Predictors of Human Immunodeficiency Virus High-Risk Sexual Behaviors among Unmarried Women

**Paddy Ssentongo[1]*,
Metahan Traore[2] and
Djibril M. Ba[3]**

[1]Center for Neural Engineering, Department of Engineering, Science and Mechanics, The Pennsylvania State University, University Park, PA, USA
[2]ICF, The Demographic and Health Surveys Program, Rockville, MD, USA
[3]Department of Public Health Sciences, Penn State College of Medicine, Hershey, PA, USA

Abstract

Rationale: Human immunodeficiency virus (HIV) incidence in Ivory Coast is the highest in West Africa, yet factors associated with high-risk sexual behaviors are not well understood. In this study, we report predictors that are dependently and independently associated with high-risk sexual behaviors among Ivory Coast unmarried women aged 15-49 using Demographic and Health Survey (DHS) data.

Methods: This study used DHS data conducted in 2012 in Ivory Coast. Univariate and multivariable logistic regression models were used to determine factors associated with high-risk sexual behaviors among unmarried women. High-risk sexual behaviors examined were non-use of condoms during sexual intercourse and having multiple sexual partners.

Results: A total of 10,060 women aged 15-49 participated in the survey. Of these, 3607 (36%) were single women. Among factors independently associated with non-use of a condom during sexual intercourse were: the use of contraceptives aOR=2.95, 95% CI (2.35-3.70, p<0.0001, living in a poor household aOR=1.71, 95% CI (1.09-2.69, p=0.019), and older age groups: 25-34, aOR=1.44, 95% CI (1.12-1.86, p=0.005), and 35-49, aOR=1.96, 95% CI (1.37-2.81, p<0.0001) compared to the 15-24 age group. Conversely, secondary and higher education aOR=0.65, 95% CI (0.48-0.90, p=0.008) and being exposed to the radio aOR=0.68, 95% CI (0.52-0.90, p=0.008), were independent protective determinants. In addition, independent risk factors contributing to having multiple sexual partners included: animist religion aOR=1.88, 95% CI (1.04-3.36, p=0.034), TV exposure aOR=2.31, 95% CI (1.17-4.55, p=0.015), geographical location: Abidjan aOR=2.02, 95% CI (1.16-3.56, p=0.014), South aOR=2.54, 95% CI (1.41-4.61, p=0.002), West aOR=2.19, 95% CI (1.19-1.02, p=0.011) and a higher education level aOR=2.26, 95% CI (1.25-4.06, p=0.007).

Conclusion: Social, regional, economic and institutional factors influence the high-risk sexual behaviors among unmarried women in Ivory Coast. Health education programs should develop a holistic outreach programs that target the social ecological model of determinants of sexual health in Ivory Coast.

Keywords: Sub-Saharan Africa; Human immunodeficiency virus/Acquired immune deficiency syndrome (HIV/AIDS); High-risk sexual behavior; DHS; Ivory Coast

Corresponding author: Paddy Ssentongo

✉ pssentongo@pennstatehealth.psu.edu

[1]Center for Neural Engineering, Department of Engineering, Science and Mechanics, The Pennsylvania State University, University Park, PA, USA

[2]ICF, The Demographic and Health Surveys Program, Rockville, MD, USA

[3]Department of Public Health Sciences, Penn State College of Medicine, Hershey, PA, USA

Tel: 814-777-2741

Background

HIV/AIDS is a pandemic, and sub-Saharan Africa is the most affected region. As of 2015, an estimated 40 million people were infected with HIV, and 70 percent of those were living in sub-Saharan Africa [1]. Despite a 41% decrease in the incidence of HIV

in sub-Saharan Africa between 2000 and 2014, the incidence in Ivory Coast is still the highest in West Africa [2,3], and it is one of the leading causes of death in women [4]. In Ivory Coast, HIV infection rates are significantly higher in women than men [5,6]. Factors associated with an increased HIV incidence rate in women include high-risk sexual behaviors such as inconsistent use of condoms, multiple sexual partners, casual sex, anal sex, alcohol and drug use [7,8]. In addition, there is a strong relationship between poverty and high-risk sexual behaviors among women [9,10]. In attempt to satisfy their material needs such as food, house rent and clothes, women are often pushed to engage in high-risk sexual behaviors [10,11]. Women are often less educated and hold a lower societal status so they find it difficult to negotiate safer sex with men, leading to more informal and unsafe sex. Therefore, combined social, economic, political, and environmental factors directly affect HIV transmission risk. However, there is a lack of information on predictors associated with high-risk sexual behaviors. Therefore, in this report, we analysis and report these factors. To our knowledge, this is the first report that describes a comprehensive set of multiple predictors of high-risk sexual behaviors among single women in Ivory Coast. Better understanding the dynamics of HIV transmission, will help inform the public and private sectors on how to effectively allocate resources to mitigate HIV transmission through screening, prevention and early treatment.

