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Epidemiological Distribution of Human Immunodeficiency Virus (HIV) among Residents of Port Harcourt Metropolis in Rivers State 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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Case Report

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ABSTRACT

Background: Human Immunodeficiency Virus is a lentivirus, a member of Retroviridae family that causes Acquired Immune Deficiency Syndrome. Globally, it was estimated that about 0.7% adult, aged 15- 49 years are living with HIV, with a prevalence of about 1.4% in Nigeria. However, a challenge lies in the insufficient and unreliable data present in much of the epidemiological research conducted in various countries and states. Therefore, this study aims to tackle this issue by focusing on gathering comprehensive demographic data and examining the distribution's impact of HIV among the subjects.
Aim: To examine the Epidemiological Distribution of HIV among Residents of Port Harcourt Metropolis in Rivers State, Nigeria.

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Methodology: A cross-sectional study was conducted in the Port Harcourt metropolis, involving adult participants aged 20 years and above selected by simple randomized method among outpatients attending the Rivers State University Teaching Hospital, Port Harcourt. A total of 392 individuals provided consent and were recruited at the hospital. The study investigated variables such as age, gender, marital status, education level and occupation. Samples were collected and examined using the ELISA method under aseptic conditions. Statistical analysis was performed using SPSS version 28, including the calculation of Mann-Whitney U and Kruskal-Wallis test values.

Results: The overall study revealed a prevalence of 1.02%, with only 4 individuals testing positive. Participants were grouped based on various demographics: age (P= .503), gender (P= .142), educational levels (P= .028), marital status (P= .000), and occupation (P= .733), with corresponding p-values indicating significance levels (P<0.05=Significant, P>0.05=Not Significant). Two demographic categories showed statistical significance: marital status, with higher prevalence among singles than married individuals, and educational level, with higher prevalence among those with no formal education.

Conclusion: This study showed low HIV prevalence in Port Harcourt. Marital and educational demographics impacted infection distribution such that married, single, and formal education level increases HIV risk. Health education, community HIV testing, consistent monitoring, and regular data updates are strongly advised as crucial measures in the fight against HIV infection.

Keywords: Demographic; ELISA method; epidemiological distribution; HIV; Port Harcourt Metropolis; Rivers State; Nigeria.

1. INTRODUCTION

Human Immunodeficiency Virus (HIV) remains a significant global public health concern, with a profound impact on the well-being of individuals and communities [1]. In recent years, the relentless efforts to understand, manage, and curb the spread of HIV have brought about substantial advancements in the field of virology and public health. Despite these efforts, HIV continues to pose challenges, particularly in sub-Saharan Africa, where its prevalence remains high [2].

Nigeria, the most populous country in Africa, has grappled with the complex epidemiology of HIV [3]. The virus has posed a substantial burden on public health, healthcare systems, and socio-economic development. Over the years, various interventions and strategies have been implemented to address the HIV epidemic, ranging from awareness campaigns and prevention programs to the provision of antiretroviral therapy (ART) [4]. However, the distribution and prevalence of HIV exhibit regional variations, emphasizing the need for targeted, context-specific interventions [5,6].

Nigeria, situated in West Africa, has a diverse demographic landscape and a complex epidemiological profile of HIV [7]. The prevalence of HIV varies across regions and populations, making it imperative to tailor interventions based on local contexts [8]. The national response to HIV has evolved over the years, with concerted efforts to increase testing, enhance access to treatment, and reduce transmission rates [9].

Despite progress in the fight against HIV, challenges persist. Factors such as socio-economic disparities, cultural practices, and regional variations in healthcare infrastructure contribute to the diverse distribution of HIV within the country [10]. Understanding these dynamics is crucial for the development of effective strategies to control and ultimately eliminate the virus [9].

This study focuses on the epidemiological distribution of HIV among residents of Port Harcourt Metropolis in Rivers State, Nigeria. Port Harcourt, as a prominent urban center in the Niger Delta region, presents a unique demographic and socio-cultural context that may influence the spread of HIV. Investigating the prevalence and distribution of HIV in this specific locale is essential for several reasons [7].

