

# RECON

Challenges and opportunities in outbreak analytics

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Imperial College London  
MRC Centre for Outbreak Analysis and Modelling

# Thanks to:



Amrish  
Baidjoe



Julie  
Middleton



James  
Hayward



Rich  
FitzJohn



Neil  
Ferguson



Susannah  
Fisher



Zhian  
Kamvar

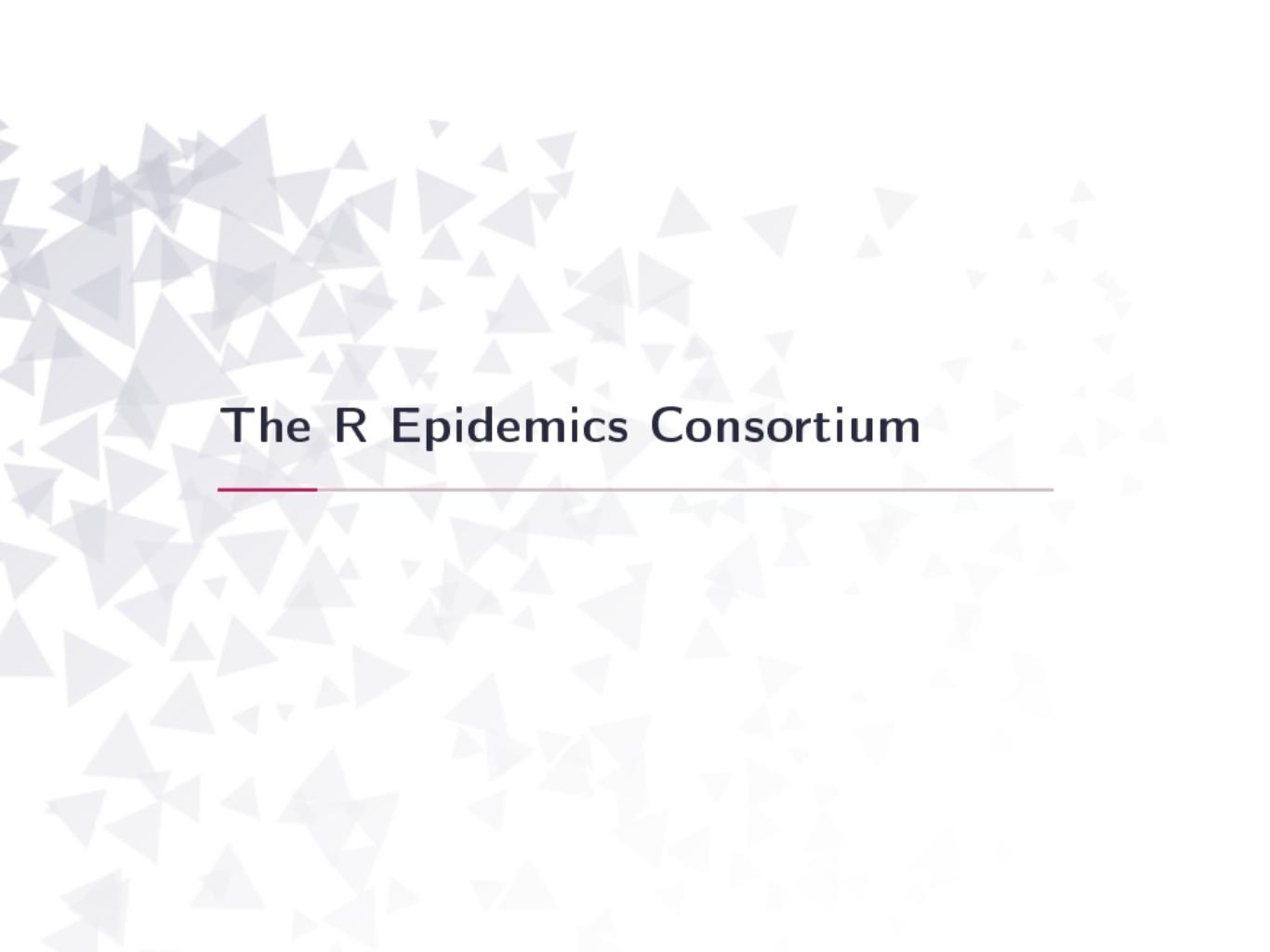


Dirk  
Schumacher



Centre for  
Outbreak Analysis  
and Modelling

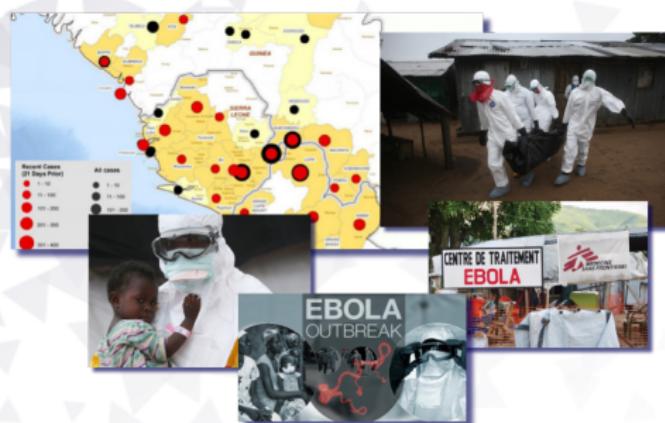




# The R Epidemics Consortium

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# Lessons learnt from the Ebola response



# Lessons learnt from the Ebola response

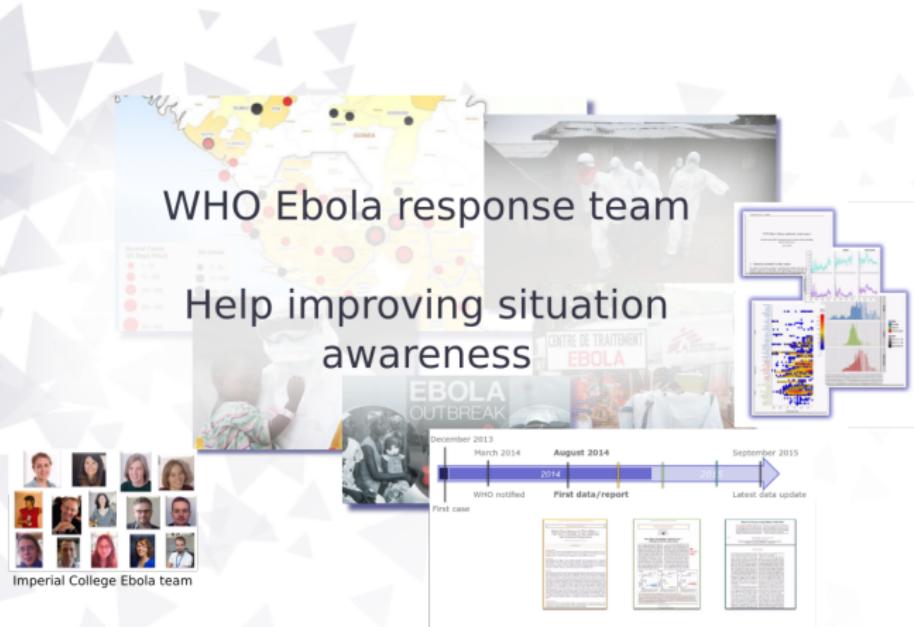


# Lessons learnt from the Ebola response

The image is a collage of various elements related to the Ebola response:

