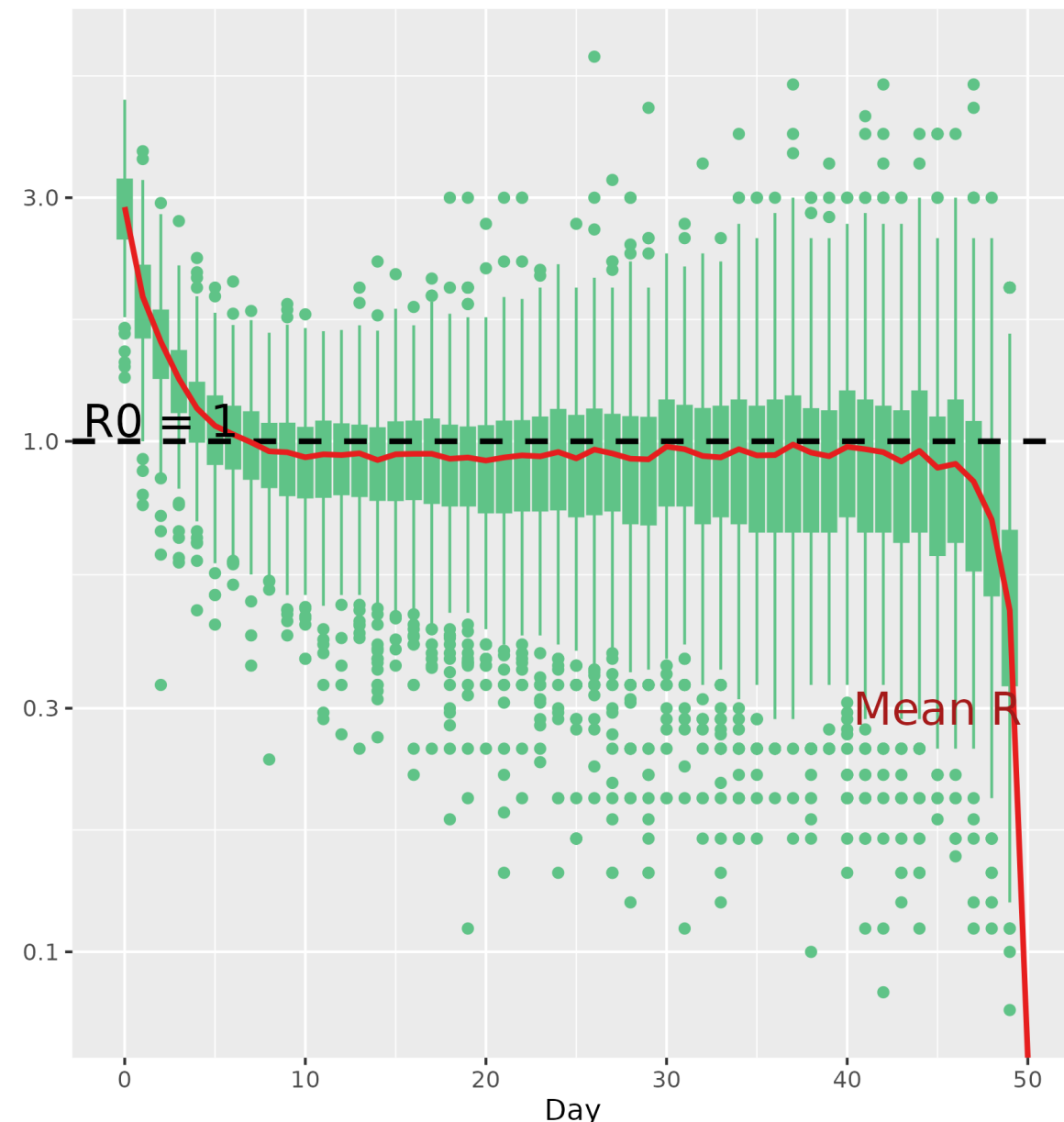


How does network structure in Agent-Based Models affect epidemiological parameters?

