

Contact Tracing and Mass Symptom Screening

Kieran Fitzmaurice

August 2020

1 Contact Tracing Alone

Based on the age and severity distribution of our population, about 62 % of people who become infected with SARS-CoV-2 will be destined to display symptoms. Of those displaying symptoms, the vast majority are mild/moderate cases. People with mild/moderate symptoms have a 30 % chance of presenting to care due to symptoms, and a 70 % chance of testing positive based off of the sensitivity of a PCR test. Thus, the probability that the secondary contacts of an index case end up being contact traced is given by

$$P(\text{CT}) = 0.62 \times 0.3 \times 0.7 = 13.02\% \quad (1)$$

For secondary cases that are asymptomatic (and otherwise would not have presented to care), the probability of presenting to care over the duration of their disease state is given by

$$P(\text{PC} \mid \text{Asym.}) = P(\text{CT}) = 13.02\% \approx 10\% \quad (2)$$

For secondary cases that are mild/moderate, the probability of presenting to care over the duration of their health state is given by

$$P(\text{PC} \mid \text{Sym.}) = (0.3) + (0.1302) - (0.3)(0.1302) = 39.11\% \approx 35\% \quad (3)$$

2 Mass Symptom Screening

The daily probability of being mass symptom screened is given by

$$P(\text{MSS}) = 1 \text{ day} \times \frac{2 \text{ screens per year}}{365 \text{ days per year}} = 0.548\% \quad (4)$$

For mild/moderate patients, whose symptoms typically last for about 10 days, the probability of being mass symptom screened is given by

$$1 - (1 - P(\text{MSS}))^{10} = 5.35\% \quad (5)$$

This increases their probability of presenting to care to roughly 33.74 %, even before contact tracing is added in.

$$(0.3) + (0.0535) - (0.3)(0.0535) = 33.74\% \quad (6)$$

If we modify the presentation to care probability of our index case shown in equation (1) to reflect the added benefit of MSS, we find that the probability that the secondary cases get contact traced is given by

$$P(\text{CT}) = 0.62 \times 0.3374 \times 0.7 = 14.64\% \quad (7)$$

For secondary cases that are asymptomatic, this results in a probability of presenting to care of about 15 %.

$$P(\text{PC} \mid \text{Asym.}) = P(\text{CT}) = 14.64\% \approx 15\% \quad (8)$$

For secondary cases that are mild/moderate, this results in a probability of presenting to care of about 40 %

$$P(\text{PC} \mid \text{Sym.}) = (0.3374) + (0.1464) - (0.3374)(0.1464) = 43.44\% \approx 40\% \quad (9)$$