

# Real-time analysis of COVID-19 – epidemiology, statistics and modelling in action

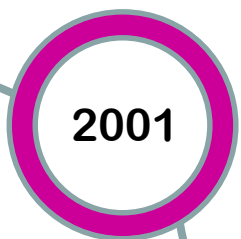
Christl Donnelly

**Department of Statistics**  
*University of Oxford*

**WHO Collaborating Centre for Infectious Disease Modelling**  
**MRC Centre for Global Infectious Disease Analysis**  
**Abdul Latif Jameel Institute for Disease and Emergency Analytics**  
*Department of Infectious Disease Epidemiology*  
*Imperial College London*



**BSE/vCJD  
in the UK**



**FMD  
in the UK**



**SARS  
in Hong Kong**



**Pandemic  
Influenza**



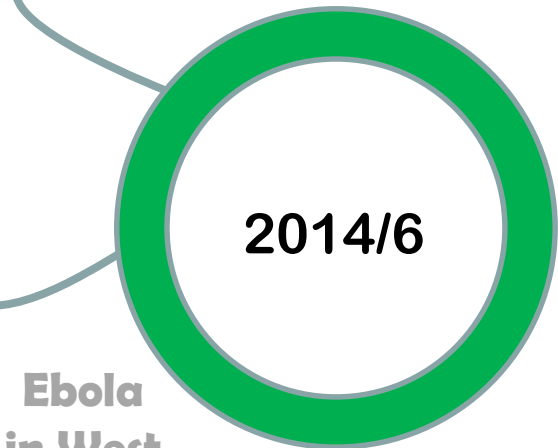
**MERS  
in Saudi  
Arabia**



**Ebola  
in DRC**



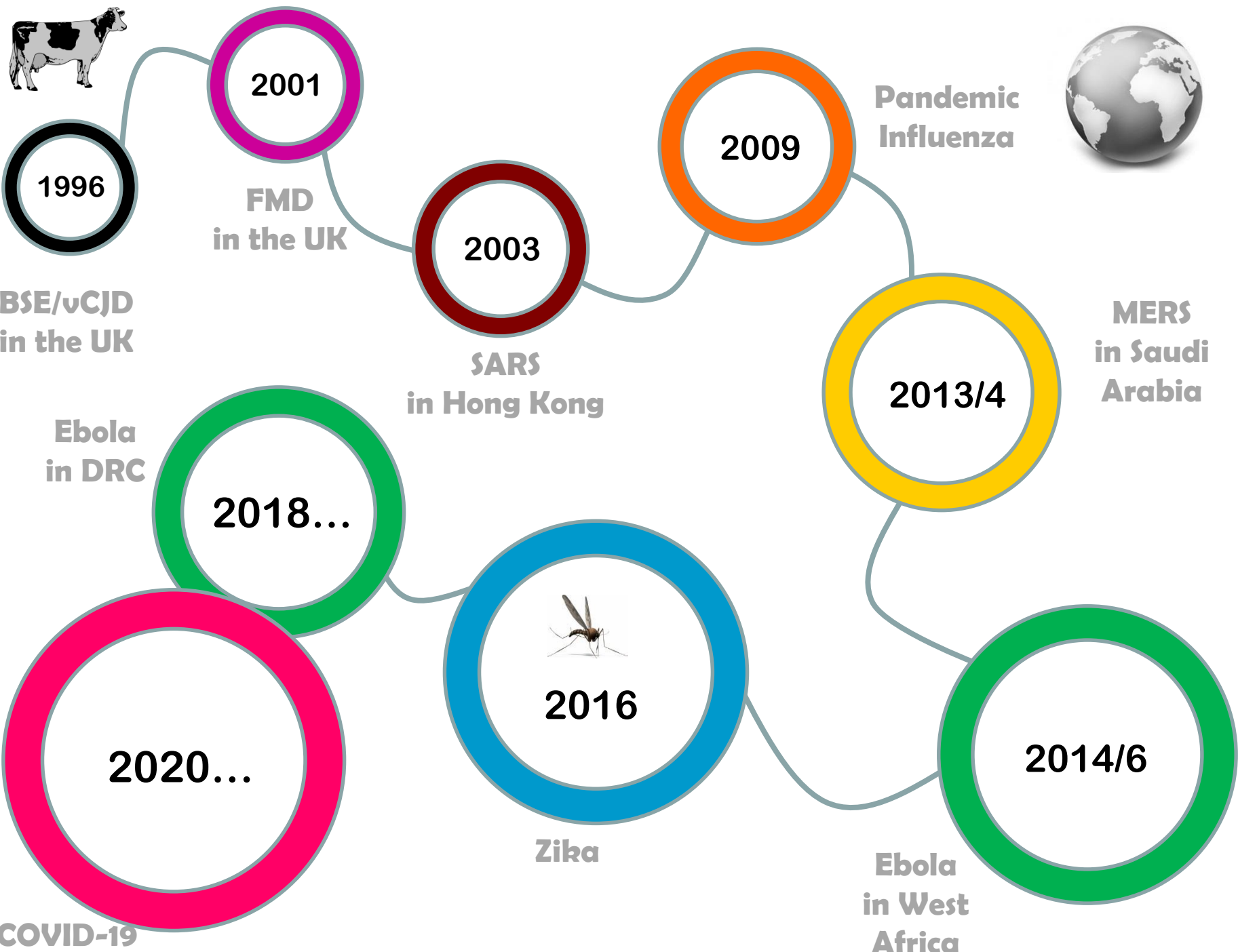
**Zika**



**Ebola  
in West  
Africa**



**COVID-19**



# What do you most want to know?

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- What are the symptoms? Characterise cases
- How many cases are there? Estimate cases in source from exportations
- How many cases might there be? Estimate epidemic growth
- How serious is the disease? Estimate the CFR
- If someone is exposed to infection, how long till they know if they are free of infection? Estimate the incubation period distribution
- How might we control the disease? Consider options, including isolation, quarantine, vaccination, as data allow.

