

Factors Associated with HIV Infection among Women of Reproductive Age (15-49) in Ngoma District of Rwanda, a Secondary Data Analysis of Rwanda Demographic Health Surveys 2019-2020

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Abstract: Background: Despite Rwanda's commendable progress in reducing the national HIV burden, women aged 15–49 continue to bear a disproportionate share of infections, especially in Ngoma district. Located near Kigali and characterized by distinct socio-economic dynamics, Ngoma faces unique challenges in HIV prevalence and transmission. While national surveys provide general trends, understanding localized factors is essential for tailoring effective interventions. This study aimed to assess the prevalence of HIV and identify associated risk factors among women of reproductive age in Ngoma district, Rwanda.

Methodology: A cross-sectional quantitative study was employed, using data from the Rwanda Demographic and Health Survey (RDHS) 2019/2020. The study population included women of reproductive age (15–49 years) residing in Ngoma district. Data were analyzed to explore socio-demographic characteristics, access to healthcare, and cultural influences. Descriptive statistics were used to determine HIV prevalence. Bivariate and multivariate logistic regression analyses were conducted to assess associations between HIV infection and explanatory variables. Statistical significance was set at $p \leq 0.05$.

Results: The overall prevalence of HIV among women in Ngoma district was 7.87%. Multivariate analysis showed that women aged 25–34 years (AOR = 15.784; 95% CI: 4.882–51.033), 35–44 years (AOR = 11.303; 95% CI: 2.654–48.140), and 45–49 years (AOR = 6.648; 95% CI: 1.373–32.178) were significantly more likely to be HIV positive compared to those aged 15–24 years. Employment status was protective: employed women were 97% less likely to be HIV positive (AOR = 0.033; 95% CI: 0.569–0.902). Similarly, women who had never been in a union (AOR = 0.137; 95% CI: 0.635–0.972) and those without a mobile phone (AOR = 0.242; 95% CI: 0.144–0.406) had significantly lower odds of HIV infection compared to their respective counterparts.

Conclusion: This study highlights a notably high HIV prevalence among women aged 25–49 years in Ngoma district. Key factors associated with increased HIV risk include older age, marital status, mobile phone ownership, and unemployment. Targeted HIV prevention strategies should prioritize older, married women, especially those who own mobile phones. Addressing underlying socio-economic determinants, such as enhancing employment opportunities and equitable access to communication tools, is also critical to reducing HIV transmission in this high-risk population.

Keywords: (MeSH): Factors Associated, HIV Infection, Reproductive age, Secondary data analysis.

I. INTRODUCTION

The human immunodeficiency virus (HIV) and its advanced stage, acquired immunodeficiency syndrome (AIDS), continue to represent a major global health challenge, particularly in low- and middle-income countries. According to the World Health Organization (WHO, 2018), approximately 37.9 million people were living with HIV globally, including 36.2 million adults and 1.7 million children under the age of 15. That same year, an estimated 1.7 million new infections were reported, resulting in 770,000 AIDS-related deaths. Adult women, especially those of reproductive age (15–49 years), bear a disproportionate burden of HIV, making them a critically vulnerable group (Agegnehu et al., 2020; Pustil, 2003). Globally, women account for more than half (55%) of all people living with HIV (Kawuki et al., 2022). This gender disparity is seen in various countries, such as Sierra Leone, where women have higher HIV prevalence rates than men (Kinuthia, 2020). HIV not only increases the risk of mother-to-child transmission but is also associated with pregnancy complications and is the leading cause of death among women of reproductive age (Paquette et al., 2022). In sub-Saharan Africa, the heightened risk for women is linked to several socio-structural factors, including gender inequality, limited access to reproductive health services, early and forced marriages, poverty, sexual violence, and the consequences of conflict and displacement (Katamba et al., 2020).

The trajectory of the HIV epidemic in sub-Saharan Africa has varied, with some countries experiencing declines in prevalence due to increased awareness and behavioral change, while others continue to report rising infection rates. For instance, Uganda has seen significant reductions in HIV prevalence over the past two decades, although localized increases have recently been documented (Rubaihayo et al., 2020). This highlights the importance of context-specific analysis to understand and address HIV transmission dynamics effectively. In Rwanda, national HIV incidence remains relatively low, ranging between 0.08% and 0.17% (Nsanziimana et al., 2022).

