



**UNIVERSITY OF RWANDA
COLLEGE OF MEDICINE AND HEALTH SCIENCES
SCHOOL OF PUBLIC HEALTH**

**Determinants of HIV Infection among Adolescent Girls and
Young Women Aged 15-24 Years: Analysis of Rwanda
Demographic Health Survey 2014-2015.**

This Dissertation is submitted in partial fulfilment of the requirement of the University of Rwanda-College of Medicine and Health Sciences for a Master of Science in Public Health.

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DECLARATION

I Florence Kayitesi, hereby declare that the thesis has been written by me without any external unauthorized help and that it has been neither presented to any institution for evaluation nor previously published in its entirety or in parts. Any parts, words or ideas, of the thesis, however limited, which are quoted from other or based on other sources, have been acknowledged as such without exception.

DEDICATION

This dissertation work is dedicated

To my husband Tharcisse, my sons Matteo, Axel and Timeo, your love, encouragement, and unmeasurable support gave the grace to achieve this great step. I will forever be grateful.

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I would like to acknowledge my parents, for their love encouragement in my life I couldn't reach my dreams without immeasurable support and love from you Thanks a lot my relatives, sisters-in-law, nephews, cousins,, and nieces you all deserve my enthusiastic thanks as well.

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To all my friends and classmates, your friendship gave me a wonderful experience. I cannot list all the names here, but you are always in my mind.

Above all, I will like to acknowledge the Lord Almighty for always being there for me, granting me favor, and directions during my daily life.

ABSTRACT

Background: In Rwanda, the prevalence of Human Immunodeficiency Virus (HIV) is 3% over ten years in Adolescent Girls and Young Women (AGYW) it is most significant, impacting their ability to achieve and accomplish future plans. The Government of Rwanda, through the Ministry of Health, has initiated a number of measures to address HIV infection among AGYW. Still, the rate of HIV infection in this population remains high. This study analyzes factors of HIV infection among AGYW aged 15-24 years old.

Methods: Descriptive statistics were summarized, and subsequently bivariate logistic regression was computed to determine associations between health risk behaviors and HIV among AGYW using the Rwanda Demographic Health Survey from 2014-15. From the bivariate analysis, odd ratios were determined (unadjusted and adjusted odd ratios) with 95% confidence interval. Adjusted odd ratios, using backward selection method, was used to find actual association with a p. value < 0.005.

Results: A total of 737 AGYW aged 15-24 years old that completed the national survey questionnaires and interview made up the sample size for this study. Among them 4.2% (n=31) tested HIV positive. The results demonstrate that HIV infection was negatively significantly associated with AGYW having secondary school students [OR=0.14, 95% CI: 0.31-0.59, p=0.008] and residents of rural area [OR=0.33, 95% CI: 0.14-0.75, p=0.009]. The findings reveal that having 2 or more sexual partners is positively and significantly associated with HIV infection [OR=7.43, 95% CI: 1.79-30.86, p= 0.006].

Conclusion: These results recommend designing combined preventive interventions targeting AGYW focusing on socioeconomic needs of this fragile group. Moreover, there is need to improve the access and promote education and special follow-up for those who are in school in order to reduce the vulnerability of AGYW to HIV infection. An education package should include knowledge; attitudes and skills specifically aimed at HIV prevention, promoting behaviors such as condom use.

Keywords: Determinants, HIV infection, Adolescent girls, Young Women, Rwanda

TABLE OF CONTENTS

DECLARATION.....	i
DEDICATION.....	ii
ACKNOWLEDGEMENT.....	iii
ABSTRACT.....	iv
TABLE OF CONTENTS	v
LIST OF FIGURES.....	viii
ACRONYMS AND ABBREVIATION.....	ix
DEFINITIONS OF TERMS	1
INTRODUCTION.....	2
1.1. BACKGROUND.....	2
1.2. PROBLEM STATEMENT.....	3
1.3. STUDY RATIONALE	4
1.4. OBJECTIVES.....	4
1.4.1. General objective.....	4
1.4.2. Specific objectives.....	4
1.4.3. Research questions.....	4
2.0. LITERATURE REVIEW.....	6
2.1. EMPIRICAL LITERATURE.....	6
2.2. CONCEPTUAL FRAMEWORK.....	8
3.0. METHODOLOGY.....	10
3.1. STUDY SETTING.....	10
3.2. STUDY DESIGN	10
3.3. STUDY POPULATION.....	10
3.4. SAMPLING METHODOLOGY.....	10
3.4.1. SAMPLE SIZE.....	10
3.4.2. INCLUSION CRITERIA.....	10
3.4.3. EXCLUSION CRITERIA.....	10
3.5. DATA COLLECTION PROCEDURES AND TOOLS.....	10
3.5.1. DATA COLLECTION PROCEDURES	10
3.6. CONCEPTUAL AND OPERATIONAL DEFINITION OF VARIABLES.....	11
3.7. DATA ANALYSIS AND PROCEDURES.....	12

3.8. ETHICAL CONSIDERATIONS	12
4.0. RESULTS	14
4.1. SOCIO-DEMOGRAPHIC CHARACTERISTICS OF THE STUDY POPULATION ...	14
4.2. HEALTH RISK BEHAVIORAL CHARACTERISTICS OF THE STUDY POPULATION	15
4.3. SOCIO-DEMOGRAPHIC FEATURES AND HIV INFECTION.....	16
4.4. HEALTH RISK BEHAVIOR ACCORDING TO HIV INFECTION.....	17
4.5. BIVARIATE ANALYSIS	18
4.5.1: Socio-demographic characteristics associated to HIV infection.....	18
4.5.2: Health Risk Behavior associated with HIV infection	19
4.6. SOCIO-DEMOGRAPHIC ADJUSTED BIVARIATE ANALYSIS	20
4.7. MULTIVARIATE ANALYSIS	21
5.0. DISCUSSION.....	23
6.0. CONCLUSION AND RECOMMENDATIONS.....	25
REFERENCES.....	27
APPENDIX.....	30
APPROVAL TO USE DATASET	30

