

## SEROPREVALENCE OF HBsAg, HCV AND HIV AND ASSOCIATED RISK FACTORS IN A CORRECTIONAL FACILITY IN SOUTHERN NIGERIA: A CROSS-SECTIONAL STUDY.

O.G. Egbi<sup>1</sup>, D.S. Oyedepo<sup>2</sup>, I.R. Edeki<sup>3</sup>, D.A. Aladeh<sup>4</sup>, T. Ujah<sup>5</sup>, J.D. Okpiri<sup>5</sup>, O.A. Adejumo<sup>6</sup>, O.A. Osunbor<sup>7</sup>, V.O. Ndu<sup>5</sup>, R. Madubuko<sup>3</sup>, S.O. Oiwoh<sup>8</sup>, M. Mamven<sup>9</sup>

1. Department of Internal Medicine, Niger Delta University Teaching Hospital, Okolobiri, Bayelsa State, Nigeria
2. Department of Internal Medicine, University of Ilorin Teaching Hospital, Ilorin, Kwara State, Nigeria
3. Department of Internal Medicine, University of Benin Teaching Hospital, Benin City, Edo, Nigeria.
4. Department of Internal Medicine, Diete Koki Memorial Hospital, Yenagoa, Bayelsa State, Nigeria
5. Department of Internal Medicine, Federal Medical Centre, Yenagoa, Bayelsa State, Nigeria
6. Department of Internal Medicine, University of Medical Sciences, Ondo State, Nigeria.
7. Department of Internal Medicine, Stella Obasanjo Hospital, Benin City, Edo State.
8. Department of Internal Medicine, Irrua Specialist Teaching Hospital, Irrua, Edo State, Nigeria.
9. Department of Internal Medicine, University of Abuja, Abuja

### Correspondence:

**Prof. O.G. Egbi**

Department of Internal Medicine,  
Niger Delta University Teaching  
Hospital, Okolobiri,  
Bayelsa State, Nigeria.  
oghenekaroegbi@mdu.edu.ng

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### ABSTRACT

**Background:** Incarceration has been known to increase the transmission of some blood-borne viruses such as hepatitis B virus (HBV), hepatitis C virus (HCV) and human immunodeficiency virus (HIV). Correctional centres are thought to be the reservoir of these infections, thereby constituting a risk to the larger society when the individuals are released. **Objectives:** The study determined the sero-prevalence of HBV, HCV, and HIV and associated factors for infections among people living in a correctional centre (PLCC) in Southern Nigeria.

**Methodology:** This was a cross-sectional study involving PLCC. An objectively structured questionnaire was administered to obtain socio-demographic information and data about the history of recreational drug use, previous incarceration, and duration of incarceration. Blood samples were screened for hepatitis B virus, hepatitis C virus and HIV.

**Results:** A total of 302 PLCC participated in this study with a male: female ratio of 12:1. The sero-prevalence of hepatitis B (HBV), hepatitis C (HCV) and HIV infections were 6.6%, 2% and 3.6% respectively. The co-infection rate of HBV/HCV was 0.3% and HIV/HBV co-infection also 0.3%. There was a significant association between gender, ethnicity, monthly income and HBV status. History of genital rashes/discharge was also significantly associated with HCV status while 'HIV status' was associated with sharing of personal belongings, history of genital rashes/discharge and cigarette smoking.

**Conclusion:** HBV, HCV and HIV infections are prevalent among PLCC. The infections were associated with some socio-demographic and clinical variables.

**Keywords:** HBV-hepatitis B virus, HCV- hepatitis C virus, HIV- human immunodeficiency virus, PLCC- people living in correctional centre.

