



HIV and AIDS Management

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Learning Objectives

- ▶ Understand **HIV epidemiology** at global, regional, and local levels
- ▶ Explain **HIV structure, replication, and pathology**
- ▶ Describe the **pathophysiology of immune suppression**
- ▶ Review **public health interventions** in HIV control
- ▶ Interpret **key HIV statistics and trends**
- ▶ Discuss **comprehensive HIV/AIDS management approaches**

Introduction to HIV

- ▶ HIV = **Human Immunodeficiency Virus**
- ▶ Retrovirus of the **Lentivirus** family
- ▶ Primary mode: **attack on CD4+ T lymphocytes**
- ▶ Leads to **progressive immune deficiency**
- ▶ Untreated infection progresses to **AIDS (Acquired Immunodeficiency Syndrome)**
- ▶ HIV is **both a medical and public health challenge**

Historical Background

- ▶ First recognized in **1981 in the USA** (clusters of unusual infections/cancers)
- ▶ HIV identified in **1983 (Luc Montagnier & Robert Gallo)**
- ▶ Initial stigma: “gay-related immune deficiency” → later recognized globally
- ▶ By mid-1980s, HIV spread rapidly across continents
- ▶ Antiretroviral Therapy (ART) introduced in the **mid-1990s**
- ▶ Today: HIV is a **chronic manageable condition** with treatment

Epidemiology – Global Perspective

- ▶ Over **39 million people** living with HIV (UNAIDS 2024)
- ▶ Majority in **sub-Saharan Africa (~67% of global cases)**
- ▶ High prevalence in **Eastern & Southern Africa**
- ▶ Decline in new infections since **2000s due to ART & prevention**
- ▶ Still **1.3 million new infections annually** worldwide
- ▶ HIV remains a **leading cause of death in low-resource settings**

Epidemiology – Zambia Case Study

- ▶ Zambia HIV prevalence: ~11% (adults 15–49 years)
- ▶ Higher burden among **women (especially 15–24 years)**
- ▶ Key drivers: **heterosexual transmission, gender inequality, poverty**
- ▶ ART coverage: ~85% of PLHIV on treatment
- ▶ Zambia aligned with **UNAIDS 95-95-95 targets**
- ▶ HIV/AIDS contributes significantly to **morbidity and mortality**

