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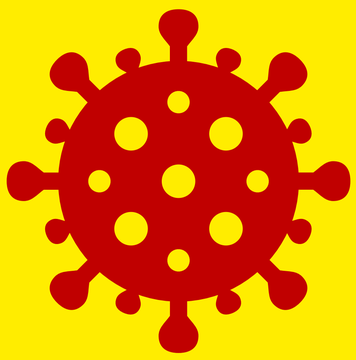


SCAN ME

Low to intermediate vaccination coverages make vaccine-escape variants more likely to appear.

Who is more likely to **generate a vaccine escape variant**, if infected?

We do not know!

Unvaccinated:
higher viral load

Vaccinated:
higher selection

If infected, generates an escape variant with **probability p_U**

Vaccinated individuals do so with **probability $p_V = \theta_E p_U$**

θ_E =: ***evolutionary ratio***, measures the vaccine within-host evolutionary effects

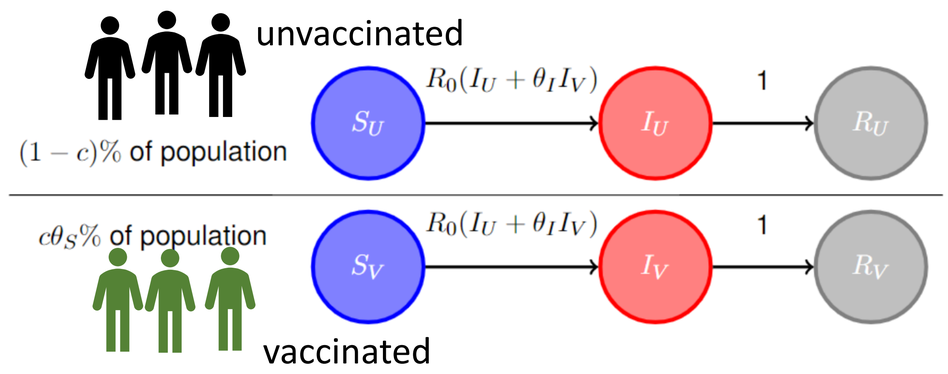
Escape Pressure

$$P = p_U(N_U + \theta_E N_V)$$

Cases in **unvaccinated** — Cases in **vaccinated**

Probability that an escape variant appears

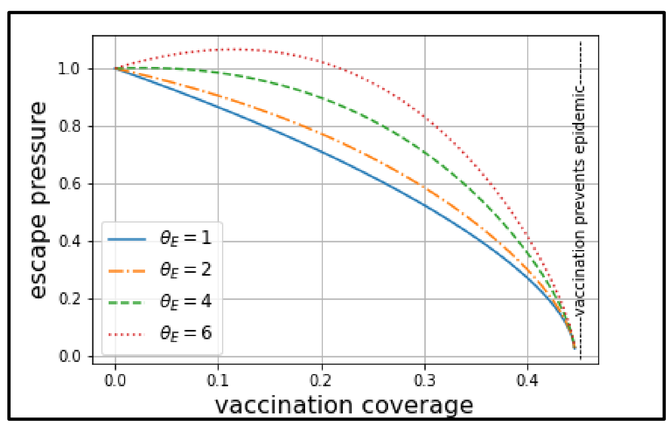
Single-strain **SIR model** with **c% vaccinated**



Vaccines

Reduced susceptibility θ_S, reduced infectivity θ_I, no waning, no change in the infectious period.

Final Size **Analytical Solution**

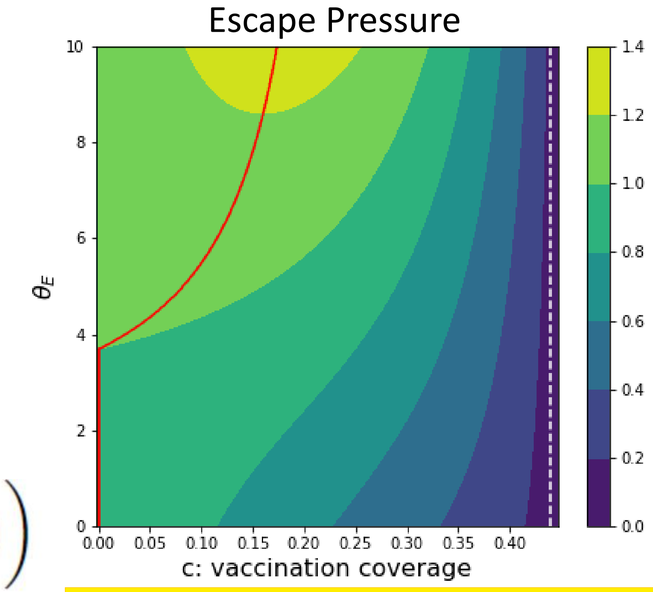


$$P = p_U(1 - c + \theta_S\theta_E c)\left(1 + \frac{1}{R_e}W\left(-R_e e^{-R_e}\right)\right)$$

$R_e = R_0(1 - c(1 - \theta_S\theta_I))$
Initial effective R-number

Lambert W-function

Escape Pressure



Red curve: vaccination level that maximises the escape pressure

Main **Results**:

- Depending on the evolutionary ratio…
- Either intermediate vaccination levels maximise the escape pressure
- Or an unvaccinated population is the most likely to generate escape variants

ESMTB European Society for Mathematical and Theoretical Biology

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