Detecting HIV, Hepatitis B, Hepatitis C, and Syphilis Infections in the Absence of Established Guidelines for Testing among Care-Seeking Individuals

Langley A. Orutugu[1], Jack P. ADAMA[2], Abdulrasheed B. Abdu[1*], Kemebradikumo D. Pondei[1]

[1]Department of Medical Microbiology and Parasitology, Faculty of Basic Clinical Sciences, College of Health Sciences, Niger Delta University, Amassoma, Wilberforce Island, Bayelsa State, Nigeria

[2]Nigerian Army, 16 Brigade Medical Centre, 16 Brigade Nigerian Army, Yenagoa, Bayelsa State (Nigeria)

***Corresponding Author**

DOI: https://doi.org/10.51244/IJRSI.2026.1315PH00155

Received: 18 October 2025; Accepted: 25 October 2025; Published: 21 August 2026

ABSTRACT

Introduction: The human immunodeficiency virus (HIV), hepatitis B virus (HBV), hepatitis C virus (HCV), and *Treponema pallidum* infections remain major public health concerns, especially in settings with limited routine diagnostic screening. In Nigeria, testing is largely confined to blood donor screening, leaving many people unaware of their infection status. This study evaluated the outcomes of offering voluntary screening for all four infections to individuals attending a healthcare facility for noninfectious reasons.

Materials and Methods: To evaluate the impact of unplanned testing for these four infections, a total of 376 participants were tested using rapid diagnostic assays. 376 subjects visiting a hospital for reasons other than testing were recruited and offered tests for HIV, HBV, HCV, and syphilis (VDRL). Venous blood was obtained from each subject, and rapid qualitative test kits were used according to the manufacturer's instructions to screen for hepatitis B surface antigen (HBsAg), antibodies against HCV (anti-HCV), HIV antibodies, and antibodies against syphilis (VDRL).

Results: Twenty-seven individuals (7.18%) were positive for at least one infection, with HIV 1 accounting for the highest proportion (4.52%). HBV, HCV, and syphilis prevalence were 1.32%, 0.79%, and 0.53%, respectively. No co-infections were detected.

Conclusion: These findings highlight the value of expanding routine testing strategies and support the integration of universal screening approaches for HBV, HCV, and syphilis alongside HIV.

Keywords: STIs, Detection, Testing, Nigeria

INTRODUCTION

Infections with the Hepatitis B Virus (HBV), the Hepatitis C Virus (HCV), the Human Immunodeficiency Virus (HIV), and Syphilis remain major public and reproductive health challenges globally, especially in developing countries. They have been variously classified among sexually transmitted diseases, sexually transmitted infections, sexually transmissible infections, reproductive tract infections, and transfusion-transmissible infections (Umoke *et al*., 2021; Okoroiwu *et al*., 2018; Holt *et al*., 2014). While they are commonly transmitted sexually, they can also be vertically and parenterally transmitted (especially blood transfusion-related). The morbidity, mortality, and economic and social effects of these four infections continue to be important public health issues (Okonko *et al*., 2012). The complications caused by chronic infection with these infectious agents are multi-systemic. HIV, Viral Hepatitis, and STI account for 2.3 million deaths per year, and about 1.2 million people develop cancer due to these infections (WHO 2021).

The Human Immunodeficiency Virus (HIV) is the causative agent of Acquired Immune Deficiency Syndrome (AIDS), which is an acquired defect of cellular immunity due to the activity of the virus (Okoroiwu *et al*., 2022). An estimated 38.7 million people were reported to be living with HIV globally in 2022 (HIV.gov, 2023), with 25.6 million people in sub-Saharan Africa. About 1.5 million people worldwide acquired HIV infection in 2021 (WHO, 2021). It is estimated that 650,000 people will die of HIV-related causes globally in 2021. In Nigeria, as of June 2023, it is estimated that 1.9 million people are living with HIV (PHIS, 2023) with a current prevalence of 1.4% (NAIIS 2019).

The Hepatitis B and C viruses are major causes of inflammation of the liver. Complications of chronic infection of the liver by these viruses include liver cirrhosis and hepatocellular carcinoma (Shen *et al*., 2023; Mendlowitz *et* al., 2021; Song *et al*., 2019). Hepatitis B and Hepatitis C are transmitted sexually, vertically, and parenterally. There were 296 million people globally living with chronic HBV infection in 2019, with about 1.5 million newly infected (WHO, 2022). Over 820,000 deaths from HBV-related causes occurred in 2019 alone (WHO 2022, 2021). The prevalence of HBV infection in Africa is 6.1% and 11.2% for Nigeria, meaning Nigeria is hyper-endemic (Ajuwon *et al*., 2021). HBV is a vaccine-preventable infection liver infection (WHO, 2023; Howe *et al*., 2019; Olayinka *et al*., 2016). Over 20 million people are estimated to be infected with HBV in Nigeria (WHO, 2023).