However, disparities exist at sub-national levels. In the Eastern Province's Ngoma district, recent health records indicate a concerning trend. As of the last reporting period, 314 individuals were receiving antiretroviral treatment in Ngoma. Over the previous six months, HIV incidence among women rose to 2.5%, surpassing the 1.5% incidence rate among men. The 2022 Health Management Information System (HMIS) report revealed that women accounted for 63.5% of all reported HIV cases in the province. Notably, the Rwanda Demographic and Health Survey (RDHS) 2019/20 indicated that women in Ngoma had the highest comprehensive knowledge of HIV in the Eastern Province. Despite this, the district continues to record high rates of new infections. Compounding the issue is the persistence of high HIV rates even among non-key populations such as married women, contradicting trends seen in other regions where prevalence among sex workers is declining. This paradox underscores the need to explore underlying contextual and behavioral drivers unique to Ngoma. Furthermore, the gap in existing literature regarding localized risk factors, particularly among women of reproductive age, hampers the development of targeted and effective intervention strategies. In light of these challenges, this study aimed to investigate the prevalence and associated factors of HIV infection among women aged 15–49 years in Ngoma district. By identifying context-specific risk factors, the findings will contribute to more effective, evidence-based public health planning and resource allocation for HIV prevention in the region.

II. METHODOLOGY

Study Design

This study employed a quantitative cross-sectional design to assess the prevalence and associated factors of HIV infection among women of reproductive age (15–49 years) residing in Ngoma district, Rwanda.

Study Setting

The research was conducted in Ngoma district, located approximately 100 kilometers southeast of Kigali in the Eastern Province of Rwanda. The district lies between latitude 2°8'S and longitude 30°33'E and is situated at an elevation ranging from 1,400 to 1,700 meters above sea level. It experiences moderate climatic conditions, with average temperatures of 20°C and annual rainfall of approximately 1,100 mm. The economy of the district is predominantly agrarian, with over 90% of the population engaged in subsistence agriculture. Ngoma district comprises 14 sectors, 64 cells, and 474 villages, forming a representative mix of rural and peri-urban communities.

Study Population

The target population for this study included women aged 15–49 years who participated in the 2020 Rwanda Demographic and Health Survey (RDHS) and resided in Ngoma district. Eligible respondents included those who were present in the selected households or had spent the night preceding the survey in the household.

Sample Design

A total of 686 women were eligible for inclusion in the 2020 RDHS in Ngoma district. The survey achieved a 95% response rate, making the sample adequately representative of the district's population. The sampling employed a stratified two-stage cluster design. In the first stage, enumeration areas or clusters were selected using probability proportional to size. In the second stage, households were systematically sampled within each cluster. A total of 457 women were systematically selected and included in the analysis for this study.

Data Collection Methods

The study utilized structured, pre-tested questionnaires adapted from the standard DHS survey tools. These were initially developed in English and translated into Kinyarwanda to ensure clarity and consistency. Trained interviewers conducted face-to-face interviews, collecting data on socio-demographic characteristics, HIV-related knowledge and stigma, reproductive health behavior, and other proximate determinants of HIV risk such as age at first sex, number of sexual partners, and recent sexually transmitted infections. Rigorous quality assurance measures, including interviewer training, pretesting, and supervision, were implemented to ensure data accuracy.

Reliability and Validity

The instruments used in the RDHS have demonstrated strong psychometric properties, including internal consistency (e.g., Cronbach's alpha), test-retest reliability, and inter-rater reliability for subjective responses. A pilot test was conducted to further improve clarity and content relevance. Validity was ensured through expert reviews for content validity, factor analysis for construct validity, and criterion validity by comparing with known predictors of HIV.

Data Analysis

Data were extracted, recoded, and analyzed using SPSS version 25. Weighting procedures were applied to restore population representativeness. Descriptive statistics were used to summarize the characteristics of the study population and determine the prevalence of HIV. Bivariable analyses were conducted to explore associations between HIV status and explanatory variables. Multivariable logistic regression was then performed to identify independent predictors of HIV infection, with statistical significance set at $p \leq 0.05$.