LIST OF TABLES

Table 1: socio-demographic demographic characteristics of adolescent's girls and young women, (n=737).....	15
Table 2: Health risk behavior characteristics of adolescent girls and young women. (n=737)	16
Table 3: Socio-demographic characteristics and HIV infection. (n=737)	17
Table 4: Health Risk behavioral characteristic associated with HIV infection (n= 737).....	18
Table 5: socio-demographic characteristic associated to HIV infection. (n=737).....	19
Table 6: Bivariate analysis for health risk behaviors. (n=737)	20
Table 7: Adjusted odd ratio (AOR) for socio-demographic characteristics. (n=737).....	21
Table 8: Multiple Logistic regression for socio demographic and health risk behaviors associated to HIV infection.	22

LIST OF FIGURES

Figure 1: Conceptual framework on determinants HIV infection among Adolescents Girls and Young Women (AGYW).....	8
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ACRONYMS AND ABBREVIATION

AGYW:	Adolescent Girls and Young Women
AIDS:	Acquired Immune Deficiency Syndrome
ART:	Antiretroviral Treatment
BCC:	Behavior Change Communications
cART :	Combined Antiretroviral Therapy
CI:	Confidence interval
COR:	Crude odd ratio
DMPA:	Depot Medroxy Progesterone Acetate
DREAMS:	Determined resilience empowered AIDS-free mentored and safe women
HIV:	Human Immunodeficiency Virus
HTS:	HIV Testing Services
IRB:	Institutional Review Board
NISR:	National Institute of Statistics of Rwanda
OR:	Odd Ratio
PMTCT:	Prevention of Mother to Child HIV Transmission
RBC:	Rwanda Biomedical Center
RDHS:	Rwanda Demographic Health Survey
SRH:	Sexual and Reproductive Health
SSA:	Sub-Saharan Africa
UNAIDS:	United Nations Acquired Immune Deficiency Syndrome
WHO:	World Health Organization

NO INDEX ENTRIES FOUND.**DEFINITIONS OF TERMS**

- **Adolescents:** Individuals who have started undergoing the process of puberty towards the development of social independence. The World Health Organization (WHO) considers adolescents as individuals age 10-19. This adolescence period is characterized by opportunities and health risk (1–3).
- **Young women:** Young adults who are within the age group 20-24 (2).
- **Determinants:** Factors that influence the health (HIV Infected or not) of individual (Adolescent Girls and Young Women). These determinants could range from socio-economic, cultural to environmental determinants (4).

INTRODUCTION

1.1. BACKGROUND

Human Immunodeficiency Virus (HIV) leading to Acquired Immune Deficiency Syndrome (AIDS) remains a major global health burden worldwide. The infection and disease increases morbidity and mortality across the world and is associated with comorbidities that decrease the quality of life in HIV infected Adolescent Girls and Young Women (AGYW) (5).

In 2015, there were 1.1 million HIV-related deaths, 2.1 million new HIV infections, and 36.7 million people living with HIV worldwide. Most of the burden of HIV infection is predominately in Sub-Saharan Africa (SSA), where 73% of deaths and 65% of new infections occurred and 70% of people live with HIV infection. The high prevalence of HIV in African countries is associated with multi-factors such as poverty, inadequate preventive information, weak norms of society that accept the sexual behaviors, early marriage, and gender inequality on HIV AIDS (6). Despite the limitations, the global response to the epidemic has been impressive, as HIV infected people now have access to Combined Antiretroviral Therapy (cART). This is also accompanied by a combination of mass media, social, and behavioral change communication campaigns around HIV, which has contributed to the global reduction (5,7,8)

Some groups of people on the planet are more vulnerable to HIV infections than others. Globally, in 2013, almost 60% of all new HIV infections among young people aged 15-24 occurred among AGYW. This is further explanation that 15% of women age 15-24 now live with HIV, of whom 80% are from SSA (9).

A global-level analysis indicates that across all age groups, AIDS-related deaths declined by 45% between 2005 and 2016. However, over the same period AIDS-related deaths increased among adolescents and remains a leading cause of death in Africa, with a more than 1% prevalence among AGYW aged 15-24 in SSA (10). Even though HIV infections are higher among AGYW, their access to Antiretroviral Treatment (ART) services is very low in SSA like Rwanda, at 34%, which is attributed to low levels of HIV testing (11).

In Rwanda, HIV prevalence has remained stable at 3% over the last 10 years. HIV prevalence among adolescents' 15-19 years is 0.6 % and 1.5% for younger adults 20-24 years old (11,12).

According to the Rwandan Demographic Health Survey 2015 (RDHS), there exists gender difference in HIV infections among the young. They found that young girls are 5 times more likely to have HIV infection compared to boys whom they have same category of age, with a prevalence rate of 2.5% among girls compared to 0.5% among boys (13).

The Government of Rwanda has engaged in a number of interventions to address HIV infections among AGYW like: creating youth friendly centers and collaborating with the Imbuto Foundation (14). Rwanda has also made great advances in different HIV programs, including: the availability of prevention services through HIV testing and counseling services (HTS) which constitute the first step toward HIV epidemic control. Many HTS approaches are available at health facilities, and within the community. To date, the coverage of ART treatment in Rwanda is high, over 90%, and the country is on track towards achievement of its 90-90-90 targets. However, the interventions and achievements made thus far, there have not been any observed declines in HIV rates among AGYW. Rather, the National HIV/AIDS target for 2018-2020-2030 states that they are projecting an increase of HIV infections among adolescents' and young adults by 2020 within the country (15).