About 58 million people globally are estimated to be infected with the Hepatitis C virus (WHO, 2022), with about 9.4 million people receiving treatment for chronic HCV infection. About 1.5 million people are newly infected with HCV yearly, with 290,000 deaths from HCV-related causes in 2019 (WHO 2022). A review of viraemic HCV infection found the largest viraemic population of HCV globally in Nigeria: viraemic prevalence of 1.5% (Maaroufi *et al*. 2017).

Syphilis is caused by infection with a microaerophilic spirochaete bacterium known as *Treponema pallidum*. It is mostly transmitted sexually but can also be transmitted during pregnancy from a mother to her child and is responsible for some stillbirths. In 2020, 7.1 million people were newly infected with *Treponema pallidum*. About 1 million pregnant women were infected with syphilis in 2016, with 350,00 adverse birth outcomes (WHO STI Factsheet, 2022). Neonates who acquire HBV infection have a 90% risk of developing chronic HBsAg carriage and chronic liver disease (Yakasai *et al*. 2012). The prevalence of syphilis in Nigeria has ranged between 0.6 to 2.3% over 30 years (Taiwo *et al*. 2007). Only 13.7% of pregnant women in Nigeria were screened for syphilis in 2015 (Olugbenga *et al*. 2018).

New infections with HIV, HBV, HCV, and syphilis are usually asymptomatic so recent infections are barely diagnosed. However, markers of these four diseases are commonly screened for, before any blood transfusion. Only 10% of people with chronic HBV infection and 21% of people with HCV are diagnosed (WHO 2021). Syndromic management of illnesses especially sexually transmitted infections means that many infections will remain undetected. There is no established testing guideline for these four diseases outside testing before blood transfusions in Nigeria. It is therefore important to note that the sexual route should not be considered as the only route for their transmission. Nonetheless, most research on HIV, HBV, HCV, and syphilis in Nigeria, has been exclusively based on sexual and mother-to-child transmissions. This has led to a paucity of data on these especially in Bayelsa State, Nigeria. There is therefore a large gap in knowledge concerning these four infections.

This study was therefore planned to determine the proportion of normal care-seeking patients infected with HIV, HBV, HCV, and syphilis, without emphasis on the sexual nature of transmission. These findings will contribute to the baseline data on these infections in Bayelsa State, Nigeria.

MATERIALS AND METHODS

Study design

This was a descriptive, cross-sectional, hospital-based study carried out between January 2019 and December 2021.

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI | Volume XIII Issue XV August 2026 | Special Issue on Public Health

Study Area

The study was conducted in Yenagoa, the Capital of Bayelsa State, Nigeria. Yenagoa also serves as the Local Government Headquarters of Yenagoa Local Government Area. Bayelsa is one of the six states in Nigeria's South-South geopolitical zone.

Study Population

Patients attending a private healthcare facility were consecutively recruited into the study after counselling. They were either attending Antenatal Clinics or visiting for medical consultations or check-ups. The tests for HIV-1, Hepatitis B and C viruses, and syphilis are not routinely done for these hospital visits. The tests were then offered to the subjects after the counselling sessions, as the majority of the subjects were ignorant of their statuses for these sexually transmissible diseases. Subjects who had earlier been diagnosed with any of the four diseases were excluded.

Ethical Clearance

Ethical clearance was obtained from the relevant Institutional Review Boards. Informed consent was obtained from study subjects.

Specimen collection and processing

Five millilitres (5ml) volume of peripheral venous blood was collected from consenting subjects into plain sterile bottles. Blood specimens were centrifuged for ten minutes at 6,000 rpm and stored at -20^{O}C before use. Commercially available Rapid qualitative test kits were used for the detection of markers for these four infections. Infection with the *Human Immunodeficiency Virus* (HIV-1) was detected using the following kits - Determine™ (Abbott Laboratories, USA) for screening, Uni-gold™ (Recombigen® Laboratories, PVT, Limited, India) for confirmation, and Stat-Pak™ (Chembio Diagnostics, USA) as a tie-breaker.

The presence of detectable Hepatitis B virus surface antigen (HBsAg) and antibodies against Hepatitis C virus (anti-HCV) were detected using rapid Enzyme-Linked Immunosorbent Assay (ELISA) kits – (Accuquick™ Test kit, USA). Infection with syphilis was tested using the Venereal Disease Research Laboratory Test (VDRL) - VDRL stabilized reagent kit (Lorne Laboratories™ UK).

Statistical analysis

Statistical analysis was performed using SPSS 29.0.10

RESULTS

Participant Characteristics

In assessing the unplanned detection of HIV-1, HBV, HCV, and syphilis, the study enrolled 390 individuals. Of these, 376 participants (96.41%) provided full data, giving a complete-record rate of 96.4%. Among those with complete information, females accounted for 251 (66.76%) and males for 125 (33.24%). Participant ages spanned from 8 months to 90 years, reflecting a broad demographic distribution.

Prevalence

Figure 1 shows that 27 of the 376 participants with complete records were positive for at least one of the screened infections, representing an overall prevalence of 7.18%. HIV-1 accounted for most of these cases, with 17 individuals (62.96%) testing positive, corresponding to a prevalence of 4.52% in the study population. Five participants (1.33%) were reactive for HBsAg, three (0.80%) for anti-HCV antibodies, and two (0.53%) for VDRL. No HIV-2 infections were detected, and importantly, all positive cases involved single infections only, with no co-infection observed.