Aníbal Olivera¹, George Vega Yon², Chong Zhang², Matthew Samore², Karim Khader², Alun Thomas²

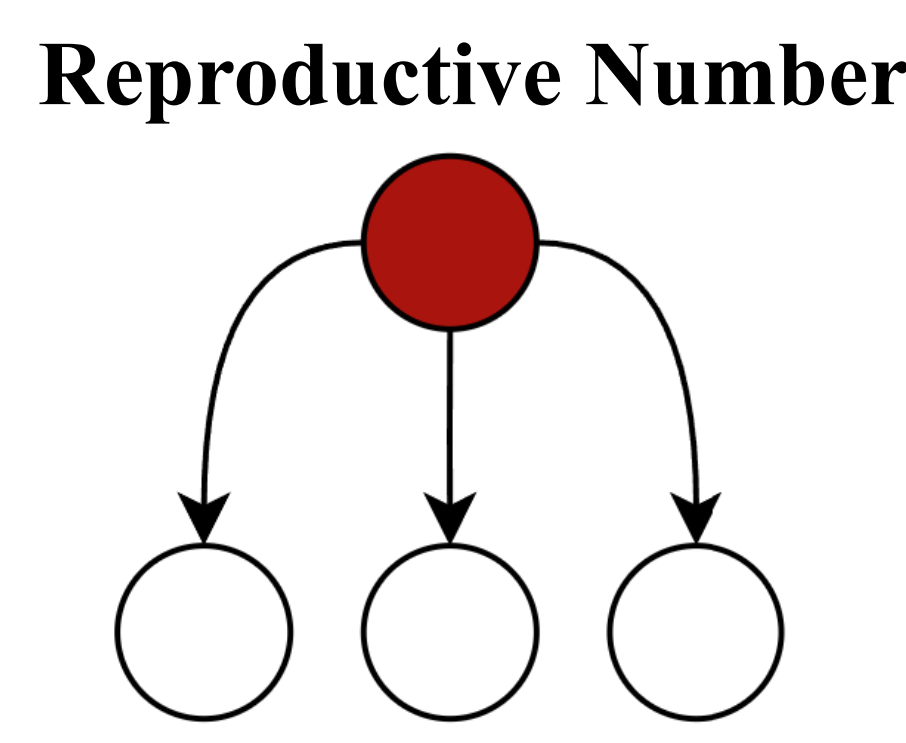
