

Progress and Challenges in Pediatric HIV Detection and Treatment

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DESCRIPTION

Pediatric HIV infection continues to pose a significant public health challenge, particularly in resource-limited settings. Despite remarkable advancements in the field of HIV diagnosis and antiretroviral therapy (ART), the early identification and effective management of HIV in children remain complex due to biological, clinical, and systemic factors. The global burden of pediatric HIV has declined considerably over the past two decades, largely owing to the implementation of prevention of mother-to-child transmission (PMTCT) programs. However, the progress is uneven, and numerous gaps persist, particularly in timely diagnosis, access to care, and long-term treatment outcomes. Pediatric HIV presents unique diagnostic and therapeutic challenges compared to adult populations, requiring tailored approaches for effective control and improved survival.

Early detection is critical for ensuring favorable health outcomes in HIV-infected infants and children. The immaturity of the infant immune system and the interference of maternal antibodies complicate the use of standard serological tests in early infancy. Therefore, virologic tests such as HIV DNA or RNA PCR are essential for accurate Early Infant Diagnosis (EID), typically performed within the first 4 to 6 weeks of life. However, these tests are often unavailable or delayed in low-resource settings, leading to missed or late diagnoses. Moreover, logistical issues such as transportation of samples, shortage of trained personnel, and lack of follow-up further compromise the timely initiation of treatment. Point of care (POC) diagnostic technologies have emerged as a promising solution to bridge this gap, providing rapid and decentralized testing capabilities that reduce turnaround time and loss to follow-up.

The initiation of ART in pediatric patients, particularly infants, presents additional challenges. The World Health Organization (WHO) recommends immediate initiation of ART in all HIV-positive infants regardless of clinical or immunological status. Early ART has been shown to significantly reduce mortality and morbidity, as well as limit the establishment of viral reservoirs. However, adherence to lifelong treatment in children is often difficult, influenced by caregiver understanding, social stigma, and the child's developmental stage. Palatability and formulation

of pediatric drugs are also critical concerns many antiretroviral medications are unpalatable or difficult to administer, especially for infants and toddlers. Recent efforts to develop pediatric friendly fixed dose combinations and dispersible tablets represent progress, but access remains limited in many regions.

Another major concern in pediatric HIV care is the transition from pediatric to adolescent and adult services. As more HIV-positive children survive into adolescence due to effective ART, they face unique psychological and social challenges, including stigma, disclosure issues, and mental health conditions. The transition of care must be managed with sensitivity to the developmental needs of adolescents, ensuring continuity of treatment and psychosocial support. Structured transition programs are rare in many healthcare systems, leading to disengagement from care and treatment failure in this vulnerable population. Comprehensive, adolescent-centered care models are urgently needed to ensure long-term success of HIV treatment.

Monitoring treatment efficacy and detecting treatment failure is another significant hurdle. In children, immunological and clinical monitoring may not always correlate with virological failure. Routine viral load testing is the gold standard, but its availability and affordability remain limited in many settings. Moreover, the risk of developing drug resistance is higher in pediatric populations due to inconsistent drug levels, poor adherence, and long treatment duration. The emergence of resistance to first-line drugs necessitates the availability of second and third-line regimens tailored for children, which are often scarce and more expensive. Ensuring access to resistance testing and alternative regimens is essential for maintaining treatment efficacy.

Despite the challenges, significant progress has been made. Global initiatives such as the UNAIDS Start Free Stay Free AIDS Free framework and the Pediatric Breakthrough Partnership have accelerated access to diagnostics and treatment for children. The increasing availability of simplified ART regimens, investment in early diagnostic tools, and expansion of PMTCT programs have dramatically reduced new pediatric infections and improved survival rates. Nevertheless, sustainable

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Received: 03-Mar-2025, Manuscript No. HICR-25-37650; **Editor assigned:** 05-Mar-2025, PreQC No. HICR-25-37650 (PQ); **Reviewed:** 18-Mar-2025, QC No. HICR-25-37650; **Revised:** 24-Mar-2025, Manuscript No. HICR-25-37650 (R); **Published:** 01-Apr-2025, DOI: 10.35248/2572-0805-25.10.432

Citation: Sokolova N (2025). Progress and Challenges in Pediatric HIV Detection and Treatment. HIV Curr Res.10:432.

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progress depends on continued investment in child-specific HIV research, policy frameworks, and health system strengthening.

In conclusion, pediatric HIV detection and treatment have witnessed encouraging advancements over the last two decades, yet formidable challenges remain. From delayed diagnosis to limited drug formulations and psychosocial barriers, each phase of pediatric HIV care demands focused, child-centric interventions. Early diagnosis, simplified ART regimens, adherence support,

and a seamless transition to adolescent care are critical components of effective long-term management. Addressing these issues requires a concerted global effort involving governments, international organizations, researchers, and communities. Only through an integrated and sustained approach can we ensure that children living with HIV not only survive but thrive into healthy adulthood.