4 Feb 2021

[look at data]

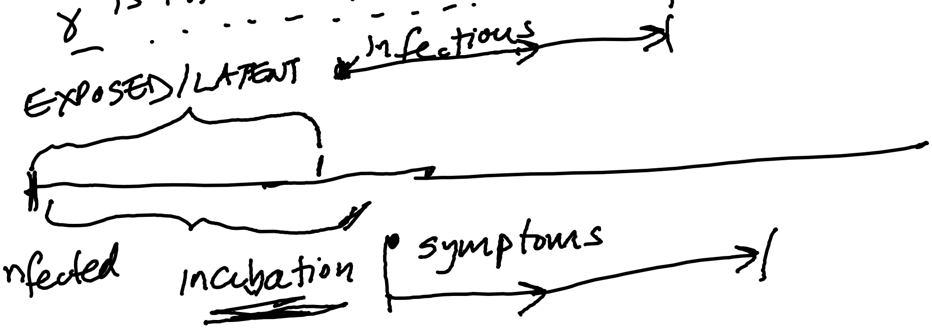
[estimating R_0 from data

run linear regression in exponential phase to get r (exp growth rate).

$r = \beta - \gamma$ [SIR model!]

usually get γ from direct observation

$\frac{1}{\gamma}$ is infectious period $\approx$ symptomatic period



r (estimated from log reg)

γ (directly observed)

SEIR

$S \to E \to I$

$\beta = r + \gamma$

$R_0 = \frac{r+\gamma}{\gamma} = 1 + \frac{r}{\gamma}$

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Levins:

more realism?

(don't want to assume SIR)

$r \longrightarrow R_0$ without assuming SIR

EULER-LOTKA equation.

$$\underline{I}(t) = \int_0^t I(t-\tau) \underbrace{K(\tau)}_{\text{rate of inf new people inf for time } \tau} d\tau$$

Shaw + ? eq 1

$$\underline{I}(0) e^{rt} = \int_0^t I(0) e^{r(t-\tau)} \cdot K(\tau) d\tau$$

$$\underline{1} = \int_0^t e^{-r\tau} K(\tau) d\tau$$

$$\int_0^\infty K(\tau) = R_0$$

$$1 = \int_0^t e^{-r\tau} K(\tau)\, d\tau$$ Euler-Lotka eq^n

$$1 = \int_0^t e^{-r\tau} \underline{R_0 g(\tau)}\, d\tau$$

$$\int_0^\infty g(\tau) = 1$$

$$\frac{1}{R_0} = \int_0^t e^{-r\tau} g(\tau)\, d\tau$$

[generation interval distribution]

LAPLACE transformation

{moment-generating functions}

SIR: $g(\tau) = \gamma e^{-\gamma\tau}$

...

substitute $g(\tau) = \gamma e^{-\gamma\tau}$ $\Rightarrow$ $R_0 = 1 + \frac{r}{\gamma}$

GAMMA - DISTRIBUTION:

$$P(x) = \underbrace{\frac{\Gamma(a)}{S^a}}_{\text{normalization constant}} \underbrace{x^{a-1} e^{-x/S}}$$

$a = 1 \rightarrow$ exponential

$a > 1$ unimodal

$a \rightarrow \infty$ Normal (smaller cv)

$a < 1$ heavy tailed

$$R_0 = \left(1 + a r \bar{G}\right)^{1/a}$$

$\bar{G}$: mean inf period