



College of Medicine and Health Sciences

School of Public Health

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**Health risk behaviors among youth: Effects of Early Sexual Debut on HIV incidence
among Rwandan youth.**

*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

This work was the endpoint of my dissertation and no single idea in it is not originally mind.

Name of testifier:

Signature:

Date:

Name of verifier:

Signature:

Date:

Dedication

This piece of work is devoted to all my family members and friends who have never been tired of listening to my dramas.

Thank you,

I owe you a lot!

Acknowledgement

My gratitude goes to God Almighty for making this effort of mind a success.

My sincere appreciation also goes to all the staff of the University of Rwanda, College of Medicine and Health Science, School of Public Health for supporting and providing me with the skills necessary to accomplish this task.

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Moreover, my gratitude goes to all who put efforts to promote the health of the youth from diseases like HIV that disturb them from achieving their heart desires.

To all those who contributed in one way or the other towards the successful realization of this dissertation, may our Good Lord reward you for me abundantly.

Abstract

Background: Youth engagement in health-risk behaviors, exposes them to Human Immunodeficiency Virus (HIV) which propagates disabilities and a decline in the economic growth. This work is aimed at understanding the determinants of health-risk behaviors among the youth, and how limiting early sexual debut could contribute in minimizing disease incidence among Rwandan youth for the attainment of sexual and reproductive health.

Methodology: Using the Rwanda Demographic Health Survey data of 2014-15. A total of 1,528 youths aged 15-24 who met the eligibility criteria for this study were included by the main investigator. The extracted health-risk behaviors of youth, were categorized. STATA version 13.0, was used to compute proportions, Chi square test, bivariate, and multivariate logistic regressions for signal categories and the final model combined for all categories at a significant level of 95%. Adjusted Odd Ratio, was used in calculating Population Attributable Fraction for the youth in the total study population, and to examine the proportions of HIV infections among them. Ethical clearance for this study was approved by the ethics committee of the University of Rwanda, college of medicine and health sciences. Data were officially provided by DHS program.

Results: The study found that 2.62% (n=40) of youth is HIV infected where 2.06% (n=26) currently not living with a partner were HIV infection, p -value=0.003. The bivariate analysis revealed that being a female, was more likely to be infected by HIV than males (OR = 3.81, 95% CI = 1.80 – 8.07, p = 0.000). The final model revealed that youth who had sexual debut at ages 6-14 were less associated with HIV infection but highly significant (OR = 0.13, 95% CI = 0.02 – 0.94, p = 0.044) compared to those aged 15 - 17 who are highly associated to HIV though not significant (OR = 1.45, 95% CI = 0.76-2.77, p =0.256) during the past 12 months. The results also showed that about 3 % of HIV infection can be avoided among youths in Rwanda if they increase their age of sexual debut.

Conclusions: Health risk behaviors are still a risk to HIV infection among youths in Rwanda and are sparsely distributed between gender. This leads to significant influence in the prevalence of HIV infection that could be avoidable if prudent interventions are put in place. Public health programs that are population based considering contextual and structural factors need to be strengthened to avert these risk factors that increase HIV infection among youths in Rwanda.

Keywords: HIV infection, youth, early sexual debut, Rwanda, Health-risk behaviors

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List of acronyms

HIV:	Human Immunodeficiency Virus
RDHS:	Rwanda Demographic Health Survey
DHS:	Demographic Health Survey
OR:	Odd Ratio
COR:	Crude Odd Ratio
AOR:	Adjusted Odd Ratio
NA:	Not applicable because explanatory variable can't independently predict the value of the dependent variable.
NA*:	Not applicable
UNAID:	United Nations Aids for International Development
WHO:	World Health Organization
RBC:	Rwanda Biomedical Center
AIDs:	Acquired Immunodeficiency Syndrome
HTC:	Human Immunodeficiency Virus Testing and Counseling
BCC:	Behavior change communication
CDC:	Center for Disease Control and Prevention
ICDP:	International Conference on Population and Development
SSA:	Sub Saharan Africa
STIs:	Sexually Transmitted Infections
CI:	Confidence Interval
PAF:	Population Attributable Fraction
IRB:	Institutional Review Board
<:	Less than

Definition of Key terms

Youth: The United Nations for Statistical Purpose (1981), General Assembly Resolution (2001), and the Commission for Social Development Resolution (2007) defined youths as individuals between the ages of 15-24. This age group is said to host half of the Worlds Human Immunodeficiency Virus (HIV) infection with a higher prevalence in females (1,2).

Health-Risk Behaviors: They can be defined as demographic characteristics, genetic or immunologic make-up, behaviors, and environmental exposures that are associated with the increase in the occurrence of HIV (3). This definition is the working definition of this paper.

1.0. Introduction

1.1. Background

Health-risk behaviors among youths are a great factor for the increase in HIV prevalence, causing various economies to lose the greater portion of their productive population (4). In 2015, youths aged 15-24, contributed to 14-20% of new HIV infections worldwide (5). The World Health Organization (WHO) identified that HIV is the second cause of death among youths in Africa and Asia because they reach maturity at an earlier age. This exposes them to risk-taking behaviors which sometimes may disturb them from achieving their full potentials. The high rate of risk taking among youth increases disabilities mainly caused by HIV, thus delaying the economic growth within communities (6–8). The United Nations Aids for International Development (UNAID) has shown that nowadays, HIV incidence generally far weights deaths. This means that many individuals live with the diseases including youths and face discrimination and stigma within their communities (2).

Rwandan youth make up 22-27% of the total population and the prevalence rate of HIV among them stood at 1.0% in 2005, 2010, and 2014/ 2015 versus 3% for the general population (9–12). The Rwanda Biomedical Center (RBC) has proven that HIV prevalence is highest among the youth as compared to other groups. HIV infection among Rwandan youth is higher among female youth that stands at 3% than male youths at 1% (9,13). The gender disparity in HIV infection is witnesses in many of Sub-Saharan Africa (SSA) (14). The Rwandan HIV target is to reduce new infections in youth through access and utilization of HIV management services, increase comprehensive knowledge on HIV/AIDs, and increase male circumcision from 66% to 75% come 2020 (12).

