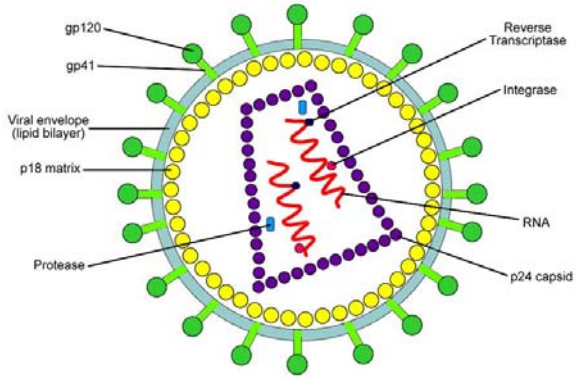
HIV/AIDS

Name(s)

- human immunodeficiency virus, HIV

- acquired immune deficiency syndrome, AIDS



Type of Virus

- spherical with conical capsid
( )

- lipid membrane envelope with protein spikes

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- HIV carries 3 enzymes with it (integrase, protease, reverse transciptase)

Description/Statistics

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- two major types HIV-1 (predominant worldwide); HIV-2 (primarily West Africa)

- US Statistics

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- ~50,000 new infections each year

- >15,000 die each year (2010 data)

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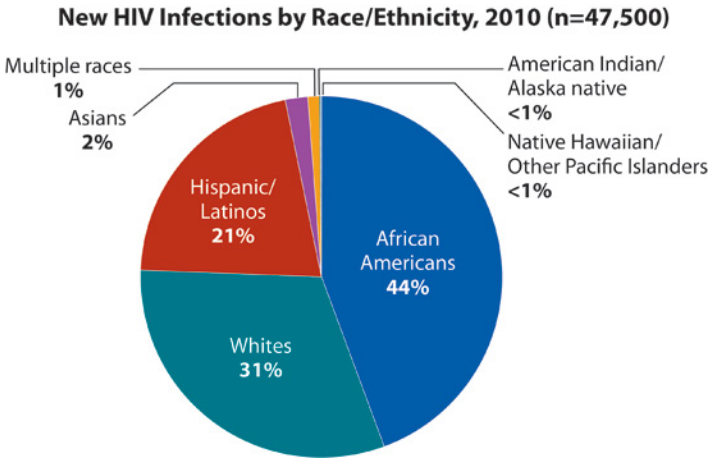
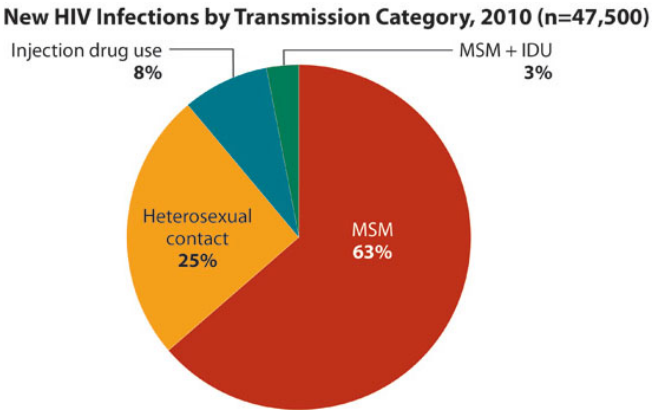
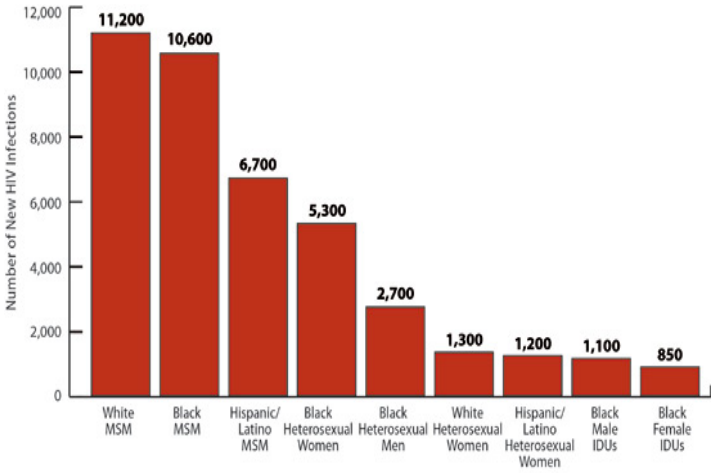
- Men who have sex with men (MSM) ~2/3 of new infections







- heterosexual transmission is significant (~25% of new infections)

- HIV is primarily an urban disease

- white males largest number of infections ( )

- blacks/African Americans and Hispanics disproportionately affected

- ~44% new infections in blacks/African Americans (only ~12% on population)

- ~21% new infections in Hispanic/Latinos (only ~16% of population)