Methods

Ethical consideration

The study protocols were approved by the National Ethics Committee for Life Sciences and Healthcare, Institutional Review Board of ICF International, and the Center for Disease Control and Prevention in Atlanta, Georgia, USA [DHS-MICS,11/12]. The Demographic Health Survey [DHS] Program maintains strict standards for protecting the privacy of all participants. Before each interview, interviewers read out an informed consent statement including that participation is voluntary and the respondent has the liberty to terminate the interview at any point. Approval for this study was not required since the data is secondary and is available in the public domain. More details regarding DHS data and ethical standards are available at: https://dhsprogram.com/data/available-datasets.cfm

Study Design

This research uses a cross-sectional survey from the DHS Macro Database. Data was collected from December 2011 to March 2012 and was used to provide demographic and health information including HIV/AIDS indicators to administrators of population and health programs in Ivory Coast. The survey used closed-ended questions. Data collection focused on women demographics, socio-cultural and socio-economic characteristics. In addition, the survey examined reproductive health behaviors, contraception use, and knowledge and prevalence of self-reported sexually transmitted infections, including HIV.

The DHS-MICS was conducted by the Ministry of Health and

the Fight against AIDS (MSLS) in collaboration with the National Institute of Statistics (INS) for the implementation of the survey. The survey was funded by the government of Ivory Coast with technical assistance from ICF International. In addition, the survey receives technical and financial assistance from the United States Agency for International Development (USAID), United Nations Population Fund (UNFPA), United Nations Children's Fund (UNICEF), the European Union, the World Bank, the Global Fund and The Joint United Nations Program on HIV and AIDS (UNAIDS).

Participants

The DHS-MICS-11/12 (EDSCI-III) survey focused on the country-wide population of individuals at the household level. A stratified two-stage cluster method of sampling was used. For the first stage, a total of 352 clusters were randomly drawn from the list of clusters of AISCI-2005. A total of 161 clusters were drawn in urban place of residency and 191 from rural zones were selected by taking a systematic sampling probability proportional to the size. There was a total of 9,873 households randomly selected for the survey. Of these, 9686 were successfully surveyed, representing a response rate of 98%. The response rate was higher in rural zones (99%) than urban areas (97%). A total of 10,848 women aged 15-49 were identified as eligible for the individual survey. Of those, 10,060 of them successfully completed the survey, producing a response rate of 93%. However, for the logistic regression analysis we analyzed a subset of women who were single, defined as never in union (married), widowed, divorced, or no longer living together/separated.

Demographic characteristics are focused on information including the age, place of residence, religion, education level, household wealth index, geographical region, exposure to communication media [radio and television], female genital mutilation, condom use during sexual intercourse, multiple sexual partners, and age at first sexual intercourse. The section on sexually transmitted infections (STIs) contains information on the prevalence of STIs, knowledge of STI/AIDS risk perception, HIV/AIDs awareness, condom use and having had multiple sexual partners in the last 12 months.

Statistical analysis

We used descriptive, univariate and multivariable logistic regression methods for the analysis using STATA version 9.0. Descriptive statistics was used to compute and tabulate the counts and percentages of individual characteristics. The univariate and multivariable logistic regression analysis methods were using to explore the association between the predictors and outcomes. All variables that were significant in the univariate logistic regression were included in the multivariable logistic regression model to identify independent predictors of high-risk sexual behaviors. Outcomes analysed were 1) non-use of condoms during sexual intercourse and, 2) having multiple sexual partners. The results were reported as odds ratios (OR), adjusted odds ratio (aOR), 95% confidence intervals and p-values. The statistical tests were reported as significant if the level of significance was less than alpha equal to 0.05.

Results

Descriptive analysis of the socio-demographic characteristics of the sample population

Socio-demographic characteristics of the survey respondents are presented in **Table 1**. A total of 10,060 women of reproductive age (15-49 years) were interviewed for the survey. Of these, age group 15-24 years represented the highest percentage (40%), followed by 25-34 years (34%) and 35-49 years (26%) category respectively. Regarding religion, Christianity was the most prevalent at 46% followed by Muslim and animists at 40% and 14% respectively. Approximately 52% of respondents lived in urban areas and 49% in rural areas. There was a difference in education level among the surveyed population with the majority of respondents reporting no education (57%), primary education (23%) and secondary education (20%).

More women did not have a job (71%), were not using contraceptives (81%), were not using condoms during sexual intercourse (87%), had knowledge of HIV/AIDS (87%), knew that use of condoms during sexual intercourse protects against

Table 1: Sociodemographic characteristics of the sample population of surveyed women in Ivory Coast (N=10060).

