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# Descriptive Epidemiology of HIV Risk Factors Among Men: Chad Vs Cameroon

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## ABSTRACT

### Descriptive Epidemiology of HIV Risk Factors Among Men: Chad Vs Cameroon.

By

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April 26<sup>th</sup> 2017

#### **Introduction**

HIV remains a severe global health problem. The Republic of Chad is moderately affected (1.3%), compared to Cameroon who suffers more of the burden of the HIV/AIDS (4.5%). We described the HIV risk factors in two neighboring Central African Republics, and compared the gaps in both countries.

#### **Methods**

This was a retrospective cross-sectional study; data was obtained from the Demographic and Health Survey. A stratified multi-stage cluster sample design was conducted. The sample size was 5248 in Chad and 7191 in Cameroon. We used SAS to fit a multilevel logistic model, and conducted a multivariate analysis.

#### **Results**

The median age of respondents was 30 (IQR, 20-40) years in Chad, and 28 (IQR, 20-40) in Cameroon. Only 12.45% reported had ever been tested for HIV in Chad, (41.77% in Cameroon). In Chad, 46.40% of participants did not know a place to get HIV test, (11.15% in Cameroon). The median number of lifetime sexual partners was 2 (IQR, 1-4) in Chad, and 6 (IQR, 3-15) in Cameroon. Among Chadian participants 31.63% had only one lifetime sexual partner, (10.76% in Cameroon). In Chad 86.95% of participants reported having no sex partner other than their spouse in the last 12 months; (57.3% in Cameroon).

#### **Conclusion**

Condom use and HIV testing rates were very low among Chadian men comparing to Cameroonian men; however, Cameroonian men were more likely to engage in multiple sexual partners and extra-marital relationship than Chadian men.

Keywords: HIV testing, HIV risk factors, Condom use, sexual partners, Chad, Cameroon;

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APPROVAL PAGE

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## Author's Statement Page

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## Chapter I. Introduction

### i. Background

The Human Immunodeficiency Virus (HIV) responsible for the Acquired Immune-Deficiency Syndrome (AIDS) remains a severe global health problem; discovered more than three decades ago, the HIV/AIDS has speedily entered the list of the deadliest infections. Its high incidence and prevalence particularly in developing world, which is a threat to the achievement of the Sustainable Development Goals (SDG), has led the World Health Organization (WHO) and its partners to reconsider several times the proper techniques and strategies to fight and control it. The report shows a decline in new infections of 38% from 2001 (3.4 million) to 2013 (2.1 million) **(1)**. However, the more recent report showed that the incidence among adults aged 15 years and older has remained steady with an estimate of 1.9 million new cases from 2010 to 2015 **(2)**.

About two million children worldwide were living with HIV in 2011, and 370,000 were infected during the same year **(3)**; more than 90% of the mother to child transmission were reported in sub-Saharan Africa where more than 90% of HIV infections in children under the age of 15 are due to mother-to-child transmission **(4)**. In June 2016, the United Nations General Assembly (UNGA) has set an ambitious goal of ending AIDS by 2030. According to the plan, three milestones should be reached by 2020: reduce global incidence to less than 500000 cases, reduce mortality to less than 500000 deaths, and eliminate HIV-related stigma and discrimination **(2)**.

The Republic of Chad as other sub-Saharan African countries affected by this scourge, though at a moderate level, is taking the same preventive approach. According to 2014 nationally representative survey, by the Demographic Health Survey (DHS) the national

prevalence was 1.3 % **(5)**. The first study that detected and reported the presence and circulation of HIV in Chad was carried out in 1989; and found a seroprevalence rate varying from 0 to 1.1% **(6)**. However, the peak of the epidemic was reached in 2002 with a national seroprevalence of 3.4% among adults aged 15 years or older **(7)**. In 2011, the ministry of health set a challenging objective with different international partners, to reduce the transmission of HIV from mother to her baby from 32% to 5% by the end of 2015 **(8)** and take other preventive measures. According to the UNAIDS 2016 estimates, Chad is among the very few countries that have reversed the HIV incidence by more than 50% change in new HIV infections among adults (aged 15 years and older), from 2005 to 2015 **(2)**.

Although significant effort has been made these recent years, the Republic of Chad is yet to reach its targets; the health system is crippled by a deficit of medical staff, and lack of real coordination at the central level. Nonetheless, the international partners have played a major role in the coordination and support to the ministry of health (MOH).

On the other hand, the Republic of Cameroon has stronger health care system, and is more equipped comparing to Chad, regarding health care facilities and qualified human resources; but paradoxically suffers more of the burden of the HIV/AIDS. Indeed, according to the UNAIDS report, the prevalence of HIV among adults aged 15 years and older was 4.5% in 2015 **(9)**. This prevalence reached a peak of 5.4 % in 2000 **(10)**. Thus, Cameroon has one of the highest HIV prevalence in Central Africa, despite its potential to better carry out the fight against the disease. According to the UNAIDS 2016 estimates, Cameroon is among the countries which have observed a 25–49% increase in the HIV incidence among adults (aged 15 years and older), from 2005 to 2015 **(2)**. So, are HIV

risk factors more prominent among populations in Cameroon than those in Chad? This is the question we will answer at the end of this study.

## **ii. Justification of the study**

Whereas it is accepted that with targeted interventions, the risk of HIV can be significantly reduced, the republics of Chad and Cameroon are still lagging behind, comparing to countries like Senegal, or the Democratic Republic of Congo (DRC), despite huge investment in the program. In Chad, this may be explained by the deficit of regular monitoring and evaluation of the national HIV/AIDS program. However, also, very few or no investigations are conducted by the domestic staffs to suggest an improvement in the surveillance and preventive methods to the government. International institutions write most reports; their data collections are mainly done in the cities. However, 80% of the Chadian population lives in the rural area **(11)** where HIV surveillance system is weak. The DHS dataset we used for this analysis was a nationally representative data collected in all the regions and included rural and urban areas.

Finally, this study is an attempt to independently quantify the magnitude, and the description of the risk factors associated with HIV distribution in two neighboring Central African Republics, and to compare the gaps in both countries.

## **iii. Objectives**

### **Main Objective:**

To describe the distribution of the HIV risk factors in both Chad and Cameroon and make an epidemiological comparison between the two nations.

### **Specific objectives:**

1. To compare the proportion of voluntary screening among rural and urban areas in both countries;
3. To determine and compare the frequency of STDs in regions of both countries;
4. To assess the magnitude of knowledge about HIV among populations in both countries;
5. To assess the and compare the proportion of condom use in both countries;
6. To compare the number of sexual partners among populations in both countries;

## **Chapter II: Literature Review**

### **i. Countries presentation**

The Republics of Chad and Cameroon are two neighboring countries in Central Africa, Cameroon is in the South-West of Chad. The North-East of Cameroon and South-West regions of Chad have much in common; some parts of these areas have similar geographic and demographic distribution with same ethnic groups across the two countries. However, the rest of the countries are very different, and there is enormous diversity in each country.

The Republic of Chad is a landlocked territory located between the 7<sup>0</sup> and 24<sup>0</sup> North latitude and 13<sup>0</sup> and 24<sup>0</sup> East longitude, with an area of 1 284 000 km<sup>2</sup> and an estimated population of 12 448 175 (12). According to the general census, 57% of the population has less than 18 years old, and 50.7 % are female; geographically speaking 47% of Chadians live in the 10% of the Southern part (13).

Since 1988, Chad has adopted the district based health system; the ministry of health skeleton has three pyramidal levels. The first or central level which comprises the general and technic directions (in the Ministry of health); the second or intermediary level, makes up of health delegations (with regional hospitals); and the third or peripheral level includes health districts ( with district hospitals), and health areas (with primary care centers). Therefore, administratively, the Republic of Chad is divided into 23 regions (with health delegation in each region); which comprise 77 official health districts and around 773 functional primary health centers (14). As the rest of the governmental sectors in Chad, the ministry of health is crippled by long-term corruption, and as a result, the populations is faced with multiple infectious diseases outbreaks every year, and high rate of infant

and maternal mortality. According to the UNDP human development index 2015 report, Chad is classified 185 over 188 (15).

Cameroon is in on central African coast and shares borders with Gabon, Congo, and Equatorial Guinea on the South, with Nigeria on the West, with the Central African Republic on the East, and with Chad in the North borders. Cameroon has a land mass area of 475,000 km<sup>2</sup> and a projected population of about 23,924,000 in 2016 (16); it is divided into ten administrative regions which are then organized into 58 districts, 360 sub-districts, and 339 councils; the health system has three levels as similar in Chad: the central, intermediate and peripheral level (17). According to the UNDP report on human development index, Cameroon is classified 153<sup>rd</sup> over 188 (15)

## **ii. History of HIV in Chad and Cameroon**

The history of HIV/AIDS goes back to the late 20<sup>th</sup> century with probably several decades of silent period when the disease was unknown or unreported until June 5, 1981 when the Centers for Disease Control and Prevention (CDC) published in their Morbidity and Mortality Weekly Report (MMWR), cases of immune system deficiencies associated with rare lung infection, *Pneumocystis carinii* pneumonia (PCP), in Los Angeles (18). On September 24, the term “AIDS” (acquired immune deficiency syndrome) was used by CDC for the first time, and they released the first case definition of AIDS: “a disease at least moderately predictive of a defect in cell-mediated immunity, occurring in a person with no known cause for diminished resistance to that disease.”(19)

On May 20, 1983, Professor Luc Montagnier, of the Pasteur Institute in France and his team reported for the first time the isolation of a retrovirus named Lymphadenopathy Associated Virus (LAV), probably the etiology of AIDS (20). Later that same year, in November 1983, Dr. Robert Gallo's lab at the National Institute of Health in the United States (US) grew the AIDS virus in immune system cells; and the next year, on April 23, 1984, it was announced that Dr. Robert Gallo and his colleagues had discovered the cause of AIDS, the retrovirus Human T-cell Lymphotropic Virus-3 (HTLV3)(21). In June 1984, Dr. Robert Gallo and Professor Luc Montagnier held a joint press conference and announced that LAV and HTLV3 are almost certainly identical and are the likely cause of AIDS.

