



**ORIGINAL ARTICLE**

## Spread of Hepatitis A and B among Inmates of Correctional Centers: A cause for concern

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### Abstract

#### Introduction

Correctional centers have populations with higher rates of blood borne infections, including hepatitis B Virus, due to the concentration of impoverished and vulnerable groups of people at increased risk in these settings, such as people who inject drugs and people who exchange sex for drugs or money. Many people who are incarcerated also have risk factors for hepatitis A virus infection mainly due to the environment of closed penal institutions and socioeconomic conditions.

#### Aim

The purpose of this study was to evaluate HAV and HBV virus status among inmates of a correctional center in Calabar, Cross River State Nigeria.

#### Method

A total of one hundred inmates with the mean age of 35 years participated in the study. Their serum samples were tested for HAV and HBsAg antibody using one step Anti-HAV and Anti-HBV test strips.

#### Result

The prevalence of HAV infection among the inmates was found to be 1.00% and 10.0% for HBV. Male prison inmates had seroprevalence of 1.14% for HAV while all the females that participated in the study were non-reactive for hepatitis A virus (0.00% prevalence). The result also showed highest prevalence of 14.28% among inmates aged 40 years and above while the lowest prevalence was observed among those aged below 20 years with 4.54% prevalence for HBsAg and highest prevalence was recorded between 20 to 40 years of age for hepatitis A with a prevalence of 1.56%. There was a statistical significant association ( $p < 0.05$ ) between duration of stay in prison, equipment sharing, sexual exposure, multiple partners and Hepatitis B virus infection. Alcoholism was also found to associate significantly with both Hepatitis A and Hepatitis B virus infection.

## Conclusion

10.0% prevalence of Hepatitis B virus infection and 1.0% Hepatitis A virus that were observed among correctional center inmates studied are high and cause for concern. Attitude and behaviors by inmates such as tattooing/scarification, injection drugs use, sharing of shaving equipment, multiple sexual partners and alcohol consumption should be discouraged. There is need to promote advocacy programs especially as regards avoiding practices that enhances hepatitis A virus and hepatitis B virus infection and transmission.

**Key Word:** Hepatitis B, Hepatitis A, Correctional Center, Infectious disease, inmates.

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## INTRODUCTION

Hepatitis is an inflammatory condition of the liver. It could be acute or chronic. It is acute when it is less than six months and chronic when it persists longer [1]. Acute and chronic hepatitis can be caused by a variety of agents such as viruses, bacteria, fungi, parasites, drugs and chemicals. Viral hepatitis is the most common type of hepatitis worldwide [2].

Viral hepatitis includes five distinct entities which are caused by at least five different viruses [3]. These five types are of greatest concern because of the burden of illness and death they cause and the potential for outbreaks and epidemic spread. They are as follows; Hepatitis A virus, Hepatitis B virus, Hepatitis C virus, Hepatitis D virus and Hepatitis E virus. These are called hepato virus. Hepatitis B and C viruses in particular

leads to chronic diseases in hundreds of millions of people and together are the most common cause of liver cirrhosis and cancer [4].

Hepatitis A is a viral disease that can cause mild to severe illness globally there are an estimated 1.4 million cases of hepatitis A every year [4]. Unlike hepatitis B and C, hepatitis A does not cause chronic liver disease and is rarely fatal but can cause debilitating symptoms and can lead to acute liver failure which is associated with high mortality rate. Hepatitis A virus is a very stable virus, frequently found in urban sewage. Infections occur early in life when sanitation is poor and living conditions crowded [5].

Hepatitis B infection is a liver disease that results from infection with a virus called Hepatitis B virus [6]. It is a DNA virus of the family

Hepadnaviridae, genus Orthohepadnavirus and species Hepatitis B virus [7;8]. The viral particle consists of an outer lipid envelope and an icosahedral nucleocapsid core which is composed of protein. The outer envelope contains proteins that are involved in viral binding and entry into susceptible cells. The outer surface or envelope contains hepatitis B surface antigen (HBsAg) and surrounds the inner nucleocapsid core that contains hepatitis B core antigen (HBcAg) [8]. The viral genome consists of a partially double stranded circular DNA, with up to 3020-3320 nucleotides and viral isolates share 80-90% nucleotide homology [8 ; 9]. WHO [4] posited that people at high risk include prison inmates, injection drug users, people who frequently require blood and blood products, mentally ill persons, people with multiple sexual partners

and health-care workers. The virus is found in body fluids and blood and it is transmitted from person to person through sex, tattooing, body piercing with unsterilized equipment, sharing of equipment like razor, toothbrush and injection drug users. Transmission from mother to child during childbirth where equipment is not adequately sterilized can also occur [3].

