

Waiting for the next influenza pandemic

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Acknowledgements

- Collaborators

- David Philp & Niels Becker (National Centre for Epidemiology & Population Health, ANU)

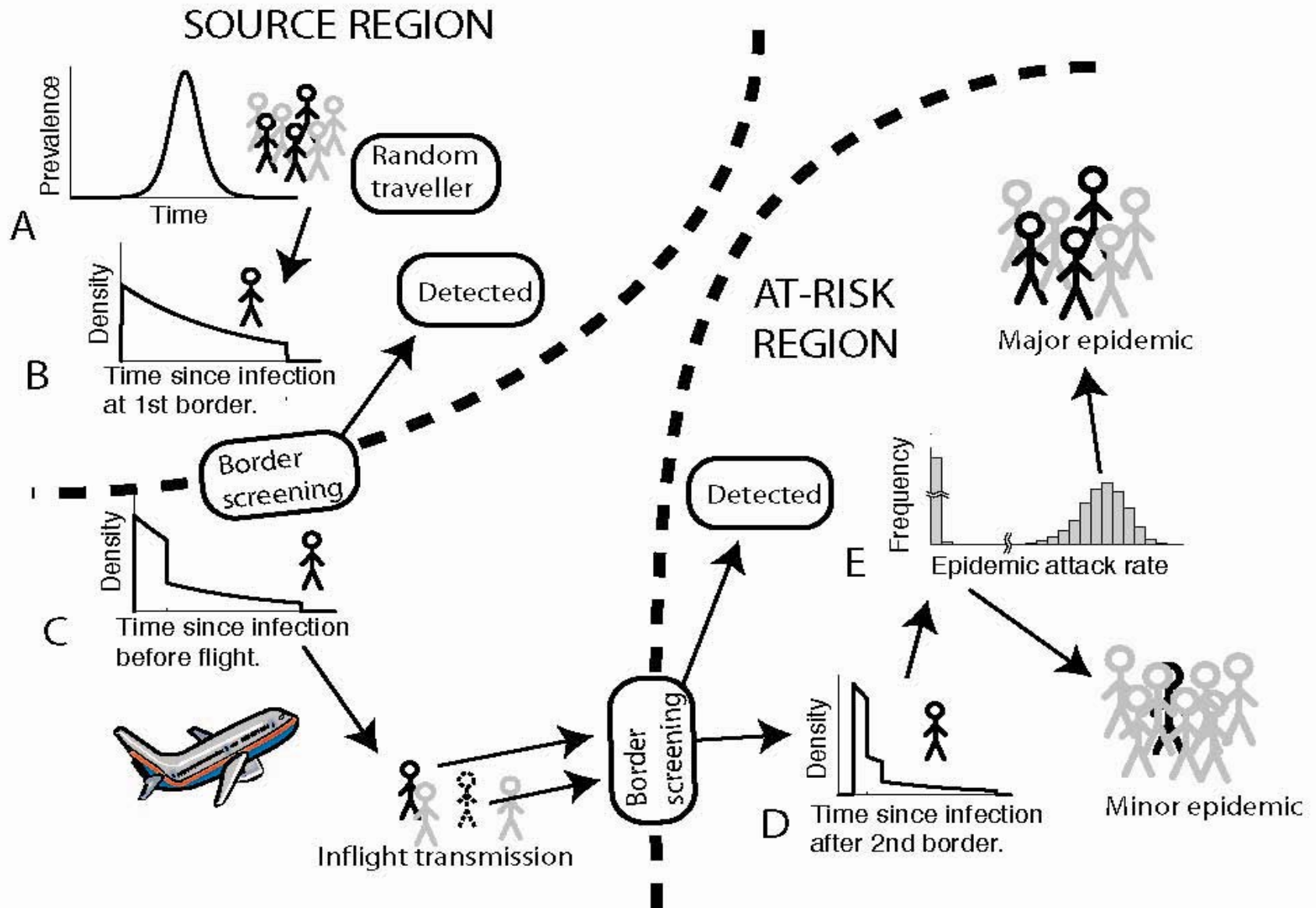
- Funding

- National Health & Medical Research Council
- Department of Health & Ageing
- ARC

Talk outline

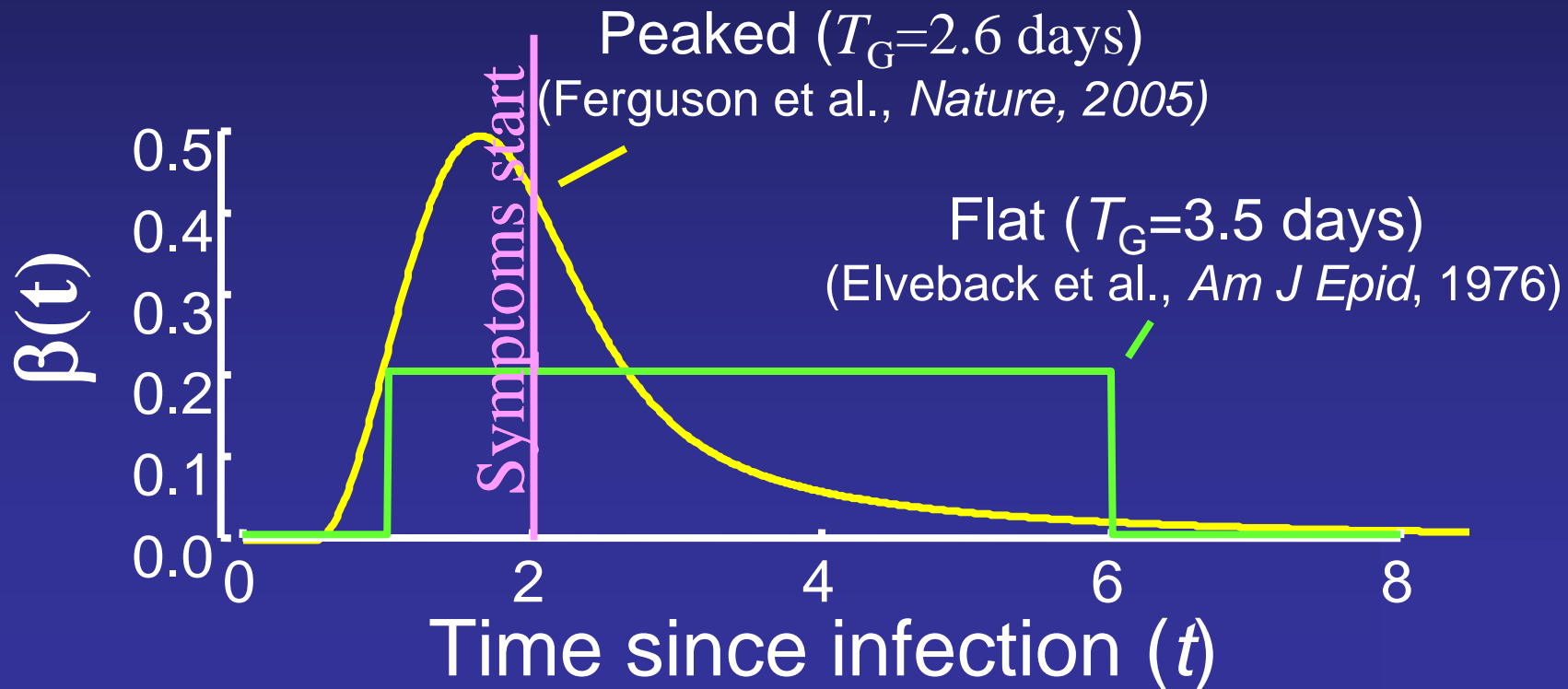
1. What drives the size and shape of epidemics?
 - basic disease reproduction number (R_0)
 - generation interval (T_G)
2. How long until the next influenza pandemic reach OZ?
 - I don't know,
 - but from when it starts (presumably overseas), we can estimate the likely delay