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI | Volume XIII Issue XV August 2026 | Special Issue on Public Health

Age and Sex

Table 1 presents the age and gender distributions of participants who tested positive for any of the four infections. The youngest infected individual was 15 years old, while the oldest was 75 years old. Most HIV-1–positive subjects were within the 11–20 and 21–30-year age groups. HBsAg positivity occurred only among individuals aged 11–20, 21–30, and 31–40 years. Anti-HCV antibodies were detected exclusively in the 11–20-year age group, whereas VDRL positivity was observed only among participants aged 21–30 years. Statistical analysis showed no significant association between age and infection status for any of the four pathogens.

Gender distribution revealed that among 251 female participants, 13 (5.18%) tested positive for HIV-1 and 3 (1.20%) were positive for HBsAg (Figure 2). Among 125 male participants, 4 (3.20%) were HIV-1 positive, 3 (2.40%) tested positive for anti-HCV antibodies, and 2 (1.60%) each were positive for HBsAg and VDRL.

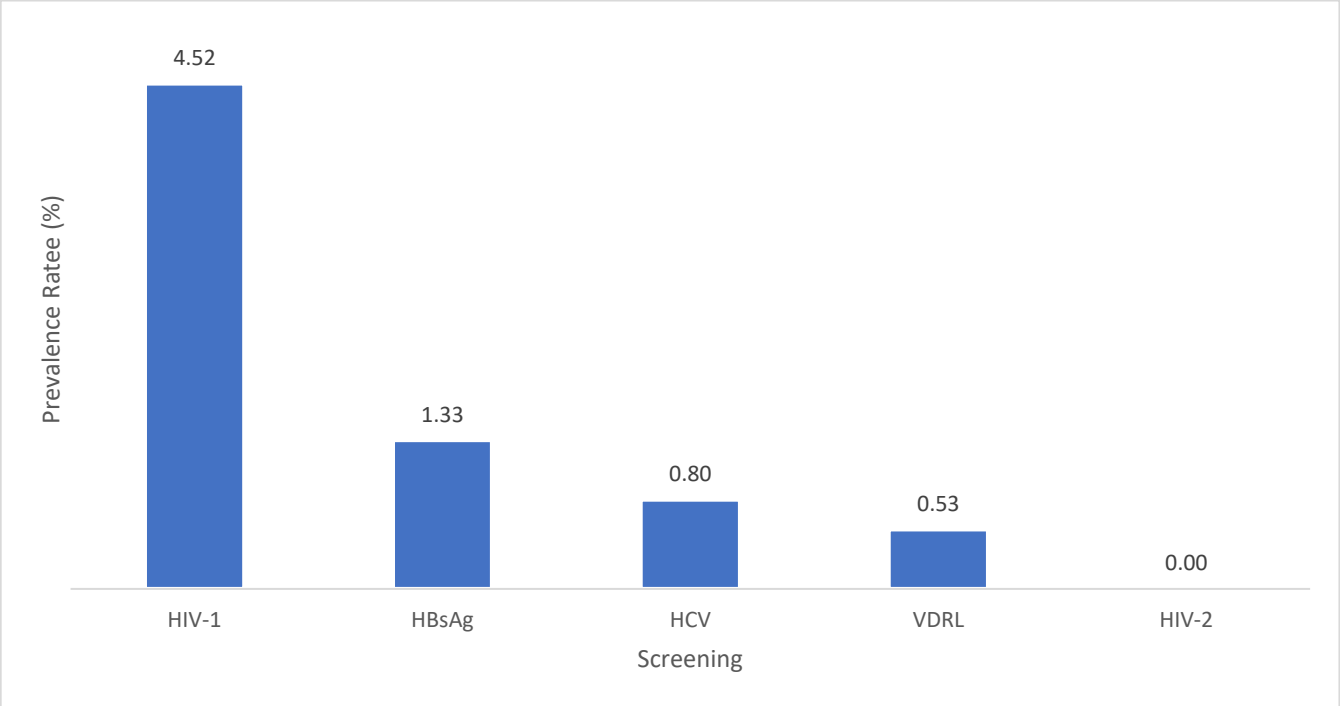

Figure 1. The Prevalence rate of HIV-1, HBV, HCV, and Syphilis amongst the Subjects from Bayelsa during the studied period. (January 2019 and December 2021).

Age group (years)	Total tested		HIV-1 (M)	HIV-1 (F)	HBV (M)	HBV (F)	HCV (M)	HCV (F)	VDRL (M)	VDRL (F)
	M	F								
0–10	11	13	0	0	0	0	0	0	0	0
11–20	17	48	1	5	0	2	2	0	0	0
21–30	39	102	2	3	0	1	0	0	2	0
31–40	36	62	0	3	2	0	0	0	0	0
41–50	10	15	1	1	0	0	0	0	0	0
51–60	3	2	0	0	0	0	1	0	0	0
>60	9	9	0	1	0	0	0	0	0	0
Total	125	251	4	13	2	3	3	0	2	0

Table 1. Distribution of positive cases according to age groups and sex

Key: M = male, F = female.

