

Human Immunodeficiency Virus testing and associated factors among pregnant women in Rwanda: a nationwide cross-sectional survey

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Abstract

Background: Human immunodeficiency virus (HIV) testing during pregnancy is crucial for the prevention of mother-to-child transmission of HIV, thus aiding in prompt treatment, care, and support. However, HIV testing among pregnant women in Rwanda has been barely explored. This study, therefore, aimed to determine the prevalence and associated factors of HIV testing among pregnant women in Rwanda.

Methods: Secondary data from the 2020 Rwanda Demographic and Health Survey comprising 870 pregnant women were used. Multistage stratified sampling was used to select participants. Multivariable logistic regression was conducted to determine the factors associated with HIV testing, using SPSS (version 25).

Results: Of the 870 pregnant women, 94.0% (95% CI: 92.3-95.4) had tested for HIV during their current pregnancy. Younger age (AOR=1.54, 95%CI: 1.54-4.42), not working (AOR=4.29, 95%CI: 1.52-12.08), large household size (AOR=2.96, 95%CI: 1.01-8.61), multiple sex partners (AOR=4.16, 95%CI: 3.01-5.74), as well as secondary (AOR=8.07, 95%CI: 2.15-11.43), primary (AOR=5.53, 95%CI: 1.28-9.74) and no (AOR=6.07, 95%CI: 1.21-10.44) education were positively associated with HIV testing. However, being unmarried (AOR=0.28, 95% CI: 0.19-0.86), belonging to the western region (AOR=0.20, 95% CI: 0.63-0.66), having not visited a health facility (AOR=0.22, 95%CI: 0.10-0.48), and not having comprehensive HIV knowledge (AOR=0.68, 95%CI: 0.30-0.55) were negatively associated with HIV testing.

Conclusions: A high proportion of pregnant women had tested for HIV. However, there is a need for improved access to HIV education and testing facilities to address regional imbalances. The need for consideration of occupation, family and household dynamics in HIV testing promotion strategies is also highlighted.

Background

The Human Immunodeficiency Virus (HIV) remains a significant public health problem, with women wielding the largest burden [1, 2]. In 2021 alone, 54% of the 38.4 million people living with HIV (PLWH) worldwide were women and girls [1]. In sub-Saharan Africa, about half of the 33 million PLWH were women of reproductive age (15–49 years), with HIV rates ranging from 15–40% among pregnant women [3, 4]. Globally, it is estimated that around 2.6 million children under the age of 15 years are infected with HIV through mother-to-child transmission (MTCT), with 88% of these cases still in sub-Saharan Africa [5]. In 2021, approximately 1.7 million children were living with HIV and 98,000 children dying from HIV-related causes [6].

HIV testing before and during pregnancy is crucial for the treatment, care, support and prevention of HIV infection and related morbidities [7–9]. For pregnant women, testing and knowing their HIV status helps early linkage to care for those diagnosed with HIV, and this reduces the risk of transmitting HIV to the fetus and newborn [10]. Out of the 38.4 million people living with HIV globally in 2021, with pregnant women included, 15% of these were not aware of their HIV status [1]. Additionally, less than 90% of

pregnant women globally are tested for HIV and over 180,000 children are infected with HIV during pregnancy, childbirth and breastfeeding by mothers aged 15–49 in sub-Saharan Africa [11–13]. This means that, there is a great risk of MTCT of HIV to the unborn child during pregnancy which ranges from 15–45% without antiretroviral therapy (ART), but can be reduced to < 5% with prenatal testing of pregnant women for HIV and early linkage to HIV care [14–16]. In sub-Saharan Africa, the rate of mother-to-child HIV transmission decreased from 27.18% in 2010 to 16.9% in 2019, which decline is largely attributed to early detection and linkage to HIV care during antenatal care (ANC) [17]. However, the rate of HIV testing among pregnant women is still very low in most sub-Saharan African countries [18].

Previous studies reported that the failure to acquire permission from the husband, the fear of stigma and discrimination, the perceived lack of secrecy from service providers and the inability to access the health facility hindered pregnant women from testing for HIV [8, 12]. Other studies showed that pregnant women with a higher educational level, married, high wealth index, living in urban areas and being exposed to media had higher rates of HIV testing [13, 19].