### INTRODUCTION

Incarceration has been known to increase the transmission of some blood-borne viruses such as hepatitis B virus (HBV), hepatitis C virus (HCV) and human immunodeficiency virus (HIV). People living in correctional centres (PLCC) have a significantly higher prevalence of these infections than the non-incarcerated general population.<sup>1,2</sup> These infections are of great public health importance with associated burdens because of the risks of chronicity, infections progression, high morbidity and mortality. Hepatitis B and C affect the liver causing both acute and chronic diseases. Hepatitis B caused 820,000 deaths globally in

2019 mainly through chronic liver disease, liver cirrhosis and hepatocellular carcinoma.<sup>3</sup> Globally, 296 million people have chronic hepatitis B virus infection, 81 million of whom are in Africa.<sup>3</sup> There are over 4 million acute clinical cases of HBV every year.<sup>3</sup> The overall estimated sero-prevalence of hepatitis B in sub-Saharan Africa (SSA) remains high at 6.1%.<sup>4</sup> The pooled prevalence of HBV in Nigeria is 9.5%, with the highest prevalence (12.1%) seen in the North West and the lowest (5.9%) seen in the South East geo-political zone.<sup>5</sup> Globally, 58 million people have chronic hepatitis C infection with 1.5 million new cases per year.<sup>6</sup>

Approximately, 290,000 people died from the virus worldwide in 2019.<sup>6</sup> The overall adult prevalence of hepatitis C in SSA is 3.94%.<sup>7</sup> The pooled prevalence of hepatitis C in Nigeria is 2.2%.<sup>8</sup> Hepatitis C infection progresses to chronicity and expensive to treat. An estimated 39 million people were living with HIV at the end of 2022, two-third of whom are in SSA.<sup>9</sup> Six hundred and thirty thousand people died from HIV-related causes and 1.3 million people were infected with HIV in 2022.<sup>9</sup> The estimated national HIV prevalence is 2.1% with the highest prevalence in the South South zone and lowest in the North West zone.<sup>10</sup>

Hepatitis B and C are transmitted through body fluids such as blood, semen, saliva and vaginal fluids infection. Hepatitis C shares a similar mode of transmission like HBV but with a low sexual transmission rate. HIV infection occurs via sexual intercourse, shared intravenous drug use and during child birth or breastfeeding. HBV, HCV and HIV share the same common route of infection and co-infection. A systematic review of studies in Africa found the overall seroprevalences of HBV infection, HCV infection and HBV/HCV coinfection in people living with HIV to be 10.7%, 5.4% and 0.7% respectively.<sup>11</sup> Correctional centres are thought to be the reservoir of these infections and people living there could spread the infection to the larger society when released. Intravenous drug abuse, tattooing, high-risk sexual behaviours, poor quality of healthcare services, overcrowding, sub-optimal sanitary and environmental condition, higher level of illiteracy and previous imprisonment are some of the identified risk factors.<sup>2,12</sup> Overcrowding is a peculiar problem in Nigeria correctional centres with 63% of PLCC awaiting trials and the percentage of overcrowding put at 81% in southern Nigeria.<sup>13</sup>

The estimated age-specific global prevalence of HBV among PLCC is 0.4%–25.2%.<sup>14</sup> while the prevalence among those in West Africa is 12.5%.<sup>1</sup> The prevalence of HBV among PLCC is as high as 23% in Nasarawa state<sup>2</sup> and 16.3% in Borno state<sup>15</sup> and as low as 4% in Port-Harcourt, River state.<sup>16</sup> The expanded HBV vaccination program has resulted in a decrease in HBV infection globally but remains highly endemic in Africa.<sup>17</sup> The estimated Hepatitis C prevalence in incarcerated settings between 2013 and 2021 globally ranged from 0.3% to 74.4%.<sup>18</sup> The prevalence of hepatitis C among PLCC in the country has been found to be as high as 29.6% in Calabar, Cross River state<sup>19</sup> and 12.3% in Nassarawa state.<sup>2</sup> Other studies found a low prevalence of 3.5% prevalence among PLCC in Port Harcourt, River state and 4% in Sokoto respectively.<sup>16,20</sup> The global prevalence of HIV among PLCC ranges from 0%–15.8%,<sup>14</sup> while it is 2.6% in

the West African sub-region.<sup>1</sup> The prevalence of HIV in prisons in Nigeria has been found to be twice higher than the general population (2.8% vs. 1.4%) according to the United Nations Office on Drugs and Crimes.<sup>21</sup> HIV prevalence among PLCC in the country is as high as 18% in Sokoto and as low as 6.5% among Port-Harcourt prison inmates.<sup>20,16</sup>