Variables	Frequency (*N*)	Percentage (%)
Women of childbearing age		
15-24	3984	39.52
25-34	3340	34.1
35-49	2736	26.38
Total	10060	-
Religion		
Muslim	4044	40.2
Christian	4596	45.69
Animist	1420	14.11
Total	10060	-
Place of residence		
Urban	5170	51.39
Rural	4890	48.61
Total	10060	-
Education level		
No education	5744	57.1
Primary	2347	23.33
Secondary and higher	1969	19.57
Total	10060	-
Occupation		
Working	2946	29.28
No working	7114	70.72
Total	10060	-
Wealth level		
Poor	3688	36.66
Middle	2100	20.87
Rich	4272	42.47
Total	10060	-
Contraceptive method		
No	8074	81.21
Yes	1986	18.79
Total	10060	-
Female circumcision		
No	5292	56.01
Yes	4157	43.99
Total	9449	-
Condom used		
No	6896	86.71
Yes	1057	13.29
Total	7953	-
Ever heard of AIDS		
No	642	6.38
Yes	9418	93.62
Total	10060	100
Know condom prevents HIV		
No	3360	35.68
Yes	6058	64.32
Total	9418	100
Region		
Center	2687	26.71
North	2754	27.38
West	1666	16.56
South	1553	15.44
Abidjan	1400	13.92
Total	10060	100
Age at first sexual intercourse		
<18	5762	57.28
>=18	4298	42.72
Total	10060	-
Multiple sex partnership		
No	9732	96.74
Yes	328	3.26
Total	10060	-
Avoid HIV by fidelity		
No	2689	28.55
Yes	6729	71.45
Total	9418	-
Radio exposure		
Never	5656	56.22
Sometimes	1932	19.2
Always	2472	24.57
Total	10060	-
TV exposure		
Never	4022	39.98
Sometimes	1647	16.37
Always	4391	43.65
Total	10060	-
Receive result from last HIV test		
No	266	7.19
Yes	3566	92.81
Total	3699	-
Current Marital Status		
Married	6453	64.15
Single	3607	35.85
Total	10060	-

HIV (64%), had their first sexual intercourse before they tuned 18 years (57%), were not involved in multiple sex partnerships (97%), knew that HIV/AIDS can be avoided by having only one partner (71%), and had a HIV test (93%).

Regarding communication media exposure, the majority of respondents were not exposed to the radio (56%). However, over a half of the respondents was either sometimes or always exposed to television (26% and 44% respectively). Middle and higher wealth class participants represented over half of the respondents; 21% and 43% respectively.

Geographically, participants were from the northern (27%), central (27%), western (17%), and southern regions (15%). Fourteen percent of respondents were from Abidjan, the economic capital of the country.

Univariate factors associated with non-use of condoms during sexual intercourse

Regression models identified factors influencing the non-use of condoms during sexual intercourse (Table 2). Compared to the 15-24 age category, women aged 25-34 and 35-49 were 1.5 and 2.2 times more likely to not use condoms during sexual intercourse: OR=1.48, 95% CI (1.25-1.75, p<0.01) and OR= 2.21, 95% CI (1.74-2.80, p<0.01) respectively. In addition, the place of residence (place of socialization) was significantly associated with the non-use of condoms during sexual intercourse. Compared to the respondents who are living in the rural areas, those living in urban settings were less likely to not use condoms during sexual intercourse: OR =0.37, 95% CI (0.31-0.43, p=<0.0001). Other factors associated with the likelihood of not using condoms include: belonging to animist religion, OR=1.95, 95% CI (1.50-2.53, p=<0.0001), being poor OR=1.89, 95% CI (1.50-2.39, p=<0.0001), using contraceptives, OR=4.16, 95% CI (3.58-4.84, p=<0.0001), and a lack of knowledge that HIV can be prevented by condoms, OR=1.43, 95% CI (1.20-1.70, p=<0.0001). Conversely, factors associated with an increased likelihood of using condoms during sexual intercourse include; living in the economic capital of the country, Abidjan, OR=0.69, 95% CI (0.56-0.85, p=0.001), having primary education, OR=0.45, 95% CI (0.37-0.54, p<0.0001),

secondary education and higher, OR=0.24, 95% CI (0.20-0.2, p<0.0001), not working, OR=0.85, 95% CI (0.64-0.87, p<0.0001), belonging to a wealthy household, OR=0.53, 95% CI (0.43-0.64, p<0.0001), having female genital mutilation, OR=0.65, 95% CI (0.56-0.77, p<0.0001) and having exposure to television, either sometimes, OR=0.51, 95% CI (0.40-0.64, p<0.0001) or always, OR=0.37, 95% CI (0.31-0.45, p<0.0001). However, there was no significant association between non-use of condoms and age at first sexual intercourse or having received HIV test results.

