### **HIV Seroprevalence and associated factors among inmates in Bamenda Central Prison: a cross-sectional study** **in the Northwest Region (NWR)** **amidst the socio-political crisis**

**ABSTRACT**

**Introduction:** People in prison have multiple vulnerabilities to Human immunodeficiency virus (HIV) and other infections. Although the number of HIV infections has decreased worldwide, this trend is high in closed settings like prisons, making the HIV pandemic a major global health problem.

**Aims:** The drive of this study is to determine the prevalence of HIV and related risk behaviors among inmates of the Bamenda Central Prisons.

**Study design:** The study included inmates of all age groups, both male and female. Blood samples were used to determine the presence of HIV. Open-close, pre-tested questionnaires were administered to identify the risk factors associated with the infection.

**Place and Duration of Study:** The study was carried out in the Bamenda Central Prison located in the Bamenda I sub-division in the Northwest Region from April to July 2023.

**Methodology:** A total of 289 inmates of both sexes with an age range of 14-69 years took part in the study. Venous blood samples were collected to determine the prevalence of HIV, and pre-tested questionnaires were used to identify the risk factors. Data were analyzed using Statistical Product and Service Solutions. The Chi-square test was used for comparison of proportions and logistic regression were used to determine the risk factors. Variables with a p-value of <0.05 were considered statistically significant.

**Results:** HIV prevalence was 9.3% (27/289). A multivariate logistic regression analysis revealed that the risk factor associated with HIV status was age group > 20years (adjusted odds ratio (AOR) =0.14; 95% CI: 0.000- 0.589: p=0.025 for 20-30 years and AOR =0.16; 95% CI: 0.25- 0.589: p = 0.32 for inmates >30 years), married inmates (AOR = 0.014; 95% CI; 0.000- 0. 756: p= 0.033), inmates who were less than 5 in a room (AOR = 0.022; 95% CI: 0.002- 0.356: p= 0.003) and sexually active inmates (p<0.05). The risk of acquiring HIV was also common among inmates imprisoned because of crime related to sex (AOR= 31.91; 95% CI: 1.751- 581.620: p=0.19) and in those who did their previous test > 6 months ago (AOR = 348; 95% CI; 45.7- 2714.28: p= 0.000 for 6-12months and AOR = 211.9 95% CI; 12.6-3567.466: p= 0.000 for > 1year.

**Conclusions:** A higher prevalence of 9.3% recommends urgent exposure-control measures such as routine screening at the time of entry, periodic screening of all inmates, and treatment of positive cases. The risk factors identified are areas of interventions for HIV prevention addressed not only in prisons but also in the larger communities the inmates will meet after serving their prison terms.

**Keywords:** Human immunodeficiency virus, Inmates. Seroprevalence, Prison and Risk factors

**1 INTRODUCTION**

The human immunodeficiency virus (HIV) infection is a global problem and constitutes the leading cause of morbidity and death in Cameroon, affecting all age groups, genders, communities, etc. (1-4).

The Northwest Region of Cameroon has been deeply affected by the ongoing socio-economic and political instability (Anglophone crisis) with the violation of human rights that has negatively impacted society, resulting in shorter life spans, poor health conditions, a decrease in living standards and increased imprisonment in the Bamenda central prison (5, 6). In addition, most prisons in crisis-affected divisions have closed up, and inmates have been transferred to the Bamenda Central Prison, increasing the number of inmates ([7](http://www.prison-insider.com)). This has led to poor hygiene conditions that may affect the health care of inmates compounded by overpopulation ([7](http://www.prison-insider.com), 8)**.** Thus**,** infections such as HIV, tuberculosis, viral hepatitis (hepatitis B and C virus), chlamydia, gonorrhea, and syphilis are of significant concern for people detained in prisons and other closed settings (8-13). Worldwide, it is known that prisoners are more at risk of being infected with HIV, and the HIV burden among people living in prisons is higher than in the general population (11,14). This is worsened by prison conditions, which are characterized by overcrowding, boredom, as well as unsafe medical practices such as lack of condoms, sterile injection equipment, and inadequate or limited access to health services (13, 15).

