



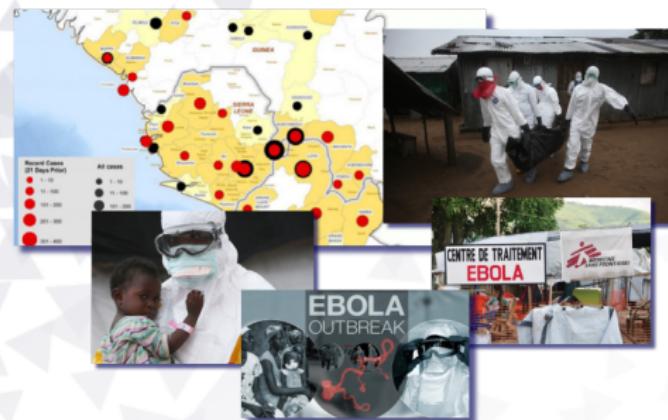
Getting ready for the next epidemic: example of the Likati Ebola outbreak, DRC 2017

Thibaut Jombart

26th February 2018

Imperial College London
MRC Centre for Outbreak Analysis and Modelling

Lessons learnt from the Ebola response



Lessons learnt from the Ebola response



Lessons learnt from the Ebola response

WHO Ebola response team

Help improving situation awareness

EBOLA OUTBREAK

December 2013 March 2014 August 2014 September 2015

First case WHO notified First data/report Latest data update

Imperial College Ebola team

Lessons learnt from the Ebola response



Most statistical/modelling tools for situation awareness missing.

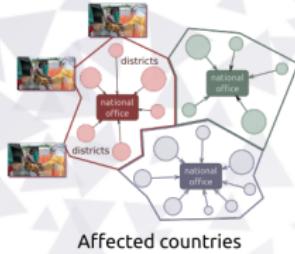
Challenges of a timely response



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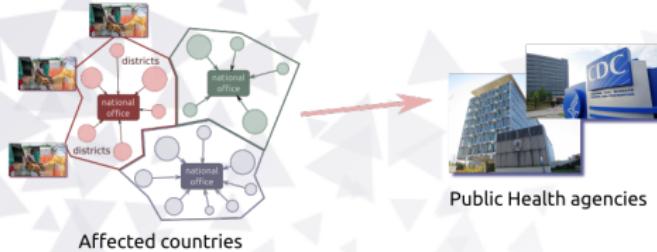


time (block = day)