Relevant paper: Cori A., Donnelly CA, Dorigatti I, *et al.* Key data for outbreak evaluation: building on the Ebola experience. *Phil. Trans. R. Soc. B372*, 20160371, 2017. <http://dx.doi.org/10.1098/rstb.2016.0371>

# Real-time analyses

As of 30 June 2020:

medRxiv receiving many new papers on coronavirus SARS-CoV-2. A reminder: these are preliminary reports that have not been peer-reviewed. They should not be regarded as conclusive, guide clinical practice/health-related behavior, or be reported in news media as established information.

## COVID-19 SARS-CoV-2 preprints from medRxiv and bioRxiv

5935 Articles (4730 medRxiv, 1205 bioRxiv)

Most recent first Page 1: Articles 1-10 | Next

**Inexpensive multi-patient respiratory monitoring system for helmet ventilation during COVID-19 pandemic**  
 Princeton Open Ventilation Monitor Collaboration, Bourriane, P, Chidzik, S, Cohen, D, J, Elmer, P, Hollowell, T, Kilbaugh, T, J, Lange, D, Leifer, A. M., Marlow, D. R., Meyers, P. D., Normand, E., Nunes, J., Oh, M., Page, L., Pereira, T., Pivarski, J., Schreiner, H., Stone, H. A., Tank, D. W., Thiberge, S., Tully, C.  
 10.1101/2020.06.29.20141283 — Posted: 2020-06-30

**EVALUATION OF THE ABBOTT SARS-COV-2 IG-G ASSAY.**  
 Lau, C., Hoo, S., Liang, Y., Aw, T.  
 10.1101/2020.06.28.20132498 — Posted: 2020-06-30