Firstly, Port Harcourt serves as a microcosm of the broader challenges faced by urban areas in Nigeria concerning HIV [11]. The dynamic nature of urban settings, with increased population mobility and diverse social interactions, may contribute to unique patterns of HIV transmission. Secondly, understanding the epidemiology of HIV in Port Harcourt can inform targeted interventions and resource allocation,

optimizing the impact of public health strategies [12].

This research seeks to contribute valuable insights into the current status of HIV in Port Harcourt, exploring demographic factors, prevalence rates, and potential determinants of infection. By doing so, a foundation is provided for evidence-based policies and interventions that can effectively address the challenges posed by HIV in this specific urban context.

The reason for this study is to examine the Epidemiological Distribution of HIV among Residents of Port Harcourt Metropolis in Rivers State Nigeria by evaluating the rate of HIV infection among Residents of Port Harcourt Metropolis in Rivers State Nigeria and also to measure and compare the prevalence rate of HIV infection about socio-demographics parameters.

2. MATERIALS AND METHODS

2.1 Study Design

The study was a cross-sectional investigation conducted between March and June 2023, involving random selection of three hundred and ninety-two (392) subjects enrolled from attendees at the general outpatient unit of Rivers State University Teaching Hospital, Portharcourt, Nigeria.

2.2 Study Area and Population

The research study took place in Port Harcourt, Rivers State, situated in the Niger Delta region of southern Nigeria. The primary hospital of interest, geographically situated in Port Harcourt, is the Rivers State University Teaching Hospital. A total of 392 adult participants, consisting of 154 males and 238 females from various age groups, including both outpatients and volunteers, were enrolled in the study.

2.3 Inclusion Criteria

Three hundred and ninety-two (392) male and female registered outpatients within the Port Harcourt metropolis, spanning all age groups, who willingly provided their informed consent by signing the consent form, were recruited and included in the research.

2.4 Exclusion Criteria

The exclusion criteria encompassed patients currently admitted to the hospital, individuals not residing in Port Harcourt, and those who declined to provide consent for participation in the study.

2.5 Study Variables

The independent variables measured in this study include demographic parameters such as age, gender, education level, occupation, marital status, while HIV status was determined as dependent variable.

2.6 Ethical Consideration

Prior to commencing this research, approval was sought and obtained from the Research Ethics Committee of Rivers State University. Permission for sample collection was granted by the management of the sampling hospital in Port Harcourt. Each participating subject received a consent letter, providing clear information about the research objectives and aims. Subjects were informed of their right to participate or withdraw from the research at any stage without consequence. Additionally, they were educated on the confidentiality of the research study results and their completed forms were collated and information extracted analyzed.

2.7 Collection of Blood Samples and Spinning for Collection of Serum

Blood samples were randomly collected from a total of three hundred and ninety-two (392) individuals. This group comprised both patients seeking medical attention, individuals accompanying them, and volunteers. Intravenous blood collection was conducted using 2ml syringes, with everyone's hand secured using a rubber tourniquet to facilitate the process. Subsequently, the collected blood samples were aseptically transferred into EDTA blood bottles and appropriately labeled. To prevent spillage and mixing, each EDTA bottle was carefully placed on a bottle rack. The blood samples were then centrifuged to facilitate rapid sedimentation, enabling the extraction of the required serum for HIV antibody screening.

2.8 Procedure for ELISA Test

Enzyme-linked immunosorbent assay (ELISA) screening test strips for HIV were provided in

accordance with the total number of sera to be screened. A disposable micropipette (25ul) was utilized to add 25ul of each test serum to individual strips. Each test strip includes a control region that detects anti-HIV antibodies (IgM and IgG) and HIV P24 antigens, along with a designated area for depositing the test serum. Sufficient time was allotted for proper reaction before interpreting results. To prevent sample mix-up or contamination, a new disposable micropipette tip was employed for each test serum sample.