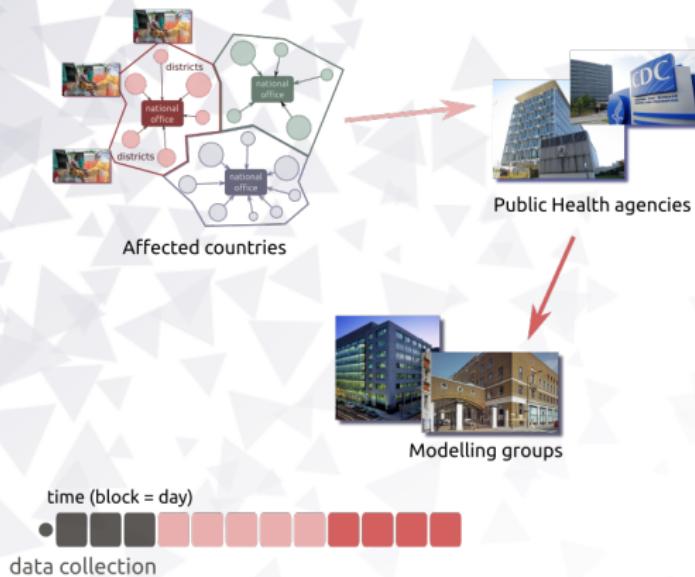


data collection

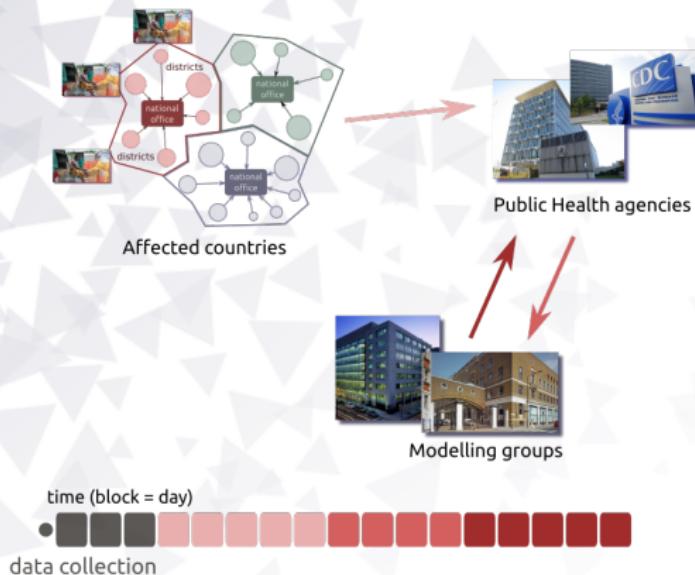
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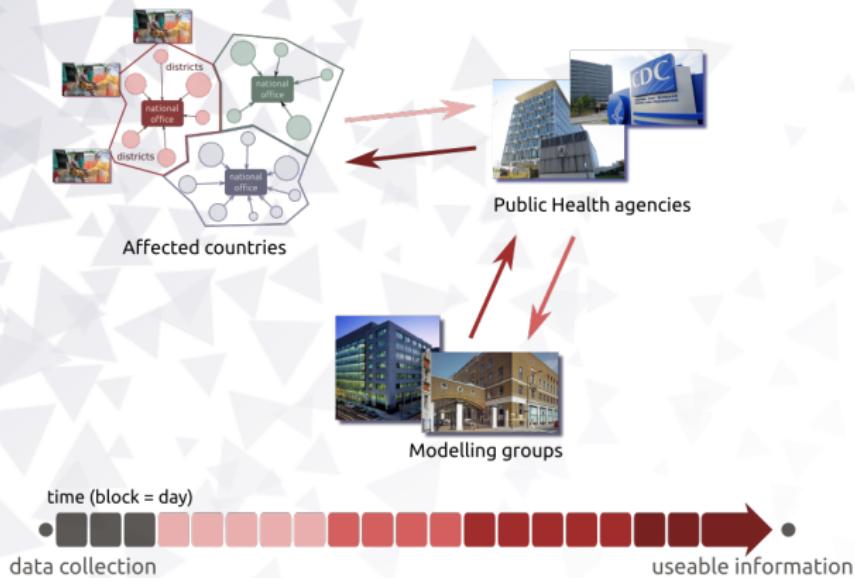
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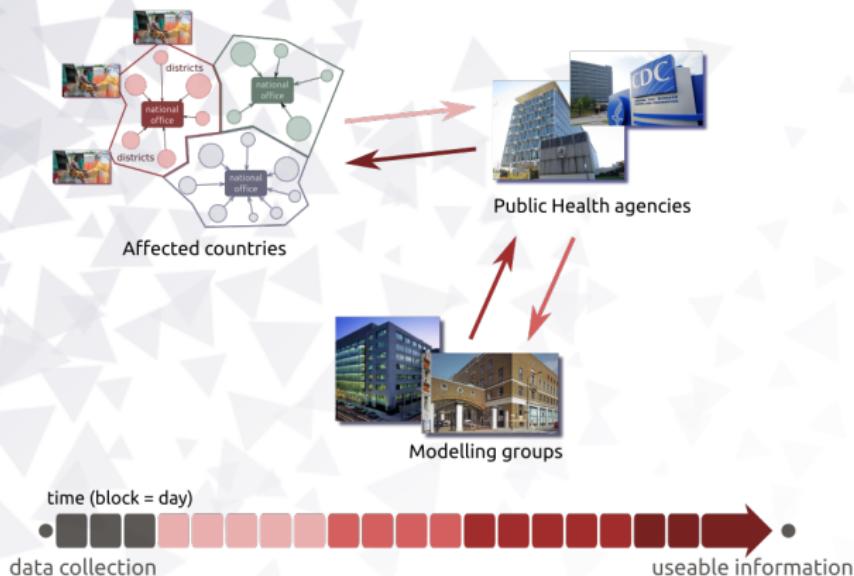
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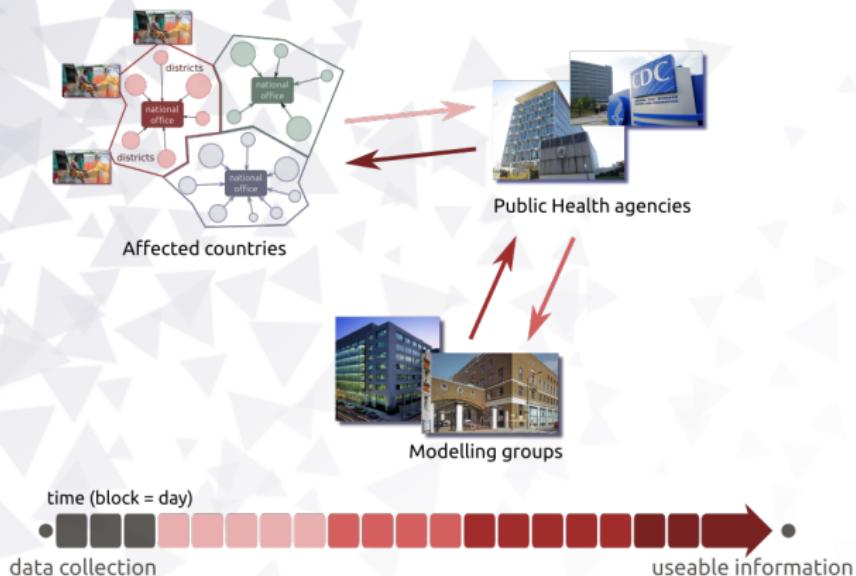