Currently there exists a substantive body of literature in Rwanda on risk factors for HIV infections among youth, but there is limited information about factors related to AGYW in Rwanda. For this reason, this study focuses on identifying determinants of HIV infection among AGYW in Rwanda.

1.2. PROBLEM STATEMENT

In Rwanda, the prevalence of HIV is at 3% and in female youth, it is more than half the prevalence of the general population at 2.5% leading to a loss of a productive sect of the population and failure of these individuals to achieve their full potential. The high rates of HIV infection among AGYW in Rwanda persist despite interventions across the country where the population has access HIV services for the prevention and control of HIV infection. The implementation of interventions such as prevention of mother to child HIV transmission (PMTCT), follow-up programs for discordant couples, and programs for key populations and Behavior Change Communications (BCC) are available to assist the manage HIV infection within the population. However, the incidence rate among youth continue to increase overtime,

mostly in AGYW,, which indicates a high need to understand determinants of HIV infection among this group in order to control and limit the prevalence among this “economic dividend” group.

1.3. STUDY RATIONALE

As a result of the health margin existing in HIV infections within male and female youth of the same age group in Rwanda, it would be important for public health specialist to conduct a study that shows determinants of HIV infection among AGYW in order to generate evidence and inform strategies to ensure that services are provided and used effectively by this targeted group. Its findings will contribute in limiting the problems faced by AGYW in-regards to HIV infections and to help improvement of services provided to this group.

1.4. OBJECTIVES

1.4.1. General objective

The overall objective of this study is to assess the determinants of HIV infection among adolescents’ and young women aged 15 to 24 in Rwanda for the design and implementation of sound strategies to limit HIV as a global burden.

1.4.2. Specific objectives

- To describe the socio-demographic characteristics of HIV infections among AGYW aged 15-24 years old in Rwanda.
- To describe health behavior determinants of HIV infections among AGYW aged 15-24 years old in Rwanda.
- To determine the association between socio-demographic characteristics associated with HIV infection among AGYW in Rwanda.
- To determine health behavior factors associated with HIV infections among AGYW in Rwanda.

1.4.3. Research questions

- What are the socio-demographic characteristics of HIV infections among AGYW aged 15-24 years in Rwanda?
- What are the health behavior determinants of HIV infections among AGYW in Rwanda

- Which socio- demographic characteristics are associated with HIV infection among AGYW in Rwanda?
- Which health behavioral factors are associated with HIV infections among AGYW in Rwanda?

2.0. LITERATURE REVIEW

2.1. EMPIRICAL LITERATURE

The health of AGYW has long been a global concern, with advocates for elimination of all forms of discrimination among them, to promote Sexual and Reproductive Health (SRH) including HIV infections. In Rwanda, the age of sexual debut is said to be associated with HIV infections. It is further explained that this factor leads to the high occurrence of HIV infections in teen girls as to boys. Elsewhere, they are also exposed to violence that put them on the track of early sexual debut, affecting their HIV status (9,16).

Furthermore, female biological make up, has been said to be associated with HIV infections, even at the very first and the only one sexual intercourse. The biological make-up of the female vagina has a mucosal surface that exposes AGYW to HIV infections faster than their male partners. Also, AGYW are more susceptible to HIV infections than older women because of the presence of more mucosa in the cervix. Additional explanation is that the acquisition of Herpes Simplex Virus -2 (HSV-2) due to sexual debut increases the vulnerability of AGYW to HIV infections (17).

Other findings state that poverty pushes AGYW to engage in unsafe sexual activities in the quest for finances, even with multiple sexual partners, especially when they are the breadwinners of their families. More so, exposure to HIV infections have been found to be rampant on young women age 20-24, all leading to variations in age-gender variations in HIV infections across countries especially in SSA (5,6,16,18,19).

Increased HIV prevalence among female youth under the age of 24 have also been said to be high among those utilizing of hormonal depot medroxyprogesterone acetate (DMPA). Interestingly, DMPA usage lowers the HIV risk among older women >24 years of age (16,17).

Still, limited education in AGYW have been found to increase the risk to HIV infections, as they lack the required knowledge to prevent themselves. This is further explained by the United Nations Convention on the Right of the Child that limits comprehensive knowledge to SRH, widening the individual vulnerability to negative health outcomes, like HIV, and delays their abilities to seek health services. Low knowledge levels may also increase risk of not gaining

skills that will enable them to have employment, hence the desire for transactional sex in order to meet needs (17,18,20).

Indeed, the engagement into sexual acts without the use of condoms because of the limited abilities of female to negotiate for the use of a condom during sexual acts, especially when sex is practiced with an older partner or through violence, as have been found to be associated with HIV prevalence in Southern Africa. These facts have led to a greater differences in the HIV infection rates between AGYW and their male counterparts (17).

Lack of parental and child communication has also been found to be associated with HIV outcomes in Zambia. The explanation for this is that culture considers open discussions of sexual topics as a taboo. Parents are also said to be uncomfortable in discussing sex matters with their female AGYW which is said to be associated with HIV infections (20).

In Zambia, AGYW have been said to be afraid of accessing HIV testing services to confirm their HIV status and reduce their vulnerability to HIV infections hence high prevalence rates among them (19).

