Case report

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

ABSTRACT

Background: Human Immunodeficiency Virus is a lentivirus, a member of Retroviridae family that causes Acquired Immune Deficiency Syndrome

Aim: to examine the Epidemiological Distribution of HIV among Residents of Port Harcourt Metropolis in Rivers State Nigeria.

Methodology: The study was a cross-sectional study with random selection carried out in the Port Harcourt metropolis were 392 individuals consented to participate in the project, their samples were properly taken and aseptically examined using the ELISA method and then statistical analysis was done with the help of SPSS version 28, getting the Mann-Whitney U value and Kruskal-Wallis test

Result: Overall study had a prevalence of 1.02% were only 4 individuals tested positive, the recruits were categorized into different demographic groups; age (*P*= .503), gender (*P*= .142), educational levels (*P*= .028), marital status (*P*= .000), occupation (*P*= .733) with their corresponding p-values which shows the level of significance, *P<0.05=Significant, P>0.05=Not Significant.* Two demographic groups were statistically significant; marital status having higher prevalence in singles and married, and the educational level having higher prevalence in the no formal education level.

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.

Keywords: Demographic, ELISA method, Epidemiological distribution, HIV, Port Harcourt Metropolis, Rivers State Nigeria

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 **t**o 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.

MATERIALS AND METHOD

Study Design

The study was a cross-sectional study with random selection, undertaken between March and June 2023, among subjects attending the general outpatient unit of Rivers State University Teaching Hospital.

Study Area and Population

The research study was undertaken in Port Harcourt, Rivers State, and a major hospital which is geographically and spatially located in Port Harcourt is Rivers State University Teaching Hospital. A total of 392 (154 males and 238 females) adults from different age groups comprising all as outpatients and volunteers.

Inclusion Criteria

Three hundred and ninety-two informed female and male registered outpatients within Port Harcourt amongst all the age groups who accepted and well gave their consent by endorsing the consent form were recruited and included in the research

Exclusion Criteria

Patients presently admitted to the hospital were excluded, individuals not resident in Port Harcourt were rightly excluded and those who did not give their consent to the project were also excluded.

Ethical Consideration

Before starting this research work, approval was sought and obtained from the Research Ethics Committee of Rivers State University to carry out this work. The management of the sampling hospital in Port Harcourt gave permission for sample collection and 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.

Collection of blood samples and spinning for collection of serum

Blood samples were collected from a total of three hundred and ninety-two (392) persons at random. They included sick persons who came to the hospital, persons who accompanied sick persons, and some volunteers. The blood samples from each individual were collected

intravenously with 2ml syringes after their hands were tied with the rubber tunicate to aid blood sample collection, then each blood sample was aseptically transferred into an EDTA blood bottle and appropriately labelled. Each of the EDTA bottleswas kept on a bottle rack to prevent pouring and mixing up, the blood sample was spun for easy and fast sedimentation to obtain the serum needed for the HIV antibody screening.

Procedure for ELISA test

ELISA Screening test strips for HIV were made available based on the total number of sera to be screened. A disposable micropipette (25ul) was used to add 25ul of each test serum to each strip. Each test strip has a control that detects anti-HIV antibody (IgM and IgG) and HIV P_{24} antigens and a position where the test serum is deposited. Adequate time was allowed for proper reaction to occur before results were read. A new disposable micropipette tip was used for each test serum sample to avoid mixing up samples or contamination.

Analysis of Data

Data obtained from the diagnosis were analyzed using SPSS software version 28. Results of the analysis were expressed in percentages, the Mann-Whitney U value was used while the 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.