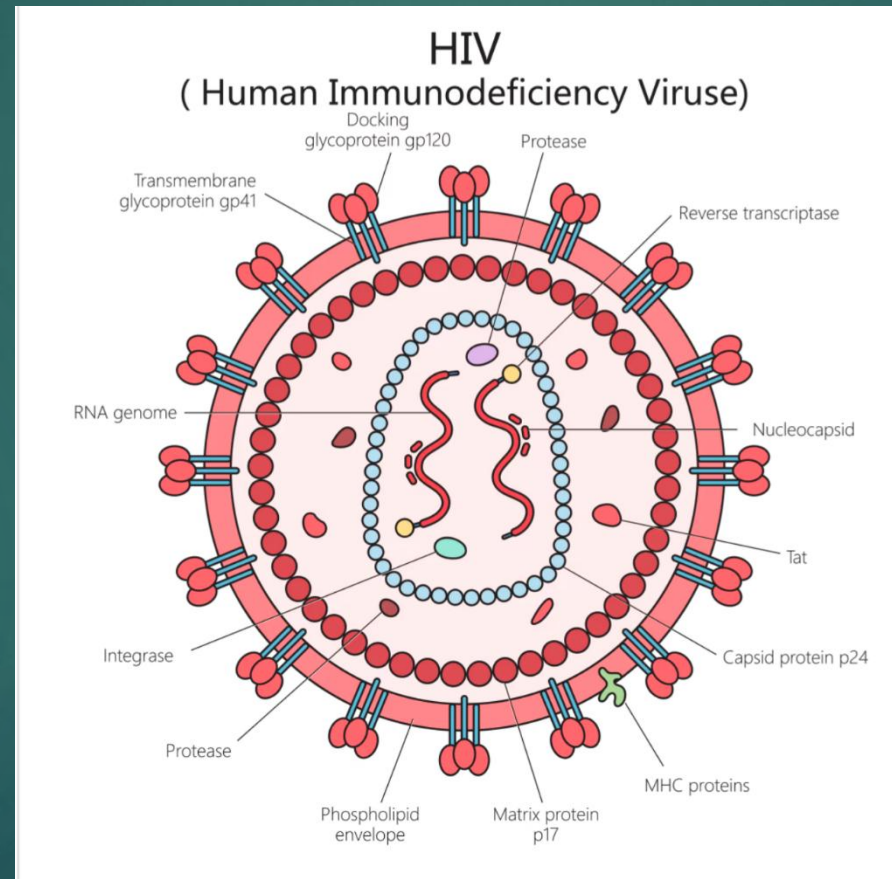
HIV Transmission

- ▶ **Sexual transmission:** heterosexual, MSM
- ▶ **Blood exposure:** transfusions, unsafe injections, needle sharing
- ▶ **Mother-to-child:** during pregnancy, delivery, or breastfeeding
- ▶ **Occupational exposure:** needlestick injuries
- ▶ Risk increased by **co-existing STIs**
- ▶ **Myths & misconceptions** still fuel stigma

HIV Structure

- ▶ Enveloped RNA virus
- ▶ **Key proteins:** gp120, gp41 (entry into cells)
- ▶ **Core enzymes:** reverse transcriptase, integrase, protease
- ▶ Targets **CD4 receptors & CCR5/CXCR4 co-receptors**
- ▶ Two types: **HIV-1 (global) & HIV-2 (West Africa, less virulent)**
- ▶ Genetic diversity complicates **vaccine development**

HIV Structure



HIV Life Cycle

- ▶ Binding to **CD4 receptor** + co-receptors
- ▶ Fusion and **viral RNA entry** into host cell
- ▶ Reverse transcription → viral DNA synthesis
- ▶ Integration into **host genome** (via integrase)
- ▶ **Replication** of viral proteins & assembly
- ▶ Budding & release of **new virions**
- ▶ Each cycle kills or damages **host CD4 cells**