Early sexual debut in Rwanda of ages <18, especially for women and multiple sexual partners, are said to increase HIV prevalence (9). It in turn, reflects itself in the older population. In Rwanda, it has also been found that youths get involved in risky health sexual behaviors as a result of inadequate access to contraceptives (15). This may be related to some cultural practices and believes, and inflexible rules, and regulations within the country (16), that increase the level of their exposure to HIV.

Given the high expectations from youth to uphold the development of the country, there is a need to enhance efforts to fight HIV by engaging communities. That is, bringing up strategies including

multiple stakeholder's and partners to improve the health and wellbeing of the youth. In Rwanda, efforts to prevent youths from contracting HIV are done through: HIV Testing and Counselling (HTC), male circumcision, Behavior Change Communication (BCC), and HIV pre-exposure Prophylaxis at all levels. This is done in collaboration with other sectors of the economy such as Ministry of sport, culture, and Education.

Despite this approach, the Fourth Rwanda Health Sector Strategic Plan 2018 still found that the health of youth is still endangered by HIV infection (17). The Rwanda Demographic and Health Survey (RDHS) indicates that youths still get involved in health-risk behaviors like early sexual debut and multiple sexual partners, a situation that increases their exposure to HIV infection (11). These risk-taking behaviors among youths are explained by the Youth Sector Strategic Plan for Rwanda 2013-2018 to be intensified by other factors like poverty, gender inequality/violence, leaving away from parents and family, and lack of professional skills to seek for opportunities (18). The risk-taking behaviors among Rwandan youth, have been commented by the National HIV/AIDS target for 2018-2020-2030 by saying that if the "business continues", new cases of HIV among them will stand at 10% by 2020 (12). In Rwanda, factors associated with HIV infection among youths have been studied (9) but less is yet known on how much associated factors like age of sexual debut, can limit youth HIV infection rate. Knowledge of this, will help the country act accountably towards the global target of ending HIV/AIDS come 2030.

1.1.1. Problem statement

The stand-still observations of 1% HIV prevalence rate among Rwanda youth since 2010 may imply that the incidence and mortality of HIV occur at a ratio greater than. It means that the occurrence of new cases is fast increasing than deaths. This may be due to increase availability of antiretroviral drugs that limits deaths, but increasing health-risk behaviors, result in new HIV cases and other chronic diseases. As a result, public health professionals need to take further actions to understand risk-taking behaviors that have the probability of inducing new HIV cases among the youth population within the country and to also implement interventions according to needs. This will help in further limiting infection rates. Therefore, this study aim at identifying youth health-risk behaviors, associated factors, and to determine how much limiting age of sexual debut, can contribute in minimizing HIV infection among the Rwandan youth. It is a move to contribute towards the achievement of sexual and reproductive health goals and the eradication of HIV/AIDS by 2030. The study will suggest measures to assist the Rwandan society achieve midterm targets

for HIV/AIDS among youths that could be replicable to other age groups for continuous efforts in tackling HIV and improving sexual and reproductive health.

1.1.2. Study rationale

The Rwandan community as a whole has keyed into achieving the country's vision and their fast-track targets' for HIV/AIDS by 2020. Part of this vision and fast-track target is to boost the community health of the youth who are future leaders. They are to be made to know and act according to expectations, provided they all have access to services according to needs (12). In this regard, and in conjunction with Rwandans aspiration to be a middle-income country, the importance of this research is vivid. It will contribute greatly to the existing knowledge on how this country can further limit HIV infection among their youth. This will assist to produce a healthy population that will help advance the country's social and economic capital.

1.2. Objectives

1.2.1. Main objective

To examine health-risk behaviors among the Rwandan youth and the effects of early sexual debut on HIV infection.

1.2.2. Specific objectives

- To describe the socio-demographic characteristics of HIV among the Rwandan youth.
- To describe health-risk behaviors for HIV observed among the Rwandan youth.
- To assess factors associated with HIV infection among the Rwandan youth.
- To examine how much limiting early sexual debut could help minimizing HIV incidence among Rwandan youth.

From the background and objectives of this study, the researcher shall be able to answer to the following research questions.

- What are the socio-demographic characteristics of HIV among youth of Rwanda?
- What are the health risky behaviours for HIV among youth in Rwanda?
- What factors are associated with HIV among the youth of Rwanda?
- To what extend can limiting early sexual debut help minimize HIV incidence among the Rwandan youth?

2.0. Literature review

2.1. Empirical literature

Health-risk behaviors among youths have long been a public health concern. As a result, the Center for Disease Control and Prevention (CDC) enacted in 1988 a Youth Risk Behavior Surveillance System to monitor the health of youth and enhancement. The surveillance system had monitored youths access to cigarettes, alcohol, and directed interventions to special populations that are in increase risk (19). The results from this surveillance made the CDC and others to discover that there is a great need for a holistic approach to tackle health risk behaviors among youths (19,20). Efforts to limit these health-risk behaviors, paved the way for the International Conference on Population and Development (ICDP) to put more efforts to improve the health of youths (4).

Despite these interventions, 33% of youths were infected by HIV between 2011 and 2014 in China. The number doubled from January to October 2015 to 65%. The prevalence is said to persist due to the incorrect and inconsistent use of condoms, negligence, and less comprehensive knowledge on sexual behaviors (21). In some countries, it is seen that the youths who had been exposed to HIV health - risk behaviors but had effective parental control and early sexual reproductive health educative measures, among others, were less likely to be HIV infected (22–24). Youth health- risk behaviors among black Americans are said to be increasing as a result of social activation and the desire for social rewards, mostly practiced by older youths (25).

A systematic study on risk-taking behaviors among youth in African and around the globe have it that youth health-risk behaviors come with age, gender, and educational level. Substance abuse had also been seen to be associated with health risk behaviors (7,23,24,26,27), resulting in increased HIV incidences among youths. In Sub Saharan Africa (SSA), youths especially those living with HIV engage in risky-behaviors that affect their health and that of their partners. Condom use have been said to be an effective means of limiting HIV prevalence (28), yet youths either do not use them, or use them incorrectly or inconsistently.