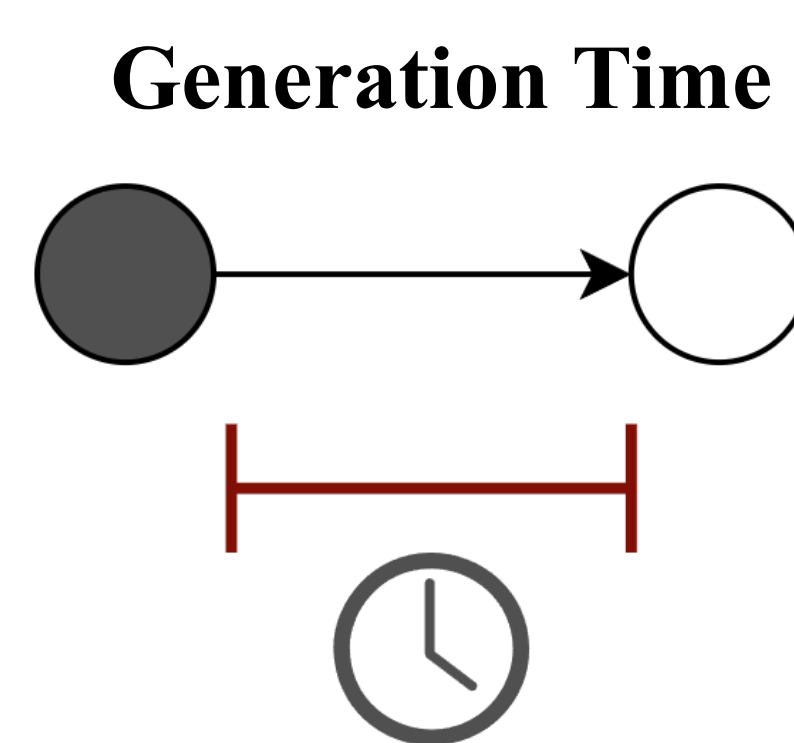
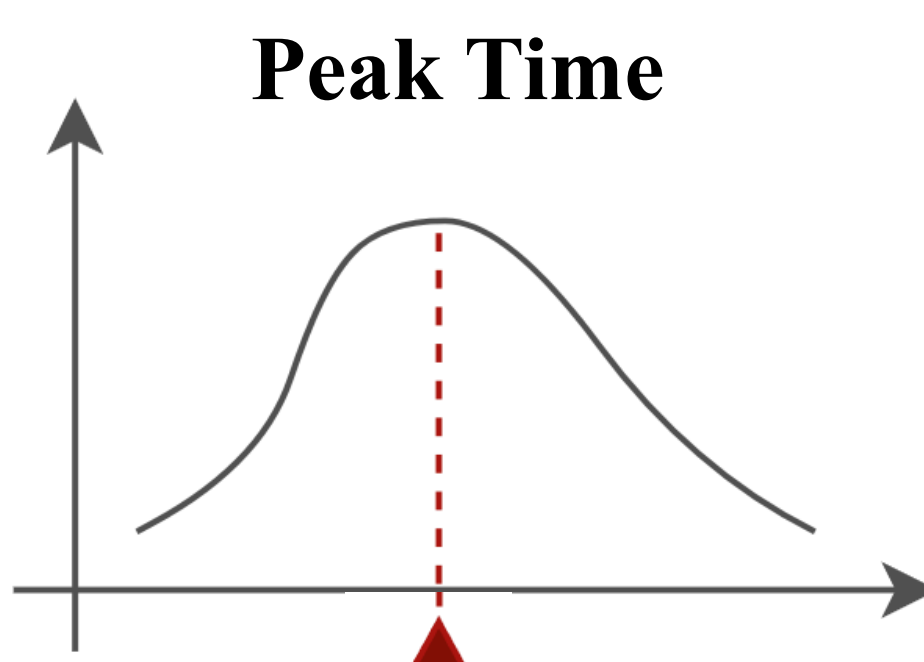
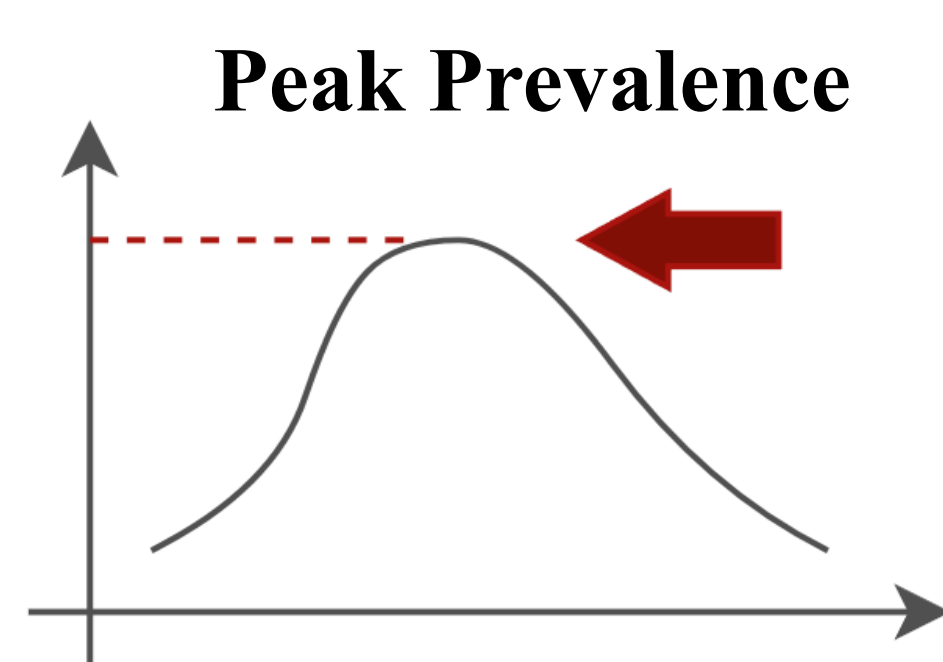
Introduction