2.2. CONCEPTUAL FRAMEWORK

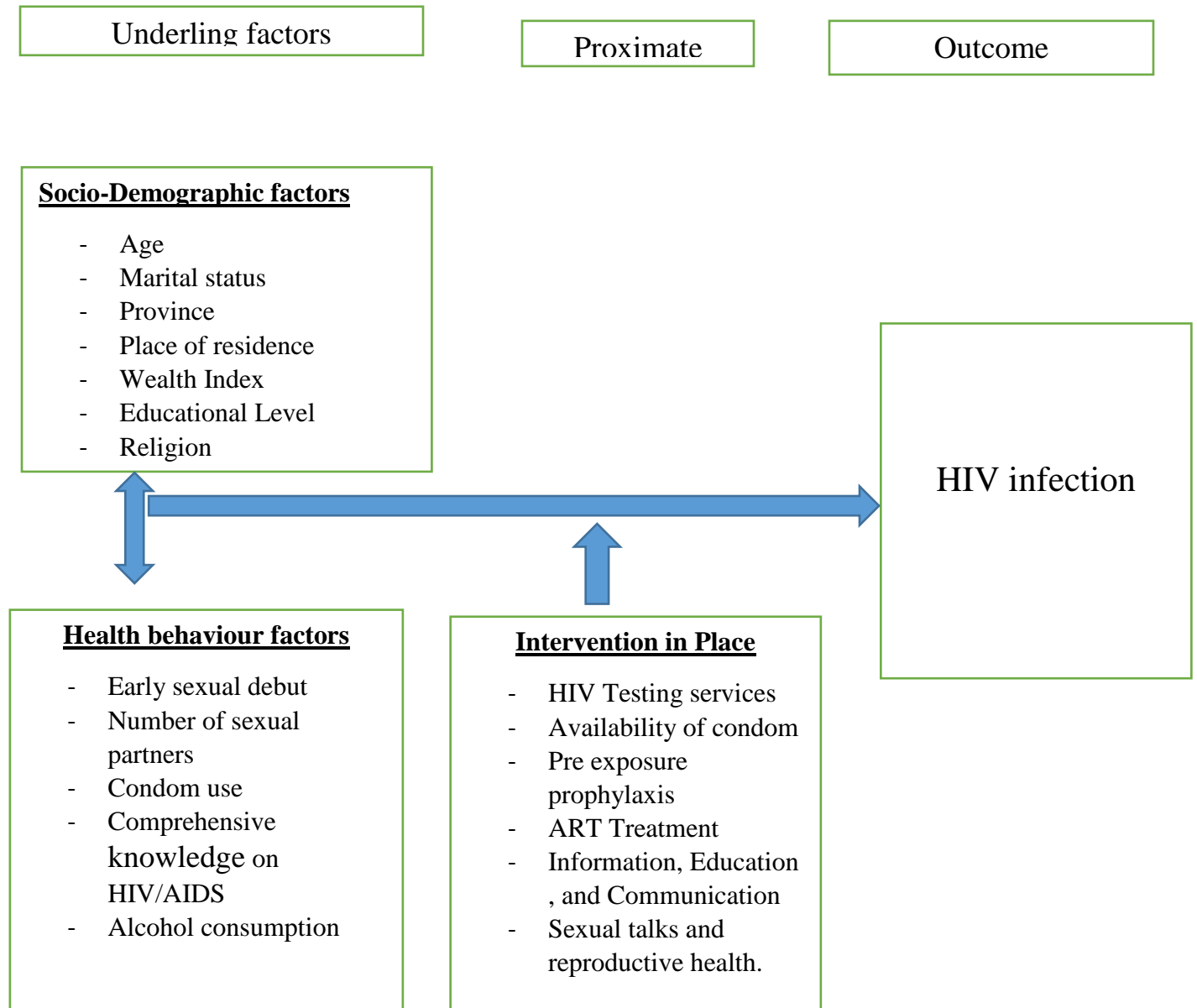


Figure 1: Conceptual framework on determinants HIV infection among Adolescents Girls and Young Women (AGYW)

The conceptual framework above demonstrates that the place of residence and province can negatively influence the behaviour of AGYW. This can be explained that AGYW may engage in early sexual activities, leading to more than one sexual partner, without the use of a condom. However, the various interventions within communities providing information, education, and communication as well as availing condoms for the protection and prevention of HIV infection,

the AGYW still do not utilize the available services, leading to raise the prevalence of HIV infection among them.

Furthermore, the Wealth Index and Educational level of the AGYW can increase HIV prevalence. In uneducated AGYW coming from a poor wealth index may lead them not to be able to have the skills and intellectual capacity to make sound decisions on responsible health sexual behaviours.

Nevertheless, the educated AGYW coming from a poor wealth index may be knowledgeable on various preventive and protective measures against HIV. Therefore, education is a way of making AGYW have skills that can be used in limiting poverty and can assist them increase their age of sexual debut, leading to a reduction in the number of sexual partners. They will also be able to have the ability to negotiate for safe sex which will in tend reduce HIV prevalence among AGYW.

3.0. METHODOLOGY

3.1. STUDY SETTING

Rwanda is a land locked country with little exportable products, found in East Africa. The country's main activity is agriculture, where less than half of the population is able to afford a hectare of land (21). The country has four provinces, and the capital, Kigali City. The Northern Province of the county is bounded by Uganda, the Southern by Burundi, the Eastern by Tanzania and the Western by Democratic Republic of Congo (12). The life expectancy is 67 years with 39% of the population being made up of youth (22,23). Rwanda has adopted a health development strategy based on decentralized management and district level service delivery.

3.2. STUDY DESIGN

This study will be an analytical cross-sectional study using the RDHS 2014/2015 data.

