

$R_0, R_t$

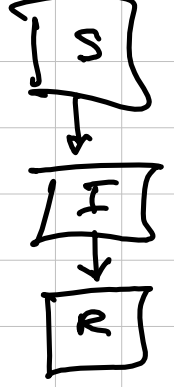
Intrinsic reproductive number

(# / generation <sup>time</sup> × generation time)

time-dependent intrinsic repr. number.

how do we measure  $R_0$ ?

$$\begin{cases} \frac{dS}{dt} = -\beta SI \\ \frac{dI}{dt} = +\beta SI - \gamma I \\ \frac{dR}{dt} = +\gamma I \end{cases}$$



$$R_0 = \frac{\beta N}{\gamma}$$

rate of new infections per infected person.

$$\begin{aligned} S &= N \\ I &= 1 \end{aligned}$$

$$\beta SI = \beta N$$

infectivity  
contact  
susceptibility

3 day

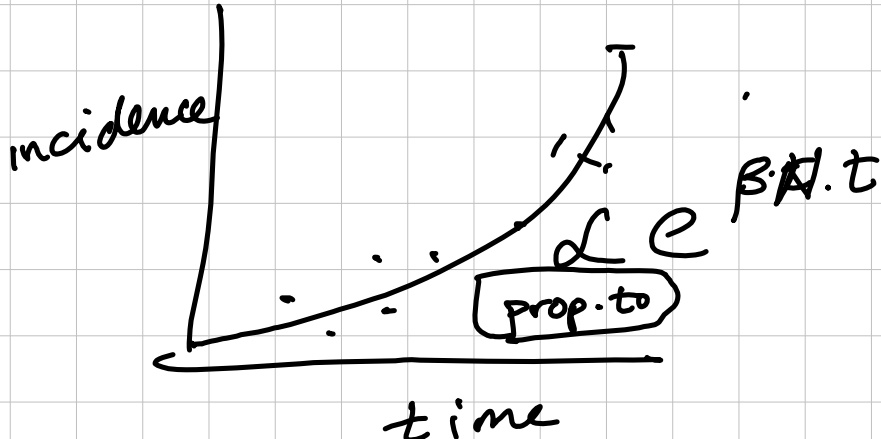
length of infectious period =

$$\frac{1}{\gamma} : 4 \text{ days}$$

rate of new infections per susc per infected.

$I/N$  or  $I$ : prevalence

$\beta SI$ : incidence



SEROPREVALENCE = proportion of individuals with pathogen-specific antibodies

$$R_0 \approx \frac{N}{S^*}$$

$$\approx \text{Recovered} \approx N - S$$

$$R_0 \times \frac{S^*}{N} = 1$$

endemic

direct observation:

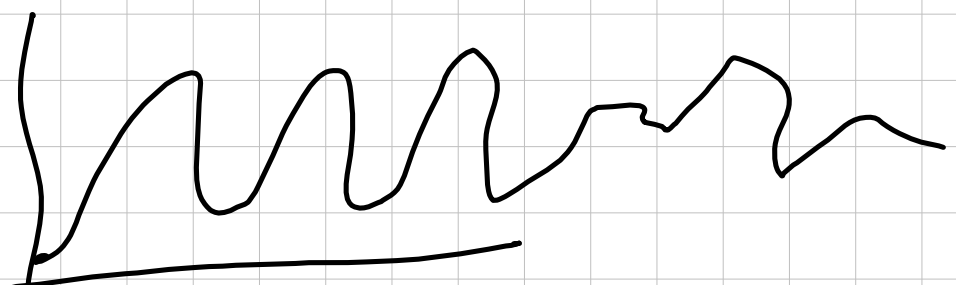
STDs, vector-borne diseases.

mosquito biting rate  
(prob (infection))

• RAKA study .

serodiscordant couples.

LONG-TERM dynamics



• persistent cycles .

SEASONALITY  
climate

• behaviour .

'childhood diseases'

measles, mumps, rubella.

MMR, DTAP, chickenpox.