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# Early Sexual Debut and Human Immunodeficiency Virus Infection in Central Africa

Emerencienne Kibangou

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## **ABSTRACT**

**Background:** A variety of studies identified early sexual debut as a significant risk factor for HIV infection, particularly among young African women. However, little is known about this relationship in Central Africa.

**Methods:** This study was based on a cross-sectional analysis of Demographic and Health Surveys data drawn from four central African countries, Cameroon and Gabon with high HIV prevalence levels, Democratic Republic of Congo and Congo with low HIV prevalence levels. Relationship between sexual activity initiated before age 15 and HIV sero-status was examined in men and women aged 15-24 years, to determine potential differences in this relationship across countries. Logistic regression was used to build a standard multivariate analysis model allowing for comparison between countries while controlling for sociodemographic, economic, behavioral, most recent partner characteristics, and HIV prevention knowledge.

**Results:** HIV prevalences were significantly higher among women from high HIV prevalence countries compared to women living in lower HIV prevalence countries ( $p < .0001$ ), and among women compared to men: 3.7%, 2.7%, 0.9%, and 2% for women and 0.8%, 0.7%, 0.2%, 0.7% for men from Cameroon, Gabon, Democratic Republic of Congo, and Congo respectively. The median age at first intercourse varied between 15 and 16 years in all four countries. Significant associations were found between early sexual debut and HIV-positive status among females in Cameroon (OR, 2.52; 95% CI, 1.57-4.01;  $p = .0001$ ) and Democratic Republic of Congo (OR, 3.92; 95%CI, 1.71-9.48;  $p = .002$ ) after controlling for age, marital status, education, religion, economic status, lifetime number of sexual partners, condom use, relationship with most recent sex partner, and knowledge of condom and fidelity as HIV prevention methods. Multivariate analyses also showed that being older (OR, 1.88; 95% CI, 1.13-3.22;  $p = .02$ ), and having more than one lifetime sexual partners (OR, 3.05; 95%CI, 1.77-5.61;  $p = .0001$ ) remained significantly associated with a positive HIV test among female Cameroonians whereas in Democratic Republic of Congo, women having a low economic status were significantly less likely to be seropositive (OR, 0.16; 95%CI, 0.04-0.5;  $p = .004$ ) compared to those from wealthier families.

**Conclusion:** Decline in heterosexual transmission of HIV in Central Africa will necessitate that behavioral interventions targeting young African women encourage delaying sexual debut and not engaging in other risky sexual behaviors.

**Keywords:** Sexual debut, HIV, women, Central Africa

**EARLY SEXUAL DEBUT AND HUMAN IMMUNODEFICIENCY VIRUS INFECTION  
IN CENTRAL AFRICA**

By  
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A Thesis Submitted to the Graduate Faculty of Georgia State University in Partial Fulfillment of  
the Requirements for the Degree

MASTER OF PUBLIC HEALTH

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2015

**APPROVAL PAGE**

EARLY SEXUAL DEBUT AND HUMAN IMMUNODEFICIENCY VIRUS INFECTION IN CENTRAL AFRICA

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## TABLE OF CONTENTS

	Pages
ACKNOWLEDGMENTS.....	iii
LIST OF FIGURES AND TABLES.....	v
CHAPTER I INTRODUCTION	
1.1 Background.....	1
1.2 Purpose of the Study.....	3
1.3 Research Questions.....	3
CHAPTER II REVIEW OF THE LITERATURE	
2.1 HIV Infection in Central Africa.....	4
2.1.1. Republic of Cameroon (Cameroon).....	7
2.1.2. Gabonese Republic (Gabon).....	9
2.1.3. Republic of Congo (Congo).....	10
2.1.4. Democratic Republic of Congo (DRC).....	11
2.2. Early Sexual Debut.....	12
2.2.1. Definition.....	12
2.2.2. Determinants of Early Sexual Debut.....	13
2.2.2.1. Individual Factors.....	13
2.2.2.2. Family Factors.....	14
2.2.2.3. Cultural Factors.....	15
2.2.2.4. Environmental Factors.....	15
2.3 Mechanisms of Influence of Early Sexual Debut on HIV Infection Risk among Women in Sub-Saharan Africa.....	16
2.3.1. Biological Factors.....	17
2.3.2. Behavioral Factors.....	18
2.3.3. Factors Related to the Sexual Partner.....	18
2.3.4. Duration of Sexual Activity.....	18
References.....	19
CHAPTER III MANUSCRIPT	
1. Introduction	
2. Methods	
2.2. Data Source.....	25
2.3. Variables and Measures.....	26
2.4. Statistical Analysis.....	26
3. Results	
3.1. Descriptive Analysis.....	27
3.2. Bivariate Analysis.....	33
3.3. Univariate and Multivariate Logistic Regression Analyses.....	39
4. Discussion	
References.....	47

**LIST OF FIGURES AND TABLES**

Figure A Central African countries.....6

Figure B Potential causal pathways influencing early sexual debut and its relationship to women’s increased risk of HIV infection in sub-Saharan Africa.....17

Table A Central African Countries by HIV/AIDS Prevalence in 2005 and 2013 .....7

Table 1 Countries included in the Study and respective samples size.....28

Table 2a Descriptive characteristics of women by country.....30

Table 2b Descriptive characteristics of men by country.....32

Table 3a Distribution of selected characteristics by HIV sero-status and country for women...35

Table 3b Distribution of selected characteristics by HIV sero-status and country for men.....38

Table 4a Unadjusted odds ratios (OR) and 95% confidence intervals (CI) of HIV sero-status association with selected characteristics among women, by country.....41

Table 4b Unadjusted odds ratios and 95% confidence intervals (CI) of HIV sero-status association with selected characteristics among men, by country.....43

Table 5 Results of the multivariate logistic regression analysis examining the relationship between early age at coital debut and HIV sero-status among women and men, by country 45

## CHAPTER I

### INTRODUCTION

#### 1.1. Background

Human Immunodeficiency Virus (HIV) is one of the rare viruses that the human immune system is unable to eliminate [1]. Once the virus enters the human body, it attacks the CD4 cells and destroys them [1]. Over time, a massive destruction of these immune cells (CD4) leads to the inability of the immune system to control infections, and the subject infected by the virus is considered to be at the final stage of HIV infection, namely, Acquired Immunodeficiency Syndrome (AIDS) [1]. However, even though HIV infection cannot be cured, the virus can be controlled by an antiretroviral therapy (ART) delaying the natural evolution of the infection to AIDS [1]. Moreover, HIV infection can be prevented by numerous methods among which HIV testing, antiretroviral prophylaxis and behavioral interventions promoting safer sexual practices [1]. These methods are undoubtedly effective in curbing the spread of the infection. Indeed, global estimates suggest that, in 2012, there was a reduction of new cases by 33% (2.3 million of new cases in 2012 compared to 3.4 million in 2001) [2]. In addition, compared to the 2.3 million of deaths due to HIV in 2005, only 1.6 million of people died from HIV in 2012 [2]. Nevertheless, HIV/AIDS remains an important health challenge since 35.3 million of children and adults are still living with HIV globally [2]. Furthermore, HIV/AIDS was considered, in 2010, the first cause of disability-adjusted life years (DALYs) among men and women aged 30-44 in Thailand, the Caribbean, and some central, eastern and southern African countries [3].

There are significant variations in geographic and demographic trends of HIV/AIDS worldwide [4]. Even though the percentage of people infected annually in Africa has decreased by 25% from 2001 to 2011 [5], Africa remains the continent most vulnerable to the HIV pandemic with 72% of new infections in 2011 [5], and the highest rates of adolescents and adults new cases [6]. The prevalence of the disease in this region is also the highest, 4.7% in the age group 15-49, compared to 0.7% and 0.5% respectively in Eastern Europe/central Asia and North America, representing the second and third most affected regions in the world [7]. The burden of the disease in sub-Saharan Africa lies on women who represent approximately 60% of infected people in this region [5]. Prostitution, concurrent sex partners, Herpes simplex virus type 2 (HSV-2) infection (more prevalent in women), and lack of circumcision in men constitute the main risk factors of HIV transmission between men and women in this part of the globe [8]. In many societies around the world, early age at first sex is considered a risky sexual behavior increasing the risk of being infected by HIV [9]. Besides being a risk factor for HIV/AIDS, early sexual debut in adolescents, particularly girls, also increases their risk of experiencing sexual abuse, unintended pregnancies, psychological disorders and even suicide [10-13]. Given that high-risk sexual behaviors, such as multiple sexual partnership and condom nonuse, increase the likelihood of acquiring HIV [8], and given that the first sexual experience, especially at earlier ages, could have an impact on a person's future sexual behaviors [13], it is necessary to evaluate the role of age at coital debut in HIV infection occurrence in sub-Saharan Africa, in order to develop targeted interventions against the disease. Many studies have been conducted on the relationship between sexual debut and HIV infection in the region, but few have been carried out in central Africa [14].

## **1.2. Purpose of the Study**

This study aimed to determine the relationship between early sexual debut and HIV infection in four central African countries, namely, Cameroon, Gabon, Democratic Republic of Congo, and Congo.

Given that these countries have different levels of HIV prevalence, we were also interested to explore whether potential variations in age at first sex could account for differences in levels of the infection in higher HIV prevalence countries (Cameroon and Gabon), compared to lower HIV prevalence countries (Democratic Republic of Congo, and Congo).

## **1.3. Research Questions**

Based on the Demographic and Health Surveys (DHS) data, the analyses conducted addressed the following questions:

1. What percentages of males and females aged 15-24 years living in Cameroon, Gabon, Republic of the Congo, and Democratic Republic of the Congo, had their first sexual intercourse before age 15?
2. What is the distribution of age at first intercourse of males compared to females?
3. What is the association of age at first intercourse with HIV status among males and females in high HIV prevalence countries compared to low HIV prevalence countries?

## CHAPTER II

### REVIEW OF THE LITERATURE

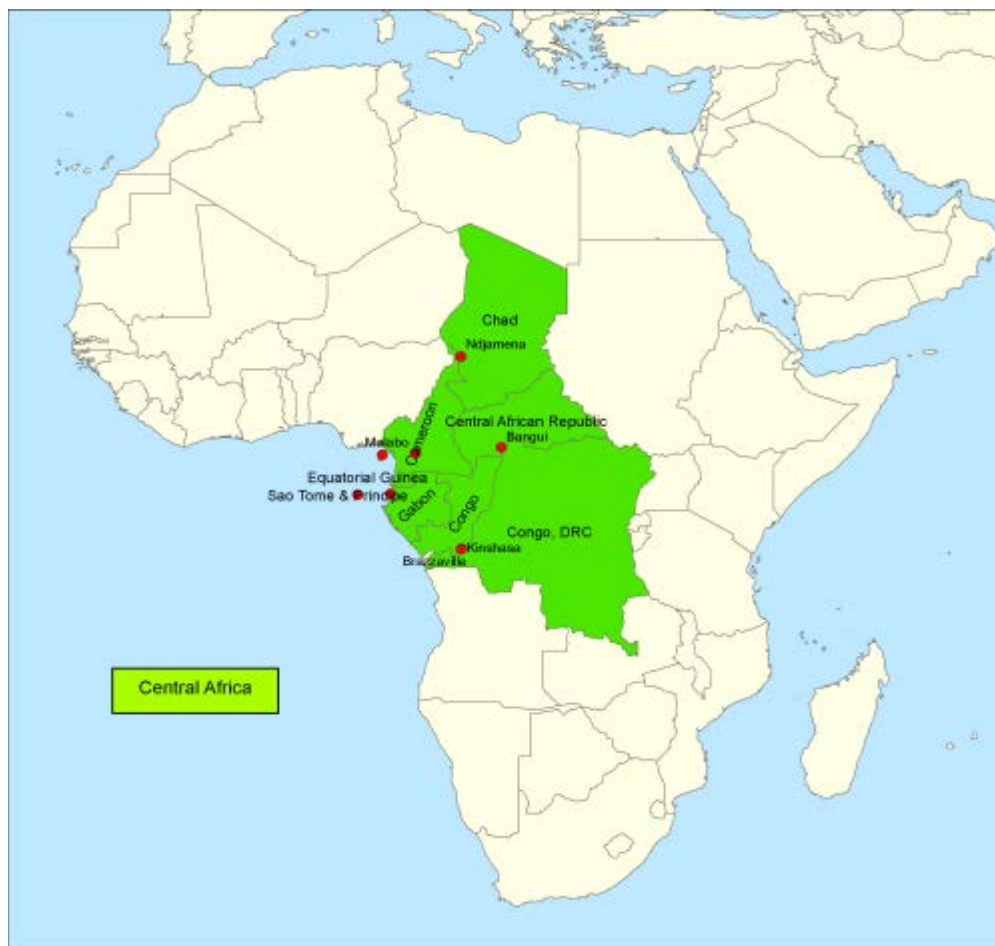
#### 2.1. HIV infection in Central Africa

Central Africa is one of the five sub-Saharan African regions, home to 134 million people [15] and which comprises eight countries [16]: Republic of Cameroon, Central African Republic, Gabonese Republic, Republic of Chad, Republic of the Congo, Democratic Republic of the Congo (formerly Zaire), Equatorial Guinea, and São Tome e Principe (figure1). Besides being border countries, these countries also have many common cultural ties, inter alia, the same ethnic groups and languages. The Pygmies, for instance, are an ethnic group found not only in Cameroon but also in the Republic of the Congo; the Fang in Cameroon and Equatorial Guinea and the Teke in Gabon, Republic of the Congo and Democratic Republic of the Congo [17]. Most of the languages spoken in central Africa are similar and constitute the Bantu languages such as Lingala and Swahili which are lingua franca spoken in both Congos for the former, and in Burundi, Rwanda and Democratic Republic of the Congo for the latter [17].