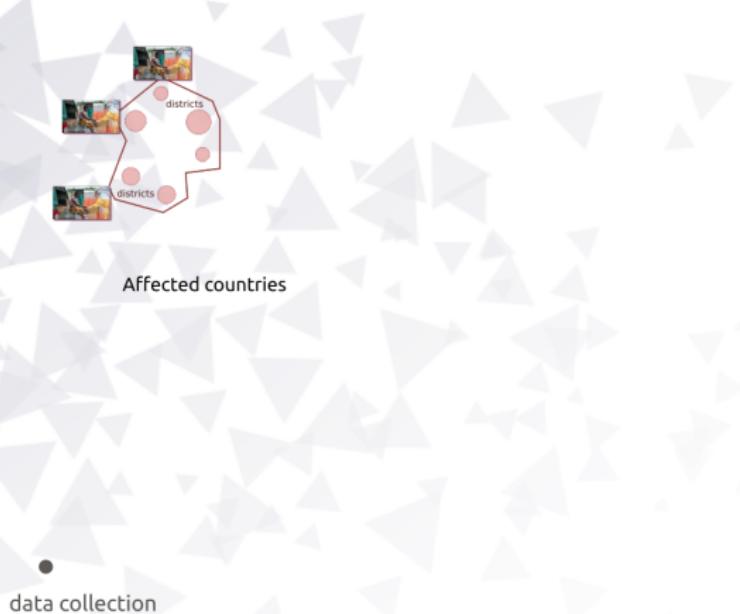
- A map of West Africa showing the locations of the Ebola outbreak.
- A photograph of the "WHO Ebola response team" in protective gear.
- A graphic titled "Help improving situation awareness" featuring a timeline and data visualization.
- A photograph of a person in a white coat and mask.
- A photograph of a medical facility labeled "CENTRE DE TRAITEMENT EBOLA".
- A grid of small images showing people in various settings, possibly related to the outbreak.
- A timeline showing the progression of the outbreak:
  - December 2013: First case
  - March 2014: WHO notified
  - August 2014: First data/report
  - September 2015: Latest data update
- A section titled "Imperial College Ebola team" featuring a grid of 16 small portraits of individuals.