Independent predictors associated with not using condoms during sexual intercourse

Table 2 presents the multivariable logistic regression analysis of not using condoms during sexual intercourse. Factors that were independently associated with the lack of condom use included age groups of 25-34, aOR=1.44, 95% CI (1.12-1.86, p=0.005), and 35-49, aOR=1.96, 95% CI (1.37-2.81, p<0.0001) compared to the 15-24 age group, coming from a poor household, aOR=1.71, 95% CI (1.09-2.69, p=0.019), and using contraceptives, aOR=2.95, 95% CI (2.35-3.70, p<0.0001). Factors associated with increased likelihood of condom use were secondary and higher education, aOR=0.65, 95% CI (0.48-0.90, p=0.008) and being always exposed to the radio, aOR=0.68, 95% CI (0.52-0.90, p=0.008).

Univariate factors associated with multiple sexual partners

Table 3 presents the univariate and multivariable logistic regression analysis of multiple sexual partners among women in Ivory Coast. Univariately, factors significantly associated with the likelihood of multiple sexual partners include; living in urban areas, OR=1.42, 95% CI (01.12-1.81, p=0.004), living in the southern region, OR=1.65, 95% CI (1.63-2.35, p=0.005) and the capital city, Abidjan, OR=1.82, 95% CI (1.31-2.53, p<0.0001), having a primary education, OR=1.78, 95% CI (1.34-2.37, p<0.0001), secondary and higher education, OR=1.9, 95% CI (1.44-2.52, p<0.0001), living in a wealthy household, OR=1.46, 95% CI (1.06-2.02, p=0.020), absence of female genital mutilation, OR=1.3, 95% CI (1.00-1.67, p=0.046), knowledge that condoms prevent HIV, OR=1.5, 95%

Table 2: Factors associated with the non-utilization of condoms using sexual intercourse among single women: univariate and multivariate logistic regression analysis.

Variables	Univariate model OR (CI 95%)	P value	Multivariable model OR (CI 95%)	P Value
Women of childbearing age				
15-24	1.00	-	1.00	-
25-34	1.48 (1.25-1.75)	0.000***	1.44 (1.12-1.86)	0.005***
35-49	2.21 (1.74-2.80)	0.000***	1.96 (1.37-2.81)	0.000***
Place of residence				
Urban	0.37 (0.31-0.43)	0.000***	0.91 (0.62-1.32)	0.625
Rural	-	-	1.00	-
Region				
Center	1.00	-	1.00	-
North	0.94 (0.77-1.62)	0.613	1.07 (0.76-1.51)	0.687

West	1.11 (0.88-1.40)	0.385	1.34 (0.92-1.96)	0.121
South	1.25	0.054	1.06 (0.75-1.50)	0.75
Abidjan	0.69 (0.56-0.85)	0.001***	1.32 (0.96-1.81)	0.084
Religion				
Muslim	1.17 (1.00-1.37)	-	1.28 (0.97-1.69)	0.086
Christian	1.00	0.052	1.00	-
Animist	1.95 (1.50-2.53)	0.000***	1.38 (0.89-2.13)	0.149
Age first sex				
<18	1.00	-	1.00	-
>=18	0.95 (0.82-1.11)	0.52	0.94 (0.74-1.18)	0.565
Education level				
No education	1.00	-	1.00	-
Primary	0.45 (0.37-0.54)	0.000***	0.77 (0.56-1.05)	0.099
Secondary & plus	0.24 (0.20-0.29)	0.000***	0.65 (0.48-0.90)	0.008***
Occupation				
No Working	0.85 (0.64-0.87)	0.000***	0.94 (0.73-1.20)	0.623
working	1.00	-	1.00	-
Household wealth				
Poor	1.89 (1.50-2.39)	0.000***	1.71 (1.09-2.69)	0.019**
Middle (medium)	1.00	-	1.00	-
Rich	0.53 (0.43-0.64)	0.000***	0.83 (0.60-1.16)	0.279
Using contraceptive methods				
Yes	4.16 (3.58-4.84)	0.000***	2.95 (2.35-3.70)	0.000***
No	1.00	-	1.00	-
Female genital mutilation				
No	0.74 (0.63-0.87)	0.000****	0.97 (0.73-1.29)	0.846
Yes	1.00	-	1.00	-
Knowledge of condom preventing AIDS				
No	1.00	-	1.00	-
Yes	0.65 (0.56-0.77)	0.000***	1.06 (0.81-1.40)	0.662
Knowledge condom to avoid AIDS				
No	1.43 (1.20-1.70)	0.000***	0.95 (0.71-1.27)	0.733
Yes	1.00	-	1.00	-
Exposure to Radio				
Never	1.00	-	1.00	-
Sometimes	0.48 (0.41-0.55)	0.000***	0.71 (0.53-0.95)	0.023
Always	0.39 (0.34-0.44)	0.000***	0.68 (0.52-0.90)	0.008***
Exposure to Television				
Never	1.00	-	1.00	-
Sometimes	0.51 (0.40-0.64)	0.000***	0.9 (0.60-1.35)	0.613
Always	0.37(0.31-0.45)	0.000***	0.89 (0.63-1.27)	0.518
Receive last HIV test				
No	1.06 (0.69-1.64)	0.784	1.00	-
Yes	1.00	-	0.84 (0.63-1.27)	0.472
Significance (model)	-	-	0.000	-
Pseudo R² (%)	-	-	25.24	-