The government of Rwanda through the ministry of health (MoH) adopted strategies to promote HIV testing services among pregnant women including mandatory HIV testing during ANC, community-based testing, self-testing and door-to-door testing [8, 9]. Although ANC remains one of the commonest HIV testing points, only 13.1% of women in Rwanda receive all the components of ANC [20, 21]. Indeed, 47.2% and 0.3% of pregnant women in Rwanda utilize at least four and eight ANC contacts respectively, which limits the opportunities for access to HIV testing services by pregnant women [20, 21]. Even though several previous studies in Rwanda have looked at HIV testing among the general population and other groups [8, 22], no accessible study has focused on pregnant women so far. Consequently, the level of utilization of HIV testing services and associated factors among pregnant women in Rwanda remains unclear.

Therefore, this study aimed to determine the prevalence and factors associated with HIV testing among pregnant women in Rwanda, using the most-recent 2020 Rwanda Demographic and Health survey. Understanding the factors associated with HIV testing among this special group is crucial in addressing reasons for the unmet need for HIV testing in Rwanda and other sub-Saharan African countries.

Methods

Study sampling and participants

This was a secondary data analysis of the 2019-20 Rwanda Demographic Survey (RDHS), a cross-sectional survey. The RDHS employed a two-stage sample design with the first stage involving cluster selection consisting of enumeration areas (EAs), and the second stage involving systematic sampling of households in all the selected EAs, leading to a total of 13,005 households [23]. The data used in this analysis were from household and women's questionnaires.

The RDHS data collection period was from November 2019 to July 2020, and eligible women for the interviews were those aged 15–49 years, including permanent residents of the selected households or visitors that stayed in the household the night before the survey [23]. Out of the total 13,005 households that were selected for the survey, 12,951 were occupied and 12,949 were successfully interviewed leading to a 99.9% response rate [23]. For this analysis, we included only pregnant women interviewed during the survey, which were 870 out of the total 14,634 women in the whole survey [23].

Variables

Dependent variables

The outcome variable is the uptake of HIV testing during pregnancy, which was a binary outcome variable coded as yes or no, and was self-reported [23].

Explanatory Variables

We included possible determinants of HIV testing based on the available literature and data [8, 13, 23, 24]. Place of residence (categorized into rural and urban), region of residence (Kigali, South, West, East, North), and problems with distance to a nearby health facility (big problem, no big problem) were the community-level factors included. Meanwhile, household size (less than six, six and above), sex of household head (male, female), husband/partner's educational level and wealth index (categorized into five quintiles that ranged from the poorest to the richest quintile) were the household-level factors. In addition, we also included various individual-level factors; age (15–24, 25–34, 35 and above), working status (yes, no), parity (4 and less, above 4) educational level (no education, primary, secondary, tertiary), marital status (married, unmarried), health insurance (yes, no), visited a health facility in last 6 months (yes, no), exposure to mass media (yes, no), having multiple sex partners (yes, no), history of sexually transmitted infections (STIs) (yes, no), healthcare decision-making (yes, no), knowledge of HIV testing kits (yes, no), comprehensive knowledge of HIV and MTCT (both coded as yes, no) and HIV stigma (no stigma, low, high). The wealth index was calculated by RDHS from information on household asset ownership using principal component analysis [23]. Media exposure was measured as a woman having access to any of these; radio, newspapers and television. Comprehensive knowledge of HIV was assessed using a six-item questionnaire: three on HIV prevention information and three questions on misconceptions of HIV transmission modes. Comprehensive knowledge of MTCT of HIV was confirmed when a woman reported knowing about the possibility of HIV transmission from HIV positive mother to her child during pregnancy, delivery, and breastfeeding (that is, scoring all three questions correctly). Moreover, the HIV stigma index was computed from six questions reflecting negative attitudes towards people living with HIV/AIDS. This index was graded “no stigma” (score 0), “low stigma” (score 1–3), “high stigma” (score 4–6) [8, 11].