# Lessons learnt from the Ebola response



Most **tools** for outbreak response analysis **were missing**.

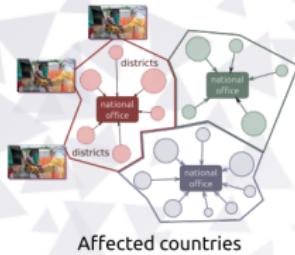
# Informing the response in 'real time'?



# Informing the response in 'real time'?



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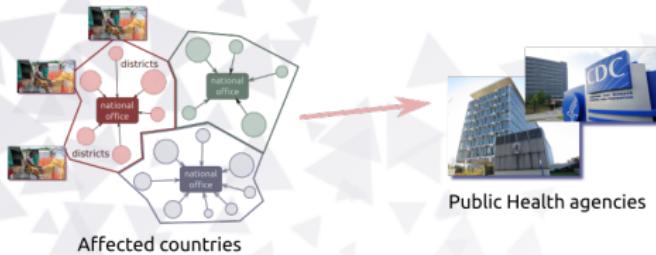
Affected countries

time (block = day)

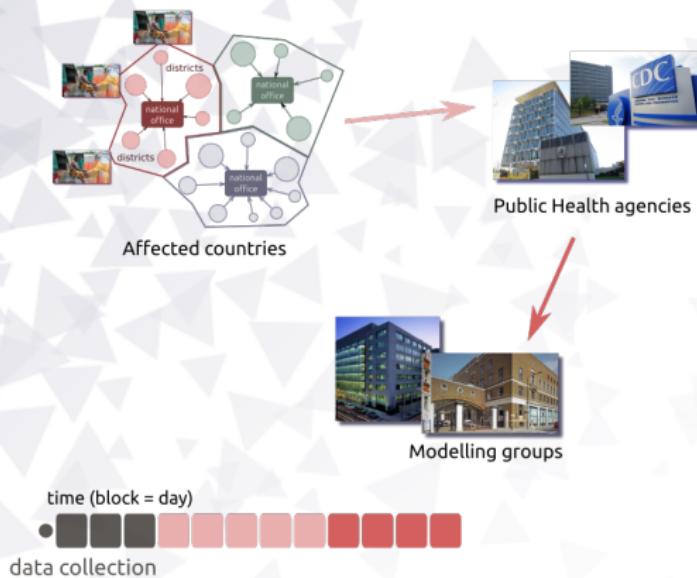


data collection

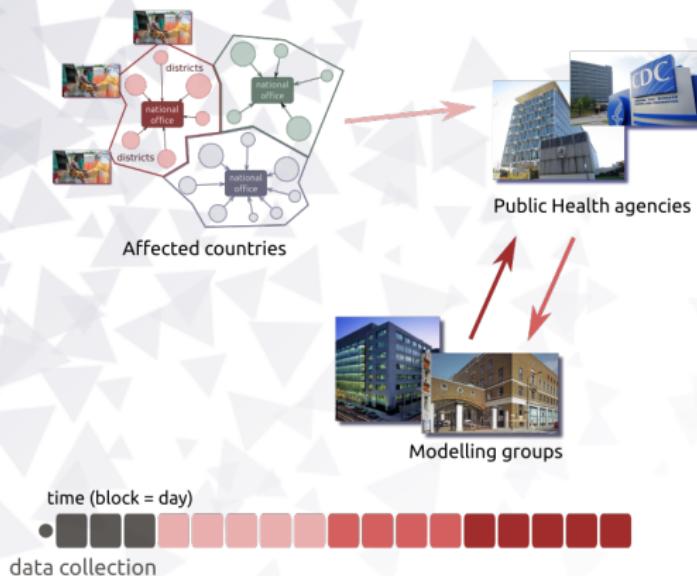
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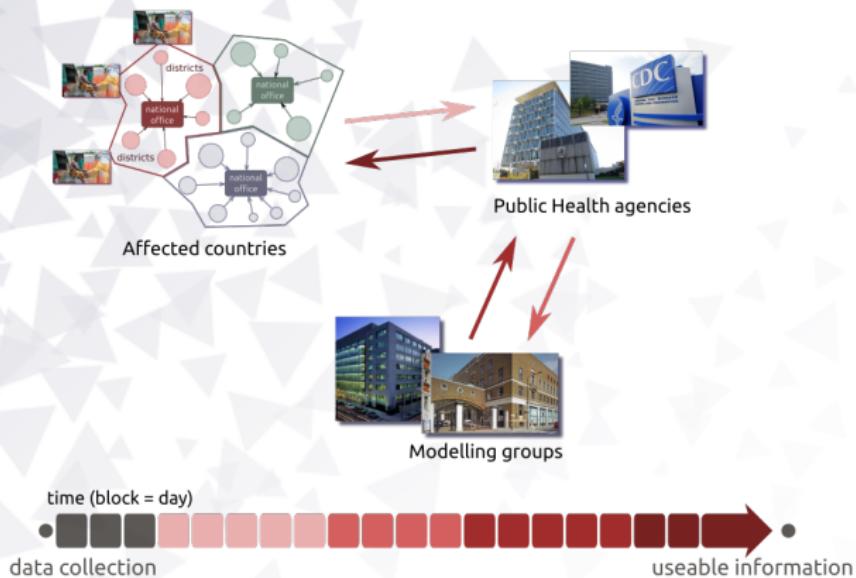
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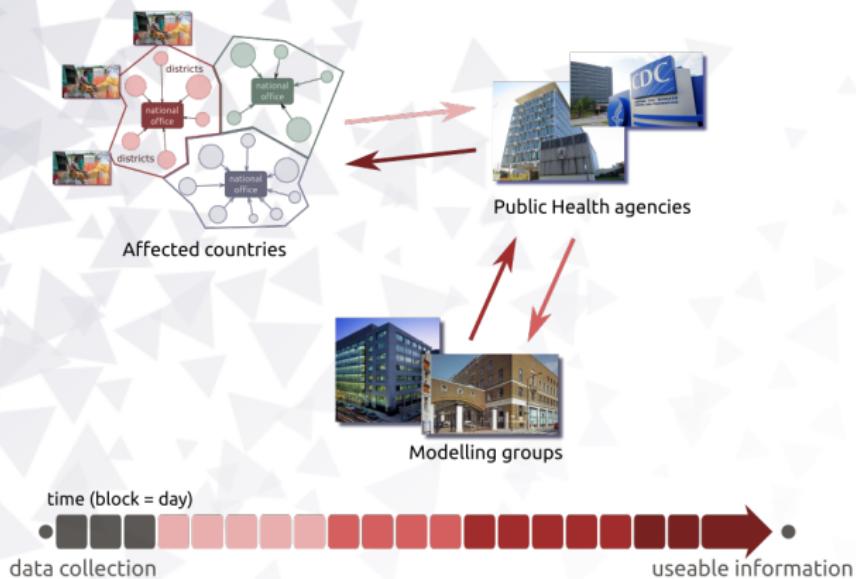
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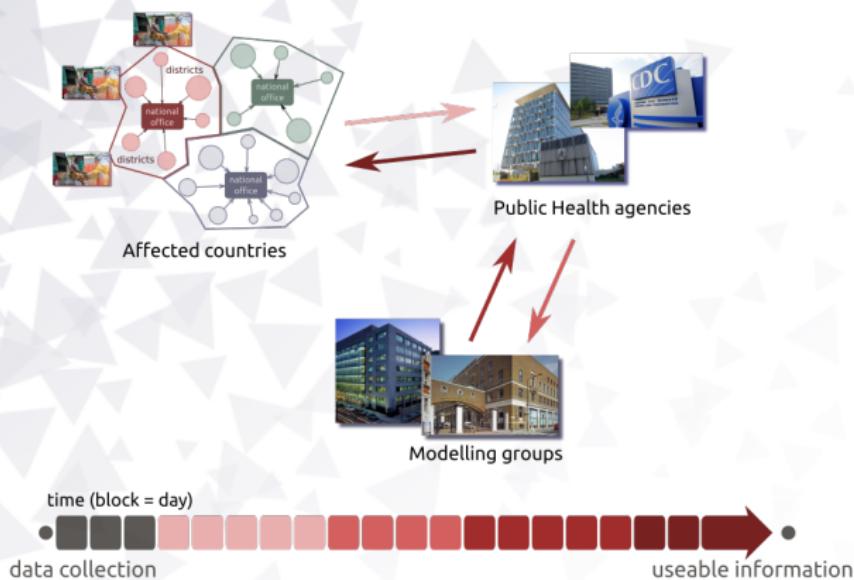