RESULT

Prevalence of HIV

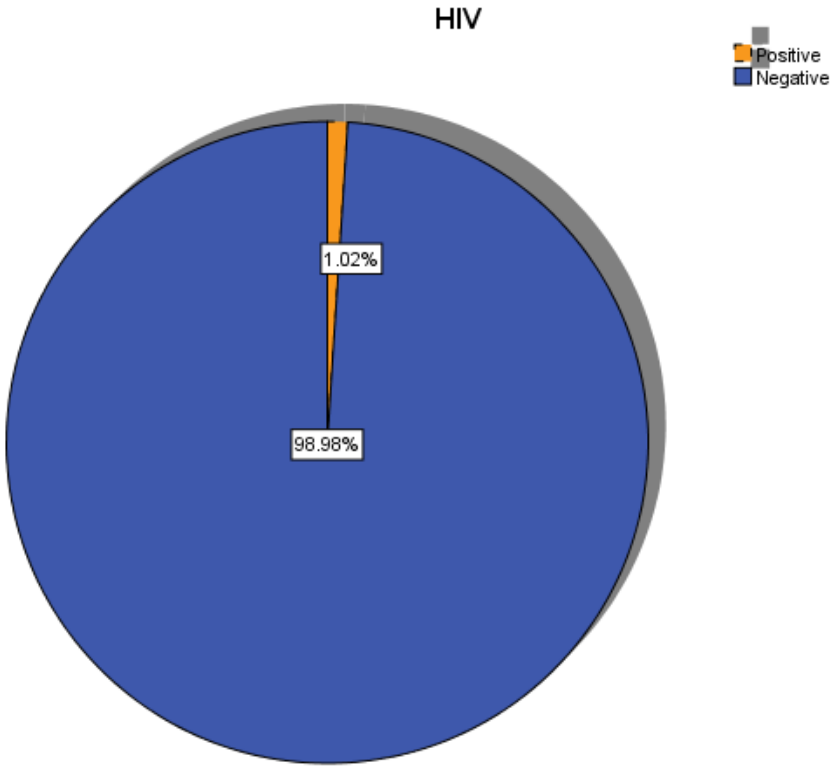

Figure 1: Pie Chart of Prevalence of HIV Infection in the Study Population

Table 1: Demographic Prevalence Distribution of HIV

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%)

Across age groups, individuals below 20 and those aged 30-39 years showed low HIV prevalence, while 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.

Mann-Whitney U Test: Used for comparison of HIV prevalence for two groups

Table 2: Mann-Whitney U showing difference in prevalence rate of HIV between Male and Female

Sex	N	Mann-Whitney U	p-value	Remark
Male	154	18046.000	.142	No significant difference in the prevalence of HIV infection between

					male and female
Female	238				
Total	392				

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

The Mann-Whitney U test results for HIV prevalence between males and females indicate a p-value of .142, suggesting no 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.

Kruskal-Wallis Test compared difference in HIV prevalence rate for more than two groups

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 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

The Kruskal-Wallis Test results for HIV prevalence across different age groups show 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 significant difference in the prevalence of HIV infection among individuals of different age groups.