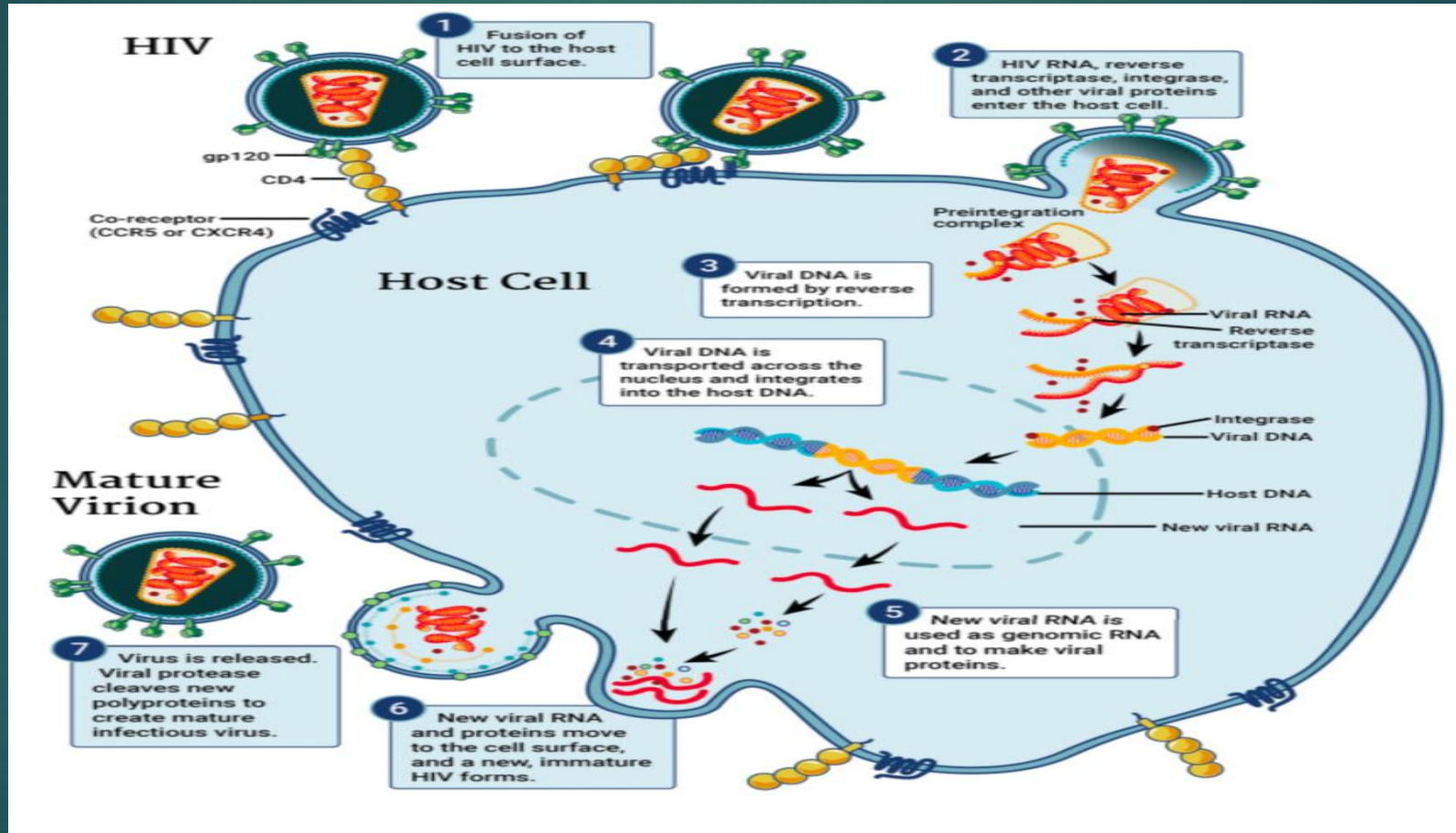
Pathology of HIV Infection

- ▶ Gradual depletion of **CD4+ T-cells**
- ▶ Immune system becomes **dysfunctional**
- ▶ Opportunistic infections (TB, candidiasis, PCP) emerge
- ▶ Increased risk of **malignancies** (Kaposi sarcoma, lymphomas)
- ▶ Chronic immune activation → **inflammation & organ damage**
- ▶ AIDS stage: **CD4 count <200 cells/μL or AIDS-defining illness**

Pathophysiology – Immune System

- ▶ Loss of **helper T-cell function**
- ▶ Reduced **B-cell antibody production**
- ▶ Impaired **cytotoxic T lymphocyte activity**
- ▶ Altered **cytokine signaling**
- ▶ Chronic immune activation → **exhaustion**
- ▶ Ultimately leads to **immune collapse**

Pathophysiology – Immune System



Clinical Stages of HIV

- ▶ **Acute HIV infection:** flu-like illness, high viral load
- ▶ **Clinical latency:** asymptomatic, slow CD4 decline
- ▶ **Symptomatic HIV:** weight loss, chronic diarrhea, infections
- ▶ **AIDS stage:** opportunistic infections, cancers
- ▶ WHO staging (1–4) guides **clinical management**
- ▶ Progression varies: **rapid progressors vs long-term non-progressors**

Opportunistic Infections

- ▶ **Tuberculosis**: most common killer in HIV+ patients
- ▶ **Oral/esophageal candidiasis**
- ▶ **Pneumocystis pneumonia (PCP)**
- ▶ **Cryptococcal meningitis**
- ▶ **Toxoplasmosis** of brain
- ▶ **Cervical cancer & Kaposi's sarcoma** (AIDS-defining)

HIV Diagnosis

- ▶ **Rapid antibody tests** (screening)
- ▶ **ELISA + Western blot** (confirmation in research settings)
- ▶ **PCR testing**: detects viral RNA (esp. in infants <18 months)
- ▶ **CD4 count monitoring** for immune status
- ▶ **Viral load testing** to assess treatment response
- ▶ Early diagnosis = better **treatment outcomes**