Moreover, these countries are grouped in socioeconomic and political institutions among which the *Economic and Monetary Community of Central Africa (CEMAC)* and the *Economic Community of Central African States (ECCAS)*. *CEMAC* includes all the central African countries, except the Democratic Republic of the Congo and São Tome e Principe [18], whereas *ECCAS* is composed of the eight central African countries, Burundi and Angola [19].

Central Africa is considered to have played a great part in the origin and human transmission of the Human Immunodeficiency Virus [20]. The Democratic Republic of the Congo (DRC) was considered as the epicenter of the first epidemic in Africa in the 1970's [21]. It has also been hypothesized that the virus strain M, responsible for the spread of the disease all over the world, could have been carried by an individual contaminated by wild Chimpanzees in Cameroon, who then travelled from Cameroon to DRC [20, 21]. Despite this critical role in the history of the HIV infection, central Africa has not remained the region the most affected by the AIDS pandemic. There is an alarming spread of the disease in Southern and East Africa which now represent the most affected areas in sub-Saharan Africa [22]. Prevalences in central Africa vary between 1% and 6% (table 1) [23].

**Figure A** Central African countries



Source: [16]



**Table A** Central African countries by HIV/AIDS prevalence in 2005 and 2013

<b>Country</b>	<b>Prevalence in 2005 % (95% CI)*</b>	<b>Prevalence in 2013 % (95% CI)*</b>
<b>Cameroon</b>	5.2 (4.9-5.5)	4.3 (4-4.6)
<b>Gabon</b>	5.8 (4.9-7)	3.9 (3.5-4.4)
<b>Congo, Democratic Republic of</b>	1.4 (1.2-1.7)	1.1 (0.9-1.3)
<b>Congo</b>	3.9 (3.6-4.2)	2.5 (2.3-2.7)
<b>Equatorial Guinea</b>	---	---
<b>Chad</b>	3.6 (3.1-4.3)	2.5 (2.1-3)
<b>São Tome e Principe</b>	1.4 (1.2-1.7)	0.6 (0.5-0.8)
<b>Central African Republic</b>	6.8 (5.9-7.8)	3.8 (3.4-4.3)

Source of data: [23]

\*HIV/AIDS Prevalence among adults aged 15 to 49

---No available data

### **2.1.1. Republic of Cameroon (Cameroon)**

The Republic of Cameroon is a central African country with a size of 475,000 square kilometers [15]. Yaounde and Douala are respectively the capital and commercial city and represent the most crowded areas of the country [15]. Cameroon is a lower middle income country and has the most diverse and productive agriculture in central Africa, yet 40% of the population live under the poverty level and starvation is periodically rife in the northern part of the country [24, 25]. Cameroon is characterized by a socio-cultural diversity. Indeed, there are six ethnic groups, with about 230 sub-ethnic groups, and three main religions: Christianity, Islam and indigenous African religions. Fifty three percent of the population is Christian and twenty-five

percent of the population belongs to indigenous African religions. Muslims (22%) are the less numerous and are likely to be found in the northern part of the country [25]. Moreover, unlike most of other central African countries which have one official language, Cameroon has two official languages, French and English.

The population which is estimated to 22.25 million people [24] is young, with 49% aged between 15 and 49 [25]. Life expectancy in Cameroon is low (55 years) and the country faces many health-related issues among which a high infant mortality rate (74‰ in 2004), the lack of medical personnel with only one physician for 13468 inhabitants, and the HIV epidemic [25]. Furthermore, women literacy rate remains relatively low (64.8%) compared with men (78.3%) [26].

Based on the Cameroon 2011 Demographic Health Survey [25], women remain the most vulnerable population and are approximately two times more infected than men, with 5.6% of HIV positive women compared with 2.9% HIV positive men. Moreover, the infection is more frequently observed in women aged 35-39 and men aged 45-49. The geographical distribution of the epidemic across the country is not homogeneous. Indeed, people living in urban areas are more affected (4.8%) than those living in rural areas (3.8%). In addition, the capital city (Yaounde), the southern, north-western, eastern, and central regions of the country present the highest prevalence rates respectively of 6.3, 7.2, 6.3, 6.3, and 6.9%, compared to the northern and western parts of the country that have respectively 2.4 and 2.8% infected people.

### **2.1.2. Gabonese Republic (Gabon)**

Gabon is a central African country, home to 1.672 million dwellers mostly located in Libreville, the capital city [24]. The official language of this country, extending over 267,667 square kilometers, is French [15]. Gabon is divided in nine provinces and comprises more than 40 ethnic groups among which the Bapounou and the Teke [15] also found in one of its border countries, the republic of Congo. Christianity, Islam, animism constitute the major religions in the country. Despite being an upper middle income country and the most prosperous producing oil country in sub-Saharan Africa [15, 27], approximately 40% of the population live under the poverty level [28]. Infant mortality (around 60‰) and HIV infection are the country's most important health-related challenges [28]. Moreover, despite the high literacy rate in the general population (89%), women generally drop out of school at the secondary level [28].

According to the Gabon 2012 Demographic Health Survey (The World Bank, 2014c), Fifty percent of the population is less than 20 years old, and women are slightly more numerous than men (94 men for 100 women). Moreover, 85% of the population lives in urban areas [29].

Gabon HIV trends are very similar to those of Cameroon. Indeed, the prevalence of HIV in Gabon is very close to that of Cameroon, with more than 4% of people infected [29]. In addition, as in Cameroon, the prevalence of infected women is about twice the prevalence of infected men (respectively 5.8% and 2.2%), and the most affected age groups are women aged 35-39 and men aged 45-49 [29]. Moreover, the disease is not evenly distributed across the country; Woleu-N'tem and Moyen-Ogooué are the most highly affected provinces with

respectively 7.2 and 5.8% of HIV positive people, while Ogooué-Ivindo has the lowest prevalences (3.3% of women and 1.3% of men) [29].

### **2.1.3. Republic of the Congo (Congo)**

Housing the World Health Organization's regional office for Africa, Republic of the Congo is a central African country with a population of 4.448 million people [24] and a size of 342,000 square kilometers [15]. Based on the Congo 2011 Demographic and Health Survey [30], the Congolese population is young with 62% of the population aged less than 25. Sixty four percent of the population lives in urban areas, especially in Brazzaville and Pointe-Noire which are respectively the capital and commercial cities [30]. These data are consistent with those of the Congo 2007 census [30] reporting that 61.8% of the general population were living in urban areas, 39% were aged less than 15 and 57% aged between 15 and 59. The Congo is composed of 15 Bantu ethnic groups, and French is the official language of the country [15]. Christianity is the second religion of the country (45%) and only 2% of the population is Muslim. Fifty percent of the population is part of traditional religions [15].

Despite consistent economic growth observed during the ten last years, 54% of Congolese children live under the poverty threshold [31]. Moreover, maternal and infant mortality, lack of access to social services and HIV/AIDS constitute important challenges to the development of the country [30, 31].

Congo 2009 AIDS Indicator Survey (AIS) has reported a HIV prevalence of 3.2% in the population aged 15 to 49 [32]. This prevalence has decreased overtime and has been estimated to 2.8% in 2012 [23]. According to the 2009 AIS [32], 4.1% of women were infected compared

with 2.1% of men. The highest seroprevalences were found in the group ages of 25-49 and 40-44 for men and women respectively [32]. The disease was not evenly distributed across the country. Lekoumou, Niari, and Pointe-Noire the commercial city, located in the southern part of the country, were the most affected with prevalences of respectively 4.8, 4.6, and 4.4%. Prevalence in the capital city, estimated at 2.4%, was approximately half the prevalence of the disease in the commercial city Pointe-Noire. The northern, central and western parts of the country generally had the lower rates of the disease (1.9% in Likouala, 1.7 in Cuvette, 1.5% in Cuvette-Ouest).

#### **2.1.4. Democratic Republic of Congo (DRC)**

Democratic Republic of the Congo constitutes along with Burundi, Kenya, Rwanda, Tanzania, and Uganda, the Great Lakes region [33]. DRC has a population of 67.51 million people and a size of 2,344,000 square kilometers [15, 24]. There are approximately 200 ethnic groups in the country, and 70% of the population is Christian, 10% are Muslim, and 20% belong to traditional religious groups and sects [15]. The population is young with 64.5% aged less than 25, and French is the official language [34]. The multiple conflicts the country has faced since its independence have set the stage to important economic difficulties (DRC is a low income country) and poor health [34, 35]. According to the DRC 2007 Demographic and Health Survey [35], the prevalence of the disease among those aged 15 to 49 is 1.2%, with only 0.5% of pregnant women infected [35], which seems to show a better control of the epidemic compared with other countries of the central African region. However, it is important to know that the regular surveillance of the epidemic among pregnant women since 1985 have shown

a generalized epidemic in DRC, with more than 1% of pregnant women infected (4.1% in 2006) [35, 36]. Moreover, HIV/AIDS is the first cause of mortality in the workforce [36], which is a proof that despite this apparent low prevalence rate, the HIV epidemic remains an important issue in DRC. As in other countries described earlier, women are the most affected by the disease [35, 36] and their literacy rate, estimated at 57%, is the lowest when compared to Cameroon (64.85%), Congo (78.4%) and Gabon (85.6%) [34].

## **2.2. Early Sexual Debut**

### **2.2.1. Definition**

According to WHO [37], a first sexual intercourse, with vaginal or anal penetration, taking place before age 15 is considered early sexual debut.

Trends in early sexual debut vary across different regions of the world, and gender differences in age at first sex are more noticeable in developing countries [38]. Indeed, sub-Saharan Africa and Asia, where early marriage is prevailing, are the regions where women first have sex earlier than men [38]. Nevertheless, some African countries have seen an increase in age at first sex [9]. In the United States, about 50% of adolescents already engaged in sexual activity by the end of high school, and age at first sex is constantly decreasing since the 1990s [39]. Moreover, African American youths tend to begin sexual activity earlier than white and Hispanic youths [40]. In Europe, early sexual debut vary between 11.5% and 36.9% for girls and between 18% and 33.1% for boys [41].

### **2.2.2. Determinants of Early Sexual Debut**

Available evidence showed that a first sexual intercourse occurring precociously, during adolescence, is more likely to be impromptu, unprotected and non-consensual [10, 38, 42]. Most consider sexual intercourse to be a normal moment of the adolescent sexual development [43]. However, in many societies, sexual debut at earlier ages is viewed as an issue, and is considered to be driven by multiple individual, familial, cultural and environmental factors [42]. Moreover, individual factors seem to induce early sexual activity more importantly compared to other factors [42].

