

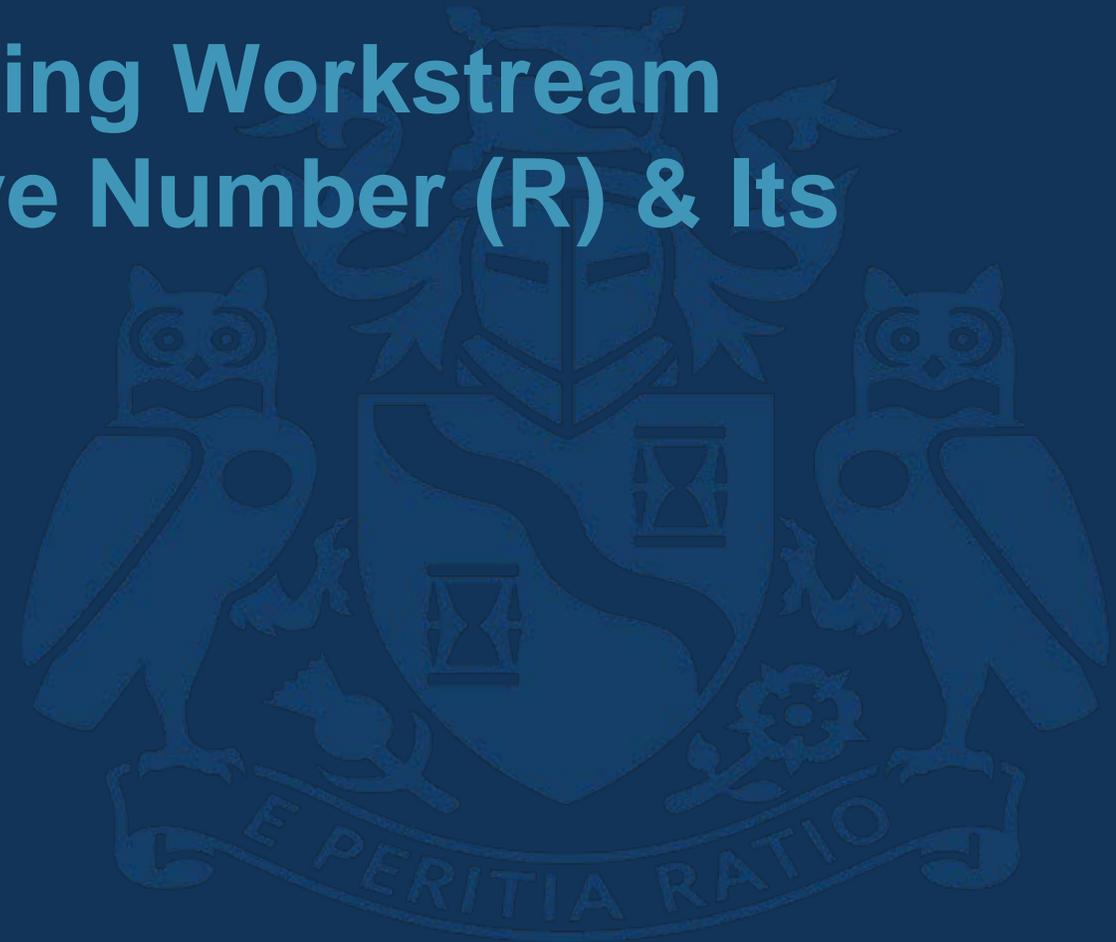


Institute  
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# IFoA ICAT: Scenario Modelling Workstream Introduction to Reproductive Number (R) & Its Calculation

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March 2021



# Reproductive Number

- *Basic Reproductive Number*
  - Average number of secondary cases per primary case in a completely susceptible population
- *Effective Reproductive Number*
  - The expected number of secondary cases per primary case at time  $t$ , considering intervention measures in place
- *Instantaneous Reproductive Number*
  - the average number of secondary cases that each infected individual at time  $t$  would infect, if the conditions remained as they were at time  $t$



# Serial Number

- *Generational Number*
  - The time between primary case exposure and secondary case exposure
- *Serial Number*
  - The time between onset of symptoms in the primary case and onset of symptoms in secondary case

Assume  $\beta$  is the infectious contact rate,  
 $\gamma$  is the recovery/removal rate,  
 $y_t$  is the number of cases at time  $t$  and  
 $(g_1, \dots, g_M)$  is the probability density for serial number, then



# Formulas

- *Basic Reproductive Number*

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

- *Effective Reproductive Number*

$$y_t = R_e(t-1)g_1y_{t-1} + \dots + R_e(t-M)g_My_{t-M} = \sum_{i=1}^M R_e(t-i)g_iy_{t-i}$$

- *Instantaneous Reproductive number*

$$\hat{R}(t) = \frac{y_t}{\sum_{s=1}^t g_s \cdot y_{t-s}}$$



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