Original Article

Factors Associated with New HIV Infection among Adolescent Girls and Young Women in the City of Kigali Rwanda

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Abstract

Background
Globally, HIV/AIDS continues to be a serious public health issue. In Sub-Saharan Africa, the incidence of new HIV infections among adolescent girls and young women (AGYW) is gradually rising. Despite efforts being made, the high HIV infection positivity rate of 5% in Kigali among adolescent girls and young women continues to be a cause for concern.

Objective
To assess factors associated with new HIV infection among AGYW in Kigali.

Methods
The study used a case-control design, whereby cases were AGYW confirmed to HIV positive, while controls were AGYW confirmed to be HIV negative. Using SPSS Version 26, bivariate and multivariable logistic regression analyses were performed to identify HIV infection-associated factors.

Results
The majority 748 (96.6%) of the study participants were in the age category of 20-24 years and 487(63.2%) were single. Multivariable logistic regression model showed the following factors as independent predictors: being employed (aOR: 1.43; 95% CI: 1.02–2.03), being resident of Kicukiro (aOR: 1.59; 95% CI: 1.07–2.36), history of commercial sex worker (aOR: 2.04; 95% CI: 1.29–3.22) and having multiple sexual partners (aOR: .05; 95% CI: 1.41–2.98.

Conclusion
Public health interventions from key policymakers are needed to strengthen public health strategies of commercial sex workers to reduce new HIV infection including raising awareness through education for HIV Prevention.

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Keywords: Adolescent girls and young women, HIV new infection, Kigali, Rwanda

Introduction

The acquired immune deficiency syndrome (AIDS), is caused by the human immunodeficiency virus and continues to be a major global problem. The disease and infection elevate the morbidity and mortality worldwide and the stated morbidities decrease the quality of life among HIV-infected adolescent girls and young women (AGYW).[1] In 2015, 20% of new HIV infections among adults aged 15 and older were among AGYW aged 15 to 24 years. The percentage was however greater in Sub-Saharan Africa (SSA), with 25% of new HIV infections occurring among AGYW.[2] In addition, SSA bears a significant share of the burden of HIV infection, accounting for 65% of new infections, 70% of HIV-positive individuals, and 73% of fatalities.[3,4] There are over 880 million young women and girls between the ages of 15 and 24 worldwide. Despite making up approximately 12% of the world's population, this group is frequently denied a voice or self-determination.[5]

The number of teenagers and young adults living with HIV in 2017 was projected to be 3.9 million [2.1-5.7million]. AGYW, who make up around 61% of adolescents and young people living with HIV, make up about 78% of all sub-Saharan Africans. Every day, around 1,600 adolescents and young people contract HIV. In addition, 1,600 teenagers and young adults develop HIV every day, accounting for 36% of all new HIV infections in those aged 15 and older.[6] Globally, HIV infection keeps being a critical public health issue, with parts of Eastern and Southern Africa the most affected ones. [7]In 2019, WHO reported that over 38 thousand people was living with HIV/AIDS infection and from above,61% were newly infected with HIV infection from SSA.[8,9] In addition to that, between 2010 and 2018 new virus infections (HIV) among the Adult and young women aged 15-24 years old decreased by 25% but however, six million still become newly infected with HIV weekly here globally.[8]

High prevalence of HIV in African countries is associated with multi-factors such as poverty, inadequate preventive information and limited access to services, society's culture.[3] Moreover, theyface barriers that prevent them from being able to protect themselves against HIV, especially as they enter adulthood. These barriers include gender-based violence, a lack of access to health care and education, as well as systems and policies that do not take young people's needs into account.[5] In order to hasten the achievement of the 2030 targets for the child, adolescent, and young populations, the Super-Fast Track agenda was established for 2020.The UN Joint Programme on HIV/AIDS targets for a reduction in the yearly number of new HIV infections among adolescent girls and young women to 100,000 in 2020.[7] A super-fast-track framework for eradicating AIDS among children, adolescents, and young women by 2020 is called "Start free, stay free, AIDS free.The development of new HIV objectives and resource projections for the global AIDS response through 2030 is being led by UNAIDS. The goal specifies a 90% reduction in AIDS-related fatalities and HIV infections between 2010 and 2030. [7] In addition, between 2010 and 2030, the number of new HIV infections and AIDS-related fatalities must drop by 90%.[8]

