HIV Subtypes, Strains and Recombinant Forms

Human Immunodeficiency Virus (HIV) is a **retrovirus** that targets and destroys the **CD4+ T-helper cells**, leading to **progressive immune suppression**. If untreated, HIV infection progresses to **Acquired Immunodeficiency Syndrome (AIDS)**.

Transmission of HIV

HIV is primarily transmitted through:

- **Sexual contact** (most common route globally)
- **Mother-to-child transmission (MTCT)**:
  - During **pregnancy**, **delivery**, or **breastfeeding**
- **Parenteral exposure**:
  - Sharing contaminated **needles or syringes**
  - **Transfusion** of infected blood products
  - Accidental **needlestick injuries** (healthcare settings)

Note: HIV is **not transmitted** via casual contact, insect bites, or respiratory droplets.

Classification of HIV

There are **two major types** of HIV:

1. HIV-1

- **Most prevalent** worldwide
- Origin: **Chimpanzees** (Pan troglodytes troglodytes)
- Associated with **faster disease progression**
- Highly transmissible

2. HIV-2

- **Primarily found in West Africa**
- Origin: **Sooty mangabey monkeys**
- **Less transmissible**
- **Slower progression** to AIDS
- Lower plasma viral loads

Both HIV-1 and HIV-2 belong to the **Retroviridae** family, **Lentivirus** genus.

HIV-1 vs HIV-2: Key Differences

Feature	HIV-1	HIV-2
Global prevalence	High (worldwide)	Low (mostly West Africa)
Disease progression	Faster	Slower
Viral load	Higher	Lower
Transmission rate	Higher	Lower
Detection challenges	Most tests detect it	Some require specific kits
Kaposi's sarcoma risk	Common in AIDS	Rare
Dual infections	Possible with HIV-2	Does **not protect** against HIV-1

Origin and Evolution of HIV

HIV-1 Origin

- Believed to have crossed species from **chimpanzees** to humans.
- The **Simian Immunodeficiency Virus (SIV)** in chimpanzees is genetically related to HIV-1.

HIV-2 Origin

- Originated from **sooty mangabey monkeys** .
- Transmitted to humans through hunting and consumption of bushmeat.

Genetic Groups and Subtypes of HIV-1

HIV-1 Groups

- **Group M (Major):** ~90% of global infections
- **Group O (Outlier):** 1–5%, mostly in West-Central Africa
- **Group N (Non-M, Non-O):** Rare, mostly in Cameroon
- **Group P:** Extremely rare, discovered in Cameroon

HIV-1 Group M Subtypes (Clades):

- At least **10 known subtypes** (A–K, skipping E and I)
- Subtypes differ in **geographic distribution** , **transmissibility** , and **response to treatment** .

Subtype	Location
A	East and Central Africa
B	Americas, Europe, Australia, Middle East
C	Sub-Saharan Africa, India, Brazil
D	Central and Eastern Africa
F	South America and Romania
G	West and Central Africa
H, J, K	Africa, Middle East

Subtype B is the most common in the **United Kingdom, Europe, and the Americas** .

Circulating Recombinant Forms (CRFs)

- When a person is infected by **two or more subtypes** , viral recombination can occur.
- This leads to the formation of **CRFs** – **Circulating Recombinant Forms** .
- CRFs are prevalent in regions with high subtype diversity.
- Example: **CRF01_AE** , **CRF02_AG**

CRFs can complicate diagnostic testing and antiretroviral therapy due to genetic variability.

Subtypes of HIV-2

HIV-2 is classified into **eight subtypes** (Groups A–H):

- **Group A and B** :
  - Most **prevalent** and **clinically significant**
  - Associated with **pathogenic infections**
- Groups C–H:
  - **Rare**
  - Primarily detected in isolated cases

Clinical Implications

- **Diagnosis:** Many commercial kits are designed to detect **HIV-1** only; HIV-2 requires specific assays.
- **Treatment:** Some **antiretroviral agents** are **less effective** against HIV-2 (e.g., NNRTIs).
- **Epidemiology:** Understanding subtype and group is critical for public health tracking, vaccine design, and therapy.

High-Yield Points

HIV-1: More transmissible, faster progression, globally prevalent
HIV-2: Slower progression, confined mainly to West Africa
HIV is a **retrovirus** – uses **reverse transcriptase** to replicate
CD4+ T-cell destruction ? immunodeficiency
Subtypes and CRFs impact transmission and treatment response
Group M, subtype B is dominant in the Western world
Always test for both HIV-1 and HIV-2 in endemic areas