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Sero-Prevalence and Distribution of Hepatitis B Surface Antigenaemia among People Living in Urban Settings in Rivers State of Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Background: Hepatitis B virus (HBV) infection remains a global health challenge, affecting millions of people worldwide. Globally, HBV prevalence is 3.2% and in Nigeria, the rate is 8.1%.
Aim: To determine the prevalence of hepatitis B surface antigen and how certain demographics affect the distribution of the infection.

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Methodology: A cross-sectional study was carried out involving 392 individuals in three LGA in Rivers State who gave their consents to participate in the project, their samples were taken and aseptically worked on using HBsAg rapid diagnostic kit and then statistically analyzed using SPSS version 28, which gave the Mann-Whitney U and Kruskal-Wallis test.
Result: The result based on demographics shows that in the age group analysis, those aged 40-50 have a higher prevalence (8.2%), while females have a lower rate (2.5%) than males (7.1%). No significant differences appear in marital status, education, or age groups. However, the test on occupation reveals a significant difference (*P*=0.001), with teachers having the lowest prevalence (2.2%) and applicants the highest (15.8%). The significant difference in HBsAg prevalence between males and females (*P*=0.028) was seen.
Conclusion: Having completed this study it has been revealed that only gender and occupation have an impact in HBsAg sero-prevalence, and targeted interventions may be needed, particularly focusing on occupations and sex with higher prevalence rates.

Keywords: Demographic; hepatitis B; Rivers State; sero-prevalence; study.

1. INTRODUCTION

Hepatitis B is a major global health issue affecting millions of people worldwide. It is caused by the Hepatitis B Virus (HBV), which is transmitted through blood and other body fluids. Chronic HBV infection can lead to severe liver diseases, including cirrhosis and hepatocellular carcinoma (HCC) [1]. Despite the availability of an effective vaccine, HBV remains a significant public health challenge, especially in sub-Saharan Africa. Globally, the prevalence of HBV is 3.2%, in Nigeria the rate is 8.1%, and in North West region of Nigeria a prevalence of 12.1% was reported. At the forefront of Hepatitis B diagnostics is the Hepatitis B surface antigen (HBsAg), a crucial marker indicating active infection [2].

Urban settings often present unique challenges in HBV control due to higher population density, varied healthcare access, and diverse socio-economic factors. Research focusing on urban populations has highlighted the increased risk of HBV transmission linked to these factors. For example, a study in Lagos, Nigeria, revealed a higher prevalence of HBV in urban areas compared to rural regions, attributing it to factors such as higher rates of risky behaviors and inadequate vaccination coverage [3].

Understanding the distribution and sero-prevalence of HBsAg is paramount in unraveling the dynamics of Hepatitis B transmission, especially within specific geographic contexts. This study delves into the sero-prevalence and distribution of Hepatitis B surface antigenemia among individuals residing in urban settings across three Local Government Areas (LGAs) in Rivers State, Nigeria.

As a viral infection, Hepatitis B manifests with diverse sero-prevalence rates across different regions. Rivers State, known for its dynamic urban communities, offers a unique backdrop for investigating the distribution of HBsAg [4]. This research aims to scrutinize the prevalence of HBsAg within distinct demographic groups, emphasizing the impact of urban living on Hepatitis B transmission dynamics. Urban settings are characterized by population density, diverse lifestyles, and varied healthcare accessibility, which play a pivotal role in shaping the prevalence and distribution patterns in the transmission of infectious diseases [5].

The correlation between the sero-prevalence of HBsAg and urban living in Rivers State is of particular interest [4]. This study seeks to unravel the intricate interplay of demographic factors such as age, gender, education, marital status, and occupation in influencing Hepatitis B prevalence within these urban communities [6]. By employing a comprehensive approach, the research aims to illuminate the nuanced connections between Hepatitis B dynamics and the urban landscape of Rivers State [7].

The urgency of this research stems from the critical need to address the gaps in knowledge regarding Hepatitis B prevalence and distribution within urban settings in Rivers State. Understanding how HBsAg is distributed among diverse demographic groups in urban areas is essential for tailoring effective public health interventions [8]. The study's findings will provide vital insights into the specific challenges posed by urban living, guiding the development of targeted vaccination programs, healthcare policies, and awareness campaigns to curb the prevalence of Hepatitis B in this region [9].

Ultimately, this research serves as a foundational step towards mitigating the impact of Hepatitis B on the health of urban communities in Rivers State and contributes to the global effort in combating this infectious disease.

This study aims to evaluate the Sero-Prevalence of HBsAg in Urban Setting in Port Harcourt City Local Government, Obio-Akpor Local Government, and Omoku Local Government Area in Rivers State of Nigeria by determining the general sero-prevalence of HBsAg in the study population of the area, of HBsAg based on the demographic characteristics and comparing the sero-prevalence of HBsAg across groups by demographic characteristics.