- ABM in networks is an important tool to **public health** [1]
- Prevalence and R_0 are important epidemiological parameters
- SM topo. results in $R_0 < 1$ and still feature **full propagation** [2, 3]
- No studies about how structural features affect other epidemiological quantities [4, 5, 6]



Methods

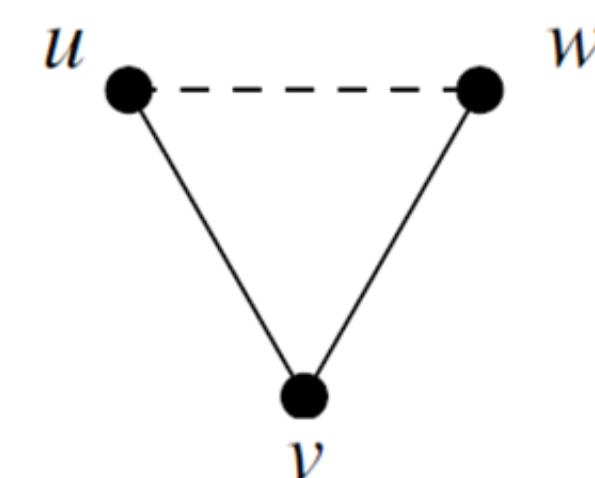
- We constructed **1,000 networks** of six topologies:
 - Scale-free — Erdős Rényi — ERGM
 - Degree-sequence ERGM — Small-World $p=0.1, p=0.2$
- We generated **20,000 SEIR outbreaks** using epiworldR [7]
- Epidemiological indicators:



- Local-structure **properties** from the networks:

ergm igraph

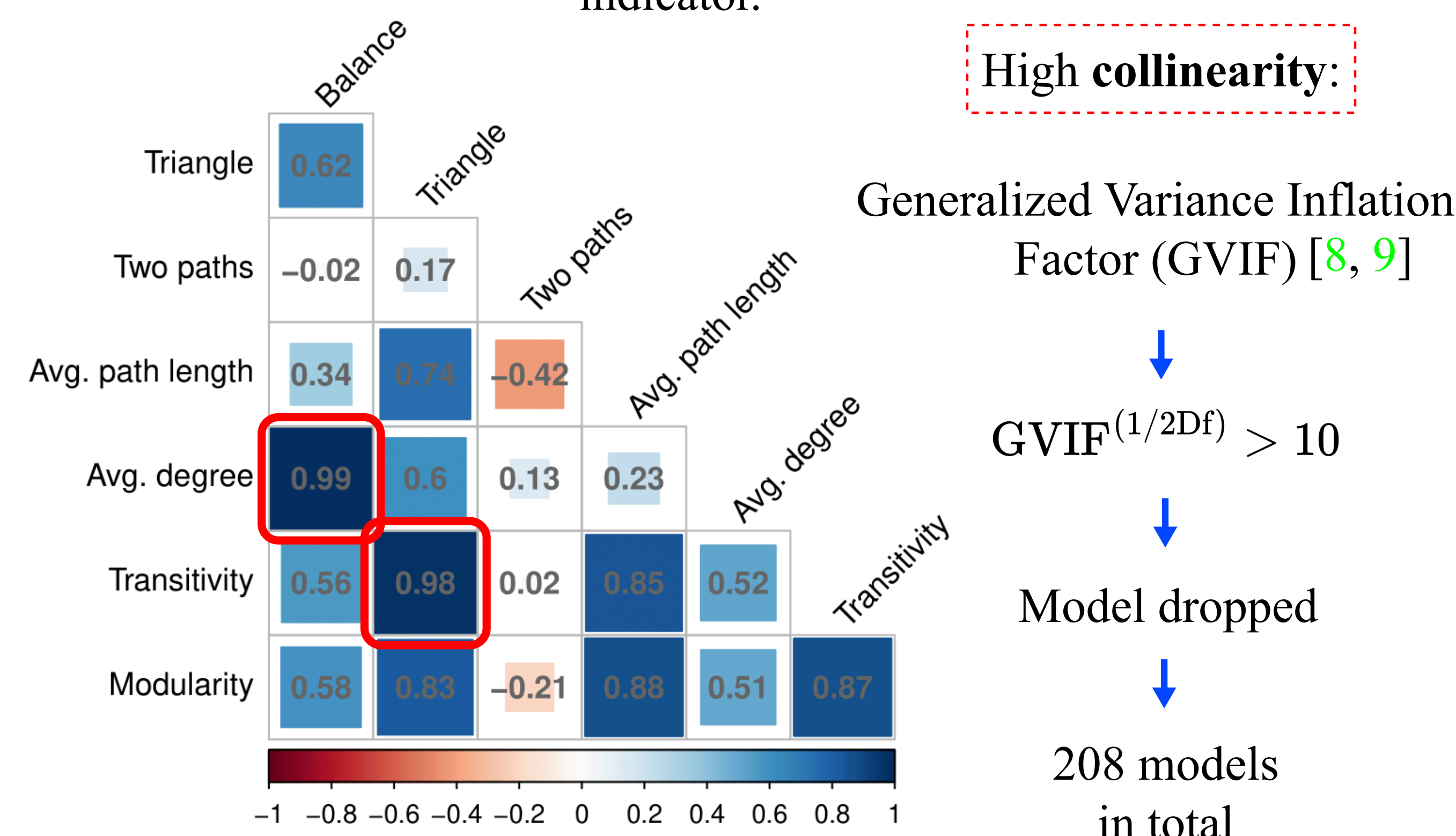
— Avg. degree — Avg. path length
— Transitivity — Modularity
— # Two paths — # Balance — # Triangles