Challenges of a timely response



- embed methodologists in outbreak response teams

Challenges of a timely response



- embed methodologists in outbreak response teams
- efficient tools can shorten delays

Who do we need to develop these tools?



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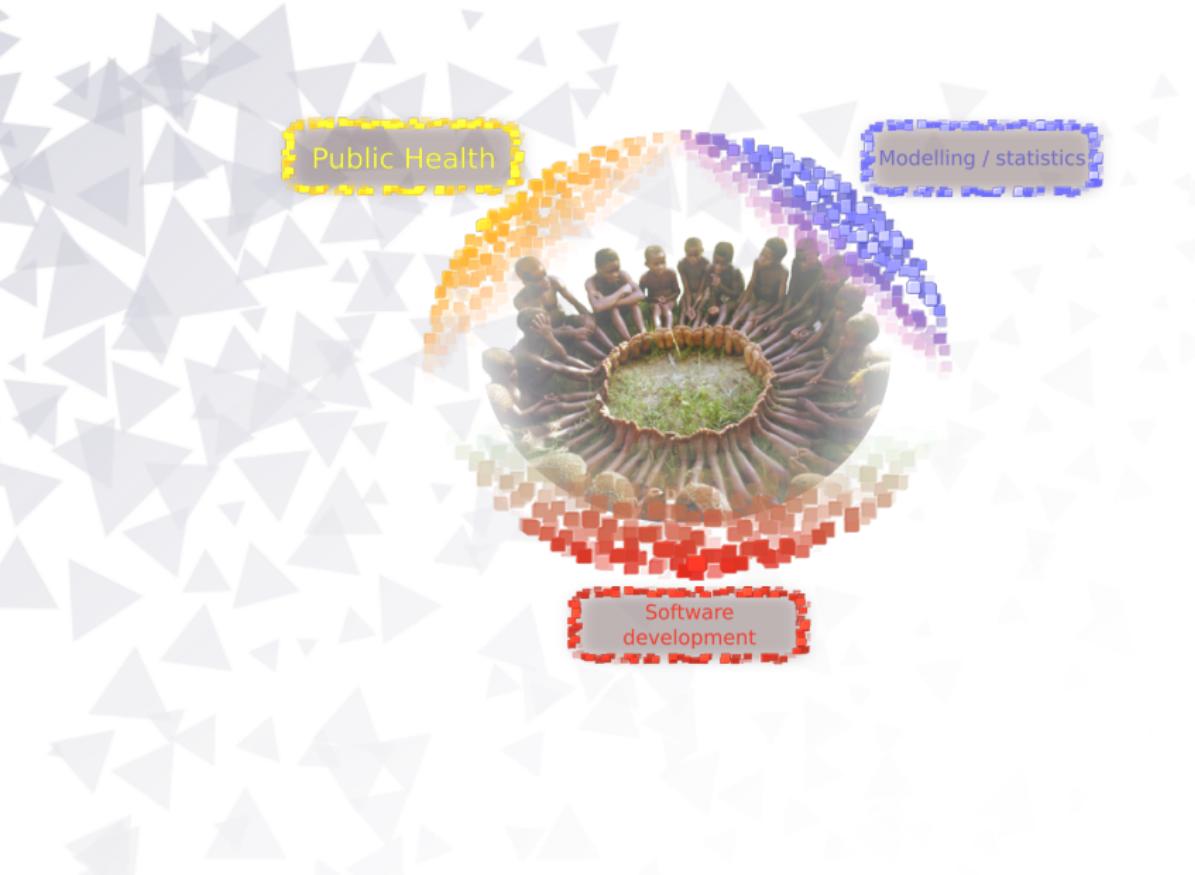
Public Health



Who do we need to develop these tools?



