Task: Pseudo-network

* Create a pseudo-network representation of HIV transmission over a heterosexual pseudo-network of agents.
* Agents may or may not be connected to the network at any given time.
* Edges in the network represent coital contact between two agents and the potential for infection.

Edge:

* Type: Marriage, Secondary (low committal, chance to progress to marriage), single contact (one night stand, transactional)
* Frequency (applicable to types 1 and 2 and indicates the frequency of coital acts during the simulation “step” period.)
* Protection likelihood
* Agent M
* Agent F

Each Agent has multiple factors that govern various aspects of their simulated lives:

* Behavior – These factors govern the behavioral aspect of the agent such as
  + Faithfulness
  + Preferred condom usage
  + Profession in the case of female sex workers
  + Overall desire level – This is used to calculate the average amount of coital interactions that they desire. If their desires are not fulfilled by their current networked relationship then they may search for an additional relationship outside of that one. The greater this unfulfilled desire the more likely they are to seek external relationships.
* Genetic- Genetic factors such lack of CRR5 receptors will reduce the likelihood of HIV infection.
  + Male/ Female – males have a reduced risk of acquiring HIV during coital acts, particularly if they’ve had a circumcision.
  + CCR5
  + Other- Other genetic factors and receptors may offer a certain level of immunity to HIV.
* Adaptable Immunity- For those with partial resistance to HIV or whose partner is newly seroconverted adaptable immunity may play a role in reducing the likelihood of infection.
  + Seroimmunity – Immunity to a particular strain of HIV may be increased through exposure to viral loads too low to cause a sustained infection. Seroimmunity is assumed to be strain specific.
  + Alloimmunity- Alloimmunity is an immunity to the tissues of another person. Since HIV may use host white blood cells to hitch a ride into the body of an exposed individual, an immune response to the invading cells could prevent HIV from “coming aboard”. Alloimmunity has been shown to be reduced in female sex workers due to the number of coital partners, thus both a specific and an overall alloimmunity factor will be applied. Specific alloimmunity is developed over repeated coital acts with the same individual and is specific to that individual. General alloimmunity governs how quickly this is developed with it being less likely to develop the more coital partners one has.
  + Circumcision- As a method to reduce the risk of transmission, males can elect to have a circumcision in order to reduce their chances of getting HIV.
* Networkd
  + A list of network edges that govern relationships: marriage, long term low comital coital relationships, single contact coital acts.
* Status – Status contains a list of factors that govern that agent’s status in the model.
  + Disease status- Whether or not they are infected. Those that are infected will have a disease matrix that represents all aspects of their disease state.
  + Infections: STDs and other infections such as Malaria may make it easier to transmit HIV per coital act.
  + Illness level – This is extracted from infections and disease status and will become part of an “appeal” level, where in, diseased individuals are less appealing and thus less likely to be accepted for a new coital relationship and may be more likely to be removed from a coital relationship.
  + Age – represents the age of the individual. This will become an important factor when birth and death are added to the system as it will govern when an individual is able to enter the sexual network and when their desires begin to wane with age and when they are no longer able to produce offspring.

Disease Matrix:

The disease matrix contains information on an agent’s particular disease state.

* Genotype(s): Coinfection with multiple strains of HIV is possible and has been shown to increase the virulence of the disease. Some genotypes commonly produce higher or lower viral loads or higher/lower virulence (normally associated)
* Stage – Acute, end stage
* Viral Load – Factor by which genotype and stage will affect the true viral load of an individual as it is not necessarily standard for all people this will be calculated based on many factors (e.g. heterogenous for CCR5) and a randomness factor.

World Factors:

Many factors will eventually effect the world including, but not limited to:

* Immigration
* Emigration
* Birth
* Death
* Disease-free life-expectancy.

Genotypes:

Mutation Rate: ~ 3.1 x 10 ^-5 per base pair per replication cycle

HIV 1- Groups--

* Major (M) – most common – Subdivided
  + A-D
    - Women infected with a non-A subtype were 8 times more likely to develop AIDS than were those infected with subtype A
    - B- Predominant in North America and developed countries.
    - C- globally most prevalent.
    - Prior studies have suggested that subtype D may be more pathogenic than subtypes A and C, possibly due to a higher replicative capacity
    - Clade D infection in particular has been shown to be more pathogenic. Here we confirm in a Nairobi-based prospective female sex worker cohort (1985-2004) that Clade D (n = 54) is associated with a more rapid CD4 decline than clade A1 (n = 150, 20.6% vs 13.4% decline per year, 1.53-fold increase, p = 0.015)
  + F-H
  + J-K
* New (N)
* Outlier (O)
* P
* In 2004–07, nearly one half of all global infections were caused by subtype C (48%), followed by subtypes A (12%) and B (11%), CRF02\_AG (8%), CRF01\_AE (5%), subtype G (5%), and subtype D (2%).[31](http://www.sciencedirect.com/science/article/pii/S1201971211001263#bib0155) Overall, subtypes F, H, J and K cause less than 1% of infections worldwide.

HIV 2- West Africa, less pathogenic, lower viral load

* 8 subtypes
* A &B most prevalent

Relationship network: **Sexual network structure and the spread of HIV in Africa: evidence from Likoma Island, Malawi** ( **AIDS**

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* On average, male respondents had 2.6 sexual partners (IQR 1–3) during the 3 years before the survey, and female respondents had 2.2 partners
* Some 6.7% of women and 12.6% of men had five or more partnerships
* Marital relationships are stable, as 84.6% of marriages of women and 92.4% of marriages of men having started more than a year before the survey were still ongoing at the time of data collection.
* Only 40% of relationships that started during the past year were still ongoing at the time of the survey, and among non-marital relationships that started more than a year ago, only a quarter were still active. Only a small proportion of all non-marital relationships reported during the survey were characterized by respondents as one-off encounters.