This study will help to promptly diagnose these blood-borne infections, initiate treatment, and provide evidence-based data to justify routine screening and HBV vaccination in the correctional centres. The identification of associated factors for these infections in this study will help in developing a comprehensive framework to prevent the transmission of these blood-borne viruses in our correctional facilities through public sensitization and demands for adequate infection control standards in our correctional centers so that they do not become incubators for the infections.

The study determines the sero-prevalence of HBV, HCV and HIV and associated factors for infections among PLCC in a Southern facility in Nigeria.

## METHODOLOGY

### Study Design and Location

This research work was a cross-sectional study involving people living in a correctional facility (PLCC) in Southern Nigeria.

### Inclusion and Exclusion criteria

Inmates who were 18 years and above who consented to be part of the study, gave written informed consent and who were present for the health screening program were included in the study. Inmates who refused consent, those not available for data collection or were in obvious ill health were exempted from the study. Standard pre- and posttest counseling were offered.

An objectively structured questionnaire was administered to obtain socio-demographic information such as age, gender, ethnicity, religion, level of education and marital status. Information about the history of recreational drug use, history of previous incarceration, and duration of incarceration were obtained from the inmates.

Venous blood was obtained into a plain tube from each study participant. The blood sample was allowed to clot at room temperature and centrifuged at 5000 rpm for 15 minutes, and then the serum was separated. HBsAg antigen for HBV infection was detected using the sandwich commercial enzyme-linked Immunosorbent Assay (ELISA) and anti-HCV antibody measured using ELISA. Testing for

antibodies to HIV was performed with ELISA and confirmed by Western blot.

### Sample Size calculations

The required sample size was obtained using Fisher's statistical formula for estimating the minimum sample size in descriptive health studies.<sup>22</sup> The sample size was determined based on the prevalence of HBV among prison inmates in Nassarawa state as reported by Adoga *et al.*<sup>2</sup> (prevalence of 23%). The minimum sample size,  $n = \frac{Z^2pq}{d^2}$

$n$ =number of participants required in the survey,  $Z$ =normal standard deviation at 1.96 (which corresponds to a 95% confidence interval,  $P$ =prevalence of Hepatitis B surface antigen from previous studies;  $p=23\%=0.23$ ,  $q=1-p=0.77$ ,  $d$ =degree of accuracy/precision expected set at 0.05.

Therefore,  $n = \frac{1.96^2 (0.23 \times 0.77)}{0.05^2} = 272$ .

However, giving an attrition risk of 10% a total number of 302 patients was arrived at.

Therefore, a total of 302 inmates were recruited for the study.

### Data analysis

Data was analyzed using the Statistical Package for Social Sciences (SPSS) version 26.0. The results were expressed in numbers and percentages for quantitative variables, mean  $\pm$  standard deviation for normally distributed variables, frequencies and proportions for

discrete variables.  $P$  values  $\leq 0.05$  were considered statistically significant. Sociodemographic and risk factors were described and compared.

### Definitions of cases

Hepatitis B infection was diagnosed when HBsAg in the serum sample was detected using a serological test.<sup>23</sup> Previous history of HIV positive test was taken as information for HIV infection.

Hepatitis C infection was diagnosed when anti-HCV antibodies in the serum sample were detected using serological tests. This indicated previous or current infection.<sup>23</sup>

Ethical approval was obtained from the State Ministry of Health Research and Ethics Committee, and permission to carry out the study was obtained from the State Comptroller of prisons.