Statistical analysis

Demographic and Health Survey (DHS) sample weights were applied to account for the unequal probability sampling in different strata and ensure the representativeness of the study results [25, 26]. The Statistical Package for Social Sciences (SPSS) (version 25.0)-complex samples package was used, incorporating the following variables in the analysis plan to account for the multistage sample design inherent in the RDHS dataset: individual sample weight, sample strata for sampling errors/design, and cluster number [25, 26]. We used frequency distributions to describe the background characteristics of the respondents; where frequencies and proportions/percentages for categorical dependent and independent variables were presented. We then conducted bivariable logistic regression to assess the association of each predictor variable with the outcome variable (HIV testing), and we presented the respective crude odds ratio (COR), 95% confidence interval (CI) and p-values. Independent variables found significant at a p-value < 0.25 were then included in the multivariable model, including those reported to be significantly associated with HIV testing in previous studies, regardless of their significance on bivariable analysis. Respective adjusted odds ratios (AOR), 95%CI and p-values were obtained and presented, with a statistical significance level set at p-value < 0.05. All predictor variables in the model were assessed for multi-collinearity, which was considered present if a variable had a variance inflation factor (VIF) greater than 10 [27]. However, none of the variables had a VIF above 3.

Results

Characteristics of participants

A total of 870 pregnant women were included in this analysis (Table 1). The majority were below 35 years of age (74.2%), married (84.7%), had attained a primary level of education (60%), were working (66.1%), and were rural residents (81.5%). In addition, most of the participants had parity below four (83.3%), had health insurance (81.9%), were from a household size of fewer than six members (77.7%), of which the majority were headed by males (82%), had exposure to media (82.6%), had no problem accessing the health facility (75.8%), and had visited a health facility in the last six months (84.4%). Furthermore, the majority had no multiple-sex partners (86.4%), no history of STIs (94.6%), participated in healthcare decision-making (67%), had comprehensive HIV knowledge (68%) and MTCT knowledge (68.4%), and with low HIV related stigma (77.3%). Regarding HIV testing, 94.0% (95%CI: 92.3–95.4) had ever tested for HIV during pregnancy.

Table 1

Background characteristics of pregnant women as per the 2020 Rwanda Demographic Health Survey

Characteristics	Frequency (%), N = 870
Age	
15–24	245(28.2)
25–34	400(46.0)
35 and above	224(25.8)
Education level	
Tertiary	44(5.0)
Secondary	230(26.4)
Primary	522(60.0)
No education	74(8.6)
Working status	
Working	575(66.1)
Not working	295(33.9)
Parity	
Below 4	724(83.3)
4 and above	146(16.7)
Marital status	
Married	736(84.7)
Unmarried	133(15.3)
Health insurance	
Yes	774(89.1)
No	95(10.9)
Wealth index	
Richest	190(21.8)
Richer	173(19.9)
Middle	178(20.5)

Missing values a = 133, MTCT - mother-to-child transmission, HIV - Human immune virus, STI - sexually transmitted diseases

Characteristics	Frequency (%), N = 870
Poorer	174(20.1)
Poorest	154(17.7)
Residence	
Urban	161(18.5)
Rural	708(81.5)
Region	
Kigali	110(12.6)
West	199(22.9)
East	222(25.5)
North	131(15.1)
South	208(23.9)
Household size	
Less than 6	676(77.7)
6 and above	194(22.3)
Sex of household head	
Male	713(82.0)
Female	156(18.0)
Husband's education ^a	
Tertiary	62(7.2)
Secondary	120(13.9)
Primary	460(52.9)
No education	94(10.8)
Exposure to media	
Yes	718(82.6)
No	151(17.4)
Distance to a health facility	

Missing values a = 133, MTCT - mother-to-child transmission, HIV - Human immune virus, STI - sexually transmitted diseases