Although there is a decline in HIV prevalence in Cameroon and other parts of the world (2, 4, 16 - 18), HIV prevalence among prisoners in Western Africa and other countries remains high compared to the general population (3, 15, 19, 20). In Cameroon, recent statistics are scarce, though, in 2016, it was estimated that HIV prevalence amongst inmates was 12% (21). As such, to meet the WHO target to end HIV/AIDS by 2030, it is recommended that routine, voluntary, and opt-out testing and treatment initiation for HIV infection be integrated into the routine health care of all, including inmates (4). Unfortunately, access to these recommendations is often unavailable in prisons and needs urgent attention.

Previous studies have identified low socioeconomic level, illiteracy, multi-use of equipment among people who inject drugs, coerced unsafe sex (homosexuality), tattooing, piercing, lack of HIV prevention programmers, multi-use of shaving razors, blood brotherhood rituals or from mother to child pregnancy or delivery as risk factors associated with HIV transmission in prisons (10, 19,-21). However, these factors cannot be universally accepted, considering the difference in study design and the nature of the prisons. As such, it is important to carry out similar research to identify all possible risk factors in different locations.

The National HIV/AIDS Strategy in Cameroon aims at reducing HIV incidence, increasing access to care, and improving health outcomes for HIV-infected people. To achieve these, it is important to understand changes in HIV prevalence and its related risk factors in all communities in Cameron. Considering that the Bamenda central prison is highly populated due to the many arrests in connection with the socio-political crisis, access to voluntary counseling, testing, and treatment is often not effective or nonexistent, as well as prevention commodities such as condoms, sterile needles, and syringes, disinfectant is not often available (7,11). Therefore, there is an urgent need to assess the prevalence of HIV and the associated risk factors in the Bamenda Central Prison. Data from this study will evaluate the effectiveness of current national strategies and also limit the spread of infection, considering that most of these inmates will go back to the community after serving their jail term.

**2 MATERIALS AND METHODS**

**2.1 Study design**

The study included inmates of all age groups, both male and female. Open-close, pre-tested questionnaires were administered to identify the risk factors associated with the infection.

**2.2 Study site.** The study was carried out in the Bamenda Central Prison located in the Bamenda I sub-division in the Northwest Region. It has a total of about 702 inmates and is divided into three units. These units include the juvenile, male, and female units.

**2.3 Sample size**

The sample size was calculated by using the following formula:

n =

Where n is the minimum sample size required, (Z21-α) is the critical value for a given confidence interval (1.96), p is the expected HIV prevalence in prison (12%) (21), and d represents a margin of sampling error (5%).

n= (1.96)2 × 0.12 ×(1 − 0.12) = 163

 0.052

Adding a 50% nonresponse rate (82), the minimum acceptable sample size of 245 inmates were required for the study.

**2.4 Selection criteria:**

**Inclusion criteria:** All voluntary inmates, irrespective of their gender, age, the reason for the detention, and those who signed the informed consent form, were eligible.

**Exclusion criteria:** Those excluded from the study include

* Those who refuse to sign the consent form
* Those on antiretroviral drugs.

**2.6 Data collection tool**

Pre-tested, open-ended questionnaires were administered to get information on sociodemographic and socioeconomic factors, living conditions, and sexual habits of the participants. Those who could read and write completed the questionnaires, and those who could not read and write were assisted by the researcher. The information was gathered with the aid of the prison attendants.

**2.7 Sample collection**

Venous blood samples were collected by trained laboratory personnel and transferred to an EDTA (Ethylenediamine tetra acetic acid) tube to prevent the blood from coagulating.