According to Rwanda population-Based HIV infection assessment(RPHIA) conducted country survey in 2019, the HIV prevalence among 15 years old adult population was 3%, among them young women were 3 times greater (1.8%) than among men in the same age group (0.6%).Also, they found that, the big number of HIV positive is located within the urban places compared to in rural areas and the women are greatly at risk of HIV infection than men.[10] Lastly, RDHS 2019-2020 shown the decrease of knowledge regarding HIV since 2014 -2015 from 65% to 59% among young women with young men from 64% to 57%. The factors linked to new HIV infections among AGYW in Rwanda, however, have not been thoroughly studied in scientific investigations. Therefore, this study focused on factors associated with

new HIV Infection among AGYW in the City of Kigali, in Rwanda.

Research Methods

Study settings

Rwanda is a land locked country with little exportable products found in East Africa. The main activity of the country is agriculture, where the by a half of the population is able to afford a hectare of land. [11] The country has four provinces ,and city of Kigali. With Growth rate of 2.44%, Rwanda was estimated to have a population 13,517,274 in July,2022 with City of Kigali having 1,208,296 as reported by United nations.[12] Furthermore, it was reported City of Kigali to comprise of people from different areas including rural areas of the country and outside the country.[13]

Research Design and study population

Unmatched case control research design was used. The study population was comprised of two groups (cases and controls). The first group (cases) were the HIV Positive AGYW aged between 15-24 years who enrolled in HIV Case based surveillance system within HIV division of Rwanda Biomedical Center in the last 12months and who tested HIV positive using HIV National testing algorithm as defined in Rwanda biomedical center HIV testing algorithm of 2016. The second group of study population were the HIV negative AGYW who were members of Determined Resilient Empowered AIDS-Free Mentored and Safe (DREAMS) program who on the time of the study showed HIV negative status and were considered as control group whereby AGYW are meeting for the Sexual Reproductive Health and HIV control education. The inclusion critera for controls was all AGWY aged 15-24 years Registered in (DREAMS) program in City of Kigali while for cases, was all AGWY aged 15 to 24 years enrolled in HIV/AIDS Case Based Surveillance program in all health facilities from City of Kigali. However, participants who were not willing to give information for the controls and participants without information in data base for the cases were excluded.

Sample size estimation

The sample size for this investigation was established using two population proportions that were created by Casagrande et al of (1978).[14]

Sample size

$$(n) = \frac{\{Z_{1-\alpha/2}\sqrt{[2p(1-p)]}+Z_{1-\beta}\sqrt{[p_1(1-p_1)+p_2(1-p_2)]}\}^2}{(p_1-p_2)^2}$$

Where:

α represent Type I Error at (0.05);

β represent Type II Error at (0.10).

With 95% confidence interval, Z1-α/2 = 1.96;

With 80% power where, Z1-β = 0.84.

P1 = The percentage/proportion of risky sexual behaviour among the HIV positive was assumed to be 50% as there was no similar study done in Rwanda, hence the population was unknown.

P2 =The percentage/proportion of risky sexual behaviour among the HIV negative adolescent, and was assumed to be 50% as there was no similar study done in Rwanda, hence the population was unknown.

In this study conducted,HIV exposed group had similar living characteristics similar to HIV positive Group.In addition,the cases and controls were not matched each other by any variables.

