



Advances in AIDS Diagnosis in Contemporary Clinical Practice

Jing Song*

Department of Physical Therapy, Chatham University Pittsburgh, Pittsburgh, PA, USA

DESCRIPTION

Acquired Immunodeficiency Syndrome (AIDS), the advanced stage of Human Immunodeficiency Virus (HIV) infection, remains a major global health challenge. Although therapeutic innovations have dramatically improved outcomes for people living with HIV, timely and accurate diagnosis continues to be essential for reducing morbidity, improving treatment responses and limiting further transmission. Diagnostic approaches have evolved substantially over the past three decades, integrating molecular technologies, point-of-care tools and refined clinical criteria. This article reviews current methods used in the diagnosis of AIDS within clinical and laboratory settings, emphasizing their strengths, limitations and relevance for modern infectious disease practice.

HIV infection progresses through several stages, beginning with acute infection, followed by a prolonged chronic phase and ultimately advancing to AIDS if untreated. AIDS is defined by severe immune suppression, typically indicated by a CD4 T-cell count below 200 cells per microliter or the presence of one or more AIDS-defining illnesses, such as Pneumocystis pneumonia, Kaposi sarcoma, or certain opportunistic infections. While these clinical benchmarks remain central, the diagnosis of HIV itself relies on laboratory detection of the virus or host immune response.

The foundation of HIV diagnosis involves serologic testing. Fourth-generation HIV tests, now widely used in clinical practice, detect both HIV-1/2 antibodies and p24 antigen. This dual detection reduces the diagnostic window period, allowing identification of acute infections approximately two weeks earlier than previous generations of assays. When a fourth-generation screening test is reactive, confirmatory testing is conducted using an HIV-1/2 differentiation immunoassay. This method distinguishes between HIV-1 and HIV-2 infections, which is important because management strategies differ slightly between them.

For individuals whose confirmatory antibody tests yield indeterminate or negative results despite a reactive initial screen,

Nucleic Acid Testing (NAT) serves as the diagnostic gold standard. NAT directly detects viral RNA in the bloodstream and is invaluable in cases of acute infection, perinatal exposure and suspected early seroconversion. In high-risk populations or cases of suspected acute retroviral syndrome, NAT may be performed even when screening tests are nonreactive, as antibody responses may not yet be detectable.

Point-of-care testing has become an important tool, especially in resource-limited settings, emergency departments and community testing programs. These rapid tests can deliver results in under 30 minutes, increasing accessibility and facilitating immediate linkage to care. Although slightly less sensitive during early infection, their ease of use and minimal equipment requirements make them important for expanding global HIV diagnostic capacity.

Once HIV infection is confirmed, determining whether an individual has progressed to AIDS requires further clinical evaluation. CD4 T-cell counts remain the most widely used metric. A count below 200 cells per microliter is considered diagnostic of AIDS, regardless of symptoms. Additionally, certain opportunistic infections or malignancies automatically classify the patient as having AIDS, even if CD4 counts are higher. This integration of clinical and immunologic criteria ensures that diagnosis accurately reflects disease severity.

Viral load testing, although not used to diagnose AIDS directly, plays an important supportive role. High viral loads often correlate with accelerated disease progression and may inform the clinician's assessment of overall immune function. Moreover, viral load monitoring is essential after diagnosis to evaluate treatment effectiveness and guide therapy adjustments.

Emerging technologies are expanding the diagnostic landscape. Novel molecular platforms, such as isothermal amplification assays and ultrasensitive antigen detection tools, aim to further shorten the diagnostic window and improve detection in low-resource settings. Advances in dried blood spot testing have also improved diagnostic reach, enabling specimen collection in remote areas and transport to centralized laboratories without sophisticated refrigeration. These innovations support global

Correspondence to: Jing Song, Department of Physical Therapy, Chatham University Pittsburgh, Pittsburgh, PA, USA, E-mail: jing@song4192.edu

Received: 29-Oct-2025, Manuscript No. JIDD-25-30654; **Editor assigned:** 03-Nov-2025, PreQC No. JIDD-25-30654 (PQ); **Reviewed:** 17-Nov-2025, QC No. JIDD-25-30654; **Revised:** 24-Nov-2025, Manuscript No. JIDD-25-30654 (R); **Published:** 03-Dec-2025, DOI: 10.35248/2576-389X.25.10.358

Citation: Song J (2025). Advances in AIDS Diagnosis in Contemporary Clinical Practice. J Infect Dis Diagn. 10:358.

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public health strategies aimed at early identification and prompt initiation of antiretroviral therapy.

Despite diagnostic advancements, several challenges remain. Stigma and limited healthcare access continue to delay testing in many regions. False negatives may occur during very early infection, especially with antibody-only tests. Conversely, false positives, though rare, require careful confirmatory protocols. Clinicians must also consider co-infections, such as tuberculosis or Hepatitis B, which may complicate diagnostic pathways and affect immune markers. Ensuring proper training, quality

control and adherence to testing algorithms remains essential for accurate diagnosis.

In conclusion, AIDS diagnosis today relies on a combination of advanced laboratory techniques, clinical assessments and robust confirmatory protocols. Early and accurate detection of HIV infection and timely recognition of progression to AIDS is important for optimizing treatment outcomes and reducing transmission. Continued improvements in diagnostic technology and broader access to testing services will remain central to global efforts to control the HIV epidemic.