Factors such as multiple sexual partners, low or no condom use (dental dam), no comprehensive knowledge on HIV (especially for girls than boys), among others, increase the prevalence of HIV in youths within SSA (28–30). In Mwanza-Tanzania, youths who take marijuana and do not live at home, are reported to have been heavily engaged in health-risk behaviors. They were reported

to have involved in risky sexual activities with suspected HIV patients or even with people well known to have HIV (31). Despite the health-risk behaviors, it had been reported that <15% of young people aged 15-19 from Tanzania, Malawi, and Ethiopia consistently use condoms. Health-risk behavioral factors like the consumption of substances is one of the main courses for youths' early initiation into of sexual acts (29,30,32).

In a study conducted in Tanzania on adolescents' consistent use of condoms, multiple sexual partners, and the prevalence of HIV, proved that only 61% of sexually active adolescents', had used condoms at their last sexual intercourse. Above all, with about 42% of them having sex with more than a single partner (27). While in Cameroon, most out-of-school youths are said to have multiple sexual partners, a situation that widens their risk of contracting HIV/AIDS. As further explained, multiple sexual relationships limit the capacity of persons involved to respect consistent condom use and due to limited academic formation, they have limited knowledge on HIV/AIDS transmission modes (33).

A systematic review on consistent condom use and its effectiveness in reducing HIV incidence on heterosexual partners showed that 80% of HIV infection will be reduced if people correctly and consistently use condom (34). Given this, one can say that reducing the number of sexual partners, reducing early sexual debut, and the consistent use of condom can have an impact on limiting HIV incidence. This may be true since the CDC has also found far less HIV infection among monogamous relationships especially with an uninfected partner (35).

Several studies from SSA, have reported that early sexual debut, especially within the ages less than 15, is associated with increased HIV infection. Therefore, they must be carefully monitored so as to help this demographic population to achieve their full potentials (16,36–38).

2.2. Conceptual framework

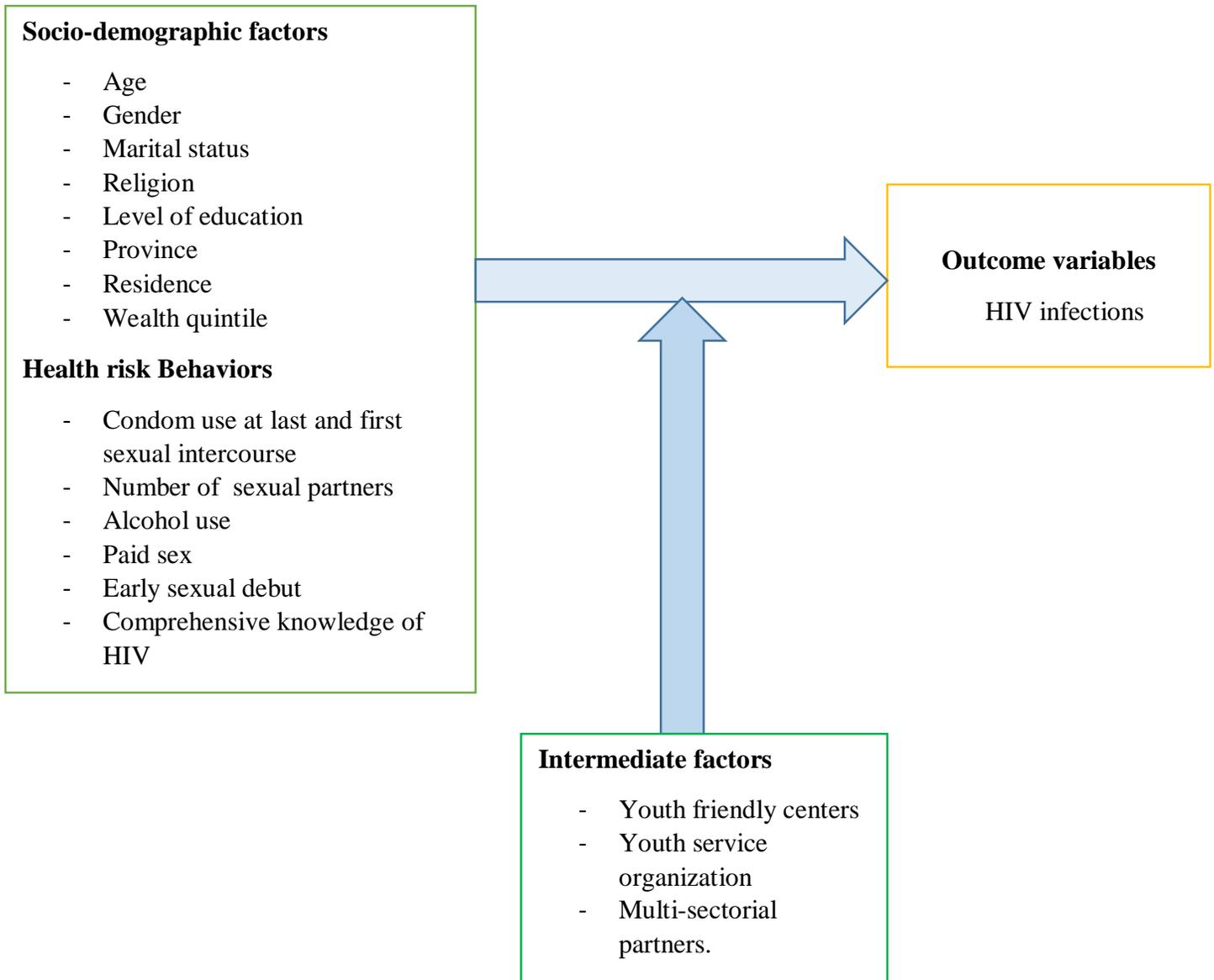


Figure 1: The Conceptual Framework for factors associated with HIV infection among youths

The above conceptual framework demonstrates the relationship that exist between a synergy of socio-demographic factors, risk taking behaviors, and HIV infections among youths.