2.9 Data Collection Instruments and Procedure

After consenting by signing a consent form, each participant engaged in a question-and-answer interview guided by a carefully crafted questionnaire customized for the study. Subsequently, HIV testing results documented in patient result forms were utilized to input data into the patient register, from which information was extracted for analysis purposes.

2.10 Analysis of Data

Data obtained from the diagnosis were analyzed using SPSS software version 28. The analysis results were presented as percentages. The Mann-Whitney U value and the Kruskal-Wallis test were utilized to determine the significance levels between the parameters, with a significance value set at less than or equal to 0.05.

3. RESULTS

3.1 Prevalence of HIV among Subjects

The result recorded an overall prevalence rate of seropositive HIV infection as 4 (1.02%) and seronegative as 388 (98.98%) of the three hundred, ninety-two (392) subjects examined. The positive and negative participants were linked to care and prevention services respectively at the hospital anti-retroviral therapy clinic.

3.2 Demographic Distribution of HIV among Age Groups

Table 1 shows the demographic prevalence and distribution of HIV in a specific population, across different age groups, genders, and educational levels. Across the age groups, individuals below 20 and those aged 30-39 years showed low HIV prevalence and the 40-50 years age group had a slightly higher rate. Males had a slightly higher HIV-positive rate than females. Education-wise, those with no formal education exhibited a higher prevalence.

3.3 HIV Prevalence Among Gender Groups (Male and Female)

Table 2 results for HIV prevalence between males and females indicate a p-value of .142, suggesting no statistically significant difference in infection rates. With a p-value above 0.05, the study concludes that there is no statistically significant disparity between the prevalence of HIV in male and female participants.

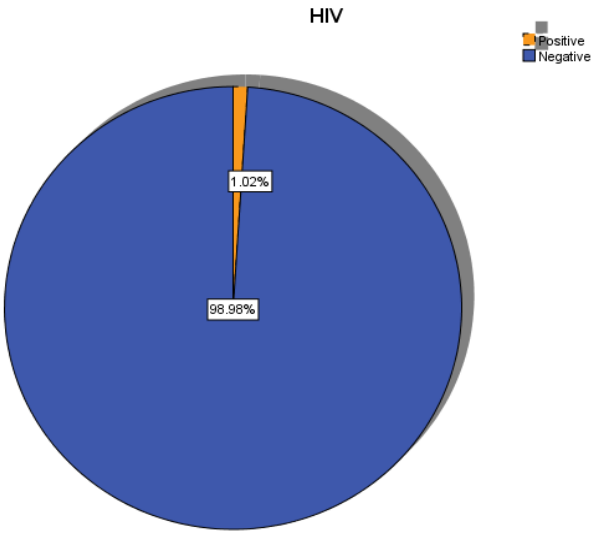

Fig. 1. Prevalence of HIV infection in the study population

Table 1. Demographic distribution of HIV among age groups

Demographics	Number Examined	HIV Negative	HIV Positive
Age (years)			
<20 years	51	51(100.0%)	
21-29 years	70	69(98.6%)	1(1.4%)
30-39 years	180	179(99.4%)	1(0.6%)
40-50 years	73	71(97.3%)	2(2.7%)
≥51years	18	18(100%)	0(0.0%)
Gender			
Male	154	151(98.1%)	3(1.9%)
Female	238	237(99.6%)	1(0.4%)
Education			
no formal education	10	9(90%)	1(10%)
Primary	8	8(100%)	0(0.0%)
Secondary	140	138(98.6%)	2(1.4%)
Tertiary	234	233(99.6%)	1(0.4%)

Table 2. Comparison of HIV prevalence for two groups (Male and Female)

Gender	N	Mann-Whitney U	p-value	Remark
Male	154	18046.000	.142	No statistically significant difference in the prevalence of HIV infection between males and females.
Female	238			
Total	392			

P<0.05=Significant, p>0.05=Not Significant

Table 3. Kruskal-Wallis Test of difference in prevalence of HIV infection by Age

Age	N	Chi-Square (Kruska-wallis)	Df	p-value	Remark
<20years	51				
21-29 years	70				
30-39 years	180	3.340	4	0.503	No statistically significant difference in the prevalence of HIV infection across the age group
40-50 years	73				
51≥years	18				
Total	392				

P<0.05=Significant, p>0.05=Not Significant

3.4 Occurrence of HIV Prevalence Rate Across Different Age Groups in the Study

Table 3: The result for HIV prevalence across different age groups shows a chi-square value of 3.340 and 4 degrees of freedom with a p-value of 0.503. The findings indicate with a p-value above 0.05, that there is no statistically significant difference in the prevalence of HIV infection among individuals of different age groups.