The process of epidemic importation



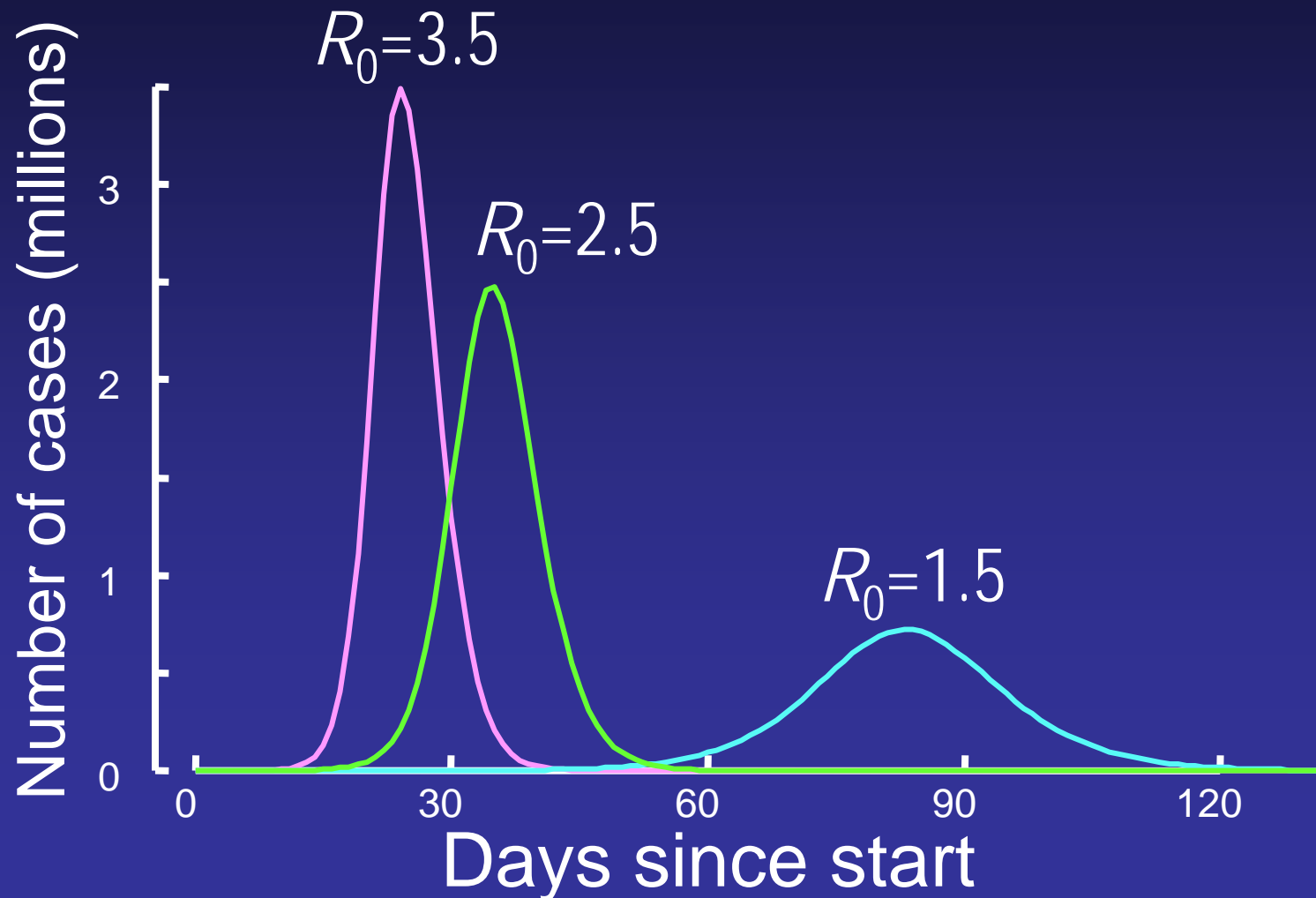
Dynamics of uncontrolled epidemics

- Determined largely by:
 - R_0 – the number of secondary cases when a fully infectious individual is released into a totally susceptible population
 - T_G – the mean generation interval
- R_0 & T_G are defined by infectiousness function $\beta(t)$