3.3. STUDY POPULATION

The study population comprises of Rwandan Adolescent Girls and Young Women (AGYW) aged 15-24 years old.

3.4. SAMPLING METHODOLOGY

3.4.1. SAMPLE SIZE.

The sample size was drawn from the RDHS 2014/15. This survey, conducted in every 5 years, collects population's information within households, from both gender (Male and Female), aged 15-49, and among key indicators collected includes information on their knowledge and attitudes toward sexually transmitted infections (STIs) and recent behavioral changes. A total of 737 AGYW aged 15-24 years old completed the RDHS questionnaires, and interviews, comprising the sample size for this study.

3.4.2. INCLUSION CRITERIA

We included in this study all AGYW aged 15-24 years of age, tested for HIV infection

3.4.3. EXCLUSION CRITERIA

- Anyone who does not meet the inclusion criteria above was not part of the study.

3.5. DATA COLLECTION PROCEDURES AND TOOLS.

3.5.1. DATA COLLECTION PROCEDURES

This study used secondary data provided by RDHS 2014/15. An application to use the data was made to the Demographic Health Survey headquarters America and an approval was granted on

April 4th, 2019. Factors that could help determine AGYW HIV infections were pulled from the women and HIV data sets to create a new data set.

3.6. CONCEPTUAL AND OPERATIONAL DEFINITION OF VARIABLES.

a. Independent variables:

Socio-Demographic factors

- **Residence:** The area in which the AGYW lives. It was classified into Urban and Rural.
- **Province:** The administrative units within the country functions. They are classified into five that is: Kigali City, South, North, West, and Eastern provinces.
- **Religion:** The variable was classified into: Catholic, Protestant, Adventist, Muslim, Jehovah witness, Non-religious, and others, depending on the faith of the individual.
- **Education level:** The intellectual class of the individual, classified as: no education, primary or secondary education.
- **Wealth Index:** The study considered the classification used by RDHS which puts households into various income categories: lowest, second, middle, fourth and highest. These categories are gotten by taking into consideration three steps. The categories once computed taking into consideration household characteristics such as: electricity at home and durable goods like owning a television. Then an index for household wealth index is computed ranging from lowest through highest.
- **Age:** How many birthdays the participant had celebrated before the date of the survey. Ages were categorized into 15-19 and 20-24 years of age.
- **Marital status:** The study considered the classification used by RDHS as: never in union, married, living with partner, widowed, divorced, and no longer living together/separated. Later run in the analysis, this variable was characterized into two as; married/living with partner and not married.

Health risk behavioral factors

- **Multiple sexual partners:** An AGYW was known to be at risk of HIV infections if she had 2 or more sexual partners within the past 12 months of the RDHS and/or at some intervals.
- **Consistent condom use:** Any AGYW who was having sexual intercourse with the use of a condom during the first and last act and within the last 12 months was considered at not at risk of HIV infections.
- **Age of sexual debut:** Any AGYW who had any time of sexual intercourse at an age <15 years old, is considered at increased risk of HIV infections according to this study.
- **Understanding knowledge on HIV:** Having knowledge on HIV transmission modalities including a healthy-looking person can have HIV, while rejecting that HIV cannot be transmitted by mosquito bites or sharing food (not considered risk factors for HIV infections for AGYW in Rwanda).
- **Alcohol consumption:** Any female AGYW who consumed drinks with ethanol. She who did consume, was labeled YES and that who didn't was labeled NO.

Dependent variable

Human immunodeficiency virus (HIV) is the agent that leads to HIV infection.

In that case,

1= HIV positive and 0 = HIV negative.

3.7. DATA ANALYSIS AND PROCEDURES

Data were analyzed using STAT version 13.0, Descriptive statistics were summarized and proportions were calculated. Chi-square test was used to assess associations where applied. Thereafter, bivariate logistic regression was computed to determine associations between factors and HIV among AGYW. From the bivariate and multivariate analyses, odd ratios were determined (unadjusted and adjusted odd ratios) with their 95% confidence intervals, where adjusted odd ratios made use of backward selection method to assess association at $p < 0.005$ value.

3.8. ETHICAL CONSIDERATIONS

This study is a secondary data analysis using RDHS 2014/15. This is a standard survey, which is internationally recognized. These datasets do not contain identities of any of the participants. The

researcher was not given any file with personal information of the participants. And did not make any effort to identify participants. As such, there was little or no possibility of breach of the participants' privacy and confidentiality. We are therefore sure that the confidentiality of the participants has been preserved. Therefore, prior Ethical Approval was obtained from UR Institutional Review Board (IRB).

4.0. RESULTS

4.1. SOCIO-DEMOGRAPHIC CHARACTERISTICS OF THE STUDY POPULATION

Table 1 describes the study sample by socio-demographic characteristics. The majority of the participants were young women, aged 20-24 years old (66.76%), not married (70.42%), were protestants (45.24%) or catholic (41.17%), with primary education (59.16%), from the East Province (22.93%), the South Province (22.25%) or the West Province (22.12%), residing mainly in rural settings (67.03%), and were from the richest households (34.19%) followed by the poorest households (17.50%).

Table 1: socio-demographic demographic characteristics of adolescent's girls and young women, (n= 737).