2. MATERIALS AND METHODS

2.1 Study Design

The study was a cross-sectional study, undertaken between March and June 2023, among subjects attending the general outpatient unit of the three selected hospitals in Rivers State, situated in different Local Government Areas, which included Obio Cottage Hospital, Rivers State University Teaching Hospital and General Hospital Omoku-Obrikom.

2.2 Study Area

This research study was undertaken in three Local governments Areas (LGAs) of Rivers State; Port Harcourt, Obio-Akpor and Omoku local government. Three major hospitals geographically and spatially located in the three LGAs were used as sampling sites, Obio Cottage Hospital is situated in Obio-Akpor Local Government Area, General Hospital Omoku-Obrikom is located in Ogba-Egbema Local Government Area and Rivers State University Teaching Hospital is situated in Port Harcourt Local Government Area.

Rivers State is a major petroleum industrial center and location for multinational firms, it is a state that experiences a tropical wet climate typically characterized by long rainy seasons and short dry seasons.

2.3 Study Populations

The study was conducted using a total of 392 (154 males and 238 females) adults from different age groups comprising all outpatients from each of the selected hospitals located in the three local governments.

2.4 Inclusion Criteria

Three hundred and ninety-two informed female and male registered outpatients of the three local governments amongst all the age groups who accepted and well gave their consent by endorsing the consent form were recruited and included in the research.

2.5 Exclusion Criteria

Patients who had been confirmed with other ailments aside from HBV were excluded from the study. Those undergoing chemotherapy were also excluded to avoid bias in the gathered sample data, and those transferred from different local governments who were not being worked with were also excluded.

2.6 Sample Collection

The vacutainer needles were, used to collect two milliliters of blood via venipuncture [10,11].

The blood collected was placed in plain bottles. It was transported to the Medical Microbiology Laboratory, within the Department of Medical Laboratory Science complex, Rivers State University for serological analysis.

2.7 Hepatitis B Test

Hepatitis B antigenemia was diagnosed by allowing the blood in the plain bottle to settle and the serum was carefully collected and used to detect hepatitis B antigen. The antigen was detected with a rapid serology assay diagnostic kit [12].

2.8 Statistical Analysis

Data obtained from the diagnosis were analyzed using SPSS software version 28. Results of the study were expressed in percentages, the Mann-Whitney U and Kruskal-Wallis test was used to conclude the significance levels between the parameters, with the significance value set at less than or equal to 0.05.

3. RESULTS

Fig. 1 shows the sero-prevalence of HBsAg. The result reveals that the sero-prevalence of HBsAg is 4.3%.

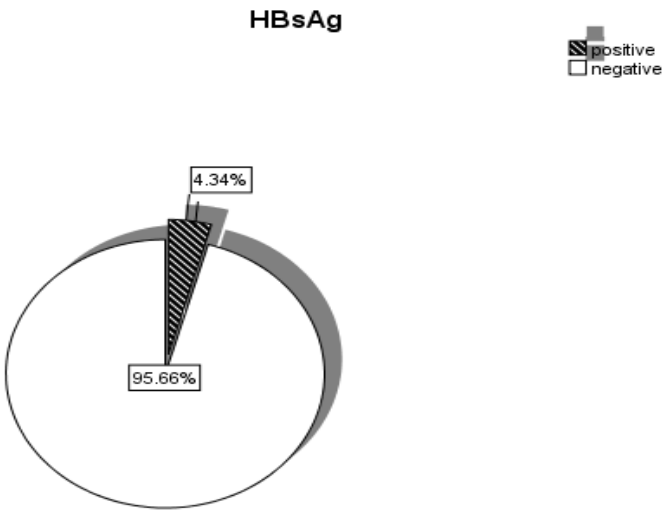

Fig. 1. Pie Chart of General Sero-prevalence of HBsAg

Table 1. HBsAg Sero-prevalence based on Demographics

Demographics	N	HBsAg Sero-positive	HBsAg Sero-prevalence
Age (years)			
<20	51	0	0.0%
21-29	70	2	2.9%
30-39	180	9	5.0%
40-50	73	6	8.2%
≥ 51	18	0	0.0%
	392	17	4.3%
Sex			
Male	154	11	7.1
Female	238	6	2.5
Education			
no formal education	10	1	10.0
Primary	8	0	0.0
Secondary	140	8	5.7
Tertiary	234	8	3.4
Occupation			
Teacher	93	2	2.2
civil servant	73	4	5.5
self-employed	70	7	10.0
Driver	7	0	0.0
Applicant	19	3	15.8
Housewife	2	1	50.0
Health	13	0	0.0
Student	74	0	0.0
Cleaner	3	0	0.0
Security	5	0	0.0
Others	33	0	0.0

Table 1 reveals varying HBsAg sero-prevalence rates across demographics. Notably, individuals aged 40-50 show the highest prevalence at 8.2%, while those below 20 exhibits no cases. Gender-wise, males have a higher prevalence (7.1%) than females (2.5%). Education-wise, those with no formal education and self-employed individuals show higher rates. Occupation-wise, applicants have the highest prevalence at 15.8%, highlighting the importance of targeted interventions based on demographic factors.