Reason for Hospital visitation

Among the 376 individuals screened, 312 (82.98%) presented for routine medical evaluation, whereas 64 (17.02%) attended antenatal services. Table 2 shows that routine care attendees accounted for 14 HIV-1 cases (4.49%), five HBsAg-positive results (1.60%), three anti-HCV detections (0.96%), and two VDRL-reactive cases (0.64%). In contrast, antenatal participants recorded only three HIV 1 infections (4.69%) and no positive results for HBV, HCV, or syphilis. Thus, all non-HIV infections occurred solely among individuals seeking routine medical consultations, while antenatal attendees exhibited HIV 1 positivity alone.

Table 2: Positive cases according to reason for hospital visit

Reason for visit	Total tested	HIV-1	HBsAg	Anti-HCV	VDRL
Medical/routine check	312	14	5	3	2
Antenatal	64	3	0	0	0
Total	376	17	5	3	2

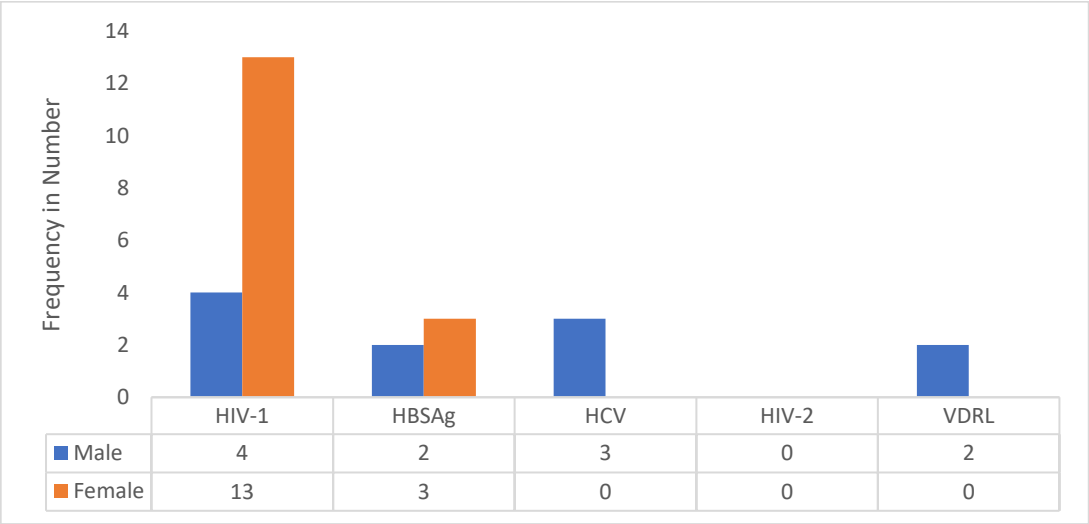

Figure 2. Gender distribution.

Marital Status

Infection rates did not differ significantly by marital status. Students and housewives recorded the highest HIV-1 positivity, while alcohol consumption and cigarette smoking showed modest associations with HBV and HIV-1 positivity.

Regarding marital status, 214 participants (56.91%) were single. Among them, 10 (4.67%) tested positive for HIV-1, and 4 (1.87%) were positive for hepatitis B surface antigen (HBsAg) (Table 3). Of the 156 married participants, 7 (4.48%) were HIV-1 positive, while 1 (0.64%) each tested positive for HBsAg and VDRL. These findings reinforce that marital status was not significantly associated with infection status across the four pathogens assessed.

Table 3: Marital status of subjects and infection positivity

Infection	**Single (n=214)**	**Married (n=156)**	**Separated (n=5)**	**Divorced (n=1)**	**p-value (Fisher's Exact Test)**
HIV-1	10 (4.67%)	7 (4.49%)	0 (0%)	0 (0%)	0.98
HBsAg	4 (1.87%)	1 (0.64%)	0 (0%)	0 (0%)	0.65
Anti-HCV	2 (0.93%)	0 (0%)	1 (20%)	0 (0%)	0.07
VDRL	1 (0.47%)	1 (0.64%)	0 (0%)	0 (0%)	1.00

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI | Volume XIII Issue XV August 2026 | Special Issue on Public Health

Occupation

With respect to occupation, 8 of the 129 students (6.20%) tested were positive for HIV-1, while 3 of the 34 housewives (8.82%) also tested positive (Table 4). The proportions of participants who tested positive for hepatitis B surface antigen, anti-HCV antibodies, or VDRL were very low across all occupational groups, indicating that HIV-1 was the only infection with notable detection among students and housewives.

Table 4: Occupation of subjects and infection positivity

Occupation	Total	HIV-1	HBsAg	Anti-HCV	VDRL
Civil servant	64	1	2	1	0
Student	129	8	1	2	2
Business	56	1	1	0	0
Housewife	34	3	0	0	0
Unemployed	50	2	0	0	0
Artisan	20	1	0	0	0
Youth corper	7	1	0	0	0
Soldier	4	0	1	0	0
Others	12	0	0	0	0

Potential risk factors

Table 5 shows the potential risk factors that can expose the studied subjects to any of the four infections shown. 5 of the 88 subjects (5.68%) who regularly consumed alcohol tested positive for HIV-1, while 3 (3.4%) of them tested positive for the hepatitis B surface antigen. One (1.14%) each was positive for HCV and VDRL.