#### **2.2.2.1. Individual Factors**

- Physiological factors are related to pubertal development. An association between early pubertal development and early sexual activity has been observed in some studies. A cross-sectional study conducted in Malawi on the relationship between age at menarche, sexual initiation and education showed that girls having had their menarche before 14 were more likely to have their first sexual intercourse before 16 [44]. On the other side, a relationship between advanced pubertal development and early sexual debut has also been described. Indeed, Price and Hyde [45] found that advanced pubertal development was associated with early sexual debut in boys after following American adolescents from age 13 to 15.
- Behaviors also play a great role in the onset of sexual activity. Aggressive behaviors in childhood have been correlated to early sexual activity in adolescence; school maladjustment and delinquency are considered potential mediators of this association

[46]. In addition, practicing risky behaviors during adolescence, such as drugs and alcohol use, can lead to early sexual initiation, through disinhibition and relationship with peers already engaged in sexual activity [10, 12, 41, 42].

- Factors related to education have been found to be important predictors of early sexual debut among girls. Indeed, little determination for school achievement and low academic performances have been found to be related to early sexual debut among girls [42, 45]. A cross-sectional study using Demographic and Health surveys data of eight sub-Saharan African countries (Mali, Zimbabwe, Burkina Faso, Tanzania, Cote d'Ivoire, Ghana, Kenya, and Senegal) showed that the higher educational level, the less the probability that girls experience first coitus before 18. This result was found in all eight countries [6].

#### **2.2.2.2. Family Factors**

Family structure and socioeconomic status are factors that could have consequences on the adolescent sexual activity. Adolescents growing in a one-parent family or a family with a low socioeconomic status are more likely to engage in early sexual activity than their peers [40, 42]. Palermo and Peterman [47] found a relationship between orphanhood and early sexual debut among girls aged between 15 and 17 in seven sub-Saharan African countries [47]. These factors are mediated by economic and lifestyle instability [42].

Similarly, level of family cohesion and communication also play a role in teenagers' early sexual initiation [42, 45].



### **2.2.2.3. Cultural Factors**

- Although a growing number of adolescents in developed countries engage in premarital sexual activity [41], adolescent marriage is customary in many developing countries, and is generally viewed as a way to put an end to individual or family economic difficulties [47]. In developing countries, one in seven adolescent girls gets married before the age of 15, and 42% of African girls are already married before turning 18 [47]. In this case, early sexual initiation represents a normal consequence of early marriage.
- Religion is considered a protective factor against early sexual debut. In a qualitative study on determinants of early sexual debut among Nigerian adolescents aged 14-19 years old, religious beliefs were one of the main reasons for delaying the first sexual intercourse [48]. In the United States, a study was conducted on the environmental factors that shape female adolescents sexual initiation and subsequent sexual behaviors. This study showed that belonging to a conservative religious community reduced the likelihood of engaging in premarital sexual activity in white and African American adolescent girls [49].

### **2.2.2.4. Environmental Factors**

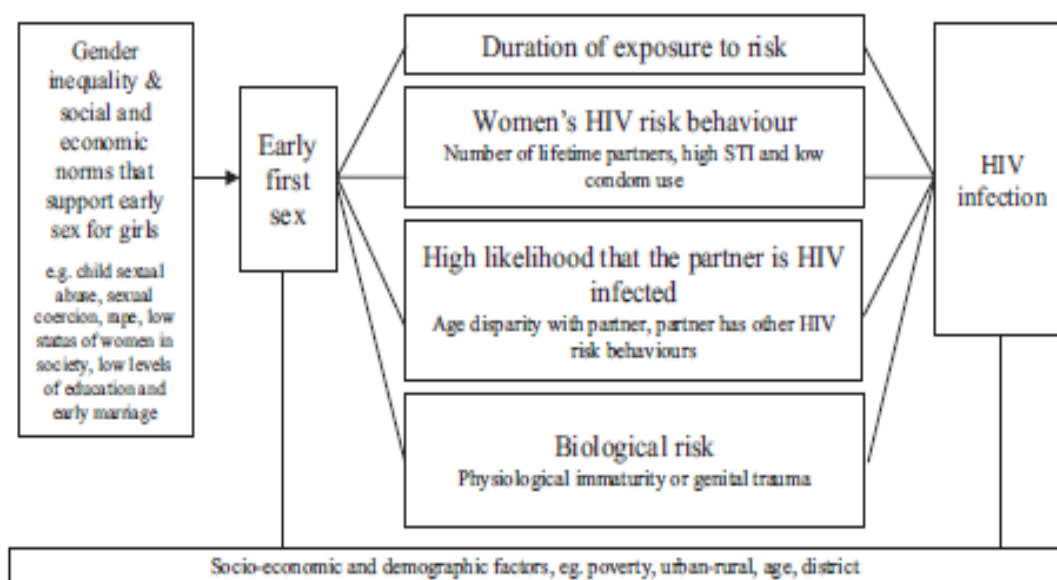
- Living environment, especially low socioeconomic neighborhoods, has been found associated with early sexual initiation in the United States [42]. Living in the rural area is also considered a risk factor for early sexual commencement in some developing countries, mainly due to the frequency of early marriage in these areas [12].

- Peer pressure and watching pornography on television have also been implicated in the early onset of sexual activity, mostly in young boys [42, 48].

### **2.3. Mechanisms of Influence of Early Sexual Debut on HIV infection Risk among Women in sub-Saharan Africa**

Four pathways of influence of early sexual initiation on risk of acquiring HIV infection, particularly among women, have been described by Stöckl, Kalra, Jacobi and Watts (figure 2) [14]. Biological and behavioral risk factors, as well as factors related to the sexual partner and duration of sexual activity, are considered to be the main potential mechanisms that could explain why early sexual debut is a risk factor for HIV infection among women in sub-Saharan Africa. Although these factors can individually lead to HIV/AIDS in young females engaging in sexual activity, they generally interact.

**Figure B** Potential causal pathways influencing early sexual debut and its relationship to women's increased risk of HIV infection in sub-Saharan Africa



Source: [14]

### 2.3.1. Biological Factors

Women have a heightened risk of being infected with HIV during heterosexual intercourse, compared to men. Indeed, genital secretions are more easily transferred from men to women during sexual intercourse, which increases their exposure to infection compared to men [50]. In addition to this risk, female adolescents present a higher susceptibility to sexually transmitted infections, including HIV/AIDS, compared to older women [51]. The physiologic and immunologic immaturity of these adolescents' genital organs constitutes one of the main reasons explaining their incapacity to eliminate the germs [52, 53].

### **2.3.2. Behavioral Factors**

Due to the frequency of condom nonuse, and subsequently, the risk of HIV transmission, a first sexual intercourse at earlier age is generally not safe for young girls [54]. Moreover, girls who have had an earlier sexual debut, voluntarily or following rape, generally engage in sexual behaviors increasing their risk of being infected by HIV/AIDS such as having multiple lifetime sex partners, concurrent partners, older partners, and not using condom during sex [14, 54, 55].

### **2.3.3. Factors Related to the Sexual Partner**

While adolescent boys have their first sexual experience with girls that are approximately the same age, their female counterparts generally first have sex with older partners [54]. In Africa, adolescent girls are more likely to date older partners [14, 55]. This age difference puts girls at risk of being infected with HIV because their older partners are more likely to have multiple sex partners [14]. In addition, they are less likely to oblige their partner to use condom because in most African societies, men are the ones who decide of the use of condom [14, 54].

### **2.3.4. Duration of Sexual Activity**

It has been hypothesized that young girls who start sexual activity earlier are at greater risk of being infected with HIV because the period of potential exposure to HIV/AIDS is longer compared to those who engage in sexual activity later [14].

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## CHAPTER III

### MANUSCRIPT

#### Early sexual debut and Human Immunodeficiency Virus infection in Central Africa

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**Abstract:** Early sexual debut has been recognized to play a seminal role in the heterosexual HIV transmission among adolescents and young adults in sub-Saharan Africa. A cross-sectional analysis of the relationship between initiation of sexual activity before age 15 and HIV sero-status, among men and women aged 15-24 years, was conducted using Demographic and Health Surveys data of four central African countries with different levels of HIV seroprevalence, namely Cameroon, Gabon, Democratic Republic of Congo, and Congo. The median age at sexual debut varied between 15 and 16 years in all countries. After adjusting for sociodemographic, economic, behavioral, and most recent partner's characteristics, as well as HIV prevention knowledge, early sexual debut was significantly associated with a positive HIV test among women in Cameroon (OR, 2.52; 95% CI, 1.57-4.01;  $p=.0001$ ) and Democratic Republic of Congo (OR, 3.92; 95%CI, 1.71-9.48;  $p=.002$ ). No association was found statistically significant among men. Among female Cameroonians, an age between 20-24 years (OR, 1.88; 95% CI, 1.13-3.22;  $p=.02$ ) and a lifetime number of sexual partners greater than one (OR, 3.05; 95%CI, 1.77-5.61;  $p=.0001$ ) remained significantly associated with HIV, whereas a negative association was found between a low economic status and HIV infection among women in Democratic Republic of Congo (OR, 0.16; 95%CI, 0.04-0.5;  $p=.004$ ), in the multivariate analyses. Early sexual debut is associated with HIV infection among young women in some central African countries, independently of the level of HIV seroprevalence of the country. Sex-education strategies for the youth in central Africa, particularly for women, should emphasize the necessity of delaying first sexual intercourse and avoiding other risky sexual behaviors.

**Keywords:** HIV, first intercourse, sexual behavior, women, central Africa

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### 1. Introduction

The HIV/AIDS pandemic represents one of the major world challenges with 35.3 million of people living with HIV worldwide, of which 25 million are located in sub-Saharan Africa, which also accounts for 1.2 million deaths and 1.6 million of new infections [1]. As HIV transmission

essentially occurs through heterosexual intercourse in sub-Saharan Africa [2], with more than 90% of infections among adults due to sexual activity [3], a variety of studies focused on the role played by high-risk sexual behaviors in the HIV epidemics in Africa [4,5]. According to the World Health Organization [6], a first sexual intercourse taking place before age 15 is considered

early sexual debut. Early sexual debut is often used as an indicator of high-risk sexual behaviors and a predictor of sexually transmitted infections, particularly among adolescents [7, 8]. Research conducted on the relationship between early sexual debut and HIV infection has shown that African women engaging in early first sex are more vulnerable to HIV than their male counterparts [5]. The decrease in the prevalence of the HIV infection among young pregnant women in Uganda, possibly associated with an increase in age at first sex between 1990 and 1995, exemplifies the critical role of this factor in the transmission of the disease [9]. Proposed mechanisms [5] to explain the role played by early sexual debut in HIV acquisition among women are, *inter alia*, the immaturity of the genital tract and its trauma caused by the coercive nature of the first intercourse; the tendency of young women who have sex early to engage in subsequent risky sexual behaviors such as multiple lifetime number of sex partners, concurrency, and unprotected sex; the power imbalance between men and women regarding the sexual act, with most African women's fear to refuse sex or ask their partner to use condom, and poverty driving them to early sex with older partners inclined to have concurrent sex partners. In Central Africa, Cameroon is the country where the relationship between early sexual debut and HIV has been studied extensively [3, 10, 11], and little is known about this relationship in other central African countries. This study was therefore intended to examine the relationship between early sexual debut and HIV infection among young men and women aged 15-24 in four central African countries with different levels of HIV prevalence. Two central African countries with relatively high

HIV prevalence, Cameroon 4.3% (4-4.6) and Gabon 3.9% (3.5-4.4), were compared to two central African countries with lower HIV prevalences, Congo 2.5% (2.3-2.7), and Democratic Republic of Congo 1.1% (0.9-1.3) [12]. It was hypothesized that young people aged 15-24, particularly women, living in higher HIV prevalence countries would be more likely to be infected with HIV compared to those living in lower HIV prevalence countries because they had their first sexual intercourse before age 15.

