How infectious is COVID-19?
Basic case reproduction number  \( R_0 \)

Average number of secondary cases per case (number of successful transmissions per case) in a totally susceptible population.
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\( R_0 > 1 \) number of cases increases
Basic case reproduction number \( R_0 \)

Average number of secondary cases per case (number of successful transmissions per case) in a totally susceptible population.

- \( R_0 > 1 \) number of cases increases
- \( R_0 = 1 \) number of cases is stable
Basic case reproduction number $R_0$

Average number of secondary cases per case (number of successful transmissions per case) in a totally susceptible population.

$R_0 > 1$ number of cases increases
$R_0 = 1$ number of cases is stable
$R_0 < 1$ number of cases decreases
Estimates between 1.5 and 4.5, most 2-3
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What does this mean?

… in the early stage of the epidemic
  … using available data
    … in Wuhan
      … on average
Difficulty in estimating R0
R0 depends on 3 factors

• duration of infectiousness

• probability of infection being transmitted during contact between a susceptible and infected individual

• average rate of contact between susceptible and infected individuals
R0 depends on 3 factors

- duration of infectiousness
- probability of infection being transmitted during contact between a susceptible and infected individual
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R0 depends on 3 factors

- duration of infectiousness
- probability of infection being transmitted during contact between a susceptible and infected individual
- average rate of contact between susceptible and infected individuals
R0 for COVID-19 ≈ 1.5-4.5
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R0 for Measles ≈ 15
R0 for Chickenpox ≈ 10
R0 for SARS ≈ 3
R0 for Ebola ≈ 2
R0 for ‘flu ≈ 1.5-3
Secondary attack rate (2\textsuperscript{o} AR) is used in the study of the spread of infections that transmit person-to-person in specific situations like households and schools.
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= the proportion of those exposed to the primary case that develop disease as a result of the exposure
Singapore

Number of household members exposed to cases = 417
No. of new cases arising = 26
Secondary attack rate = 26/417 = 6.2%
NB: Secondary attack rate is context specific

Depends on:

Closeness of contact
SARS in Beijing 2\textsuperscript{o} AR higher in those caring for patient (31\%) than living in same residence (4.6\%)

Stage of illness
SARS:
2\textsuperscript{o} AR higher in hospital than at home – due to stage of illness?
R0 Average number of secondary cases per case in a totally susceptible population

2° AR The proportion of those exposed to the primary case that develop disease as a result of the exposure in a particular situation
R0 and $2^o\ AR$

**R0** Average number of secondary cases per case in a totally susceptible population

**$2^o\ AR$** The proportion of those exposed to the primary case that develop disease as a result of the exposure in a particular situation

$$R0 = 2^o\ AR\ [\text{household}] \times \text{no. of contacts [household]}$$

$$+ 2^o\ AR\ [\text{other family}] \times \text{no. of contacts [other family]}$$

$$+ 2^o\ AR\ [\text{community}] \times \text{no. of contacts [community]}$$

$$+ \text{etc}$$