On January 11, 1985, the CDC revised the AIDS case definition to note that AIDS is caused by a newly identified virus and issued provisional guidelines for blood screening (22). In May 1986, the International Committee on the Taxonomy of Viruses declared that the pathogen agent responsible for AIDS would officially be known as Human Immunodeficiency Virus (HIV). Moreover, Pr Montagnier will be awarded later the Nobel Prize in Medicine for its discovery. In February 1987, the World Health Organization (WHO) launched The Global Program on AIDS to raise awareness, to initiate research, and to formulate policies. That same year, the Food and Drug Administration (FDA) in the US approved the first antiretroviral drug, zidovudine (AZT), and the Western Blot blood test kit, a more specific test for HIV antibodies (23). In October 1987, AIDS became the first disease ever of main concern at the United Nations (UN) General Assembly. The General Assembly decided to mobilize the entire UN system in the struggle against AIDS worldwide and the WHO was assigned to be the leader.

In 1988, the WHO declared December 1<sup>st</sup> to be the first World AIDS Day. The same year, the UNAIDS reported that women are more affected by HIV/AIDS in sub-Saharan Africa than men.

In the Republic of Chad, several investigations were conducted in the late eighties in different regions with the aim of detecting the presence of circulation of the HIV. However, none of the reports revealed the presence of the HIV infection among populations (24, 25, 26, 27, 28). The first investigation to reveal the presence of HIV in Chad was carried out by Louis et al. (29) in 1989 and reported a prevalence varying among regions from 0 to 1.1%, the southern parts sharing border with Cameroon were the most affected; the report showed no presence of HIV in the Northern regions. Since then the epidemic has perniciously evolved to reach a peak in 2002 with a national prevalence of 3.4% among adults aged 15 years or older **(7)**.

There were only seven infectious diseases surveillance sites in Chad in 1999; however, with the introduction of HIV in the regions, the ministry of health supported by partners has improved the monitoring system, by 2003 there were 17 surveillance sites in the countries; which has improved the report. Alarmed by the reports, the health authorities took following actions. First, the national prevention of mother-to-child transmission (PMTCT) of HIV program was established in 2002. In 2005, the national prevalence of 3.3%(30) was estimated. Consequently, the report showed a decline in the prevalence of HIV among pregnant Chadian women from 5% in 2002 to 3.1% in 2010(31).

Different programs and groups played important roles in the fight against HIV/AIDS in Chad. Within the ministry of health, the national program of combating HIV (Programme National de Lutte Contre le VIH or PNLV), this program is managed by National staffs

and supported by partners such as the WHO, UNFPA, and UNICEF. The program oversees elaborating the national protocol and guidelines usually based on the WHO/UNAIDS recommendations. Nonetheless, the obstacles that faced the team is the lack of financial and qualified human resources to conduct regular monitoring and evaluation of the program, the implementation of activities in some regions, and regular surveillance in the regions.

In Cameroon, the first case of HIV has been reported in 1986 (32). As in Chad, the infection was rampant and little was done effectively to stop its progression at that early stage. However, unlike its neighbor Chad, the Cameroonian health system was better in place to fight the epidemic. The level of education is higher among Cameroonian population comparing to Chadian. Moreover, the critical lack of qualified national staffs that can conduct monitoring/evaluation as mentioned in Chad may not be observed in Cameroon at the same level. However, the HIV infection scaled up quickly among the Cameroonian populations. The epidemic is disproportionately distributed among regions. The antenatal care PMTCT (ANC/PMTCT) was established in 2000 to impact the incidence of the infection. In 2004, the Men as Partners (MAP) (33) program was initiated to improve men participation in the PMTCT program. Similarly, to the organization in Chad, the Cameroonian Ministry of health has established the National AIDS Control Committee (NACC) that monitor the progress of infection in the regions, and implement protocols.

On January 28, 2003, President George W. Bush created the U. S President's Emergency Plan For AIDS Relief (PEPFAR). That same year on March 31, the Bill and Melinda Gates Foundation awarded 60 million US dollars as a grant to the International Partnership for

Microbicides to support research and development to prevent transmission of HIV. In Cameroon the PEPFAR program began in 2009-2010, the PEPFAR initiative is administered by CDC and UNAIDS, and aligns with the Cameroonian HIV/AIDS strategic plan in the areas of PMTCT; HIV counseling, screening and testing; prevention of sexual HIV transmission; blood safety; HIV care and support; and laboratory strengthening (34). The Republic of Chad does not benefit from the PEPFAR program; the main external support comes from the WHO, UNFPA, and UNICEF.

One of the fact to be acknowledged is that the U.S institutions have played a major role in the history and evolution of the HIV/AIDS more than all the rest of the countries combined. Relatively recent inventions, protocols, or pharmaceutical products made in the U.S have shaped the future of the pandemic. On May 7, 1993, the FDA approved the female condom; that same year, on December 18, the CDC expanded the case definition of AIDS, declaring that those with CD4 counts below 200 to have AIDS (35). In that same *MMWR*, CDC added three new conditions: pulmonary tuberculosis, recurrent pneumonia, and invasive cervical cancer to the list of clinical indicators of AIDS. In 1995 Saquinavir the first protease enzyme inhibitor was approved by the FDA. This has revolutionized a new era of highly active antiretroviral therapy (HAART) (36).

In 1996, several improvements were approved by the FDA including the first HIV home testing and collection kit, the viral load test, the first non-nucleoside reverse transcriptase inhibitor (NNRTI) drug, Nevirapine (NVP) and the first HIV urine test. In 1997, on September 26, Combivir, a combination of two antiretroviral drugs in one tablet was approved (36). The CDC reported the first substantial decline in AIDS deaths in the United

States largely credited using HAART. However, the UNAIDS estimated that year that 30 million people were infected worldwide (37).

In 1999, the WHO estimated that 33 million people were living with HIV worldwide, 14 million have died of AIDS; thus, the HIV/AIDS has become the fourth biggest killer worldwide and the number one killer in Africa (38). Later that year the CDC released a new HIV case definition to help expand the surveillance efforts and to more accurately track the changing course of the epidemic (39).

In September 2000 within the Millennium Declaration, the United Nations adopted the Millennium Development Goals (MDG), which included a specific goal of reversing the spread of HIV/AIDS, malaria, and TB. In July 2002, UNAIDS reported that HIV is the new leading cause of death by far in sub-Saharan Africa and the number four biggest global killer. Average life expectancy in sub-Saharan Africa fell from 62 years to 47 years because of AIDS. During that year, approximately 3.5 million new infections occurred in sub-Saharan Africa, and the epidemic claimed the lives of about 2.4 million people in Africa (40).

On June 10, 2004, leaders of the “Group of Eight” (G8) Summit called for the creation of a “Global HIV Vaccine Enterprise,” a consortium of government and private-sector parties assigned the coordination and research to find an effective HIV vaccine. However, up to now, the HIV vaccine is yet to be approved although several laboratories are working on it at different levels of clinical trial. Although, the treatment has tremendously improved with HAART and the life expectancy for people receiving ART now approaches normal life expectancy in some countries (41). However, despite this progress HIV/AIDS remains among the biggest killers in sub-Saharan Africa.

### **iii.Epidemiology of HIV in Chad and Cameroon**

Globally, it is estimated that 35 million people were living with HIV at the end of 2013 (1). From the very beginning of the reported cases to the present, approximately 79 million people were infected with HIV, and 39 million died worldwide. However, the pandemic is inequitably distributed across demographics and regions; sub-Saharan Africa bears the heaviest burden. Indeed, 71% of people living with HIV (PLHIV) are in Africa (42). The high-burden countries are Southern African countries (43).

Women are the most affected; it is estimated that of the global 35 million PLHIV, 16 million are women, and 80% of them live in sub-Saharan Africa (1). Most recent data from countries surveillance system show prevalence among women of reproductive age attending antenatal care service (ANC) of 41.1% in Swaziland, 30.4% in Botswana, 29.5% in South Africa, 24.3% in Lesotho, and 18.8% in Namibia; however, the prevalence is lower in some countries, less than 1% of ANC attendees in Senegal, Mauritius or Eritrea (43).

In Chad, although the national prevalence is relatively lower (comparing to its neighbor Cameroon), HIV is a big concern in large cities and among women. The epidemiology of HIV/AIDS in Chad was insidious within the first decade of its introduction because no serious measure was taken by the authorities to counteract its spread. Most of the actions were undertaken by non-governmental organizations (NGOs) to inform the populations about the disease, its mode of transmission, and measures of protection. The emphasis was on education and sexual behavior change. Young people were trained to educate

their fellows about the use of condoms in the communities, in high schools and colleges, but mainly in large cities, because HIV was still unknown and remained taboo in many regions of Chad.