## **2. Methods**

### **2.1. Data Source**

Data for this study were drawn from two types of retrospective nationally-representative cross-sectional surveys, namely, the AIDS Indicator Survey (AIS) carried out in Congo in 2009 during the fifth round of Demographic and Health Surveys, and the sixth round of Demographic and Health Surveys (DHS) carried out in Cameroon, Gabon, and Democratic Republic of the Congo between 2011 and 2014. The DHS and AIS samples were designed using a two-stage stratified sampling method including the selection of enumeration areas or clusters, followed by the selection of households [13]. The AIS focuses on the collection of HIV/AIDS-related information, whereas the DHS is designed to collect a wider range of data on health and nutrition [13]. Standard model questionnaires were used and HIV biomarkers measured for each survey round (fifth and sixth). Albeit some questionnaires modules were modified with each DHS round, the variables necessary for our analyses were included in both rounds. During the surveys, questionnaires were administered and HIV biomarkers measured

for all women aged 15-49 and men aged 15-59 eligible in the household in Cameroon, Gabon, and Democratic Republic of the Congo, and all men and women aged 15-49 in Congo. For the purpose of this study, analyses were limited to respondents aged 15-24 who ever had sex, for whom data on HIV sero-status and age at first sex were reported.

## 2.2. Variables and Measures

The outcome measured for this study, HIV sero-status, was defined as a binary outcome: HIV seropositive and HIV seronegative respectively based on the respondent positive or negative results to HIV testing. The main predictor for which we intended to study the association with HIV sero-status was age at sexual debut, defined as a dichotomous variable: <15 versus 15 and above. A respondent was considered as having had an early sexual debut when the first sexual intercourse took place before age 15. Other factors explored as potential determinants of HIV infection in the study population were grouped into 4 areas of interest: (1) Sociodemographic and economic factors: respondent current age at the time of the survey (ages 15-19 years and 20-24 years); residence (living in urban or rural area), marital status (currently married/living with partner, or not); highest educational level ('no education' for those who never attended school, 'primary level' for those who did not attain high-school level, and 'secondary/higher level' for those who attained high-school or university level at the time of the survey); religion ('Christians' including catholic and protestants, 'Muslims', 'Other religions' including country-specific religions, and 'none'); wealth index (based on household assets

and utility services reflecting economic status; agricultural land ownership, and presence of domestic servant in the household) [14]. (2) High-risk sexual behaviors including lifetime number of sexual partners (one or more than one partner); condom use every time the respondent had sex with the most recent partner in the 12 months preceding the survey; cumulative concurrency (overlapping sexual relationships in the 12 months preceding the survey). (3) Most recent partner characteristics, comprising the type of relationship with the most recent sexual partner (spouse, boyfriend/girlfriend not cohabiting, casual sex partner, commercial sex worker or live-in partner) and the most recent partner age (a partner was considered older when age difference with the respondent's current age was equal or greater than 3). (4) Knowledge of the respondent regarding HIV/AIDS prevention, measured by asking the respondent whether or not HIV/AIDS could be prevented by 'always using a condom during sex', and 'having one sex partner only, who had no other partners'. Age at sexual debut, respondent current age, most recent partner age, and lifetime number of sexual partners were described both as continuous and categorical variables.

## 2.3. Statistical Analysis

Description of the study population was based on medians, 25<sup>th</sup>, and 75<sup>th</sup> percentiles for continuous variables; frequency and percent distribution for categorical variables. Kruskal-Wallis and chi-square tests were conducted where appropriate to identify differences in selected characteristics between women and between men of the four countries. In

bivariate analyses, Chi-square test of homogeneity was used to determine the significance of the differences between levels/values of the independent variables according to HIV sero-status, by sex and country. Fisher's exact test was used when one or more of the expected cell frequencies were less than 5 (chi-square test of homogeneity not valid). Univariate association between HIV sero-status and each predictor was examined in logistic regression analysis, and unadjusted odds ratios (ORs) and 95% confidence intervals (CI) were computed. Finally, multivariate logistic regression analysis was performed to determine the association between age at coital debut and HIV sero-status, controlling for sociodemographic and economic factors, other high-risk sexual behaviors, most recent partner characteristics and HIV prevention knowledge. A standard model was developed to allow for comparison between countries, after performing a manual selection of variables coupled to a stepwise elimination (with alpha level at entry  $P \leq .10$ ). Variables that were found to be significantly associated with HIV at the level  $P \leq .05$  in the univariate analysis, in at least one country, were the first ones to be manually included into the model. Age at coital debut was kept in the adjusted model regardless of the level of significance of its association with the outcome. Data on cumulative concurrency and last partner age were not available for Congo; therefore, these variables were not included into the standard model. Statistical significance was set at an alpha level of 0.05. All analyses were conducted using SAS version 9.3 (SAS Institute, Cary, NC, USA).

### 3. Results

#### 3.1. Descriptive Analysis

Female respondents aged 15-24 years from Cameroon, Gabon, Democratic Republic of Congo, and Congo represented respectively 56.7%, 53.4%, 57.5%, and 57.1% of the study samples included in the analyses (Table 1).

**Table1** Countries included in the study and respective samples size

Country (survey period)	% aged 15-24	Study Sample size	Men n (%)	Women n (%)
<b>Higher HIV Prevalence</b>				
Cameroon (January-August 2011)	9,511	3,760	1,628 (43.3)	2,132 (56.7)
Gabon (January-May 2012)	5,369	3,264	1,521 (46.6)	1,743 (53.4)
<b>Lower HIV Prevalence</b>				
DRC (November 2013-February 2014)	10,730	4,568	1,941 (42.5)	2,627 (57.5)
Congo (March-June 2009)	4,558	3,485	1,496 (42.9)	1,989 (57.1)

DRC: Democratic Republic of Congo

The proportions of HIV-positive females were significantly higher in the higher HIV prevalence countries than the lower HIV prevalence countries ( $p < .0001$ ). Indeed, 3.7% and 2.7% of females respectively in Cameroon and Gabon were HIV-positive, whereas 0.9%, and 2% of females in Democratic Republic of Congo and Congo had HIV infection. The respective prevalences among males were 0.8%, 0.7%, 0.2%, and 0.7% ( $p < .0001$ ). Overall, the proportions of males and females having engaged in early sexual debut were lower compared to those who had sex at age 15 or later. The median ages at sexual debut (with 25<sup>th</sup> and 75<sup>th</sup> percentiles) among females were respectively 16 (14-17), 16 (14-17), 15 (14-17), and 15 (14-16) in Cameroon, Gabon, Democratic Republic of Congo, and Congo ( $p < .0001$ ). The proportions of females respondents having experienced early sexual debut were significantly lower in the higher HIV prevalence countries than in the lower HIV prevalence countries ( $p = .0001$ ). Indeed, 25.4% and 27.4% of females respectively in Cameroon and Gabon reported having had their first sexual intercourse before age 15 compared to 31%, and 29.6% in Democratic Republic of Congo and Congo respectively (Table 2a). Among those females who experienced early sexual debut, 50.3%, 57%, 50.5%, and 52.9% in Cameroon, Gabon, Democratic Republic of Congo, and

Congo were aged between 15 and 19 years at the time of the survey. The median ages at sexual debut among males from Cameroon, Gabon, Democratic Republic of Congo, and Congo were 16 (15-18), 15 (14-16), 15 (14-17), and 15 (14-17) respectively ( $p < .0001$ ). Gabon and Congo were the countries with the highest proportions of early sexual debut among males, respectively 40.2% and 34.8% (Table 2b). Males in the age group 15-19 engaged in sexual activity earlier than those in the age group 20-24, and represented respectively 59.4%, 62.5%, 58%, and 52.2% of males engaging in early sexual debut in Cameroon, Gabon, Democratic Republic of Congo, and Congo.

The median age of females included in the study was 20 years (18-22) in the four countries. Most females from high HIV prevalence countries were living in urban areas whereas most of those in low HIV prevalence countries were living in rural areas (Table 2a). Most females in Gabon (61%) and Congo (57.4%) were not married whereas those in Cameroon (56.3%) and Democratic Republic of Congo (59.4%) were married or living with a partner. Most females in the four countries already attained the high-school or university level at the time of the survey (Table 2a). Catholicism and Protestantism were the most common religions among females in Cameroon, Gabon, and Democratic Republic of Congo, and most females in

Gabon, Democratic Republic of Congo, and Congo had a low economic status (Table 2a). The median age of male respondents included in the study was 20 years (18-22) in Cameroon, Democratic Republic of Congo, Congo, and 19 years (17-22) in Gabon. As Cameroonian and Gabonese females, most Cameroonian and Gabonese males were living in urban areas whereas males from low HIV prevalence countries were mostly living in rural areas (Table 2b). Most males in the four countries were Christians, not married or living with their partner and already attained the high-school or university level at the time of the survey (Table 2b). Most males in Gabon and Congo had a low economic status whereas those in Cameroon and Democratic Republic of Congo had a higher economic status (Table 2b).

Regarding the behavioral profile of females and males in the four countries, although males had more lifetime number of sex partners than females, the median lifetime number of sex partners was higher in males and females from Gabon and Congo compared to other countries. Most females and males in Cameroon, Gabon and Democratic Republic of Congo engaged in concurrency during the 12 months preceding the survey; females and males in the four countries who did not use condom every time they had sex with their most recent partner in the 12 months preceding the survey were less numerous than those who used condom regularly (Tables 2a and 2b).

Regarding the female respondents most recent sex partner's characteristics, most of these partners were the spouses or boyfriends of the respondents; only few

females' most recent sex partner was a casual acquaintance, and only one female (from Gabon) most recent sex partner was a commercial sex worker (Table 2a); Compared to females, more males' most recent sex partner was a casual acquaintance or a commercial sex worker (Table 2b). Females' most recent partners were older in the four countries, whereas males' most recent partners were younger. Most female and male respondents in the four countries were aware that HIV could be prevented by using condom and being faithful to one's partner.

**Table 2a** Descriptive characteristics of women by country

	High HIV Prevalence Country		Low HIV Prevalence Country		P-value
	Cameroon	Gabon	DRC	Congo	
<b>Sociodemographic/Economic factors</b>					
<b>Age group</b>					< .0001*
15-19	842 (39.5)	818 (46.9)	1044 (39.7)	858 (43.1)	
20-24	1290 (60.5)	925 (53.1)	1583 (60.3)	1131 (56.9)	
<b>Residence n (%)</b>					< .0001*
Urban	1099 (51.5)	1248 (71.6)	931 (35.4)	824 (41.4)	
Rural	1033 (48.4)	495 (28.4)	1696 (64.6)	1165 (58.6)	
<b>Marital Status n (%)</b>					< .0001*
Not married	931 (43.7)	1064 (61)	1066 (40.6)	1142 (57.4)	
Married	1201 (56.3)	679 (39)	1561 (59.4)	847 (42.6)	
<b>Educational level n (%)</b>					< .0001*
No education	267 (12.5)	45 (2.6)	329 (12.5)	123 (6.2)	
Primary	661 (31)	457 (26.2)	938 (35.7)	694 (34.9)	
Secondary/Higher	1204 (56.5)	1241 (71.2)	1360 (51.8)	1172 (58.9)	
<b>Religion<sup>a</sup> (n) %</b>					-
Christian	1541 (72.4)	892 (51.2)	1501 (57.3)	920 (46.8)	
Muslim	440 (20.7)	65 (3.7)	41 (1.6)	15 (0.8)	
Other	101 (4.7)	650 (37.3)	1062 (40.5)	953 (48.5)	
None	47 (2.2)	135 (7.7)	15 (0.6)	77 (3.9)	
<b>Wealth Index n (%)</b>					< .0001*
Poor	718 (33.7)	1064 (61)	1167 (44.4)	1229 (61.8)	
Middle	453 (21.2)	288 (16.5)	533 (20.3)	311 (15.6)	
Rich	961 (45.1)	391 (22.4)	927 (35.3)	449 (22.6)	
<b>High-risk sexual behaviors</b>					
<b>First sex before 15 n (%)</b>					.0001*
Yes	541 (25.4)	477 (27.4)	815 (31)	588 (29.6)	
<b>Median lifetime number of sex partners<sup>b</sup></b>					< .0001*
	2 (1-3)	3 (2-4)	1 (1-3)	3 (2-4)	
<b>Concurrency in last 12 months n (%)</b>					.0953
Yes	96 (56.5)	146 (64.3)	82 (68.3)	NA	
<b>Used condom every time had sex with most recent partner in last 12 months (%)</b>					< .0001*
No	207 (35.4)	234 (33.4)	107 (46.5)	191 (48.5)	
<b>Partner characteristics</b>					
<b>Relationship with most recent sex partner n (%)</b>					< .0001*
Spouse	770 (41.3)	82 (5.2)	1078 (46.7)	191 (10.3)	
Boyfriend not cohabiting	809 (43.4)	990 (62.7)	736 (31.9)	1015 (54.5)	
Casual acquaintance	6 (0.3)	59 (3.7)	44 (1.9)	18 (1)	
Commercial sex worker	0 (0.0)	1 (0.1)	0 (0.0)	0 (0.0)	
Live-in partner	278 (14.9)	448 (28.3)	452 (19.6)	638 (34.3)	
<b>Median age of most recent partner<sup>b</sup></b>					.0002*
	27 (24-31)	26 (21-3)	26 (23-30)	NA	
<b>Older partner</b>					< .0001*
Yes	1604 (85.8)	1189 (75)	1946 (83.9)	NA	