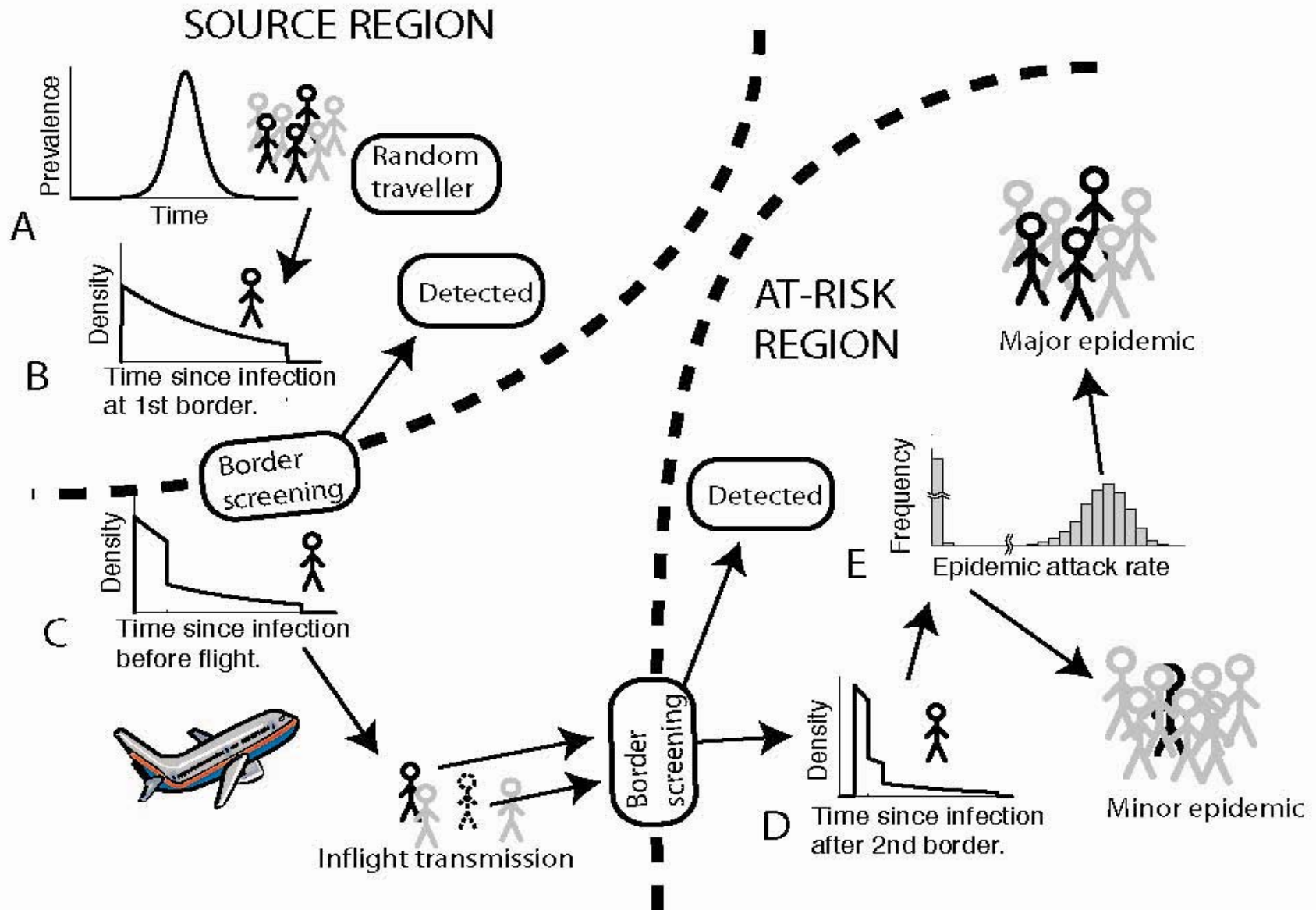


Epidemic curve in source region in relation to R_0

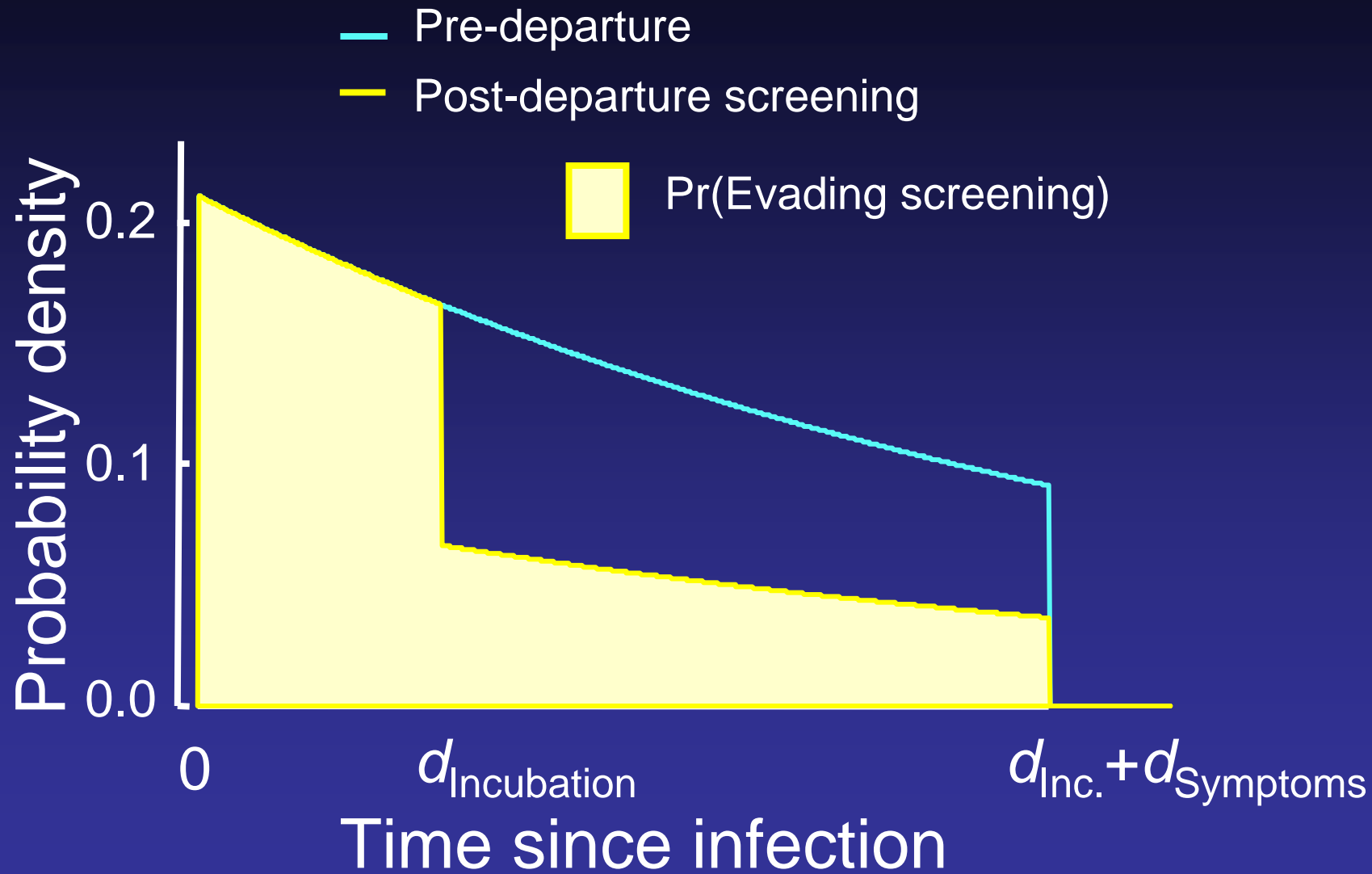
(assuming 5 million people & $T_G=2.6$ days)



