



Prevalence and Eligibility for Treatment of Chronic Hepatitis B Infection among Prison Inmates and Female Sex Workers in Calabar, Cross River State, Nigeria

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Authors' contributions

This work was carried out in collaboration between all authors. Author ISE designed the study, performed the statistical analysis, wrote the protocol, and wrote the first draft of the manuscript and managed literature searches. Authors IBOB, MN and SJU managed the analyses of the study and literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Hepatitis B is a growing worldwide public health issue today. The pathologies are responsible for considerable increase in healthcare expenses despite the widely recognized public health authority to keep them under control. Facts and figures have hitherto been misconstrued as regards Eligibility for treatment of chronic *hepatitis B* in most hospitals in Nigeria.

This Cross-sectional study therefore is to evaluate the prevalence and determine the proportion of the female sex workers and prison inmates eligible for treatment of chronic *hepatitis B* in Calabar.

Methods: Preliminary screening was done with a highly specific and sensitive HBsAg strip. Reactive samples were analyzed for *hepatitis B* markers using commercially available enzyme linked immunosorbent assay (ELIZA) kits. Chemistry and hematology analyzers were employed in carrying out LFT and FBC.

Results: The overall prevalence of HBV was 5.72%. The prevalence rate of 8.16% and 4.70% were recorded for the female sex workers and prison inmates respectively. A significant proportion of the inmates were chronically living with the virus and are eligible for treatment going by the APRI scores. Infections were significantly associated with the use of unsterilized equipment for tattooing and injection drug use.

Conclusion: The low observed intraprison and interbrothels prevalence of HBV underscore the need to vaccinate the inmates and sex workers population.

Keywords: Hepatitis B surface antigen; sero-positivity; liver; hepatocytes; hepatocellular carcinoma.

1. INTRODUCTION

Hepatitis is a disease of the liver and is a serious public health issue today. The five viruses such as hepatitis A-E that cause infections of the liver are responsible for a widely prevalent and growing disease burden and these can cause infectious diseases in their own right [1].

Hepatocellular necrosis and inflammation are complications central to *hepatitis B* infection, a double stranded DNA virus with reverse transcriptase that infects the liver.

HBV infection can be delineated into acute or chronic and the attendant insidious illness ranging in severity from asymptomatic to symptomatic. Acute *hepatitis B* is characterized by astronomical increase in liver transaminases and active replication of the virus as evidence in the sero-positivity status of the envelope (early) antigen. It is self-limiting and does not require treatment with a case fatality rate of 0.5–1% [2]. Chronic *hepatitis B* (CHB) infection on the other hand is the persistence of *hepatitis B* surface antigen [HBsAg] in the blood or serum for greater than six months with or without active replication of the virus (HBeAg can either be reactive or non-reactive) and liver transaminases in most cases tend to be normal, though with an ongoing insidious activity [2].

Age is a determining factor in assessing risk of chronicity. Neonates and children under the age of 5 years born to HBeAg positive mothers have greater than 90% and 20-60% likelihood of developing chronic infection respectively. However, chronicity rarely occur (<5%) when infection is acquired in adulthood [3].

Globally the proportion of people with CHB was infected at birth or in early childhood [2]. An estimated 240 million people were chronically infected with a greater proportion in low- and middle-income countries (LMICs). Between 20% and 30% of chronically infected individuals will develop complications and an estimated 650,000 of them will die annually due to these complications [4]. Hepatitis B Virus infection is a silent killer and rarely presents with signs and symptoms until a greater proportion of the liver is destroyed. Incidence and prevalence of hepatitis B have been drastically reduced owing to the universal hepatitis B immunization programs that target infants with the first dose given at birth. However, these programs may not have an immediate impact on HBV-related deaths until several years to come. The thrust of the hepatitis treatment with the available antiviral agents is to suppress HBV replication, prevent progression to cirrhosis and reduce the risk of HCC and liver-related deaths. Although there is no known cure for HBV infection for now and this trend can most likely necessitate lifelong treatment. These drugs are expensive in LMICs; therefore timely intervention to prevent the onset of complications does not occur.

It is not possible, on clinical grounds, to differentiate *hepatitis B* from hepatitis caused by other viral agents and, hence, laboratory confirmation of the diagnosis is essential. A number of blood tests are available to diagnose and monitor people with *hepatitis B*. There can be used to distinguish acute and chronic infections. Laboratory diagnosis of hepatitis B infection focuses on the detection of the *hepatitis B* surface antigen HBsAg.