**Table 2a** Descriptive characteristics of women by country (Continued)

	<b>High Prevalence Country</b>		<b>Low Prevalence Country</b>		<b>P-value</b>
	<b>Cameroon</b>	<b>Gabon</b>	<b>DRC</b>	<b>Congo</b>	
<b>HIV/AIDS Prevention Knowledge</b>					
<b>Always use condoms during sex</b>					< .0001*
No	329 (15.9)	293 (17.1)	547 (22.8)	393 (20.6)	
Don't know	206 (10)	68 (4)	328 (13.7)	155 (8.1)	
<b>Have 1 sex partner only, who has no other partners</b>					< .0001*
No	225 (10.9)	247 (14.4)	343 (14.3)	377 (19.8)	
Don't know	139 (6.7)	84 (4.9)	133 (5.5)	129 (6.8)	

\* $P \leq .05$ .

a. Religion is a country-specific variable- 'other religions' differ between countries.

b. The 25<sup>th</sup> and 75<sup>th</sup> percentiles are displayed in the parentheses.

Percentages may not total 100% because of rounding.

DRC= Democratic Republic of Congo.

NA= data not available.

**Table 2b** Descriptive characteristics of men by country

	High Prevalence Country		Low Prevalence Country		P-value
	Cameroon	Gabon	DRC	Congo	
<b>Sociodemographic/Economic Factors</b>					
<b>Age group</b>					< .0001*
15-19	659 (40.5)	800 (52.6)	776 (40)	652 (43.6)	
20-24	969 (59.5)	721 (47.4)	1165 (60)	844 (56.4)	
<b>Residence n (%)</b>					<.0001*
Urban	945 (58)	1088 (71.5)	738 (38)	629 (42)	
Rural	683 (41.9)	433 (28.5)	1203 (62)	867 (57.9)	
<b>Marital Status n (%)</b>					<.0001*
Not married	1373 (84.3)	1352 (88.9)	1524 (78.5)	1263 (84.4)	
Married	255 (15.1)	169 (11.1)	417 (21.5)	233 (15.6)	
<b>Education n (%)</b>					<.0001*
No education	51 (3.1)	30 (2)	34 (1.8)	33 (2.2)	
Primary	382 (23.5)	311 (20.4)	363 (18.7)	377 (25.2)	
Secondary/Higher	1195 (73.4)	1180 (77.6)	1544 (79.5)	1086 (72.6)	
<b>Religion<sup>a</sup> n (%)</b>					-
Christian	1248 (76.7)	815 (53.6)	1193 (61.5)	633 (42.7)	
Muslim	270 (16.6)	75 (4.9)	42 (2.2)	12 (0.8)	
Other	49 (3)	314 (20.7)	658 (33.9)	578 (39)	
None	60 (3.7)	316 (20.8)	47 (2.4)	260 (17.5)	
<b>Wealth Index n (%)</b>					<.0001*
Poor	420 (25.8)	924 (60.7)	752 (38.7)	888 (59.4)	
Middle	351 (21.6)	225 (14.8)	426 (21.9)	236 (15.8)	
Rich	857 (52.6)	372 (24.5)	763 (39.3)	372 (24.9)	
<b>High-risk Sexual Behaviors</b>					
<b>First sex before 15 n (%)</b>					<.0001*
Yes	345 (21.2)	611 (40.2)	543 (28)	521 (34.8)	
<b>Median lifetime number of sex partners<sup>b</sup></b>					<.0001*
	3 (2-7)	5 (3-10)	4 (2-8)	5 (3-10)	
<b>Concurrency in last 12 months n (%)</b>					.4337
Yes	354 (65.2)	282 (61.6)	296 (64.9)	NA	
<b>Used condom every time had sex with most recent partner in last 12 months n (%)</b>					<.0001*
No	141 (16.1)	139 (15.3)	91 (29.1)	142 (29.2)	
<b>Partner characteristics</b>					
<b>Relationship with most recent sex partner n (%)</b>					<.0001*
Spouse	106 (7.6)	18 (1.3)	256 (15.1)	17 (1.2)	
Girlfriend not cohabiting	1022 (73.7)	1003 (74.6)	1069 (63)	1000 (71.3)	
Casual acquaintance	166 (12)	232 (17.3)	201 (11.8)	203 (14.5)	
Commercial sex worker	8 (0.6)	3 (0.2)	43 (2.53)	8 (0.6)	
Live-in partner	85 (6.1)	88 (6.5)	128 (7.5)	174 (12.4)	
<b>Median age of most recent partner<sup>b</sup></b>					<.0001*
	18 (17-20)	18 (16-20)	17 (16-19)	NA	
<b>Older partner</b>					.5932
Yes	84 (6)	77 (5.7)	112 (6.6)	NA	

**Table 2b** Descriptive characteristics of men by country (Continued)

	High Prevalence Country		Low Prevalence Country		P-value
	Cameroon	Gabon	DRC	Congo	
<b>HIV/AIDS Prevention Knowledge</b>					
<b>Always use condoms during sex</b>					< .0001*
No	214 (13.3)	146 (9.7)	321 (17)	173 (11.75)	
Don't know	48 (3)	21 (1.4)	90 (4.7)	37 (2.51)	
<b>Have 1 sex partner only, who has no other partners</b>					.0008
No	187 (11.6)	154 (10.2)	240 (12.7)	196 (13.31)	
Don't know	28 (1.7)	29 (1.9)	66 (3.5)	42 (2.85)	

\* $P \leq .05$ .

a. Religion is a country-specific variable-‘other religions’ differ between countries.

b. The 25<sup>th</sup> and 75<sup>th</sup> percentiles are displayed in the parentheses.

Percentages may not total 100% because of rounding.

DRC= Democratic Republic of Congo.

NA= data not available.

### 3.2. Bivariate Analysis

The sociodemographic, economic, and behavioral characteristics of the respondents, as well as their last partner characteristics and HIV prevention knowledge, according to their HIV sero-status, were displayed in Tables 3a and 3b. The majority of females who tested positive for HIV in the four countries were aged between 20 and 24 years, and, except for females in Democratic Republic of Congo, they had had their sexual debut at age 15 or later (Table 3a). Most HIV-positive females in Gabon and Democratic Republic of Congo were living in urban areas (78.7% and 52.2% respectively), whereas it was the opposite in Cameroon and Congo (50.6% and 56.4%, respectively, were living in rural areas). HIV-positive females in high HIV prevalence countries were, in majority, married or living with a partner (respectively 59.5% and 53.2%); contrariwise, most of their counterparts in low HIV prevalence countries were not married or living with a partner (52.2% and 69.2%). Most HIV-positive females already attained at least

the level of education ‘primary’ at the time of the survey; Christianity was the most common religion among those infected (except for Congo where ‘other religions’ predominated); a low economic status was mostly observed among those infected in Gabon and Congo (55.3% and 59% respectively), whereas HIV-positive females in Cameroon and Democratic Republic of Congo were, in majority, from a wealthy family (46.8% and 56.5% respectively). Most HIV-positive females had more than one lifetime sexual partner in all four countries; irregular condom use and concurrency in the 12 months preceding the survey, among HIV-positive females, were mostly reported in Cameroon (Table 3a). The most recent sex partner of the majority of HIV-positive females who provided information for this characteristic in Democratic Republic of Congo was their spouse (47.6%); in other three countries, this partner was a boyfriend not cohabiting with the respondent. The most recent partner was older, with an age difference equal or greater than three, in the majority of

infected females in Cameroon, Gabon, and Democratic Republic of Congo. The majority of HIV-positive females in the four countries

were aware of the two methods of HIV prevention examined in the study, namely, condom use and fidelity.

**Table 3a** Distribution of selected characteristics by HIV sero-status and country for women

HIV Sero-status N (%)	High Prevalence Country				Low Prevalence Country			
	Cameroon		Gabon		DRC		Congo	
	Positive	Negative	Positive	Negative	Positive	Negative	Positive	Negative
	79 (3.7)	2053(96.3)	47 (2.7)	1696 (97.3)	23 (0.9)	2604 (99.1)	39 (2)	1950 (98)
<b>Sociodemographic/Economic Factors</b>								
<b>Age n (%)</b>								
15-19	21 (26.6)	821 (40)	12 (25.5)	806 (47.5)	7 (30.4)	1037 (39.8)	9 (23.1)	849 (43.5)
20-24	58 (73.4)*	1232 (60)	35(74.5)**	890 (52.5)	16 (69.6)	1567 (60.2)	30 (76.9)*	1101 (56.5)
<b>Residence n (%)</b>								
Urban	39 (49.4)	1060 (51.6)	37 (78.7)	1211 (71.4)	12 (52.2)	919 (35.3)	17 (43.6)	807 (41.4)
Rural	40 (50.6)	993 (48.4)	10 (21.3)	485 (28.6)	11 (47.8)	1685 (64.7)	22 (56.4)	1143 (58.6)
<b>Marital Status n (%)</b>								
Not married	32 (40.5)	899 (43.8)	22 (46.8)	1042 (61.4)	12 (52.2)	1054 (40.5)	27 (69.2)	1115 (57.2)
Married	47 (59.5)	1154 (56.2)	25 (53.2)*	654 (38.6)	11 (47.8)	1550 (59.5)	12 (30.8)	835 (42.8)
<b>Educational level n (%)</b>								
No education	5 (6.3)	262 (12.8)	1 (2.1)	44 (2.6)	1 (4.3)	328 (12.6)	5 (12.8)	118 (6)
Primary	27 (34.2)	634 (30.9)	12 (25.5)	445 (26.)	11 (47.8)	927 (35.6)	16 (41)	678 (34.8)
Secondary/ Higher	47 (59.5)	1157 (56.4)	34 (72.3)	1207(71.2)	11 (47.8)	1349 (51.8)	18 (46.1)	1154 (59.2)
<b>Religion n (%)</b>								
Christian	60 (75.9)	1481 (72.2)	28 (59.6)	864 (50.9)	15 (68.2)	1486 (57.2)	14 (35.9)	906 (47)
Muslim	15 (19)	425 (20.7)	1 (2.1)	64 (3.8)	1 (4.5)	40 (1.5)	0 (0.00)	15 (0.8)
Other	3 (3.8)	98 (4.8)	16 (34)	634 (37.4)	6 (27.3)	1056 (40.7)	22 (56.4)	931 (48.3)
None	1 (1.3)	46 (2.2)	2 (4.3)	133 (7.8)	0 (0.00)	15 (0.6)	3 (7.7)	74 (3.8)
<b>Wealth Index n (%)</b>								
Poor	22 (27.8)	696 (33.9)	26 (55.3)	1038 (61.2)	3 (13)	1164 (44.7)	23 (59)	1206 (61.8)
Middle	20 (25.3)	433 (21.1)	11 (23.4)	277 (16.3)	7 (30.4)	526 (20.2)	6 (15.4)	305 (15.6)
Rich	37 (46.8)	924 (45)	10 (21.3)	381 (22.5)	13(56.5)**	914 (35.1)	10 (25.6)	439 (22.5)
<b>High-risk Sexual Behaviors</b>								
<b>First sex before 15 n (%)</b>								
Yes	34 (43)	507 (24.7)	10 (21.3)	467 (27.5)	14 (60.9)**	801 (30.8)	13 (33.3)	575 (29.5)
No	45(57)***	1546 (75.3)	37 (78.7)	1229 (72.5)	9 (39.1)	1803 (69.2)	26 (66.7)	1375 (70.5)
<b>Lifetime number of sexual partners n (%)</b>								
1	15 (19)	891 (43.5)	3 (6.4)	415 (24.5)	6 (26.1)	1314 (50.5)	6 (15.4)	421 (21.6)
>1	64 (81)***	1157 (56.5)	44 (93.6)**	1281(75.5)	17(73.9)*	1289 (49.5)	33 (84.6)	1528 (78.4)
<b>Used condom every time had sex with most recent partner in last 12 months n (%)</b>								
Yes	5 (35.7)	372 (65.3)	12 (66.7)	454 (66.6)	1 (50)	122 (53.5)	5 (71.4)	198 (51.2)
No	9 (64.3)*	198 (34.7)	6 (33.3)	228 (33.4)	1 (50)	106 (46.5)	2 (28.6)	189 (48.8)