Variable	Values	n	Percentages (%)
Age	15-19	245	33.24
	20-24	492	66.76
Marital status	Never in union	519	70.42
	Married	37	5.02
	Living with partner	146	19.81
	Widowed	1	0.14
	Divorced	11	1.49
	No longer living together/separated.	23	3.12
Religion	Catholic	303	41.17
	Protestant	333	45.24
	Adventist	70	9.51
	Muslim	21	2.85
	Jehovah witness	6	0.82
	No religion	3	0.14
Level of education	No education	23	3.12
	Primary	436	59.16
	Secondary	268	36.36
	Higher	10	1.36
Province	Kigali city	148	20.08
	South	164	22.25
	West	163	22.12
	North	93	12.62
	East	169	22.93
Residence	Urban	243	32.97
	Rural	494	67.03
Wealth quintile	Poorest	129	17.50
	Poorer	103	13.48
	Middle	125	16.96
	Richer	128	17.37
	Richest	252	34.19

4.2. HEALTH RISK BEHAVIORAL CHARACTERISTICS OF THE STUDY POPULATION

Table 2 describes the study sample by health risk behaviors. Overwhelmingly, the high number of AGYW revealed that they started having sexual intercourse at age 15 or older (83.29%) and had only one sexual partner (56.17%) with adequate knowledge on HIV infection (77.88%).

Table 2: Health risk behavior characteristics of adolescent girls and young women. (n=737)

Variable	Values	n	Percentages (%)
Consistent condom use within the last 12 months	No	54	7.36
	Yes	680	92.64
Number of sexual partners within the last 12 months	0	305	41.38
	1	414	56.17
	2+	18	2.44
Age of sexual debut	6-14	123	16.71
	15-24	613	83.29
Comprehensive knowledge of HIV	Inadequate	163	22.12
	Adequate	574	77.88
Alcohol use *	No	34	30.63
	Yes	77	69.37
Outcome factor			
HIV infection	No	706	96.79
	Yes	31	4.21

*: data was extracted from another dataset within the survey and does not equal overall total.

4.3. SOCIO-DEMOGRAPHIC FEATURES AND HIV INFECTION

Table 3 shows the relationship that exists between the sample population and HIV infection. It illustrates the overall HIV prevalence among AGYW is 4.21%. The proportion of HIV infection was significantly higher among young women living in urban areas (4.67%, $p=0.008$) and those were mostly without education, though the difference is not statistically significant (13.04%, $p=0.109$).

Table 3: Socio-demographic characteristics and HIV infection. (n=737)

Variable	HIV -		HIV +		P.value
	n	%	n	%	
Age					
15-19	237	96.73	8	3.27	0.369
20-24	469	95.3	23	4.67	
Marital status					
Not married	534	96.39	20	3.61	0.161
Married /Living with partner	172	93.99	11	6.01	
Religion					
Catholic	292	96.37	11	3.63	0.227
Protestant	318	95.50	15	4.50	
Adventist	67	95.71	3	4.29	
Muslim	20	95.24	1	4.76	
Jehovah witness	6	100	0	0.00	
No religion	2	66.67	1	33.33	
Level of education					
No education	20	86.96	3	13.04	0.109
Primary	416	95.41	20	4.59	
Secondary	260	97.01	8	2.99	
Higher	10	100	0	0.00	
Province					
Kigali city	136	91.89	12	8.11	0.054
South	158	96.34	6	3.66	
West	161	98.77	2	1.23	
North	89	95.70	4	4.30	
East	162	95.86	7	4.14	
Residence					
Urban	226	93	17	7.00	0.008
Rural	480	97.17	14	2.83	
Wealth quintile					
Poorest	124	96.12	5	3.88	0.611
Poorer	100	97.09	3	2.91	
Middle	122	97.60	3	2.40	
Richer	122	95.31	6	4.69	
Richest	238	94.44	14	5.56	

4.4. HEALTH RISK BEHAVIOR ACCORDING TO HIV INFECTION

Table 4 demonstrates the HIV status was positively higher among AGYW who had two or more sexual partners (16.67%, $p=0.010$) and among those who had sexual intercourse at age 15 and above (4.89%, $p = 0.040$).

Table 4: Health Risk behavioral characteristic associated with HIV infection (n= 737)

Variable	HIV -		HIV +		P.value
	n	%	n	%	
Consistent of using Condom within the last 12 months					
No	54	100	0	0.00	0.109
Yes	649	95.44	31	4.56	
Number of sexual partners within the last 12 months					
0	297	97.38	8	2.685	0.010
1	394	95.17	20	4.83	
2+	15	83.33	3	16.67	
Early Sexual Debut					
6-14	122	99.19	1	0.81	0.040
15-24	583	95.11	30	4.89	
Comprehensive knowledge of HIV					
Inadequate	158	96.93	5	3.07	0.412
Adequate	548	95.47	26	4.53	
Alcohol use *					
No	34	100	0	0.00	0.051
Yes	69	89.61	8	10.39	

*: data was extracted from another dataset within the survey and does not equal overall total.

4.5. BIVARIATE ANALYSIS

4.5.1: Socio-demographic characteristics associated to HIV infection

In Table 1 and 3, socio-demographic factors related to HIV infection are described, where Table 5 depicts socio-demographic factors that increase the likelihood of HIV infection. The results show that HIV infection was more likely to be 13.7 time higher among those not reporting religion affiliation [OR=13.7, 95% CI: 1.12-157.69, $p= 0.041$] compared those with any sort of religion affiliation. Decreased likelihood of HIV infection was significantly associated with secondary school students [OR=0.21, 95% CI: 0.05-0.83, $p=0.027$] coming from the Western province [OR=0.14, (95% CI: 0.31-0.64), $p=0.011$], and residing in rural areas [OR=0.39, 95% CI: 0.19-0.80, $p=0.010$].

Table 5: socio-demographic characteristic associated to HIV infection. (n=737).

