Contact tracing for COVID-19

Forwards and backwards: an introduction

Nicola Low, Institute of Social and Preventive Medicine, University of Bern, CH

Wednesday 7th October, 2020. WHO/GOARN Global Consultation on Contact Tracing for COVID-19

Outline

UNIVERSITÄT BERN

What does contact tracing do?

Forward and backward contact tracing

Case study

Expected impact

Discussion

What does contact tracing do?

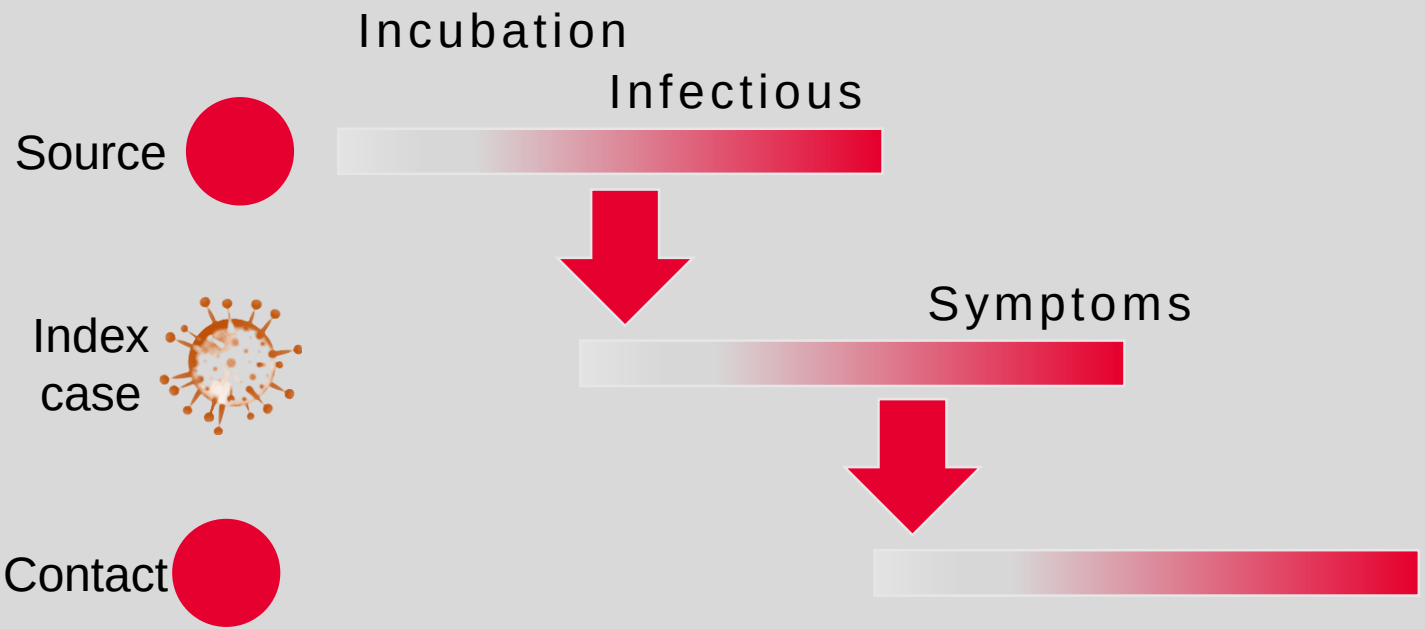
Basic reproduction number

$$R_0 = \beta\, c\, D$$

Transmissibility (β)	Contact rate (c)	Duration of infection (D)
Isolation	Size of gatherings	Contact tracing
Masks		Drugs
Hand hygiene		
Vaccine		

Contact tracing

Why do we say ‘forwards’ and ‘backwards’?