III. ETHICAL CONSIDERATIONS

This study was based on secondary data obtained from the 2020 RDHS, which had received ethical clearance from the Rwanda National Ethics Committee, ICF Institutional Review Board, and the U.S. Centers for Disease Control and Prevention (CDC). No direct interaction with human subjects occurred. The analysis was conducted using anonymized, aggregate-level data, ensuring the privacy and confidentiality of all respondents.

IV. FINDINGS

Demographic Characteristics of Respondents

A total of 686 women of reproductive age (15–49 years) from Ngoma district were included in the study. As shown in Table 1, nearly half of the respondents (49.13%) were aged 15–24 years, followed by 22.16% aged 35–44 years and 17.06% aged 25–34 years, indicating a predominantly youthful population. In terms of education, 54.37% had completed primary education, 33.09% had secondary education, while only 2.77% had higher education and 9.77% had no formal education. Employment status showed that 54.96% were employed, and 45.04% were not. Regarding marital status, 54.66% had never been in a union, 25.07% were married, and 10.79% were cohabiting. Others were widowed (3.06%), divorced (4.66%), or separated (1.75%). Most respondents were Catholic (45.19%), followed by Protestants (41.84%). Health insurance coverage was reported by 84.26% of participants, with 15.74% uninsured. Wealth distribution was relatively balanced, with the richest (25.95%) and richer (26.38%) groups comprising over half the respondents. The majority (86.44%) lived in rural areas, and 69.53% of households were headed by men. Most participants (76.97%) lived in households with more than six members. Notably, 54.23% did not own a mobile phone, and 88.48% reported never using the internet.

Table 1: Background characteristics of respondents as per the 2020 Rwanda Demographic and Health Survey

Variables	Freq	Percentage %
Age of respondent in years		
15-24	337	49.13
25-34	117	17.06
35-44	152	22.16
45-49	80	11.66
Educational level		
No education	67	9.77
Primary	373	54.37
Secondary	227	33.09
Higher	19	2.77
Working status		
No	309	45.04
Yes	377	54.96
Marital status		
Never in union	375	54.66
Married	172	25.07
Living with partner	74	10.79
No-longer living with partner	65	9.47
Religion		
Catholic	310	45.19
Protestant	287	41.84
Adventist	59	8.60
Muslim	24	3.50
Jehovah witness	4	0.58
No religion	2	0.29
Health insurance		
No	108	15.74
Yes	578	84.26
wealth index		
Poorest	74	10.79
Poorer	106	15.45
Middle	147	21.43
Richer	181	26.38
Richest	178	25.95
Residence		
Urban	93	13.56
Rural	593	86.44
Sex of household head		
Male	477	69.53
Female	209	30.47
Household size		
<=6	158	23.03
>6	528	76.97

Mobile phone ownership

No	372	54.23
Yes	314	45.77

Internet use

Never	607	88.48
Yes, last 12 months	70	10.20
yes, before last 12 months	9	1.31

HIV infection

No	632	92.13
Yes	54	7.87

Prevalence of HIV Infection

As illustrated in Figure 2, the HIV prevalence among women of reproductive age in Ngoma district was 7.87%, with 54 out of 686 women testing positive for HIV.

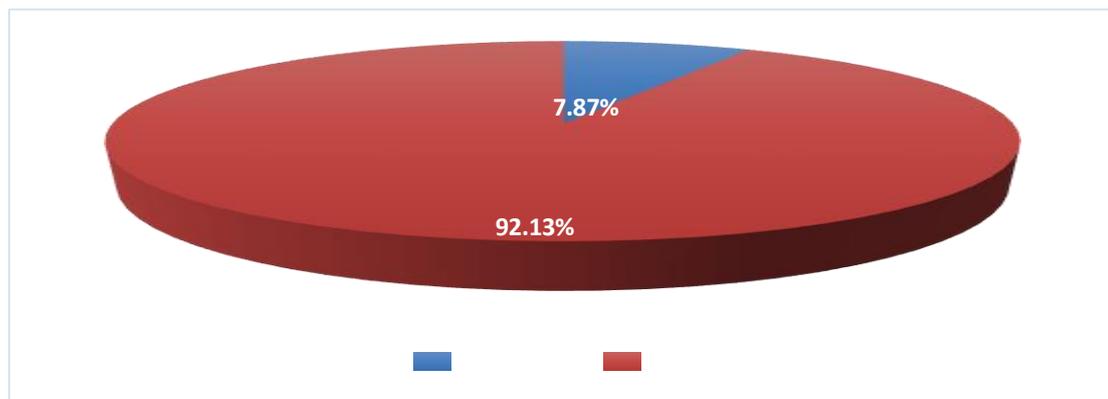


Figure 1: Prevalence of HIV infection among women of reproductive age in Ngoma district.