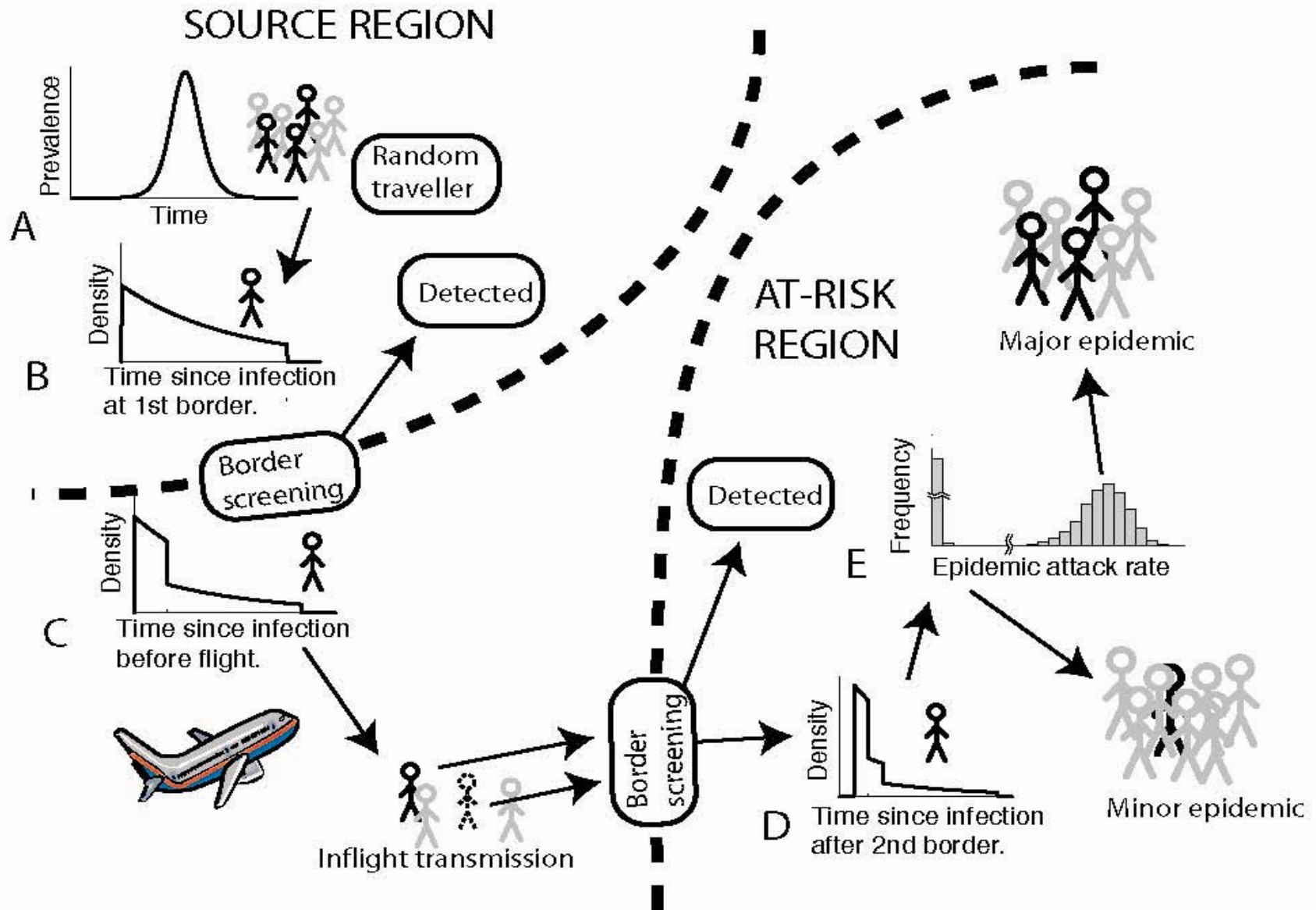
The process of epidemic importation



Distribution of time since infection on departure

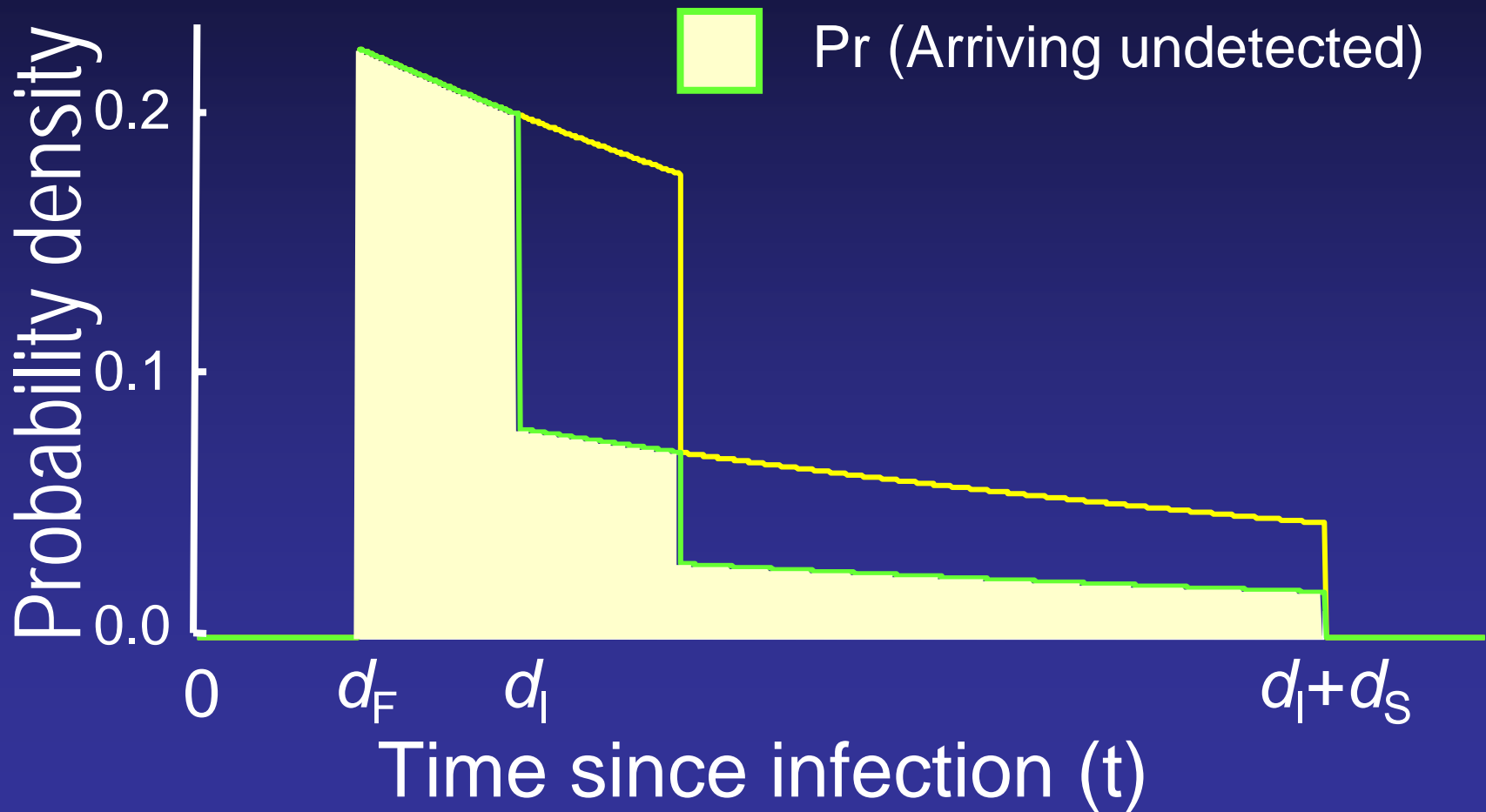


The process of epidemic importation



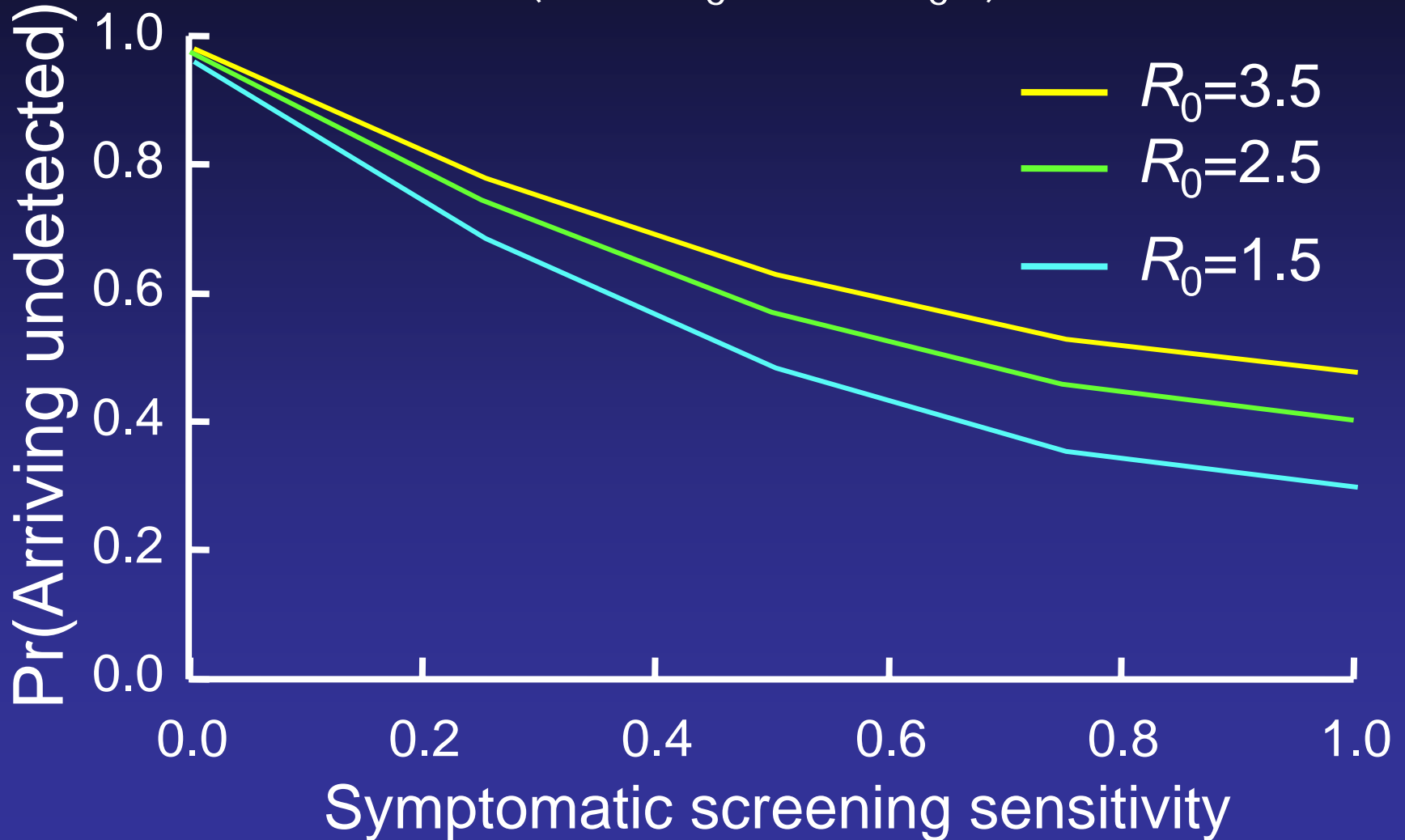
Distribution of time since infection on arrival