**Table 3a** Distribution of selected characteristics by HIV sero-status and country for women (Continued)

HIV sero-status N (%)	High Prevalence Country				Low Prevalence Country			
	Cameroon		Gabon		DRC		Congo	
	Positive	Negative	Positive	Negative	Positive	Negative	Positive	Negative
	79 (3.7)	2053(96.3)	47 (2.7)	1696 (97.3)	23 (0.9)	2604 (99.1)	39 (2)	1950 (98)
<b>Concurrency in last 12 months n (%)</b>								
Yes	6 (100)*	90 (54.9)*	2 (25)	144 (65.7)	1 (100)	81 (68.1)	NA	NA
No	0 (0.0)	74 (45.1)	6 (75)	75 (34.3)	0 (0.0)	38 (31.9)	NA	NA
<b>Partner Characteristics</b>								
<b>Relationship with most recent sex partner n (%)</b>								
Spouse	24 (33.8)	746 (41.6)	3 (6.5)	79 (5.1)	10 (47.6)	1068 (46.7)	4 (11.4)	187 (10.2)
Boyfriend not cohabiting	29 (40.8)	780 (43.5)	22 (47.8)	968 (63.1)	8 (38.1)	728 (31.8)	20 (57.1)	995 (54.5)
Casual acquaintance	0 (0.0)	6 (0.3)	1 (2.2)	58 (3.8)	1 (4.8)	43 (1.9)	1 (2.9)	17 (0.9)
Commercial sex worker	0 (0.0)	0 (0.00)	0 (0.00)	1 (0.1)	0 (0.0)	0 (0.00)	0 (0.0)	0 (0.0)
Live-in partner	18 (25.3)	260 (14.5)	20 (43.5)	428 (27.9)	2 (9.5)	450 (19.7)	10 (28.6)	628 (34.4)
<b>Older partner n (%)</b>								
Yes	66 (93)	1538 (85.5)	36 (78.3)	1153 (74.9)	21 (100)*	1925 (83.7)	NA	NA
No	5 (7)	261 (14.5)	10 (21.7)	386 (25.1)	0 (0.0)	374 (16.3)	NA	NA
<b>HIV/AIDS Prevention Knowledge</b>								
<b>Always use condoms during sex</b>								
Yes	65 (82.3)	1466 (73.8)	38 (84.4)	1310 (78.7)	13 (61.9)	1514 (63.6)	25 (73.5)	1331 (71.2)
No	10 (12.7)	319 (16)	5 (11.1)	288 (17.3)	4 (19)	543 (22.8)	4 (11.8)	389 (20.8)
Don't know	4 (5.1)	202 (10.2)	2 (4.4)	66 (4)	4 (19)	324 (13.6)	5 (14.7)	150 (8)
<b>Have 1 sex partner only, who has no other partners</b>								
Yes	64 (81)	1639 (82.4)	36 (80)	1344 (80.7)	15 (71.4)	1915 (80.3)	29 (85.3)	1373 (73.3)
No	10 (12.7)	215 (10.8)	7 (15.6)	240 (14.4)	4 (19)	339 (14.2)	2 (5.9)	375 (20)
Don't know	5 (6.3)	134 (6.7)	2 (4.4)	82 (4.9)	2 (9.5)	131 (5.5)	3 (8.8)	126 (6.7)

DRC=Democratic Republic of Congo.

NA=data not available.

Percentages were computed based on available data for each variable and may not total 100% because of rounding.

P-values are for country-specific comparisons between HIV sero-status and the selected characteristics.

\* $P \leq 0.05$ .

The predominant age group of males who tested positive for HIV was 20-24 years in Cameroon, Gabon, and Democratic Republic of Congo (respectively 69.2%, 72.7%, and 75%) and 15-19 years in Congo (54.5%); most of these HIV-positive males had their first sexual experience at age 15 or later, respectively 76.9%, 54.5%, 75% and

81.8% in Cameroon, Gabon, Democratic Republic of Congo, and Congo; those from high HIV prevalence countries were mostly living in urban areas; half of the males infected in Democratic Republic of Congo and 54.5% in Congo were living in rural areas. All infected males in the four countries were not married; most of them

were Christians and already attained the secondary/higher level of education at the time of the surveys (Table 3b). Forty-six percent, 63.6%, and 54.5% had a low economic status (poor) in Cameroon, Gabon, and Congo, whereas 2 of the four males (50%) infected in Democratic Republic of Congo were from wealthy families. Among those who provided information on their sexual behaviors, all infected males in Gabon and Congo, 69.2% in Cameroon and 75% in Democratic Republic of Congo had more than one lifetime sexual partners. Cumulative concurrency was reported by 2 (50%), 5 (83.3%), and 1(100%) infected males in Cameroon, Gabon, and Democratic Republic of Congo respectively; regular condom use was reported by 6 (100%), 4 (80%), and 1 (100%) HIV-positive males in Cameroon, Gabon, and Congo respectively, whereas 1 (100%) HIV-positive male in Democratic Republic of Congo did not use condom regularly in the 12 months preceding the survey. Regarding the most recent sex partner's characteristics of HIV-positive males, most of these partners in

the four countries were girlfriends not cohabiting with the respondents. Most of the most recent partners of the male respondents were younger than the respondents in countries where data on this variable were available. Most HIV-positive male respondents who reported information on their knowledge about condom use and fidelity, as means of HIV prevention, were aware that these methods could help avoid HIV (Table 3b).

Table 3b Distribution of selected characteristics by HIV sero-status and country for men

HIV Sero-status N (%)	High Prevalence Country				Low Prevalence Country			
	Cameroon		Gabon		DRC		Congo	
	Positive	Negative	Positive	Negative	Positive	Negative	Positive	Negative
	13 (0.8)	1615 (99.2)	11(0.7)	1510 (99.3)	4 (0.2)	1937 (99.8)	11 (0.7)	1485 (99.3)
<b>Sociodemographic /Economic Factors</b>								
<b>Age n (%)</b>								
15-19	4 (30.8)	655 (40.6)	3 (27.3)	797 (52.8)	1 (25)	775 (40)	6 (54.5)	646 (43.5)
20-24	9 (69.2)	960 (59.4)	8 (72.7)	713 (47.2)	3 (75)	1162 (60)	5 (45.5)	839 (56.5)
<b>Residence n (%)</b>								
Urban	7 (53.8)	938 (58.1)	6 (54.5)	1082 (71.7)	2 (50)	736 (38)	5 (45.5)	624 (42)
Rural	6 (46.2)	677 (41.9)	5 (45.5)	428 (28.3)	2 (50)	1201 (62)	6 (54.5)	861 (58)
<b>Marital Status n (%)</b>								
Not married	9 (69.2)	1364 (84.5)	6 (54.5)	1346 (89.1)	4 (100)	1520 (78.5)	11 (100)	1252 (84.3)
Married	4 (30.8)	251 (15.5)	5 (45.5)	164 (10.9)	0 (0.0)	417 (21.5)	0 (0.0)	233 (15.7)
<b>Educational level n (%)</b>								
No education	1 (7.7)	50 (3.1)	0 (0.0)	30 (2)	1 (25)	33 (1.7)	0 (0.0)	33 (2.2)
Primary	5 (38.5)	377 (23.3)	2 (18.2)	309 (20.5)	1 (25)	362 (18.7)	3 (27.3)	374 (25.2)
Secondary/Higher	7 (53.8)	1188 (73.6)	9 (81.8)	1171 (77.5)	2 (50)	1542 (79.6)	8 (72.7)	1078 (72.6)
<b>Religion (n) %</b>								
Christian	10 (76.9)	1238 (76.7)	7 (63.6)	808 (53.5)	2 (50)	1191 (61.5)	6 (54.5)	627 (42.6)
Muslim	2 (15.4)	268 (16.6)	1 (9.1)	74 (4.9)	0 (0.0)	42 (2.2)	0 (0.0)	12 (0.8)
Other	0 (0.0)	49 (3)	0 (0.0)	314 (20.8)	1 (25)	657 (33.9)	3 (27.3)	575 (39.1)
None	1 (7.7)	59 (3.7)	3 (27.3)	313 (20.7)	1 (25)	46 (2.4)	2 (18.2)	258 (17.5)
<b>Wealth Index n (%)</b>								
Poor	6 (46.1)	414 (25.6)	7 (63.6)	917 (60.7)	1 (25)	751 (38.8)	6 (54.5)	882 (59.4)
Middle	1 (7.7)	350 (21.7)	0 (0.0)	225 (14.9)	1 (25)	425 (21.9)	4 (36.4)	232 (15.6)
Rich	6 (46.1)	851 (52.7)	4 (36.4)	368 (24.4)	2 (50)	761 (39.3)	1 (9.1)	371 (25)
<b>High-risk Sexual Behaviors</b>								
<b>First sex before 15 n (%)</b>								
Yes	3 (23.1)	342 (21.2)	5 (45.5)	606 (40.1)	1 (25)	542 (28)	2 (18.2)	519 (34.9)
No	10 (76.9)	1273 (78.8)	6 (54.5)	904 (59.9)	3 (75)	1395 (72)	9 (81.8)	966 (65.1)
<b>Lifetime number of sexual partners n (%)</b>								
1	4 (30.8)	342 (21.2)	0 (0.0)	208 (13.8)	1 (25)	348 (18)	0 (0.0)	173 (11.7)
>1	9 (69.2)	1272 (78.8)	11 (100)	1298 (86.2)	3 (75)	1588 (82)	11 (100)	1309 (88.3)
<b>Used condom every time had sex with most recent partner in last 12 months<sup>n</sup> (%)</b>								
Yes	6 (100)	728 (83.8)	4 (80)	764 (84.7)	0 (0.0)	222 (71.1)	1 (100)	343 (70.7)
No	0 (0.0)	141 (16.2)	1 (20)	138 (15.3)	1 (100)	90 (28.9)	0 (0.0)	142 (29.3)
<b>Concurency in last 12 months n (%)</b>								
Yes	2 (50)	352 (65.3)	5 (83.3)	277 (61.3)	1 (100)	295 (64.8)	NA	NA
No	2 (50)	187 (34.7)	1 (16.7)	175 (38.7)	0 (0.0)	160 (35.2)		