Contact tracing

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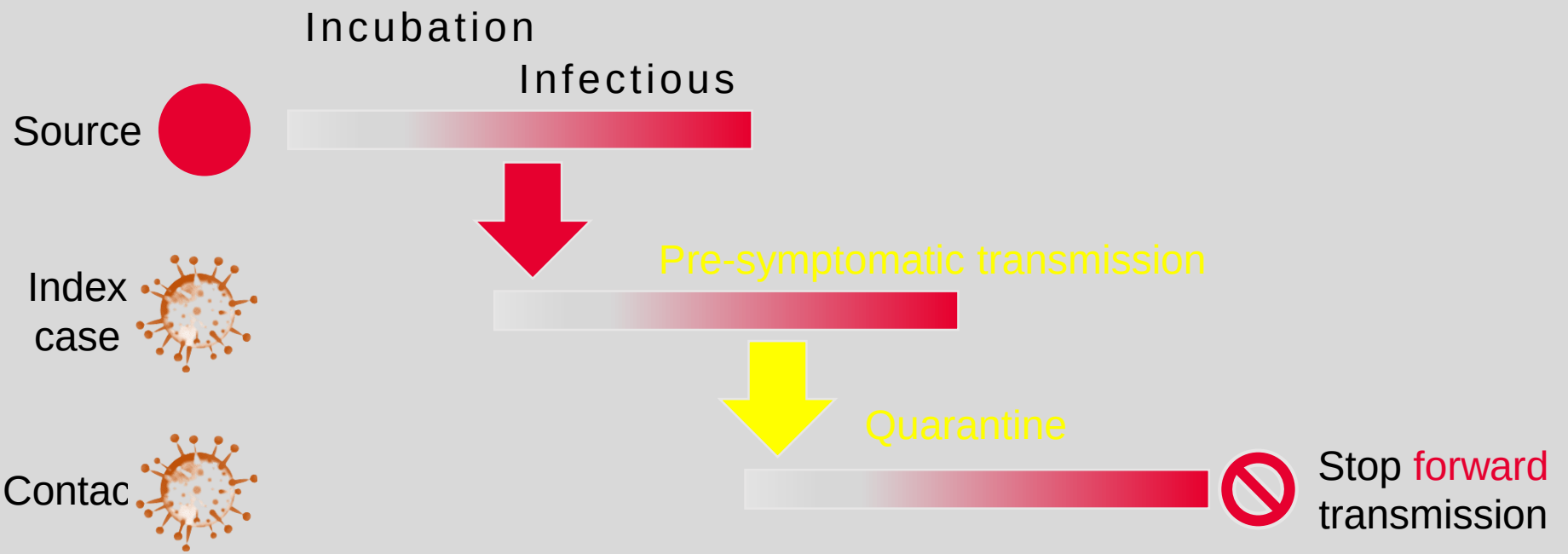