***: Significant to α=0.01

**: Significant to α=0.05

1.00=Reference group

Table 3: Factors associated with multiple sexual partnerships among single women: univariate and multivariate logistic regression analysis.

Variables	Univariate model OR (CI 95%)	p value	Multivariable model OR (CI 95%)	p value
Women of childbearing age				
15-24	1.00	0.000	1.00	-
25-34	1.15 (1.25-1.75)	0.308	1.01 (0.66-1.55)	0.96
35-49	0.51 (0.35-0.76)	0.001***	0.73 (0.40-1.33)	0.306
Place of residence				
Urban	1.42 (1.12-1.81)	0.004***	1.26(0.60-2.63)	0.543
Rural	1.00	-	1.00	-
Region				
Center	1.00	0.000	1.00	-
North	1.06 (0.75-1.51)	0.742	1.36 (0.71-2.63)	0.353
West	1.62 (1.13-2.32)	0.008	2.19 (1.19-1.02)	0.011**
South	1.65 (1.63-2.35)	0.005***	2.54 (1.41-4.61)	0.002***
Abidjan	1.82 (1.31-2.53)	0.000****	2.02 (1.16-3.56)	0.014**
Religion				
Muslim	0.54 (0.42-0.71)	0.000***	0.85 (0.52-1.37)	0.496
Christian	1.00	0.735	1.00	-
Animist	0.94 (0.68-1.32)	-	1.88 (1.04-3.36)	0.034**
Age first sex				
<18	1.00	-	-	-
≥ 18	0.88 (0.69-1.14)	0.339	0.86 (0.58-1.26)	0.430
Education level				
No education	1.00	-	1.00	-
Primary	1.78 (1.34-2.37)	0.000***	1.7 (0.95-3.04)	0.072
Secondary& plus	1.9 (1.44-2.52)	0.000***	2.26 (1.25-4.08)	0.007***
Occupation				
No Working	0.9 (0.71-1.14)	0.389	0.7 (0.46-1.07)	0.097
working	1.00	-	1.00	-
Household wealth level				
Poor	1.23 (0.87-1.74)	0.248	1.57 (0.673.69)	0.296
Middle (medium)	1.00	-	1.00	-
Rich	1.46 (1.06-2.02)	0.020**	1.31 (0.72-2.37)	0.378
Using contraceptive methods				
Yes	0.36 (0.29-0.45)	0.000***	0.49 (0.34-0.71)	0.000***
No	1.00	-	1.00	-
Female genital mutilation				
No	1.3 (1.00-1.67)	0.046**	0.75 (0.47-1.20)	0.234
Yes	1.00	-	1.00	-
Knowledge of condom preventing AIDS				
No	1.00	-	1.00	-
Yes	1.5 (1.15-1.95)	0.002***	0.81 (0.52-1.27)	0.358
Knowledge condom to avoid AIDS				
No	0.78 (0.59-1.02)	0.065	0.98 (0.60-1.60)	0.93
Yes	1.00	-	1.00	-
Exposure to Radio				
Never	2.06 (1.75-2.43)	0.000***	1.00	-
Sometimes	1.21 (1.00-1.46)	0.056	0.81 (0.49-1.33)	0.402
Always	1.00	-	0.99 (0.64-1.56)	0.986
Exposure to TV				
Never	1.00	-	1.00	-
Sometimes	1.82 (1.28-2.57)	0.001***	2.31 (1.17-4.55)	0.015**
Always	1.78 (1.37-2.38)	0.000***	1.64 (0.86-3.12)	0.131
Received last HIV test				
No	0.45 (0.17-1.25)	0.126	1.00	-
Yes	1.00	-	2.04 (0.73-5.74)	0.173
Significance (model)	-	-	0.00	-
Pseudo R² (%)	-	-	15.8	-

***: Significant to α=0.01
**: Significant to α=0.05
1.00: Reference group

CI (1.15-1.95, p=0.002), lack of radio exposure, OR=2.06, 95% CI (1.75-2.43, p<0.0001), and exposure to television both sometimes, OR=1.82, 95% CI (1.28-2.57, p=0.001) and always, OR=1.78, 95% CI (1.37-2.38, p<0.0001). Similarly compared to those who do not use contraceptives, respondents who used contraceptives were less likely to have multiple sexual partners, OR=0.36, 95% CI (0.29-0.45, p=0.001). Compared to Christians, Muslims were half as likely to have multiple sexual partners, OR=0.54, 95% CI (0.42-0.71, p<0.0001). Compared to respondents aged 15-24, those aged 35-49 were half as likely to have multiple sexual partners, OR=0.51, 95% CI (0.35-0.76, p=0.001).