- All possible combinations of linear, logarithmic, and quadratic form of each variable:

$$\text{Total formulas} = \sum_{k=1}^n (1 + 2k) \binom{n}{k}$$

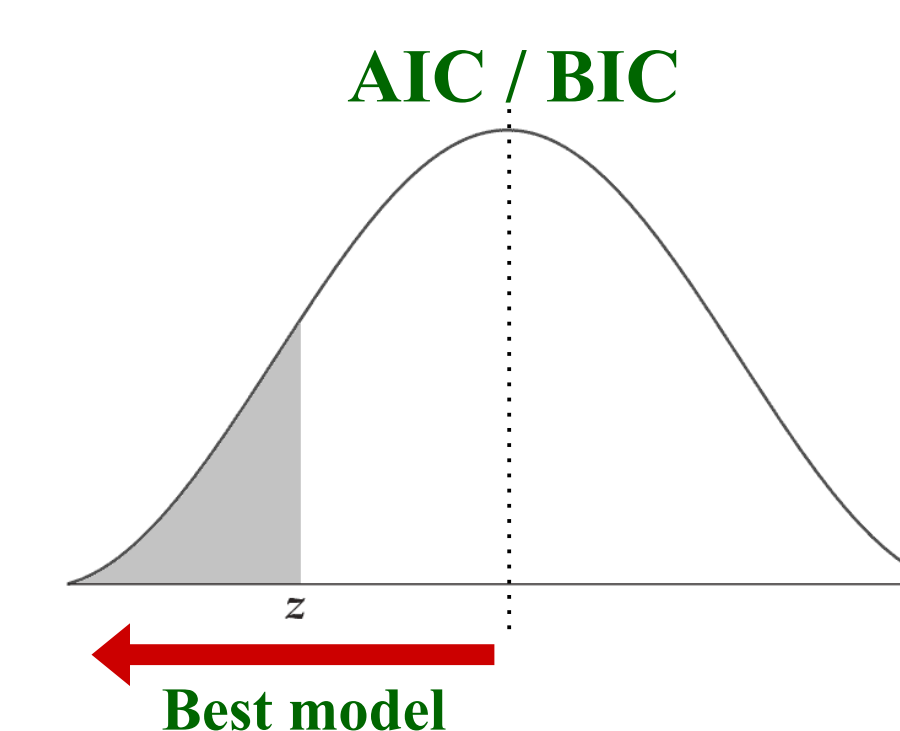
$n = 7 \rightarrow 1,023$ for each epidemiological indicator. $\rightarrow 4,092$ in total