Contact tracing

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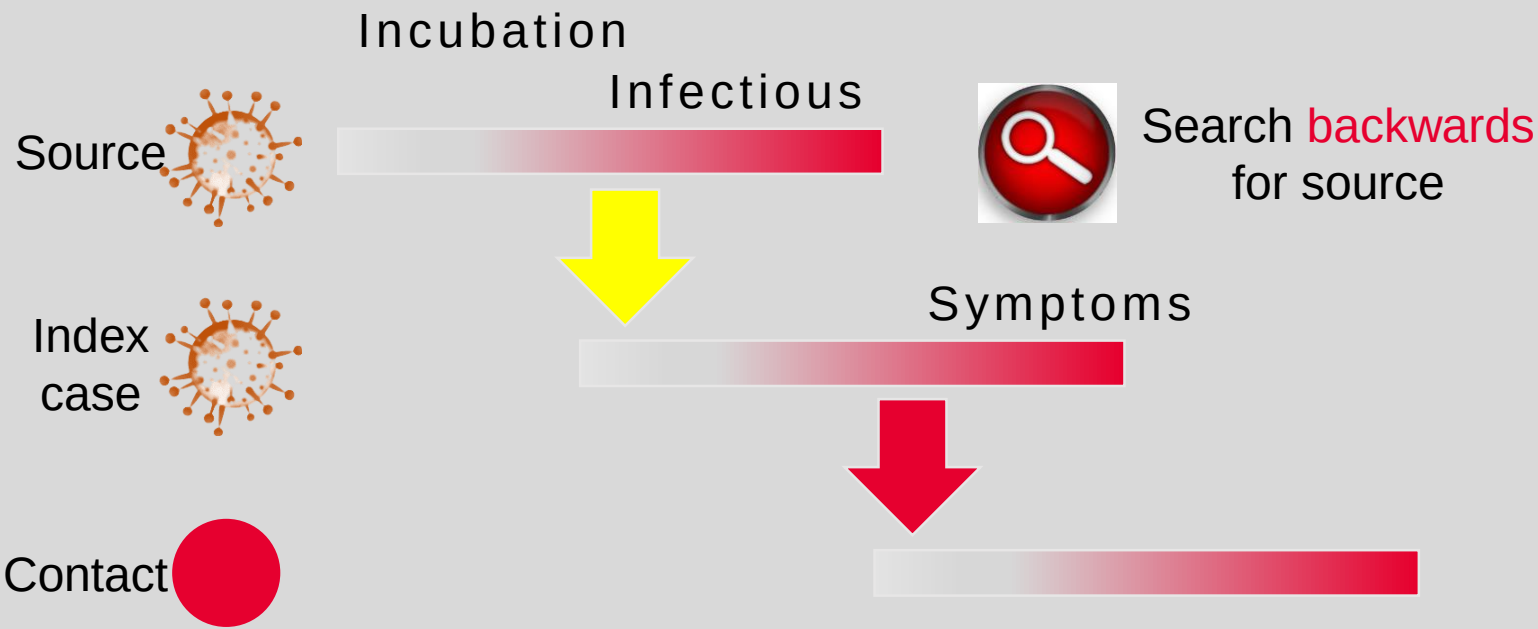
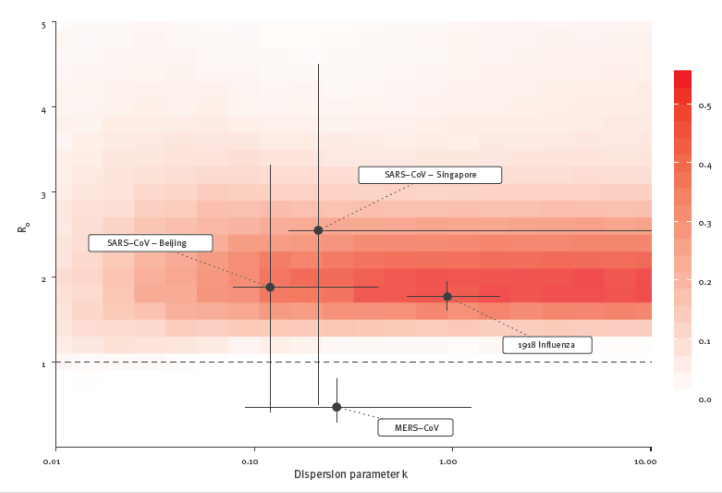
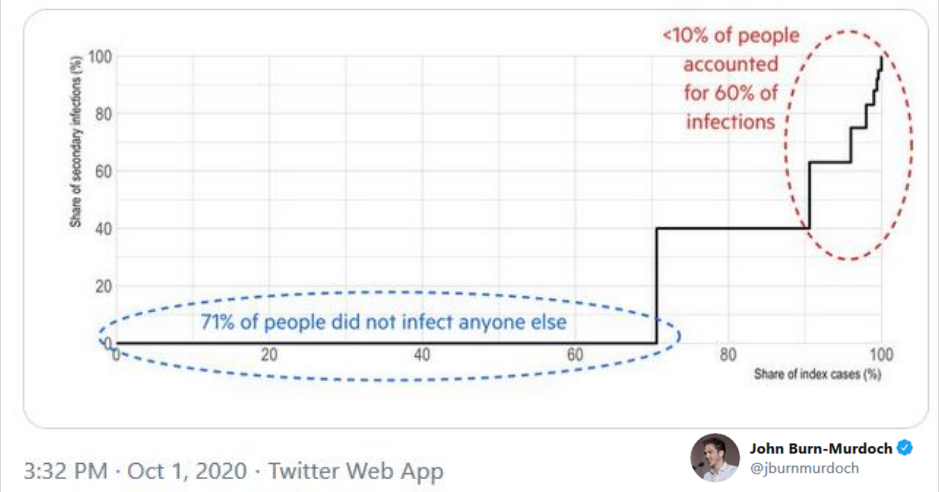