HIV is disproportionately distributed among Chadian regions; the Southern regions bear the highest burden, this is probably due to the proximity with Cameroon and the Republic of Central African where HIV prevalences are higher (respectively 4.5% and 3.7%) than in Chadian regions **(9)**.

In 2005 the national survey **(44)** estimated the prevalence at 3.3% at national level. However, the report showed the prevalence in the urban areas of 7% and 2.3% in the countryside. According to that survey, the capital city (N'djamena) had the second highest HIV prevalence in the country (8.3%) following the region of Logone Occidental (9.8%). Nonetheless, from 2005 to 2015, there was a progressive decline in the incidence of HIV in Chad due to communities' mobilization, mass campaign awareness, and programs focusing on behavior change. The national survey conducted in 2014 showed a prevalence of 1.3% **(5)**.

In Cameroon, HIV/AIDS is among the top public health priorities, according to the recent estimations and surveys, the prevalence was 4.5% in 2015 **(9)** among adults aged 15 years and older and 620000 PLHIV. This was the second highest HIV prevalence in Central Africa in 2015, following its neighbor country, the Equatorial Guinea with a prevalence of 4.9% among adults 15 and older **(9)**. However, as in Chad, HIV is unevenly distributed, the prevalence decreases from the Northern regions (with 1,2% in extreme North to 5.5% in Adamawa) to the Southern regions (with 5.7% in South West, to 7.2% in South region) **(45)**. Women bear the highest burden, according to the national survey

carried out among pregnant women in 2009 (7.6%) and 2012 (7.8%), HIV was, unfortunately on rising among this group **(45)** and again women living in the Southern regions were the most concerned (with prevalence reaching 9.5% in South region and 11.9% in central region). As in Chad HIV transmission in Cameroon is mainly heterosexual **(46)**, and the mother to child transmission rate is high in both countries, the estimated rate was 17% in 2013 according to the WHO report **(47)**. However, a respondent-driven sampling survey carried out by Park JN et al. among a group of MSM in Yaoundé and Douala the two biggest cities in Cameroon, showed high HIV prevalence of 47.3% (98/207) and 28.6% (73/255) respectively **(48)**.

#### **iv.HIV risk factors in Chad and Cameroon**

To effectively prevent HIV infection, the WHO promote key components of health intervention and behavior change in the communities, which consist of combination of approaches including reduction of number of sexual partners, correct and consistent use of condoms, delaying in sexual debut, HIV testing and counseling, treatment for STIs and circumcision **(49)**.

Although Men are known to be more frequently involved in risky behavior comparing to women in sub-Saharan Africa, they, however, fall less victim to HIV. In Cameroon, as in Chad sexual behavior varies from one region to another, and there is sometimes enormous discrepancy due to cultural, educational, and religious factors. Premarital sex is still viewed as a break with tradition, but the reality is that it is more and more acceptable and less relevant among the new generation.

In Cameroon, a study showed that the percentage of sexually active adolescents before marriage varies from 8% in the Northern regions to 69% in the Central and Southern parts (50); new data might even surmount these statistics. According to the 2004 national demographic health survey, the mean age of first sexual intercourse was 16.5 years (51) and, a study carried out by N. Lydié et al. (52) in the capital city, Yaounde found that the median age at first sexual intercourse was 16 for men and 17 for women; in addition, 55.7% of the men had had two or more partners in the last 12 months, whereas 66.3% of the women had had only one partner. More recent survey conducted among 2660 high school students aged 16-19 years old in Yaounde showed 64.3% had their first heterosexual contact when they were between 10 and 16 years old, the mean age at the first sexual debut was 15.3 years; and 43.6% of the sexually active participants had at least two partners (53).

In Chad also, the average age at first sexual intercourse is low, 15.9 years for boys and 18.9 years for girls (54) according to a recent survey by Rwenge JRM et al. (54), 10.7 % of males and 19% of girls aged 15-19 years and 9.7% of boys and 35.5% of girls aged 20-24 years in Chad have experienced their first sexual intercourse, whereas in Cameroon these statistics were respectively 11.5% and 18% for boys and girls aged 15-19 years old, and 10.7% and 21.6% for males and girls aged 20-24 years.

Although, studies showed that married adolescents girls in sub-Saharan Africa are particularly at higher risk of HIV comparing to girls that completed their adolescence prior to marriage (55), surveys in some countries including Cameroon has contradicted this result (56, 57), concluding that girls that get married at older age are at increased risk for HIV because of longer period between first sexual intercourse and first marriage.

A more recent study conducted among university students in Northern Cameroon concluded that there were alarming risks of sexual behavior among this group, 80.3% of the participants had exposure with pornographic viewing and was positively associated with HIV risk; The frequency of premarital sex was 92.8 % with a significant male predominance (58).

Generally, HIV risk is inversely associated SES. However, recent studies have contradicted this finding among Cameroonian women, who despite their higher educational level, and good standing in life have high HIV prevalence comparing to women with a lower educational level (59). Despite their good knowledge about HIV infection, this group of women reported engaging in the risky sexual behavior. Similar observation was made among wealthy Cameroonian men who conversely with high SES have high HIV prevalence because they are frequently involved in risky behaviors such as non-regular sexual partners, increased exposure to STDs, increased concurrencies, and lifetime sexual partners (60). Among both men and women of this group, there was reported decreased condom use with other partners. A study conducted in Kenya has revealed that wealthy women are more likely to engage in materialism, and therefore asking frequently for an expensive gift such as cars, cell phones, or cash, which are drivers of transactional sex (61). However, we did not come across in the literature if this finding could be extrapolated to the Cameroonian population.

The national demographic health survey conducted in 2014 in Chad found that 0.7% of Chadian women aged 15-49 years old were engaged in multiple sexual partnerships within the last 12 months, however this proportion was found to be 3% among women with higher educational level, the average number of lifetime sexual partners was 1.3 for

women with less education and 1.8 for women with higher education (62). Among men of 15-49 years old, 16% reported having multiple sexual partners in the last 12 months; there was no significant difference between educational or SES levels (62).

Another HIV risk factor among populations in Chad and Cameroon frequently reported in the literature is the infrequent use of a condom. A survey conducted among Cameroonian students found 43.4% did not use a condom during the first sexual intercourse (58). A recent study conducted in the region of Northwest revealed that 72% of 414 adolescents that participated reported inconsistent condom use, 35% reported having used condom at last sexual intercourse, and 56% reported having used condom at least once (63). A similar survey conducted among high school students in Yaoundé showed 52.1% of the sexually active adolescent girls used condoms, among them 41.5% used it occasionally, and 6.4% had regular unprotected sex (53).

On the other hand, Chad is among the sub-Saharan countries with the lowest condom use. According to the national survey in 2004, only respectively 9.5% and 3.5% of sexually active boys and girls aged 15-19 years used a condom at their first sexual intercourse (64). The more recent national survey, conducted in 2014-2015 reported that, among the women aged 15-49 years old that had multiple sexual partners, 20% reported using a condom, and condom use were significantly higher among women with tertiary education (38.7%). However, among men aged 15-49 years old with multiple sexual partners, only 7.6% used a condom; nonetheless, condom use was significantly higher among men with highest educational level (42.2%) and higher SES (25.7%) (62).

Alcohol consumption is more and more being reported as positively associated with risk of acquiring HIV infection because under the influence of alcoholic beverage consumers are tempted to engage in unprotected sex irrespective of the partner profile (65). In Cameroon, as in Chad, alcohol consumption is not uncommon, according to the WHO report, about 41.4% of men and 25.8% of women consume alcohol regularly in Cameroon (66). In Chad, according to 2014 WHO global status report on alcohol and health, 37.5% of males aged 15 and older and 24.7% of females aged 15 and older consume alcohol (67). Kongnyuy EJ et al. analyzed the Cameroon Demographic Health Survey (DHS Cameroon) 2004, among the 2678 married men participants aged 15 to 59 years, 25.8% reported taking alcohol before their last sexual intercourse and 21% indicated that their last sexual intercourse was with a woman other than their wife or cohabiting partner (68).

#### **v. HIV counseling and testing services in Chad and Cameroon**

HIV testing and counseling is the single most important step for treatment and prevention. The UNAIDS has set an ambitious goal for the control and prevention of the HIV pandemic, one of the targets includes that 90% of PLHIV should know their HIV status by 2020 (69). The proportion of PLHIV that are aware of their status has increased globally over the last decade; in sub-Saharan Africa, it was estimated that only 10% of people with HIV knew their situation (70), however, in 2015 it was estimated that 55% of all individuals with HIV in Africa and 60% of people with HIV globally knew their status (71). There is a discrepancy between the proportion of men and women who had HIV test in Low and Middle-income countries; report showed that about 70% of adult HIV tests done in 2014

were conducted for women alone (72). This could be explicated by the increase in maternal health activities and the incorporation of PMTCT care packet of the antenatal care.

Despite the increase in HIV testing in sub-Saharan Africa where the burden of the disease is even higher, many people still don't know their status; and many of those who dare to attend the voluntary and counseling test (VCT) do not return for their results, hence the WHO estimates that less than 40% of PLHIV know their status (73). In Cameroon as well as in Chad the testing rates are low. According to the CNLS (Comite National de Lutte Contre le Sida), surveys conducted in Cameroon in 2008, showed that 40.8% of people got tested for HIV, but this percentage declined gradually to 24.6% in 2009, and then with an upward trend in 2012 reaching 41% (74). Moreover, another study revealed that 36% of infected men and 30% of infected women never tested for HIV (75). In a retrospective analysis of records in 6 district hospitals in Douala (second biggest city), Ngangué P et al. found that among the 32,020 analyzed records, the failure to return rate was 14.3% among people who had counseling and testing between January 2009 and December 2013 (76); reasons for not returning for their results were various including housewife status or having a positive/undetermined/requiring confirmation result, and provider-initiated testing and counseling.

