

Herd immunity in a network

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28th of July 2017

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Herd immunity

Disease types

Networks

Herd immunity

Protect the flock by immunizing

Disease types

Networks

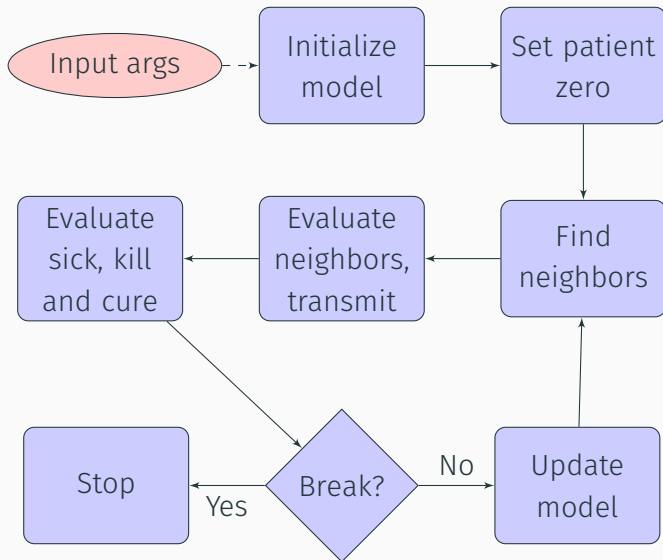
Herd immunity

- R_0 : 'basic reproduction number'
Avg. no. of people infected pr. person
- p_c : herd immunity threshold
$$p_c = 1 - 1/R_0$$
- Herd immunity passively protects whole population

Diseases

	R_0	Mortality rate	HIT
Ebola	1.5-2.5	0.25-0.90	0.33-0.60
Bubonic plague	3	0.6	0.67
Pneumonic plague	2	0.90-0.95	0.50
Measles	12-18	0.15	0.92-0.94
Flu	1.5-1.8	0.001	0.33-0.44
SARS	2-5	0.096	0.50-0.80
Polio	5-7	0.15-0.30	0.80-0.86

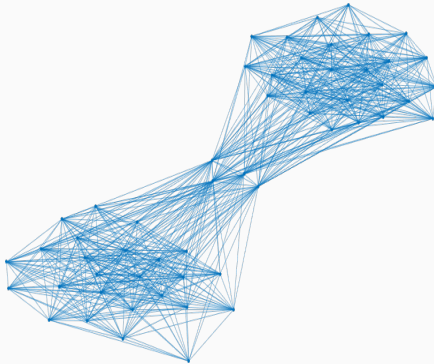
Table 1: Data from https://en.wikipedia.org/wiki/Herd_immunity & <https://www.duo.uio.no/bitstream/handle/10852/45490/KDPlagueThesis.pdf?sequence=9>



- Small world
- Scale free
- Random
- Custom network (two cities with commuters)

Custom network

Custom network, simulating two cities with commuters



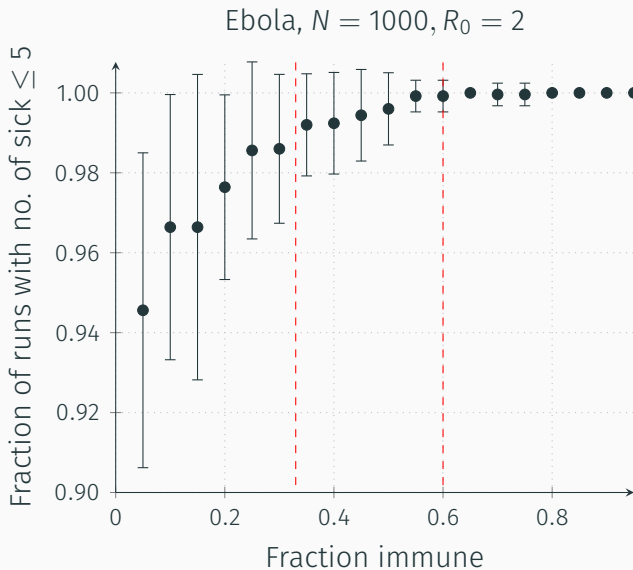
Success criteria

- Real world
 - No percolation
 - Disease no longer endemic
- Our model
 - Unable to define percolation
 - Discussion of alternate criteria
 - **Total sick < arbitrary threshold**
 - Effective reproductive number ≤ 1
 - $n_{\text{sick}} = 0$ and $n_{\text{healthy}} \neq 0$
 - $n_{\text{healthy}} = 0$

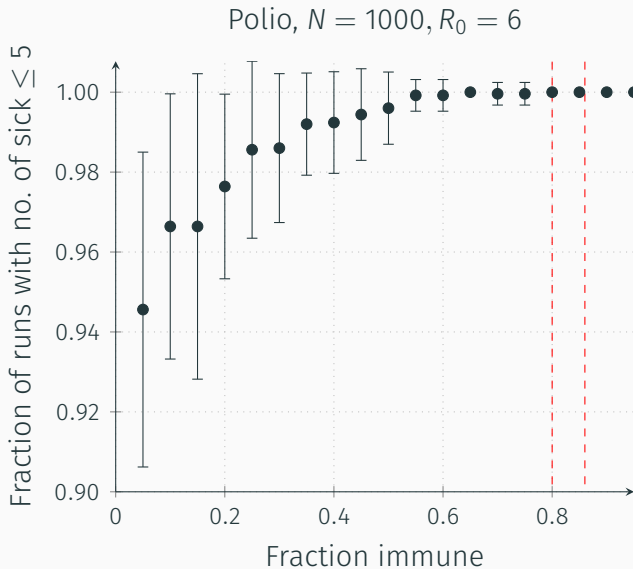
The simulations

- Run each disease 50 times on each network
- With 20 p_I values
- Save relevant output

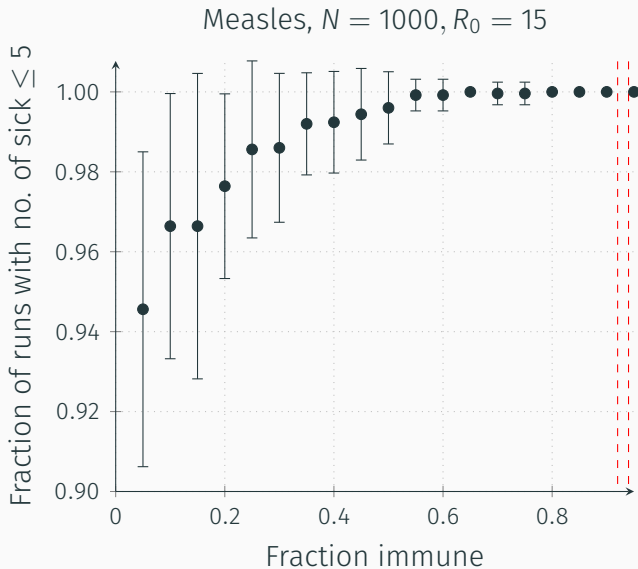
Results



Results



Results



Video Galore