- most infections are in young people/adults ( )

  - (CDC website)

- World Statistics

- ~35 million infected worldwide

- most infections in sub-Saharan Africa ( )

- infections ~equal for men and women; this makes HIV a <u>HETEROSEXUAL</u> disease

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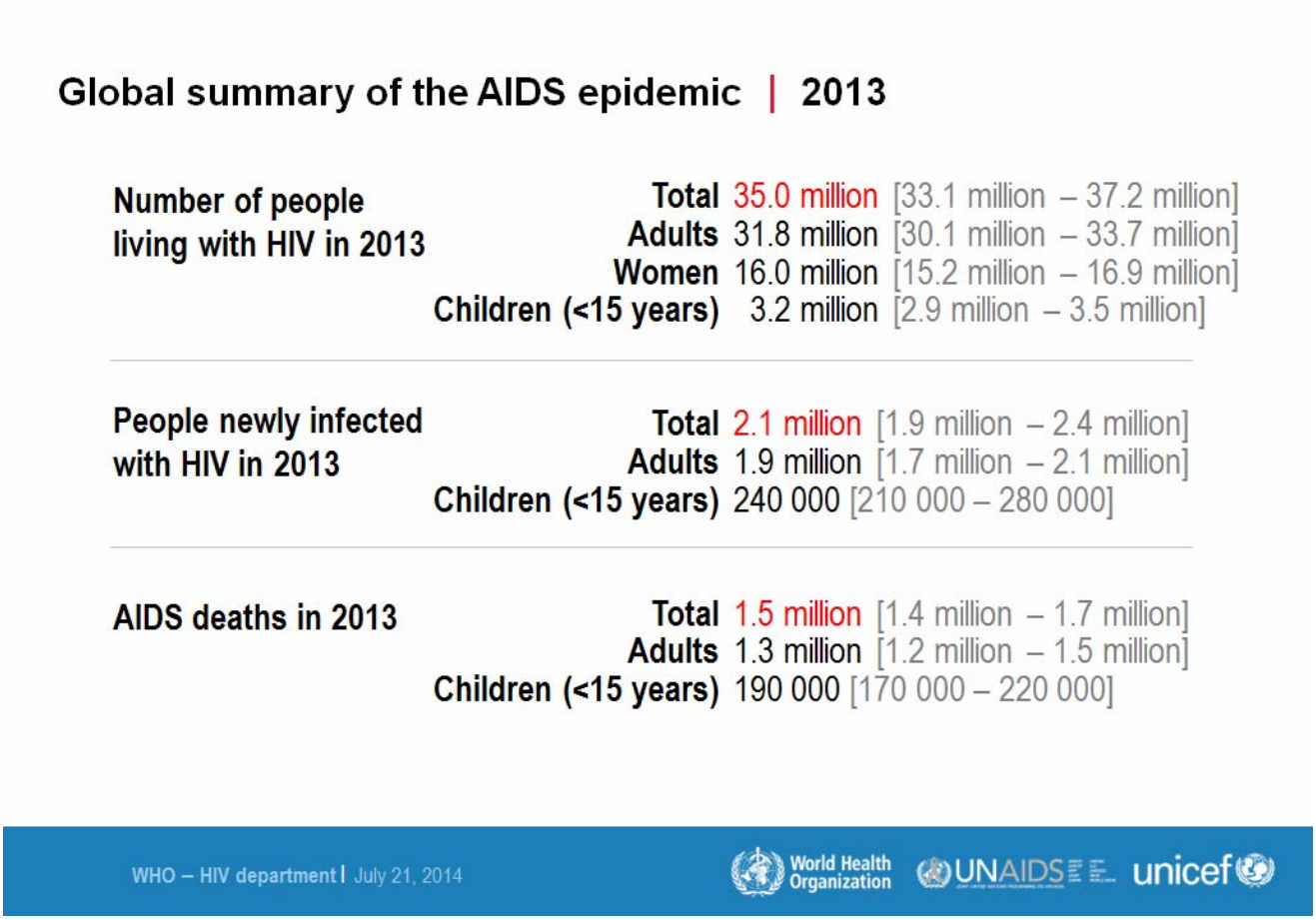

Origin

- controversial since believed to have originated in Africa within past 100 years

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- SIV (simian immunodeficiency virus) mutated

- transmitted to humans thru bushmeat (eating chimpanzees – hunter theory), then human to human

- believed that a chimp was co-infected with 2 SIV strains; genetic shift occurred to create HIV!