- Sort best performing models according to lowest average between z-scores of AIC and BIC

- Seeing the best models we get:

— Number of variables
— Actual variables



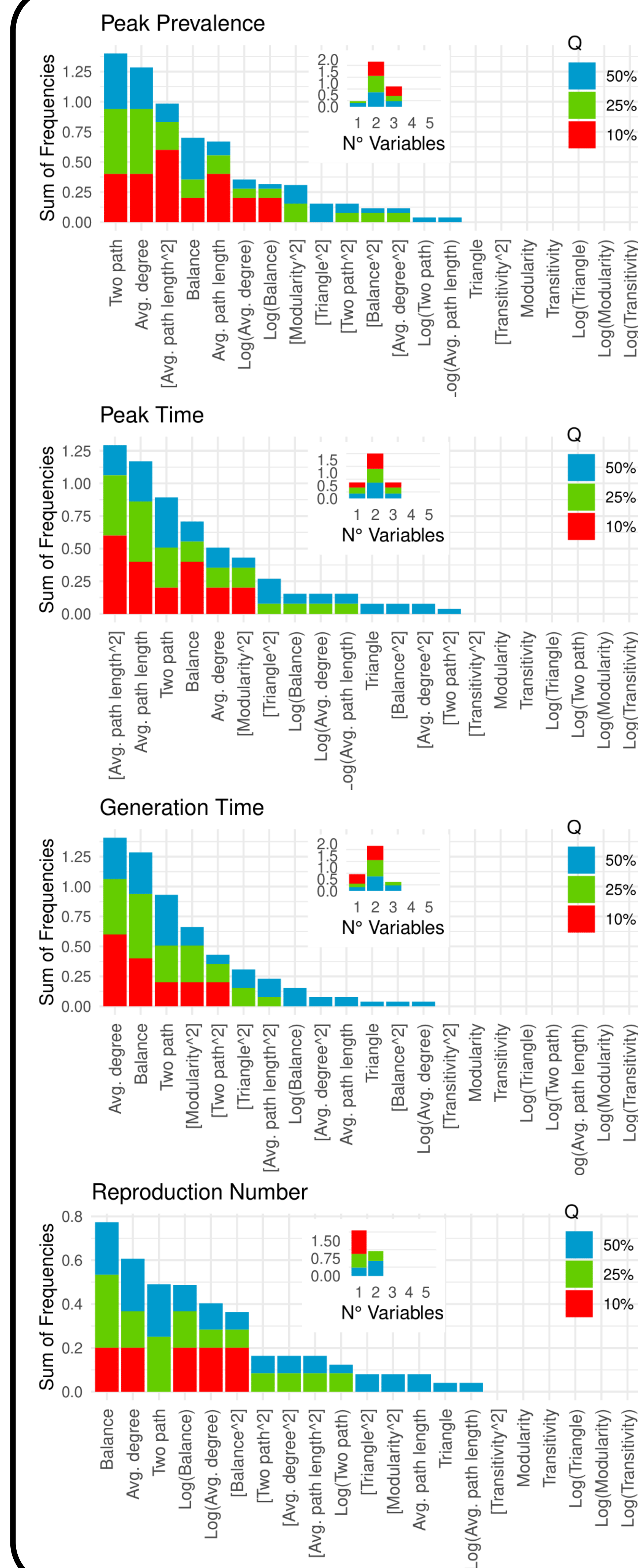
Results

- In order to construct a general model, we select Q% best-performing models:

$$Q \in (10, 25, 50)$$



References, all regression tables and PDF version of the poster!



2-3 variables

\uparrow Peak_P ~ two path
+ avg. degree
+ [avg. path length²]

2 variables

\uparrow Peak_T ~ balance
+ [avg. path length²]

1-2 variables

\uparrow Gen. Time ~ balance
or
 \uparrow Gen. Time ~ balance
+ [modularity²]

1 variable

\uparrow R₀ ~ Log(balance)

Conclusions

- Recommended models
 - Few variables \rightarrow 1 - 3 variables
 - Non-trivial forms
 - Role of balance and avg. path length
- Add more variables to refine work $\rightarrow \langle k^2 \rangle$