P which stands for the mean of P1 and P2 =0.45 (sum of P1 and P2 divide by 2)

$$\text{Sample size} = \frac{\{Z_{1-\alpha/2}\sqrt{[2p(1-p)]}+Z_{1-\beta}\sqrt{[p_1(1-p_1)+p_2(1-p_2)]}\}^2}{(p_1-p_2)^2}$$

$$\text{Sample size} = \frac{\{1.96\sqrt{[2*0.45(1-0.45]}+0.84\sqrt{[0.5(1-0.5)+(0.4(1-0.4)]}\}^2}{(0.5-0.4)^2}$$

$$\text{Sample size} = \frac{\{1.96\sqrt{[0.12(0.94]}+0.84\sqrt{[0.25+0.24]}\}^2}{(0.1)^2}$$

$$\text{Sample size} = \frac{\{1.378+0.84[0.7]\}^2}{0.01}$$

Sample size = $\{1.966\}^2$ /0.01

Sample size = 3.865 /0.01

Sample size =387

Hence, sample size was 774 in Total (387 cases and 387 controls)

Sampling techniques

A simple random sampling (SRS) strategy as a form of probability sampling methods was used. The list of cases and controls were obtained from CBS program and DREAMS program respectively. From CBS program since January to December 2022 there were 13,882 cases and 387 of AGYW aged between 15 to 24 years were selected randomly by first generating random numbers using MS Excel. Moreover, the sampling was applied proportionetly based on the population size in each District of Kigali City: Gasabo district had 134 cases out of 4,807, Kicukiro had 121 out of 4,340 and Nyarugenge had 132 out of 4,735.

However, ther controls (387) were selected consecutively based on the inclusion criteria as they came for education sessions for sexual and reproductive health and HIV prevention. These education session are held in safe space including schools, cell offices and churches. A total of 52,102 AGYW aged between 15 to 24 years was obtained from DREAMS program. The sample size was distributed proportionately to the population size of each District of Kigali City:136 out of 18,337 in Nyarugenge, Kicukiro 92 out of 12,420 and 159 out of 21,345 in Gasabo.

Data Collection Methods

The data were collected using data extraction questionnaire installed in tablets, and used for both cases and controls.The participants were selected from those documented in HIV case-based surveillance system in HIV Prevention unit of the Division of HIV/AIDS and STIs Diseases in the Rwanda Biomedical Center, which routinely gathers all data from all health facilities. The controls were collected from DREAMS project whereby participants were recruited by systematic random sampling. The data collection tool was comprised sections on social demographic characteristics and sexual behavioral factors of new HIV acquisition. Both case and control groups used the data collection questionnaire having the same questions.

Reliability and Validity

The questionnaire was designed based on literature and studies conducted in Ethiopia.[15,16] However, it was adjusted according to the availability of data in the records mentioned above. Moreover, to maintain the validity and reliability, data collected were checked on a regular basis. Upon completion of the fieldwork each day, all data were assembled and consolidated for consistency and completeness checks. Four trained enumerators with medical sciences background were employed during the period of data collection.

Data processing and analysis

The data to be used for the cases were extracted from Case Base Surveillance (CBS) database from RBC/HIV unit according to the essential information defined in our conceptual framework. As for the controls, data were gathered using structured questionnaire in the field. Finally, data for both cases and controls were pooled to form one single dataset of excel which were imported into IBM SPSS Statistics for Windows version 26 (IBM Corp, Armonk, NY, USA) for final data cleaning and analysis, starting with exploratory data analysis (EDA). To generate the output results, descriptive analysis of cleaned data set for means, frequencies and percentages was done; and later, binary logistic regression bivariate analysis of HIV infection potential risk factors and HIV infection status as outcome variable was done. Lastly, the risk factor variables which were significant in bivariate analysis were entered into multivariable binary logistic regression model whereby the odds ratio with confidence intervals not crossing one or with P values <5% were considered to be of significantly associated with HIV infection.

Ethical considerations

Before data collection, the Ethical clearance were obtained from University of Mount Kenya (MKU), of Public Health Department with No. MKU/ETHICS/24/3/2023. The permission No.17RBC/2022 for data collection was obtained from RBC/HIV Unit.