Hepatitis B prevalence is highest in sub-Saharan Africa and East Asia, where between 5-10% of the adult population is chronically infected. High rates of chronic infections are also found in the Amazon and the southern parts of eastern and central Europe. In the Middle East and the Indian subcontinents. An estimated 2-5% of the general population is chronically infected. Less than 1% of the population in Western Europe and North America is chronically infected [5].

Hepatitis virus is present in all the body fluids and blood with a reduced degree in perspiration, breast milk, tears and urine of an infected person. Hepatitis B virus can survive outside the body for at least 7 days because it is highly resilient and resists breakdown [6]. During this time, the virus can still cause infection if it enters the body of a person who is not protected by the vaccine. Hepatitis B surface antigen (HBsAg) and antibody to hepatitis B core antibody (IgM HBcAb) are the first antigen and antibody to appear in the blood on an average of 75 days; however it can vary from 30 to 180 days. The IgM- HBcAb may be detected within 30 to 60 days after infection and can persist and develop into chronicity [7].

The prevalence of hepatitis infections varies greatly in different parts of the world, but is higher in tropical regions causing both acute and chronic liver diseases [8]. In Nigeria, 11.6% prevalence rate has been reported from Maiduguri [9]. (Harry et al., 1994), 13.8% from Lagos [10], 4.3% from Port Harcourt [11], 5.7% from Ilorin [12], 8.3% from Zaria [13], 17.1% from female sex workers [14], 14.9% from healthy blood donors [15] and 25.7% among Surgeons [16]. The prevalence rate of HCV varies between 5.8 - 12.3% [17].

Liver fibrosis or HCC may be suspected from complaints and combined assessment of clinical features including blood tests (HBV DNA, Virus particles, Liver function test, albumin, platelets) and liver scan.

Although liver biopsy is considered the gold standard method of staging liver disease and assessing the degree of fibrosis, it is rarely done in LMICs because of its high cost, invasiveness, patient discomfort, risk of complications, sampling error, as well as the need for expert histological interpretation.

In LMIC, the available non-invasive fibrosis tests based on blood or serum indices are APRI, FIB-4

and a commercial assay-Fibro Test). Ultrasound principles are also currently available and there has been an increasing use of the principles for evaluating and staging liver fibrosis, which reduces the need for liver biopsy in persons with an established cause of liver disease.

There has been a palpable dearth of knowledge as regards the proportion of people eligible for treatment and management of hepatitis B in Calabar based on the evidence from previous studies done.

This research is therefore intended to evaluate the prevalence and eligibility for treatment of chronic hepatitis B infection among prison inmates and female sex workers in Calabar, Cross River State.

1.1 Null Hypothesis

- I. There is no hepatitis B prevalence among Prison inmates and Female sex workers in Calabar, Cross River State.
- II. Infection prevalence is equal among males and females In Calabar.
- III. There is a designed established protocol for the treatment of Hepatitis B virus In Calabar, Cross River State.

All results were considered basing on the p value of <0.05.

2. METHODOLOGY

2.1 Study Design

This was a Cross-sectional study involving the use of quantitative methods for data collection in Calabar, Cross River State.

2.2 Study Area

Calabar Municipal is situated within the tropics between 4°57'N and 8°19'E. In the North, the Municipality is bound by Odukpani Local Government area in the North-East by the great Kwa River. Its Southern shores are bound by the calabar river and calabar south-south geopolitical zone, Nigeria. It has a total land area of about 233.3 sq km and a population of 199,706 (National Population Commission, 2006). Two seasons exist, the rainy and dry season. The rainy season extends from April to October while the dry season stretches from December to March. There is a variable extension of both

seasons into the months of November and March.

Calabar South Local Government Area of Cross River State in South-South Nigeria has an area of 264km² with a density of 725.4 inh/km² and a population of 191,630 (NPC,2006). It lies between latitude 4°15' and 5°N and longitude 8°25'E. It is an urban area and consists of 12 wards and the people are predominantly traders, fishermen and civil servants.

2.3 Study Population

This study was conducted among prison inmates and female sex workers in Calabar, Cross River State on people older than 15 years of age.

2.4 Specimen Collection

After obtaining the relevant information and explaining to the respondents the test procedures, 5ml of blood was collected aseptically through venepuncture using sterile syringe and needle following application of tourniquet. Two (2) ml was transferred to an EDTA container for complete blood count analysis and the remaining to a plain container where it was allowed to clot at room temperature. The clot was dislodged and centrifuged at 1000rpm for 5 minutes. The serum was harvested using a Pasteur pipette and transferred into serum containers with caps and properly labeled. The test was performed immediately, unless stated otherwise, in which case, the samples were kept frozen at -20°C.

