

Team 3: Vaccine Effectiveness

- SEIR model
 - **E** compartment represents “pre-infectious” state: period of time before they can infect others
- Adding vaccination
 - **V** compartment to represent those who have been vaccinated
 - parameter “ ν ” is vaccination rate: how quickly are susceptibles being vaccinated?
 - even if we vaccinate majority of the population, we cannot vaccinate everyone in one day – how many can be vaccinated per day? (use the same time scale as your model)
 - parameter “ VE ” is vaccine efficacy (%): what level of protection is given by the vaccine?

Vaccine Efficacy

- Average level of protection provided by any given vaccine
 - 0-100%
 - differs by manufacturer
 - differs by strain/subtype of pathogen that is being transmitted
 - variation because of individual differences in response to vaccine
- Vaccines used for COVID-19 in Bangladesh
 - Pfizer
 - AstraZeneca
 - Moderna
 - Johnson & Johnson
 - Sinopharm

Team 3 Model

- SVEIRHD
 - no vaccination
 - efficacy levels:
 - all reported for vaccines used in Bangladesh
 - range: 60%, 70%, 80%, 90%
 - need to run the model each time with the new efficacy level
- Model setup
 - keep **RH** and **DH** separate so we can count hospitalizations correctly
 - Number of equations: 9
 - Number of parameters: 9

Parameters: Use Averages

1. β : transmission coefficient, new infections
2. σ : rate to become infectious
3. γ : recovery rate for non-hospitalized
4. γ_H : recovery rate for hospitalized
5. δ : death rate for non-hospitalized
6. δ_H : death rate for hospitalized
7. τ : hospitalization rate, severe infections
8. ν : vaccination rate
9. VE : vaccine efficacy

[illegible]

Parameters

- sigma: develop infectiousness
 - need to know how many days between pre-infectious and infectious stage (latent period)
 - time from infection to symptoms
 - incubation period median: 5-6 days
 - infectiousness: 2-3 days before symptoms
 - latent period: 2-4 days
 - $\text{sigma} = 1 / \text{latent period} = 1/3$

Parameters

- gamma: recovery rate
 - need to know how long it takes for infected people to recover - when do they stop being infectious? (recovery period)
 - how long are people infectious?
 - ____ days
 - $\text{gamma} = 1 / \text{recovery period} = 1 / \text{____}$