Table 5: Potential risk factor exposure and infection positivity

Risk factor	Total exposed	HIV-1	HBsAg	Anti-HCV	VDRL
Alcohol	88	5	3	1	1
Cigarette smoking	54	0	2	0	1
Previous surgery	17	0	0	1	0
Blood transfusion	47	0	0	0	0
Abortions	26	0	0	0	0
Total	232	5	5	2	2

DISCUSSION

The findings of this study highlight a critical gap in Nigeria's current healthcare practices: individuals seeking routine medical care are rarely screened for infections that can have substantial long-term health consequences. The detection of HIV-1, HBV, HCV, and syphilis among participants who did not present with symptoms demonstrates that a considerable number of infections remain hidden within the general population. This silent reservoir of undiagnosed cases sustains ongoing transmission and delays access to treatment.

Our three-year investigation into the prevalence of HIV-1, HBV, HCV, and syphilis among hospital-visiting individuals revealed patterns that both align with and diverge from national trends. The HIV-1 prevalence of 4.52% observed in this study is notably higher than the Nigerian national estimate of 1.40% (NAIIS 2019) and the Bayelsa State prevalence of 1.90%. It also exceeds the 0.30% prevalence previously reported among blood donors (Nwokeukwu et al., 2014). This elevated prevalence may reflect differences in population characteristics, healthcare-seeking behaviour, or local epidemiological dynamics. It may also suggest that individuals who visit healthcare facilities for routine consultations constitute a group with unmet testing needs.

Among pregnant women attending antenatal care, the HIV-1 prevalence of 4.48% was higher than estimates from several regions across Nigeria, including Ebonyi (0.90%), Plateau (3.20%), Oyo, Imo, and Abuja (3.00%) (Umoke et al., 2021; Isichei et al., 2015; Olugbenga et al., 2018). However, it remained lower than earlier reports from Jos (8.2%), Okada (10.2%), and Abuja (11.5%) (Sagay et al., 2005; Oladeinde et al., 2011; Agboghoroma et al., 2015). HIV infection in pregnancy has been associated with significant complications in developing countries (Gray & McIntyre, 2007), and the wide disparities in prevalence have been linked to factors such as gender norms, poverty, violence, cultural practices, and political contexts (Awofala et al., 2018). These variations underscore the need for broader evaluation of determinants influencing HIV burden among pregnant women.

Across all four infections, HIV-1, HBV, HCV, and syphilis, there was no statistically significant association between marital status and infection status. All *p-values* exceeded 0.05, confirming that marital status does not influence the likelihood of acquiring any of these infections within this study population. Specifically, HIV-1 prevalence was 4.48% among married participants and 4.67% among single participants, demonstrating almost identical rates and reinforcing the absence of a meaningful statistical relationship ($p > .05$). This finding is consistent with the report by Fagbamigbe et al. (2016), who similarly observed equal HIV prevalence (3.40%) among married and single individuals across Nigeria.

The prevalence of hepatitis B surface antigen (HBsAg) in this study was 1.32%, far lower than the national estimate of 11.2% (NAIIS 2018). This finding is comparable to earlier reports of low prevalence among blood donors (0.30%) and HIV-positive individuals (2.20%) (Nwokeukwu et al., 2014; Diwe et al., 2013), though markedly lower than the 23% reported among prisoners (Pashangzadeh et al., 2022). Notably, none of the pregnant women in this study tested positive for HBV, contrasting with previous findings from Bayelsa (3.67%), Ebonyi (4.10%), Nnewi (6%), Ekiti (6.78%), Ibadan (8.30%), and Kano (7.90%) (Pondei & Ibrahim, 2013; Umoke et al., 2021; Oluboyo et al., 2014; Esan et al., 2014; Anaedobe et al., 2015; Yakasai et al., 2012). These discrepancies may reflect regional variations, improvements in vaccination uptake, or differences in study design.

The HCV prevalence of 0.79% was lower than the national estimate of 2.00%, yet similar to previous reports among blood donors (0.20%), students (0.40%), and HIV-positive individuals (0.70%) (Nwokeukwu et al., 2014; Jemilohun et al., 2014; Diwe et al., 2013). In contrast, a higher prevalence (3.60%) has been documented among blood donors in Calabar (Okoroiwu et al., 2018). As with HBV, none of the pregnant women in this study tested positive for HCV, differing from earlier findings in Bayelsa (1.33%) and Ebonyi (4.10%) (Pondei & Ibrahim, 2013; Umoke et al., 2021).

Syphilis prevalence was 0.53%, similar to the 0.40% reported in Yola (Olokoba et al., 2009), but lower than the historical Nigerian range of 0.60–2.30% (Taiwo et al., 2007) and more recent reports from Osun (1.00%), Ebonyi (1.80%), and Calabar (3.60%) (Olowe et al., 2014; Umoke et al., 2021; Okoroiwu et al., 2018). Given the limitations of non-treponemal tests such as VDRL, the true burden of syphilis may be underestimated, and more sensitive treponemal assays are recommended for future surveillance.