Independent predictors associated with multiple sexual partners

Geographical location was independently associated with having multiple sexual partners. The odds of having multiple sexual partners were twice in respondents living in the western, southern and Abidjan regions compared to those living in the central region. Similarly, compared to Christians, animist, were twice as likely of having multiple partners. Those who attained secondary education or higher, had an increased likelihood of having multiple sexual partners, aOR=2.26, 95% CI 1.25-4.08, p=0.007). In addition, those who were sometimes exposed to television, had increased likelihood of having multiple sexual partners, aOR=2.31, 95% CI (1.17-4.55, p=0.015). In contrast, the use of contraceptives was independently associated with reduced likelihood of multiple sexual partners, aOR=0.49, 95% CI (0.34-0.71, p<0.0001).

Discussion

Characterizing predictors of high-risk sexual behaviors among women of childbearing age does not only help to create programs that prevent HIV transmission among women, but also helps to prevent transmission of HIV from mother-to-child by preventing maternal infections. The analyses reported in this article have documented the factors associated with not using condoms during sexual intercourse and having multiple sexual partners. In addition, it has provided evidence of the association between multiple predictors, and sexual high-risk behaviors. In this study, age, contraceptive use, educational level and wealth index were independent predictors of non-use of condoms among single women of reproductive age. The 25-34 and 35-49 age groups were more likely to not use condoms than those aged 15-24. The high-risk sexual behaviors in these age groups contribute to the high HIV prevalence in sub-Saharan Africa that is seen in the same age group [12,13]. In contrast, secondary and higher education and continual exposure to the radio were associated with the increased likelihood of condom use during sexual intercourse.

Multiple sexual partnerships were significantly associated with the region of residence, religion, education level, television exposure and contraceptive use. Other studies have also shown a regional distribution of the likelihood of multiple sexual partnerships [14]. Similarly, compared to Christians, animists were twice as likely to have multiple sexual partners. This is in contrast with a Ghanaian study that did not find religious affiliation to be associated with

changes in specific protective behavior, particularly the use of condoms [15]. Those who have attained secondary education or more, have an increased likelihood of having multiple sexual partners. Even though our study findings showed that those who are sometimes exposed to television, have an increased likelihood of having multiple sexual partners, it also showed that communication media exposure is associated with higher odds of using condoms. This is consistent with other sexual behavior studies in Ivory Coast, where exposure to communication media such as radio and television were associated with increased likelihood of using condoms [16]. This could be explained by the advantageous exposure to anti-HIV programs and messages that usually air on radios and televisions. Therefore, reductions in HIV transmission needs a combination of communication channels to disseminate messages that motivate people to engage in a range of options to reduce risk. Programs need to also target those without access to television or radio. The effect of behavioral strategies could be increased by aiming for many HIV prevention methods such as delay in onset of first intercourse, reduction in number of sexual partners and increases in condom use [17]. In addition, in the context of exploring factors associated with failure to use condom during sexual intercourse and having multiple partners, women's celibacy, although not explored in our study, is known to be a protective factor for engaging in high-risk sexual behavior and acquiring HIV infection [18]. Furthermore, having knowledge of HIV is not equivalent to being educated and empowered to use condoms. In our study, over 90% of the women had heard about HIV, albeit lower percentage who knew that HIV spread can be prevented by wearing a condom during sexual intercourse. This implies that the message about HIV shouldn't stop only on knowing about the disease but should further address protective methods of HIV prevention.

Socioeconomic status (SES) was associated with condom use and having multiple sexual partners. Although higher SES women were more likely to have multiple sexual partners, they also were more likely to use condoms. Women from poor households were 71% more likely to not use condoms compared to those from wealthier households. This is congruous with prior African studies on HIV showing that low SES increases female odds of exchanging sex for money or goods, coerced sex, and having multiple sexual partners [19,20]. The use of contraceptives had mixed results, an independent risk factor for non-use of a condom, but independently associated with the reduced likelihood of having multiple sexual partners. In the low resource countries like Ivory Coast, women use condoms primarily as a mean of contraception. When the "fear" of getting pregnant is removed by using contraceptive pills, injections, or intrauterine devices, women tend to not wear condoms during sexual intercourse hence predisposing them to HIV. On the other hand, it remains to be explained why using contraception methods is a protective factor against multiple sexual partners. This is beyond the scope of this study.