3.5 HIV Prevalence Based on Marital Statuses

Table 4: The results show HIV prevalence across different marital statuses reveal a statistically significant difference with a chi-square value of 18.247, 3 degrees of freedom, and a p-value of .000. This suggests that there are variations in the prevalence of HIV infection among individuals with different marital statuses in Port Harcourt Metropolis.

Table 4. Kruskal-Wallis Test of difference in prevalence of HIV infection by marital status

Marital Status	N	Chi-Square (Kruska-wallis)	df	p-value	Remarks
Single	186				
Married	198				
Divorced	5	18.247	3	.000	There is a statistically significant difference in the prevalence of HIV infection across the various marital statuses examined
widowed/ widower	3				
Total	392				

P<0.05=Significant, p>0.05=Not Significant

Table 5. Kruskal-Wallis Test of difference in prevalence of HIV infection by education

Education	N	Chi-Square (Kruska-wallis)	df	p-value	Remark
no formal education	10				
Primary	8	9.089	3	.028	There is a statistically significant difference in the prevalence of HIV infection across the various educational levels
Secondary	140				
Tertiary	234				
Total	392				

P<0.05=Significant, p>0.05=Not Significant

Table 6. Kruskal-Wallis Test of difference in prevalence of HIV infection by Occupation

Occupation	N	Chi-Square (Kruska-wallis)	Df	p-value	Remark
Teacher	93				
civil servant	73				
self-employed	70				
Driver	7				
Applicant	19	6.923	10	.733	There is no statistically significant difference in the prevalence of HIV infection across the various occupations studied
Housewife	2				
Health	13				
Student	74				
Cleaner	3				
Security	5				
Others	33				
Total	392				

P<0.05=Significant, p>0.05=Not Significant

3.6 Prevalence of HIV Infection by Education Status among Study Subjects

Table 5. The results for HIV prevalence across different educational levels indicate a significant difference with a chi-square value of 9.089, 3 degrees of freedom, and a p-value of .028. This underscores the impact of education on the prevalence of HIV infection in Port Harcourt Metropolis, with varying rates observed across different educational backgrounds.

3.7 HIV Prevalence Across Different Occupations Examined in the Study

Table 6 results for HIV prevalence across different occupations show that there is no statistically significant difference with a chi-square value of 6.923, 10 degrees of freedom, and a *p*-value of .733. This suggests that there is no substantial variation in the prevalence of HIV infection among individuals in different occupations in the Port Harcourt Metropolis.

4. DISCUSSION

The HIV prevalence rate was 1.0% among the 392 individuals examined, with 98.98% (388) testing negative and 1.02% (4) testing positive. This rate pertains specifically to the study's population. Globally, HIV remains a significant health concern, with an estimated 37.9 million people living with the virus in 2019 according to WHO [13]. In this study, the HIV prevalence in Port Harcourt, Rivers State, Nigeria, was 1.02%, lower than rates reported in other Nigerian studies, ranging from 2.8% to 10.6% in various states [14-19]. These disparities may stem from differences in sample populations, sizes, study durations, and socio-cultural factors. While these findings offer insight into HIV prevalence and epidemiology, a negative ELISA test doesn't rule out HIV exposure or infection, as false negatives can occur, especially soon after infection [20]. Hence, the actual HIV seropositive rate might be higher than reported. These results underscore the need to consider specific demographics, socio-economic variables, and geographic regions when interpreting HIV prevalence and planning targeted interventions.