The disease is either acute or chronic [10] The acute disease is a short term illness which occurs within six months after the individual is exposed to the virus and does not always lead to chronic infection [6]. The likelihood of developing a chronic infection depends on the age at which a person becomes infected [10]. Young children less than six years old are most likely to develop a chronic infection when infected with the virus and infants infected during the first year of life develop chronic infection by 80%-95% [9]. Five percent of adults develop chronic infection and 15-25% of adults who become chronically infected during childhood die of liver cirrhosis or cancer related to HBV [6]. Two (2) billion people who have been infected with the HBV globally, more than 350 million have chronic infection and over 20 million people are infected annually with this virus [3 ; 11].

There are more than 10.74 million people jailed in penal

institutions worldwide, either as pre-trial detainees/remand prisoners or having been convicted and sentenced [12]. Nigeria has the 5th highest number of prisoners (75,772) in Africa just below South Africa (164,129), Ethiopia (113,727), Egypt (106,000), and Morocco (82,512) and 24th in the world as of 2018 [2]. The United Nations maintains that people in correctional centers should have access to health services available in the country without discrimination on the grounds of their legal situation. However, in practice, this is scarcely applied in real life and inmates in most countries have lesser possibility of medical assistance than the citizens [13]. There is paucity of information on the prevalence of hepatitis A and B infection in this locality especially in correctional centers hence the need for this study

### Materials And Methods

This study took a descriptive cross sectional approach using purposive sampling technique. The study was carried out in Calabar, Cross River State. Cross River is a state located in Southern Nigeria [14], in the Niger Delta region. It is bounded in the north by Benue State, the west by Ebonyi and Abia State, the east by Cameroon Republic and the south by Akwa Ibom and the Atlantic Ocean [15]. Cross River State

has an area of 21,787km<sup>2</sup> and a population of 2,892,988 (2006 census) [16]. It is administered into 18 Local Government Area [16]. The correctional center is located in Afokang Street, Calabar South Local Government Area of the state. Calabar has a geographical coordinates of 4057'32.15"N, 8019'37.02"E with an estimated population of 375,196 (2006 census) [16] comprising of Calabar South and Calabar Municipality.

One hundred (100) prison inmates within the age range of 18 - 50 years and above were recruited for this study. A structured questionnaire was administered to all participating prison inmates to obtain demographic and other vital information of the study participants. Subjects who were incarcerated and gave informed consent were recruited while subjects who were not incarcerated and incarcerated subjects who withheld consent were excluded. Ethical approval was obtained from Cross River State Ministry of Health. Informed consent was obtained from the prisoners before enrolment.

Five milliliters (5 ml) of blood was collected from each subject and dispensed into sterile plain container and allowed to clot. The serum obtained was used for serological diagnosis of hepatitis A and B virus. The HAV and HBV assay

were performed using rapid diagnostic test (RDTs) for HAV and HBV by ACON laboratories incorporated, USA.

### Hepatitis A virus

Principle: the one step hepatitis A virus (HAV) test strip (serum/plasma) is a qualitative lateral flow immunoassay for the detection of HAV in serum and plasma. The membrane is procoated with anti-HAV antibodies on the test line region of the strip. During testing, the serum or plasma specimen reacts with the particles coated with anti HAV antibody. The mixture migrated upward on the membrane chromatographically by capillary action to react with the anti HAV antibodies on the membrane and generates a coloured line. The presence of this coloured line in the test region indicates a positive result, while its absence indicates a negative result. To serve as a procedural control, a coloured line will always appear in the control region indicating that a proper volume of specimen has been added and membrane wicking has occurred.

### Hepatitis B virus

Principle: the one step hepatitis B surface antigen (HBsAg) test strip (serum/plasma) is a qualitative lateral flow immunoassay

for the detection of HBsAg in serum and plasma. The membrane is procoated with anti-HBsAg antibodies on the test line region of the strip. During testing, the serum or plasma specimen reacts with the particles coated with anti HBsAg antibody. The mixture migrated upward on the membrane chromatographically by capillary action to react with the anti HBsAg antibodies on the membrane and generates a coloured line. The presence of this coloured line in the test region indicates a positive result, while its absence indicates a negative result. To serve as a procedural control, a coloured line will always appear in the control region indicating that a proper volume of specimen has been added and membrane wicking has occurred.