**Table 3b** Distribution of selected characteristics by HIV sero-status and country for men (Continued)

	High Prevalence Country				Low Prevalence Country			
	Cameroon		Gabon		DRC		Congo	
HIV sero-status	Positive	Negative	Positive	Negative	Positive	Negative	Positive	Negative
N (%)	13 (0.8)	1615 (99.2)	11 (0.7)	1510 (99.3)	4 (0.2)	1937 (99.8)	11 (0.7)	1485 (99.3)
<b>Partner Characteristics</b>								
<b>Relationship with most recent sex partner n (%)</b>								
Spouse	1 (7.7)	105 (7.6)	1 (10)	17 (1.3)	0 (0.0)	256 (15.1)	0 (0.0)	17 (1.2)
Girlfriend not cohabiting	7 (53.8)	1015 (73.9)	7 (70)*	996 (74.7)	2 (66.7)	1067 (63)	9 (81.8)	991 (71.2)
Casual acquaintance	3 (23.1)	163 (11.9)	0 (0.0)	232 (17.4)	1 (33.3)	200 (11.8)	1 (9.1)	202 (14.5)
Commercial sex Worker	0 (0.0)	8 (0.6)	0 (0.0)	3 (0.2)	0 (0.0)	43 (2.5)	0 (0.0)	8 (0.6)
Live-in partner	2 (15.4)	83 (6)	2 (20)	86 (6.4)	0 (0.0)	128 (7.6)	1 (9.1)	173 (12.4)
<b>Older partner n (%)</b>								
Yes	2 (15.4)	82 (5.9)	1 (10)	76 (5.7)	0 (0.0)	112 (6.6)	NA	NA
No	11 (84.6)	1308 (94.1)	9 (90)	1257 (94.3)	3 (100)	1584 (93.4)		
<b>HIV/AIDS Prevention Knowledge</b>								
<b>Always use condoms during sex</b>								
Yes	9 (69.2)	1341 (83.9)	11 (100)	1333 (88.9)	4 (100)	1478 (78.2)	8 (80)	1254 (85.8)
No	4 (30.8)	210 (13.1)	0 (0.0)	146 (9.7)	0 (0.0)	321 (17)	2 (20)	171 (11.7)
Don't know	0 (0.0)	48 (3)	0 (0.0)	21 (1.4)	0 (0.0)	90 (4.8)	0 (0.0)	37 (2.5)
<b>Have 1 sex partner only, who has no other partners</b>								
Yes	12 (92.3)	1387 (86.6)	11 (100)	1317 (87.8)	4 (100)	1585 (83.8)	8 (80)	1227 (83.9)
No	0 (0.0)	187 (11.7)	0 (0.0)	154 (10.3)	0 (0.0)	240 (12.7)	2 (20)	194 (13.3)
Don't know	1 (7.7)	27 (1.7)	0 (0.0)	29 (1.9)	0 (0.0)	66 (3.5)	0 (0.0)	4.2 (2.9)

DRC=Democratic Republic of Congo.

NA=data not available.

Percentages were computed based on available data for each variable and may not total 100% because of rounding.

P-values are for country-specific comparisons between HIV sero-status and the selected characteristics.

\* $P \leq .05$ .

### 3.3. Univariate and Multivariate Logistic Regression Analyses

Tables 4a and 4b present the unadjusted estimates of the relationship between the independent variables and the main outcome among female and male respondents.

Female respondents who reported having had sex before age 15 were more likely to be infected with HIV in one of the high HIV prevalence countries, Cameroon [odds ratio (OR), 2.3; 95% confidence interval (CI), 1.45-3.63], and both low HIV prevalence countries, Democratic Republic of Congo

[OR, 3.5; 95% CI, 1.53-8.44], and Congo [OR, 1.2; 95% CI, 0.59-2.3]; the association between early sexual debut and HIV infection was found to be statistically significant in Cameroon and Democratic Republic of Congo only ( $p=.0003$  and  $p=.0035$  respectively). Other factors that were significantly associated with HIV among Cameroonian female respondents were being 20-24 years old [OR, 3.5; 95% CI, 1.53-8.44;  $p=.02$ ], having more than one lifetime sexual partners [OR, 3.28; 95% CI, 1.91-6.02;  $p<.0001$ ], having used condom regularly with the most recent partner

during the 12 months preceding the interview [OR, 3.38; 95% CI, 1.15-11.13;  $p=.03$ ], the most recent sex partner being a live-in partner [OR, 2.15; 95% CI, 1.14-4.01;  $p=.02$ ]. In Gabon, HIV infection was associated with being 20-24 years old [OR, 2.64; 95% CI, 1.4-5.34;  $p=.004$ ], being married or living with a partner [OR, 1.82; 95% CI, 1.01-3.26;  $p=.05$ ], having more than one lifetime sexual partners [OR, 4.75; 95% CI, 1.72-19.66;  $p=.009$ ]; HIV-positive Gabonese females were significantly less likely to have engaged in concurrency during the 12 months preceding the survey [OR, 0.17; 95% CI, 0.03-0.77;  $p=.03$ ]. HIV-positive females from Democratic Republic

of Congo were significantly less likely to be poor [OR, 0.18; 95% CI, 0.04-0.56;  $p=.008$ ] but significantly more likely to have had more than one lifetime sexual partners [OR, 2.89; 95% CI, 1.2-8.03;  $p=.03$ ]. In Congo, HIV infection was significantly associated with being 20-24 years old [OR, 2.57; 95% CI, 1.26-5.78;  $p=.014$ ].

**Table 4a.** Unadjusted Odds Ratios (OR) and 95% Confidence Intervals (CI) of HIV Sero-status Association with Selected Characteristics among Women, by Country

	High Prevalence Country		Low Prevalence Country	
	Cameroon	Gabon	DRC	Congo
<b>First sex before 15</b>				
Yes	2.3 (1.45-3.63)***	0.71 (0.33-1.39)	3.5 (1.53-8.44)**	1.2 (0.59-2.3)
No (ref)	1.00	1.00	1.00	1.00
<b>Age (years)</b>				
15-19 (ref)	1.00	1.00	1.00	1.00
20-24	1.84 (1.13-3.12)*	2.64 (1.4-5.34)**	1.51 (0.64-3.95)	2.57 (1.26-5.78)*
<b>Residence</b>				
Urban (ref)	1.00	1.00	1.00	1.00
Rural	1.1 (0.7-1.72)	0.68 (0.32-1.32)	0.5 (0.22-1.15)	0.91 (0.48-1.76)
<b>Marital Status</b>				
Not married (ref)	1.00	1.00	1.00	1.00
Married	1.14 (0.73-1.83)	1.82 (1.01-3.26)*	0.62 (0.27-1.43)	0.59 (0.29-1.15)
<b>Education</b>				
No education	0.47 (0.16-1.09)	0.81 (0.05-3.88)	0.37 (0.02-1.93)	2.72 (0.88-6.95)
Primary	1.05 (0.64-1.69)	0.96 (0.47-1.81)	1.46 (0.62-3.41)	1.51 (0.76-2.99)
Secondary/Higher (ref)	1.00	1.00	1.00	1.00
<b>Religion</b>				
Christian (ref)	1.00	1.00	1.00	1.00
Muslim	0.87 (0.47-1.51)	0.48 (0.03-2.32)	2.48 (0.14-12.69)	---
Other	0.76 (0.18-2.09)	0.78 (0.41-1.43)	0.56 (0.2-1.39)	1.53(0.79-3.08)
None	0.54 (0.03-2.52)	0.46 (0.07-1.57)	---	2.62(0.6-8.26)
<b>Wealth Index</b>				
Poor	0.79 (0.46-1.34)	0.95 (0.47-2.09)	0.18 (0.04-0.56)**	0.84 (0.41-1.85)
Middle	1.15 (0.65-1.99)	1.51 (0.63-3.68)	0.94 (0.35-2.3)	0.86 (0.29-2.35)
Rich (ref)	1.00	1.00	1.00	1.00
<b>Lifetime number of sexual partners</b>				
1 (ref)	1.00	1.00	1.00	1.00
>1	3.28 (1.91-6.02)***	4.75 (1.72-19.66)**	2.89 (1.2-8.03)*	1.52 (0.68-4.04)
<b>Used condom every time had sex with most recent partner in last 12 months</b>				
Yes (ref)	1.00	1.00	1.00	1.00
No	3.38 (1.15-11.13)*	1 (0.34-2.6)	1.15 (0.05-29.32)	0.42 (0.06-1.97)
<b>Concurrency during last 12 months</b>				
Yes	---	0.17 (0.03-0.77)*	---	---
No (ref)	1.00	1.00	1.00	NA
<b>Relationship with most recent sex partner n (%)</b>				
Spouse (ref)	1.00	1.00	1.00	1.00
Boyfriend not cohabiting	1.16 (0.67-2.02)	0.6 (0.2-2.57)	1.17 (0.45-2.99)	0.94 (0.35-3.26)
Casual acquaintance	---	0.45 (0.02-3.65)	2.48 (0.13-13.42)	2.75 (0.14-19.94)
Commercial sex worker	---	---	---	---
Live-in partner	2.15 (1.14-4.01)*	1.23 (0.41-5.31)	0.48 (0.07-1.81)	0.74 (0.25-2.74)
<b>Older partner</b>				
Yes	2.24(0.99-6.44)	1.21 (0.62-2.59)	---	---
No (ref)	1.00	1.00	1.00	NA

**Table 4a.** Unadjusted Odds Ratios (OR) and 95% Confidence Intervals (CI) of HIV Sero-status Association with Selected Characteristics among Women, by Country (Continued)

	High Prevalence Country		Low Prevalence Country	
	Cameroon	Gabon	DRC	Congo
<b>HIV knowledge/Always use condoms during sex</b>				
Yes (ref)	1.00	1.00	1.00	1.00
No	0.71 (0.34-1.34)	0.6 (0.21-1.4)	0.86 (0.24-2.44)	0.55 (0.16-1.42)
Don't know	0.45 (0.14-1.1)	1.05 (0.17-3.51)	1.44 (0.4-4.09)	1.78 (0.59-4.34)
<b>HIV knowledge/Have 1 sex partner only, who has no other partners</b>				
Yes (ref)	1.00	1.00	1.00	1.00
No	1.19 (0.57-2.25)	1.09 (0.44-2.33)	1.51 (0.43-4.18)	0.25 (0.04-0.84)
Don't know	0.96 (0.33-2.19)	0.91 (0.15-3.05)	1.95 (0.31-7.01)	1.13 (0.27-3.23)

DRC=Democratic Republic of Congo. NA= data not available.

--OR <.0001 or >999.999 because none or all of HIV infected respondents had the reported characteristic.

\* $P \leq 0.05$ ; \*\* $P \leq 0.01$ ; \*\*\* $P \leq 0.001$ .

In univariate analysis, Congo was the only country where HIV infection was found to be associated with early sexual debut among males, even though this association was not statistically significant [OR, 1.56; 95% CI, 0.47-5.43;  $p = .47$ ]. HIV-infection

was significantly associated with being married in Gabonese males [OR, 6.84; 95% CI, 1.95-22.95;  $p = .002$ ], and never having attended school in males from Democratic Republic of Congo [OR, 23.36; 95% CI, 1.07-250;  $p = .01$ ].