Socio-demographic characteristics	COR*	(95 Confidence interval)	P. value
Age			
15-19	1		1
20-24	1.45	[0.64-3.29]	0.372
Marital status			
Not married	1		1
Married /Living with partner	1.71	[0.80-3.63]	0.165
Religion			
Catholic	1		1
Protestant	1.25	[0.57-2.77]	0.579
Adventist	1.19	[0.32-4.38]	0.795
Muslim	1.33	[0.16-10.80]	0.791
Jehovah witness	***	***	***
No religion	13.7	[1.12-157.69]	0.041
Level of education			
No education	1		1
Primary	0.32	[0.09-1.17]	0.085
Secondary	0.21	[0.05-0.83]	0.027
Higher	***	***	***
Province			
Kigali city	1		1
South	0.43	[0.16-1.18]	0.101
West	0.14	[0.31-0.64]	0.011
North	0.51	[0.16-1.63]	0.255
East	0.49	[0.19-1.28]	0.145
Place of residence			
Urban	1		1
Rural	0.39	[0.19-0.80]	0.010
Wealth quintile			
Poorest	1		1
Poorer	0.74	[0.17-3.19]	0.690
Middle	0.61	[0.14-2.61]	0.505
Richer	1.22	[0.36-4.10]	0.748
Richest	1.46	[0.51-4.14]	0.478

4.5.2: Health Risk Behavior associated with HIV infection

Table 2 and 3 describes health risk behavior factors related with HIV infection. Table 6 indicates health risk behavioral factors with high likelihood of increasing HIV infection. Only having 2 or more sexual partners, lead to being 7.43 times more likely to be infected by HIV [OR=7.43, 95% CI: 1.79-30.86, $p= 0.006$] than those without a partner.

Table 6: Bivariate analysis for health risk behaviors. (n=737)

Health risk behaviors	COR	(95 Confidence interval)	P. value
Consistent Condom use within the last 12 months			
No	1	1	
Yes	***	***	***
Number of sexual partner within the last 12 months			
0	1	1	
1	1.88	[0.82-4.34]	0.132
2+	7.43	[1.79-30.86]	0.006
Early Sexual Debut			
6-14	1	1	
15-24	6.28	[0.85-46.46]	0.072
Comprehensive knowledge of HIV			
Inadequate	1	1	
Adequate	1.49	[0.57-3.97]	0.415
Alcohol use			
No	1	1	
Yes	***	***	***

***: variable can't independently predict the outcome value

4.6. SOCIO-DEMOGRAPHIC ADJUSTED BIVARIATE ANALYSIS

Table 5 shows socio-demographic factors that increase the likelihood of HIV infection, while Table 7 illustrates factors which are highly associated with HIV infection. The results demonstrate that HIV infection was less significantly associated with AGYW having secondary school education [OR=0.14, 95% CI: 0.31-0.59, $p=0.008$] and residing in a rural area [OR=0.33, 95% CI: 0.14-0.75, $p=0.009$].

Table 7: Adjusted odd ratio (AOR) for socio-demographic characteristics. (n=737)

Socio-demographic characteristics	AOR	(95 Confidence interval)	P. value
Level of education			
No education	1	1	
Primary	0.29	[0.74-1.11]	0.070
Secondary	0.14	[0.31-0.59]	0.008
Higher	***	***	***
Religion			
Catholic	1		
Protestant	1.15	[0.78-1.66]	0.469
Adventist			
Muslim			
Jehovah witness			
No religion			
Province			
Kigali city	1		
South	0.97	[0.73-1.28]	0.822
West			
North			
East			
Place of residence			
Urban	1		
Rural	0.33	[0.14-0.75]	0.009

***: variable can't independently predict the outcome value

4.7. MULTIVARIATE ANALYSIS

Table 9 shows a model of adolescent girls (15-19 years old) and young women (20-24 years old). The model states that engaging in sexual activities with 2 or more sexual partners exposed AGYW to 6.82 times more increased risk to HIV infection [OR=6.82, 95% CI: 1.54-30.21, $p=0.011$] than those having a single or no partner. A negative association was seen of AGYW being HIV infected if they reside in rural settings [OR=0.9, 95% CI: 1.3-0.63, $p=0.002$] and were secondary school students [OR=0.11, 95% CI: 0.03-0.51, $p=0.005$].

Table 8: Multiple Logistic regression for socio demographic and health risk behaviors associated to HIV infection.

Variables	AOR	(95 Confidence interval)	P. value
Place of residence			
Urban	1		
Rural	0.9	[1.3-0.63]	0.002
Number of sexual partner within the last 12 months			
0	1	1	
1	2.15	[0.92-5.05]	0.78
2+	6.82	[1.54-30.21]	0.011
Level of education			
No education	1	1	
Primary	0.27	[0.07-1.05]	0.058
Secondary	0.11	[0.03-0.51]	0.005
Higher	***	***	***

5.0. DISCUSSION

In Rwanda, several efforts have been made to curb HIV infection rates. Despite these efforts, there still exists a high proportion of HIV infection among AGYW. The findings from this study reveal that the HIV rates among this population stands at 4.21%. This high prevalence could be explained by the fact that AGYW engage in sexual acts with numerous partners, partially influenced by peer groups (24). Similar to South Africa, HIV infection is said to be propagated in AGYW due to the fact that they have concurrent sexual partners gained through their sexual networks. The act is said to expose them more toward HIV than any other group because it is practiced with older men (25).

Understanding multiple sexual partners' contribution to HIV has been further explained by studies from Rwanda, Nepal, and South Africa. AGYW start having sex at an early age which increases their likelihood to participate in risky sexual behaviors, such as inadequate use of condoms due to insufficient information on their benefit (26–28). This is explained in that early sexual debut increases number of years of sexual activity, hence providing many sexual partners over time. The early sexual practice linked with lower power to discuss protected sex, particularly due to power imbalances between the sexual partners. (28).