In Chad, the screening rate is among the lowest in central Africa; according to a national survey in 2004, only 0.4% of women had HIV test and received their results, comparing to 4% for men (64). A more recent survey carried out in 2014, revealed that 41% of women knew where to get the HIV test, but only 14% got tested and received their results; 2% did not return for their results. However, the report showed that there was significant

difference among educational level, with 73% of HIV testing among women with higher education and only 8% of women with lower educational attainment got tested; significant difference was also observed among different SES levels, 37%, and 7% respectively for women of high and low SES (62). Among men, 51% knew where to get tested, but only 14% did the test and received their results; testing was higher among wealthier and educated men (62).

Counseling and screening are the core step in the control and prevention HIV/AIDS. It is the cornerstone that links people to care and enable them to initiate ART or induce behavior change in the community. Since the approval of the rapid diagnostic test in the 1990s, the screening method for HIV has been simplified and expanded to the remote areas around the world. However voluntary screening that allows people to know their status is still a problem; according to the WHO, millions of people still ignore their positive status and unwillingly continue to transmit the virus to their partners, some people are aware of their positive serology too late when HAART could not improve their health. HIV screening is also beneficial for individuals identified as HIV seronegative or seroconcordant negative couples, as the counseling provides access to HIV prevention services, including condoms, male circumcision and other awareness of the risk factors. The main purpose of the national protocols should include maximum early tracking of seropositive individuals in the community. To make the service of HIV screening test easier and accessible, the WHO recommends the use of rapid diagnostic tests (RDT) rather than the conventional laboratory-based diagnostics such as enzyme immunoassay (EIA) (77). Although the WHO supports the mandatory HIV and other blood borne viruses test prior to transfusion of blood, it clearly opposes the mandatory testing of people;

therefore, the WHO recommends practitioners to adhere to the 5Cs: Consent, Confidentiality, Counseling, Correct test results and Connections to treatment, care and prevention services; which protect the human rights (78, 79).

To improve the overall HIV testing the WHO has recently introduced the new HIV self-testing (HIVST), a new initiative to help achieve the United Nations 90–90–90 targets (80), and specifically the first target of diagnosing 90% of all people with HIV by 2020 (69). HIVST is intended to complement the already existing testing methods; in addition, it aims at reaching more men, and adolescents in developing countries; the WHO also recommend that “voluntary assisted partner notification services should be offered as part of a comprehensive package of testing and care provided to people with HIV” (81).

The WHO acknowledges the need to give high priority to increased access to HIV screening services for adolescents and to support approaches to improving adherence to treatment and retention in care for adolescents living with HIV (ALHIV). It is necessary to consider Post-test support particularly for teens, and standards for quality post-test counseling are needed because the lack of linkages between testing, and subsequent care discourages adolescents from seeking HIV testing in the first place (82).

Screening policies also target children and adolescents; in 2012, it was reported that 630 000 infants, children, and young adolescents below 15 years had been started on ART, representing a 28% coverage rate among children in need of ART (83); once again it can't be stressed enough that screening was determinant. This coverage follows increased emphasis on PMTCT programs that included early infant diagnosis and early initiation of ART for infants. The main hindrances to HIV screening include stigma and discrimination.

HIV testing for newborns and infants less than two years is challenging, the presence of maternal anti-HIV antibody makes it impossible to use standard RDT to diagnose infection in HIV-exposed infants up to 18 months of age. However, more complex and costly virologic tests such as nucleic acid testing (NAT) can be performed to detect the presence of the virus itself (84).

In 1995, after perinatal transmission of HIV was proven to be substantially reduced by administration of AZT to HIV seropositive pregnant women and their babies it was recommended in the United States that all pregnant women be counseled and encouraged to undergo voluntary testing for HIV (85, 86). The recommendation will be gradually improved and expanded to the rest of world. It is reported that about 40% of pregnant women in low- and middle-income countries were counseled and tested in 2012, up from 26% in 2009 (87); The Republic of Chad has failed to make progress in that matter too, indeed up to now there are no national HIV testing guidelines, but the Chadian PMTCT program relies on the WHO HIV screening guidelines.

In Chad, there is low access to HIV test screening which is partially due to low ANC coverage. However, the ministry of health recommends systematic proposition of HIV counseling and testing to anybody accessing a medical service nationwide. However, this recommendation is not observed in practice. Testing coverage among pregnant women in Chad was 7% in 2012 it was the lowest coverage in the group of high burden countries followed by Democratic Republic of Congo 9%, and Nigeria 19%; whereas countries like Zambia, Mozambique, South Africa, and Botswana have respectively greater than 95%; in addition, Chad has only 4% of early infant diagnosis which was the lowest coverage (83).

## **vi.HIV Management and PMTCT programs in Chad and Cameroon**

HIV treatment is one of the key factors for the prevention and control of the epidemic among the communities. Since the discovery of the first drug, significant efforts have been made to improve the protocols, and new drugs with fewer side effects which have tremendously improved patient's adherence to treatment and care.

Since it was discovered that AZT could lower the risk of transmission of HIV from the pregnant mother to its baby in 1995 (86), enormous effort has been made to treat infected pregnant women and to prevent mother to child transmission of HIV. Indeed, it is known that in the absence of any intervention the likelihood of vertical transmission of HIV is 15-45% (5–10% during pregnancy, 10–20% during labor and delivery and 5–20% through breastfeeding); antiretroviral (ARV) drugs can reduce this transmission to less than 5% in breastfeeding and to less than 2% in non-breastfeeding (87, 88). However, in sub-Saharan Africa where 80% of HIV-seropositive women live (1), there are still many obstacles such as stigma or discrimination that prevent the uptake of the PMTCT national programs. In 2000 the first WHO recommendation for ARV drugs for PMTCT guidelines (89) including short-course prophylaxis starting late in pregnancy or during labor, with single-dose NVP for mothers and infants had changed considerably. These treatment guidelines have been updated several times, in 2004, 2006, 2010 and recently the edition of 2013(79) recommends early and immediate initiation of ART for pregnant women living with HIV, serodiscordant couples, people with TB-HIV co-infection, people with hepatitis

B-HIV co-infection, and children less than 5 years old living with HIV, irrespective of their CD4 cell count.

For the PMTCT, these guidelines recommend two options: “providing lifelong ART to all pregnant and breastfeeding women living with HIV regardless of CD4 count or clinical stage or providing ART for pregnant and breastfeeding women with HIV during the mother-to-child transmission risk period and then continuing lifelong ART”(79). Therefore, the terms option A, B, and B<sup>+</sup> are no longer used. To simplify the HIV management and to improve adherence to treatment, the new WHO guidelines recommends a regimen of TDF + 3TC or FTC + EFV, taken as single fixed-dose combination pill once daily, which is safer and affordable (79). As countries shift toward TDF-based regimens, the use of a fixed-dose combination of the single pill should continue to be given priority (90).

For the adults living with HIV the CD4 threshold for treatment of is being raised to 500 cells/mm<sup>3</sup>. The new guidelines for HIV treatment in adults, adolescents, and infants is provided in the WHO 2016 recommendations (91).

Globally, the ART coverage for all people living with HIV reached an estimate of 41% (15 million people) in 2015 (92). Nonetheless, the developing world is lagging in term of ART coverage.

The Republic of Chad is among the 21 priority African countries identified in the “Global Plan towards the elimination of new HIV infections among children by 2015 and keeping their mothers alive” (93) these high-burden countries account for 90% of the pregnant women living with HIV. Nonetheless, the report shows that there has been a decline from 26% in 2009 to 17% in 2012 of mother to child transmission (79).

In 2011 in Chad, the reported number of people receiving ART was 32832 out of 100000 estimated eligible people, making 33% of the ART coverage. However, in 2012 the ART coverage has increased to 40% (40856 people received ART out of 100000 estimated) (83). For 20000 children, eligible for ART only 1531 (8%) received in 2011, but the increase was significant in 2012 when over 20000 eligible children, 5842 (29%) received it (83). For an estimated 13000 pregnant women living HIV needing ART for PMTCT in 2011, 1311(13%) received it; a slight scale up was observed in 2012 when out 12000 pregnant women in need of ART for PMTCT 1680 (14%) received it (83). In Chad, the ministry of health still adopts the former WHO Option B regimen (initiation of ART to all pregnant women living with HIV, lifelong if treatment-eligible, or through the end of the mother-to-child transmission risk period if not eligible for treatment) the latest guidelines were established in Mai 2011 (94).

## **Chapter III: Methods**

### **Study design and setting**

This was a retrospective cross-sectional study, in which we did a quantitative, and secondary analysis of data. We used data obtained from the Demographic and Health Survey (DHS) for Chad and Cameroon: Chad DHS-2014-15, and Cameroon DHS-2011. DHS data are available from the DHS website (<https://dhsprogram.com/>). DHS surveys are designed to be nationally representative as well as at the first administrative levels; but not at the subnational levels. Data was collected by DHS in Chad and Cameroon among men aged 15-59 years old, the questionnaire included modules on HIV knowledge, sexual behavior, condom use, HIV testing, sociodemographic information, and STIs.