Who do we need to develop these tools?



From a hack to a pack



Hackout 3, summer 2016, Berkeley

From a hack to a pack



Hackout 3, summer 2016, Berkeley



A word cloud illustrating the themes and tools developed during the hackathon, including:

- functional incubation
- userfriendly secure dictionary
- systems testing automated continuous
- rppt efficiency collection series
- parsing secured bias number repository
- outbreaks fast
- code integration gui
- reporting vhl
- situation synchronised
- epidemian contact
- delay interface tree
- data security peak
- reporting
- opensource
- epiinfo
- clean time
- compiled
- outbreaker
- interface tree
- symptoms
- linelist
- shiny
- tracing
- incidence
- automation
- epicontacts
- cds
- ecdc
- cds
- bayesian site report
- cleaning
- ggplot
- clusters rates
- parallel
- contacttracing
- parameters
- epidemics
- genomics
- distribution
- estimation
- censoring
- transmission
- package
- reproducible
- logistics
- reproduction
- exposure period
- mutations
- line lists
- encryptions
- aws
- aws

From a hack to a pack



Hackout 3, summer 2016, Berkeley

functional
incubation
userfriendly secure dictionary
systems testing automated continuous
collection series repository
rpp efficiency number fast
secured bias outbreaks
parsing code integration
reporting gui
unit data delay
epidemiologist security peak
contact interface tree
epilist clean time
symptoms compiled
outbreaker interface
tracing shiny
automation fellow
epicontacts cdc
ggplot edc
clusters rates free
parallel contacttracing
parameters reliability
epidemics genomics
distribution

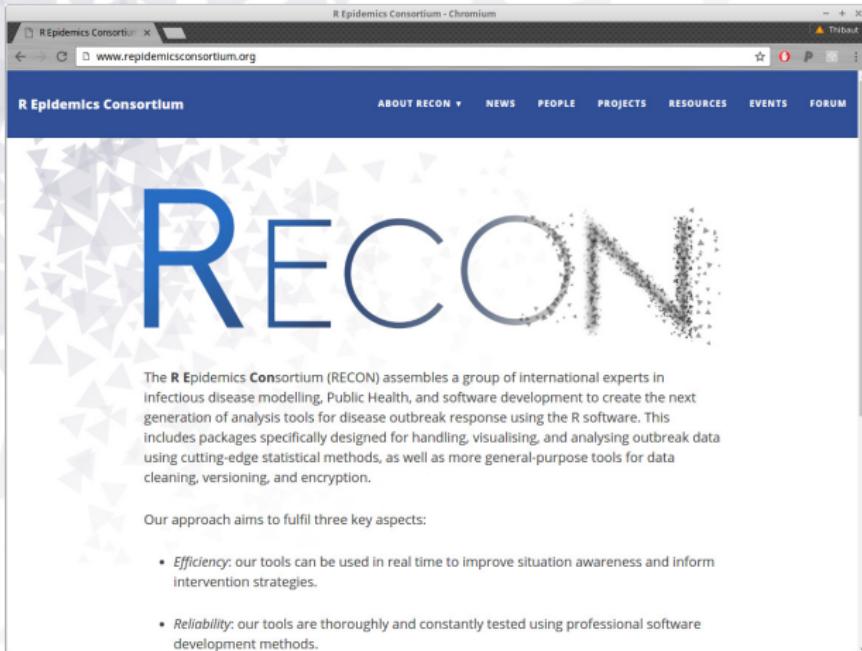
RECON
[The R Epidemics Consortium]

From a hack to a pack



RECON: the R Epidemics Consortium

A taskforce to build a new generation of outbreak response tools in .