Prevalence rates vary across demographic categories, with the highest observed in the 40-50 years age group. Slight differences exist between males and females, as well as among individuals with varying education levels. Comparing these findings, the overall HIV prevalence rate of 1.0% is slightly lower than Nigeria's national rate of 1.4% among adults aged 15–49 years, according to UNAIDS [21]. However, regional variations in HIV prevalence within Nigeria are evident, with different states showing diverse rates. For instance, Rivers State in Nigeria, as studied by Lokesh *et al.* [13], reports a higher HIV prevalence, consistent with the elevated rates in the 40-50 years age group.

Gender disparities are evident, with women aged 15–49 years being over twice as likely to have HIV as men in Nigeria (1.9% versus 0.9%) [21], aligning with the slightly higher prevalence among females. Tailored interventions and resource allocation are crucial based on HIV's demographic distribution. The breakdown of HIV prevalence across demographic categories underscores the need for targeted interventions, highlighting varying rates among age groups and educational levels. These findings generally align with broader patterns of HIV prevalence in Nigeria, emphasizing the importance of understanding and addressing demographic variations to inform targeted interventions and resource allocation.

There is no statistically significant difference between male and female participants, as indicated by a p-value of 0.142, which is above the conventional threshold of 0.05 for significance. Likewise, research by Mbakwem-Aniebo *et al.* [22] found that males had a slightly higher HIV infection rate (0.9%) compared to females (0.8%, n=3), yet no significant difference in infection distribution by sex was observed. Another study by Hessou *et al*. [23] conducted a systematic review and meta-analysis of HIV prevalence among men who have sex with men (MSM) in sub-Saharan Africa, revealing a notably higher average prevalence rate of 17.81% among MSM compared to men in the general population. However, the lack of statistical significance in the current study's findings may be attributed to both males and females having similar access to HIV information. Despite this, due to HIV's lengthy incubation period and asymptomatic phase, infected individuals may unknowingly spread the virus [24], potentially influencing the observed lack of statistical significance.

The results also investigate HIV infection prevalence differences across various age

groups within the study population, ranging from under 20 years to 51 years and older. It was found that there is no statistically significant variance in HIV infection prevalence among these age groups, suggesting insufficient evidence to reject the null hypothesis. Similarly, a study published in the *Journal of Acquired Immune Deficiency Syndromes* discovered that HIV diagnosis rates were higher for Black and Hispanic men who have sex with men (MSM) compared to White MSM, yet trends within age groups from 2001 to 2004 remained consistent across racial/ethnic categories. This implies that HIV prevalence may not significantly differ among age groups within specific demographic categories [25].

While various studies have shown variations in prevalence rates across age groups, with a slight increase noted in the 15 - 24 age bracket, this aligns with regional and global trends where young adults are deemed a vulnerable population due to lifestyle factors and risky behaviors, as noted by Vito-Peter *et al.* [26] Okafor *et al.* [27] and Queen *et al.* [28]. Furthermore, a CDC study revealed that individuals aged 13 to 34 accounted for 58% of the estimated 32,100 new HIV infections in the US in 2021 [29]. Based on the gathered data, age may not emerge as a significant determinant influencing HIV distribution in the studied population. This insight is vital for comprehending HIV's epidemiological patterns in Port Harcourt and may inform targeted public health interventions.

The study explores the variation in HIV infection prevalence across different marital status categories within the analyzed population. The reported p-value of 0.000, falling below the conventional significance threshold of 0.05, indicates a statistically significant difference in HIV infection prevalence among the various marital status groups. Specifically, the single and married groups exhibited higher prevalence compared to the divorced and widowed groups, mirroring findings from a study by Jakheng and Obeagu [30] which noted significant associations between HIV and marital status, with married women showing a prevalence of 1.9% and widows 1.0%. This suggests meaningful disparities in HIV prevalence across the examined marital status categories. A primary reason for these differences could be behavioral patterns and practices, including engaging in unprotected sex, having multiple sexual partners of unknown HIV status, and marital infidelity (such as polygamy and sexual promiscuity). These findings hold significant implications for public health interventions.