### **Sample collection**

In each country, a stratified multi-stage cluster sample design was conducted in urban and rural areas. The sample size was 5248 in Chad and 7191 in Cameroon. Data was collected in Chad from October 2014 to April 2015; in Cameroon from January to August 2011. Participants were asked whether they have ever been tested for HIV, used condom during sex with last partner, the total number of life time sexual partners, the number of sexual partner excluding wife during the last 12 months, their educational level, their wealth index, their marital status, and history of STIs. The possible answers for some categorical variables were “No”, “Yes”, and “Don’t know”.

## Description of variables

Our two dependent variables were “ever been tested for HIV”, and “condom use during last sex with most recent partner”. These variables were dichotomized into “Yes” or “No” based on the response to the question “have you ever been tested for HIV?”, and “did you used condom during sex with your most recent partner?” respectively. There were two missing values for condom use, and were not included in the analysis.

Covariates were grouped into two categories consisting of HIV knowledge and risk factors (“know a place to get HIV test”, “a healthy-looking person can have HIV”, “ever heard of HIV”, “have ever paid anyone in exchange for sex”, “had any STI in the last 12 months”, “had genital sore/ulcer in the last 12 months”, “don’t know any source for condoms”, “total lifetime number of sex partners”, “number of sex partners excluding spouse in the last 12 months”, “children should be taught about condoms to avoid AIDS”, and “know a place to get HIV test”), and sociodemographic characteristics included age, educational level, wealth index, marital status and type of place of residence.

The possible answers to the variable “Educational level” were coded “no education”, “primary”, “secondary” and “higher”. But we decided to regroup the participants into “primary or less”, “secondary”, and “higher”. Wealth index was coded as “poorest”, “poorer”, “middle”, “richer”, and “richest”; we decided to regroup these answers into “lower” (for poorest and poorer), “middle” (for middle), and “upper” (for richer and richest). Marital status was coded as “never in union”, “married”, “living with partner”, “widowed”, “divorced”, and “no longer living together/separated”; we reorganized the respondents into “never in union”, “married/living with partner”, “divorced/widowed/separated”.

Continuous variables were categorized and proportions were compared using a chi-squared test.

## **Statistical analysis**

In the first part of the analysis we computed the proportions of the sociodemographic characteristics and the distribution of HIV knowledge and risk factors in both countries for comparison, and the difference in the data (Chad-Cameroon) was noted (table 1 and 2).

In the second part of the analysis we fitted a separate multilevel logistic model for each country for the outcome variable “Ever been tested for HIV” and “condom used during last sex with most recent partner”. The two explanatory variables were used in interaction with sociodemographic covariates and HIV knowledge and risk factors covariates. The Estimated Odds Ratios (EOR) were obtained from the logistic regression models, and the 95% confidence interval. Chi-square was used for p-values (tables 3, 4, 5, and 6).

Finally, we conducted a separated multivariate analysis with the two outcomes variable in each country looking for interaction between knowing a place to get HIV test and ever tested for HIV. In this multivariate logistic regression, we controlled for the variable age, wealth index, marital status, educational level and place of residence (table 7). The last multivariate logistic regression model looked at the interaction between knowing a source of condom and condom use. For this model, we adjusted for the variables age, wealth index, marital status, educational level, and place of residence.

All statistical analyses were performed using Statistical Analysis System software, SAS<sup>®</sup> 9.4 for window. A P-value of less than 0.05 was considered statistically significant. Microsoft Excel was used to display tables and graphs.

## **Ethics**

Prior to this survey the DHS questionnaires and procedure have been reviewed and approved by the by the ICF International Institutional Review Board (IRB), and by each host country IRB. Before each interview, an informed consent statement is read to the participant, who may accept or decline to participate (See more at: <http://dhsprogram.com/>). The ICF International IRB procedure complies with the U.S. Department of Health and Human Services regulations for the protection of human subjects (45 CFR 46). In Addition, we submitted a research application to the Georgia State University Review Board and we obtained an IRB waiver (IRB Number: H17467, Reference Number: 343492).

## **Chapter IV: Results**

### **Sociodemographic characteristic of the participants**

In Chad, 5248 participants were included in the study, whereas in Cameroon the sample size was 7191. The median age of respondents was 30 (IQR, 20-40) years in Chad, and 28 (IQR, 20-40) in Cameroon. Most of the participants (70.05%) in Chad had only primary education or none, in Cameroon 42.46% never attended school or had only primary educational level. Almost half of the participants (49.58%) in Cameroon lived in rural areas, whereas majority (71.1%) of Chadians lived in rural areas. Majority of participants (60.65%) in Chad were married or living with partner; in Cameroon 50.55% were married or living with partner. The wealth index was similar in both countries, at all levels as shown in table 1.

### **HIV Knowledge and risk factors distribution among participants**

HIV testing was very low in Chad, only 12.45% reported had ever been tested for HIV, in Cameroon 41.77% had been tested before. In Chad, 46.40% of participants did not know a place to get HIV test, whereas 11.15% did not know where to get a test. The median number of lifetime sexual partners was 2 (IQR, 1-4) in Chad, and 6 (IQR, 3-15) in Cameroon. Among Chadian participants 31.63% had only one lifetime sexual partner, 10.76% Cameroon had only one lifetime sex partner. In Chad 86.95% of participants reported having no sex partner other than their spouse in the last 12 months; in Cameroon, the proportion was 57.3%. Among the respondents in Chad and Cameroon, 6.65% and 32.53% respectively reported using condom during last sex with most recent

partner; 54.49% and 11.85% of participants respectively in Chad and Cameroon did not know any source for condoms. The proportion of people who reported having ever paid anyone in exchange for sex was respectively 9.33% and 4.96% in Chad and Cameroon. Only 1.11% of Chadians have had a STI in the last 12 months, the proportion was 3.98% in Cameroon. Among respondents in Chad, 18.05% never heard of AIDS whereas in Cameroon the proportion was 1.63%. Respectively, 17% and 10.36% of participants in Chad and Cameroon believed that a healthy-looking person cannot have HIV; 41.48% and 27.02% in Chad and Cameroon considered that children should be taught about condoms to avoid HIV. Table 2 shows the details of the distribution.

### **Bivariate association between Condom use and the Sociodemographic characteristics**

As shown on the table 3, in Chad, the age group 20-24 years old had the highest condom use during last sex with most recent partner (2.55%), with an estimated odds ratio (EOR) of 0.79 (0.54, 1.2). In Cameroon, the highest rate of condom use with most recent partner was observed among the age group 25-34 years (10.37%) with an EOR of 0.24 (0.19, 0.29). In both countries participants with upper level of wealth index had the highest rate of condom use with most recent partner, 5.24% with an EOR of 5.46(3.71, 8.04) in Chad; and 21.13% with an EOR of 4.43(3.82, 5.14). There was significant difference between those that reported “Yes” and “No” (P value <0.001) among this group in both countries. People that reported never been in union in both countries had the highest rate of condom use with most recent partner (4.89% in Chad, and 21.31% in Cameroon). Urban

respondents in both countries used more condom with their most recent partner compared to people living in the rural areas (4.67% in Chad and 21.96% in Cameroon).

### **Bivariate association between Condom use and HIV risk factors**

Condom use during last sex with most recent partner was highest among participants who reported having 2-5 lifetime sexual partners in both Chad and Cameroon, (3.21% and 12.76% respectively) with EOR of 2.13 (1.45, 3.15) and 1.25 (1.02, 1.55) respectively.

Among those that ever heard of AIDS, 6.49% used condom during last sex with most recent partner in Chad with an EOR of 6.5 (2.87, 14.68). In Cameroon 32.5% (EOR 4.85(1.73, 13.56)) of participants who ever heard of AIDS, used condom with most recent partner, and there was statistically significant difference between those who responded “Yes” and “No” to condom use with most recent partner (P value 0.0026). Condom use with most recent partner was low among Chadians who reported ever paid anyone in exchange for sex (1.95% with EOR 5.06 (3.73, 6.87)). In Cameroon 2.49% of those who used condom with last partner responded having ever paid someone for sex with an EOR of 2.19(1.7, 2.8). The detail of bivariate associations is shown in the table 4.

### **Bivariate association between HIV test and sociodemographic characteristics**

The table 5 shows that the proportion of people who reported ever tested for HIV increased with age in both countries. The highest rate of HIV test was in age group  $\geq 35$  years (5.49% with EOR 6.32(4.33, 9.22) in Chad, and 17.87% with EOR 6.02 (5.14, 7.06) in Cameroon). The lowest rate of ever been tested for HIV was observed among individuals with highest educational level in both countries (2.04% with EOR 28.14 (20.05,

39.5) in Chad), and 6.56% with an EOR 11,8(9.44, 14.77) in Cameroon). The highest proportion of people who reported ever been tested was observed among individuals with wealth index of upper level in both countries (8.6% with EOR 2.74 (2.23, 3.37) in Chad, and 25.87% EOR 4.37(3.89, 4.9) in Cameroon). Chadian and Cameroonians who were married or living with partner had highest HIV test, respectively 8.08% with EOR 1.41(1.18, 1.7) and 25.94% EOR 2.44 (2.2, 2.69). More people had ever received HIV test among urban than rural residents; 7.53% and 26.16% among urban resident in Chad and Cameroon respectively.