### Statistical Analysis

Data generated in this study was analyzed using SPSS version 20 (Armonk, NY. IBM Corp). Categorical demographic and clinical variables were summarized as frequencies and percentages while continuous variables were represented as mean and standard deviations. Fisher's exact test was used to assess association between categorical variables. Significant difference was determined at  $p < 0.05$ .

### Results

A total of 100 inmates with the mean age of 35 years participated in the study. The demographic data of this study showed male preponderance (87.0%,) over females (13.0%,). Age bracket 20 -40 years represented more than half of the studied population (64.0%,) while the age brackets < 20 and > 40 years constituted 22.0% and 14.0%, respectively of the studied subjects. Approximately, 39.0%, 56.0%, 2.0% , 2.0% and 1.0% , of the studied subjects were married, single, divorced, separated and widowed, respectively. Majority of the inmates (53.0%,) attended up to secondary school education while 15.0%, 27.0% and 4.0% attended up to primary, tertiary and non-formal education, respectively. Students, civil servants, public servants, businessmen and unemployed persons constituted 40.0% , 3.0%, 9.0% , 39.0% and 9.0% of the subjects, respectively. Greater number (53.0%,) of the inmates recruited have stayed in prison within 12 months, while 19.0% , 12.0%, 9.0% and 7.0% have stayed within 13 - 24, 25 - 36, 37 - 48 and > 49 months, respectively. Approximately 16.0%, 24.0%, 11.0% , 13.0% , 19.0% , 30.0% , 9.0% , 23.0% , 9.0% and 30.0% of the studied inmates has been previously incarcerated, had tattoos/scarification, had previous

blood transfusion, had history of surgery, used injection drugs, consumed alcohol, had sexual experience, had multiple sex partners, had history of STI, shared shaving equipments, shared needle and syringes, and shared clothes, respectively (Table 1).

**Table 2** shows the prevalence of hepatitis A and B amongst the population, and Hepatitis B was found in 10 inmates (10.0%) followed by hepatitis A which was only 1(1.0%).

**Table 3** shows the prevalence of hepatitis A and B among the correctional center inmates according to gender. This finding reveals that the male inmates have the highest prevalence (9.20% and 1.15%) of reactive cases for HBV and HAV viruses respectively.

Prevalence of hepatitis A and B amongst correctional Center

inmates according to age is shown in table 4. The finding revealed that the age 40 years and above had the highest number of reactive cases for hepatitis B virus 7(14. 29%) and age range between 20-40 years for HAV, 1 (1.56%).

**Table 5** shows the prevalence of hepatitis A and B among inmates based on predisposing factors. This finding revealed that the prevalence of hepatitis B virus was highest in correctional center inmates who have had sexual experience (10.10%), alcohol consumers (13.32%), those that have had multiple sex partners (8.70%) and STI (8.70%).

**Table 6** shows the prevalence of hepatitis A and B among correctional center inmate based on the duration of stay in the center, this reveals

that inmate who has been imprisoned for more than 49 months has the highest prevalence of (14.28%) for HBV while highest prevalence of HAV infection was found among to that have spent 37 to 48 months in the correctional center. Seroprevalence of HBV infection among studied subjects based on socio-demographic characteristics was shown on table 7. The tables shows that hepatitis B infection was more prevalent among the inmates who are single when compared to those married, divorced or widowed.

**Table 1:** Demographic and socio-demographic characteristics of the studied Correctional Center Population

Parameter	Frequency	Percentage (%)
<b>GENDER</b>		
Male	87	87.0
Female	13	13.0
<b>AGE (Years)</b>		
< 20	22	22.0
20 - 40	64	64.0
> 40	14	14.0
<b>MARITAL STATUS</b>		
Married	39	39.0
Single	56	56.0
Divorced	2	2.0