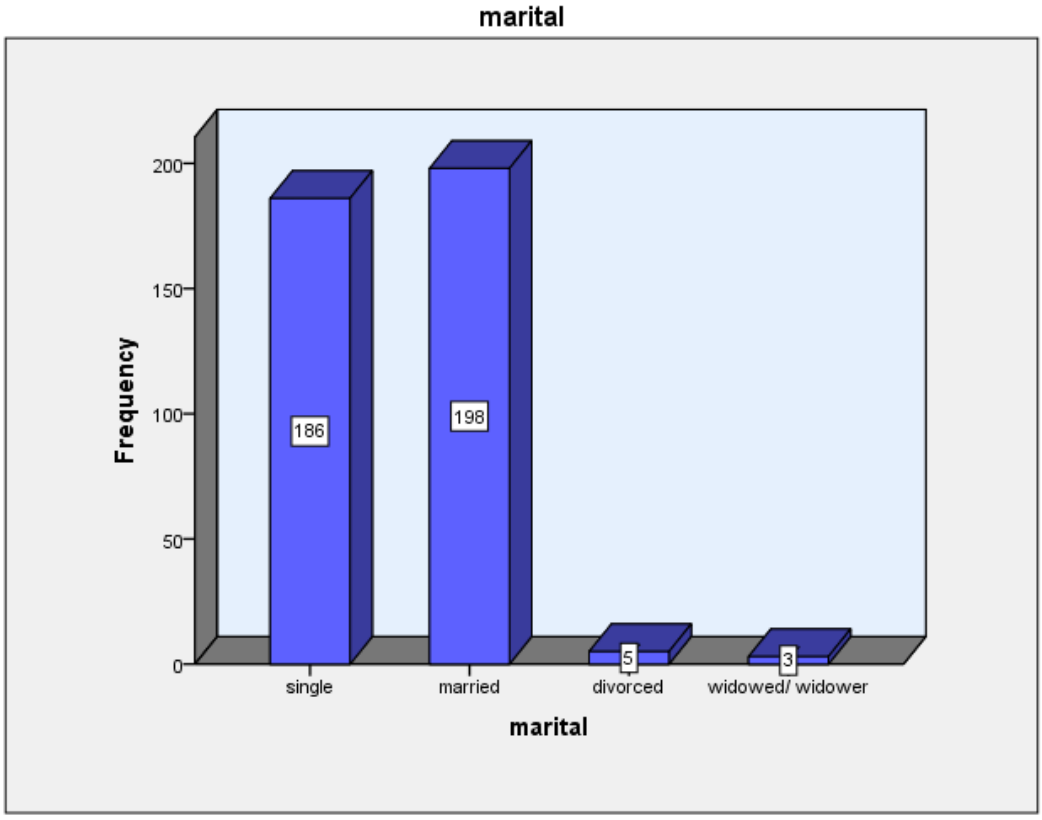

Figure 2: Bar Chart showing Frequency Distribution of Marital Status of Subjects

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	Remark
Single	186				
Married	198				
Divorced	5	18.247	3	.000	There is Significant difference in the prevalence of HIV infection across the various marital status examined
widowed/ widower	3				
Total	392				

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

The Kruskal-Wallis Test results for HIV prevalence across different marital statuses reveal a 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 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 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

The Kruskal-Wallis Test 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.

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

Education	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 significant difference in the prevalence of HIV infection across the various occupations studieds
Housewife	2				
Health	13				
Student	74				
Cleaner	3				
Security	5				
Others	33				
Total	392				

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

The Kruskal-Wallis Test results for HIV prevalence across different occupations show a non-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 Port Harcourt Metropolis.

DISCUSSION

The Pie chart shows an overall HIV prevalence rate of 1.0% based on the examination of 392 individuals, with 98.98% (388) testing negative for HIV and 1.02% (4) testing positive. This prevalence rate is specific to the study population from which the data was obtained. Infection arising from HIV is a serious health menace worldwide with about 37.9 million (32.7 - 44.0 million) people living with HIV by WHO region in 2019 [13]. In this study only about 1.02% had the virus in Port Harcourt metropolis in Rivers State Nigeria, this was lower than 4.6%, 3.8%, 3.5%, 2.8%, 10.6%, and 8.3% reported in other Nigerian studies in Sokoto State [14]. Kano State [15]. Enugu State [16]. Kaduna State [17]. Abia State [18] and in Edo State [19]. These variations might come from the sample population, population size, length of time studies were done, and different socio-cultural practices. The result provided a broader context of HIV prevalence rates and epidemiological data. However, a negative Elisa test at any time does not preclude the possibility of exposure or infection by HIV. This is so because a false negative result may occur if ELISA testing is carried out soon after infection by HIV [20]. This shows that the percentage of HIV sero-positive persons may be higher than reported in this study. These results emphasize the importance of considering specific demographic groups, socio-economic factors, and geographic locations when interpreting HIV prevalence rates and developing targeted interventions.

The provided table1 presents the demographic prevalence and distribution of HIV in a specific population, showing the HIV prevalence rates across different age groups, genders, and educational levels. The prevalence rates vary across the demographic categories, with the highest prevalence observed in the 40-50 years age group, the prevalence rates differ slightly between males and females, as well as among individuals with different levels of education. In comparison to the results, the overall HIV prevalence rate of 1.0% is slightly lower than the national HIV prevalence rate of 1.4% among adults aged 15–49 years in Nigeria, as reported by UNAIDS [21]. However, the search results also highlight the regional variations in HIV prevalence within Nigeria, with different states exhibiting varying prevalence rates. For example, observing the study of [13] Rivers State in Nigeria is reported to have a high HIV prevalence, which aligns with the higher prevalence observed in the 40-50 years age group in the provided table. Furthermore, the results provide insights into the gender disparities in HIV prevalence, with women aged 15–49 years being more than twice as likely to be living with HIV as men in Nigeria (1.9% versus 0.9%) [21].This is consistent with the slightly higher HIV prevalence observed among females in the provided table. The research results also emphasize the importance of tailored interventions and resource allocation based on the demographic distribution of HIV. The provided table's detailed breakdown of HIV prevalence across different demographic categories aligns with the need for targeted interventions, as it highlights the varying prevalence rates among different age groups and educational levels, these findings are generally consistent with the broader patterns of HIV prevalence in Nigeria, as reported in the results. The table's data underscores the importance of understanding and addressing the

demographic variations in HIV prevalence to inform targeted interventions and resource allocation.