In a country where approximately 90% of the population is turned to religion and over 40% of the women are circumcised, attraction to sex could possibly be explained by intrapersonal,

interpersonal, institutional and behavior factors such as poverty, lower social economic status. There is mounting body of evidence showing that being religious or female genital mutilation (FGM) doesn't protect against high-risk sexual behaviors and HIV/AIDS [21,22]. In fact, women with genital mutilation have a higher likelihood of acquiring HIV through mechanisms such as higher probability of bleeding during coitus [22] and potentially a higher likelihood of engaging in unprotected receptive anal intercourse. In addition, religious influences such as Catholicism moralize against condom use [23]. In other words, factors justifying sexual behaviors of the Ivory Coast women are shaped by factors at multiple levels, including institutional, community, and policy levels in addition to intrapersonal and interpersonal levels. In light of these factors, to better improve HIV prevention strategies in Ivory Coast, HIV prevention programs should use multilevel approaches including intrapersonal, interpersonal, social and sexual networks, institutions, and entire communities within populations of both uninfected and infected individuals with HIV [17]. Furthermore, HIV positive individuals can greatly benefit from disease and care management programs supervised and coordinated by care managers so as to increase patient health knowledge, self-management skills, and readiness to make changes in health behaviors [24].

Limitations

Our study has some limitations. First; lack of qualitative data on the attitude and opinions of women on sexuality. This would have helped to explore factors associated with risky sexual behaviors. Second, there is a lack of data on the distribution of health infrastructures and outreach programs which would have explained the geographical accessibility of HIV prevention services such as condom use education programs. Third, this is a retrospective study which has the limitations of the study design. These limitations include lack of data on potential confounding factors that could alter the outcome of the study. Such potential confounders include mental health status of the participants, sexual orientation and the availability of condoms either in the local shops or health centers. Fourth, like with all self-reported surveys, items in the questionnaire elicit self-reported information on sensitive issues such as condom use and HIV/AIDS, and the respondent might have been biased in responding to these items. However, assurance of confidentiality and anonymity might have minimized this problem. Even with this limitation, this study is a strong study due to its large sample size and that the findings are generalizable because of the well-designed sampling method and the sample is a representative of the study population. In addition, to our knowledge, this is the first study to explore a large composite of factors associated with high-risk sexual behaviors among women of reproductive age in Ivory Coast using recent data. Therefore, the findings of this study will aid in structuring HIV prevention strategies.

Recommendations

The regional disparities observed necessitate actions against HIV/

AIDS and health policies to be targeted specifically to regional, religion, and education levels. The fight against HIV/AIDS must be intensified in the region of Abidjan, southern and western. Anti-HIV campaigns should be intensified specifically by disseminating information, education and awareness on the use of condoms consistently and correctly and to avoid sexual networks. Finally, for individuals diagnosed with HIV/AIDS, implementing disease and care management programs by care managers is key to increasing patient health knowledge, self-management skills, and readiness to make changes in health behaviors.

Conclusion

The high rates of HIV infections in Ivory Coast can be mitigated by employing multilevel HIV/AIDS prevention approaches including intrapersonal, interpersonal, social and sexual networks, institutions, and entire community within populations of both uninfected and infected with HIV.

Ethical Approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Acknowledgement

Authors' Contributions

MT and DMB and PS participated in the conception and design of the study, data cleaning and analysis, results interpretation, and drafting and revision of the manuscript. MT and DMB and PS participated in review of statistical methods, results interpretation, and revision of the manuscript. All authors read and approved the final manuscript.

Competing Interests

The authors declare that they have no competing interests.

Consent for Publication

No consent to publish was needed for this study as we did not use any details, images or videos related to individual participants. In addition, data used is available in the public domain.

References

1   Wang H, Wolock TM, Carter A, Nguyen G, Kyu HH, et al. (2016) Estimates of global, regional, and national incidence, prevalence, and mortality of HIV, 1980–2015: the Global Burden of Disease Study 2015. Lancet HIV 3: e361-e387.

2   Maheu-Giroux M, Vesga JF, Diabaté S, Alary M, Baral S, et al. (2017) Population-level impact of an accelerated HIV response plan to reach the UNAIDS 90-90-90 target in Côte d'Ivoire: Insights from mathematical modeling. PLoS Med 14: e1002321.

3   Hadish MT, Mao J, Gong G, Hadish BT, Tesfamariam EH (2017) Predictors of High HIV/AIDS Risk Sexual Behaviors: Comparison Study among Cameroonian and Gabonese Youth Aged 15-24 years. J HIV Retrovirus 3:1.