The screenshot shows a web browser window for the "R Epidemics Consortium - Chromium" tab, displaying the homepage at www.repidemicsconsortium.org. The page features a dark blue header with the "R Epidemics Consortium" logo and navigation links for ABOUT RECON, NEWS, PEOPLE, PROJECTS, RESOURCES, EVENTS, and FORUM. Below the header is a large, stylized "RECON" logo where the letters are composed of small, scattered dots. A descriptive paragraph explains the consortium's purpose: "The R Epidemics Consortium (RECON) assembles a group of international experts in infectious disease modelling, Public Health, and software development to create the next generation of analysis tools for disease outbreak response using the R software. This includes packages specifically designed for handling, visualising, and analysing outbreak data using cutting-edge statistical methods, as well as more general-purpose tools for data cleaning, versioning, and encryption." A section titled "Our approach aims to fulfil three key aspects:" lists three bullet points:

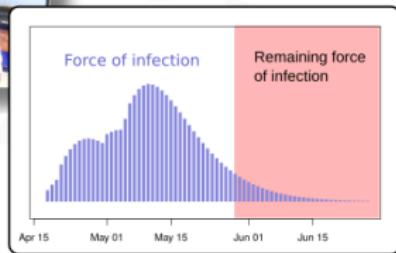
- *Efficiency:* our tools can be used in real time to improve situation awareness and inform intervention strategies.
- *Reliability:* our tools are thoroughly and constantly tested using professional software development methods.

www.repidemicsconsortium.org

Ebola outbreak, Likati (DRC) 2017



- EVD outbreak May 2017
- contact data visualisation tools used in contact tracing
- simple model informed response (scaling)
- end: 2nd July 2017



Context / questions

Context

- remote, rural location (jungle), **difficult travel conditions**
- **dangerous area** (poor WASH, diseases, armed groups)
- **new deployments** being discussed

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Preliminary information

- 4 confirmed cases, last onset 20 days ago
- initial epicurves suggested exponential growth
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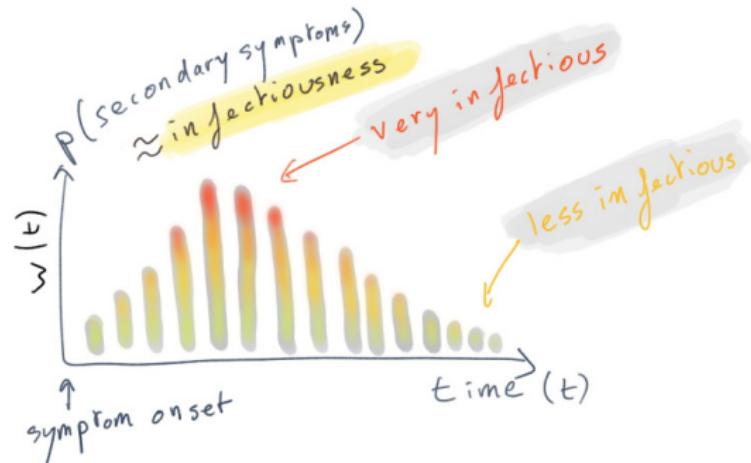
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Key questions: Is it growing? Is it over?

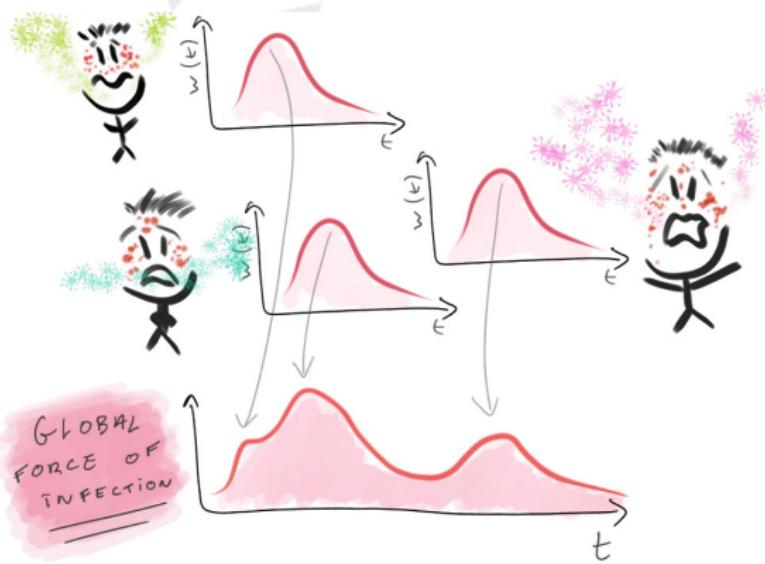
Individual infectiousness over time

Serial interval: delay between symptom onset in infector and infectees



Indicates when we expect new cases, if there are any.