**Table 4b.** Unadjusted Odds Ratios and 95% Confidence Intervals (CI) of HIV Sero-status Association with Selected Characteristics among Men, by Country

	High Prevalence Country		Low Prevalence Country	
	Cameroon	Gabon	DRC	Congo
<b>First sex before 15</b>				
Yes	0.65 (0.18-2.01)	0.34 (0.07-1.17)	0.5 (0.03-3.91)	1.56 (0.47-5.43)
No (ref)	1.00	1.00	1.00	1.00
<b>Age (years)</b>				
15-19 (ref)	1.00	1.00	1.00	1.00
20-24	1.54 (0.5-5.68)	2.98 (0.86-13.65)	2 (0.26-40.47)	0.64 (0.18-2.14)
<b>Residence</b>				
Urban (ref)	1.00	1.00	1.00	1.00
Rural	1.19 (0.38-3.59)	2.11 (0.6-7.03)	0.61 (0.07-5.11)	0.87 (0.26-3.03)
<b>Marital Status</b>				
Not married (ref)	1.00	1.00	1.00	1.00
Married	2.42 (0.65-7.48)	6.84 (1.95-22.95)**	---	---
<b>Education</b>				
No education	3.39 (0.18-19.6)	---	23.36(1.07-250)*	---
Primary	2.25 (0.66-7.09)	0.84 (0.13-3.29)	2.13 (0.1-22.29)	1.08 (0.24-3.76)
Secondary/Higher (ref)	1.00	1.00	1.00	1.00
<b>Religion</b>				
Christian	1.00	1.00	1.00	1.00
Muslim	0.92 (0.14-3.53)	1.56 (0.08-8.94)	---	---
Other	---	---	0.91 (0.04-9.48)	0.55 (0.12-2.08)
None	2.1 (0.11-11.23)	1.11 (0.24-4.01)	12.95 (0.6-137)	0.81 (0.12-3.54)
<b>Wealth Index</b>				
Poor	2.06 (0.64-6.61)	0.7 (0.21-2.69)	0.51 (0.02-5.3)	2.52 (0.43-47.74)
Middle	0.41 (0.02-2.39)	---	0.9 (0.04-9.37)	6.4 (0.94-125)
Rich (ref)	1.00	1.00	1.00	1.00
<b>Lifetime number of sexual partners</b>				
1 (ref)	1.00	1.00	1.00	1.00
>1	0.61 (0.2-2.24)	---	0.66 (0.08-13.31)	---
<b>Used condom every time had sex with most recent partner in last 12 months</b>				
Yes (ref)	---	1.38 (0.07-9.44)	---	---
No	1.00	1.00	1.00	1.00
<b>Cumulative concurrency</b>				
Yes	0.53 (0.06-4.45)	3.16 (0.5-60.76)	---	---
No (ref)	1.00	1.00	1.00	NA

**Table 4b.** Unadjusted Odds Ratios and 95% Confidence Intervals (CI) of HIV Sero-status Association with Selected Characteristics among Men, by Country (Continued)

	High Prevalence Country		Low Prevalence Country	
	Cameroon	Gabon	DRC	Congo
<b>Relationship with most recent sex partner</b>				
<b>n (%)</b>				
Spouse (ref)	1.00	1.00	1.00	1.00
Boyfriend not cohabiting	0.72 (0.13-13.6)	0.12(0.02-2.3)	---	---
Casual acquaintance	1.93 (0.24-39.33)	---	---	---
Commercial sex worker	---	---	1	1
Live-in partner	2.53 (0.24-54.95)	0.4 (0.04-8.78)	1	---
<b>Older partner</b>				
Yes	2.9 (0.44-11.03)	1.84 (0.09-9.97)	---	---
No (ref)	1.00	1.00	1.00	NA
<b>HIV prevention knowledge/Always use condoms during sex</b>				
Yes (ref)	1.00	1.00	1.00	1.00
No	2.84 (0.76-8.8)	---	---	1.83 (0.28-7.39)
Don't know	---	---	---	---
<b>HIV prevention knowledge/Have 1 sex partner only, who has no other partners</b>				
Yes (ref)	1.00	1.00	1.00	1.00
No	4.28 (0.23-22.95)	---	---	1.58 (0.24-6.37)
Don't know	---	---	---	---

DRC=Democratic Republic of Congo. NA= data not available.

---OR <.0001 or >999.999 because none or all of HIV infected respondents had the reported characteristic.

\*p≤0.05; \*\*p≤0.01; \*\*\*p≤0.001.

Table 5 presents the results of the standard multivariate logistic regression model examining the relationship between early sexual debut and HIV infection, by country and sex, after adjusting for age, marital status, education, wealth index, religion, total lifetime number of sexual partners, condom use, relationship with the most recent sex partner, knowledge of condom an fidelity as means to prevent HIV. After controlling for confounding, there was, overall, an increase in the estimates of the association between early age at first sex and HIV infection in females respondents and their male counterparts (except for males in Congo), showing that other factors came into play to make early age at first sex a significant predictor or not of the HIV

infection. Among females, early age at first sex remained significantly associated with HIV infection in Cameroon [OR, 2.52; 95% CI, 1.57-4.01; p=.0001] and Democratic Republic of Congo [OR, 3.92; 95% CI, 1.71-9.48; p=.002], and the association remained non-significant in Congo [OR, 1.51; 95% CI, 0.73-3; p=.25]. Being 20-24 years old remained significantly associated with HIV infection among females in Cameroon, Gabon, and Congo (Table 5). Other factors found to be positively and significantly associated with HIV at the end of the multivariate regression analysis were having more than one lifetime sexual partners in Cameroon and Gabon (Table 5).

**Table 5** Results of the multivariate logistic regression analysis examining the relationship between early age at coital debut and HIV sero-status among women and men, by country

	Women		Men	
	OR (95% CI)	P-value	OR (CI 95%)	P-value
<b>Cameroon</b>				
<b>First sex before15</b>	2.52 (1.57-4.01)	0.0001*	1.12 (0.25-3.67)	0.87
Yes( versus no)				
<b>Age (years)</b>				
20-24 (versus 15-19)	1.88 (1.13-3.22)	0.02*	---	---
<b>Lifetime number of sexual partners</b>				
>1 (versus 1)	3.05 (1.77-5.61)	0.0001*	---	---
<b>Gabon</b>				
<b>First sex before 15</b>				
Yes (versus no)	0.73 (0.34-1.44)	0.39	1.26 (0.36-4.21)	0.71
<b>Age (years)</b>				
20-24 (versus 15-19)	2.11 (1.1-4.32)	0.02*	---	---
<b>Marital Status</b>				
Married (versus not married)	---	---	6.85 (1.96-22.99)	0.002*
<b>Lifetime number of sexual partners</b>				
>1 (versus 1)	4.02 (1.43-16.8)	0.03*	---	---
<b>DRC</b>				
<b>First sex before 15</b>				
Yes (versus no)	3.92 (1.71-9.48)	0.002*	0.86 (0.04-6.82)	0.9
<b>Education</b>				
No education (versus Secondary/Higher)	---	---	23.33 (1.07-249)	0.01*
Primary (versus Secondary/Higher)	---	---	2.14 (0.1-22.35)	0.54
<b>Wealth Index</b>				
Middle (versus rich)	0.88 (0.33-2.16)	0.78	---	---
Poor (versus rich)	0.16 (0.04-0.5)	0.004*	---	---
<b>Congo</b>				
<b>First sex before 15</b>				
Yes (versus no)	1.51 (0.73-3)	0.25	0.41 (0.06-1.61)	0.26
<b>Age (years)</b>				
20-24 (versus 15-19)	3.58 (1.7-8.28)	0.001*	---	---
<b>Marital Status</b>				
Married (versus not married)	0.38 (0.18-0.77)	0.009*	---	---
<b>HIV prevention knowledge/ Have 1 sex partner only, who has no other partners</b>				
No (versus yes)	0.25 (0.04-0.84)	0.059	---	---
Don't know (versus yes)	1.17 (0.28-3.38)	0.8	---	---

OR=Odds Ratio.

CI=Confidence Interval. DRC=Democratic Republic of Congo.

\*P ≤.05.

After adjusting for other HIV predictors, Cameroonian males and Gabonese married males who engaged in early sexual debut were more likely to be tested positive for HIV, but the association was not statistically significant in both countries (Table 5). As in

the univariate analysis, having no education remained significantly associated with being HIV-positive in males from Democratic Republic of Congo [OR, 23.33; 95% CI, 1.07-249; p=.01].

#### 4. Discussion

We postulated that, as a risky sexual behaviors' indicator, early sexual debut could account for high proportions of HIV infection among young people, particularly women, in central African countries with higher HIV prevalences (Cameroon and Gabon) compared to countries with lower HIV prevalences (Democratic Republic of Congo and Congo). The results of this study partly support our hypothesis since various patterns of the association between age at sexual initiation and HIV were observed across countries.

Median age at sexual debut varied between 15 and 16 years among females and males respondents. In a study examining the trends in age at sexual debut among males and females aged 15-24 in eight sub-Saharan African countries, using DHS data, median ages ranged from 16.2 to 18.6 years for females, and 15.8 to 18.6 years for males [9]. Ferry et al [3] found median ages of 16.9 to 19 and 25.5 to 29.5 respectively for males and females aged 15-49 years old in Kisumu (Kenya), Ndola (Zambia), Cotonou (Benin), and Yaoundé (Cameroon). Thus, median ages at first sexual intercourse seem to vary greatly between countries in sub-Saharan Africa.

Even though the odds of having HIV among males who reported early sexual debut uniformly increased in the multivariate analysis, no association was statistically significant among males included in the study. Females from Cameroon and Democratic Republic of Congo were the ones to have significantly more likely engaged in early sexual activity compared to females from other countries. This association remained significant after adjusting for other sociodemographic, economic, behavioral, most recent partner's characteristics, and HIV prevention knowledge. These observed associations among females of Cameroon and Democratic Republic of Congo corroborate those of previous studies carried out in sub-Saharan Africa [10, 15-19]. Low economic status and education level seemed to

not have played a role in these findings. In Cameroon, having more than one lifetime number of sexual partners (OR, 3.05; 95% CI, 1.77-5.61, in multivariate analysis) and irregularity of condom use over the year preceding the survey (OR, 3.38; 95% CI, 1.15-11.13, in univariate analysis), that were found significantly associated with HIV infection, suggest that early sexual initiation could have increased the risk of engaging in other risky sexual behaviors among HIV-positive females of this country. A study by Welty et al [10], assessing the implementation of a mother-to-child transmission of HIV-1 prevention program in Cameroon, also revealed significant association of HIV-1 with sexual initiation during adolescence and multiple lifetime number of sex partners in 13-45 year-olds women surveyed during the program implementation. In Democratic Republic of Congo, a low economic status remained negatively associated with HIV in the multivariate analysis; as HIV-positive females in this country were also less likely to live in rural areas, one can suggest that modernization played a role in the development of risky sexual behaviors among female respondents from this country, by exposing, for example, young women who had access to media to perverse audio-visual programs. These programs might have spurred their willingness to start sexual activity earlier and engage in other risky sexual behaviors such as multiple lifetime number of sexual partners that was significantly associated with HIV in univariate analysis (OR, 2.89, 95% CI, 1.2-8.03).

Females engaging in early sexual activity were more likely to have been tested positive for HIV compared to their male counterparts, even in the countries where the association between early sexual debut and HIV infection was not statistically significant. Moreover, it is also important to underline that, overall, the magnitude of the association between HIV and risky sexual behaviors (multiple lifetime number of sexual partners and irregularity of



condom use) was greater in females compared to males in the four countries. These findings are congruent with the gender imbalance regarding the risk of HIV acquisition, with women being more vulnerable to the infection because they engage more in risky sexual behaviors and are unable to impel condom use to their partners [5].

These findings should be interpreted in light of several limitations. First of all, in the four countries, the sample sizes of HIV-positive males were too small to yield significant results. In addition, there was no available data for some important variables such as cumulative concurrency and most recent partner's age in the Congo datasets; therefore, we could not include them in the standard model to assess their impact on the relationship between early sexual debut and HIV infection. Moreover, the cross-sectional nature of the data did not allow us to make causal inferences between HIV infection and early sexual debut among respondents of the four countries included in the study. Finally, information on first sexual intercourse and other predictors were dependent on self-reporting, which may have introduced a recall bias. Indeed, even though we used an imputed age at first sex and limited our focus on respondents in the youngest age groups (15-19 and 20-24 year olds) to minimize the effect of recall bias, it still may have occurred with regard to the age at first sex among respondents aged 20-24, since most of them reported late sexual debut in the four countries.

In our study, HIV was significantly associated with early sexual debut and multiple lifetime number of sexual partners, at least in the univariate analysis, among females in Cameroon and Democratic Republic of Congo. These findings show that, delaying first sexual intercourse should be encouraged but could not be a sufficient strategy when attempting to reduce HIV among young people. Sexual education programs should be targeted to all high-risk sexual behaviors that may lead to

HIV/AIDS. Moreover, emphasis should be put on sexual education of young women in Cameroon and Democratic Republic of Congo. In conclusion, our study suggests that a simplistic analysis of HIV traditional risk factors hardly explain the differences observed between central African countries and by gender in the spread of the infection. Therefore, a more in-depth analysis of the socioeconomic, cultural, and even political contexts of sexual partnerships should be conducted if we are to understand why transmission is more rapid in some central African settings compared to others and among females compared to males.

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