The variables used to demonstrate risk behaviors for this study are gotten from the RDHS 2014-15. These risk behaviors tell us that age, residential area, gender and other demographic factors increase the chances of risk-taking behaviors at a certain period in time. That is: area of residence and the social network in which the youths find themselves can make them initiate the use alcohol, seek for paid sex, with multiple partners, just to name a few. If they are already sexually active and dependent on the health-risk behaviors, they may tend to be inconsistent condom users. According to the framework, outcome from such behaviors is HIV infections.

This conceptual framework of health risk behaviors and HIV outcomes matches with existing knowledge on the link between non-modifiable risk factors and modifiable risk factors that increase youths' chances of being infected by HIV.

The conceptual frame work also shows how intermediate factors influence HIV infections. This means that if these factors are well managed, there will be a great decline in HIV infections among youths. However, if these intermediate factors aren't present, then they shall not be any substantive decline in HIV infections.

3.0. Methodology

3.1. Study design

The study used an analytical cross-sectional design of the RDHS 2014-15.

3.2. Study setting

Rwanda is a landlocked mountainous country with a relief of 26,338 km² in East Africa. Rwanda has 4 provinces and one city: Kigali city. It has an average temperature of about 18.5⁰c, two rainy seasons (2000mm) and two dry seasons each year (9,39). Rwanda has an estimated population density of 483 persons/square kilometer and is the densest African country. The population is expected to grow by a proxy from 11 million in 2016 to 16.9 million in 2032, and a good fraction of the population is said to be made up of the youth (9,40). The natural growth rate of Rwanda is at 2.8% per annum(9,39). Rwandans speak one common language called Kinyarwanda. English is their second language followed by French and Kiswahili (9,41)

3.3. Study population

The study population was made up of the Rwandan young population. These youths were between the ages of 15-24.

3.4. Sampling methodology

3.4.1. Sample size.

The sample was drawn from the RDHS 2014/15. The RDHS is conducted every 5-year showing a national representation of 12,699 households, 13,497 women age 15-49, and 6,217 men age 15-59. Data were collected on the knowledge and attitudes of women and men regarding sexually transmitted infections (STIs) including HIV evaluation of recent behavioral changes with respect to condom use. A total of 1,528 youth aged 15-24 who correctly completed the RDHS questionnaires were included in the present study.

3.4.2. Inclusion criteria

- Youths aged 15-24 years of age.
- Youths who were tested for HIV
- Sexually active youths

3.4.3. Exclusion criteria

- Older than 24 years of age and less than 15 years of age.
- Youths not tested for HIV.
- Youths who are not sexually active

3.5. Data collection procedures

Secondary data were used for this study. They were gotten from RDHS that was conducted from November 9, 2014, to April 8, 2015 and then published in March 2016 with questionnaires available in English and Kinyarwanda. A registration and application to use the RDHS data, approved on August 10th, 2018. Variables indicating youths' health-risk behaviors and HIV infection data were extracted. Men and women data were later merged to with HIV status to create a new dataset using STATA version 13.

3.6. Conceptual and operational definition of variables.

Independent variables:

Demographic and other factors

- **Residence:** It was defined as the geographical location of youths. They were classified into Urban and Rural.
- **Province:** It was defined as the administrative units within the country. They were divided into five as Kigali city, South, North, West, and Eastern provinces.
- **Education level:** The study considered this to be the highest cognitive level of a person. They were classified as: no education, primary and secondary education.
- **Wealth quintile:** It is the average living standards of a household. They were classified into lowest, second, middle, fourth and highest. The classifications are based on the responses to certain questions related to household durable such as ownership of television and household characteristics like roofing materials.
- **Age:** This refers to how old the respondents were at the time of survey. Their ages were later classified into two subgroups of 15-19 and 20-24.
- **Gender:** In this study, it was used in reference to the sexuality of a human being as male and female.
- **Marital status:** This variable was defined as: never in union, married, living with partner, widowed, divorced, and no longer living together/separated. These variables were later

categorized as **currently living with partner** (married and living with) and **currently not living with a partner** (widowed, divorced, and no longer living together/separated, and never in union).

- **Religion:** This variable was labeled depending on the belief of the individual: Catholic, Protestant, Adventist, Muslim, Jehovah witness, No religion, and others.

Health-risk behavioral factors

- **Number of sexual partners:** A youth was considered to have been taking health risky behaviors if he or she had 2 or more sexual partners within the past 12 months of the RDHS and was termed **multiple sexual partners** in the RDHS.
- **Consistent condom use:** This was referred to as the ability for a youth to use a condom during the first and last sexual intercourse. Sexual intercourse within the last 12 months without using a condom was considered a youth health-risk behavior. This variable was originally organized as No, Yes, and Don't Know. In this current study, only No and Yes were considered.
- **Age of sexual debut:** The age at which a youth starts to engage into sexual activities. Any engagement in this act at an age < 15 is generally considered having early sexual debut. In Rwanda, the age of sexual debut is considered <18. However for the purpose of this study both ages were taken into considerations. Values for this variable, were numerically collected but in this study, they were categorized into 6-14 and 15-17, and 18-24. The entries at "marriage" and "never had sex", were deleted.
- **Alcohol use:** The consumption of any drink that has ethanol which was coded as YES/NO. Variable was extracted from the drug abuse dataset.
- **Comprehensive knowledge of HIV:** This referred to a youth who is aware that a healthy-looking person can have HIV. They reject the two most common local misconceptions (that HIV can be transmitted by mosquito bites and by sharing food). Therefore someone who responded correctly to the three questions, is considered to have sufficient knowledge about HIV, and the one who did not respond as expected, is considered to have insufficient knowledge in the present study

- **Paid sex:** The ability for any youth to get into sexual activities within the last 12 months with an aim to gain something out of it. This was categorized into yes and No, but values were only collected for males during the drug abuse survey.

Dependent variable

HIV infection = (0) HIV positive and (1) HIV negative.