**2.8 Laboratory procedure**

**HIV diagnosis**

**First line test Alere Determine™ HIV–1/2 Ag/Ab Combo)**

The first line test was done using Alere Determine HIV 1 and 2 rapid test kits **(Abbott Diagnostics)** as described by the manufacturer (22). In brief, a total of 50 µl of whole blood was placed on the Alere determine HIV test strip and a drop of chase buffer was added on top of the blood and allowed to migrate. The results were read after 15 minutes. It was considered a positive test when two red lines appeared on the control and test lines.

**Confirmatory test using**

The confirmatory test was done usingthe OraQuick test kit as described by the manufacturer (23)**.** Exactly 50 µl whole blood was added directly to the developer solution vial. The absorbent pad was inserted into the OraQuick test device developer solution vial containing the plasma. The device was read within 20 to 40 minutes minutes. Interpret the results based on the appearance of lines in the designated "C" (control) and "T" (test) regions on the test device.

**2.9 Data analysis**

Data obtained from the laboratory was entered into Microsoft Excel and analyzed using the statistical Statistical Product and Service Solutions (SPSS) version 23. Descriptive statistics was used to compute the prevalence of HIV parasites and socio-demographic characteristics. Binary and multivariate logistic regression analyses were used to determine the risk factors. Variables with a p-value <0.25 in Binary logistic analysis were considered candidates for multivariable logistic regression, while variables with a p-value < 0.05 in the multivariable logistic regression analysis were considered risk factors. The level of significance was set at p<0.05.

**3 RESULTS**

 **3.1 Socio-demographic characteristics of the study participants**

Two hundred and eighty-nine (289) inmates with an age range of 14 – 69 years and a mean (SD) age of 34.83(10.99) years participated in this study. The majority, 95(32.9%) of the participants belonged to the age group 20–30 years. A higher number of the participants, 273(94.5%), were males, while 178(61.6%) of the participants were married. More than half of the participants, 247(85.5%), had attended secondary level education and were unemployed 223(77.2%). As concerns religion, many of the participants, 265(91.7%), were Christians. Regarding the prison characteristics of the participants, the majority of them 253(87.5%) were in the male detention unit, had been in detention for less than 2 years 185(64.0%), and most of them 262(90.7%) were in rooms that have more than 10 inmates (Table 1).

**Table 1: Socio-demographic and Prison characteristics of the study participants (n=289)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Variable** | **Category** | **Number** | **Percentage** |
| Age (years) | <20 | **95** | **32.9** |
| **20-30** | 20 | 6.9 |
| 31-40 | 89 | 30.8 |
| >40 | 85 | 29.4 |
|  |  |  |
| Gender  | **Male** | **273** | **94.5** |
| Female | 16 | 5.5 |
|  |  |  |
| Marital Status | Single | 111 | 38.4 |
| **Married** | **178** | **61.6** |
|  |  |  |
| Level of Education | Primary | 42 | 14.5 |
| **Secondary** | **247** | **85.5** |
|  |  |  |
| Occupation | **Unemployed** | **223** | **77.2** |
| Self-employed | 14 | 4.8 |
| Employed | 52 | 18.0 |
|  |  |  |
| Religion | **Christian** | **265** | **91.7** |
| Muslim | 24 | 8.3 |
| Detention Unit | **Male** | **253** | **87.5** |
|  | Female | 16 | 5.5 |
|  | Juvenile | 20 | 6.9 |
| Duration (years) | **<2** | **185** | **64.0** |
|  | 2-5 | 82 | 28.4 |
|  | >5 | 22 | 7.6 |
| Number in room | <5 | 10 | 3.5 |
|  | 5-10 | 17 | 5.9 |
|  | **>10** | **262** | **90.7** |

**3.2 Seroprevalence of HIV among the study population**

Out of the 289 inmates who participated in the study, 27 (9.3%) of them tested positive for HIV (Figure 1).