Separated	2	2.0
Widowed	1	1.0
LEVEL OF EDUCATION		
Primary	16	16.0
Secondary	53	53.0
Tertiary	27	27.0
Non-formal	4	4.0
OCCUPATION		
Student	40	40.0
Civil Servant	3	3.0
Public servant	9	9.0
Business	39	39
Unemployed	9	9.0
DURATION IN PRISON (Months)		
≤12	53	53.0
13-24	19	19.0
25-36	12	12.0
37-48	9	9.0
≥49	7	7.0
PREVIOUS IMPRISONMENT		
Yes	16	16.0
No	84	84.0
PRESENCE OF TATOO/SCARIFICATION		
Yes	24	24.0
No	76	76.0
PREVIOUS BLOOD TRANSFUSIN		
Yes	11	11.0
No	89	89.0
HISTORY OF SURGERY		
Yes	13	13.0
No	87	87.0
INJECTION DRUG USE		
Yes	19	19.0
No	81	81.0
ALCOHOL CONSUMPTION		
Yes	38	38.0
No	62	62.0
SEXUAL EXPERIENCE		
Yes	99	99.0
No	1	0.1

MULTIPLE SEX PARTNER		
Yes	69	69.0
No	31	31.0
HISTORY OF STI		
Yes	23	23.0
No	77	77.0
SHARING OF SHAVING EQUIPMENT		
Yes	37	37.0
No	63	63.0
NEEDLE AND SYRINGE SHARING		
Yes	9	9.0
No	91	91.0
CLOTHE SHARING		
Yes	30	30.0
No	70	70.0

**Table 2:** Prevalence of hepatitis A and B among Correctional Center inmates

	NO. Of sample	No. Reactive	Prevalence (%)
HAV	100	1	1.00
HBsAg	100	10	10.0

**Table 3:** Prevalence of hepatitis A and B based on gender

Type of Hepatitis	Male	Percentage	Female	Percentage
	(n=87)	Reactive (100%)	(n=13)	Reactive (100%)
	Number reactive	R	Number reactive	R
HAV	1	1.15%	0	0.00%
HBsAg	8	9.20%	2	15.38%

$P < 0.005$

**Table 4: Prevalence of hepatitis A and B based on age**

Age range	HAV		HBsAg	
	No. Reactive	Percentage distribution	No. Reactive	Percentage distribution
Below 20yrs (N=22)	0	0.00%	1	4.55%
20-40 years (N=64)	1	1.56%	7	10.94%
Over 40yrs (N=14)	0	0%	2	14.29 %

p= 0.5332

**Table 5: Prevalence of hepatitis A and B based on predisposing factors**

Factors	HAV		HBsAg	
	No. reactive	Percentage distribution	No. reactive	Percentage distribution
Tattoos (N=24)	0	0.00%	1	4.17%
Alcohol (N=38)	1	2.63%	5	13.15%
Transfusion (N=11)	0	0.00%	2	18.18%
Sexual exposure (N=99)	0	0.00%	10	10.10%
Multiple partner (N=69)	0	0.00%	6	8.70%
STI (N= 23)	0	0%	2	8.70%
Shared equipment/Cothings (N=55)	0	0%	3	5.45%

P < 0.05



**Table 6:** Prevalence of hepatitis of A and B based on duration of stay in correctional center

Duration (Months)	HAV		HBsAg	
	No. reactive	Percentage distribution	No. reactive	Percentage distribution
≤ 12 (N=53)	0	0.00%	6	11.32%
13 - 24 (N=19)	0	0.00%	2	10.52%
25 - 36 (N=12)	0	0.00%	1	8.33%
37 - 48 (N=9)	1	11.11%	0	0.00%
49 and Above (N= 7)	0	0.00%	1	14.28%

**P < 0.05**

**Table 7:** Seroprevalence of HBV infection among studied subjects based on socio-demographic characteristics.

Variable	No. screened	No. reactive for HBV (%)	P-value
<b>MARITAL STATUS</b>			
Married	39	3 (7.69)	0.860*
Single	56	7 (12.50)	
Divorced	2	0(0.0)	
Separated	2	0 (0.0)	
Widowed	1	0 (0.0)	

\*Fisher’s exact test.

## Discussion

Correctional centers have populations with higher rates of blood borne infections, including HBV, due to the concentration of impoverished and vulnerable groups of people at increased risk in these settings, such as people who inject drugs and people who exchange sex for drugs or money [17 ; 18]. Many people who are incarcerated also have risk factors for hepatitis A virus (HAV) infection mainly due to the environment of closed penal institutions and socioeconomic conditions.

