoor and his collaborators of pregnant women attending ANC [4].

Early sexual debut, along with the multiplicity of sexual partners, increases the risk of HIV infection [11, 12]. Our study showed that the more the first sexual intercourse was delayed, the lower the HIV-positive odd, so that the group of

women who had had sexual intercourse before 15 years of age had an HIV-positive odd increased by 33% compared with the group that started at age 18 or older. Other researchers also made these findings. For example, J. Kembo found that in Zimbabwe young people whose first sexual intercourse occurred before 14 years of age were significantly more at risk of contracting HIV infection (2.696 times higher than their counterparts for whom their first sexual experience took place at 20-24 years of age) [13]. Moreover, in Zambia the decline in the proportion of young people beginning the sexual experience before age 15 was one of the factors contributing to the significant decline in HIV prevalence among young women aged 15-24 [14]. In a South African study, Wand and Ramjee found that women whose age at first intercourse was 15 years of age or younger had a higher incidence of HIV than women who started later [12]. Early sexual intercourse may itself be due to acts of violence (such as rape), or to early and/or arranged marriages. Even in this context, it remains a major risk factor for HIV infection, as noted by L. Ackerman and GW de Klerk [15]. In a Chinese study, R. Xu and colleagues found that even among men who had sex with men, the HIV-positive odd was higher among those who had started these relationships earlier [16]. The reason for this association between early sexual intercourse and a positive HIV test result is that; the sooner the sexual experience begins, the longer it will be in a lifetime, the greater the likelihood of a multi-partnership sexuality, and also the probability that at least one of these sexual partners is infected. The biological fragility during adolescence has also to be mentioned [17]. Research has already shown that this biological fragility exposes young girls to HIV infection, more than young boys [18].

The presence, or even the history, of a sexually transmitted infection is known to be a major risk factor for HIV infection. For some STIs, the interaction with HIV infection is bi-directional: STI increases the incidence of HIV infection, and the latter affects the prognosis of the STI [19]. The present study shows that the odd of positive HIV test result is twice as high among women with syphilis compared with those, without. Moreover, Korenromp and collaborators found the same association in Tanzania [20]. In South Africa, it was found a HIV-positive odds ratio of 1.5 between the two groups [21]. In the United States, an HIV-positive test result odds ratio of 5.0 and 4.2 was found respectively in women and men with syphilis compared with those, without. STIs also influence the natural evolution of HIV infection, and the viral load [22]. The high prevalence of syphilis among pregnant women in our series (4.4% in 2013) is therefore both a risk factor for HIV infection and also a factor of poor prognosis in its evolution.

## 5. Limitation of Study

The main limitation of this research is the use of data collected by different actors over a decade. We therefore assumed the results of the HIV and syphilis tests reported by

the successive teams. However, the control measures and even the quality assurance and compliance with the monitoring protocol put in place reassure the validity of the data. Another limitation could have been the fact that the monitoring protocol was modified after 2011. This difficulty was solved as we, the researchers, used to re-test all the samples of 2013 on the basis of the previous algorithm.

## 6. Conclusion

In the DRC, the typical HIV-positive pregnant woman is a woman aged 25 years and older, having stopped education at the secondary school level, having had sexual debut before age 15, and carrying a sexually transmitted infection. Primary prevention efforts against HIV infection should include delaying first sexual intercourse, encouraging complete formal education of women, and preventing and adequately managing sexually transmissible infections among sexually active young people.

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