### **Bivariate association between HIV test and HIV risk factors**

As shown in table 6, 15.2% of respondents who had ever been tested for HIV knew a place to get HIV test in Chad, whereas, in Cameroon the proportion was 42.49%. The proportion of people who have ever been tested for HIV was highest among individuals with 2-5 total lifetime sexual partners; 7.20% in Chad, with EOR of 2.14 (1.68, 2.74), In Cameroon the proportion was highest among respondents with 10 or more lifetime sex partners, 22.76% with EOR 5.02 (4.1, 6.15). There was low HIV testing among people who reported having an STI in the last 12 months (0.36%) in Chad; In Cameroon, the proportion was 2.23% (EOR 1.83 (1.45, 2.33)). In Chad 12.45% of those who ever heard of AIDS had been tested at least once; the proportion is 41.79% in Cameroon. The proportion of HIV testing is low among people who reported ever paid for sex in both countries; 3.29% with EOR 3.52(2.79, 4.45) among Chadians; and 2.45% with EOR of 1.04 (0.81, 1.32) among Cameroonians.

**Multivariate logistic regression: interaction between knowing a source of condom and condom use.**

After controlling for confounding variables such as age, wealth index educational level and the place of residence, the adjusted odds ratio of interaction between knowing a source of condom and condom use was 0.17(0.1, 0.3) in Chad and 0.1(0.06, 0.17) in Cameroon.

**Table 1:** Sociodemographic distribution of Chadian and Cameroonian Men, Demographic and Health Survey (Chad DHS 2014-15, and Cameroon DHS 2011)

	<b>Chad N (%)</b>	<b>Cameroon N (%)</b>	<b>Difference</b>
Population, N	5248 (100)	7191 (100)	
<b>Age in year (median, IQR)</b>	30(20, 40)	28(20, 40)	2
<b>Educational level</b>	5248	7191	
primary or less	3676 (70.05)	3053 (42.46)	27.59
Secondary	1400(26.68)	3558(49.48)	-22.8
Higher	172(3.28)	580(8.07)	-4.79
<b>Wealth index</b>	5248	7191	
Lower	1704 (32.47)	2419 (33.64)	-1.17
Middle	1099 (20.94)	1474 (20.50)	0.44
Upper	2445 (46.59)	3298 (45.86)	0.73
<b>marital status</b>	5248	7191	
never in union	1926 (36.70)	3187(44.32)	-7.62
married/living with partner	3183 (60.65)	3635 (50.55)	10.1
Div/wid/sep	139 (2.65)	369 (5.13)	-2.48
<b>Type of place of residence</b>	5248	7191	
Urban	1515(28.87)	3626(50.42)	-21.55
Rural	3733(71.13)	3565(49.58)	21.55

Difference: Quantitative difference between Chad and Cameroon data

Div/wid/sep: Divorced, widowed or separated

IQR: Interquartile range

**Table 2:** Distribution of HIV knowledge and risk factors among Chadian and Cameroonian men, Demographic and Health Survey (Chad DHS 2014-15, and Cameroon DHS 2011)

	<b>Chad N (%)</b>	<b>Cameroon N (%)</b>	<b>Difference</b>
<b>Population, N</b>	5248 (100)	7191 (100)	
<b>Ever been tested for HIV, N (%)</b>	5246	7191	
No	4593(87.55)	4187(58.23)	29.32
Yes	653(12.45)	3004(41.77)	-29.32
<b>Know a place to get HIV test</b>	4297	7070	
No	1994(46.40)	788(11.15)	35.25
Yes	2303(53.60)	6282(88.85)	-35.25
<b>Total lifetime number of sex partners</b>	4000	5992	
1	1265 (31.63)	645 (10.76)	20.87
2 – 5	2005 (50.13)	2128 (35.51)	14.62
6 – 9	316 (7.90)	951 (15.87)	-7.97
>=10	414 (10.35)	2268 (37.85)	-27.5
median, IQR	2(1, 4)	6(3, 15)	-4
<b>Number of sex partners, excluding spouse, in last 12 months</b>	5233	7171	
0	4550 (86.95)	4109(57.30)	29.65
1	588 (11.24)	1966(27.42)	-16.18
2 – 5	85 (1.62)	963 (13.43)	-11.81
6 – 9	3 (0.06)	77 (1.07)	-1.01
>=10	7 (0.13)	56(0.78)	-0.65
<b>Condom used during last sex with most recent partner</b>	3684	5533	
No	3439(93.35)	3733(67.47)	25.88
Yes	245(6.65)	1800(32.53)	-25.88
<b>Don't know any source for condoms</b>	5219	7150	
No (source known)	2375(45.51)	6303(88.15)	-42.64
Yes (no source known)	2844(54.49)	847(11.85)	42.64
<b>Children should be taught about condoms to avoid AIDS</b>	4229	7036	
No	1754(41.48)	1901(27.02)	14.46
Yes	1913(45.24)	4887(69.46)	-24.22
Don't know/ depends	562(13.29)	248(3.52)	9.77
<b>Heard about other STIs</b>	5130	7146	
No	2083(40.60)	833(11.66)	28.94
Yes	3047(59.40)	6313(88.34)	-28.94
<b>Had genital sore/ulcer in last 12 months</b>	5205	7180	
No	5156(99.06)	6958(96.91)	2.15
Yes	34(0.65)	212(2.95)	-2.3
Don't know	15(0.29)	10(0.14)	0.15
<b>Had any STI in last 12 months</b>	5221	7164	
No	5158(98.79)	6868(95.87)	2.92
Yes	58(1.11)	285(3.98)	-2.87
Don't know	5(0.10)	11(0.15)	-0.05
<b>Ever heard of AIDS</b>	5246	7189	
No	947(18.05)	117 (1.63)	16.42
Yes	4299(81.95)	7072(98.37)	-16.42
<b>A healthy-looking person can have HIV</b>	4240	7056	
No	721(17.00)	731(10.36)	6.64
Yes	2379(56.11)	6004(85.09)	-28.98
Don't know	1140(26.89)	321(4.55)	22.34
<b>Have ever paid anyone in exchange for sex</b>	3954	5501	
No	3585(90.67)	5228 (95.04)	-4.37
Yes	369(9.33)	273(4.96)	4.37

Difference: Quantitative difference between Chad and Cameroon data  
IQR: interquartile range

**Table 3:** Bivariate association between condom use and sociodemographic characteristic of Chad and Cameroonian men, (Chad DHS 2014-15, Cameroon DHS 2011)

	Condom used during last sex with most recent partner							p value*
	Chad			Cameroon				
	No N=3438 (93.35%)	Yes N=245 (6.65%)	EOR (CI)	P Value*	No N=3733 (67.47)	Yes N= 1800 (32.53)	EOR (CI)	
<b>AGE group</b>								
15-19	143 (3.88)	51 (1.38)	1		178 (3.22)	380 (6.87)	1	
20-24	331 (8.98)	94 (2.55)	0.79(0.54, 1.2)	<.0001	356 (6.43)	528 (9.54)	0.69(0.55, 0.87)	<.0001
25-34	1051 (28.53)	75 (2.04)	0.2 (0.14, 0.3)	0.0047	1130 (20.42)	574 (10.37)	0.24(0.19, 0.29)	<.0001
>=35	1914 (51.95)	25 (0.68)	0.04 (0.02, 0.06)	<.0001	2069 (37.39)	318 (5.75)	0.07 (0.06, 0.08)	<.0001
<b>Educational level</b>								
primary or less	2617 (71.04)	45 (1.22)	1		1928 (34.85)	447 (8.08)	1	
Secondary	717 (19.46)	165 (4.48)	13.38 (9.53, 18.8)	<.0001	1550 (28.01)	1107 (20.01)	3.08 (2.7, 3.5)	<.0001
Higher	105 (2.85)	35 (0.95)	19.4(11.96, 31.42)	<.0001	255 (4.61)	246 (4.45)	4.16 (3.4, 5.01)	<.0001
<b>Wealth index</b>								
Lower	1260 (34.20)	31 (0.84)	1		1534 (27.72)	285 (5.15)	1	
Middle	742 (20.14)	21 (0.57)	1.15 (0.65, 2.02)	0.0034	779 (14.08)	346 (6.25)	2.391 (2.0, 2.86)	0.0892
Upper	1437 (39.01)	193 (5.24)	5.46(3.71, 8.04)	<.0001	1420 (25.66)	1169 (21.13)	4.43 (3.82, 5.14)	<.0001
<b>marital status</b>								
never in union	331 (8.98)	180 (4.89)	1		516 (9.33)	1179 (21.31)	1	
married/with partner	3054 (82.90)	52 (1.41)	0.03(0.02, 0.04)	<.0001	3023 (54.64)	505 (9.13)	0.07(0.06, 0.08)	<.0001
div/wid/sep	54 (1.47)	13 (0.35)	0.44 (0.24, 0.83)	0.0042	194 (3.51)	116 (2.10)	0.26 (0.20, 0.34)	0.7895
<b>Type of place of residence</b>								
Urban	803 (21.80)	172 (4.67)	1		1559 (28.18)	1215 (21.96)	1	
Rural	2636 (71.55)	73 (1.98)	0.13 (0.01, 0.17)	<.0001	2174 (39.29)	585 (10.57)	0.34 (0.30, 0.38)	<.0001

EOR: Estimated Odds Ratio

CI:95% Confidence Interval

Div/wid/sep: Divorced, widowed or separated

\*: chi-square

**Table 4:** Bivariate association between condom use and HIV risk factors among Chadian and Cameroonian men (Chad DHS 2014-15, Cameroon DHS 2011)