### RESULTS

A total of 302 PLCC participated in this study with their age ranging between 18 to 70 years and a mean age of  $32.4 \pm 9.16$  years. Two hundred and seventy nine (92.4%) of the PLCC were males (M: F ratio-12:1), 211 (69.9%) were single, the majority (72.5%) were of Ijaw ethnicity and 206 (68.5%) had secondary level of education. (Table 1)

The sero-prevalence of HBV (by HBsAg assay), HCV and HIV infections were 6.6% [20/302], 2% [6/302] and 3.6% [11/302] respectively, with 0.3% [1/302]

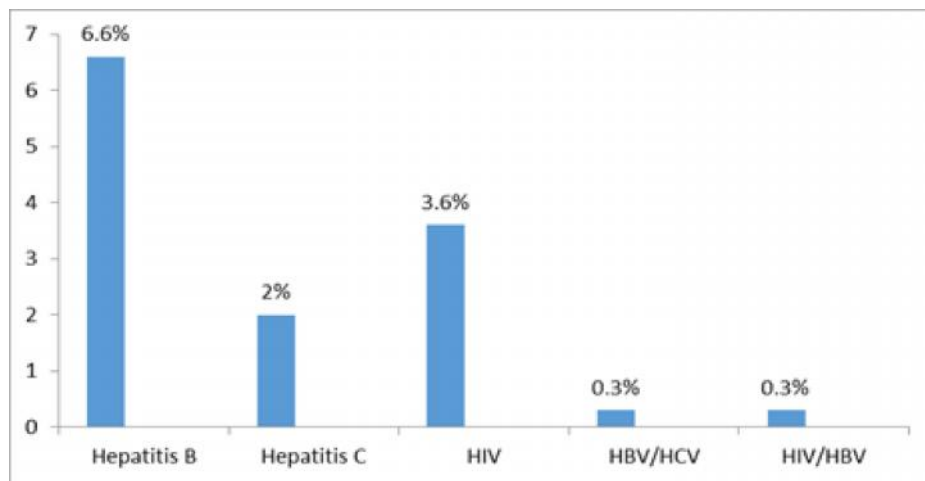
**Table 1:** Socio-demographic characteristics among 302 PICC in Southern Nigeria

Variables		Mean	SD
Age (Years)		32.37	9.16
		Frequency	Percentage (%)
Gender	Female	23	7.6
	Male	279	92.4
Ethnicity	Hausa	12	4.0
	Ijaw	219	72.5
	Yoruba	3	1.0
	Others	68	22.5
Marital Status	Divorced/ Separated	7	2.3
	Married	79	26.2
	Single	211	69.9
	Widowed	5	1.6
Occupation	Civil Servant	43	14.2
	Driving	30	9.9
	Farming	27	8.9
	Fishing	11	3.6
	Student	25	8.4
	Trading	21	7.0
	Others	145	48.0
Highest Level of Education	No Formal	8	2.7
	Primary	37	12.2
	Secondary	206	68.2
	Tertiary	51	16.9

each of HBV/HCV and HIV/HBV co-infections. (Figure 1)

From Table 2, there was a significant association between HBV status, gender, ethnicity, and monthly

income. HBV infection (by HBsAg assay) was higher in males ( $p=0.029$ ), the Hausa ethnic group ( $p=0.002$ ) and in those with relatively lower monthly income compared with their counterparts. HBV infection was not associated with a history of genital rashes/



HIV- human immunodeficiency virus, HBV- hepatitis B, HCV- hepatitis C

**Fig 1-** Seroprevalence of hepatitis B (HBsAg), hepatitis C, HIV and their co-infections among PLCC in Southern Nigeria

**Table 2:** Statistics of HBV (HBsAg), HCV, HIV and the significant associated risk factors among 272 PLCC in Southern Nigeria

