Agent Based Modeling of the Transmission of STDs

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Progression

- Progression [Chlamydia & Gonorrhea]
  - Susceptible
  - Gestation
  - Infection
  - Pelvic Inflammatory Disease (PID)
    - Chronic Pelvic Pain
    - Ectopic Pregnancy
    - Tubal Infertility
Transmission

- Actions
- Interactions
- Infections

What is an Agent Based Model?

- Individual-based modeling

- Class of computational models to simulate actions and interactions of autonomous agents.

- Emergence
Landscape / Relationship Space
Aspects

Progression Transmission → Sex Location
Agent Attributes

- 15 - 44 years
- Race / Ethnicity
- Socioeconomic status
- Gender
- Location
- Sexual preferences
- Core
Agent Attributes

- **Core**
  - Behavior-based
  - Location-based
Running the Model

- Initialization
- Behavioral / endogenous running
Initialization

- Location
- Infection
- SES
- Core
Behavioral / Endogenous Running

- Find partners
- Find better location
- Assortative
Find Partners

Within partnership-reach

- Age
- Ethnicity
- SES
- Core
Find Better Location

- Within comfort-zone
  - Ratio of similar to dissimilar agents

- Within better-neighborhood
  - Find agents with maximum comfort-levels
Segregation and Disparities

- Schelling’s segregation
- Core / non-core
Core

- Source of endemic nature
- Inward turning relationships
- Leaking silos
Sustenance

- 15-year olds are not infected
- Environment is the source
- Characteristics of disease decides prevalence levels
Self-regulation

- Local satiation
- Limited spatial reach
- Limited search
- Limited ability to move
- Spontaneous resolution of infection
Prevalence rates
- Chlamydia ~ 3%
- Gonorrhea ~ 0.1%
- Syphilis ~ 0.001%
Focus on cores

- Magnitudes higher prevalence levels
- Adjust for the larger proportion of core-members
ABM Interface
Chlamydia

- USPSTF recommends screening for chlamydial infection for all sexually active non-pregnant young women aged 24 and younger and for older non-pregnant women who are at increased risk.
- There is good evidence that screening for chlamydial infection in women who are at increased risk can reduce the incidence of PID. The USPSTF concluded that the benefits of screening women at increased risk are substantial.
Gonorrhea

- USPSTF recommends that clinicians screen all sexually active women, including those who are pregnant, for gonorrhea infection if they are at increased risk for infection.
- Women and men under the age of 25—including sexually active adolescents—are at highest risk for genital gonorrhea infection. Risk factors for gonorrhea include a history of previous gonorrhea infection, other sexually transmitted infections, new or multiple sexual partners, inconsistent condom use, sex work, and drug use.
- Individual risk depends on the local epidemiology of disease.
Differences

- Lower prevalence
- Progression
- Proportion who are symptomatic
The U.S. Preventive Services Task Force (USPSTF) strongly recommends that clinicians screen persons at increased risk for syphilis infection.

Populations at increased risk for syphilis infection (as determined by incident rates) include men who have sex with men and engage in high-risk sexual behavior, commercial sex workers, persons who exchange sex for drugs, and those in adult correctional facilities. There is no evidence to support an optimal screening frequency in this population. Clinicians should consider the characteristics of the communities they serve in determining appropriate screening strategies.
Differences

- Lower prevalence – highly localized
- MSM
- Stages
  - Primary [infectious]
  - Secondary [infectious]
  - Latent
  - Late
Next Steps / Future Use

- HIV
- Modeling STDs in a single model
- Social pathologies