Similarly, under the support of ethical clearance letter obtained from MKU the principal investigator managed to request permission for data collection on DREAMS program in Kigali District offices (Gasabo,Kicukiroand Nyarugenge) where the clients gather monthly. Enumerators requested each participant to sign a consent form, after explanation about the study was provided and opportunity for asking questions given, before proceeding with data collection. Under 18 years old study participants signed assent forms, while in addition, their parents/guardians signed the consent forms of adults on their behalf. Confidentiality was assured to the data obtained and each participant's information was given a code to maintain the anonymity of individual person's data.

Results

Social demographic characteristics of the study population

Table1 shows that majority of participants (748, 96.6%) were 20 to 24 years old. Singles were predominant (487, 63.2%). More than one third (293, 37.9%) were from Gasabo district followed by Nyarugenge district (268, 34.6%). The majority (542, 70%) were not employed. The result further reveals that the proportion of employed participants was significantly higher for the cases (33.3%) than controls (26.6%), P=0.041. Furthermore, Gasabo district showed a slightly higher proportion of new HIV infections than Kicukiro district at 34.6% and 31.3% respectively (P=0.046). The proportion singles was higher among cases (72.8%) than controls (53.5%), (p <0.001).

Table 1. Social demographic characteristics of the study population

Variables	HIV new infection status			X^2 (*P* value)
	Total, n (%)	Cases, n (%)	Controls, n (%)	
Age in years				
15-19	26(3.4)	11(2.8)	15(3.9)	0.64(0.425)
20-24	748(96.6)	376(97.2)	372(96.1)	
Employment status				
Employed	232(30)	129(33.3)	103(26.6)	4.16**(0.041)**
Not Employed	542(70)	258(66.7)	284(73.4)	
District				
Gasabo	293(37.9)	134(34.6)	159(41.1)	6.14**(0.046)**
Kicukiro	213(27.5)	121(31.3)	92(23.8)	
Nyarugenge	268(34.6)	132(34.1)	136(35.1)	
Current resident type				
Correctional	11(1.4)	3(0.8)	8(2.1)	5.43(0.143)
Residential	304(39.3)	159(41.1)	145(37.5)	
Homeless	18(2.3)	12(3.1)	6(1.6)	
Temporary	441(57)	213(55)	228(58.9)	
Marital status				
Single	487(63.2)	281(72.8)	206(53.5)	40.97**(<0.001)**
Cohabitated	183(23.7)	59(15.3)	124(32.2)	
Divorced/Separated/Widow	40(5.2)	24(6.2)	16(4.2)	
Married	61(7.9)	22(5.7)	39(10.1)	

Notes: Bolded P values indicate statistical significance at <0.05.

Sexual behaviour related factors associated with new HIV infection

Table 2. Sexual behaviour related factors associated with new HIV infection

Variables	New HIV infection status			x^2(*P* value)
	Total n (%)	Cases, n (%)	Controls, n (%)	
Vaginal or anal sex				3.42(0.064)
Yes	708(91.7)	346(89.9)	362(93.5)	
No	64(8.3)	39(10.1)	25(6.5)	
History of commercial sex worker in last 12 months				42.53**(<0.001)**
Yes	137(17.7)	101(26.1)	36(9.3)	
No	591(76.4)	258(66.7)	333(86)	
Other	46(5.9)	28(7.2)	18(4.7)	
Number of sexual partners in last 3 months				762.09(**<0.001**)
0	82(10.6)	82(21.2)	0(0.0)	
1	390(50.4)	3(0.8)	387(100)	
2 and more	302(39)	302(78)	0(0.0)	
Sex with HIV positive person				27.17(**<0.001**)
Yes	119(15.4)	67(17.3)	52(13.4)	
No	239(30.9)	86(22.2)	153(39.5)	
Unknown/refuse	416(53.7)	234(60.5)	182(47)	
Sex with multiple partner				44.76**(<0.001)**
Yes	364(47)	224(57.9)	140(36.2)	
No	375(48.4)	141(36.4)	234(60.5)	
Unknown/refuse	35(4.5)	22(5.7)	13(3.4)	
Number of sexual partners last 12months				179.01**(<0.001)**
0	19(2.5)	19(4.9)	0(0.0)	
1	252(32.6)	41(10.6)	211(54.5)	
2 and more	503(65)	327(84.5)	176(45.5)	