Human immunodeficiency virus (outcome) that was used to determine the effect of risk behaviors in a human being.

3.7. Data analysis and procedures

Statistical analysis was performed using STATA version 13.0 for data science to describe youth health risk behaviors/risk factors (**Education level, gender, wealth quintile, province, Religion residence, age, number of sexual partners, alcohol, paid sex, early sexual debut, comprehensive knowledge of HIV, and Condom use**) and HIV infections using proportions and Chi square test. All variables were categorized.

Bivariate logistic regression was computed to determine associations between behaviors and HIV infections. Multivariate logistic regressions was also performed for all variables significant in each category using backward selection method. All this were performed at a 5% significance level and 95% confidence intervals (CI).

The Population attributable fraction (PAF) was calculated for youth in the total study population, to examine the proportions of HIV infections among youth that would have been avoided if they were not practicing early sexual activities. It was calculated, by making use of Adjusted Odd Ratio (AOR) (42,43).

The following formula was used to that effect:

$$PAF = P_e (AOR - 1) / (AOR)$$

Where:

P_e = proportion with HIV infection who had sexual intercourse

AOR = Adjusted odds ratio for the association between Early Sexual Debut and HIV infection.

3.8. Ethical considerations

There is no risk that is known yet from this sort of research design. Personal information of participants were not provided to the researcher. Also, the investigators of RDHS were not part of the present study, hence it is not a human subject study.

This study had no direct contact with humans nor with any identifiable information/parts of human beings. The study was not a human subject research, the researcher found no need for an informed consent/assent from for participation.

Ethical approval for the study was granted by the Institutional Review Board (IRB), University of Rwanda.

4.0. Results

4.1. Socio-demographic characteristics of youth in Rwanda

Among 1,528 youth screened, 20-24 were 64.14% (n=980) and males 51.77% (n=791). Of those youths, 79.97 % (n=1,222) had never been in union with the majority being Catholics, 42.83%. Amongst them, those who had at least primary education were 58.51% (n=894) and from the East province were 23.56% (n=360). Youths who were mostly living in rural settings were 67.87% (n=1,037) but from households in the richest wealth quintile 34.88% (n=533). [See table 1]

Table 1: Socio-demographic characteristics of the youth.

Variables	Categories	Totals	Percentages (%)
Age	15-19	548	35.86
	20-24	980	64.14
Gender	Male	791	51.77
	Female	737	48.23
Marital status	Never in union	1,222	79.97
	Married	48	3.14
	Living with partner	215	14.07
	Widowed	1	0.07
	Divorced	12	0.79
	No longer living together/separated.	30	1.96
Religion	Catholic	654	42.83
	Protestant	638	41.78
	Adventist	146	9.56
	Muslim	62	4.06
	Jehovah witness	12	0.79
	No religion	15	0.98
Level of education	No education	42	2.75
	Primary	894	58.51
	Secondary	555	36.32
	Higher	37	2.42
Province	Kigali city	272	17.80
	South	356	23.30
	West	326	21.34
	North	214	14.01
	East	360	23.56
Place of residence	Urban	491	32.13
	Rural	1,037	67.87
Wealth quintile	Poorest	215	14.07
	Poorer	204	13.35
	Middle	278	18.19
	Richer	298	19.50
	Richest	533	34.88

4.2. Health-risk behaviors' characteristics of youths in Rwanda

Amidst youth in Rwanda, 94.75% (n=1,444) were consistent condom users. Taking into considerations the number of sexual partners within the last 12 months, 48.04% (n=734) reported no sexual partner and the same figures for having just a single partner. A total of 3.93% (n=60) youths said that they had had two or more sexual partners within the last 12 months. Those who had their sexual debut within 18-24 were 44.76% (n=683). When looking at comprehensive knowledge on HIV, 74.87% (n=1,144) of youths had sufficient knowledge. Among those youths,

57.82% (n=85) said they consumed alcohol. With respect to paid sex, 94.18% (n=340) had not been engaged in paid sexual activities.

HIV infection was reported to be absent in 97.38% (n=1,488) of youths and present in 2.62% (n=40) of them. [See table 2]

Table 2: Health-risk behaviors' characteristics of youths in Rwanda.

Values	Categories	Totals	Percentages (%)
Consistent condom use within the last 12 months*	No	80	5.25
	Yes	1,444	94.75
Number of sexual partners within the last 12 months	0	734	48.04
	1	734	48.04
	2+	60	3.93
Age of sexual debut *	6-14	368	24.12%
	15-17	475	31.13%
	18-24	683	44.76%
Comprehensive knowledge of HIV	Insufficient	384	25.13
	Sufficient	1,144	74.87
Alcohol use **	No	62	42.18
	Yes	85	57.82
Paid sex **	No	340	94.18
	Yes	21	5.82
HIV status	Negative	1,488	97.38
	Positive	40	2.62

*: totals do not sum up to overall totals, **Alcohol use **/ Paid sex****: data were extracted from drug abuse data set.

4.3. Socio-demographic characteristics according to HIV infection distribution among Rwandan youth.

There was a statistical significant relationship between age 20-24, 3.27% (n=32), p -value = 0.034, gender female 4.21% (n= 31) p -value =0.000, marital status currently living with a partner 5.32% (n=14), province of Kigali city 6.25% (n=17), p -value = 0.000, place of residence urban 4.28% (n=4.28) p -value 0.005 and HIV infection. [See table 3]

Table 3: Socio-demographic characteristics according to HIV infection.