Characteristics	Frequency (%), N = 870
No big problem	659(75.8)
Big problem	210(24.2)
Visited health facility in the last 6 months	
Yes	734(84.4)
No	136(15.6)
Multiple sex partners	
Yes	118(13.6)
No	752(86.4)
STI history	
Yes	47(5.4)
No	823(94.6)
Healthcare decision making ^a	
Yes	583(67.0)
No	154(17.7)
Comprehensive MTCT knowledge	
Yes	595(68.4)
No	275(31.6)
Comprehensive HIV knowledge	
Yes	599(68.8)
No	271(31.2)
Know about HIV test kits	
Yes	147(16.9)
No	723(83.1)
HIV-related stigma	
No	85(9.7)
Low	672(77.3)

Missing values a = 133, MTCT - mother-to-child transmission, HIV - Human immune virus, STI - sexually transmitted diseases

Characteristics	Frequency (%), N = 870
High	113(13.0)
Ever tested for HIV	
No	52(6.0)
Yes	817(94.0), (95%CI: 92.3–95.4)
Missing values a = 133, MTCT - mother-to-child transmission, HIV - Human immune virus, STI - sexually transmitted diseases	

Factors Associated With Hiv Testing Among Pregnant Women

Results of the bivariable analysis are detailed in Table 2, with significant factors independently associated with HIV testing highlighted. On adjusting for all the included variables in the multivariable logistic regression model, the factors found with significant association included; age, education level, working status, marital status, region, household size, visited a health facility in the last 6 months, multiple sexual partners, comprehensive HIV knowledge (Table 2).

Pregnant women aged 25–34 years were 1.54(95%CI: 1.54–4.42) times more likely to test for HIV compared to those aged 35 and above. Compared to those with tertiary education, pregnant women with secondary, primary and no education were 8.07(95%CI: 2.15–11.43), 5.53(95%CI: 1.28–9.74) and 6.07(95%CI: 1.21–10.44) times, respectively, more likely to test for HIV. Similarly, compared to working pregnant women, those not working were 4.29(95%CI: 1.52–12.08) times more likely to test for HIV. Those from households of 6 and above members were also 2.96(95%CI: 1.01–8.61) times more likely to test for HIV compared to their counterparts from households of less than 6 members. Moreover, pregnant women with no multiple sex partners were 4.16(95%CI: 3.01–5.74) times more likely to test for HIV, compared to those with multiple sex partners.

However, unmarried women (AOR = 0.28, 95%CI: 0.19–0.86) and those from the western region (AOR = 0.20, 95%CI: 0.63–0.66) were 72% and 80% less likely to test for HIV, compared to married pregnant women and those from Kigali, respectively. Similarly, pregnant women who had not visited a health facility in the last 6 months (AOR = 0.22, 95%CI: 0.10–0.48) and those with no comprehensive HIV knowledge (AOR = 0.68, 95%CI: 0.30–0.55) were 78% and 32% less likely to test for HIV, compared to those that had visited a health facility and with comprehensive HIV knowledge, respectively.

Table 2

Factors associated with HIV testing among pregnant women, as per the 2020 Rwanda Demographic Health Survey

Variable	Crude odds ratio, COR (95% CI)	p-value*	Adjusted odds ratio, AOR (95% CI)	p-value**
Age		0.001		0.015
35 and above	1		1	
25–34	1.22(1.53–2.84)		1.54(1.54–4.42)	
15–24	0.31(0.15–0.66)		0.40(0.12–1.32)	
Education level		0.443		0.046
Tertiary	1		1	
Secondary	1.01(0.22–4.66)		8.07(2.15–11.43)	
Primary	0.52(0.12–2.38)		5.53(1.28–9.74)	
No education	0.64(0.11–3.61)		6.07(1.21–10.44)	
Working status		0.030		0.006
Working	1		1	
Not working	2.36(1.09–5.12)		4.29(1.52–12.08)	
Parity		0.475		0.400
4 and above	1		1	
Below 4	0.61(0.23–1.61)		1.89(0.43–8.35)	
Marital status		0.017		0.021
Married	1		1	
Unmarried	0.45(0.23–0.87)		0.28(0.19–0.86)	
Health insurance		0.144		0.914
Yes	1		1	
No	0.56(0.25–1.22)		0.93(0.26–3.29)	
Wealth index		0.127		0.655
Richest	1		1	

Bold = significant, * = significant at 0.25, ** = significant at 0.05, CI = confidence interval, RDHS = Rwanda demographic health survey, MTCT = mother-to-child transmission, HIV = Human immune virus, STI = sexually transmitted diseases