**Figure 1: Seroprevalence of HIV among the study population**

**3.3 Assessing the risk factors for HIV infection**

All variables in binomial logistic analysis that were significant (*p*-value ≤ 0.05) and those with *p-value* ≤0.25 were taken to the multivariate logistic regression model. After controlling for all these variables (Table 2), our data revealed the risk of HIV infection decreased by 0.14% in participants who were more than 20 years old (adjusted odds ratio (AOR) =0.14; 95% CI: 0.000- 0.589 for 20-30 years and by 0.14% for inmates >30 years (AOR =0.16; 95% CI: 0.25- 0.589). Married inmates also show a lower risk of infection, with a decreased risk of 0.014%. Prison rooms with less than 5 inmates were at risk (AOR =0.022; 95% CI: 0.002- 0.356) of acquiring HIV. The likelihoods of being infected with HIV include sexually active inmates. Furthermore, inmates imprisoned because of crime related to sex had an increased risk of acquiring HIV infection (AOR= 31.91; 95% CI: 1.751- 581.620). Similarly, the risk of acquiring HIV increased by 348 times in those who did their previous test 6-12 months ago and > 1 year by 211.96 (table 2).

**Table 2: Factors associated with HIV infection among inmates.**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Variable** | **Category** | **Number n %** | **Positive n %** | **Univariate analysis** |  |  **Multivariate analysis** |  |
|  |  |  |  | **COR(95% CI)** | ***P-value*** | **AOR (95% CI)** | ***P-value*** |
| Age (years) | <20 | 95(32.9) | 5(5.3) | 0.874(0.061- 12.53) | 0.921 | 0.373(0.044- 3.143) | 0.366 |
| 20-30 | 20(6.9) | 2(10) | 3.7(2.38- 5.6x103) | **0.022** | 0.14(0.000- 0.589) | **0.025** |
| 31-40 | 89(30.8) | 14(15.7) | 6.56(1.031- 43.011) | 0.046 | 0.16(0.025- 0.853) | **0.032** |
| >40 | 85(29.4) | 6(7.1) | Ref |  | Ref |  |
| Gender  | Male | 273(94.5) | 24(8.8) | 0.986 (0.074- 763.0) | 0.995 |  |  |
| Female | 16(5.5) | 3(18.8) | Ref |  |  |  |
| Marital Status | Single | 111(38.4) | 7(6.3) | 0.066 (0.005- 0.59) | **0.051** | 0.014 (0.000- 0. 756) | **0.033** |
| Married | 178(61.6) | 20(11.2) | Ref |  | Ref |  |
| Level of Education | Primary | 42(14.5) | 6(14.3) | 5.75(0.979- 716.893) | **0.114** | 0.469(0.091- 2.428) | 0.367 |
| Secondary | 247(85.5) | 21(8.5) | Ref |  | Ref |  |
| Occupation | Unemployed | 223(77.2) | 24(10.8) | 3.125 (0.160- 60.913) | 0.452 |  |  |
| Self-employed | 14(4.8) | 1(7.1) | 0.15(0.000- 42.72) | 0.299 |  |  |
| Employed | 52(18.0) | 2(3.8) | Ref |  |  |  |
| Religion | Christian | 265(91.7) | 26(9.8) | 0.57(0.026- 12.49) | 0.724 |  |  |
| Muslim | 24(8.3) | 1(4.2) | Ref |  |  |  |
| Duration (years) | **<2** | 185(64.0) | 18(9.7) | 2.12(0.099- 45.126) | 0.631 |  |  |
| 2-5 | 82(28.4) | 7(8.5) | 0.929(0.049- 29.83) | 0.905 |  |  |
| >5 | 22(7.6) | 2(9.1) | Ref |  |  |  |
| Number in room | <5 | 10(3.5) | 2(20) | 23.83 (4.67- 1216) | .006 | 0.022(0.002- 0.356) | **0.003** |
| 5-10 | 17(5.9) | 2(11.8) | 4.67 (0.103- 478.8) | .366 | 0.489(0.025- 9.582) | 0.637 |
| >10 | 262(90.7) | 23(8.8) | Ref  |  | Ref |  |
| Practice homosexuality | No | 274(94.8) | 24(8.8) | 1.436(0.003- 736.694) | 0.910 |  |  |
| Yes | 15(5.2) | 3(20) | Ref |  |  |  |
| Use condoms always | No | 236(81.7) | 23(9.7) | 0.87(0.82- 8.553) | 0.693 |  |  |
| Yes | 53(18.3) | 4(7.5) | Ref |  |  |  |
| Last Sexual contact | <6months | 11(3.8) | 1(9.1) | 25..9(0.54- 435.7) | 0.034 | 0.010(0.000- 0.47) | **0.129** |
| 6– 12months | 172(59.5) | 10(5.8) | 86.3(0.62- 119.6) | 0.113 | 0.009(0.002- 0.156) | **0.001** |
| >1year | 76(26.3) | 10(13.2) | 49.85(0.699- 355) | 0.004 | 0.007(0.001- 0.11) | **0.000** |
| Never | 30(10.4) | 6(20.0) | Ref |  | Ref |  |
| Tattooing  | No | 241(83.4) | 21(8.7) | 0.087.946(0.095- 663.2) | 0.395 |  |  |
| Yes | 48(16.6) | 6(12.5) | Ref |  |  |  |
| Drug Use | No | 239(82.7) | 19(7.9) | 0.030(0.002- 1.924) | 0.098 |  |  |
| Yes | 50(17.3) | 8(16.0) | Ref |  |  |  |
| Imprisonment crime is sex-related  | No | 280(96.9) | 23(8.2) | 0.030(0.002- 0.5594) | 0.03 | 31.91(1.751- 581.620) | **0.019** |
| Yes | 9(3.1) | 4(44.4) | Ref |  | Ref |  |
| Previous HIV test | <6months | 232(80.3) | 6(2.6) | 0.000(0.000- 14.271) | 0.141 | 51.66(0.43- 6272.52) | 0.107 |
| 6-12months | 38(13.1) | 4(10.5) | 0.02(0.000-0.09) | **0.000** | 348(45.7- 271428.6) | **0.000** |
| >1year | 3(1.0) | 2(66.7) | 0.001(0.000- 0.029) | **0.001** | 211.98(12.6-3567.466) | **0.000** |
| None | 16(5.5) | 15(93.8) | Ref |  | Ref |  |