- Pre-arrival
- Post-arrival screening

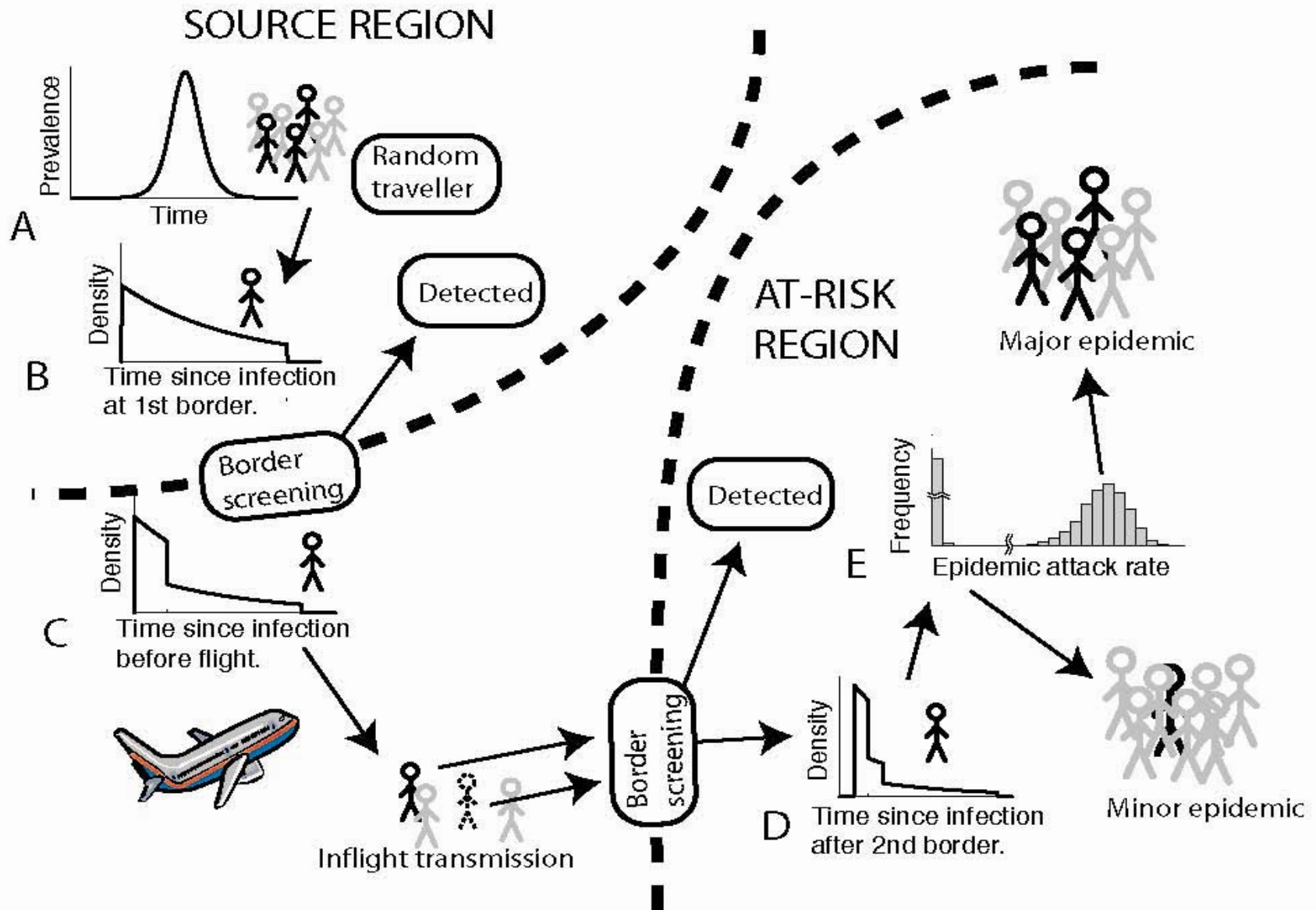


Probability of infected traveler arriving undetected vs. screening sensitivity

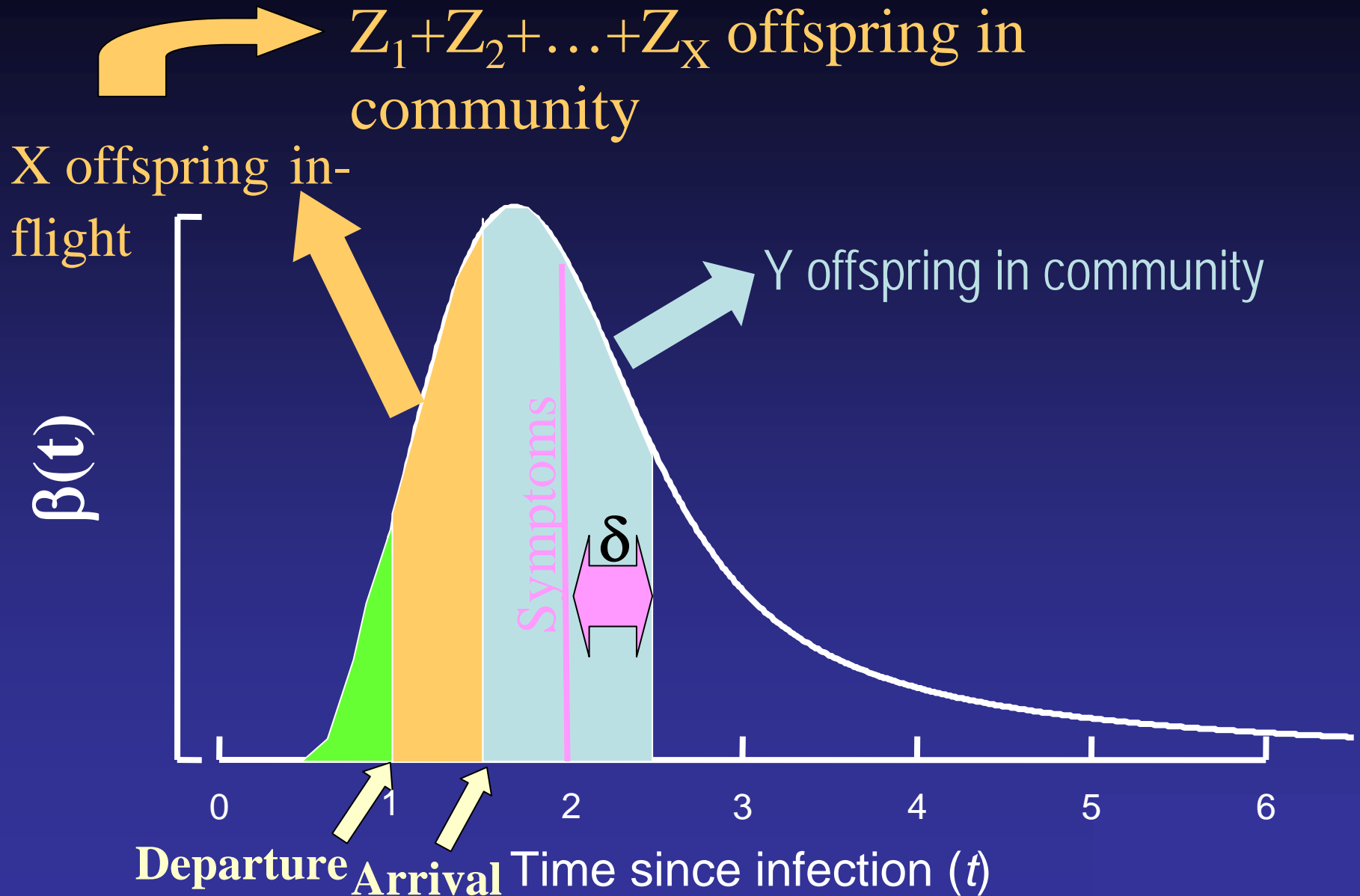