A significant strength of this study is that testing was offered to individuals who visited the hospital for unrelated reasons and who would not ordinarily undergo screening for these infections. The high acceptance rate mirrors outcomes from "Universal Testing and Treatment" (UTT) programmes, which have demonstrated reductions in HIV morbidity and mortality (Eshleman et al., 2020; Girum et al., 2020). This suggests that the general population may be receptive to expanded routine testing initiatives.

Given the paucity of data on liver cirrhosis and hepatocellular carcinoma in Bayelsa State and Nigeria, and the uncertain impact of early detection on disease outcomes, our findings underscore the urgent need for large-scale screening programmes. We support calls for expanding UTT-style strategies to include HBV, HCV, and syphilis, aligning with recent recommendations that all individuals undergoing blood tests in selected hospital emergency units should be screened for HIV, HBV, and HCV unless they opt out (Fenwick & Smith, 2024). Increasing diagnosis rates is essential to reducing new transmissions and improving long-term health outcomes.

Overall, this study reinforces the importance of integrating routine screening for HIV, HBV, HCV, and syphilis into general healthcare services. Early detection benefits individuals and advances broader public health goals by reducing transmission and enabling timely treatment. A key limitation of this study is the use of non-treponemal tests for syphilis screening, which may have underestimated the true prevalence.

CONCLUSION

The results of this study demonstrate that offering diagnostic screening to individuals seeking routine healthcare can uncover infections that would otherwise remain undetected. The presence of HIV-1, HBV, HCV, and syphilis among asymptomatic individuals highlights the need for more inclusive testing policies in Nigeria. Expanding routine screening beyond blood transfusion services and antenatal clinics could significantly improve early diagnosis, reduce transmission, and enhance treatment outcomes.

Given the public health implications of these infections, adopting universal or opt-out testing strategies, similar to those implemented for HIV in some settings, may be beneficial (Atkins, 2023; Elton, 2023). Integrating such approaches into primary healthcare could help close existing detection gaps and contribute to national and global efforts to reduce the burden of chronic viral and sexually transmitted infections.

REFERENCES

1. Ajuwon, B. I., Yujuico, I., Roper, K., et al. (2021). Hepatitis B virus infection in Nigeria: A systematic review and meta-analysis of data published between 2010 and 2019. BMC Infectious Diseases, 21, 1120. https://doi.org/10.1186/s12879-021-06800-6 (doi.org in Bing)
2. Agboghoroma, C. O., & Iliyasu, Z. (2015). HIV prevalence and trends among pregnant women in Abuja, Nigeria: A 5-year analysis. Tropical Journal of Obstetrics and Gynaecology, 32(1), 82–89.
3. Anaedobe, C. G., Fowotade, A., Omoruyi, C. E., & Bakare, R. A. (2015). Prevalence, socio-demographic features and risk factors of hepatitis B virus infection among pregnant women in Southwestern Nigeria. Pan African Medical Journal, 20.
4. Atkins, V. (2023). Opt-out blood tests for HIV, Hepatitis B and Hepatitis C will be rolled out to a further 46 hospitals across England. BBC News. https://www.bbc.com/news/uk-politics-67555895 (bbc.com in Bing)
5. Awofala, A. A., & Ogundele, O. E. (2018). HIV epidemiology in Nigeria. Saudi Journal of Biological Sciences, 25(4), 697–703. https://doi.org/10.1016/j.sjbs.2016.03.006 (doi.org in Bing)
6. Diwe, C. K., Okwara, E. C., Enwere, O. O., Azike, J. E., & Nwaimo, N. C. (2013). Sero-prevalence of hepatitis B virus and hepatitis C virus among HIV patients in a suburban University Teaching Hospital in South-East Nigeria. Pan African Medical Journal, 16(7).
7. Elton, J. (2023). HIV blood tests to be rolled out to more hospitals. BBC News. https://www.bbc.com/news/uk-politics-67555895 (bbc.com in Bing)
8. Esan, A. J., Omisakin, C. T., Ojo-Bola, T., Owoseni, M. F., Fasakin, K. A., & Ogunleye, A. A. (2014). Sero-prevalence of hepatitis B and hepatitis C virus co-infection among pregnant women in Nigeria. American Journal of Biomedical Research, 2(1), 11–15.
9. Eshleman, S. H., Piwowar-Manning, E., Wilson, E. A., Lennon, D., Fogel, J. M., Agyei, Y., Sullivan, P. A., Weng, L., Moore, A., & Laeyendecker, O. (2020). Determination of HIV status and identification of incident HIV infections in a large, community-randomized trial: HPTN 071 (PopART). Journal of the International AIDS Society, 23(2), e25452.
10. Fagbamigbe, A. F., Adebayo, S. B., & Idemudia, E. (2016). Marital status and HIV prevalence among women in Nigeria: Ingredients for evidence-based programming. International Journal of Infectious Diseases, 48, 57–63. https://doi.org/10.1016/j.ijid.2016.05.002 (doi.org in Bing)
11. Girum, T., Yasin, F., Wasie, A., Shumbej, T., Bekele, F., & Zeleke, B. (2020). The effect of universal test and treat program on HIV treatment outcomes and patient survival among adults taking ART in low-income settings of Gurage zone, South Ethiopia. AIDS Research and Therapy, 17(1), 1–9.
12. Gray, G. E., & McIntyre, J. A. (2007). HIV and pregnancy. BMJ, 334(7600), 950–953. https://doi.org/10.1136/bmj.39219.410718.BE (doi.org in Bing)

