Session5

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COVID-19 has loss of immunity.

The SIRS model is:

$$\frac{dS}{dt} = \underbrace{\mu N}_{\text{birth}} - \underbrace{\beta I \frac{S}{N}}_{\text{infection}} + \underbrace{\omega R}_{\text{resusceptible}} - \underbrace{\mu S}_{\text{death}} \tag{1}$$

$$\frac{dI}{dt} = \underbrace{\beta I \frac{S}{N}}_{\text{infection}} - \underbrace{\gamma I}_{\text{recovery}} - \underbrace{\mu I}_{\text{death}} \tag{2}$$

$$\frac{dR}{dt} = \underbrace{\gamma I}_{\text{recovery}} - \underbrace{\omega R}_{\text{lost immmunity}} - \underbrace{\mu R}_{\text{death}}, \tag{3}$$

where ω is the rate of loss of immunity (~ 0.5 year^{-1}), an infectious period ($1/\gamma$) of 3.8 days and maybe suggets an early R_0 of 2.9. Modeling fractions ($N = 1$) the weekly SIRS appropriate parameters are:

```
N = 1
gamma = 7 / 3.8
omega = 1 / (52 * 4)
mu = 1 / (52 * 70)
R0 = 2.9
```

The call for back-calculating β to get the right R_0 and gathering parameters is:

```
#R0 = beta / (gamma + mu)
beta = R0 * (gamma + mu)
paras = c(beta = beta, gamma = gamma,
   mu = mu, omega = omega)
```

STEP 1:

STEP 2:

STEP 3:

STEP 4:

STEP 5:

Work in groups to see if you can start work on the problem...