Values	HIV -		HIV +		P.value
	n	%	n	%	
Age					
15-19	540	98.54	8	1.46	0.034
20-24	948	96.73	32	3.27	
Gender					
Male	782	98.86	9	1.14	0.000
Female	706	95.79	31	4.21	
Marital status					
Currently not living with partner	1,239	97.94	26	2.06	0.003
Currently living with partner	249	94.68	14	5.32	
Religion					
Catholic	639	97.71	15	2.29	0.120
Protestant	621	97.34	17	2.66	
Adventist	143	97.95	3	2.05	
Muslim	59	95.16	3	4.84	
Jehovah witness	12	100.00	0	0.00	
No religion	13	86.67	2	13.33	
Level of education					
No education	39	92.86	3	7.14	0.279
Primary	870	97.32	24	2.68	
Secondary	543	97.84	12	2.16	
Higher	36	97.30	1	2.70	
Province					
Kigali city	255	93.75	17	6.25	0.000
South	350	98.31	6	1.69	
West	324	99.39	2	0.61	
North	209	97.66	5	2.34	
East	350	97.22	10	2.78	
Place of residence					
Urban	470	95.72	21	4.28	0.005
Rural	1,018	98.17	19	1.83	
Wealth quintile					
Poorest	209	97.21	6	2.79	0.554
Poorer	201	98.53	3	1.47	
Middle	273	98.20	5	1.80	
Richer	290	97.32	8	2.68	
Richest	515	96.62	18	3.38	

4.4. Health-risk behavioral characteristics according to HIV infection distribution among the Rwandan youth

There was a relationship between early sexual debut and HIV infection. Those with sexual debut between ages 15-17 related to HIV infection at 4.00% (n=19), p -value = 0.003. In addition, those youths who had drunk alcohol and were HIV positive were 9.41% (n=8), p -value =0.141. [See table 4]

Table 4: Health-risk behavioral characteristics according to HIV infection.

Values	HIV -		HIV +		P.value
	n	%	n	%	
Consistent Condom use within the last 12 months *					
No	80	100.00	0	0.00	0.131
Yes	1,404	97.23	40	2.77	
Number of sexual partners within the last 12 months					
0	722	98.37	12	1.63	0.052
1	709	96.59	25	3.41	
2+	57	95.00	3	5.00	
Early Sexual Debut *					
6-14	367	99.73	1	0.27	0.003
15-17	456	96.00	19	4.00	
18-24	663	97.07	20	2.93	
Comprehensive knowledge of HIV					
Insufficient	377	98.18	7	1.82	0.260
Sufficient	1,111	97.12	33	2.88	
Alcohol use **					
No	60	96.77	2	3.23	0.141
Yes	77	90.20	8	9.41	
Paid sex **					
No	335	98.53	5	1.47	0.576
Yes	21	100.00	0	0.00	

*: totals do not add to overall total due to missing data and **Alcohol use **/ Paid sex****: data were extracted from drug abuse data set.

4.5. Socio-demographic factors associated with HIV infections among youth

Independent predictors of HIV infection revealed that youths aged 15-19, were 0.44 times less likely to be infected with HIV compared to those aged 20-24 (OR=0.44, 95% CI=0.20 – 0.95, $p=0.039$). In terms of gender, females were almost 4 times more likely to be infected with HIV than males (OR = 3.81, 95% CI = 1.80 – 8.07, $p=0.000$). Considering marital status, currently living with partners, were about 3 times likelihood of being HIV positive, compared to those currently not living with partner (OR=2.68, 95% CI=1.38-5.20, $p=0.004$). Regarding religion, Catholic was made a reference category and the rest of the religious groups were compared to it. The odds of HIV infection within No religion, was approximately 6 times as higher compared to those who were Catholics (OR = 6.55, 95% CI = 1.36 – 31.64, $p=0.019$). Looking at provinces where Kigali city was taken as a reference group, youths who were resident in the West were 0.09 times less likely of being HIV infected (OR=0.09, 95% CI=0.02 – 0.40, $p=0.002$). Residing in Rural areas, they has a negative association to HIV with the odd of 0.43 to HIV infection compared to urban areas (OR=0.43, CI =0.22 – 0.78 and $p=0.007$). [See table 5]

Table 5: Socio-demographic factors associated with HIV infection.

Values	COR	(95% CI)	P. value
Age			
15-19	0.44	[0.20-0.95]	0.039
20-24	1		
Gender			
Male	1		
Female	3.81	[1.80 8.07]	0.000
Marital status			
Currently not living with partner	1		
Currently living with partner	2.68	[1.38- 5.20]	0.004
Religion			
Catholic	1		
Protestant	1.17	[0.58-2.36]	0.668
Adventist	0.89	[0.26-3.13]	0.860
Muslim	2.16	[0.61-7.69]	0.232
Jehovah witness	NA	NA	NA
No religion	6.55	[1.36-31.64]	0.019
Level of education			
No education	1		
Primary	0.36	[0.10-1.24]	0.106
Secondary	0.29	[0.08- 1.06]	0.061
Higher	0.36	[0.04-3.63]	0.387
Province			
Kigali city	1		
South	0.26	[0.09-0 .66]	0.005
West	0.09	[0.02-0.40]	0.002
North	0.36	[0.13-0.99]	0.048
East	0.43	[0.19-0.95]	0.037
Place of residence			
Urban	1		
Rural	0.42	[0.22-0 .78]	0.007
Wealth quintile			
Poorest	1		
Poorer	0.52	[0.13- 2.11]	0.360
Middle	0.64	[0.19-2.12]	0.463
Richer	0.96	[0.33-2.81]	0.942
Richest	1.22	[0.48-3.11]	0.681

4.6. Health-risk behaviors factors associated with HIV infections among youths.

Youths having one sexual partner, are at a higher risk of being HIV infected compared to those with no sexual partners (OR=2.12, 95% CI=1.06 – 4.26, $p=0.034$). Looking at early sexual debut, the age group 18-24 was taken as the reference group. Those, who started having sexual activities at ages 6-14 were less likely to be infected by HIV infections (OR=0.09, 95% CI=0.01–0.68, $p=0.019$) compared to the reference group [See table 6]

Table 6: Health-Risk behaviors associated with HIV among youth.