SARS-CoV-2 transmission
The role of overdispersion



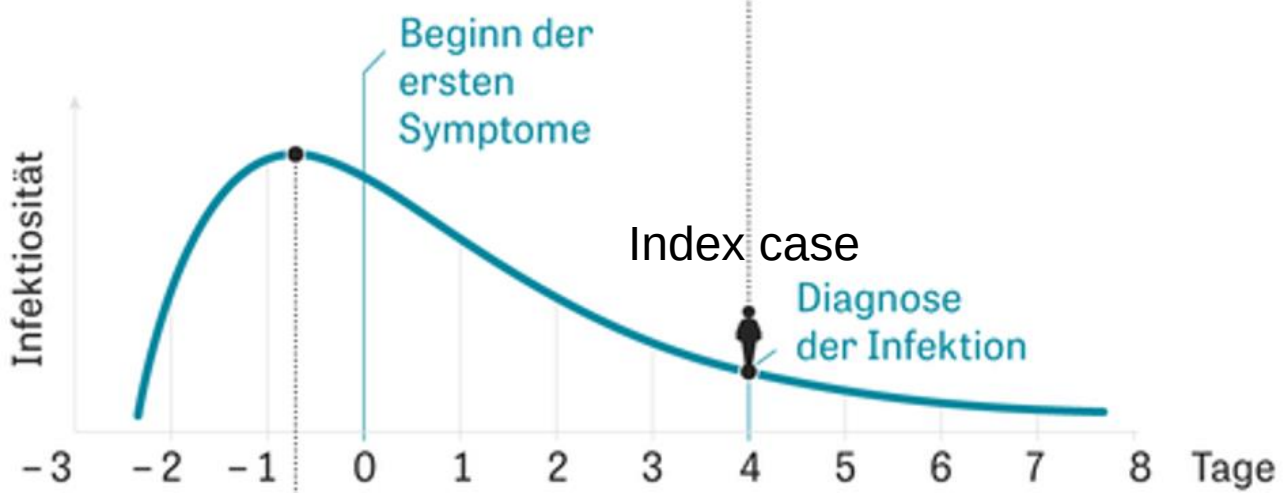
Riou J and Althaus CL. Eurosurveillance. Jan. 2020



Based on Laxminarayan R, et al. Science. Sept. 2020

Overdispersion and contact tracing

Index case is disproportionately likely to have been infected by a source who also infected others in a cluster



Index case might infect few contacts

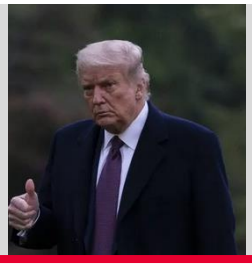
Drosten C. Die Zeit 33/2020, 06.08.20

Case study: COVID-19 outbreak

Forward and backward contact tracing

Day 1

- A 74 year old man has a mild fever, cough and fatigue
- He has a nasopharyngeal swab taken for a SARS-CoV-2 rapid antigen test, which is positive
- He has a second swab taken for RT-PCR, which is positive
- The index case is isolated at home and the case is notified



Disclaimer: All references to real persons or events are entirely coincidental

Photo credits: www.theguardian.com 02.10.20

Case study: COVID-19 outbreak

Forward contact tracing

Day 2

- A contact tracer asks the index case about his contacts in the two days before his symptoms started
- The index case was in close contact with his wife and children. He travelled to an event on a helicopter with his wife and an aide
- All go into quarantine and are tested

Photo credits: www.nytimes.com and www.theguardian.com 02.10.20

Case study: COVID-19 outbreak

Backward contact tracing

Day 2

- The contact tracer asks the index case about his activities in the two weeks before his symptoms started
- Did he go to any events where he was in contact with people for more than 15 minutes, without masks and without a distance of 1.5m or more?
- They make an activity map