# Informing the response in 'real time' ?



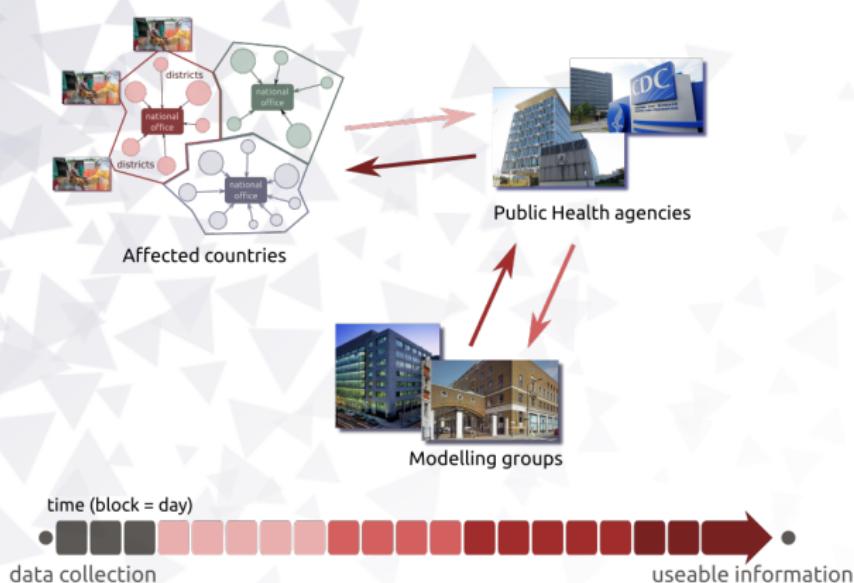
- good **tools** will shorten only some delays

# Informing the response in 'real time'?



- good **tools** will shorten only some delays
- potential for **embedding analysts** in response teams

# Informing the response in 'real time' ?



- good **tools** will shorten only some delays
- potential for **embedding analysts** in response teams
- two-way road: lots to learn from the field for analysts

# Who do we need to develop outbreak analytics tools?



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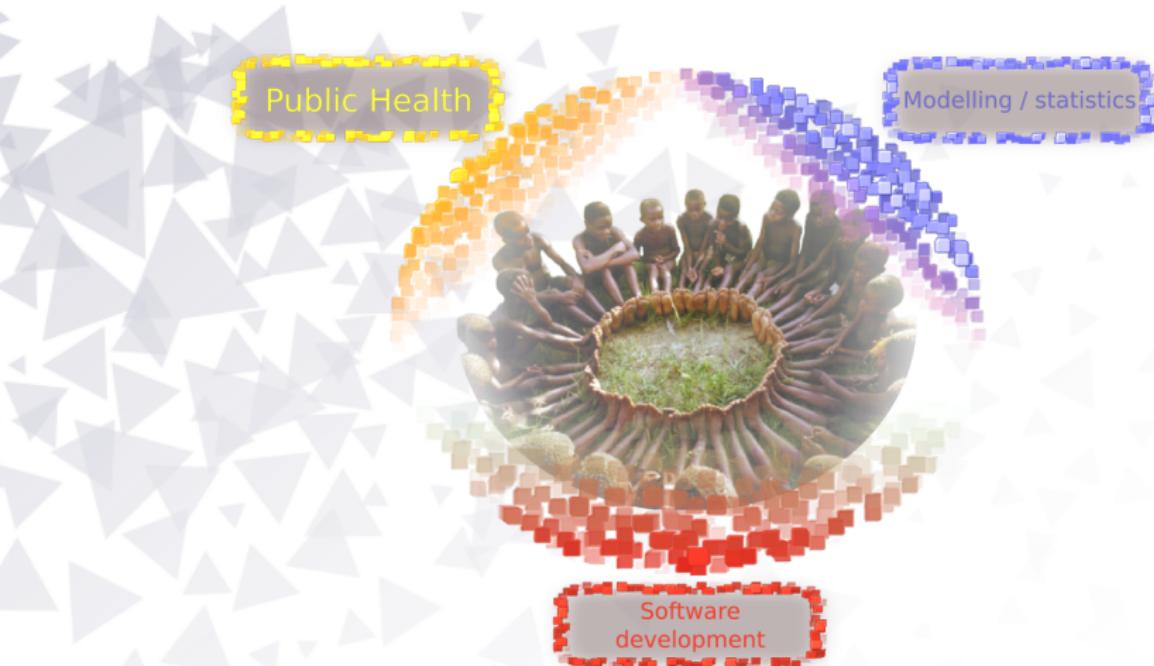
Public Health



# Who do we need to develop outbreak analytics tools?



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How do we bring these people together?

