The effects of assortative mixing and susceptibility on the spread of TB

Background:

TB epidemiology:

- TB is a globally distributed infectious disease
- Concentrated in Africa and Asia
- Spread through respiratory transmission and is thought to require close contact
- Across the world, TB is more common among adults and men

What causes observed variation in TB among men and women?

- Prevalence studies and incidence reports match up indicating that variation is not due to access to health care or reporting
- Most like a combination of factors alter susceptibility in men: genetics, immune responses, hormones, smoking, fat
- Potentially, higher exposure among men could be equally as important: work, school, contact, travel, leisure.. basically who you contact

Assortativity in the number of contacts can cause differences in overall prevalence

- more assortative = larger R0
- prevalence maximized at intermediate R0
- more assortative = targeted contact-tracing works better
- Most studies have found males and females to have the same number of contacts but same-sex contacts (i.e., sex-assortativity) could affect overall prevalence and male-bias in TB cases

Study questions:

1. Can sex-assortative mixing lead to observed levels of overall TB prevalence and sex-specific TB prevalence?
2. Are sex-specific differences in susceptibility required to explain male-bias in TB cases?

Study design:

We will simulate outbreaks of TB on networks of varying sex-assortativity and measure male-bias.

Data sources:

- WHO data for estimations of prevalence in high-burden countries (can be as high 1/4 people have LTBI)
- TBD Outbreak simulation code

Analysis:

Checklist:

- literature review on assortativity in social networks
- decide on data source for assortativity across countries
- decide on how to model assorted networks
- decide on how to model epidemics on networks
- pilot study on small number or size of networks

Protocol changes:

- [bullet list of changes to protocols with reasons for each change]