Table 2 comparing between male and female HBsAg sero-prevalence rates reveals a significant difference *P*=0.028. Males, with a mean rank of 191.00, have a lower prevalence compared to females, whose mean rank is 200.06. The p-value below 0.05 suggests a statistically significant variation.

Table 3 result on HBsAg sero-prevalence across age groups shows no significant difference (p=0.176). While there is a slight variation in mean ranks, the chi-square value does not reach significance.

Table 4 result on HBsAg sero-prevalence by marital status indicates no significant difference, giving a Chi-square value of 1.151, 3 degrees of freedom and *P*=0.765. Despite minor variations in mean ranks, the chi-square value does not reach significance, suggesting that marital status is not a significant factor in the distribution of HBsAg prevalence.

Table 5 result on HBsAg sero-prevalence by education reveals no significant difference giving a chi square value of 2.246, with 3 degrees of freedom and *P*=0.523. Although there are slight variations in mean ranks, the chi-square value does not reach significance.

Table 6 result on HBsAg sero-prevalence by occupation reveals a significant difference giving 10 degrees of freedom, a chi-square value of 28.818, and *P*=0.001. Various occupations show distinct mean ranks, with teachers having the lowest prevalence (2.2%) and applicants the highest (15.8%). indicating a significant variation.

Table 2. Comparison of the sero-prevalence of HBsAg between male and female gender

Dependent Variable	Sex	N	Mean Rank	Sum of Ranks	Mann-Whitney U	p-value
HBsAg	Male	154	191.00	29414.00	17479.000	.028
	Female	238	200.06	47614.00		
	Total	392				

Note: p>0.05=Not Significant, p<0.05=Significant

Table 3. Comparison of HBsAg sero-prevalence across Age Groups

Dependent Variable	Age	N	Mean Rank	Chi-Square (Kruska-wallis)	Df	p-value
HBsAg	<20years	51	205.00	6.324	4	.176
	21-29 years	70	199.40			
	30-39 years	180	195.20			
	40-50 years	73	188.89			
	51 years & Greater	18	205.00			
	Total	392				

Note: p>0.05=Not Significant, p<0.05=Significant

Table 4. Comparison of HBsAg sero-prevalence by Marital Status

Dependent Variable	Marital Status	N	Mean Rank	Chi-Square (Kruska-wallis)	df	p-value
HBsAg	Single	186	194.46	1.151	3	.765
	Married	198	198.07			
	Divorced	5	205.00			
	widowed/ widower	3	205.00			
	Total	392				

Note: p>0.05=Not Significant, p<0.05=Significant

Table 5. Comparison of HBsAg sero-prevalence across Educational levels

Dependent Variable	Education	N	Mean Rank	Chi-Square (Kruska-wallis)	df	p-value
HBsAg	No Formal Education	10	185.40			
	Primary	8	205.00			
	Secondary	140	193.80	2.246	3	.523
	Tertiary	234	198.30			
	Total	392				

Note: p>0.05=Not Significant, p<0.05=Significant

Table 6. Comparison of HBsAg sero-prevalence across Occupation

Dependent Variable	Occupation	N	Mean Rank	Chi-Square (Kruska-wallis)	df	p-value
HBsAg	Teacher	93	200.78	28.818	10	.001
	civil servant	73	194.26			
	self employed	70	185.40			
	Driver	7	205.00			
	Applicant	19	174.05			
	Housewife	2	107.00			
	Health	13	205.00			
	Student	74	205.00			
	Cleaner	3	205.00			
	Security	5	205.00			
	Others	33	205.00			
	Total	392				

Note: p>0.05=Not Significant, p<0.05=Significant

4. DISCUSSION

The findings presented offer significant insights into the demographic variations in HBsAg sero-prevalence, highlighting distinct patterns across age, sex, education, occupation, and marital status. Our data indicate no significant difference across age groups. Although it was observed that HBsAg sero-prevalence was consistent among individuals aged 40-50, whereas younger populations, particularly those under 20, exhibited no cases. This perhaps, is due to the fact that chronic hepatitis B often accumulates over years and is more prevalent in older populations [13,14]. This trend might reflect cumulative exposure or risk accumulation over time, which aligns with existing literature suggesting that chronic hepatitis B infection often develops over years and may become more prevalent in older age groups due to long-term exposure [15]. In contrast, the lack of cases in the youngest age group could imply effective vaccination programs or lower historical exposure rates among this cohort. Previous studies have similarly observed age-related variations in HBsAg prevalence, often linked to historical differences in vaccination coverage and infection rates [16].

