Message #1 : the friendship paradox

- on average, your friends have more friends than you do

  $\rightarrow$ a random individual has k friends with probability p_k

  $\rightarrow$ however, their friends have k friends with probability $\propto kp_k$

- by spreading on a contact network, the disease naturally over-samples individuals more likely to cause a larger number of secondary infections

- ignoring this effect leads back to the mass-action assumption

Message #2 : the effect of superspreading events

- the PGF formalism falls back to the outcome of the SIR dynamics when p_k is a Poisson distribution

$$G_0(x) = G_1(x) = \mathrm{e}^{R_0(x-1)} \; ; \qquad R(\infty) = 1 - \mathrm{e}^{-R_0 R(\infty)}$$

- the mass-action assumption is not appropriate for diseases whose propagation is driven by superspreading events

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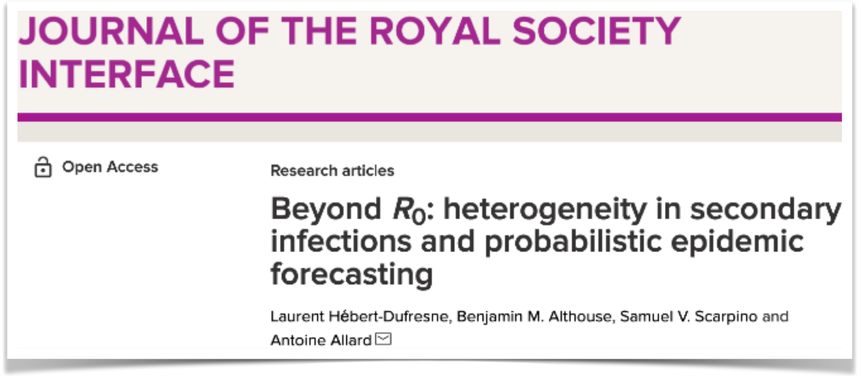
Beyond R_0: heterogeneity in secondary infections and probabilistic epidemic forecasting

Laurent Hébert-Dufresne, Benjamin M. Althouse, Samuel V. Scarpino and Antoine Allard ✉



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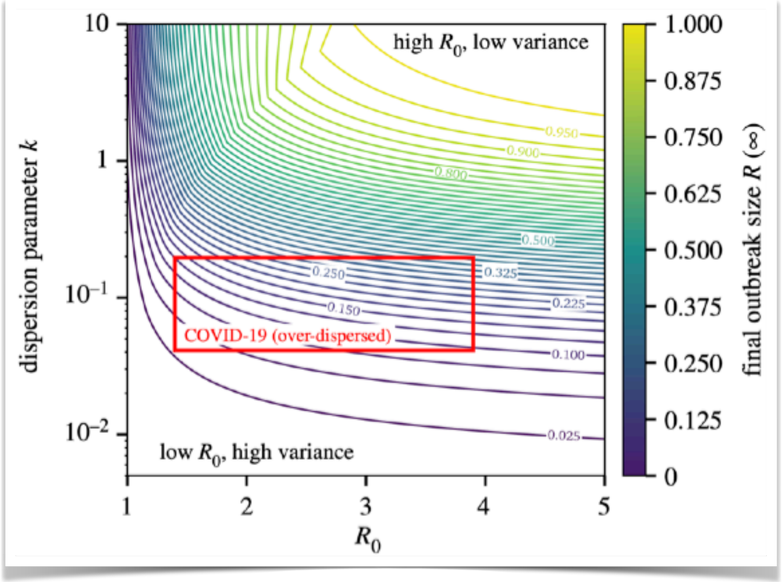
Message #3 : we need to look beyond R_0 for overdispersed infectious diseases like COVID-19

– negative binomial distribution for secondary cases

$$G_1(x) = \left[1 + \frac{R_0(x-1)}{\gamma}\right]^{-\gamma}$$

shows the great impact overdispersion (small γ) has on the spreading dynamics

– in other words, if $R_0 > 1$, our attention should not be focused on whether R_0 equals 2.5 or 3.5, but rather be focused on figuring out how much heterogeneity there is behind it (what is γ ?)



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