Photo credit: www.nytimes.com 04.10.20

Case study: COVID-19 outbreak

Backward contact tracing

Day 3

- The index case had a garden party a week before he developed his symptoms
- The contact tracers cross-checked their records
- Some of the guests had tested positive for SARS-CoV-2

Photo credit: https://www.washingtonpost.com 03.10.20

Case study: COVID-19 outbreak

Backward contact tracing

Day 4-6

- Contact tracers try to identify and contact all the staff at the index case's home and guests across different states
- They send all guests into quarantine and ask them to be tested
- They find 20 additional cases
- The contact tracers carry on to test, trace, isolate and quarantine
- A potential superspreading event is avoided

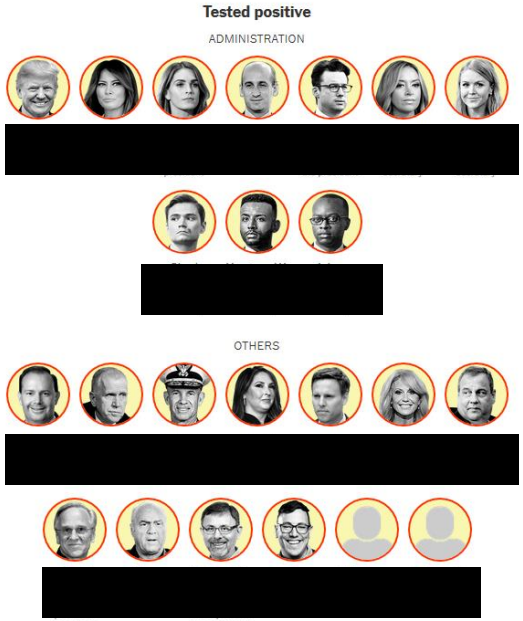


Photo credit: https://www.washingtonpost.com, 03.10.20

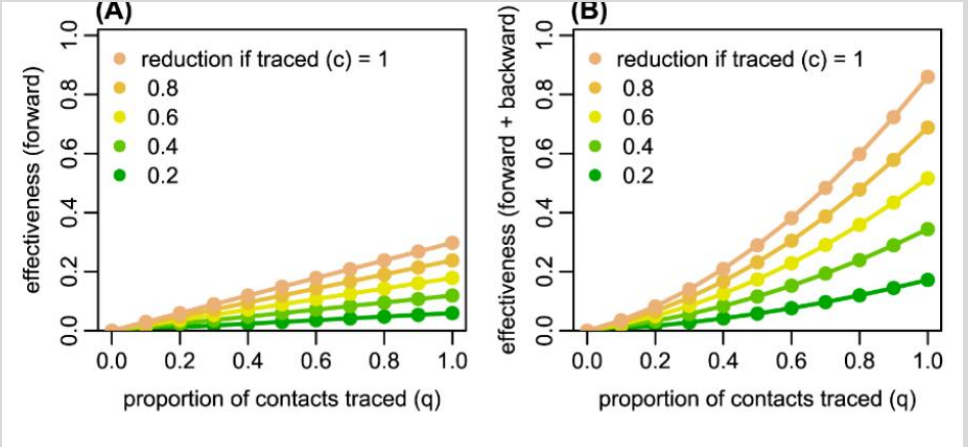
Forward and backward contact tracing

What is the impact?

Mathematical model

A. Forward contact tracing only
Identifies, at most, the mean number of secondary infections

B. Forward and backward tracing
Increases cases found by factor 2-3
Identifies high-risk settings



c, reduction in infectiousness due to quarantine

Endo A, et al. medRxiv preprint https://doi.org/10.1101/2020.08.01.20166595

Forward and backward contact tracing

Discussion

- Contact tracing effectiveness limited by
  - Pre-symptomatic transmission and overdispersion
- Forward contact tracing stops forward transmission through quarantine of contacts
- Backward contact tracing looks backward for the source

- Backward contact tracing finds clusters and could reduce the size of superspreading events
- Additional prevention measures contribute to effects
- What conditions make backward contact tracing feasible?
- What should the balance be?