- oldest known case from 1959 in the Congo (tissue and blood samples saved, later tested)

- other origin theories – oral polio vaccine theory – ( )

- contaminated needle theory – reusing syringes with sterilizing in between

- conspiracy theory – manmade biological warfare ( )

Transmission

- bodily fluids

- sexual activity ( )

- intravenous (IV) drug use, sharing needles

- blood transfusion and organ transplants (early in epidemic, 1980's; low risk today)

Mode of Infection

- HIV requires 2 cell surface receptors to attach and infect host cell

- immune cells are primary targets (macrophages, T helper cells)

- macrophages wander throughout the body looking for pathogens to eat
  - when they eat HIV, they get infected

- macrophages take what they find to helper T cells thereby infecting helper T cells

- HIV's genome is made of RNA which is reversed transcribed into DNA; which then integrates with a host chromosome forming a_____

- once a host cell is infected with a provirus, the cell is infected FOREVER! ( )

- each time the host cell divides to make more cells, the daughter cells have a provirus

- T cells are critical to the normal functioning of the immune system (normal T cell count = 500-1500 cells/mm^3)

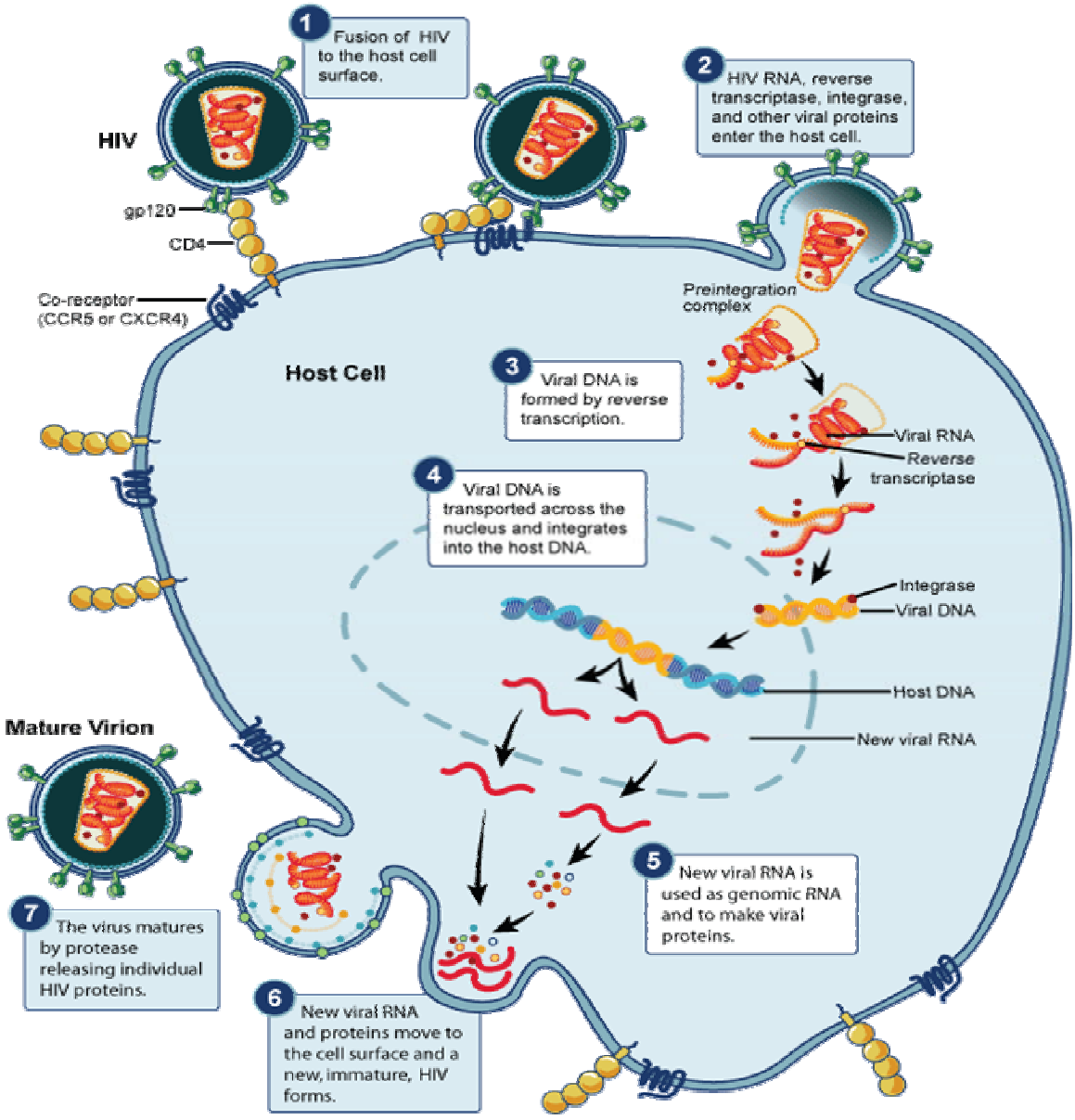
- when T cells are destroyed by HIV (count <200 cells/mm^3), the immune system crashes ( )