When considering educational level, this research found that schooling is a protective factor against HIV infections among AGYW, unlike those who are not educated. This is further explained by the DREAMS study, conducted in Sub-Saharan African countries, which illustrated that keeping AGYW in schools protects them from HIV infection, contrary to those who left school (29). In Rwanda, Botswana, Malawi, and Uganda it has been shown that decreased HIV infection are a result of an additional year in education (26,29,30). The time spent at school is considered as a protective measure because AGYW have less time to spend with high risk population (older men), as they are more likely to be HIV-positive. In this study, education is strongly related to HIV infection rates, as it is found that having secondary education, as opposed to primary education level, is a defensive factors against HIV infection among AGYW. In SSA countries, findings are that educated AGYW are less likely to be HIV infected due to their exposure to education at school regarding sexual and reproductive health (29,31). In addition, this education exposure at school, upon completion, enables these AGYW to gain employment that increases their social-economic status. This makes them more independent, with less interest

on paid sex with high risk population (29). The AGYW are capable of negotiating for safe sex, hence protecting them from HIV infection.

Place of residence has been found to predict HIV infection rates among AGYW in this study, increased by residing in an urban setting. That may be explained by, AGYW residents in rural areas with fewer distractions, as opposed to those AGYW living in urban areas. This is in line with finding from previous studies that state, place of residence put AGYW at risk of HIV (5,6).

Despite benefits this study brings by displaying determinants of HIV among AGYW, it is worthy to consider some limitations. Firstly, the study is cross-sectional and cannot adequately determine causality of factors for HIV infection among AGYW. Secondly, the study did not comprehensively explore all variables that could possibly explain HIV infection among AGYW. This study used secondary data that didn't collect other important variables that have been found to explain determinants of HIV infection among AGYW, such as manner in which the sex was practiced, drug abuse, and status of sexual partners.

6.0. CONCLUSION AND RECOMMENDATIONS

The globe strives to have a world free of HIV infection. This could be further achieved through HIV prevention among AGYW. This study reports the determinants of HIV infection among AGYW in Rwanda. HIV infection is still a problem affecting health and wellbeing of Rwandan AGYW due to factors like: education, number of sexual partners, and place of residence. Interventions need to focus on highlighted factors and beyond to achieve the global goal of zero HIV infection by 2030.

Based on our findings we recommend different interventions to the National HIV prevention program that could be integrated and would help to monitor the reduction of HIV infection among AGYW in Rwanda are:

- Educate AGYW the benefits of abstinence, this information should be given to all AGYW through the EIC message, distribution of fliers, and the use of mass media. This can go with the help of parental support to willingly discuss with their AGYW on sexual and reproductive health in order to have sufficient information.
- For those who are sexual active, Education session on the use of condom as one of the effective measure to protect them from HIV infection is highly recommended
- There should be implementation of comprehensive programs with messages that reinforce positive individual and group norms, inform them about protected sex, teach them how to negotiate safer sex, and make sure condoms are available for all.
- Moreover, there is a need to properly follow-up AGYW who are in school in order to promote educational attainment and reduce their vulnerability towards HIV infection.
- Strengthening national actions to achieve universal access to basic education, addressing equity and equality in gender and location especially the AGYW.
- Interventions should also target those AGYW already living with HIV so as to reduce the viral load and enhance immunity for their participation in community development and protecting their peers.
- Sensitization of communities should be encouraged to promote positive environments for AGYW to practice positive sexual behaviors like use of condoms in case of sexual desires.

- AGYW should be empowered with the skills necessary to negotiate condom use successfully.
- We recommend that the National Institute of Statistics should include vital variables during DHS data collection such as manner in which the sex activities was practiced, information on drug abuse , and the status of sexual partners as those variable may be linked to the HIV infection among AGYW .

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APPENDIX

APPROVAL TO USE DATASET



Apr 04, 2019
Florence KAYITESI
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Request Date: 04/04/2019

Dear Florence KAYITESI:

This is to confirm that you are approved to use the following Survey Datasets for your registered research paper titled: "Determinants of HIV infection among adolescents girls and young women":

Rwanda

To access the datasets, please login at: https://www.dhsprogram.com/data/dataset_admin/login_main.cfm. The user name is the registered email address, and the password is the one selected during registration.

The IRB-approved procedures for DHS public-use datasets do not in any way allow respondents, households, or sample communities to be identified. There are no names of individuals or household addresses in the data files. The geographic identifiers only go down to the regional level (where regions are typically very large geographical areas encompassing several states/provinces). Each enumeration area (Primary Sampling Unit) has a PSU number in the data file, but the PSU numbers do not have any labels to indicate their names or locations. In surveys that collect GIS coordinates in the field, the coordinates are only for the enumeration area (EA) as a whole, and not for individual households, and the measured coordinates are randomly displaced within a large geographic area so that specific numeration areas cannot be identified.

The DHS Data may be used only for the purpose of statistical reporting and analysis, and only for your registered research. To use the data for another purpose, a new research project must be registered. All DHS data should be treated as confidential, and no effort should be made to identify any household or individual respondent interviewed in the survey. Please reference the complete terms of use at: <https://dhsprogram.com/Data/terms-of-use.cfm>.

The data must not be passed on to other researchers without the written consent of DHS. Users are required to submit an electronic copy (pdf) of any reports/publications resulting from using the DHS data files to: archive@dhsprogram.com.

Sincerely,
Bridgette Wellington
Data Archivist
The Demographic and Health Surveys (DHS) Program