(Assuming 12 hour flight)



The process of epidemic importation

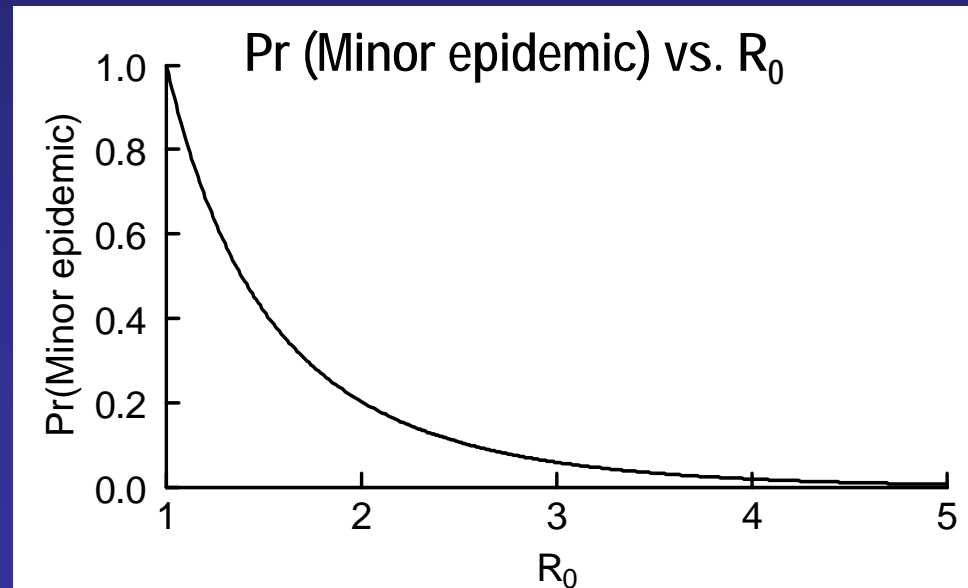
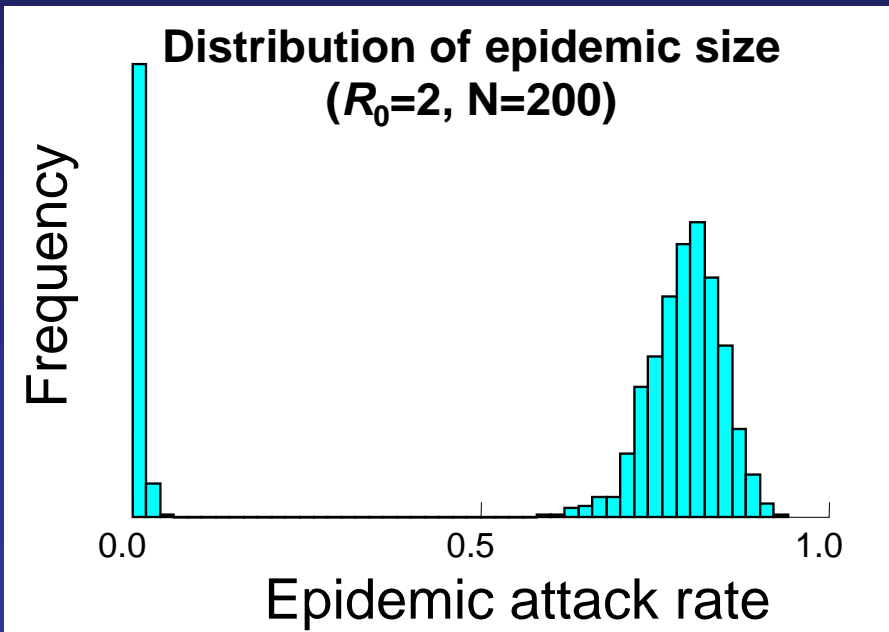
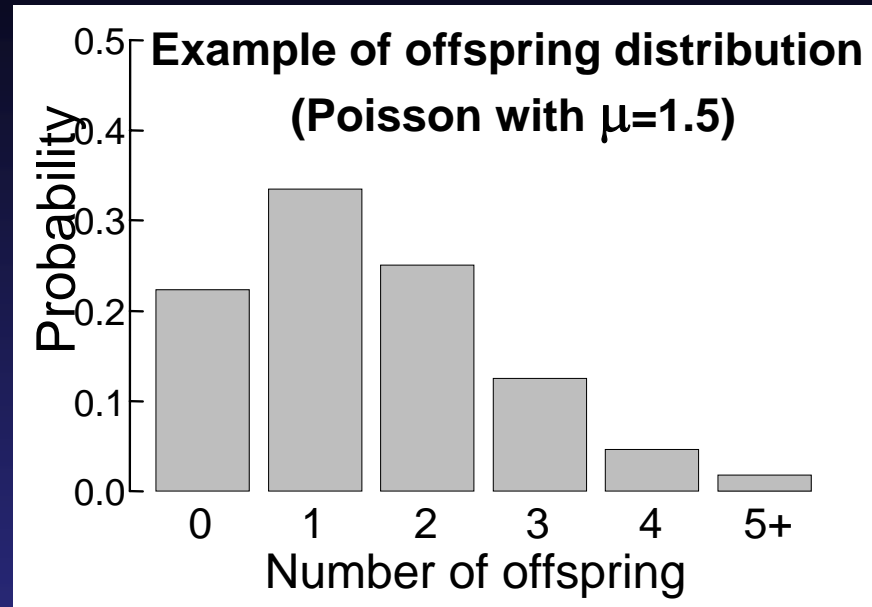