Preliminary screening was done with a highly specific and sensitive HBsAg strip. Reactive samples were analyzed for hepatitis B markers using commercially available enzyme linked immunosorbent assay (ELISA) kits. Chemistry and hematology analyzers were employed in carrying out LFT and FBC.

The test was done using (see appendix I and II) and the principles were based on the immunochromatographic sandwich.

Procedures adopted for all the tests and the interpretations of the results were in accordance with the manufacturers' specification.

2.5 Data Management

The completed questionnaires were examined on the field for accuracy and completeness. Double entry was employed to minimize data entry errors.

2.6 Data Analysis

The data obtained was analyzed using descriptive statistics such as frequency distribution, percentages, means and corresponding standard deviations; inferential statistics such as Chi-square test for testing the association between categorical variables, ANOVA- test and independent T-test for examining differences between group means of categorical and continuous data variables. The statistical significance of all results was considered when the p value is < 0.05.

2.7 Ethical Considerations

Ethical approval was obtained from the State Ministry of Health Human Research Ethics Committee, Calabar before proceeding with the study. Informed consent was sought from each respondent before questionnaires were administered and taking of samples for laboratory analysis. The privacy, dignity, and autonomy of the respondents were maintained accordingly throughout the conduct of the study. Those found positive for HBsAg were further tested with the five panel ELISA test kit to determine the replicability or otherwise of the virus before carrying out the APRI.

3. RESULTS

A total of 332 respondents were interviewed. Of these, 98 were from the female sex workers and 234 were from the inmates of prisons in Calabar.

3.1 Socio Demographic Characteristics of the Respondents

As shown in Table 1, overall, the average mean age was 33.93 years.

Table 1. Mean age of respondents (years)

Designations	Mean	Std. deviation
FSW	26.85	5.71
Inmates	41.00	11.9
Total (mean)	33.93	8.81

The mean age ranges from 26.85 among the FSWs to 41.00 among the prison inmates.

Table 2 shows that the majority of the respondents were males 200(60.24).

However, the FSWs constitute 29.51% of the total female respondents.

Table 2. Sex of respondents

Designation	Female N (%)	Male N (%)
FSW	98(29.51)	00(00.0)
Inmates	34(10.24)	200(60.24)
Total	132(39.76)	200(60.24)

Table 3 shows that 50.90% of the total respondents were single while 27.71% were married.

In all both the FSWs and the prison inmates recorded varying degrees of marital dislocations.

A majority (96.69%) of the respondents had one form of education or the other.

While more than half of the respondents had secondary education 209 (63.33%), about a quarter of them had primary education 72 (21.69%).

Overall, 7.53% of the respondents had income below N18, 000 naira with a few (6.93%), having an income above 120,000 naira.

3.2 Exposure to Risk Factors

Many risk factors have been associated with hepatitis B Virus. These risk factors include having sexual partners who is not one's spouse, doing work that involves contact with blood, scarification/tattoo on the body etc.

A total of 332 respondents were interviewed 94.58 % reacted on the affirmative while 5.42% said otherwise.

All in all, as shown in the above table, majority of the respondents have had a sexual partner who was not their spouse. This was highest among the FSW (100%), followed by the prison inmates (92.31%).

Coming in contact with blood in the course of one's work is a risk factor.

As shown in Table 7, among the respondents, those who have ever come in contact with blood in the course of their work were 83.13%.

Among these, prison inmates had the highest number with 93.16% followed by the FSWs with 59.18%.

Table 3. Marital status and types of marriage of respondents

Designation	Marital status				
	Single N (%)	Married N (%)	Separated N (%)	Divorced N (%)	Widowed N (%)
FSW	90(27.11)	0(.0)	03(0.90)	01(0.30)	04(1.20)
Inmates	79(23.79)	92(27.71)	12(3.61)	30(9.04)	21(6.33)
Total	169(50.90)	92(27.71)	15(4.52)	31(9.34)	25(7.53)

Table 4. Highest educational attainment of respondents

Designations	No formal education N (%)	Primary N (%)	Secondary N (%)	Tertiary N (%)	Post graduate N (%)
FSW	04(1.21)	14(4.24)	76(23.03)	04(1.21)	00(00.00)
Inmates	07(2.12)	58(17.58)	133(40.30)	27(8.18)	09(2.73)
Total	11(3.33)	72(21.82)	209(63.33)	31(9.39)	09(2.73)