13. HIV.gov. (2023). The global HIV and AIDS epidemics: Global statistics. https://www.hiv.gov/hiv-basics/overview/data-and-trends/global-statistics/ (hiv.gov in Bing)
14. Holt, M., Hull, P., Lea, T., Guy, R., Bourne, C., Prestage, G., Zablotska, I., De Wit, J., & Mao, L. (2014). Comprehensive testing for, and diagnosis of, sexually transmissible infections among Australian gay and bisexual men: Findings from repeated cross-sectional behavioural surveillance, 2003–2012. Sexually Transmitted Infections, 90(3), 208–215.
15. Howe, R., Abate, E., Seyoum, B., Kassa, T., Abebe, T., Teshome, S., Biazin, H., Ayalew, G., Geta, M., & Kedir, R. (2019). Exploring the impact of childhood HBV vaccination in Ethiopia: A synopsis and discussion of preliminary findings. Ethiopian Medical Journal, 57(Suppl. 2), 87–95.
16. Isichei, C., Brown, P., Isichei, M., Njab, J., Oyebode, T., & Okonkwo, P. (2015). HIV prevalence and associated risk factors among rural pregnant women in North Central Nigeria. American Journal of Health Research, 3(1), 18–23.
17. Jemilohun, A. C., Oyelade, B. O., & Oiwoh, S. O. (2014). Prevalence of hepatitis C virus antibody among undergraduates in Ogbomoso, Southwestern Nigeria. African Journal of Infectious Diseases, 8(2), 40–43.
18. Maaroufi, A., Vince, A., Himatt, S. M., Mohamed, R., Fung, J., Opare-Sem, O., Workneh, A., Njouom, R., Al Ghazzawi, I., & Abdulla, M. (2017). Historical epidemiology of hepatitis C virus in select countries (Volume 4). Journal of Viral Hepatitis, 24, 8–24.
19. Mendlowitz, A. B., Feld, J. J., & Biondi, M. J. (2022). Hepatitis B and C in pregnancy and children: A Canadian perspective. Viruses, 15(1), 91.
20. NAIIS. (2019). Nigeria HIV/AIDS indicator and impact survey.
21. Nwokeukwu, H. I., Nwabuko, C. O., Chuku, A., Ajuogu, E., & Dorathy, O. A. (2014). Prevalence of HIV, hepatitis B virus, hepatitis C virus, and syphilis in blood donors in a tertiary health facility in South Eastern Nigeria. Hematology and Leukemia, 2(1), 4.
22. Okonko, I. O., Akinpelu, A., & Po, O. (2012). Prevalence of sexually transmitted infections among attendees of AFRH Centre in Ibadan, Southwestern Nigeria. Middle-East Journal of Scientific Research, 11(1), 24–31.
23. Okoroiwu, H. U., Okafor, I. M., Asemota, E. A., & Okpokam, D. C. (2018). Seroprevalence of transfusion-transmissible infections among prospective blood donors in Calabar, Nigeria: An eleven-year evaluation. BMC Public Health, 18(1), 1–8.
24. Okoroiwu, H. U., Umoh, E. A., Asanga, E. E., Edet, U. O., Atim-Ebim, M. R., Tangban, E. A., Mbim, E. N., Odoemena, C. A., Uno, V. K., Asuquo, J. O., Effiom-Ekaha, O. O., Dozie-Nwakile, O. C., Uchendu, I. K., Echieh, C. P., Emmanuel, K. J., Ejemot-Nwadiaro, R. I., Nja, G. M. E., Oreh, A., Uchenwa, M. O., … Povedano-Montero, F. J. (2022). Thirty-five years (1986–2021) of HIV/AIDS in Nigeria: Bibliometric and scoping analysis. AIDS Research and Therapy, 19(1), 1–15.
25. Oladeinde, B. H., Omoregie, R., Olley, M., & Anunibe, J. A. (2011). Prevalence of HIV and anemia among pregnant women. North American Journal of Medical Sciences, 3(12), 548.
26. Olayinka, A. T., Oyemakinde, A., Balogun, M. S., Ajudua, A., Nguku, P., Aderinola, M., Egwuenu-Oladejo, A., Ajisegiri, S. W., Sha'aibu, S., Musa, B. O., Gidado, S., & Nasidi, A. (2016). Seroprevalence of hepatitis B infection in Nigeria: A national survey. American Journal of Tropical Medicine and Hygiene, 95(4), 902–907.
27. Olokoba, A. B., Salawu, F. K., Danburam, A., Desalu, O. O., Midala, J. K., Badung, L. H., Olokoba, L. B., & Abdulkarim, A. (2009). Syphilis in pregnant Nigerian women: Is it still necessary to screen? European Journal of Scientific Research, 29(3), 315–319.
28. Olowe, O. A., Makanjuola, O. B., Olowe, R. A., Olaitan, J. O., Ojurongbe, O., & Fadiora, S. O. (2014). Prevalence of syphilis among pregnant women in two health care facilities in South Western Nigeria. British Journal of Medicine and Medical Research, 4(34), 5431–5438.
29. Oluboyo, B. O., Ugochukwu, V. I., Oluboyo, A. O., Ihim, A. C., Chukwuma, G. O., Ogenyi, S. I., & Onyemelukwe, A. (2014). Prevalence of hepatitis B and C viral infections in pregnant women attending antenatal clinic in Nnewi, Nigeria. European Scientific Journal, 10(3).
30. Olugbenga, I., Taiwo, O., Laverty, M., Ngige, E., Anyaike, C., Bakare, R., Ogunleye, V., Peterson Maddox, B. L., Newman, D. R., & Gliddon, H. D. (2018). Clinic-based evaluation of the diagnostic