4   De Cock KM, Barrere B, Diaby L, Lafontaine M-F, Gnaore E, et al. (1990) AIDS--the leading cause of adult death in the West African City of Abidjan, Ivory Coast. Science 249: 793-796.

5   Mackelprang RD, Baeten JM, Donnell D, Celum C, Farquhar C, et al. (2012) Quantifying Ongoing HIV-1 Exposure in HIV-1–Serodiscordant Couples to Identify Individuals With Potential Host Resistance to HIV-1. J Infect Dis 206: 1299-1308.

6   Naicker N, Kharsany AB, Werner L, van Loggerenberg F, Mlisana K, et al. (2015) Risk factors for HIV acquisition in high risk women in a generalised epidemic setting. AIDS Behav 19: 1305-1316.

7   Ghys PD, Fransen K, Diallo MO, Ettiègne-Traoré V, Coulibaly I-M, et al. (1997) The associations between cervicovaginal HIV shedding, sexually transmitted diseases and immunosuppression in female sex workers in Abidjan, Cote d'Ivoire. AIDS 11: F85-F93.

8   Maheu-Giroux M, Baral S, Vesga JF, Diouf D, Diabaté S, et al. (2018) Anal intercourse among female sex workers in Côte d'Ivoire: Prevalence, determinants, and model-based estimates of the population-level impact on HIV transmission. Am J Epidemiol 187: 287-297.

9   Krishnan S, Dunbar MS, Minnis AM, Medlin CA, Gerdts CE, et al. (2008) Poverty, gender inequities, and women's risk of human immunodeficiency virus/AIDS. Ann N Y Acad Sci 1136: 101-110.

10 Weiser SD, Leiter K, Bangsberg DR, Butler LM, Percy-de Korte F, et al. (2007) Food insufficiency is associated with high-risk sexual behavior among women in Botswana and Swaziland. PLoS Med 4: 1589-1597.

11 Gillespie S (2008) Poverty, food insecurity, HIV vulnerability and the impacts of AIDS in sub-Saharan Africa. IDS bulletin 39: 10-18.

12 Korra A, Bejiga M, Tesfaye S (2005) Socio-demographic profile and prevalence of HIV infection among VCT clients in Addis Ababa. Ethiop J Health Dev 19: 109-115.

13 Vollmer S, Harttgen K, Alfven T, Padayachy J, Ghys P, et al. (2017) The HIV epidemic in sub-saharan africa is aging: evidence from the demographic and health surveys in sub-Saharan Africa. AIDS Behav 21: 101-113.

14 Shannon K, Strathdee SA, Shoveller J, Rusch M, Kerr T, et al. (2009) Structural and environmental barriers to condom use negotiation with clients among female sex workers: implications for HIV-prevention strategies and policy. Am J Public Health 99: 659-665.

15 Takyi BK (2003) Religion and women's health in Ghana: Insights into HIV/AIDS preventive and protective behavior. Soc Sci Med 56:1221-1234.

16 Shapiro D, Meekers D, Tambashe B (2003) Exposure to the'SIDA dans la Cité'AIDS prevention television series in Côte d'Ivoire, sexual risk behaviour and condom use. AIDS care 15: 303-314.

17 Coates TJ, Richter L, Caceres C (2008) Behavioural strategies to reduce HIV transmission: how to make them work better. Lancet 372: 669-684.

18 Guinan ME, Hardy A (1987) Epidemiology of AIDS in women in the United States: 1981 through 1986. JAMA 257: 2039-2042.

19 Hallman K (2004) Socioeconomic disadvantage and unsafe sexual behaviors among young women and men in South Africa.

20 Dunkle KL, Jewkes RK, Brown HC, Gray GE, McIntryre JA, et al. (2004). Transactional sex among women in Soweto, South Africa: prevalence, risk factors and association with HIV infection. Soc Sci Med 59: 1581-1592.

21 Monjok E, Essien EJ, Holmes L (2007) Female genital mutilation: potential for HIV transmission in sub-Saharan Africa and prospect for epidemiologic investigation and intervention. Afr J Reprod Health 11: 33-42.

22 Kun KE (1997) Female genital mutilation: the potential for increased risk of HIV infection. Int J Gynaecol Obstet 59: 153-155.

23 Sarkar N (2008) Barriers to condom use. Eur J Contracept Reprod Health Care 13: 114-122.

24 Ciccone MM, Aquilino A, Cortese F, Scicchitano P, Sassara M, et al. (2010) Feasibility and effectiveness of a disease and care management model in the primary health care system for patients with heart failure and diabetes (Project Leonardo). Vasc Health Risk Manag 6: 297-305.