Table 5. Income level per month of respondent

Designations	Below N18, 000 N (%)	N18, 000-Below N35, 000 N (%)	N35, 000-Below N70, 000 N (%)	N70, 000-120000 N (%)	Above N120, 000 N (%)
FSW	07(2.11)	87(26.20)	02(0.60)	01(0.30)	01(0.30)
Inmates	18(5.42)	18(5.42)	89(26.81)	28(8.43)	22(6.63)
Total	25(7.53)	164(49.40)	91(27.41)	29(8.73)	23(6.93)

Table 6. Respondents who have had a sexual partner who was not their spouse

Designations	No	Yes
	N (%)	N (%)
FSW	00(0.0)	98(100.0)
Prison inmates	18(7.70)	216(92.31)
Total	18(5.42)	314(94.58)

Table 7. Respondents who have ever done work that had contact with blood

Designations	No	Yes
	N (%)	N (%)
FSW	40(40.82)	58(59.18)
Inmates	16(6.84)	218(93.16)
Total	56(16.87)	276(83.13)

Table 8. Hepatitis B surface antigen prevalence

Designations	Hepatitis B	
	Negative N (%)	Positive N (%)
FSW	90(91.84)	08(8.16)
Inmates	223(95.29)	11(4.70)
Total	313(94.28)	19(5.72)

Table 8 shows that the prevalence of Hepatitis B in the sampled population is 5.72% with the highest prevalence recorded among the FSWs.

Among those who were positive to HBV infection, 57.89% of them were males and 42.11% were females.

As shown above, a total of 19 subjects were reactive to the hepatitis B surface antigen with the highest replicability rate found among the inmates (09) and a total of 13 subjects chronically living with the disease.

4. DISCUSSION

Viral hepatitis is a major global health problem with more than 500 million patients chronically infected, causing over 1 million deaths per year. [18]. The World Health Assembly in April 2014, reaffirmed resolution WHA63.18 that recognized viral hepatitis as a global health problem [19]. They also highlighted the need for governments and populations to take action on prevention, diagnosis and treatment [19].

This study was carried out to determine the prevalence of hepatitis B virus infection and to ascertain the proportion of the female sex

workers and prison inmates eligible for treatment of chronic hepatitis B virus. A total of 332 respondents were screened with 132(39.76%) and 200(60.24%) females and males respectively. Ninety eight (29.52%) and 234 (70.48%) were from the female sex workers and prison inmates respectively. A total of 19 (5.7%) respondents were positive to the surface antigen of the hepatitis B virus with 8(42.11%) females and 11(57.89%) males. The 42.11% and 57.89% were exclusively from the female sex workers and prison inmates as no female prison inmates was reactive to the surface antigen of the hepatitis B virus. There was a lower significant difference between the female sex workers that were positive (8.16%) and the inmates of the prison that were positive (4.7%) when $p < 0.05$, so the null hypothesis is rejected.

This trend could have extensive implications for our national growth and development since the high infection rate was palpable in the prime age of productivity of the inmates. Suffice to mention that the mean age of the female sex workers and prison inmates were 26.85 ± 5.71 and 41.00 ± 11.90 respectively. There was a high significant difference between the mean age of the female sex workers and the prison inmates ($p < 0.05$). However, this is not in agreement with the 13.6% reported by Musa et al. [20]. The inmates of the prison had a prevalence level of 4.7%. Again this is not in agreement with the 27.2% reported in Iran by Daneshmand et al. [21]. These differences in prevalence may be explained by the different characteristics of the population studied. The inmates of the brothels had a prevalence level of 8.16%. However, there was a significant difference between the female sex workers and prison inmates basing on ($p < 0.05$). The prevalence rate can succinctly be said to be lower than in many other professional groups studied in Nigeria. This may be central to the increased awareness of the use of condoms and post exposure prophylaxis among the at risk groups. This again contrasts the 17.1% reported in Nasarawa state by Forbi [14] and 14.1% in Benin City by Halim [22].

Those within the prime age of 26.85 years made up the most frequent group infected with chronic hepatitis B infection among the female sex workers. This is in contrast to the age group of 35 years reported by Forbi [14]. The mean age of the prison inmates frequently infected with chronic hepatitis B was 41 years. This again is not in tandem with the 36 years reported by Daneshmand in Iran [21].