accuracy of a dual rapid test for screening HIV and syphilis in pregnant women in Nigeria. PLOS ONE, 13(7), e0198698.

31. Pashangzadeh, S., SeyedAlinaghi, S., Dadras, O., Pashaei, Z., Soleymanzadeh, M., Barzegary, A., Mirzapour, P., Vahedi, F., Fakhfouri, A., Noori, T., Hossein Irani, S. M., Mehraeen, E., & Jahanfar, S. (2022). Prevalence of hepatitis in prisoners: A systematic review of current evidence. Infectious Disorders – Drug Targets, 22(8), 61–72.
32. Pondei, K., & Ibrahim, I. (2013). Seroprevalence of hepatitis B surface antigen and anti-hepatitis C antibody among women attending antenatal clinic in the Niger Delta of Nigeria. Global Advanced Research Journal of Medicine and Medical Sciences, 2(1), 6–12.
33. Public Health Information Systems (PHIS). (2023). HIV AIDS epidemic control report. https://www.phis3project.org.ng/phis3-resources/hiv-aids-epidemic-control-report-june-2023/ (phis3project.org.ng in Bing)
34. Sagay, A. S., Kapiga, S. H., Imade, G. E., Sankale, J. L., Idoko, J., & Kanki, P. (2005). HIV infection among pregnant women in Nigeria. International Journal of Gynecology & Obstetrics, 90(1), 61–67.
35. Shen, C., Jiang, X., Li, M., & Luo, Y. (2023). Hepatitis virus and hepatocellular carcinoma: Recent advances. Cancers, 15(2), 533. https://doi.org/10.3390/cancers15020533 (doi.org in Bing)
36. Song, C. I., Lv, J., Liu, Y., Chen, J. G., Ge, Z., Zhu, J., Dai, J., Du, L.-B., Yu, C., & Guo, Y. (2019). Associations between hepatitis B virus infection and risk of all cancer types. JAMA Network Open, 2(6), e195718.
37. Taiwo, S. S., Adesiji, Y. O., & Adekanle, D. A. (2007). Screening for syphilis during pregnancy in Nigeria: A practice that must continue. Sexually Transmitted Infections, 83(5), 357–358.
38. Umoke, M., Sage, P., Bjoernsen, T., Umoke, P. C. I., Ezeugworie, C., Ejiofor, D., Agha, O., Nwalieji, C. A., Onwe, R. N., & Nwafor, I. E. (2021). Co-infection and risk factors associated with STIs among pregnant women in rural health facilities in Nigeria: A retrospective study. INQUIRY: The Journal of Health Care Organization, Provision, and Financing, 58, 1–9.
39. World Health Organization. (2021). Global progress report on HIV, viral hepatitis and sexually transmitted infections, 2021.
40. World Health Organization. (2022). Hepatitis B. https://www.who.int/news-room/fact-sheets/detail/hepatitis-b (who.int in Bing)
41. World Health Organization. (2022). Hepatitis C. https://www.who.int/news-room/fact-sheets/detail/hepatitis-c (who.int in Bing)
42. World Health Organization. (2022). Sexually transmitted infections (STIs). https://www.who.int/news-room/fact-sheets/detail/sexually-transmitted-infections-stis (who.int in Bing)
43. World Health Organization. (2023). Nigeria boosting viral hepatitis awareness and treatment. https://www.afro.who.int/countries/nigeria/news/nigeria-boosting-viral-hepatitis-awareness-and-treatment (afro.who.int in Bing)
44. Yakasai, I. A., Ayyuba, R. U., Abubakar, I. S., & Ibrahim, S. A. (2012). Sero-prevalence of hepatitis B virus infection and its risk factors among pregnant women attending antenatal clinic at Aminu Kano Teaching Hospital, Kano, Nigeria. Journal of Basic and Clinical Reproductive Sciences, 1(1–2), 49–55.