Notes: Bolded P values indicate statistical significance at <0.05

Results in Table 2 show that there was a significant association (P<0.001) between the following sexual behaviour related factors and having a new HIV infection: being a commercial sex worker, having 2 or more sexual partners in the last 3 months, having sex with HIV positive person, having sex with multiple partners, and having two or more sexual partners in the last 12 months.

Multivariable analysis of factors associated with new HIV infection

The findings in Table 3 show that participants who were employed were 1.43 as likely to acquire new HIV infection as those who were not employed (aOR: 1.43, 95% CI: 1.02, 2.03; P=0.038). Kicukiro district was 1.59 times more likely to have HIV positive new infections (aOR: 1.59, 95% CI: 1.073, 2.35; P=0.021) than Gasabo. As for marital status, singles were 2.82 as likely to be HIV positive as the married, (aOR: 2.82; P=0.001, 95% CI: 1.53, 5.18).The divorced/separated were 2.73 more likely than the married to be HIV positive (aOR: 2.73; 95% CI: 1.13, 6.61, P=0.025). Participants who had ever been commercial sex workers were 2.04 times as likely to acquire new HIV infection as the control group (aOR: 2. 04,95% CI:1.29, 3.22, P=0.002). Participants who had had sex with multiple sex partners were 2.05 times more likely to acquire HIV infection than those who had not had multiple sex partners, (aOR: 2.05; 95% CI: 1.41, 2.98; P value <0.001).

Table 3. Multivariable analysis of factors associated with new HIV infection

Variable(s)	Univariate logistic regression model		Multivariable logistic regression model	
	COR (95%CI)	*P* value	aOR (95%CI)	*P* value
Employment status				
Employed	1.37(1.01,1.87)	0.042	1.43(1.02,2.03)	**0.038**
Not Employed (Ref)	1.00		1.00	
District				
Gasabo (Ref)	1.00		1.00	
Kicukiro	1.56(1.09,2.22)	0.014	1.59(1.073,2.35)	**0.021**
Nyarugenge	1.15(0.82,1.60)	0.04	1.17(0.79,1.71)	0.421
Marital status				
Single	2.48(1.39,4.20)	0.002	2.82(1.53,5.18)	**0.001**
Cohabitated	0.84(0.45,1.54)	0.583	1.04(0.53,2.01)	0.899
Divorced/separated	2.6(1.17,6.04)	0.019	2.73(1.13,6.61)	**0.025**
Married (Ref)	1.00		1.00	
Commercial sex workers				
Yes	3.6(2.39,5.47)	<0.001	2.04(1.29,3.22)	**0.002**
No (Ref)	1.00		1.00	
Other	2(1.08,3.71)	0.026	1.23(0.52,2.89)	0.633
Sex with HIV positive person				
Yes	2.29(1.46,3.58)	<0.001	1.62(0.944,2.77)	0.079
No (Ref)	1.00		1.00	
Unknown/refuse	2.28(1.64,3.17)	<0.001	1.39(0.93,2.08)	0.105
Sex with multiple partner				
Yes	2.65(1.97,3.57)	<0.001	2.05(1.41,2.98)	**<0.001**
No (Ref)	1.00		1.00	
Unknown/refuse	2.8(1.37,5.75)	<0.005	2.52(0.86,3.75)	0.068

Abbreviations: COR, Crude odds ratio; aOR, Adjusted odds ratio;
Note: Bolded P values indicate statistical significance at <0.05.