Offspring from undetected traveler

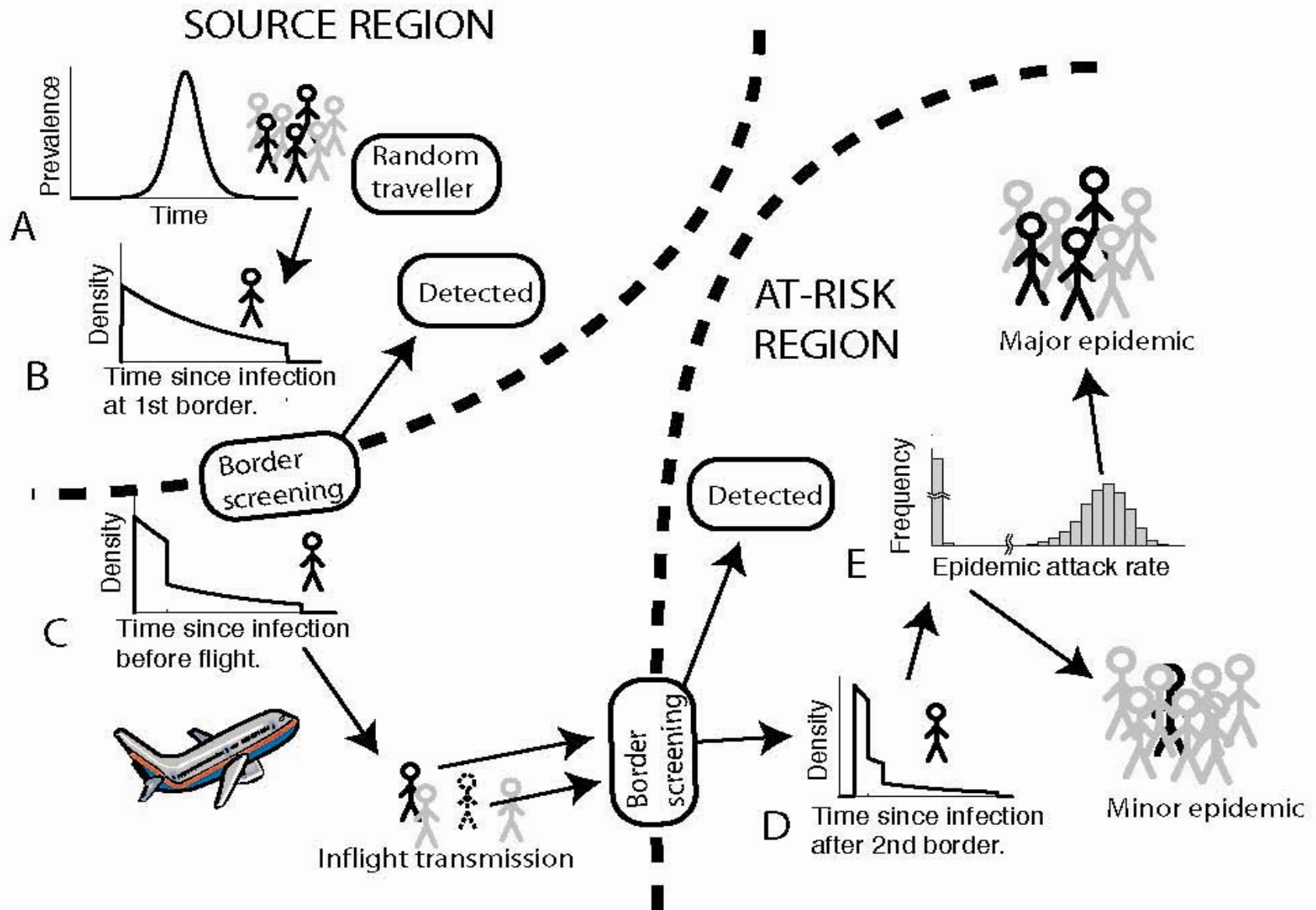


Will an undetected arrival initiate an epidemic?