Variable	Crude odds ratio, COR (95% CI)	p-value*	Adjusted odds ratio, AOR (95% CI)	p-value**
Richer	0.91(0.35–2.37)		1.56(0.38–6.36)	
Middle	0.69(0.26–1.84)		2.26(0.58–8.88)	
Poorer	0.46(0.18–1.20)		2.98(0.71–12.42)	
Poorest	0.33(0.13–0.85)		2.16(0.49–9.47)	
Residence		0.129		0.506
Urban	1		1	
Rural	0.34(0.08–1.38)		0.56(0.10–3.08)	
Region		0.001		0.001
Kigali	1		1	
West	0.11(0.62 – 0.19)		0.20(0.63–0.66)	
East	0.21(0.97–4.57)		0.89(0.19–4.19)	
North	0.19(0.90–4.06)		0.78(0.17–3.46)	
South	0.18(0.11–3.20)		0.83(0.24–2.85)	
Household size		0.287		0.047
Less than 6	1		1	
6 and above	1.50(0.71–3.15)		2.96(1.01–8.61)	
Sex of household head		0.830		0.719
Male	1		1	
Female	1.09(0.51–2.30)		1.27(0.35–4.59)	
Husband's education		0.510		0.558
Tertiary	1		1	
Secondary	0.39(0.04–3.50)		0.24(0.03–2.27)	
Primary	0.26(0.03–2.01)		0.20(0.02–1.81)	
No education	0.27(0.03–2.33)		0.20(0.02–2.26)	
Exposure to media		0.183		0.446

Bold = significant, * = significant at 0.25, ** = significant at 0.05, CI = confidence interval, RDHS = Rwanda demographic health survey, MTCT = mother-to-child transmission, HIV = Human immune virus, STI = sexually transmitted diseases

Variable	Crude odds ratio, COR (95% CI)	p-value*	Adjusted odds ratio, AOR (95% CI)	p-value**
Yes	1		1	
No	0.63(0.32–1.24)		1.45(0.56–3.74)	
Distance to a health facility		0.589		0.442
No big problem	1		1	
Big problem	1.23(0.59–2.56)		1.44(0.57–3.66)	
Visited health facility in last 6 months		☐ 0.001		☒ 0.001
Yes	1		1	
No	0.22(0.117–0.396)		0.22(0.10–0.48)	
Multiple sex partners		0.100		0.030
Yes	1		1	
No	1.84(0.89–3.83)		4.16(3.01–5.74)	
STI history		0.714		0.409
Yes	1		1	
No	0.76(0.17–3.34)		1.79(0.45–7.11)	
Healthcare decision making		0.287		0.957
Yes	1		1	
No	0.65(0.31–1.33)		0.97(0.36–2.64)	
Comprehensive MTCT knowledge		0.123		0.457
Yes	1		1	
No	1.66(0.87–3.17)		1.39(0.58–3.30)	
Comprehensive HIV knowledge		0.041		0.035
Yes	1		1	
No	0.51(0.26–0.97)		0.68(0.30–0.55)	

Bold = significant, * = significant at 0.25, ** = significant at 0.05, CI = confidence interval, RDHS = Rwanda demographic health survey, MTCT = mother-to-child transmission, HIV = Human immune virus, STI = sexually transmitted diseases

Variable	Crude odds ratio, COR (95% CI)	p-value*	Adjusted odds ratio, AOR (95% CI)	p-value**
Know about HIV test kits		0.250		0.786
Yes	1		1	
No	0.61(0.27–1.41)		0.85(0.26–2.74)	
HIV-related stigma		0.360		0.355
No	1		1	
Low	0.44(0.11–1.77)		0.25(0.03–1.81)	
High	0.32(0.07–1.55)		0.20(0.02–1.89)	
Bold = significant, *= significant at 0.25, **= significant at 0.05, CI = confidence interval, RDHS = Rwanda demographic health survey, MTCT = mother-to-child transmission, HIV = Human immune virus, STI = sexually transmitted diseases				

Discussion

In this study, the prevalence and factors associated with HIV testing among pregnant women in Rwanda were assessed. The prevalence of HIV testing among pregnant women was found to be 94.0%. This is higher than the overall prevalence reported from 11 East African countries (77.5%) and that from Nigeria (42.7%) [28, 29]. The observed difference in HIV testing among pregnant women may be attributed to the differential efforts and resources put into HIV prevention programs, as well as differences in socio-demographics across countries [13, 19].