	Negative N (%)	Positive N (%)	Total		P-Value
<b>HBsAg</b>					
<b>Gender</b>				0.224	<b>0.029*</b>
Female	20 (95.2)	1 (4.8)	21 (100)		
Male	232 (92.4)	19 (7.6)	251 (100)		
Total	252 (92.6)	20 (7.4)	272 (100)		
<b>Ethnicity</b>				14.746	<b>0.002*</b>
Hausa	7 (63.6)	4 (36.4)	11 (100)		
Ijaw	185 (94.4)	11 (5.6)	196 (100)		
Others	57 (91.9)	5 (8.1)	62 (100)		
Yoruba	3 (100)	0 (0.0)	3 (100)		
Total	252 (92.6)	20 (7.4)	272 (100)		
<b>Sharing of Personal Belongings</b>				5.539	<b>0.019*</b>
No	74 (98.7)	1 (1.3)	75 (100)		
Yes	89 (89.9)	10 (10.1)	99 (100)		
Total	163 (93.7)	11 (6.3)	174 (100)		
<b>HCV</b>					
<b>History of Genital Rashes</b>				4.645	<b>0.031*</b>
No	105 (100)	0 (0.0)	105 (100)		
Yes	66 (95.7)	3 (4.3)	69 (100)		
Total	171 (98.3)	3 (1.7)	174 (100)		
<b>HIV</b>					
<b>Cigarette Smoking</b>				0.120	<b>0.021*</b>
No	105 (95.5)	5 (4.5)	110 (100)		
Yes	156 (96.3)	6 (3.7)	162 (100)		
Total	261 (96.0)	11 (4.0)	272 (100)		
<b>Sharing of Personal Belongings</b>				3.900	<b>0.048*</b>
No	75 (100)	0 (0.0)	75 (100)		
Yes	94 (94.9)	5 (5.1)	99 (100)		
Total	169 (97.1)	5 (2.9)	174 (100)		
<b>History of Genital Rashes</b>				3.502	<b>0.041*</b>
No	104 (99.0)	1 (1.0)	105 (100)		
Yes	65 (94.2)	4 (5.8)	69 (100)		
Total	169 (97.1)	5 (2.9)	174 (100)		

discharge. ( $p=0.031$ ) However, a history of previous imprisonment, use of recreational drugs or sharing of sharps and personal belongings were not significantly associated with HCV infection.

There was a statistically significant association between HIV status and sharing of personal belongings ( $p=0.048$ ), history of genital rashes/discharge ( $p=0.041$ ) and cigarette smoking. ( $p=0.021$ ) However, sharing of sharps, use of recreational drugs, previous imprisonment and socio-demographic characteristics were not significantly associated with HIV status. ( $p<0.05$ )

## DISCUSSION

This study sought to determine the sero-prevalence of HBV (by HBsAg assay), HCV and HIV infections and their associated risk factors in a correctional facility in southern Nigeria.

The risk of acquisition of these infections among PLCC has been reported to be high due to sharing of contaminated sharps, unhygienic intravenous drug use, high risk sexual behaviors and poor access to health care facilities.<sup>2,12</sup>

The prevalence of HBV infection by HBsAg assay in this study was 6.6%. This is similar to the prevalence reported by Kassa *et al.* in Ethiopia (6.5%).<sup>24</sup> However, this is lower than previously reported in different parts of Nigeria by Dan-Nwafor *et al.* (13.7%), Adoga *et al.* (23%) and Lawan *et al.* (16.3%) and Ochei *et al.* (10.67%).<sup>25,2,15,26</sup> Lower HBV prevalence has been reported in Mexico (0.4%) and Iran (3.3%).<sup>27,28</sup> The prevalence of HCV infection in this study was 2%, which is similar to previous findings in Nigeria by Vito-Peter *et al.* in Port Harcourt (3.5%) and Uchechukwu *et al.* in Sokoto (4%).<sup>16,20</sup> Higher reported sero-prevalence of HCV was reported in Calabar (29.6%) and Nasarawa (12.3%).<sup>19,2</sup> Even though the methods used in the latter studies were similar to that used in our study, the lower HCV prevalence in our study may be due to better knowledge on disease transmission and prevention among the PLCC in our study. The Calabar study was carried out over a decade ago.