This study shows that the hepatitis B infections are more prevalent among the correctional center inmates studied. The overall 10.0% HBsAg prevalence obtained in this study was slightly higher than the 9.50% obtained by Ajuwon et al., [19] in Kwara State Nigeria but lower than 12.20% obtained by Olayinka et al., [20] in their study that involved the six geopolitical zones in Nigeria. When compared to international studies, the prevalence of HBV found in our study is higher than 2.72% reported by Hwang and Cheung [21] among inmates in New Delhi and 9.0% found by Kaker et al. [22] in Parkistan but lower than 10.5% estimated by WHO as a prevalence around the world in 2019. The observed difference in the prevalence of HBV in correctional centers in the different areas could be due to the type of correctional center inmates studied on the basis of significant risk factors such as injection drug use, practice of high risk sexual behaviour, history of imprisonment as well as other high risk behaviour prevalent in the studied population [23]. More so, the choice of HBV screening test method could as well influence the variations observed

The HAV prevalence of 1.00% obtained in this study was also higher than 0.75% reported by Adjei et al. [24] among inmates in Accra, Ghana. In a survey by Center for Disease and Control USA, they recorded a prevalence 11.4% of Hepatitis A infection among those

that where recently incarcerated in about 33 correctional center in USA [25]. A high prevalence rate of HAV exposure ( 88.1%) was also recorded in a study in 12 prisons in central Brazil Republic [26]. This observed differences in the different studies outcome may be attributed to differences in the various correctional centers environmental, housing and socioeconomic conditions.

We found an association between gender and both HAV and HBV infection in this study. Male inmates recorded a significant higher prevalence of HBsAg (9.20%) and HAV (1.15%). This finding agrees with that of Puga et al. [28] where males had the higher seropositive of HBsAg with a prevalence of 8.9%. This might be that male subjects were more exposed to the risk factor that predisposed them to these infections.

In this study, HBsAg and HAV infection were not associated with age ( $p= 0.5332$ ). The highest prevalence of HBsAg infection was found among subjects aged 40 years and above while that of HAV infection was found among those between 20 – 40 years old. This could be due to the fact that people of older age are more susceptible to infectious disease particularly Hepatitis since many people at risk in these age groups have not been vaccinated as recommended [4]. The highest prevalence of HBsAg was found among the single subjects than the married subjects in this study. This may be due to the fact that the unmarried individuals are more likely to engage in behaviours that put them at risk of these infections example, frequent unprotected sexual exposures with multiple partners than the married individuals.

The statistically significant association observed between HBsAg and predisposing factors such as tattoo, transfusion, sexual transmitted infection, sexual exposure, multiple sexual partner and shared equipment (needles and sharps) has further confirmed that shared equipment might be one of the

ways one can acquire HBV [6] which is a common practice among inmates. Notably, alcoholism was associated with both Hepatitis A and Hepatitis B virus infection in this study. The only positive hepatitis A virus (2.63%) was found among those that consume alcohol. Gitto et al., [28] stated in their study that that alcohol consumption is often associated with viral hepatitis.

Duration of stay in the correctional center was significantly associated with HBV and HAV infection in which the highest prevalence occurs in those who have stayed 49 months and above with 14.28% prevalence for hepatitis B and 11.11% prevalence for hepatitis A virus infection. This points towards the conclusion that majority of the inmates in our study population probably were infected during incarceration. However, other report has also linked longer incarceration to higher risk of Hepatitis virus infection prevalence [27].

The recidivism rate of 16.00% among the correctional center inmates observed in this study is a cause for public health concern as these could serve as source of inter and intra-prison transmission of hepatitis B virus. Hence, the need to enact policies that would aid in confinement of the spread of infectious diseases by released correctional center inmates.

In conclusion, hepatitis B (10.0%) and A (1.00%) Virus infections were seen among the correctional center population studied. Attitude and behaviors by inmates such as

tattooing/scarification, injection drugs use, sharing of shaving equipment, multiple sexual partners and alcoholism should be discouraged. This result seeks to promote consideration of routine hepatitis virus antibody screening especially Hepatitis B and behavioral interventions among incarcerated men and women. Screening of the inmates at the point of incarceration should be considered in order to curtail the spread of infectious diseases such as hepatitis.

As a limitation, we believe that some demographic risk factors may have been underreported owing to fear of punishment, discrimination and stigmatization associated with some social behaviour in developing countries.

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### Conflict Of Interest

The authors declare that they have no competing interest

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