Association Between Sociodemographic Variables and HIV Infection

Bivariate analysis using the chi-square test showed significant associations between HIV infection and several factors, including age, education level, employment status, marital status, type of residence, household size, and mobile phone ownership (all $p < 0.05$). No significant associations were found for religion, health insurance status, wealth index, sex of household head, or internet use (Table 2).

Table 2: Bivariate analysis of the association between sociodemographic and HIV infections

	Freq	No Percentage (%)	Freq	Yes Percentage (%)	<i>P-value</i>
Respondent age					<0.001
15-24	188	94.5	149	30.6	
25-34	4	2.0	113	23.2	
35-44	4	2.0	148	30.4	
45-49	3	1.5	77	15.8	
Educational level					<0.001
No education	8	4.0	59	12.1	
Primary	91	45.7	282	57.9	
Secondary	98	49.2	129	26.5	
Higher	2	1.0	17	3.5	

Respondent currently working					<0.001
No	157	78.9	152	31.2	
Yes	42	21.1	335	68.8	
Current marital status					<0.001
Never in union	190	95.5	185	38.0	
Married	4	2.0	168	34.5	
Living with partner	4	2.0	70	14.4	
No-longer living with partner	1	0.5	64	13.2	
Religion					0.053
Catholic	106	53.3	204	41.9	
Protestant	70	35.2	217	44.6	
Adventist	18	9.0	41	8.4	
Muslim	4	2.0	20	4.1	
Jehovah witness	0	0.0	4	0.8	
No religion	1	0.5	1	0.2	
Having health insurance					0.396
No	35	17.6	73	15.0	
Yes	164	82.4	414	85.0	
Wealth index					0.205
Poorest	18	9.0	56	11.5	
Poorer	35	17.6	71	14.6	
Middle	52	26.1	95	19.5	
Richer	48	24.1	133	27.3	
Richest	46	23.1	132	27.1	
Type of place of residence					0.001
Urban	14	7.0	79	16.2	
Rural	185	93.0	408	83.8	
Sex of household head					0.304
Male	144	72.4	333	68.4	
Female	55	27.6	154	31.6	
Household size					0.015
≤6	58	29.1	100	20.5	
>6	141	70.9	387	79.5	
Owns a mobile telephone					<0.001
No	152	76.4	220	45.2	
Yes	47	23.6	267	54.8	
Use of internet					0.069
Never	183	92.0	424	87.1	
Yes, last 12 months	16	8.0	54	11.1	
Yes, before last 12 months	0	0.0	9	1.8	

Multivariate Analysis of Factors Associated with HIV Infection

Multivariate logistic regression identified several independent predictors of HIV infection (Table 3). Women aged 25–34 (AOR = 15.784, 95% CI: 4.882–51.033), 35–44 (AOR = 11.303, 95% CI: 2.654–48.140), and 44–49 years (AOR = 6.648, 95% CI: 1.373–32.178) were significantly more likely to be HIV-positive compared to those aged 15–24 years. Employment appeared protective, with currently working women being significantly less likely to have HIV (AOR = 0.033, 95% CI: 0.569–0.902). Marital status also showed significant associations; women who had never been in a union were 86% less likely to have HIV compared to married women (AOR = 0.137, 95% CI: 0.635–0.972). Mobile phone ownership was positively associated with HIV infection, with non-owners being significantly less likely to test positive (AOR = 0.242, 95% CI: 0.144–0.406).