	Condom used during last sex with most recent partner							p value*
	Chad			Cameroon				
	No N=3438 (93.35%)	Yes N= 245 (6.65%)	EOR	p value*	No N=3733 (67.47)	Yes N=1800 (32.53)	EOR	p value*
<b>Total lifetime number of sex partners</b>								
1	1083 (29.45)	34 (0.92)	1		333 (6.03)	153 (2.77)	1	
2 – 5	1763 (47.93)	118 (3.21)	2.13 (1.45, 3.15)	0.06	1220 (22.11)	704 (12.76)	1.25 (1.02, 1.55)	0.0001
6 – 9	274 (7.45)	27 (0.73)	3.14 (1.86, 5.3)	0.237	607 (11)	296 (5.36)	1.06(0.84, 1.35)	0.8153
10+	313 (8.51)	66 (1.79)	6.72 (4.36, 10.35)	<.0001	1561 (28.28)	645 (11.69)	0.9 (0.73, 1.11)	0.0015
<b>Number of sex partners, excluding spouse, in last 12 months</b>								
0	2967 (80.63)	32 (0.87)	1		2263 (40.95)	204 (3.69)	1	
1	421 (11.44)	165 (4.48)	36.34 (24.5, 53.79)	0.9705	989 (17.90)	974 (17.63)	10.92 (9.23, 12.93)	<.0001
2 – 5	43 (1.17)	42 (1.14)	90.56 (52.27, 156.92)	0.9822	412 (7.46)	551 (9.97)	14.84(12.24, 18)	<.0001
6 - 9	0(0)	3 (0.08)	***	0.964	39 (0.71)	38 (0.69)	10.8 (6.76, 17.28)	0.0691
>=10	4 (0.11)	3 (0.08)	69.54 (14.95, 323.38)	0.9788	24 (0.43)	32 (0.58)	14.8(8.55, 25.6)	0.0029
<b>Had any STI in last 12 months</b>								
No	3369 (92.02)	233 (6.36)	1		3529 (64.05)	1695 (30.8)	1	
Yes	46 (1.26)	9 (0.25)	2.83 (1.37, 5.85)	0.7107	182 (3.30)	95 (1.72)	1.09 (0.84, 1.4)	0.4154
Don't know	3 (0.08)	1 (0.03)	4.82 (0.5, 46.52)	0.368	7 (0.13)	2 (0.04)	0.6(0.12, 2.87)	0.486
<b>Ever heard of AIDS</b>								
No	482 (13.09)	6 (0.16)	1		40 (0.72)	4 (0.07)	1	
Yes	2955 (80.26)	239 (6.49)	6.5 (2.87, 14.68)	<.0001	3691 (66.73)	1796 (32.5)	4.85 (1.73, 13.56)	0.0026
<b>Have ever paid anyone in exchange for sex</b>								
No	3130 (86.18)	165 (4.54)	1		3577 (65.05)	1649 (30)	1	
Yes	266 (7.32)	71 (1.95)	5.06 (3.73, 6.87)	<.0001	136 (2.47)	137 (2.49)	2.19 (1.7, 2.8)	<.0001

EOR: Estimated Odds Ratio

CI:95% Confidence Interval

\*: chi-square

\*\*\*: >999.999 (<0.001, >999.999)

**Table 5:** Bivariate association between HIV test and sociodemographic characteristics of Chadian and Cameroonian men, (Chad DHS 2014-15, Cameroon DHS 2011)

	Ever been tested for HIV							
			Chad		Cameroon			
	No N=4593 (87.55%)	Yes N=653 (12.45%)	EOR (95% CI)	P value	No N=4187 (58.23)	Yes N=3004 (41.77)	EOR (95% CI)	p value
<b>AGE group</b>								
15-19	1191(22.70)	31(0.59)	1		1377(19.15)	235(3.27)	1	
20-24	624(11.89)	111(2.12)	6.84 (4.54, 10.3)		717(9.97)	474(6.59)	3.88 (3.23, 4.64)	0.1133
25-34	1027 (19.58)	223 (4.25)	8.34(5.68, 12.26)		843 (11.72)	1010(14.05)	7.02(5.95, 8.28)	<.0001
>=35	1751 (33.38)	288 (5.49)	6.32(4.33, 9.22)		1250(17.38)	1285 (17.87)	6.02 (5.14, 7.06)	<.0001
<b>Educational level</b>								
primary or less	3472 (66.18)	203 (3.87)	1		2228(30.98)	825(11.47)	1	
secondary	1056 (20.13)	343 (6.54)	5.56(4.6, 6.7)	0.6646	1851(25.74)	1707(23.74)	2.5 (2.25, 2.77)	<.0001
higher	65 (1.24)	107 (2.04)	28.14(20.05, 39.5)	<.0001	108 (1.50)	472(6.56)	11.8 (9.44, 14.77)	<.0001
<b>Wealth index</b>								
Lower	1574 (30)	130 (2.48)	1		1866 (25.95)	553 (7.69)	1	
middle	1026 (19.56)	72 (1.37)	0.85 (0.6, 1.15)	<.0001	883 (12.28)	591 (8.22)	2.26(1.2, 2.6)	0.2013
upper	1993 (37.99)	451 (8.60)	2.74 (2.23, 3.37)	<.0001	1438 (20)	1860 (25.87)	4.37(3.89, 4.9)	<.0001
<b>marital status</b>								
never in union	1735(33.07)	189(3.60)	1		2224(30.93)	963(13.39)	1	
married/with part	2759 (52.59)	424 (8.08)	1.41 (1.18, 1.7)	0.0062	1770 (24.61)	1865 (25.94)	2.44 (2.2, 2.69)	<.0001
div/wid/sep	99 (1.89)	40 (0.76)	3.71(2.5, 5.52)	<.0001	193 (2.68)	176 (2.45)	2.1 (1.7, 2.62)	0.0052
<b>Type of place of residence</b>								
Urban	1119(21.33)	395(7.53)	1		1745(24.27)	1881(26.16)	1	
Rural	3474(66.22)	258(4.92)	0.21 (0.18, 0.25)	<.0001	2442(33.96)	1123(15.62)	0.427 (0.39, 0.5)	<.0001

EOR: Estimated Odds Ratio

CI:95% Confidence Interval

\*: chi-square

**Table 6:** Bivariate association between HIV test and HIV risk factors among Chadian and Cameroonian men, (Chad DHS 2014-15, Cameroon DHS 2011)

	Ever been tested for HIV							
	Chad		EOR (95% CI)	P value*	Cameroon		EOR (95% CI)	p value*
No N=4593 (87.55%)	Yes N=653 (12.45%)	No N=4187 (58.23)			Yes N=3004 (41.77)			
<b>Know a place to get HIV test</b>								
No	1994(46.42)	0(0%)	1		788(11.15)	0(0)	1	
Yes	1649(38.38)	653(15.20)	***	0.925	3278(46.36)	3004(42.49)	***	0.931
<b>Total lifetime number of sex partners</b>								
1	1172(29.31)	92(2.30)	1		496(8.28)	149(2.49)	1	
2 – 5	1716 (42.92)	288 (7.20)	2.14 (1.68, 2.74)	<.0001	1253 (20.91)	875 (14.60)	2.33 (1.9, 2.85)	0.114
6 - 9	240 (6.00)	76 (1.90)	4.04 (2.89, 5.64)	0.003	476 (7.94)	475 (7.93)	3.32(2.66, 4.15)	<.0001
10+	247 (6.18)	167 (4.18)	8.62 (6.45, 11.5)	<.0001	904 (15.09)	1364 (22.76)	5.02 (4.1, 6.15)	<.0001
<b>Number of sex partners, excluding spouse, in last 12 months</b>								
0	4082(78.03)	467(8.93)	1		2663(37.14)	1446(20.16)	1	
1	446(8.53)	141(2.70)	2.77 (2.24, 3.42)	0.955	999(13.93)	967(13.48)	1.79 (1.6, 2)	0.282
2 – 5	51 (0.97)	34 (0.65)	5.83(3.74, 9.09)	0.967	460 (6.41)	503 (7.01)	2.01 (1.75, 2.32)	0.702
6 - 9	0(0%)	3 (0.06)	***	0.958	31 (0.43)	46 (0.64)	2.74 (1.73, 4.33)	0.081
>=10	4 (0.08)	3 (0.06)	6.56 (1.47, 29.4)	0.969	22 (0.31)	34 (0.47)	2.85 (1.66, 4.89)	0.09
<b>Had any STI in last 12 months</b>								
No	4523(86.66)	633(12.13)	1		4042(56.42)	2826(39.45)	1	
Yes	39(0.75)	19(0.36)	3.5 (2, 6.06)	0.966	125(1.74)	160(2.23)	1.83 (1.45, 2.33)	0.112
Don't know	5(0.10)	0(0)	**	0.971	6(0.08)	5(0.07)	1.19 (0.36, 3.91)	0.835
<b>Ever heard of AIDS</b>								
No	947(18.06)	0(0)	1		117(1.63)	0(0)	1	
Yes	3644(69.49)	653(12.45)	***	0.954	4068(56.59)	3004(41.79)	***	0.937
<b>Have ever paid anyone in exchange for sex</b>								
No	3103(78.52)	480(12.15)	1		2687(48.85)	2541(46.19)	1	
Yes	239(6.05)	130(3.29)	3.52 (2.79, 4.45)	<.0001	138(2.51)	135(2.45)	1.04 (0.81, 1.32)	0.785

EOR: Estimated Odds Ratio

CI:95% Confidence Interval

\*: chi-square

\*\*\*: >999.999 (<0.001, >999.999)

\*\*\*: <0.001 (<0.001, >999.999)

**Table 7:** Interaction between knowing a source of condom and condom use

Variable	Condom use	
	Chad AOR	Cameroon AOR
Don't know any source for condoms		
No (source known)	1	1
Yes (no source known)	0.17 (0.10, 0.3)	0.1(0.06, 0.17)
Age	0.38(0.33, 0.44)	0.39(0.36, 0.42)
Wealth index	1.55(1.2, 1.99)	1.53(1.36, 1.71)
education level	2.49(1.93, 3.2)	1.44(1.3, 1.61)
place of residence	0.45(0.23, 0.68)	0.74(0.61, 0.89)

Multivariate logistic regression, adjusted for Age, Wealth index, educational level, and place of residence.