# 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 representing the themes and technologies discussed during the Hackout 3 event. The words are arranged in a cluster, with larger words indicating more frequent topics.

Keywords include: functional, incubation, userfriendly, secure, dictionary, systems, testing, automated, continuous, rcpp, efficiency, collection, series, repository, fast, secured, bias, outbreaks, code, integration, reporting, vhl, gui, reporting, integration, reporting, delay, data, contact, report, contacts, peak, security, peak, transmission, censored, reproducible, tools, incubation, synchronised, anonymised, situation, epistemic, contact, delay, clean, time, interface tree, interface tree, outbreaker, fellow, symptoms, tracing, shiny, cdc, automation, lineelist, coda, incidence, cleaning, incidence, cleaning, ggplot, clusters, rates, reliable, contacttracing, parallel, bayesian, siteresult, estimation, curation, model, parameters, epidemics, genomics, distribution, encrypted, annotations, environments, mutations, linelist, reproduction, exposure period, period.

# From a hack to a pack



Hackout 3, summer 2016, Berkeley

A large cluster of words representing the tools and concepts used in the project, including:  
functional incubation  
userfriendly secure dictionary  
systems testing automated continuous  
collection series repository  
rpp efficiency number fast  
secured bias outbreaks  
parsing code integration  
reporting gui vhl  
unit data delay interface tree  
epidemiologist contact follow  
epilist compiled  
outbreaker symptoms  
tracing lineelist  
automation automation  
epicontacts incidence  
ggplot clusters rates  
parallel reliable contacttracing  
parameters epidemics genomics  
distribution

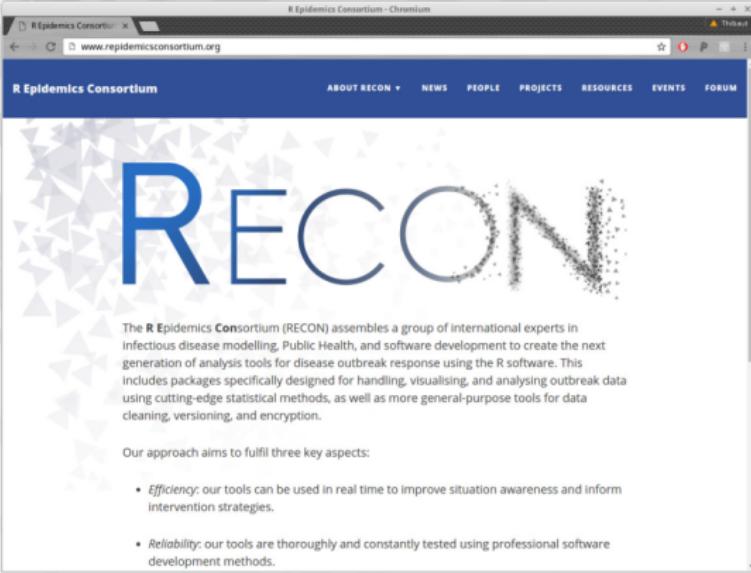
**RECON**  
[The R Epidemics Consortium]

# 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" browser. The URL in the address bar is [www.repidemcisconsortium.org](http://www.repidemcisconsortium.org). The page has a dark blue header with the "RECON" logo and navigation links for ABOUT RECON, NEWS, PEOPLE, PROJECTS, RESOURCES, EVENTS, and FORUM. The main content area features a large, stylized "RECON" title where the letters are composed of small dots. Below the title is a paragraph of text about the consortium's mission, followed by a section titled "Our approach aims to fulfil three key aspects:" with two bullet points.

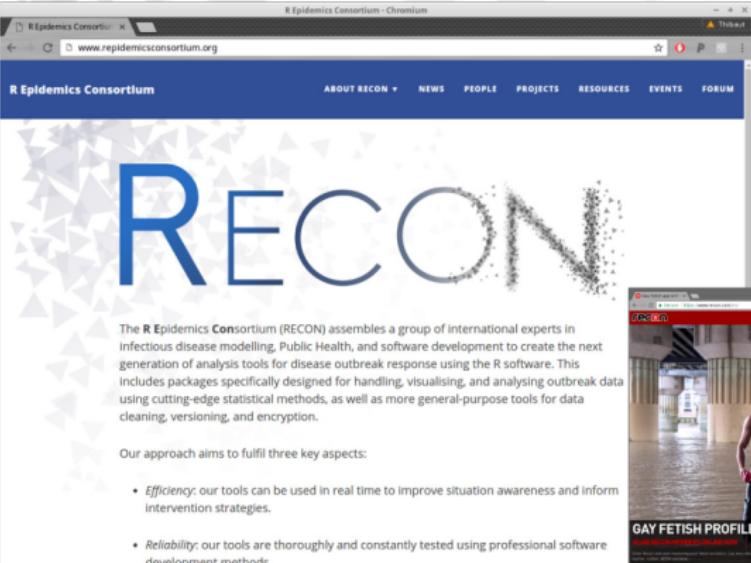
The R Epidemics Consortium (RECON) assembles a group of international experts in infectious disease modelling, Public Health, and software development to create the next generation of analysis tools for disease outbreak response using the R software. This includes packages specifically designed for handling, visualising, and analysing outbreak data using cutting-edge statistical methods, as well as more general-purpose tools for data cleaning, versioning, and encryption.