A significant difference in sero-prevalence between males and females was observed, with males showing higher prevalence rates [17]. This disparity might be attributed to behavioral or occupational risk factors, such as higher rates of high-risk behaviors or differences in healthcare access [18]. For instance, males might be more exposed to risk factors associated with hepatitis B, including higher rates of injection drug use or occupational exposure. Males may have higher exposure to risk factors associated with HBV transmission, such as higher rates of injection drug use, risky sexual behavior, or higher rates of certain occupational exposures. Behavioral patterns play a significant role in the differential prevalence between genders. Differences in healthcare-seeking behavior and access to preventive measures between genders can also influence prevalence rates.

Furthermore, males might delay seeking medical care or preventive services, leading to higher rates of undiagnosed and untreated chronic HBV infection. This finding is consistent with other studies that have reported gender-based variations in hepatitis B prevalence, reflecting the complex interplay between biological, behavioral, and social factors influencing disease transmission [19]. Educational attainment and occupation also show substantial variability in HBsAg prevalence. Individuals with no formal education and those in self-employment roles exhibit higher prevalence rates. This suggests that lower educational levels and certain occupations might correlate with increased risk due to limited access to preventive healthcare, lower health literacy, or exposure to high-risk environments [20,21].

In particular, occupations with higher HBsAg prevalence, such as applicants, could be indicative of specific socioeconomic conditions or environments that facilitate higher transmission rates. Studies have shown that lower education and specific occupational exposures can be associated with increased hepatitis B risk, underscoring the need for targeted health interventions in these groups [22]. There was no significant variation in HBsAg prevalence across different marital statuses was observed in this study. This could imply that marital status alone is not a strong determinant of hepatitis B risk, or that other factors, such as sexual behavior or partner's infection status, play a more significant role. Previous research has similarly found mixed results regarding the association between marital status and hepatitis B prevalence, suggesting that other contextual factors may be more influential [23].

The findings of this study resonate with existing research on hepatitis B epidemiology, highlighting the importance of demographic factors in understanding disease prevalence [24]. For example, higher prevalence among males and older age groups is frequently documented, reflecting both biological susceptibility and exposure risks. The educational and occupational disparities observed in our study echo findings from other regions, suggesting that targeted educational and occupational health interventions could be beneficial in mitigating risk.

Overall, these results underscore the need for targeted public health strategies that address specific demographic vulnerabilities. Tailoring interventions to high-prevalence groups, such as older adults, males, and those with lower education or certain occupations, could enhance the effectiveness of hepatitis B prevention and control programs. Additionally, continued monitoring and research are essential to adapt strategies as demographic and epidemiological patterns evolve. The high prevalence of HBV in males and among applicants underscores the need for continued public health efforts, including enhanced vaccination programs, targeted screening, and education campaigns. Addressing the socio-economic determinants of health and improving access to healthcare services are crucial for reducing HBV transmission. Additionally, localized studies such as those in Rivers State provide valuable data that can inform public health strategies and policies tailored to specific regions.

5. CONCLUSION

The sero-prevalence study of Hepatitis-B surface antigen provides a comprehensive analysis of a study population of 392 individuals, revealing interesting trends across demographic factors. The overall prevalence of 4.3% indicates a relatively low but concerning level of HBsAg positivity within the groups, having completed this study it has been revealed that age, gender, and occupation play significant roles in HBsAg sero-prevalence and targeted interventions may be needed, particularly focusing on occupations and sex with higher prevalence rates, warranting public health attention due to the potential complications associated with Hepatitis B.

6. RECOMMENDATION

Further exploration into the factors contributing to most discrepancies such as behavioral patterns, occupational exposure, healthcare-seeking behavior, or biological differences should be done as this could provide valuable insights into designing more targeted and effective interventions, also there is a need to sensitize individuals on the need of being vaccinated.

7. LIMITATION

The seroprevalence observed in this study may accurately represent the disease burden in the study area, given that only hospital-based cases were included. However, the findings might not be applicable nationwide, as they diverged from results in some published studies from other regions of Nigeria. Despite these limitations, this

research establishes fundamental seroprevalence data for HBsAg co-morbidity, serving as a baseline for future studies.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

ETHICAL CONSIDERATION

Before starting this research work, approval was sought from the Research Ethics Committee of Rivers State University to carry out this work. The management of each sampling hospital in the three local governments permitted sample collection. A consent letter was administered to each of the participating subjects after clearly informing them about the objectives as well as the aim of the research. They were also informed of their right to participate or withdraw from the research before, during, and even after the research with no consequence. They were also educated on the confidentiality of the results of the research study.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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