Variables	COR	(95% CI)	P. value
Consistent Condom use within the last 12 months*			
No	1		
Yes	NA	NA	NA
Number of sexual partner with in the last 12 months			
0	1		
1	2.12	[1.06 - 4.26]	0.034
2+	0.17	[0.87 - 11.54]	0.081
Early Sexual Debut *			
6-14	0.09	[0.01-0.68]	0.019
15-17	1.38	[0.73-2.62]	0.322
18-24	1		
Comprehensive knowledge of HIV			
Insufficient	1		
Sufficient	1.59	[0.71 - 3.65]	0.264
Alcohol use			
No	1		
Yes	3.12	[0.64 - 15.22]	0.160
Paid sex***			
No	1		
Yes	NA	NA	NA

*: total do not add to overall total due to missing data and **Alcohol use **/ Paid sex****: data were extracted from drug abuse data set.

4.7. Multivariate analysis for socio-demographic characteristics of youths.

After identifying the socio demographic variables significant in the bivariate, a multivariate analysis was performed. From that, the study found that female youths were 3.64 times more likely than males to be HIV infected (OR= 3.64, 95% CI=1.65-8.05, $p=0.001$). More so, those who had no religion, were 10.26 times more likely to be infected by HIV compared to those youths who were Catholics (OR= 10.26, 95% CI=1.81-58.07, $p=0.008s$). [See table 7]

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

Variables	AOR	(95% CI)	P. value
Age			
15-19	0.57	[0.25-1.29]	
20-24	1		0.179
Gender			
Male	1		
Female	3.64	[1.65-8.05]	0.001
Marital status			
Currently not living with partner	1		
Currently living with partner	2.04	[0.97-4.28]	0.060
Religion ***			
Catholic	1		
Protestant	0.96	[0.46-1.99]	0.913
Adventist	0.84	[0.23-3.04]	0.793
Muslim	1.78	[0.46-6.93]	0.406
Jehovah witness	NA	NA	
No religion	10.26	[1.81-58.07]	0.008
Province***			
Kigali city	1		
South	0.33	[0.11-0.96]	0.043
West	0.11	[0.02- 0.52]	0.005
North	0.46	[0.15-1.44]	0.184
East	0.52	[0.19-1.38]	0.189
Place of residence			
Urban	1		0.388
Rural	0.69	[0.31-1.59]	

*** = The model didn't give outputs for highlighted values probably due to too many variables in the model.

4.8. Multivariate analysis for health-risk behaviors of youth.

Sexually experienced youths in Rwanda who had first sexual intercourse between the ages 6-14, had 0.11 times odds of being HIV infected (OR= 0.11, 95% CI=0.01-0.84, $p=0.033$), compared with those aged 18-24. Those youths who had first sexual intercourse between the ages 15-17 had 1.41 odds of being HIV infected (OR= 1.41, 95% CI=0.74-2.68, $p=0.292$). [See table 8]

Table 8: Bivariate analysis adjusted odd ratio (AOR) for HIV health-risk behaviors.

Variables	AOR	(95% CI)	P.value
Number of sexual partners within the last 12 months			
0	1		
1	1.51	[0.86-2.61]	0.252
2+	2.21	[0.60-8.12]	0.233
Early Sexual Debut			
6-14	0.11	[0.01-0.84]	0.033
15-17	1.41	[0.74-2.68]	0.292
18-24	1		

*** = The model didn't give outputs for highlighted values probably due to too many variables in the model.

4.9. Multivariate analysis for HIV infection factors among youth.

In the final model where two socio-demographic variables were associated, the study revealed that female youths were 3.33 time most likely to HIV infected as compared to male youth (OR = 2.19, 95% CI=1.57 – 7.07, $p= 0.002$).

While in terms of health risk behaviors and early sexual debut, where youth aged 18-24 were taken as reference group, those aged 6-14 who had sexual intercourse, were 0.13 times less associated with being HIV infected (OR = 0.13, 95% CI = 0.02 – 0.94, $p = 0.044$) compared to the reference population. Also, youths who had sexual intercourse before the ages 15 – 17, were 1.45 times more likely to be HIV infected compared to those aged 15-17 who are highly associated to HIV (OR = 1.45, 95% CI = 0.76-2.77, $p=0.256$). Additionally, youths who had no religion, were 11 time more likely to be HIV positive compared to those who were Catholics (OR = 10.80, 95% CI = 1.79-65.13, $p = 0.009$) [See table 9]

Table 9: Multiple Logistic regression for socio demographic and health-risk behaviors.

Variables	AOR	(95% CI)	P. value
Gender			
Male	1		
Female	3.79	[1.73-8.30]	0.001
Early Sexual Debut			
6-14	0.13	[0.02-0.98]	0.047
15-17	1.43	[0.74-2.75]	0.287
18-24	1		
Province			
Kigali city	1		
South	0.29	[0.11-0.78]	0.014
West	0.11	[0.24-0.48]	0.003
North	0.43	[0.15-1.22]	0.112
East	0.46	[0.20-1.05]	0.065
Religion			
Catholic	1		
Protestant	1.02	[0.49-2.12]	0.947
Adventist	0.83	[0.23-2.98]	0.780
Muslim	2.23	[0.59-8.29]	0.232
Jehovah witness	NA	NA	NA
No religion	10.80	[1.79-65.13]	0.009

4.10. Population Attributable Fraction

The result show that about 2 % of HIV infection, would have been avoided within the age group of youth having early sex at ages 6-14. Similarly, about 1% of HIV infection would have been avoided among youth aged 15-17 in Rwanda had started having sexual intercourse within the past 12 months in 2014/15. [See table 10]

The following formula was used to that effect:

$$PAF = P_e (AOR - 1) / (AOR)$$

Where:

P_e = proportion with HIV infection who had sexual intercourse

AOR = Adjusted odds ratio for the association between Early Sexual Debut and HIV infection.

Table 10: Population Attributed Fraction

Variables	PAF
Early Sexual Debut	
6-14	1.8
15-17	1.2
18-24	NA*

5.0. Discussion and limitations

5.1. Discussion

This study has shown that early sexual debut before the age 15 is the main factor that exposes youth to HIV infection. It also reveals that more females are at risk of HIV infection than males with more infections occurring in Urban than Rural areas.