According to the results of the Mann-Whitney U test, which was conducted to assess the difference in the prevalence rate of HIV between male and female participants in the study. There is no statistically significant difference between the two independent groups because in this case, the p-value is 0.142 and a p-value greater than 0.05 is generally considered not significant. Similarly, a study done by [23] presented that its gender-specific infection rate showed that males had a higher infection rate of 3(0.9%) for HIV than their female counterparts (0.8%, n=3). However, there was no significant difference in the distribution of HIV infection and sex of subjects, while a study carried out by [22] with a systematic review and meta-analysis of HIV prevalence rates among men who have sex with men (MSM) in sub-Saharan Africa revealed that the average prevalence rate of HIV was 17.81% among MSM, which is significantly higher than the prevalence rate among men alone in the general population. However, the result from this study in Table 2 could be becausemales and females are open to the same level of information on knowing their HIV status and avoiding the virus but given the long incubation period of HIV, most infected persons would be seen healthy and within this asymptomatic period, they could also pose a danger to the public by spreading the virus [24] and this reason could have caused their statistical insignificance. In light of this better examinations should be carried out to rule out the possibility of false negative results being given.

The result of this study in Table 3 presents the Kruskal-Wallis test, which was conducted to assess the difference in the prevalence of HIV infection across different age groups in the study population. The table categorizes the study participants into different age groups, ranging from less than 20 years to 51 years and above, the p-value associated with the Chi-Square statistic is 0.503. Therefore there is no significant difference in the prevalence of HIV infection across the age groups indicating that there is insufficient evidence to reject the null hypothesis, similarly a study published in the Journal of Acquired Immune Deficiency Syndromes found that HIV diagnosis rates were higher for Black and Hispanic men who have sex with men (MSM) than for White MSM, but trends within age groups from 2001 to 2004 did not differ by race/ethnicity [25], this suggests that the prevalence of HIV may not differ significantly among different age groups within specific demographic categories. Although different studies have shown that their prevalence rates exhibited variations across age groups, with a slight increase in the 15 - 24 age group. This is consistent with regional and global trends where young adults are considered a vulnerable population due to lifestyle factors and risky behaviour according to [26] [27] [28]. A further study published by the CDC found that people aged 13 to 34 accounted for 58% of the estimated 32,100 new HIV infections in the US in 2021 [29]. Based on the data collected, age may not be a significant factor influencing the distribution of HIV in the studied population. This information is crucial for understanding the epidemiological patterns of HIV in Port Harcourt and may have implications for targeted public health interventions.

Table 4 explains the results of a Kruskal-Wallis test examining the difference in the prevalence of HIV infection across different marital status categories within the studied population. *P*-value is reported as 0.000, 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 marital status groups. In this study the single and married group presented with higher prevalence compared to divorced and widowed this is similar to a study by [30] reporting that the comparison of the infection concerning marital status irrespective of pregnancy status showed that there was a significant association between HIV and marital status with married women having HIV prevalence of 1.9% and widows, 100.0%.Therefore, it is reasonable to conclude that there are meaningful disparities in HIV prevalence across the examined marital status categories. A major reason for this disparity could be the behavioral pattern and practice, having multiple sexual partners whose HIV status is unknown, cheating in marriages (polygamy and sexual promiscuity), and engaging in unprotected sex or "unsafe sex" practices. These findings have important implications for public health interventions. Understanding the association between HIV prevalence and marital status can help in tailoring targeted prevention and awareness campaigns. For example, identifying higher prevalence rates in specific marital status groups may inform strategies aimed at increasing HIV testing, promoting safe practices, and improving access to healthcare services within those communities.

Table 5 presents the results of a Kruskal-Wallis test examining 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 [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 due to the fact that 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.

As shown by the results of a Kruskal-Wallis test examining the difference in the prevalence of HIV infection across different occupations within the studied population in Table 6, participants were categorized into different occupations and their overall statistics were assessed reporting

the p-value as 0.733, which is greater than the conventional significance threshold of 0.05, therefore indicating that there is no statistically significant difference in the prevalence of HIV infection across the various occupations, While occupation has been shown in previous studies to have a direct correlation to the prevalence of HIV infection, for example long distance drivers and commercial sex workers [31], this study results could be due to the fact that most jobs are not directly related to the cause of HIV infection and the ones which are related such as medical jobs, orientation is given on how to work with personal protective equipment therefore it is reasonable to conclude that there are no meaningful disparities in HIV prevalence across the examined occupational categories. This information is important for public health planning, as it indicates that interventions and awareness campaigns may need to be tailored differently compared to situations where specific occupations show significant disparities in HIV prevalence.

LIMITATIONS

This study has some limitations namely, the retrospective nature and limited study variables for risk factors, errors in data abstraction, and selection bias because of loss to follow-up. 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.

CONCLUSION

Having completed this study, it has been revealed that the prevalence of HIV infection in Port Harcourt, Rivers State is low compared to others. 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 and 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.

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.

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