Ref: Reference; undefined: COR and CI not computed

**4 DISCUSSION**

In our study, the general prevalence of HIV among inmates was 9.3%. This is higher compared to the 2.7%-3% range reported in HIV general prevalence in Cameroon (2, 24). However, this prevalence was within the 0.9 to 12% prevalence range reported in other studies (8,10, 11, 21, 25). Factors associated with this high prevalence might be a result of some of the actions that led to imprisonment, such as drugs, rape, etc. Secondly, the common practice of homosexuality, use of drugs, sexual violence, multi-use of shaving razors, tattooing, as well as the use of shared objects in the so-called practice of brotherhood rituals or initiation. All these practices have been recorded in other countries (10, [11](http://10), 14)

As regards age group, individuals of the age group 20-40 years were more at risk of infection. This sexually active age is involved in social activities such as drinking, smoking, etc., which expose them to risky behavior such as unprotected sexual intercourse,injection drug use, tattooing, promiscuous heterosexuality, and homosexuality. Secondly, they are of childbearing age and, as such, are likely to have unprotected sexual intercourse. This study is also similar to reports from Ameya *et al*. (1) but contrary to a study carried out in Nigeria by Joshua and Ogboi (28), which states that the age group 29-30 years more at risk of acquiring HIV.

Our data showed that the odds of being HIV positive were significantly higher in married inmates, with a prevalence of 11.3%, in line with studies carried out elsewhere (1, 21). On the contrary, Jha *et al.,* (10) reported a significantly higher prevalence among singles. Extramarital affairs are common practices in our community and have proven to be a significant risk factor for HIV infection among married couples (29). In addition, poverty and hardship, which might be a result of the displacement of people in this crisis zone, have driven women to barter sex for money or goods. These social and behavioral aspects also contribute to HIV transmission within the community. Thirdly, it might also be due to the increasing rate of incarceration in prisons, as reported in other countries (20) resulting in higher HIV prevalence rates.