Table 3: Univariate and Multivariate Analysis of factors associated with HIV infection among the respondents, Rwanda Demographic and Health Survey 2019/2020

Variables	HIV Infection							
	Crude Odd Ratio				Adjusted Odd Ratio			
	COR	95% (C.I)		p-value	AOR	95% (C.I)		p-value
	Lower	Upper			Lower	Upper		
Respondent Age								
15-24	Ref				Ref			
25-34	35.644	12.852	98.857	<0.001	15.784	4.882	51.033	<0.001
35-44	46.685	16.899	128.966	<0.001	11.303	2.654	48.14	<0.001
45-49	32.385	10.018	104.687	<0.001	6.648	1.373	32.178	0.019
Educational level								
No education	0.868	0.168	4.476	0.865	0.536	0.057	5.049	0.585
Primary	0.365	0.083	1.608	0.183	1.108	0.156	7.862	0.919
Secondary	0.035	0.155	0.686	0.014	1.375	0.212	8.912	0.738
Higher	Ref				Ref			
Respondent currently working								
No	Ref				Ref			
Yes	0.082	0.121	0.179	<0.001	0.033	0.569	0.902	0.02
Current marital status								
Never in union	0.023	0.008	0.064	<0.001	0.137	0.635	0.972	0.006
Married	Ref				Ref			
Living with partner	0.417	0.101	1.713	0.225	1.078	0.226	5.132	0.925
Widowed	1.735	0.512	3.316	0.998	1.968	0.631	6.174	0.998
Divorced	0.738	0.08	6.827	0.789	1.117	0.102	12.275	0.928
Separated	0.735	0.052	4.324	0.999	1.572	0.093	9.291	0.999
Wealth index combined								
Poorest	1.084	0.578	2.032	0.801	1.639	0.607	4.425	0.329
Poorer	0.707	0.418	1.196	0.196	0.608	0.253	1.461	0.266
Middle	0.637	0.395	1.025	0.063	0.61	0.281	1.326	0.212
Richer	0.966	0.603	1.546	0.884	1.315	0.655	2.637	0.441
Richest	Ref				Ref			
Type of place of residence								
Urban	2.559	1.412	4.636	0.002	0.474	0.204	1.099	0.082
Rural	Ref				Ref			
Owns a mobile telephone								
No	0.255	0.176	0.37	<0.001	0.242	0.144	0.406	<0.001
Yes	Ref				Ref			

95% C.I: Confidence interval, COR: Crude Odd Ratio, AOR: Adjusted Odd Ratio, Ref: Reference Category

V. RESULTS DISCUSSION

This study found a 7.87% HIV prevalence among women of reproductive age in Ngoma District, highlighting a significant public health concern. Several sociodemographic factors were significantly associated with HIV infection, including age, education, employment status, marital status, place of residence, household size, and mobile phone ownership. Older women, particularly those aged 25–49, were more likely to be HIV-positive compared to younger women aged 15–24. This

aligns with findings from South Africa (Shisana et al., 2014), suggesting cumulative exposure to risk factors over time. Interestingly, although higher education is generally associated with lower HIV prevalence (Hargreaves et al., 2008), this was not the case in this study, possibly due to differences in education quality or access to sexual health information. Employment was associated with lower HIV risk, echoing findings from Uganda (Tumwesigye et al., 2012), possibly due to increased economic independence and access to healthcare. Similarly, women who had never been in a union were less likely to be HIV-positive than married women, supporting evidence that marital dynamics may increase women's vulnerability (Durevall & Lindskog, 2014). Urban residence was linked to higher HIV prevalence, consistent with literature attributing this to greater mobility and dense sexual networks (UNAIDS, 2018). Larger household size was also associated with increased risk, potentially reflecting economic hardship and related vulnerabilities (Bärnighausen et al., 2011). Surprisingly, mobile phone ownership was linked to higher HIV prevalence, despite studies suggesting mobile phones can enhance access to prevention information (Katz & Bärnighausen, 2013).

VI. CONCLUSION

This study highlights a 7.87% HIV prevalence among women of reproductive age in Ngoma District, with key sociodemographic factors significantly influencing infection rates. Women aged 25–49, those living in urban areas, and those in larger households face higher HIV risk, while secondary education, employment, and being unmarried were associated with lower risk. Despite high health insurance coverage, gaps in mobile phone ownership and internet use may limit access to vital health information. These findings underscore the need for targeted, context-specific interventions to address the diverse drivers of HIV among women in this setting.

VII. CONFLICT OF INTEREST

There is no conflict of interest

VIII. FUNDING

This research was conducted without any external grant funding. The resources utilized for this study were provided by the research team, who funded the project independently to ensure the integrity and independence of the research process.

IX. DISCLAIMER

This is original work with no submission to any other institution. Any individual or organization intending to use any portion of this thesis should obtain permission from the Authors.

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