Pregnant women aged 25–34 years were more likely to test for HIV compared to their older counterparts (35 years and above). This may be attributed to the fact that sexual education tends to be focused on young women who may be involved in high-risk sexual behaviours [29, 30]. These findings are consistent with studies from Vietnam and Ethiopia which also reported older age to be associated with less HIV testing [31, 32]. Nonetheless, further studies should be conducted to critically identify reasons why older women (35 years and above) are less likely to test for HIV during pregnancy in Rwanda.

The study results showed that pregnant women who lived in the western region of the country had lower odds of HIV testing compared to those who lived in Kigali. These findings are supported by other studies in Rwanda and Senegal which also reported differential rates in HIV testing among regions [8, 9]. Kigali as the capital and predominantly urban city has more widespread and multi-service health infrastructures which offer more opportunity for its residents to access diverse health services. The western region of Rwanda, on the other hand, is 87.8% rural and relatively remote, making it less developed with fewer health facilities, and therefore lesser chances of access to health services including sexual and reproductive awareness. Further, compared to Kigali, rural Rwanda might have less variety of media exposure in the form of television, radio, billboards, and social media which are key sources of

information about the importance of HIV testing during pregnancy [22, 33]. It is therefore imperative to ensure balanced efforts and resource allocation in HIV prevention programs across the country. Moreover, developing an appropriate and targeted community-based intervention such as community or home visits by health workers to test individuals in remote and hard-to-reach areas would increase access to HIV testing services among pregnant women [14].

Surprisingly, lower levels of education (secondary, primary and none) were associated with more odds of HIV testing compared to tertiary level of education. Notably, tertiary education was associated with fewer odds of HIV testing, a finding contrary to previous studies associating higher educational attainment with a higher likelihood of HIV testing [24, 34, 35]. Education is well established to be a potent tool that may be utilized to not only improve HIV knowledge but also to empower individuals, especially women, to make right decisions regarding attendance and utilization of health services [29, 36]. However, the probable reason for the lower odds of HIV testing among pregnant women with tertiary education could be attributed to the stigmatizing attitudes highly educated people hold towards HIV-positive people hence they may fear utilizing HIV testing services [37]. Therefore, this study finding warrants further exploration to establish why women with tertiary education were less likely to use HIV testing services.

Pregnant women in this study with no comprehensive knowledge about HIV were less likely to test for HIV compared to those with comprehensive knowledge. This is not surprising and further highlights a need to strengthen the means of HIV information dissemination through the use of media campaigns and emphasis on HIV health education and counselling by health workers during antenatal care, and community outreaches. This should consider addressing possible misconceptions among various education levels and needs.

Furthermore, it was observed that pregnant women who had visited a health facility in the last 6 months had higher odds of HIV testing compared to their counterparts who had not. This finding is supported by a similar study in Ethiopia which also reported a positive association between recent health facility visit and HIV testing [15]. Pregnant women who visit a health facility are more likely to be attending antenatal care, of which health education and HIV testing are compulsory components [19], explaining the above observation. Pregnant women from large household sizes were also more likely to be tested for HIV compared to their counterparts from smaller households. This is in agreement with a study from Sudan which also reported that women in extended families are more likely to test for HIV [38]. This may be because of the influence and concern of their older relatives who may tend to encourage them to attend antenatal care where they can access and receive HIV testing services.