Our approach aims to fulfil three key aspects:

- *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.

# RECON: the R Epidemics Consortium

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



The screenshot shows the homepage of the RECON website. The title "RECON" is prominently displayed in large blue letters, with the "O" composed of numerous small dots. Below the title is a paragraph of text about the consortium's mission. A sidebar on the left lists three key aspects: Efficiency, Reliability, and Transparency. To the right of the main content is a smaller window showing a different website for "GAY FETISH PROFILES FOR MEN".

**RECON**

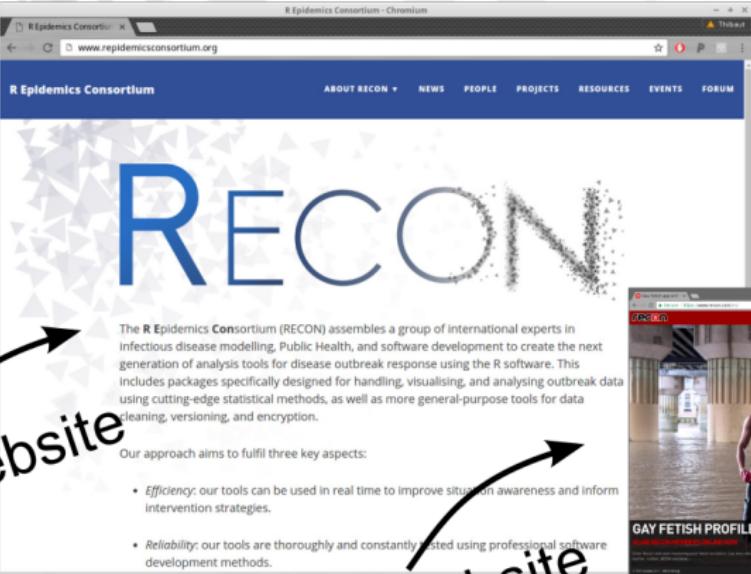
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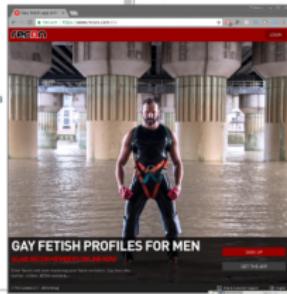
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**Our website**

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- *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.
- *Transparency:* our tools are open source and released under the GNU General Public License Version 3.



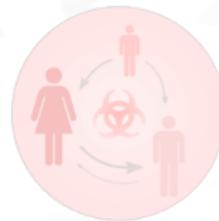
# RECON

*[www.repidemicsconsortium.org](http://www.repidemicsconsortium.org)*

- started 6th September 2016
- ~70 members
- 20 countries, > 40 institutions
- ~ 9 packages released, 15 under development
- public forum, blog, online resources

# RECON packages

- released (9): epicurves, contact data, transmissibility, forecasting, outbreak reconstructions



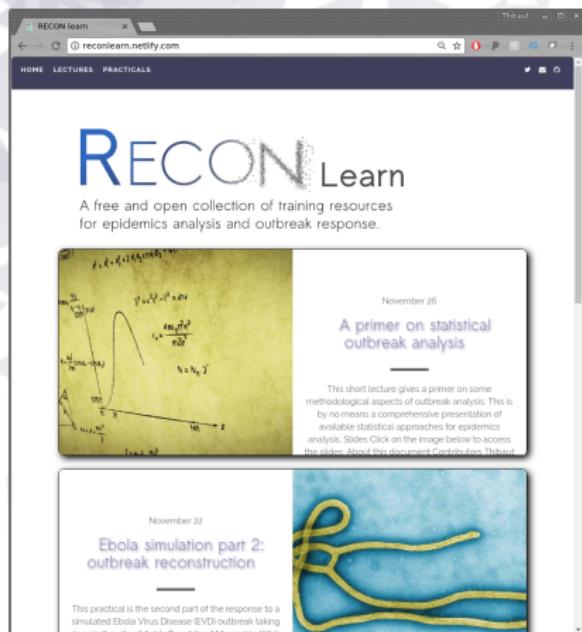
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- released (9): epicurves, contact data, transmissibility, forecasting, outbreak reconstructions
- upcoming (~15): deployable systems (RECON deployer), population flows, outbreak clusters, reproducible data cleaning, GUIs
- planned (?): automated reports, mapping, outbreak simulators