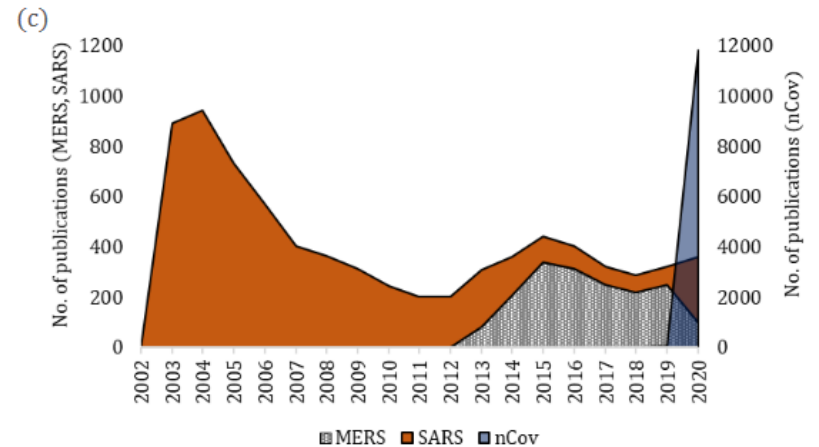
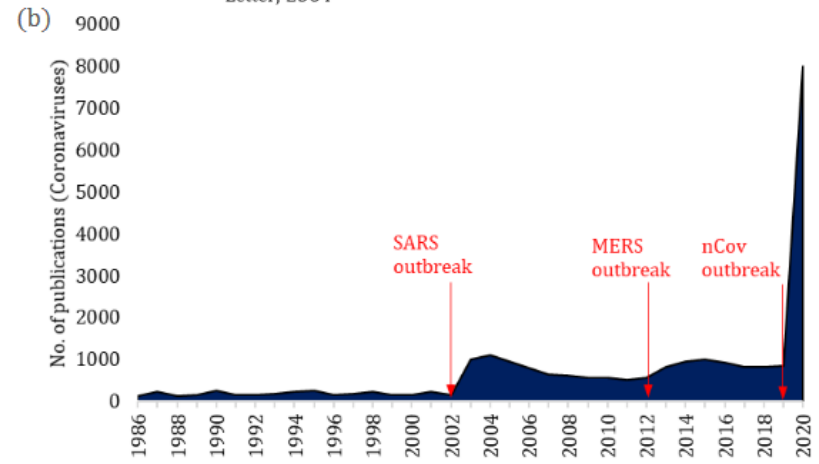
**SARS-CoV-2 serological testing using electrochemiluminescence reveals arapid onset of seroconversion in severe COVID-19 patients**  
 Munitz, A., Edry-Botzer, L., Itan, M., Tür-Kaspa, R., Dicker, D., Markovitch, D., Goren, M., Mor, M., Lev, S., Gottesman, T., Muhsen, K., Cohen, D., Qimron, U., Freund, N., Wine, Y., Gerlic, M., Stein, M.  
 10.1101/2020.06.28.20141838 — Posted: 2020-06-30

**Assessment of a Diagnostic Strategy Based on Chest Computed Tomography in Patients Hospitalized for COVID-19 Pneumonia: an observational study**  
 Thieux, M., Kalenderian, A. C., Chabrol, A., Gendt, L., Giraudier, E., Lelievre, H., Lounis, S., Mataix, Y., Moderni, E., Paradisi, L., Ranchon, G., El Khoury, C.  
 10.1101/2020.06.29.20140129 — Posted: 2020-06-30

**Subject Areas**

All Articles

- Addiction Medicine
- Allergy and Immunology
- Anesthesia
- Cardiovascular Medicine
- Dentistry and Oral Medicine
- Dermatology
- Emergency Medicine
- Endocrinology (including Diabetes Mellitus and Metabolic Disease)
- Epidemiology
- Forensic Medicine
- Gastroenterology
- Genetic and Genomic Medicine
- Geriatric Medicine
- Health Economics
- Hematology
- HIV/AIDS
- Infectious Diseases (except HIV/AIDS)



Temporal distributions of  
 (b) the number of Coronavirus studies,  
 (c) the SARS, MERS and Covid-19 studies.

from Haghani & Bliemer  
<https://www.biorxiv.org/content/10.1101/2020.05.31.126813v1.full>

# MRC Centre for Global Infectious Disease Analysis

## COVID-19

- COVID-19 reports**
- COVID-19 planning tools
- COVID-19 scientific resources
- COVID-19 public resources
- COVID-19 publications

### Contact us

For any enquiries related to the MRC Centre please contact:

**Scientific Manager**  
Susannah Fisher  
+44 (0)20 7594 1031

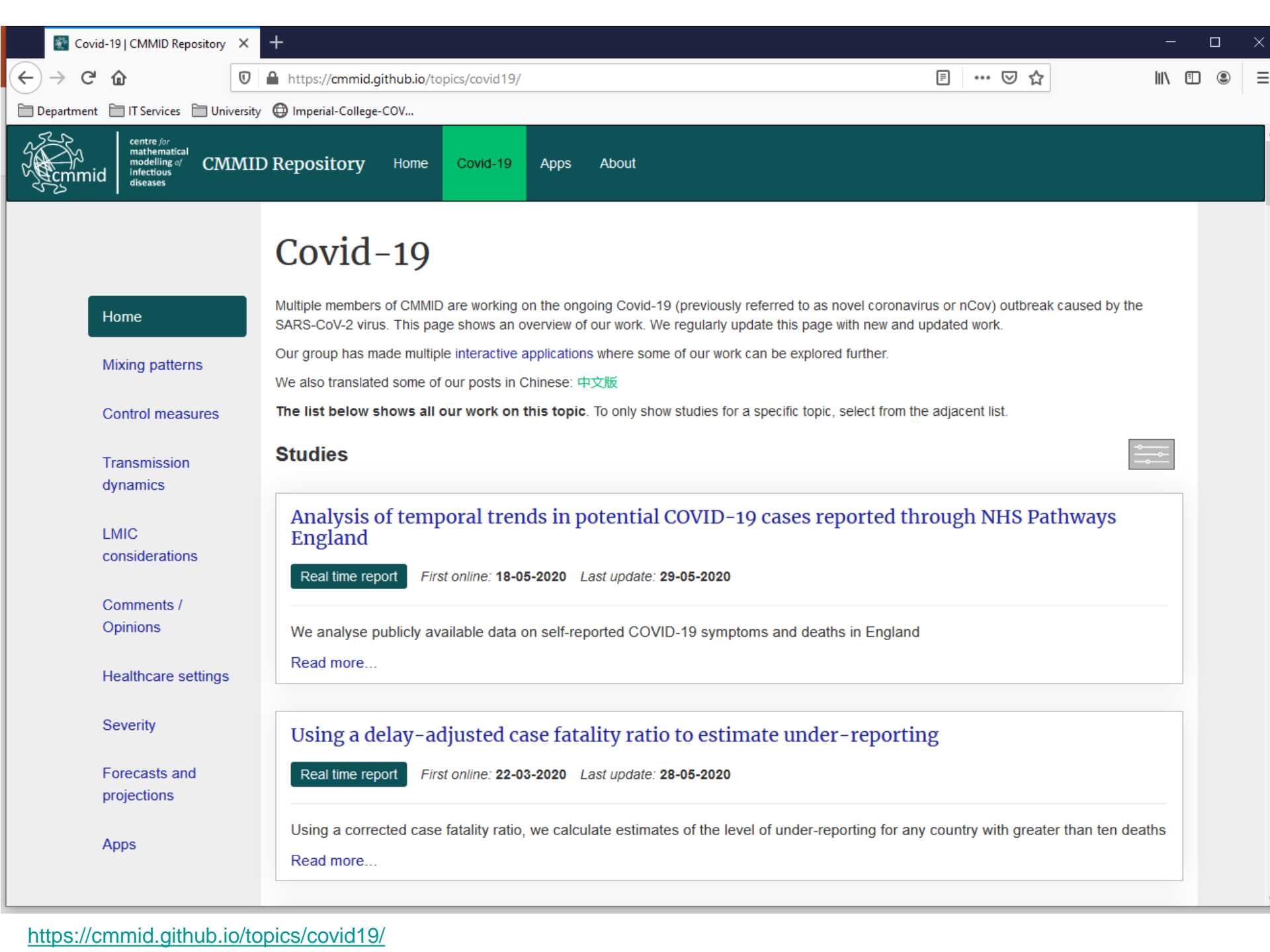
**External Relationships and Communications Manager**  
Sabine L. van Elstrand  
+44 (0)20 7594 3896

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## COVID-19 reports

Since the emergence of the new coronavirus (COVID-19) in December 2019, we have adopted a policy of immediately sharing research findings on the developing pandemic. This page provides all publicly published online reports by the Imperial College COVID-19 Response Team.

