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Towards Strengthening HIV Case Detection and Management: A Review of The Role of Oral Healthcare and Enhanced Laboratory Diagnostics

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PUO and EE contributed to the conception and design of the study. All authors wrote the first and final drafts of the manuscript. All authors reviewed the final manuscript and approved of its publication.

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Abstract

An estimated 84.2 million people have suffered the disease since its discovery. Although the number of new cases decreased by 32% since 2010, it is most prevalent in Africa 68% [25.7 million], resulting in approximately 470,000 AIDS-related deaths with Nigeria having the highest number of people living with HIV/AIDS (PLWHA) in the region and the second highest globally. Rapid diagnostic tests (RDTs) have emerged as indispensable tools for point-of-care testing, providing quick results with minimal infrastructure requirements.

Dentists play a critical role in the early detection of HIV, as they are in a unique position to identify oral manifestations associated

with the infection. The oral cavity is frequently the first site where symptoms of HIV appear, often even before individuals are aware of their serostatus. Dentists have a responsibility to be aware of the oral manifestations of HIV and to consider HIV infection in the differential diagnosis of these conditions. Additionally, dentists can play a proactive role in HIV screening by offering rapid HIV testing services in their dental.

With recent findings demonstrating the high transmissibility of HIV early in infection, and the potential benefit of early initiation of treatment, it is essential to identify as many infected individuals as possible. HIV testing is the key part of diagnosis and prevention efforts hence the need for synergy between oral health practitioners and laboratory diagnostic experts in bridging the gap of diagnosis and prevention among healthcare professionals.

Keywords: Dentist; Detection; Diagnostics; Eradication; HIV; Laboratory.

Introduction

Since its identification, the Human Immunodeficiency Virus (HIV) has remained a major global public health challenge. The virus primarily targets CD4+ T lymphocytes, leading to a gradual decline in immune function and increased susceptibility to opportunistic infections and certain cancers [1]. Globally, approximately 84.2 million people have been infected since the epidemic began [2].

Although there has been a 32% decline in new HIV cases since 2010, the disease burden remains disproportionately high in sub-Saharan Africa. The region accounts for 68% of global HIV cases (approximately 25.7 million individuals) and about 470,000 AIDS-related deaths annually [1]. Nigeria, notably, holds the highest HIV burden in West and Central Africa and ranks second globally in the number of people living with HIV/AIDS (PLWHA) [3].

Over the past few decades, there have been significant advancements in the management of HIV, including improvements in medical care, the introduction of combination antiretroviral therapy (cART), and expansion of community support services [4]. Nevertheless, access to oral healthcare and advanced diagnostic services remains limited in many regions of Nigeria [5].

While cART has reduced the prevalence of several HIV-associated oral conditions, emerging trends show a shift in the types of manifestations observed. For instance, the incidence of oral candidiasis and Kaposi's sarcoma has declined, while



conditions such as HIV-associated salivary gland disease and xerostomia have become more frequent [6,7]. This paper discusses the role of enhanced oral healthcare and advanced laboratory diagnostics in improving HIV case detection and management, particularly within the Nigerian healthcare context.

HIV BURDEN AND DETECTION IN NIGERIA

Between 2003 and 2021, Nigeria saw a significant decline in HIV prevalence among adults aged 15 to 49 years—from 4.4% to 1.3%. This figure has stabilized over the last four years [8,9]. Despite various national and international efforts aimed at curbing the epidemic, Nigeria remains among the top five countries globally in terms of the total number of HIV cases [10].

Currently, an estimated 1.9 million Nigerians are living with HIV, with women aged 15 and older constituting more than 63% of the infected population [11]. Vulnerable groups continue to bear a disproportionate burden of the epidemic: men who have sex with men have an estimated prevalence of 25%, sex workers 16.7%, and people who inject drugs (PWID) 10.9% [11]. HIV-related mortality remains a concern, with approximately 51,000 deaths recorded annually in Nigeria [11].