The variations in the reported HBV and HCV prevalence may be due to difference in population sample sizes, variation in risk behaviors among PLCC, region/country's pooled prevalence, prior immune status and assay methods.

The HIV sero-prevalence in this study was 3.6% and it is lower than 18%, 19.2% and 16% reported among PLCC in Nasarawa (Nigeria), Ghana and Brazil,<sup>2,29,30</sup> but quite similar to a report in the West African sub-

region by Jaquet *et al.* (2.6%).<sup>1</sup> It is noteworthy that this prevalence is higher than the current community HIV prevalence in most states in Nigeria.<sup>10</sup> The reason for this may be due to the fact that PLCC are more likely to have high risk behaviours such as sharing of sharps and high risk sexual behaviours.

In this study, there was no association between socio-demographic characteristics and viral infections, except gender and HBV infection. This is similar to reports by Vito Peter *et al.*<sup>16</sup> and Kassa *et al.*<sup>24</sup> These findings may be due to similarities in characteristics of the study population and economic status among participants. However, sharing personal belongings was associated with HBV infection. This may likely be due to contamination of these belongings with infected body fluids. HBV is a highly infective virus that is environmentally stable with a half-life of more than 22 days at 37 °C. It is also resistant to commonly used disinfectants and washing soaps.<sup>31,32</sup>

A history of genital rash/discharge was associated with HCV infection in this study. Prior to year 2000, HCV was not regarded as a sexually transmitted infection (STI), as it was thought to be transmitted primarily via blood exposure. It is now being considered an STI especially among HIV infected homosexual men and heterosexual couples.<sup>33,34</sup> The presence of genital rash/discharge may suggest the sexual transmissible nature of the infection but may not be sufficient to suggest sexual transmissions until the appropriate log of the viral load among other factors are met. This finding among Sub-Saharan PLCC will add to the body of knowledge on sexual transmissibility of HCV.

The prevalence of both HIV/HBV and HBV/HCV co-infection in this study was 0.3% each. This is lower than 2.7% and 0.7% respectively reported in Nasarawa, Nigeria.<sup>2</sup> Also, Abdel-Rasoul *et al.* reported a prevalence of HBV/HCV co-infection of 1.9% among Egyptian PLCC.<sup>35</sup> A higher HIV/HBV co-infection prevalence of 26.5% was reported among HIV patients in Nigeria by Mustapha *et al.*<sup>36</sup> The obvious reasons for these co-infections are that both infections have similar routes of transmission and an already compromised immune status in HIV patients puts them at higher risk of acquiring the other infections.

A major limitation encountered in this study was that only HbsAg used for the detection of HBV infection could result in false positives results. The non-assay of Hepatitis B core antibody (HBc Ab) could result in under-estimation of the prevalence rates of hepatitis B infection. Similarly, recall and social desirability biases could not be ruled out as previous history of HIV positivity was asked. However, the strength of this

study lies in the provision of additional information on the prevalence and associated risk factors of HIV, HBV and HCV infections in PLCC in Southern Nigeria, as well as in the comparison of these prevalence rates with the national figures as there is paucity of information on this. The study results will also serve for the needed advocacy for improved health care among PLCC while strengthening local as well as national surveillance on these infections among this population.

In conclusion, this study showed a relatively lower sero-prevalence of HBV and HCV infections among PLCC compared to previously reported prevalence in different regions of Nigeria, but a higher prevalence of HIV infection among PLCC compared to the community prevalence. We therefore recommend that incorporation of routine/periodic infection screening, health education on routes of infection transmission and preventive measures and hepatitis B vaccination into correctional facilities policies should be implemented to keep prevalence low in PLCC and the general population.

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