COVID

Tze Hong

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1 Features of the model

This model accounts for several factors:

- Dorm cases, Local - Unlinked cases and local linked cases are modelled separately
- Imported cases can add to the daily infected individuals
- Non pharmaceutical interventions can impact $R_e(t)$ the effective $R(t)$
- Accounting for daily variation in number of cases detected based on number of tests / tests positivity rate

2 Equations

2.1 Notation

- I_t - Number of newly infected individuals at time t.
- D - Dormitory, U - Unlinked, L - Linked
- g - Generation Time PMF values
- γ - Onset - Delay Time PMF values
- $R_e(t)$ - Effective Rt
- λ_t - Qurantine Rate
- α_t - Test capture rate -¿ How likely we are to detect an infected individual as positive

2.2 Latent Infection Process

$$I_t^D = \sum_{i=1}^{S} I_{t-i}^D * R_e^d(t-i) * g_{s-i}$$

$$I_t^U = \lambda_t \left[\sum_{i=1}^{S} (I_{t-i}^U * R_e^l(t-i) * g_{s-i}) + \epsilon_t * im_t \right]$$

$$I_t^L = \frac{1-\lambda_t}{\lambda_t} * I_t^U$$

2.3 Mean Case Counts process

$$y_t^D = \alpha_t^D \sum_{i=1}^{K} y_{t-i}^D * \gamma_{t-i}^D$$

$$y_t^U = \alpha_t^U \sum_{i=1}^{K} y_{t-i}^U * \gamma_{t-i}^U$$

$$y_t^L = \alpha_t^L \sum_{i=1}^{K} y_{t-i} L * \gamma_{t-i}^L$$

2.4 Priors

g: S Dimensional probability vector, Generation Time (Discrete) distribution PMF values
γ: K Dimensional probability vector Onset - Delay (Discrete) distribution PMF values

$$R_e^D(t) \sim exp(GRW(\sigma = 0.0035) + \beta * NPIs_t)$$

$$\epsilon_t \sim beta(1,1)$$

$$\alpha^D(t) \sim exp(GRW(\sigma = 0.0035) + \eta^D * testRate_t)$$

$$\alpha^U(t) \sim exp(GRW(\sigma = 0.0035) + \eta^U * testRate_t)$$

$$\alpha^L(t) \sim exp(GRW(\sigma = 0.0035) + \eta^L * testRate_t)$$

$$\lambda_t \sim exp(GRW(\sigma = 0.0035) + \rho * qurantineRate_t)$$

$$\beta \sim Normal(0, 0.01)$$

$$\eta \sim Normal(0, 0.01)$$

$$\rho \sim Normal(0, 0.01)$$