To meet the UNAIDS target of ending the HIV epidemic by 2030, Nigeria must scale up interventions that improve testing, treatment initiation, and viral load suppression. Data from the Nigeria AIDS Indicator and Impact Survey (NAIIS) revealed progress toward the UNAIDS 90-90-90 target at 47% for diagnosis, 96% for treatment, and 81% for viral suppression. Notably, states such as Rivers, Benue, and Akwa Ibom account for over 50% of the national burden [12,13].

An 18-month Antiretroviral Therapy (ART) surge programme initiated in 2020 by the Nigerian government, in collaboration with PEPFAR and the Global Fund, markedly improved HIV case detection. A key success factor was the integration of community-based rapid diagnostic testing alongside facility-based services [14].

Rapid diagnostic tests (RDTs), which employ lateral flow immunoassay techniques, provide a low-cost and efficient method for HIV screening, especially in resource-limited settings like Nigeria's. Platforms such as Uni-Gold, Determine, and Stat-Pak have been validated for use by WHO and the Nigerian Ministry of Health [15,16]. These tests have demonstrated comparable sensitivity and specificity to ELISA and Western Blot assays [17,18]. Nonetheless, limitations exist, particularly in detecting infections during the early seroconversion window, leading to potential false negatives [19,20].

ROLE OF ORAL HEALTHCARE IN HIV CASE DETECTION

Dentists are often the first healthcare providers to detect signs of HIV due to the prevalence of oral manifestations in early stages of infection. These manifestations may appear before individuals become aware of their serostatus, making the dental setting a valuable point for early diagnosis. Therefore, dentists must remain vigilant in assessing such signs and include HIV in their differential diagnoses when appropriate. Furthermore, dental professionals can provide rapid HIV testing or referrals, particularly for patients with indicative lesions [21–23].

Rapid HIV testing in dental clinics enhances early diagnosis by providing immediate results, thereby enabling prompt linkage to care. Studies show that incorporating HIV screening into dental practices increases the identification of undiagnosed cases, especially in populations less likely to access traditional healthcare services.

ORAL MANIFESTATIONS OF HIV

HIV infection is associated with a wide range of oral pathologies. Common manifestations include oral candidiasis, characterized by creamy white lesions on the tongue or inner cheeks; oral hairy leukoplakia, a white corrugated lesion typically found on the sides of the tongue; and Kaposi's sarcoma, a vascular tumor affecting the oral mucosa. Additional findings include recurrent aphthous ulcers, persistent herpes simplex virus infections, gingival hyperplasia, xerostomia, non-Hodgkin lymphoma, salivary gland disease with reduced salivary flow, and advanced periodontal disease presenting with halitosis and oral pain [21,24–26].

Recognizing these signs provides an opportunity for dentists to engage in proactive HIV detection, education, and referral, especially as the healthcare model shifts toward integrated, multidisciplinary approaches [27].

BARRIERS TO HIV SCREENING IN DENTAL SETTINGS

Despite the strategic role of dental clinics in HIV screening, several barriers hinder their involvement. Time and staffing constraints often limit the capacity to conduct additional testing during routine visits. A lack of specialized training in HIV testing protocols and counseling further impedes dentist participation. Moreover, concerns persist about patient acceptance of HIV testing in a dental setting [28,29].

Overcoming these barriers requires targeted education and training initiatives, supported by policy changes that normalize



HIV screening in all healthcare settings, including dentistry [27–29].

ENHANCED LABORATORY DIAGNOSTICS IN HIV CASE DETECTION

Laboratory diagnostics have evolved significantly, transitioning from first-generation antibody assays to highly sensitive and specific fourth-generation antigen/antibody combination tests. Earlier methods, such as Western Blot and IFA, often failed to detect acute infections due to their reliance on IgG antibody responses [30,31]. The 2014 adoption of fourth-generation assays revolutionized HIV screening by enabling detection of both p24 antigen and HIV-1/2 antibodies, reducing the diagnostic window and enabling earlier intervention [32–35].