- patient becomes susceptible to many different infections

- immune system makes antibodies but antibodies do not confer resistance

- HIV reverse transcriptase makes many mistakes leading to many mutations

- <u>rapid</u> antigenic drift makes it impossible for immune system to keep up



Symptoms

- initial HIV infection – flu-like symptoms within 2 months (2-4 weeks for most people) after infection ( )

- latent infection has no specific symptoms (Clinical Latency - inapparent infection); patient appears healthy! ( )

- AIDS – early stage

- Fever (this is the most common symptom)
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- Sore throat
- Rash
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- Muscle and joint aches and pains
- Headache

- AIDS – late stage

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- Recurring fever or profuse night sweats
- Extreme and unexplained tiredness
- Prolonged swelling of the lymph glands in the armpits, groin, or neck
- Diarrhea that lasts for more than a week
- Sores of the mouth, anus, or genitals
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- Red, brown, pink, or purplish blotches on or under the skin or inside the mouth, nose, or eyelids
- Memory loss, depression, and other neurologic disorders.
    - (www.aids.gov website)

Prevention/Treatment

- abstinence ( )

- safer sex ( )

- HIV testing, knowing your status and taking precautions

- circumcision – multiple studies have shown a significantly reduced risk ( ) of HIV transmission from <u>female to male</u>

- mutant cell surface receptor in humans - ~4-16% of people of European descent ( ) have this mutation
    - they are partially to fully resistant to HIV infection

    - this mutation may also confer resistance to smallpox (original reason mutation occurred?)

- this receptor is not critical to survival and now is a target for anti-HIV drugs; blocking the receptor should reduce HIV infections
    - an HIV+ patient with leukemia who received a bone marrow transplant from a mutant donor has apparently been cured!

- long-term non-progressors – these individuals have the ability to keep HIV under control without drugs ( )

    - they have other mutations including the receptor mutation

- antiretroviral drugs – very effective at stopping replication and progression to AIDS; <u>not cures</u>

- Atripla is 1 pill/day– combination of 3 drugs to <u>treat</u> HIV (_____)

- Truvada – used to <u>prevent</u> HIV infection (pre-exposure prophylaxis) – varying degrees of effectiveness

- How can health care workers protect themselves from being infected with HIV?

Controversy/Problems

- around 1980, unusual infections began to occur in young homosexual men in US

- doctors and scientists began to suspect a new pathogen was the cause

- in 1983, they discovered HIV (then called LAV or HTLV III)
    - Luc Montagnier (France, LAV); Robert Gallo (US, HTLV III)
    - Montagnier won the Nobel prize, not Gallo

- stigmatization, discrimination, violence (at the beginning of the epidemic 1980's thru today)

- relationship with tuberculosis (TB) – as the rate of HIV has increased, the rate of active TB has increased (1/3 of world's population is infected with TB!)

- Middle East – why little or no data from Middle East?

- HIV/AIDS Denialism – since the beginning of the epidemic, there have been those who claim that HIV does not cause AIDS
    - the scientific evidence is overwhelming that HIV causes AIDS

    - antiretroviral therapy is highly effective at keeping patients alive

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    - HIV denialism in Africa is problematic (denialism increases spread and death)

- Conspiracy Theory
    - Africans disproportionately affected ( ) – because Caucasians of European descent had immunity some speculated HIV was manmade (absurd!)

- babies aggressively treated with anti-HIV drugs originally thought to have been cured but eventually they all reverted
    - apparently HIV reservoirs are established early in the body and cannot be eliminated by antiretroviral drugs

- 40+ years after the start of the pandemic, there is still no vaccine
    -traditional vaccine strategies not effective

- HIV/AIDS is entirely preventable, HOW?

Study Objectives

1. **What kind of virus is HIV?**
2. **What makes HIV/AIDS a pandemic?**
3. **Describe how HIV is transmitted.**
4. **Describe the typical symptoms of HIV in early infection, latency, and early and late stage AIDS.**
5. **Discuss the origin of HIV including the other possible theories.**
6. **Describe how HIV can be treated and prevented.**
7. **How many receptors are needed for HIV to attach and infect host cells?**
8. **What cell types get infected with HIV?**
9. **How do scientists believe HIV was produced by antigenic shift?**
10. **How does antigenic drift make HIV difficult to fight with antibodies or vaccines?**
11. **How do some people naturally resist HIV?**
12. **Know the normal T cell count vs. the T cell count for AIDS.**
13. **Who discovered HIV and when?**
14. **What is the relationship between HIV and TB?**
15. **What is AIDS denialism and how does it contribute to the spread of HIV?**
16. **Explain why some people believe in the HIV conspiracy theory. Is there evidence to support it?**
17. **HIV/AIDS is entirely preventable, HOW?**
18. **How can health care workers protect themselves from being infected with HIV?**