Furthermore, inmates with less than five people per room were considered a predictor for HIV. This might be because of the practice of homosexuality, which is common among prisoners (3, 28). In addition, a lack of non-custodial measures in prison cells may lead to socially undesirable behaviors, which include intravenous or intramuscular drug use with unsterile needles or homosexuality. Considering that most of the inmates have been in prison for more than 2 years is a clear indication that they might be engaged in activities like homosexuality, the use of unsterilized sharp objects for brotherhood initiation, skin tattoos, and barbering. Though most inmates deny the act of homosexuality, those who accepted did attest that most of them practice homosexuality but refuse to say so because it is not acceptable by law. The small number of persons in a room can maintain confidentiality in their actions.

Duration of previous sex was also a risk factor for HIV transmission. Similarly, it could also be that they were infected before being imprisoned. This can be attested to the fact that most inmates did their previous text more than 6 months ago. All participants who were infected with HIV have had sexual intercourse. This implies that most of them did not practice protective measures like the effective use of condoms. This result is similar to those of Tarkang *et al*. (21), which shows that most HIV infection occurs as a result of unprotected sex.

The risk of HIV transmission was 31.91 times low (95% CI: 1.751- 581.620) in inmates whose crimes were not related to sex. Inmates who were imprisoned because of cases of rape had a higher prevalence of HIV. This is supported by the fact that the main route of HIV transmission is by sexual contact. Additionally, 21 (77.8%) of all those who positive, had been involved in one or more sexual activities.

HIV prevalence increased with the increased duration of the previous test. Inmates who did HIV test < 6 months ago were less likely to be infected. HIV testing is one of the possible ways to combat the spread of the disease as such, recent testing will create awareness of the risk of transmission and severity of HIV. It can also promote testing of their sexual partners, which can lead to referral services and thus avert the spread of the virus, as testing canlead to protective behavior adoption by the individual concerned. The high prevalence seen in persons who tested > 1 year is similar to a study by Nabukenya *et al.* (29), who state that prior HIV testing was associated with decreased condom use.Hernandez *et al.* (30), on the other hand, reported that the highest number of HIV-positive results were seen in individuals who tested ≤12 months.

**5 CONCLUSIONS**

In conclusion, the overall prevalence of HIV among inmates was 9.3%. Risk factors associated with HIV infection were age group (31-40 years), inmates who were married, inmates living less than 5 in a room, the duration of previous HIV test done in months (>6 months), participants with imprisoned crime related to sex, and previous HIV test more than 6 months. Considering that these inmates will virtually return to their communities after they have served their prison terms, it is necessary to carry out measures that will curb the spread of HIV by linking the positive case to care and treatment centres and by continuous education on the prevention of HIV.

**6 LIMITATIONS**

The main limitation of this study is that some sections of the prison were left out of the exercise for security reasons. Secondly, for fear of the unknown, some participants were not truthful in filling the questionnaire.

**Abbreviations**

AOR: Adjusted odds ratio

CL: Confidence interval

HIV: Human immunodeficiency virus

**Ethical Approval and Consent:**

Ethical clearance for the study was obtained from the University of Bamenda Ethical Committee (2023/0693H/ UBa/IRB). Administrative authorization was obtained from the prison's superintendent before recruiting the participants. The informed consent form was signed by each participant above 18 years, while the minor consent form was signed by the chief superintendent of the Bamenda Central Prison for those less than 18 years. All methods were conducted following the ethical principles outlined in the Declaration of Helsinki.

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**DISCLAIMER (ARTIFICIAL INTELLIGENCE)**

Author(s) hereby declare that NO generative AI technologies have been used during the writing or editing of this manuscript.

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