Oral fluid-based RDTs such as OraQuick Advance and Chembio DPP have improved accessibility, though concerns remain regarding their ability to detect early infection stages [36–38]. The Alere Determine HIV-1/2 Combo and Bio-Rad Geenius serve as more sensitive confirmatory tools in this regard [39–41].

Molecular diagnostics represent a paradigm shift in HIV detection. The Aptima HIV-1 RNA NAAT, the first FDA-approved RNA test, can identify infections during the acute phase, even before seroconversion [42]. This test targets the HIV-1 5'-LTR and pol genes to ensure broad strain coverage [43]. Additionally, HIV DNA assays provide critical information for identifying viral reservoirs or diagnosing infants. Viral load testing, commonly performed using RT-PCR platforms such as the COBAS TaqMan and Abbott RealTime systems, remains the gold standard for monitoring treatment efficacy [44–46].

RECOMMENDATIONS

To significantly improve HIV detection and management in Nigeria, a multi-stakeholder strategy is essential. The following refined recommendations are directed toward the government, healthcare facilities, and diagnostic laboratories.

Government-Level Recommendations

The Nigerian government should establish and periodically update a national HIV diagnostic algorithm, ensuring it incorporates global best practices and emerging technologies. This may be accomplished through consultative stakeholder meetings involving clinicians, laboratory experts, policymakers, and civil society. Alternatively, Nigeria may adopt and adapt WHO's existing diagnostic algorithm, which promotes a two-step approach involving a screening test followed by confirmatory testing using antibody differentiation or molecular assays [47,49].

Additionally, a robust national quality assurance (QA) program must be enforced across all levels of testing. This should encompass comprehensive training, development of standard operating procedures, equipment calibration, biohazard safety, and regular performance monitoring via external QA schemes [50].

The establishment of Communicable Disease Surveillance Centres (CDSCs) across all geopolitical zones is also recommended. These centers would aggregate data from local testing facilities to track regional trends and guide resource allocation, public education, and policy interventions [51].

Hospital and Dental Clinic Recommendations

Healthcare workers, including dentists and general practitioners, should be systematically trained to recognize and manage HIV-related oral lesions, such as oral candidiasis and leukoplakia. These clinical signs are often early indicators of immunosuppression and warrant immediate follow-up testing [52].

Routine HIV screening should be incorporated into clinical care using an opt-out approach, whereby patients are informed that testing is standard unless they specifically decline. This strategy has proven effective in increasing testing uptake, particularly in high-prevalence regions [48].

Laboratory and Diagnostic Centre Recommendations

A **tiered laboratory network** should be implemented to streamline referrals and ensure that patients or specimens requiring advanced testing (e.g., viral load, CD4 count, infant diagnosis) are efficiently directed to higher-tier laboratories. National and regional reference labs should offer periodic training to lower-tier facilities, particularly on point-of-care tools and new diagnostic technologies [50].

Laboratories must adhere to stringent internal and external quality assurance protocols, aligning with national regulations. Participation in regular QA schemes and implementation of standard algorithms are essential for maintaining diagnostic accuracy and public trust [51].

Conclusion

Nigeria's progress in combating HIV requires a coordinated, integrated approach that bridges oral healthcare, community testing, and advanced laboratory diagnostics. Dentists play a critical role in early case detection through the recognition of oral manifestations and provision of rapid testing.



Meanwhile, innovations in diagnostic technologies, including fourth-generation assays and molecular testing, enhance early detection and treatment monitoring.

To achieve epidemic control, Nigeria must adopt inclusive policies that expand diagnostic access, strengthen quality assurance systems, and support routine screening across all healthcare settings. Training, surveillance, and tiered lab networks are essential to closing existing gaps.

Ultimately, by aligning clinical, community, and policy efforts, Nigeria can accelerate progress toward the UNAIDS 95–95–95 targets and bring the country closer to ending the HIV epidemic by 2030.

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