Married women were also more likely to test for HIV during pregnancy compared to the unmarried. This is similar to a study from Thailand [19] and that from East Africa [24] which also reported a positive association between marital status and HIV testing. The possible explanation may be that married women are more likely to be reminded and encouraged by their partners to go for antenatal care where they can receive HIV testing services. Moreover, since married women tend to have premarital HIV testing with their partners, they, thus, tend to be more receptive to regular HIV testing. Additionally, it was also

observed that pregnant women without multiple sexual partners were more likely to test for HIV compared to those with multiple sexual partners. This is in agreement with a study done in East Africa which showed that women with multiple sexual partners had lower odds of HIV testing [24]. However, the finding is contradictory to studies in Ethiopia which identified women with multiple sexual partners as having higher odds of HIV testing compared to those with one sexual partner, due to a higher perceived risk of acquiring HIV [15, 39]. Nonetheless, further studies are needed to explore the association between the number of sexual partners and HIV testing during pregnancy.

Study findings also indicate that non-working pregnant women had higher odds of HIV testing compared to those working. This deviates from study findings in Vietnam and Ethiopia which reported employed pregnant women being more likely to test for HIV [31, 40]. Although employment is a vital component of women's empowerment for making healthy decisions and choices, it has also been reported to have a negative effect on other women's health aspects, predisposing women to sexual violence [41] and reducing antenatal and postnatal care attendance [42, 43] partly due to the busy work schedules. This implies a need to strengthen work-related policies such as work leaves, to enable working women to attend to vital health aspects of pregnancy and child-care, without risking their jobs and careers.

Strengths And Limitations

We used the most-recent data from the 2020 Rwanda Demographic and Health survey, with a large sample size and standardized data collection protocols. Moreover, we weighted the dataset making our results generalizable to all pregnant women in Rwanda. However, this study also had some limitations such as the risk of information and recall bias due to the sensitivity of the HIV topic (prone to social desirability effects) and data was self-reported, without verifying with health records. All this could have affected the true estimation of HIV testing prevalence. In addition, the cross-sectional design of this study limits inferring causality but rather only association.

Conclusions

The study revealed that a big proportion of pregnant women in Rwanda had tested for HIV during pregnancy. The study also found several sociodemographic factors associated with HIV testing in pregnancy, which include; age, marital status, education level, working status, region, comprehensive HIV knowledge, visit to a health facility, household size, and having multiple sex partners. The above factors are therefore worth consideration when rethinking strategies to enhance HIV testing among pregnant women. There is a need for improved access to HIV education and testing facilities for pregnant women to address the regional imbalances, for example through massive community awareness about HIV via campaigns and outreaches. Moreover, HIV testing promotion strategies need to consider occupation, family and household dynamics as crucial aspects for increasing the uptake of HIV testing services among pregnant women.

Abbreviations

PMTCT	Prevention of Mother to Child Transmission
EA	Enumeration area
PLWH	People Living with HIV
AOR	Adjusted Odds Ratio
ANC	Antenatal Care
CI	Confidence Interval
ART	Anti-Retroviral Therapy
DHS	Demographic Health Survey
VIF	Variance Inflation Factor
COR	Crude Odds Ratio
RDHS	Rwanda Demographic Health Survey
OR	Odds Ratio
SPSS	Statistical Package for Social Science

Declarations

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Availability of data and materials

The data set used is openly available upon permission from the MEASURE DHS website (URL: <https://www.dhsprogram.com/data/available-datasets.cfm>). However, authors are not authorized to share this data set with the public but anyone interested in the data set can seek it with written permission from the MEASURE DHS website (URL: <https://www.dhsprogram.com/data/available-datasets.cfm>).

Authors' contributions

L.N and J.K Conceived the idea, drafted the manuscript, performed analysis, interpreted the results and drafted the subsequent versions of the manuscript. A.N, J.B.A, Q.S, E.D and G.G. reviewed the first draft,

helped in results interpretation and drafted the subsequent versions of the manuscript. All authors read and approved the final manuscript.

Ethics approval and consent to participate

High international ethical standards are ensured during MEASURE DHS surveys and the study protocol is performed following the relevant guidelines. The RDHS 2019 survey protocol was reviewed and approved by the Rwanda National Ethics Committee (RNEC) and the ICF Institutional Review Board. Written informed consent was obtained from human participants and written informed consent was also obtained from legally authorized representatives of minor participants.

Consent for publication

Not applicable.

Competing interests

All authors declare that they have no competing interests.

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