Understanding the link between HIV prevalence and marital status can inform tailored prevention and awareness campaigns. For instance, identifying higher prevalence rates in specific marital status groups can guide strategies aimed at increasing HIV testing, promoting safe sexual practices, and enhancing access to healthcare services within those communities.

For the difference in the prevalence of HIV infection across different education levels within the studied population, the *P*-value is reported as 0.028, which is less than the conventional significance threshold of 0.05. This indicates a statistically significant difference in the prevalence of HIV infection across the various education levels. Therefore, it is reasonable to conclude that there are meaningful disparities in HIV prevalence across the examined educational categories.

Contrastingly the study by Jakheng and Obeagu, [30] showed that there was no significant difference between level of education and HIV infection among pregnant women and non-pregnant women. In the study conducted the category of individuals with no formal education had the highest prevalence rate in percent and this could reasonably be because they are not educated and have not heard about the infection and so do not have measures put in place to avoid the viral infection. Understanding the association between HIV prevalence and education levels can have important implications for public health interventions. The significant difference observed suggests that there may be specific educational groups with higher or lower HIV prevalence. This information can guide targeted educational campaigns, interventions, and outreach efforts to address the varying needs of different education levels especially those with no formal education in preventing and managing HIV.

According to the results of a Kruskal-Wallis test investigating the variance in HIV infection prevalence across different occupations within the studied population (Table 6), participants were grouped into various occupational categories, and their collective statistics were evaluated. The reported p-value of 0.733 exceeds the conventional significance threshold

of 0.05, suggesting no statistically significant difference in HIV infection prevalence among the various occupations. While previous studies have indicated a direct correlation between occupation and HIV infection prevalence, such as observed in long-distance drivers and commercial sex workers [31], the findings of this study may stem from the majority of jobs not directly contributing to HIV infection. Moreover, professions with potential exposure to HIV, such as medical occupations, typically receive training on working with personal protective equipment, mitigating transmission risks etc.

Thus, it is reasonable to conclude that there are no substantial differences in HIV prevalence across the assessed occupational categories. This insight is critical for public health planning, indicating the need for tailored interventions and awareness campaigns that account for the absence of significant disparities in HIV prevalence among specific occupations compared to scenarios where such disparities exist.

5. CONCLUSION

Having completed this study, it has been revealed that the prevalence of HIV infection in Port Harcourt, Rivers State is low compared to other studies. While other demographic parameters did not influence the distribution of the infection, marital and educational statuses were found to impact the distribution of the infection such that people with formal education were more at risk of HIV infection than other levels of education and the single than married group in Port Harcourt. This has offered important insights into infection prevalence and the effectiveness of a medical outreach program within the state. The success of the program in encouraging testing, providing counseling, and facilitating care linkage underscores its potential as a model for future interventions within similar contexts.

6. LIMITATIONS

This study has some limitations namely, the limited study variables for risk factors, errors in data abstraction, and selection bias. We only studied the individuals who attended one general hospital in Port Harcourt. Our rates might have underestimated or overestimated the prevalence of HIV as a significant number of individuals (out-patients) were absent because of inaccessibility to the clinic or as a result of personal, behavioural, or socio-economic (cost to travel) reasons. Additionally, the cross-sectional nature of the study provides a snapshot of infection prevalence at a specific point in time and does not establish causality. While the convenience sampling approach facilitated practicality and ease of recruitment, it is acknowledged that this method may introduce selection bias and limit the generalizability of the findings.

7. RECOMMENDATION

Study recommendations include compulsory HIV testing for all, health education in public and private hospitals in Port Harcourt, and training healthcare providers for rapid diagnostic testing. Future research should delve into infection determinants like sexual behaviour, vaccination, and socioeconomic factors. Implementing sophisticated sampling techniques like stratified random sampling can enhance sample representativeness for broader applicability. Qualitative studies can explore testing decisions, counselling experiences, and barriers to care linkage.

CONSENT

Statement of informed consent was obtained from all individual participants in the study

ETHICAL APPROVAL

Ethical approval was obtained from the Rivers State Ethics Committee.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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