Lecture 12: HIV (cont.)
Today’s events

• A bit of history

• A bit of virology

• Presentations of the readings
HIV and AIDS

HIV – Human Immunodeficiency Virus

AIDS – Acquired ImmunoDeficiency Syndrome
– Condition whereby the body’s immune defense system ceases to function properly

• origin of HIV/AIDS in the US:
  – Currently, it is believed that there was a Haitian immigrant who worked in the DR Congo in the 1960s
  – First known case of HIV death in a human was in DR Congo in 1959
    • Probably from monkey blood from hunting
  – Various studies put it back to the 1930s and 1940s
  – Earliest viral isolation of HIV-1 from blood from Zaire in 1976
  – First cases? Lots of studies
2 types of HIV in humans

• **HIV-1** is thought to have originated in southern Cameroon after jumping from wild chimpanzees (*Pan troglodytes troglodytes*) to humans during the twentieth century.
  – It evolved from (SIV$_{cpz}$)

• **HIV-2** may have originated from the Sooty Mangabey (*Cercocebus atys*), an Old World monkey of Guinea-Bissau, Gabon and Cameroon

• Probably not as an STD

Pictures: pin.primate.wisc.edu
New York Times chronicle of the onset of AIDS epidemic in the U.S.

• 1981:
  – June, LA – 5 cases of an unusual pneumonia, pneumocystis (CDC)
  – July – 41 cases of Kaposi’s Sarcoma, a rare skin cancer
  – August – 100 cases of homosexual men dying of rare diseases
  – December – report in NE J. Med – harmless viruses and bacteria can cause fatal illnesses in homosexual men
  – End of 1981: 121 deaths
• 1982:
  – May – immune system disorder known to doctors for nearly a year, mostly affecting homosexuals – around 335 people
  – July – 34 cases of a serious immune disorder among Haitians
  – December – infant dies of AIDS after multiple blood transfusions
• 1983:
  – Pasteur Institute - new virus in patient with symptoms preceding AIDS
    • named it lymphadenopathy-associated virus, or LAV
  – Women can catch it too
  – 1476 deaths
New York Times chronicle of the onset of AIDS epidemic in the U.S.

- 1984
  - Robert Gallo (US) CDC reports that HTLV may cause AIDS
  - 3500 deaths
  - Drug users are getting AIDS
- 1985
  - Blood test made available to blood banks
  - Rock Hudson admits to having AIDS
    - Dies in October
  - Blood supply declared free of HIV virus
  - Pentagon starts screening recruits
    - Will reject positives
  - Gallup poll – 37% of US less favorable towards homosexuals
  - 6850 deaths
- 1986
  - Women may transmit HIV to men
  - ~12,000 deaths
- 1987
  - Insurers want to test for HIV
  - WHO makes global map of AIDS cases
  - 17,000 deaths
Global increase in the next decade

Cumulative AIDS cases worldwide. AIDS cases reported to the World Health Organization through December 1994
Death rates from leading causes of death in persons aged 25-44 years, United States, 1982-1993

Reference: Centers for Disease Control and Prevention (c. 1994)
• 1988:
  – AMA urges privacy breach to tell potential victims
  – First suggestion of federal policy against AIDS discrimination
  – 21,000 deaths
• 1989
  – Prison testing
  – AZT starts
  – Cost of AIDS estimated around $5 billion a year
  – 27,500 deaths
• 1990
  – Hopes for vaccine in research
  – Teenagers at risk
  – 31,000 deaths
• 1991
  – Roman Catholic church in Ireland prevent AIDS education
  – Doctors and Dentists with AIDS are urged to self-report or quit
  – Magic Johnson announces he has AIDS
• 1992
  – Agencies argue over definitions of AIDS
  – Arthur Ashe announces he has AIDS
• 1993
  – New strains resist AIDS drugs
  – Latin America proves to have a bigger epidemic with less control than the US
  – Needle programs start
• 1994
  • 49,000 deaths
• 1995
  • 49,987 deaths
• 1996
  – Clinton signs bill to cut troops with HIV
  – Recognition that most people with HIV can’t afford the treatment
    • 37,359 deaths
• 1997
  – Russia looks to be like the US and Europe 16 years prior
    • 21,000 deaths
• 2000
  – HIV soars in Hispanic and Black men, despite downturn in US AIDS deaths
  – Thabo Mbeki, S. African former health minister, President successor to Mandela writes letter to Clinton about AIDS – thought to be a hoax in the US
  – Antiviral drugs appear to be working – but cost too much
• 2001
  – Romanian AIDS orphans
  – Merck cuts the prices of drugs in Brazil
Global summary of the AIDS epidemic
December 2007

<table>
<thead>
<tr>
<th>Number of people living with HIV in 2007</th>
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<tbody>
<tr>
<td>Total</td>
<td>33.2 million [30.6–36.1 million]</td>
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<tr>
<td>Adults</td>
<td>30.8 million [28.2–33.6 million]</td>
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<tr>
<td>Women</td>
<td>15.4 million [13.9–16.6 million]</td>
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<tr>
<td>Children under 15 years</td>
<td>2.5 million [2.2–2.6 million]</td>
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<tr>
<th>People newly infected with HIV in 2007</th>
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<tr>
<td>Total</td>
<td>2.5 million [1.8–4.1 million]</td>
</tr>
<tr>
<td>Adults</td>
<td>2.1 million [1.4–3.6 million]</td>
</tr>
<tr>
<td>Children under 15 years</td>
<td>420 000 [350 000–540 000]</td>
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<tr>
<th>AIDS deaths in 2007</th>
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<tr>
<td>Total</td>
<td>2.1 million [1.9–2.4 million]</td>
</tr>
<tr>
<td>Adults</td>
<td>1.7 million [1.6–2.1 million]</td>
</tr>
<tr>
<td>Children under 15 years</td>
<td>330 000 [310 000–380 000]</td>
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</tbody>
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The ranges around the estimates in this table define the boundaries within which the actual numbers lie, based on the best available information.
The virus

- HIV is a retrovirus, one of the lentiviruses
  - Copies RNA to DNA
    - has 2 identical RNA strands within a protein core
    - Membrane protein on the envelope binds to T-cells

In the T-cell, the envelope is removed, core is broken down and the RNA makes DNA which binds into host cell DNA to make more viral particles

Highly mutating: HIV is about 65x as fast at strain evolution than influenza
The virus – HIV immune system trickery: a simple overview

- T-cells and B-cells – Thymus and Bone
- B-cells essentially make antibodies
- T-cells
  - help B-cells make antibodies (helper T-cells)
  - kill damaged or foreign cells (cytotoxic T-cells)
  - 2 kinds of helper T-cells (biochemical messengers)
    - Th2 – help B-cells
    - Th1 – help cytotoxic T-cells
- HIV (usually) just gradually eliminates Th1 & Th2 cells
  - HIV has a surface protein gp120 which binds to CD4+ receptor on Th1 & Th2
  - Immune system keeps producing T-cells, but after up to 10-15 years, the body can’t keep up with the rate of cell death
  - No immune response to infection – AIDS begins
The virus – HIV immune system trickery: a simple overview

• Healthy CD4 cell counts range from 500 to 1,800 per cubic millimeter of blood.

• AIDS is diagnosed when CD4 cell count goes below 200.

• Even if CD4 cell count is over 200, AIDS can be diagnosed if patient has HIV and certain diseases such as tuberculosis or *Pneumocystis carinii* pneumonia (PCP).
On to the readings!