AOR: Adjusted Odds Ratio

## **Chapter V: Discussion and Conclusion**

### **Sociodemographic characteristic of the participants**

We observed that the age distribution is similar in Chad and Cameroon. However, there was significant difference in educational level among participants in these countries; with very low level in Chad where 70.05% of the respondents had only primary education or none, compared to 42.46% in Cameroon. This difference is also shown in the human development index report 2015 (15) of adult literacy rate. Cameroonian men were equally distributed in rural and urban areas, whereas majority of Chadian men lived in the rural areas (71.1%), even though wealth index was similar in both countries, at all levels.

### **HIV Knowledge and risk factors distribution among participants**

We found that very high percentage (46.40%) of Chadian men did not know where to get the HIV test, resulting in very low HIV testing, only 12.45% reported having ever been tested. This could be explained by the fact that in Chad majority of testing centers are in the cities, however, most Chadian (71.1%) live in the rural areas; in addition, majority of testing centers are linked to ANC activities and PMTCT program which does not include men yet. Nonetheless, previous national surveys have shown even lower proportion (7.04%) of HIV testing among men in Chad (95). These results in Chad are substantially different from the finding in Cameroon where 11.15% did not know a place to get the HIV test, and the proportion of ever testing for HIV was 41.77%.

On the other hand, this survey shows that Chadian men have lower number of lifetime sexual partner, the median was 2 (IQR, 1-4) comparing to Cameroonian, the median of 6

(IQR 3-15) and substantial proportion of Chadian men (86.96%) reported being faithful to their wives whereas 57.30% of Cameroonians were loyal to their partners in the last 12 months. This difference could be partially explained by the even distribution of Cameroonians in the rural and urban areas, and the difference in tradition and culture among the communities.

Majority of Chadian men did not know a source for condoms (54.49%) thus, very few reported using condom during last sex with most recent partner (6.65%), whereas in Cameroon 11.85% did not know a source for condoms, and 32.53% had a protected sex with most recent partners. This substantial difference might be attributed to the fact that Chadian population is a more traditional society where discussion about condom and sex is still taboo. In addition, this survey shows that 41.48% of Chadian participants believed that children should not be taught about condoms to avoid AIDS; whereas 27.02% of Cameroonians were opposed to children's education about condoms.

In general Cameroonians were more knowledgeable about HIV than Chadian men; 98.37% of them heard of AIDS before, and 85.09% reported that a healthy-looking person can have HIV; whereas 81.95% of Chadian had ever heard of AIDS before and only 56.11% believe that a healthy-looking person could be HIV seropositive. These results show that there is need for more emphasis on HIV communication and education among Chadian men, which will substantially reduce the present prevalence and incidence of the infection among the communities.

### **Bivariate association between Condom use and the Sociodemographic characteristics**

Condom use with most recent partner was low among all age groups; the lowest rates were observed among age group  $\geq 35$  years old in both countries. This age group is associated with marriage, which is inversely associated with condom use with last partner in this survey. The highest rate of condom use was observed among men that reported never been in union in both countries but still substantially low in Chad. Condom use was more observed among urban than rural resident in both countries. The proportion was very low among rural respondents in Chad. This shows that condom distribution program should target also rural areas where important number of communities are exposed to HIV in both countries with more emphasis on Chad. Most wealthy people in both countries had highest condom use with last partner, probably because of their correlation with urban residencies where access to condom is easier comparing to provinces.

### **Bivariate association between Condom use and HIV risk factors**

Among Chadian participants the odds of condom use increases with the number of lifetime sexual partners. This could be explained by the fact that people with multiple sexual partners use condom mainly with another partner than their wife. Unlike in Chad the odds of condom use with last partner did not increase with number of life time sexual partner in Cameroon, where the lowest odds (0.9(0.73, 1.11)) were observed among people with 10 or more lifetime sexual partners.

Our results also show that the odds of condom use with last partner were higher among Chadian men comparing to Cameroonians, although the proportion of condom use were higher among Cameroonian. This could justify the fact that condom use could be improved in Chad if condom were distributed evenly in the regions. However, it should be

stressed that both countries need emphasis on condom use among communities, especially for men with multiple sexual partners.

We found that Chadian men were more likely to engage in compensation in exchange for sex than Cameroonian men and small percentage of them used condom, the odds of condom use were (5.06 (3.73, 6.87)) for Chadian and (2.19(1.17, 2.8)) among Cameroonians of this group. These findings might be the result of inconsistent availability of condoms where sex workers are employed in Chad.

### **Bivariate association between HIV test and sociodemographic characteristics**

HIV testing increased with age group in both countries, the highest testing was observed among the age group  $\geq 35$  years old. However, previous studies showed that youngers people are more at risk (7). Therefore, screening and testing activities in both countries should target more adolescents and young adults.

We also found that Condom use during last sex with most recent partner was strongly and positively associated with education level, people with higher education are likely to get HIV testing than individuals with secondary and primary education in both countries, however, this group represent an insignificant proportion of the population. Testing activities should also target people of lower education level.

There was also strong association between ever been test for HIV and upper level of wealth index in Chad (EOR 2.74(2.23, 3.37)) and in Cameroon (EOR 4.37(3.89, 4.9)). This correlate with the fact that wealthy people in these countries are more likely to be aged more than 35 years, and educated.

Rural residency was inversely associated with ever been tested for HIV in both countries (EOR 0.21 (0.18, 0.25) in Chad and EOR of 0.42 (0.39, 0.5) in Cameroon).

### **Bivariate association between HIV test and HIV risk factors**

Knowing a place to get HIV test was extremely positively associated with ever been tested in both countries. Perhaps, the low testing rate in Chad could be attributed to the lack of information about testing facilities in the regions. The odds of ever being tested for HIV among participants increased with the number of lifetime sexual partners in both countries. And there was strong positive association between having ever paying anyone in exchange for sex and ever being tested for HIV, among Chadian EOR 3.52(2.79, 4.45).

### **Multivariate logistic regression**

After controlling for potential confounding factors such as age, wealth index, educational level, place of residency, there was strong and positive association between knowing a place to get HIV test and ever being tested for HIV in both countries. However, after controlling for all these variables there was inverse association between knowing a source of condom and condom use in both countries. (AOR 0.17(0.1, 0.3) in Chad and 0.1(0.06, 0.17) in Cameroon).

### **Strengths and limitations**

Our study has several limitations, first as the data was collected from a survey, we conducted a cross sectional study from which we could not make a causal inference about our findings. Second, this survey was a self-reported sexual behavior in the communities

where open discussion about sex is still taboo, therefore is difficult to eliminate some biases such as under reporting and over reporting. Third, we did a comparative analysis between two neighboring countries; although data collection in both countries were done by the DHS and used the same methodology, however, the surveys were not conducted in the same period. In Chad, the survey was conducted in 2014-15, and in Cameroon in 2011, and therefore, it is possible that the findings might have changed little bit in Cameroon since 2011. Finally, in this study we defined our outcome variable as condom use during last sex with most recent partner. This does not allow us to capture the overall consistent and correct use of condom in the two countries.

Nonetheless, despite these limitations, our study used a DHS data which has a very good representativeness at the national and regional levels. Surveys were conducted in all the regions in both countries.

### **Implication for public health policies**

Our study has several implications for health policies, first, our findings suggest that there is crucial need to emphasize on HIV testing and screening among Chadian men, in the rural as well as in the urban areas. In addition, we found that HIV knowledge was very low among Chadian men, and low rate of condom use. The ministry of health and its partners should therefore focus more on HIV literacy among communities in Chad; not only in the cities but also in the regions where majority of people live. Also, the HIV prevention program in Chad should find a practical way to improve the poor rate of condom use which would decrease the HIV incidence.

In Cameroon, although there is also need to improve the rate of condom use and HIV testing, however, the main and dominant risk factor was multiple sexual partners.

Previous program in Uganda known as “zero-grazing” aiming at reducing multiple sexual partners, and concurrency among populations have shown to be very effective and was correlated with HIV reduction among communities (96).

## **Conclusion**

Condom use and HIV testing rates were very low among Chadian men comparing to Cameroonian men; and were positively associated with educational level and wealth index in both countries. However, Cameroonian men were more likely to engage in multiple sexual partners and extra-marital relationship than Chadian men. Although HIV knowledge was higher among respondents in Cameroon than those in Chad, STIs were observed more frequently among Cameroonian than Chadian men.

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