Table 9. Sex distribution of respondents that had hepatitis B

Designations	Hepatitis B			
	Negative N (%)		Positive N (%)	
	Female	Male	Female	Male
FSW	90(91.84)	00(0.00)	08(6.06)	00(00)
Inmates	34(14.53)	189(80.77)	00(00)	11(5.5)
Total	124(39.62)	189(60.38)	08(42.11)	11(57.89)

Table 10. Serology panel of the hepatitis B positive respondents

Designations	HBsAg	IgG Anti-HBs	HBeAg	IgG Anti-HBe	IgM Anti-HBc	IgG Anti-HBc
FSW	08	--	07	--	02	05
Inmates	11	--	09	--	01	08
Total	19	--	16	--	03	13

Table 11. Chemical and hematological indices of the sero-positive respondents

Respondents	AST (Iu/L)	PLATELETS (/L)	APRI
I	22.86	241*10 ⁹	0.24
II	30.90	305*10 ⁹	0.25
III	77.00	102*10 ⁹	1.89
IV	26.80	280*10 ⁹	0.24
V	300	72*10 ⁹	10.42
VI	273.2	98*10 ⁹	6.97
VII	39.0	211*10 ⁹	0.46
VIII	42.2	188*10 ⁹	0.56
IX	77.1	107*10 ⁹	1.80
X	28.8	277*10 ⁹	0.26
XI	20.2	300*10 ⁹	0.17
XII	18.7	302*10 ⁹	0.15
XIII	97.00	100*10 ⁹	2.43

Values greater than 2 are consistent with the presence of cirrhosis

Overall 60.24% of the people infected were males with about 39.76% females. It can be inferred here that the male folks serve as the major reservoir for the transmission of the infection. This is in agreement with Baruch which says that the females are more likely than males to develop anti-HBs in response to infection [23].

The level of income of the respondents, most especially the female sex workers appears to greatly influence the commercial sex work. As observed, 49.40% of the respondents had income below N40,000 naira with very few (6.93%) having an income above 120,000 naira per month. More so, more than half of the respondents 173 (51.21%) were not married, and over 60% of them had secondary school as their highest educational qualification. This in no small measure will open the door of opportunity for promiscuity leading to the transmission of the virus.

Coming in contact with blood in the course of one's work is a risk factor, among the respondents; those who had ever come in contact with blood in the course of their work were 83.13%. Among these, prison inmates had the highest number with 93.16% followed by the FSWs with 59.18%. This can be explained as the result of the illegal use of intravenous drugs. Aseptic measures are not always adhered to leading to an increase in transmissible infection among the inmates.

From the analysis of the serological panel, it was observed that a total of 16 and 13 respondents were active and chronic carriers of the disease respectively.

Results obtained from the chronically infected respondents had it that both the inmates of the brothels and prisons had a total of 7 and were highly unlikely to have significant fibrosis. This is in agreement with Chou [24] and Lin [25] which

reported that the lower the APRI score (less than 0.5), the greater the negative predictive value (and ability to rule out cirrhosis) and the higher the value (greater than 1.5) the greater the positive predictive value (and ability to rule in cirrhosis). From the foregoing assertion by Chou [25] and Lin [23], it can succinctly be said that 4 inmates of the female sex workers and prisons are likely to have severe fibrosis or cirrhosis going by the varying APRI scores greater than 0.5. Two of the respondents had greater than 90% likelihood that they had cirrhosis. These respondents should urgently call the attention of the government to begin the treatment as all indices and parameters show that they are eligible for treatment.

5. CONCLUSION

There should be a need to formulate a national policy on screening, vaccination and management of Hepatitis B. This would increase public awareness, while strengthening efforts to reduce the prevalence of the disease. Immunization is one of the key measures in preventing HBV world-wide. Immunization programs decrease incidence of acute hepatitis B, prevalence of chronic HBV infection and incidence of HCC. The vaccine is safe and efficacious, and it is 95% effective in preventing development of the chronic carrier state.

In addition to the above measures where it is feasible, HBV infection in Nigeria can be prevented through safe sex practices, safe injection practices, and avoidance of sharing of sharps even within house hood.

The HBV DNA cost should be subsidized because treatment ought to have been determined based on the result outcome. Relying on the APRI will actually place the sero-positives at an increased risk of fibrosis.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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APPENDIX I

EQUIPMENT

- Elitech Chemistry Analyzer
- Coulter Act2 Hematology Analyzer
- HBV ELISA kit

APPENDIX II

REAGENTS

- Elitech Reagents
- Coulter diff AcT Tainer Reagent Pack
- Diluent
- Lytic reagent
- Shutdown diluent
- HBsAg ELISA kit
- HBsAb ELISA kit
- HBcAg ELISA
- HBcAb IgM ELISA
- HBeAg ELISA
- HBeAb ELISA

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