

# Herd immunity in a network

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Herd immunity

Disease types

Networks

# Herd immunity

Protect the flock by immunizing

Disease types

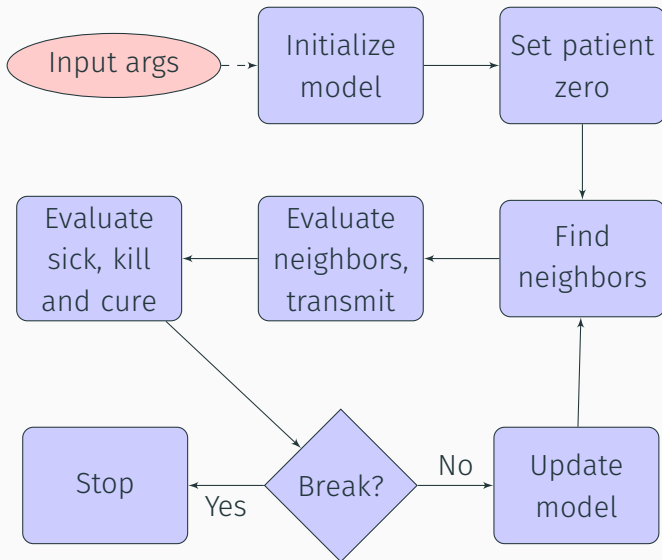
Networks

# 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

	$R_0$	Mortality rate	HIT
Ebola	1.5-2.5	0.25-0.90	0.33-0.60
Measles	12-18	0.15	0.92-0.94
Polio	5-7	0.15-0.30	0.80-0.86

Table 1: Data from [https://en.wikipedia.org/wiki/Herd\\_immunity](https://en.wikipedia.org/wiki/Herd_immunity)



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

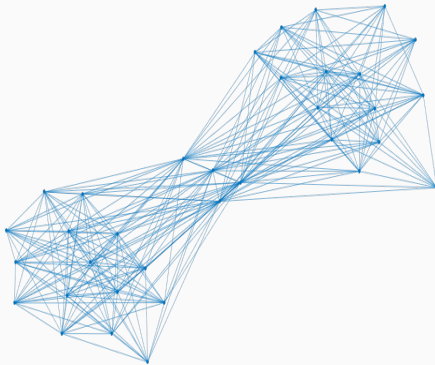
Movie time: two cities, death



Movie time: two cities, immunity

# Custom network

Custom network, simulating two cities with commuters



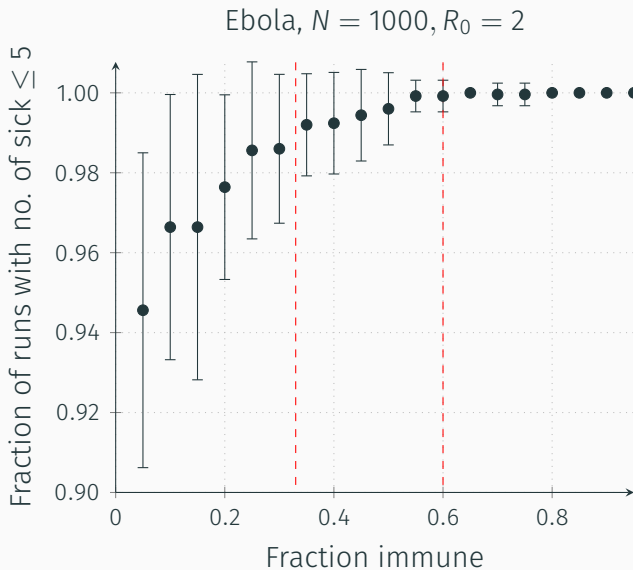
# Success criteria

- 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  $\leq 1$
    - $n_{\text{sick}} = 0$  and  $n_{\text{healthy}} \neq 0$
    - $n_{\text{healthy}} = 0$

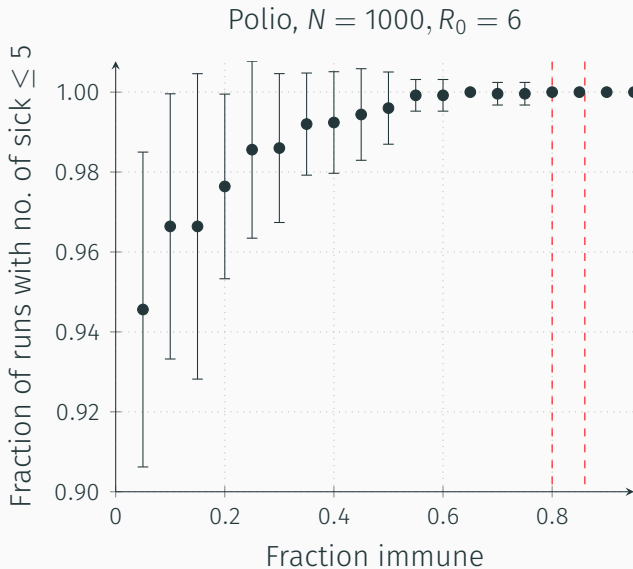
# The simulations

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

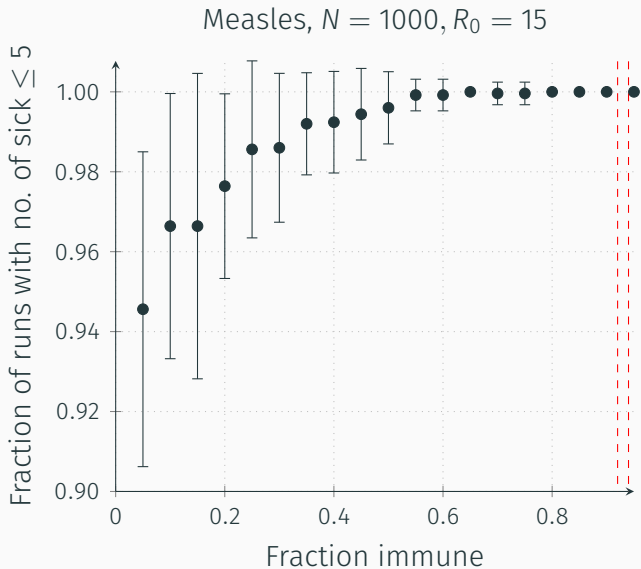
# Results



# Results



# Results



Video Galore