# *RECON learn:* training resources for epidemics analysis



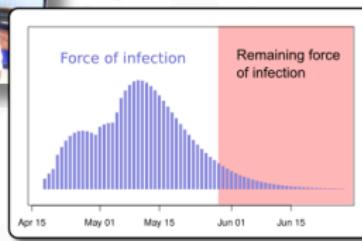
[reconlearn.netlify.com](http://reconlearn.netlify.com)

- repository for free, open training material
- lectures, practicals, case studies, code gists
- emphasis on community contributions
- podcast: **Rtips** on YouTube

# Supporting outbreak response in the field: Ebola outbreak in Likati (DRC) 2017



- Ebola outbreak April-May 2017
- small scale (8 confirmed / probable cases)
- challenging settings: remote, rural area (jungle), poor WASH
- statistical analysis part of sitrep, discouraged scaling up



# RECON events

The screenshot shows a web browser window with the URL [www.repidemicsconsortium.org/events/](http://www.repidemicsconsortium.org/events/). The page has a header with the 'Epidemics Consortium' logo and navigation links for About RECON, News, People, Projects, Resources, Events, and Forum. The main content features a large title 'Events' and a section titled 'RECON gathering'. It describes these events as larger meetings aimed at fostering exchanges within the community, drawing a snapshot of state-of-the-art epidemic analysis tools, discussing recent outbreak response challenges as well as future directions taken by our field, and creating new projects. A bullet point lists 'RECON gathering 1 (2018, London): Challenges and Opportunities in Outbreak Response Analytics'. Below this, another section titled 'RECON Hackfests' discusses how these events continue the process initiated during the Hackout events, bringing people together to make new advances in the development of tools for outbreak response. It lists two hackfests: 'Hackfest 1 (2017, London): making outbreak analysis easier and prettier' and 'Hackfest 2 (2017, London): mapping epidemics'.

- **hackathons:** code-focussed workshops (RECON Hackfest 1 and 2 in 2017)

*www.repidemicsconsortium.org/  
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- **hackathons:** code-focussed workshops (RECON Hackfest 1 and 2 in 2017)
- **short courses:** Epidemics6, Bogota, CDC, EPIET alumni network, PHE, WHO, MSF, ...

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- **hackathons:** code-focussed workshops (RECON Hackfest 1 and 2 in 2017)
- **short courses:** Epidemics6, Bogota, CDC, EPIET alumni network, PHE, WHO, MSF, ...
- **larger meetings:** here and now!

*www.repidemicsconsortium.org/  
events/*

The background of the slide features a large number of small, light-gray triangles of various sizes scattered across the entire area, creating a subtle geometric pattern.

## This meeting

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## Session 1. Outbreak response in the field

- Recent outbreak responses
- What are the questions, the constraints, and the challenges?
- Technical needs, methodological problems

## This afternoon (1/2)



### Session 2. Data analytics and modelling for outbreak response

- Statistics and modelling for informing outbreak response
- How to increase situation awareness?
- Potential and limitations

## This afternoon (2/2)



### Session 3. Looking ahead: new initiatives in outbreak response

- Impact of new technologies (e.g. DNA sequencing)
- Tomorrow's toolbox for field epidemiology
- Working better together: multidisciplinary response teams

## Parallel session 4a. Training and tools development: reflection and perspectives

- Current state of analytics in field epidemiology training
- What are the gaps? How can we help filling them?

## **Parallel session 4a.** Training and tools development: reflection and perspectives

- Current state of analytics in field epidemiology training
- What are the gaps? How can we help filling them?

## **Parallel session 4b.** Community-driven hackathon for epidemics analysis

- Community-contributed project fair
- A few hours to generate pilot results
- Most promising projects will form our future RECON Hackfests

# Making connections



Connecting **questions** and answers..

# Making connections



Connecting **questions** and **answers**.. often relies on connecting the right people.

# Making connections



Connecting **questions** and **answers**.. often relies on **connecting the right people**. Use this event to:

- **meet** people
- **exchange** experiences and viewpoints
- **start** new projects and collaborations