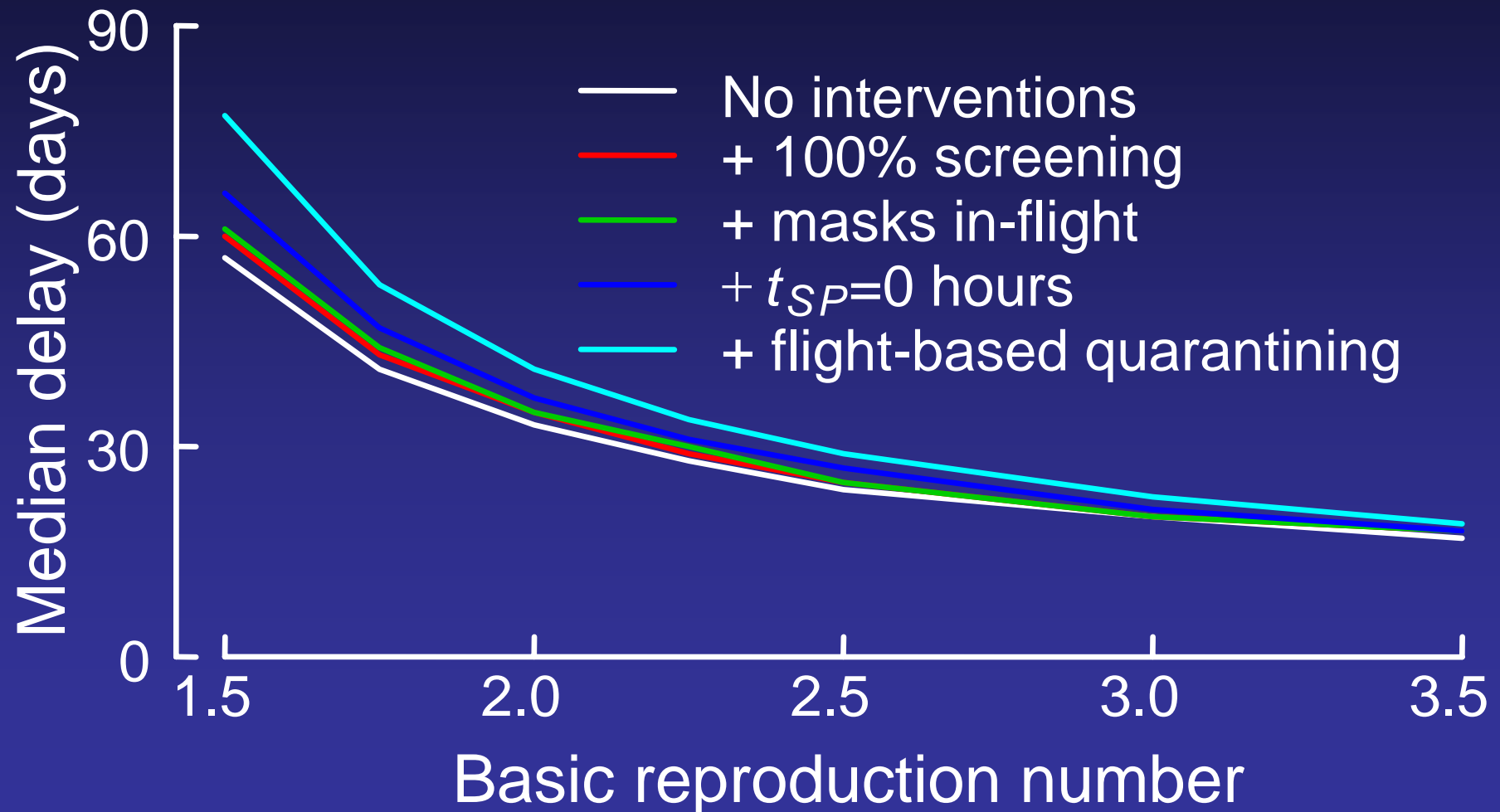
- Not necessarily -- there is an element of chance involved
- Assume that transmission follows a Poisson branching process (BP).
- Epidemics can be 'minor' or 'major'



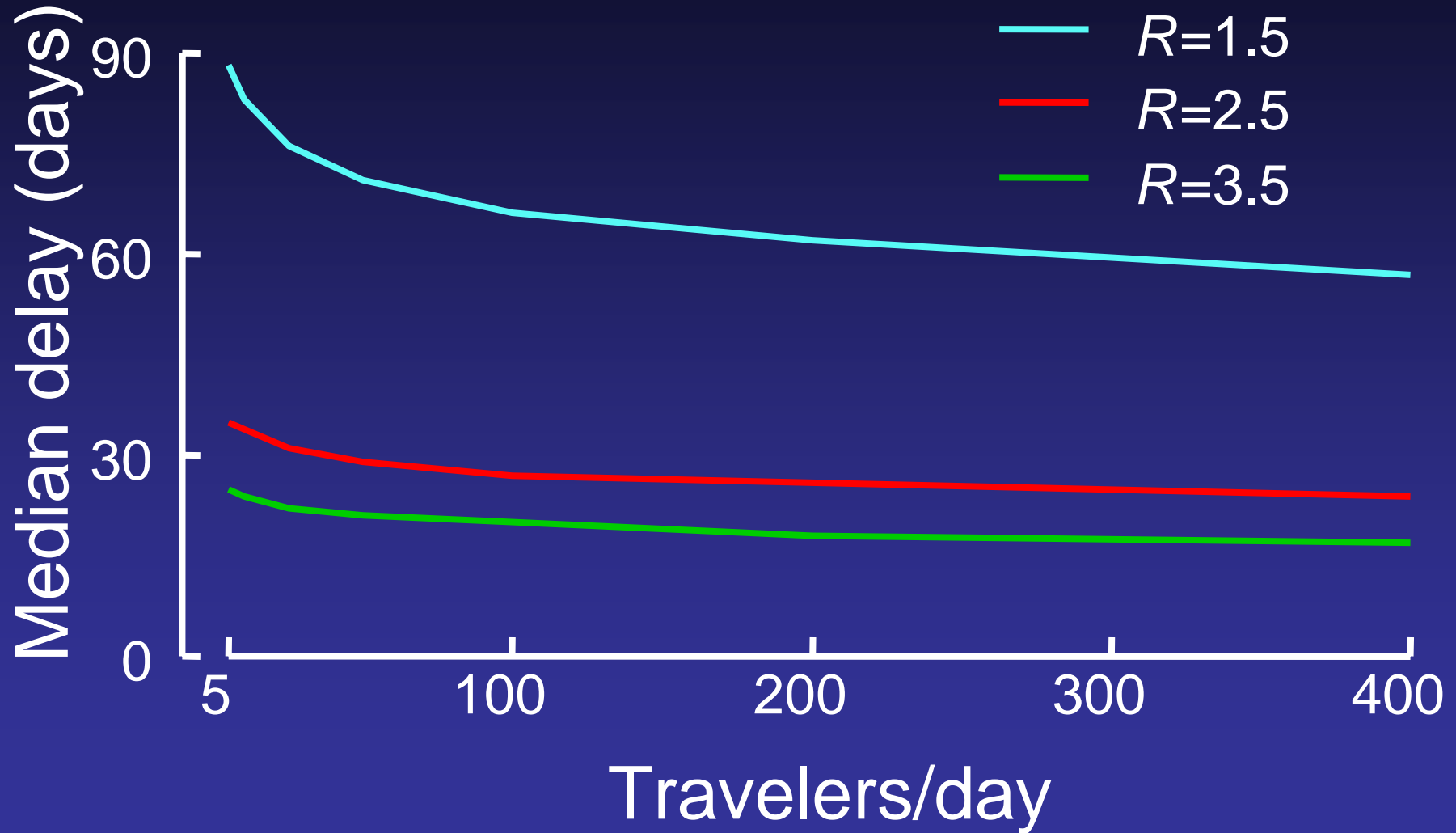
The process of epidemic importation



Effect of travel interventions on delay (assumes 400 travelers/day)



Effects of traveler numbers on delay until major epidemic is initiated



Thank you!

Further reading & info:

Caley, Becker & Philp (2007) The waiting time for inter-country spread of pandemic influenza. *PLoS ONE*, 2(1). e143.

doi:10.1371/journal.pone.0000143.

Caley, Philp & McCracken (2007) Quantifying social distancing arising from pandemic influenza. *Journal of the Royal Society Interface*.

doi:10.1098/rsif.2007.1197

Department of Health & Ageing website (<http://www.health.gov.au/>)