Despite the fact that safe sexual behaviors like delaying early sexual debut have been identified to limit HIV infection especially among female youths (44–46), a significant proportion of Rwandan youth, remains at risk of contracting HIV. This can be further explained by the fact that they get engaged into sexual activities with high-risk partners and/or multiple partners. In most cases, with less prospect of using a condom (44,47). Increase HIV prevalence in youth resulting from early engagement into sexual relation has also been identified in some African countries (48).

Although this study did not work on multiple sexual partners and condom use rate as necessary factors for HIV infection among the youth, other research work did. Their findings including Rwanda, have demonstrated that youths engagement in sexual activities with multiple high-risk partners and with limited use of condoms, makes them more vulnerable to HIV infection (27,33,45,46,49,50). This explains why HIV infection is still a great challenge to this population. However, inconsistent/ improper use of condom may also be blamed since the RDHS indicates that 3% of youths who use a condom during their most recent sexual intercourse, were tested HIV positive. (9). This supports recent findings that youths in Rwanda start having sexual activities very early in their lives, and with time, are at high risk of having multiple sexual partners.

Above all, early sexual debut is highly associated with HIV infection's spatial distribution according to gender in this study. It shows that females are almost 3% more likely than their male counterparts to be infected by HIV. The findings are backed by RDHS in that females are at least 1% HIV infected compared to males (9). Other studies have identified gender as a factor associated with HIV prevalence among youth and rampant in females (36,37). However, other scientists have found the gender association with HIV infection, is determined by age (36,49), educational level especially of the females (47).

This study finds a link between the province of origin youths or their place of residence and HIV infection as was already identified in another study in Rwanda (17). This may be explained by

the fact that youths, especially those residing in urban settings, live in areas where the prevalence is higher, and are also influenced by peers to be involved in risky sexual behavior. These findings align with some previous ones which state that adequate parental, family, communities, schools, and peer support, are vital in promoting informed decisions-making among youths on their health and wellbeing. Consistent, positive, emotional connectedness with caring adults help youths feel safer and secured, allowing them to develop the resiliency needed to manage their emotional development (18,22–24,50).

Furthermore, this study finds that belonging to any religious group could protect youths against HIV infection. This could be explained by the fact that belonging to religious group helps youths learn some ethical and moral values of life. As a result, they are less likely to engage into health-risk sexual relations, thus reducing the risk of HIV infection. These results are similar to those from Ethiopia where it was found that religion is a protective factor for youths against health-risk behaviors (49).

Therefore, looking at the population attributable fraction calculation, it is shows that early sexual debut among youths below the recommended age by WHO, increases HIV infection hazards by 2%. Furthermore, the findings also communicate that about 1% of HIV infection can be eliminated from among the youths aged 15-19 if they did not practice this coital act at that age. Thus, it is highly recommended that authorities should adopt any strategy to increase the age of sexual debut so as to reduce the prevalence of HIV infection among the youthful population of Rwanda.

5.2. Limitations

This study has some limitations that should be noted. The study used only available variables from the RDHS to conduct analysis. These variables did not have exact ages of marriage and wealth index representing actual facts on ground. This is seen as only household possessions are used to classify individuals under different wealth categories without considering other factors for example those possessions might be gifts from other individuals.

Secondly, the use of secondary data made it difficult for the study to determine associations between some factors like condom-use and HIV infection due to insufficient sample size.

Moreover, the dataset analyzed is at least 5 years old and may not reflect the current state of things in Rwanda. Nevertheless, it remains the most current edition in the series of such data at the time

this study was carried out. This creates a solid foundation for future research works especially as its analysis remain valid.

6.0. Conclusion and recommendations

6.1. Conclusion

This study showed that the place of religion, province, gender, and early sexual intercourse are significantly associated with HIV infection among the Rwandan youth. It was delineated from this study that limiting early sexual intercourse among the target population would enable Rwanda as a community to avoid approximately 3% of HIV infection among youths. This would be best if sex before the ages 14 is extremely discouraged. This will mean adopting it as a public health priority in Rwanda, and set the country on the right path towards eliminating HIV infection among youths by 2030.

6.2. Recommendations

To the Rwandan Government and partners /stakeholders like the National Health Survey team, they should continue to conduct country wide survey enriching it with variables such as specific age of marriage, drug or substance used/consumed, and Paid sex among youth. These variables have been found in several settings associated with increased HIV infections among youths, and they can, therefor be helpful in the appropriate assessment of HIV infection among youths.

Let the Ministry of Health, Rwanda Biomedical Center, and partners, ensure the availability, and the accessibility of population-based preventive behavioral and cost-effective actions like the use of mobile platforms tailored towards tackling sexuality among of youths. This action shall help limit the initiation of early sexual activities and the promotion of safe sex being by faithful to a single sexual partner and the consistent or proper use of condoms.

The Ministry of Health, Rwanda Biomedical Center, and schools should encourage adolescent development transition education on sexual behavior. These interventions, should be implemented hand in hand with schools youth-oriented areas like youth corners. These youth comers should be as friendly as possible with information and communication facilities, peer educators, staff characteristics, books, and games available. The interventions would be aged specific and tailored towards practicing safe sexual activities especially among the female population.

The parents are also recommended to have discussion on modes of HIV transmission and methods of prevention at household's levels with youths. This can be done by maintaining a good parental

relationship, refuting dangerous traditional practices like hesitating to talk about safe sexual activities and encouraging sound cultural and religious beliefs on abstinence before marriage.

The government of Rwanda is encouraged to continue with youth scholars' programs in various dimensions to divert the reasoning of youth and allow them focus on the development of their potentials. The school performance packages should be encouraged and allow students concentrate on what is essential for their wellbeing.

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Appendices

Letter of approval to use dataset



Sep 25, 2018

Roseline Dzekem Dine

University of Rwanda

Rwanda

Phone: 0780515802

Email: roseline@yaho.com

Request Date: 09/25/2018

Dear Roseline Dzekem Dine:

This is to confirm that you are approved to use the following Survey Datasets for your registered research paper titled: "Health risk behaviors and HIV among youth aged 15-24 in Rwanda: Factor-based analysis of RDHS 2014/1":

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 enumeration 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