HIV Statistics – Key Indicators

- ▶ **Prevalence:** proportion of population living with HIV
- ▶ **Incidence:** new HIV infections in a given year
- ▶ **Mortality:** deaths due to AIDS-related illness
- ▶ **ART coverage rates**
- ▶ **PMTCT coverage** (prevention of mother-to-child transmission)
- ▶ Indicators guide **programs and policies**

Public Health Impact

- ▶ High **economic burden**: treatment + lost productivity
- ▶ Impacts **life expectancy & national development**
- ▶ Strains health systems in low-income countries
- ▶ Gender inequality increases vulnerability in women
- ▶ Children orphaned by AIDS remain a **social challenge**
- ▶ HIV is a **development and human rights issue**

Prevention Strategies

- ▶ **Abstinence, fidelity, condom use (ABC)**
- ▶ **Male circumcision** reduces transmission risk
- ▶ **Pre-exposure prophylaxis (PrEP)**
- ▶ **Post-exposure prophylaxis (PEP)**
- ▶ **PMTCT programs** for pregnant women
- ▶ **Behavioral & structural interventions** (stigma reduction, empowerment)

Antiretroviral Therapy (ART)

- ▶ Combination of **≥3 ARVs** (HAART)
- ▶ Classes: NRTIs, NNRTIs, PIs, integrase inhibitors, entry inhibitors
- ▶ **Suppresses viral replication** to undetectable levels
- ▶ Improves **immune function** (CD4 recovery)
- ▶ Lifelong therapy with **strict adherence** needed
- ▶ “U=U” concept: **Undetectable = Untransmittable**

Antiretroviral Therapy (ART)



ART in Zambia

- ▶ National free ART program since early 2000s
- ▶ First-line regimen: **Dolutegravir-based combinations**
- ▶ High ART coverage but **adherence challenges remain**
- ▶ Viral load monitoring scaled up countrywide
- ▶ Decentralized ART delivery to rural areas
- ▶ Zambia aligned with **UNAIDS 95-95-95 strategy**

HIV and TB Co-infection

- ▶ TB = **leading opportunistic infection in HIV**
- ▶ HIV increases risk of **latent TB reactivation**
- ▶ TB accelerates HIV progression
- ▶ Integrated **TB/HIV care programs**
- ▶ **Isoniazid preventive therapy (IPT)** reduces risk
- ▶ TB/HIV syndemic is a **public health priority**

HIV and Reproductive Health

- ▶ High burden in **young women of reproductive age**
- ▶ Vertical transmission risk without intervention = **15–45%**
- ▶ With ART, risk reduced to **<5%**
- ▶ Family planning important for **HIV+ women**
- ▶ Safe conception options for **serodiscordant couples**
- ▶ HIV programs must integrate **SRH services**

HIV and Mental Health

- ▶ HIV diagnosis linked with **depression, anxiety, PTSD**
- ▶ Stigma fuels **psychological distress**
- ▶ Poor mental health → poor ART adherence
- ▶ Psychosocial support crucial in HIV care
- ▶ Peer support groups improve **coping & retention**
- ▶ Integrated **mental health services** improve outcomes

Global HIV Response

- ▶ UNAIDS 95-95-95 targets: by 2030
 - ▶ 95% know status
 - ▶ 95% on treatment
 - ▶ 95% virally suppressed
- ▶ PEPFAR and Global Fund major funding sources
- ▶ Innovations: **long-acting injectables, HIV vaccines in trials**
- ▶ Strong civil society involvement (activism, rights advocacy)
- ▶ HIV response a model for other health challenges
- ▶ Still **gaps in access, equity, and stigma**

Challenges in HIV Management

- ▶ Persistent **stigma & discrimination**
- ▶ Limited resources in **low-income countries**
- ▶ **Adherence issues** (drug fatigue, side effects)
- ▶ Drug resistance mutations
- ▶ Gaps in services for **key populations** (MSM, sex workers, PWID)
- ▶ Emerging **non-communicable diseases** in HIV+ individuals