Discussion

Despite the availability of drugs that help manage HIV and even lower viral transmission, HIV remains a primary cause of death and a threat to the health of millions of people globally.[17] In light of this, this study was conducted to assess the risk factors of new HIV infection in Kigali city as one of Regions in Rwanda with high HIV prevalence.

The findings of this case-control study showed that, being employed is a risk factor for new HIV infection. This finding is consistent with scoping review conducted on employment and HIV whereby employment was associated with HIV infection.[18] In contrast, these findings differ with those of a study done on HIV prevalence among the young women in nine Eastern and South Africa countries where the employed women were positively and significantly protected from HIV infection.[19] This could be due to the fact that adolescent girls and young women, find it challenging and difficult to insist on safer sexual practices; and given their poor status and being dependent on men, they risk acquiring HIV infection for monetary gain.[20]

Being single or divorced/separated are positively associated with HIV infection. This finding is consistent with reports from

other similar studies whereby increased risk was associated with being divorced, widowed, single or not married.[21] In addition, study conducted on the role of state level-economic policy on HIV reduction showed that due to low social demographic status of single mothers, there is a likelihood of acquiring HIV infection more easily than other groups particularly in low and middle income countries in SSA.[22] The place of residence has been found to predict new HIV infection rates among AGYW in this study, being higher in urban settings. This may be explained by the fact that residing in urban areas exposes AGYW to many more distractions, than is the case for their counterparts living in rural areas.[20]

The study results showed that having been a commercial sex worker was a factor associated with HIV infection. In addition, study conducted on HIV-related behavioural sexual risk factors associated with sex commercial workers showed that having been commercial sex worker is significantly associated with HIV and STI infections.[23] Likewise, the Center for Disease and Control reported that HIV infection is higher among persons who exchange sex for money or non-monetary items.[24] Due to frequent sexual contact with numerous clients, inconsistent condom use, anal sex, drug use, violence, stigma and discrimination, and limited access to HIV services, commercial sex workers are likely to contract HIV. Similar findings were also reported in a study conducted in Guatemela where the women who practiced commercial sex worker experienced high rate of HIV infection and the main factor is that these women they exchange sex for money as way of survival. [25,26] The study findings showed that adult girls and young women who had multiple sexual practices are likely to acquire HIV new infection.These findings are consistent wih resuts of other studies whereby HIV new infection was associated with having history of multiple sexual practices among the females sex workers and women in reproductive age who were sexually active; and it was further explained that people who have multiple sex partners expose themselves to a catastrophy of HIV infection for life.[27-30]

The study's strengths include using sufficient sample size which maximized the external validity of the results. The study has some limitations related to using secondary data for the cases whereby not all the needed characteristics were available in the data set, such as education level of participants and some other behavioural factors.

Conclusion

The study shows that the risk factors for new HIV infections are employment status, marital status, multiple sexual practices and commercial sex worker history. Based on these findings, the following interventions are recommended to the National HIV prevention program and other stakeholders involved in HIV response in Rwanda: Sensitization AGYW in Kicukiro district focusing on the employed, single, and divorced or widowed or separated families will need to be done to raise their awareness about HIV infectionand available interventions.

Authors' contribution

BS, study design, data collection,and manuscript writing, data analysis; RN, interpretation of results; HB and JO, supervision of the study and manuscript writing. All authors have read the manuscripts and approved it for publication.

Declaration of conflict of interest

The authors declared no conflict of interest related to this study and the Authors of this article.