A “simple” branching process model

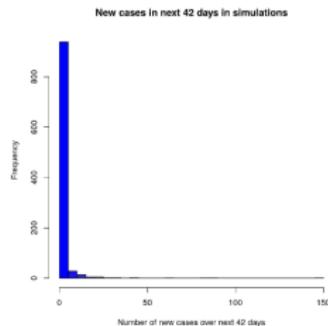
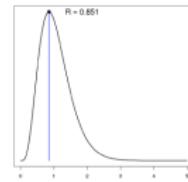
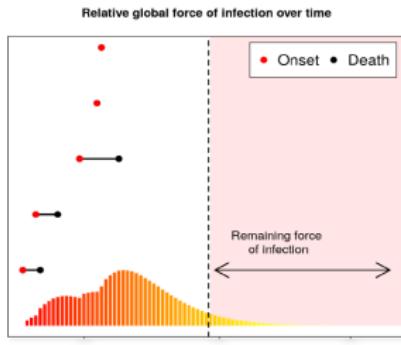


$$y_t \sim \mathcal{P}(\lambda_t) \quad ; \quad \lambda_t = R_0 \times \sum_i w(t - t_i)$$

y_t : incidence at time t ; $\mathcal{P}()$: Poisson distribution; λ_t : **global force of infection**; $w()$: serial interval distribution; t_i : date of symptom onset

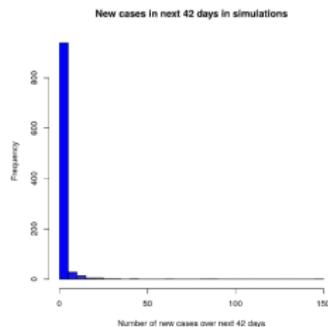
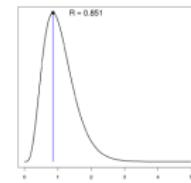
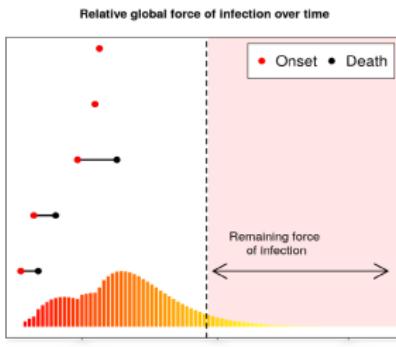
Scaling the response in real-time

Estimating remaining force of infection,
transmissibility (R), predicting new cases



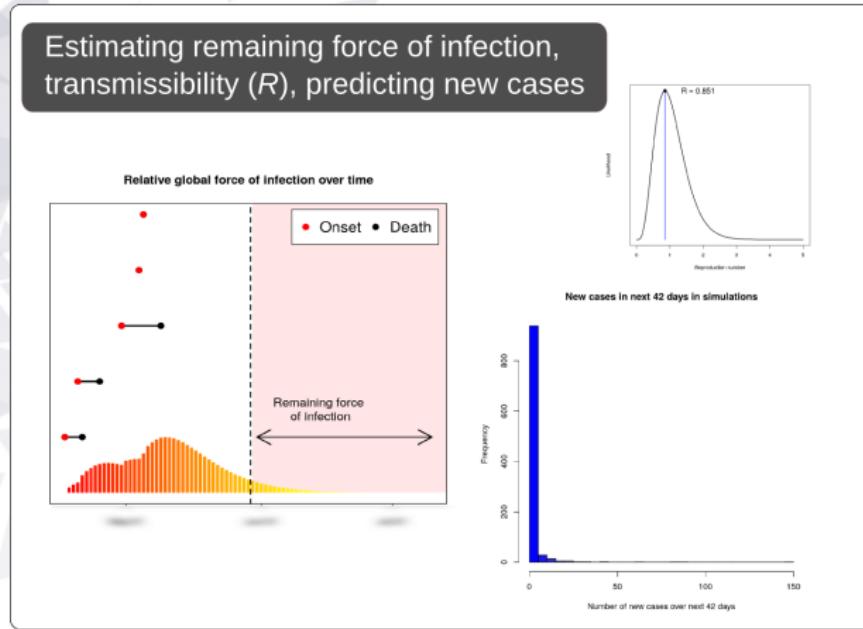
Scaling the response in real-time

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Despite uncertainty in R_0 , new cases were unlikely.

Scaling the response in real-time



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Discouraged scaling up in resource-limited context.

Conclusion

- outbreak analytics can be useful to inform response in real-time
- analytic tools still in development
- increasingly relevant for analysts to be sent to the field
- different outbreaks will have different contexts
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Links

- RECON: <http://www.repidemicsconsortium.org/>
- RECON learn: <https://reconlearn.netlify.com/>
- R Tips on Youtube: search “R tips” “RECONepi”