Pilot study: SIR with susceptibility

Research questions:

1. Can sex-assortative mixing lead to male-bias by itself or is sex-specific susceptibility required to explain male-bias?
2. What are the effects of sex-assortative mixing on disease spread (peak size/time, variation in outbreak size/duration)?

Pilot set-up

Table 1: Network parameters.

Variable	Value
Sex-assortativity, r	0, 0.2, 0.4, 0.6, 0.8, 0.9
Degree distribution, $p(K)$	$\frac{k^{-\alpha}}{\zeta(\alpha)}$
Mean degree, $< K >$	10
Network size, N	500, $1 \cdot 10^3, 1.5 \cdot 10^3$
Tolerance, ϵ	0.035
Rewiring proportion, α	0.2
Replicates	10

Table 2: Disease parameters for SIR model.

Variable	Value
Initial susceptible, S_0	$N - 0.05 \cdot N$
Initial infected, I_0	$0.05 \cdot N$
Infection rate, τ	0.05, 0.1, 0.2
Recovery rate, γ	1
M:F susceptibility ratio, α	1, 1.5, 2
Estimated R_0	$[\tau \frac{<K^2 - K>}{<K>}]$

How network assortativity and susceptibility affect male-bias:

How network assortativity and susceptibility affect epidemic dynamics:

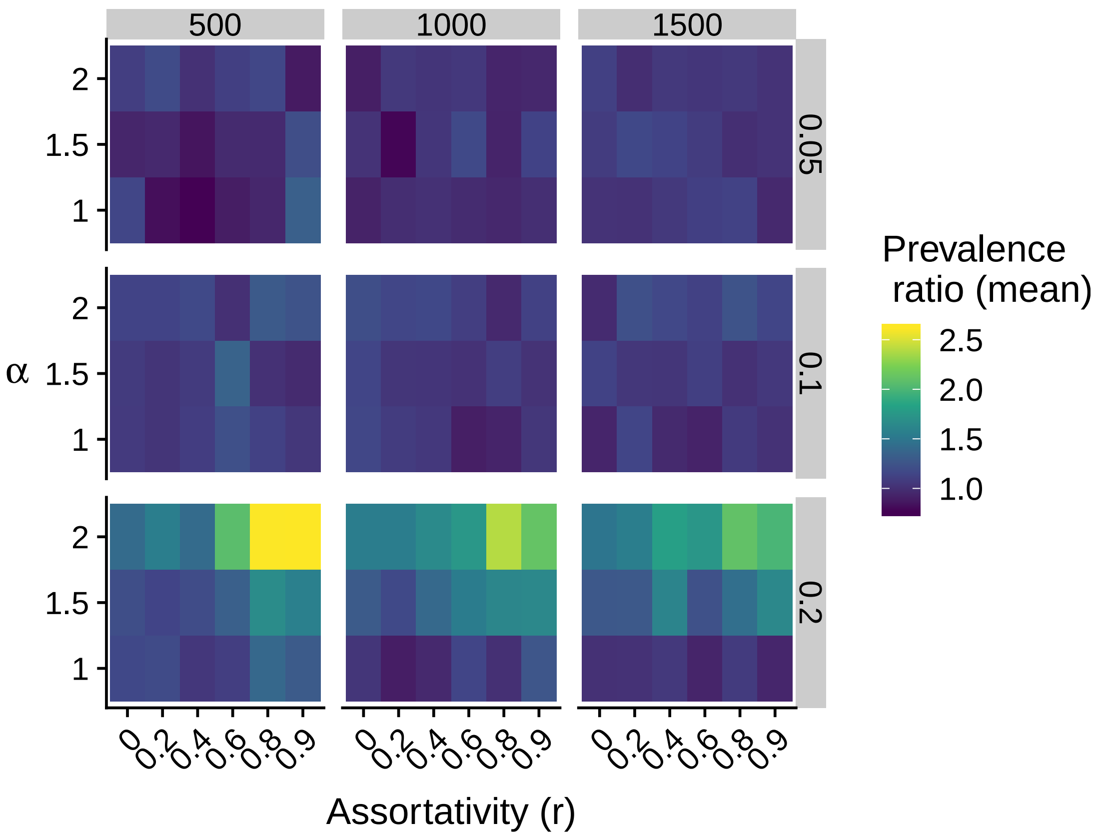

Figure 1: Prevalence ratio across assortativity values. Columns faceted by network size. Rows faceted by transmission rate (R0=1, 2, 3). Each block shows the mean of 10 simulations. Brighter colors show more male-bias.

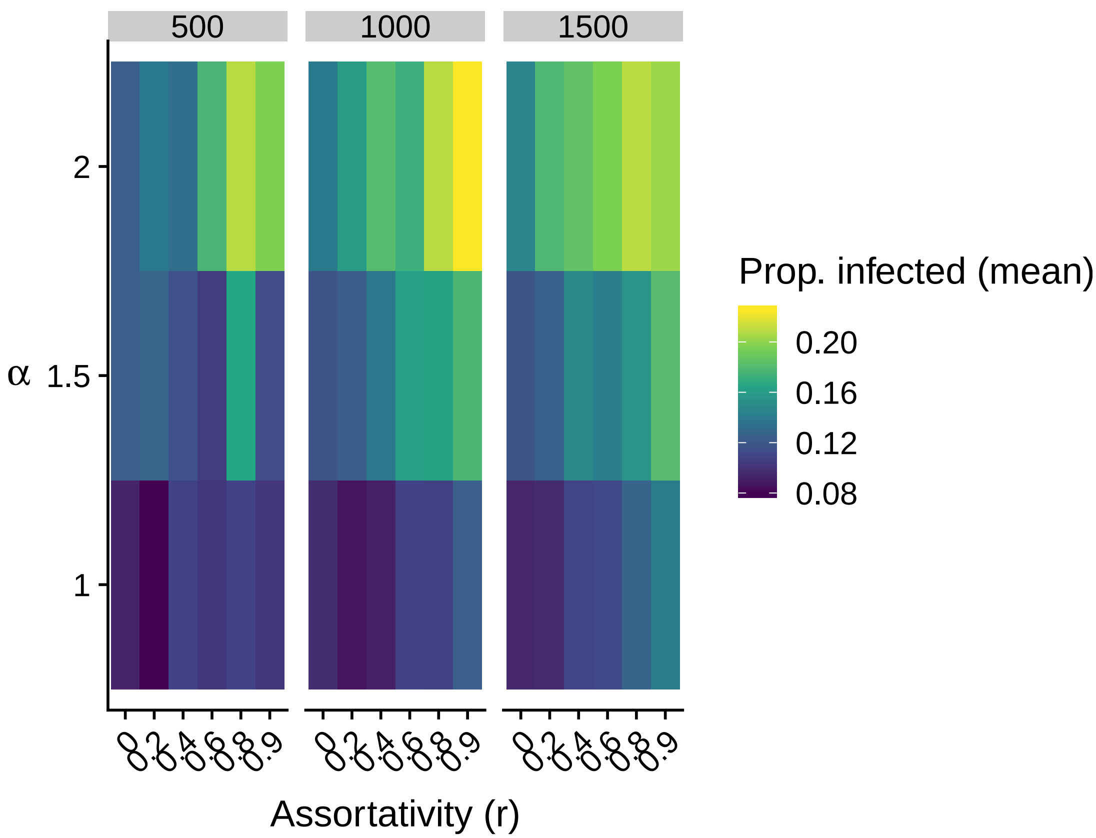

Figure 2: Outbreak size across assortativity values. Columns faceted by network size. Results shown for R0=3. Brighter colors show higher proportions of infected.

Notes

- Generated using rewiring algorithm
- Pilot study shows results for 10 network replicates
- One epidemic simulated per network