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References

1. UNICEF. 2021 HIV and AIDS Global Snapshot.*unicef website*. Available from: https://www.unicef.org/malawi/media/6266/file/2021%20Global%20Snapshot%20on%20HIV%20&%20AIDS.pdf. Accessed November 2021
2. Murewanhema G. HIV and adolescent girls and young women in sub-Saharan Africa: A call for expedited action to reduce new infections. *IJID Reg.* 2022; Doi: 10.1016/j.ijregi.2022.08.009
3. Moyo E, Moyo P, Murewanhema G, Mhango M, Chitungo I, Dzinamarira T. Key populations and Sub-Saharan Africa's HIV response. *Front Public Health.* 2023;11:1079990. https://doi.org/10.3389/fpubh.2023.1079990
4. Kharsany ABM, Karim QA. HIV Infection and AIDS in Sub-Saharan Africa: Current Status, Challenges and Opportunities. *Open AIDS J.* 2016;10:34–48. Doi:10.2174/1874613601610010034
5. Joint United Nations Programme on HIV/AIDS (UNAIDS).Gap report *UNAIDSWebsite*.http://www.unaids.org/sites/default/files/media_asset/UNAIDS_Gap_report_en.pdf Accessed 27 Sept 2023
6. Khalifa A, Stover J, Mahy M, Idele P, Porth T, Lwamba C. Demographic change and HIV epidemic projections to 2050 for adolescents and young people aged 15-24. *Global Health Action.* 2019;12(1):1662685.DOI:10.1080/16549716.2019.1662685
7. Joint United Nations Programme on HIV/AIDS (UNAIDS). Understanding FastTrack to HIV/AIDS prevention. *UNAIDS Website* : https://www.unaids.org/sites/default/files/media_asset/201506_JC2743_Understanding_FastTrack_en.pdf . accessed 27 September 2023
14. Joint United Nations Programme on HIV/AIDS (UNAIDS).New report from UNAIDS shows that AIDS can be ended by 2030 and outlines the path to get there. *UNAIDS Website*. https://www.unaids.org. Accessed accessed 27 September 2023
15. Joint United Nations Programme on HIV/AIDS (UNAIDS).Communities at the center. *UNAIDS Website*. https://www.unaids.org/sites/default/files/media_asset/2019-global-AIDS-update_en.pdf. Accessed .Accessed 20 June 2019
16. Rwanda Population-based HIV Impact Assessment(RPHIA).Summary sheet of 2018-2019.*PHIA website*. https://phia.icap.columbia.edu/wp-content/uploads/2019/10/RPHIA-Summary-Sheet_Oct-2019.pdf.Accessed October/2019.
17. Abbott P, Sapsford R, Binagwaho A. Learning from Success: How Rwanda Achieved the Millennium Development Goals for Health. *World Development*. 2017;92:103–16. Doi:10.1016/j.worlddev.2016.11.013
18. Institut National d'etudes Demographiques(INED). Rapport d'activité 2022. *INED Websit*e. https://www.ined.fr/fichier/s_rubrique/29368/wpp2019_10.key.findings_embargoed.version.en.pdf accessed 27 September 2023
19. World bank, report. Reshaping Urbanization in Rwanda [Internet]. 2017. *worldbank website*. https://documents1.worldbank.org/curated/fr/875101513836698339/pdf/122174-WP-P157637-PUBLIC-Note-1-Rwanda-Urbanization-12-07-17-rev2.pdf.
20. Casagrande, JT., Pike, MC. and Smith, PG. An Improved Approximate Formula for Calculating Sample Sizes for Comparing two Binomial Distribution. *California: International Biometric Society. Biometrics.* 1978; 34, 483-486. https://doi.org/10.2307/2530613

15. Wondemagegn F, Berkessa T. High level risky sexual behavior among persons living with HIV in the urban setting of the highest HIV prevalent areas in Ethiopia: Implications for interventions. Gebremedhin S, editor. *PLoS ONE.* 2020;15:e0242701. doi: 10.1371/journal.pone.0242701.
16. Moges NA, Adesina OA, Okunlola MA, Berhane Y, Akinyemi JO. Risky Sexual Practice, Sexually Transmitted Infection and Associated Factors Among Newly Diagnosed HIV-positive People in Northwest Ethiopia. *HIV*. 2020;Volume 12:431–439. doi: 10.2147/HIV.S267215.
17. Centers for Disease Control and prevention(CDC). Global impact of HIV .*CDC website*. https://www.cdc.gov/globalhealth/newsroom/topics/hiv/index.html.Accessed November 30, 2020
18. Maulsby CH, Ratnayake A, Hesson D, Mugavero MJ, Latkin CA. A Scoping Review of Employment and HIV. *AIDS Behav*. 2020;24(10):2942–55. Doi:10.1007/ s10461-020-02845-x
19. Mee P, Fearon E, Hassan S, Hensen B, Acharya X, Rice BD, et al. The association between being currently in school and HIV prevalence among young women in nine eastern and southern African countries. *PLoS One*. 2018;13(6):e0198898.Doi: 10.1371/journal.pone.0198898
20. Low A,ThinK, Davia S, Mantell J, Koto M, McCracken S, et al. Correlates of HIV infection in adolescent girls and young women in Lesotho: results from a population-based survey. *The Lancet HIV*. 2019;6(9):e613–22.Doi:10.1016/S2352-3018(19)30183-3
21. Rodrigo C, Rajapakse S. HIV, poverty and women. *International Health*. 2010;2(1):9–16. DOI:10.1016/j.inhe.2009.12.003
22. Mabaso M, Sokhela Z, Mohlabane N, Chibi B, Zuma K, Simbayi L. Determinants of HIV infection among adolescent girls and young women aged 15–24 years in South Africa: a 2012 population-based national household survey. *BMC Public Health*. 2018;18(1):183.Doi:10.1186/s12889-018-5051-3
23. Gavin L, Galavotti C, Dube H, McNaghten AD, Murwirwa M, Khan R, et al. Factors Associated with HIV Infection in Adolescent Females in Zimbabwe. *Journal of Adolescent Health*. 2013;39(4):596.e11-596.e18. DOI: 10.1016/j.jadohealth.2006.03.002
24. Narain KDC, Harawa N. Evidence for the Role of State-Level Economic Policy in HIV Risk Reduction: State Earned Income Tax Credit Generosity and HIV Risk Behavior Among Single Mothers. *AIDS Behav*. 2023;27(1):182–8. Doi: 10.1007/s10461-022-03754-x
25. YANG H, LI X, STANTON B, CHEN X, LIU H, FANG X, et al. HIV-Related Risk Factors Associated with Commercial Sex Among Female Migrants in China. *Health Care Women Int*. 2012;26(2):134–48. Doi:10.1080/07399330590905585
26. Jung M. Risk factors of sexually transmitted infections among female sex workers in Republic of Korea. *Infectious Diseases of Poverty*. 2019;8(1):6. Doi: 10.1186/s40249-019-0516-x
27. Kerrigan D, World Bank, editors. The global HIV epidemics among sex workers. *Washington, DC: World Bank*; 2013. 305 p. (Directions in development).
28. Boyce SC, Morales-Miranda S, Ritter J, Triplett DP, Loya-Montiel I, Silverman JG. HIV Infection and Risk Heightened Among Female Sex Workers Who Entered the Sex Trade as Adolescents in Guatemala. *AIDS Behav*. 2020;24(10):2906–17.Doi: 10.1007/s10461-020-02841-1
29. Bekele Z, Mussa I, Assefa Y, Abera N, Amerga EW, Girma A, et al. Risky sexual practice and associated factors among adult people living with HIV/AIDS in public hospitals of Kembata Tambaro Zone, Southern Ethiopia: a cross-sectional study. *BMJ Open*. 2023;13(7):e072505.Doi: 10.1136/bmjopen-2023-072505
30. Hareru HE, Kaso AW, Ashuro Z, Mareg M. Risky sexual practice and associated factors among people living with HIV/AIDS receiving antiretroviral therapy in Ethiopia: Systematic review and meta-analysis. *PLOS ONE*. 2022;17(4):e0266884.Doi:10.1371/journal.pone.0266884