- Report 28: 18 June 2020**  
Excess non-COVID-19 deaths in England and Wales between 29th February and 5th June 2020  
[Find out more](#)
- Report 27: 15 June 2020**  
Adapting hospital capacity to meet changing demands during the COVID-19 pandemic  
[Find out more](#)
- Report 26: 8 June 2020**  
Reduction in mobility and COVID-19 transmission  
[Find out more](#)
- Report 25: 29 May 2020**  
Response to COVID-19 in South
- Report 24: 29 May 2020**  
Anonymised and aggregated
- Report 23: 21 May 2020**  
State-level tracking of COVID-19



Home

Mixing patterns

Control measures

Transmission dynamics

LMIC considerations

Comments / Opinions

Healthcare settings

Severity

Forecasts and projections

Apps

# Covid-19

Multiple members of CMMID are working on the ongoing Covid-19 (previously referred to as novel coronavirus or nCov) outbreak caused by the SARS-CoV-2 virus. This page shows an overview of our work. We regularly update this page with new and updated work.

Our group has made multiple [interactive applications](#) where some of our work can be explored further.

We also translated some of our posts in Chinese: [中文版](#)

**The list below shows all our work on this topic.** To only show studies for a specific topic, select from the adjacent list.

## Studies



### Analysis of temporal trends in potential COVID-19 cases reported through NHS Pathways England

**Real time report** First online: 18-05-2020 Last update: 29-05-2020

We analyse publicly available data on self-reported COVID-19 symptoms and deaths in England

[Read more...](#)

### Using a delay-adjusted case fatality ratio to estimate under-reporting

**Real time report** First online: 22-03-2020 Last update: 28-05-2020

Using a corrected case fatality ratio, we calculate estimates of the level of under-reporting for any country with greater than ten deaths

[Read more...](#)

World Map

U.S. Map

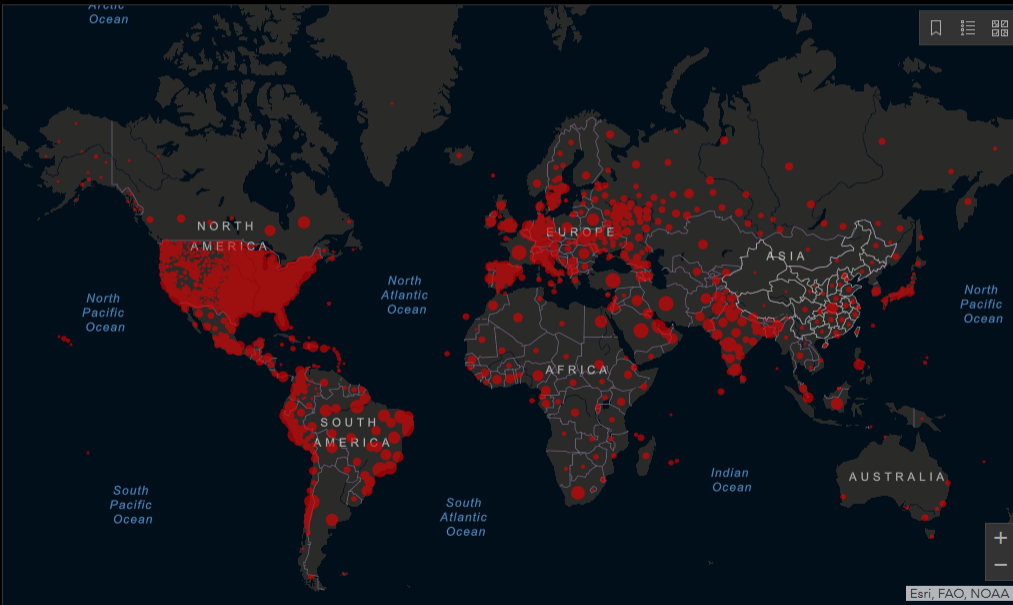
Critical Trends

COVID-19 Dashboard by the Center for Systems Science and Engineering (CSSE) at Johns Hopkins University (JHU)

Total Confirmed 10,424,992

Confirmed Cases by Country/Region /Sovereignty

- 2,683,000 US
- 1,368,195 Brazil
- 646,929 Russia
- 566,840 India
- 313,470 United Kingdom
- 282,365 Peru
- 275,999 Chile
- 248,970 Spain
- 240,436 Italy
- 227,662 Iran
- 220,657 Mexico
- 209,337 Pakistan
- 201,522 France
- 198,613 Turkey
- 195,391 Germany



Cumulative Confirmed Cases Active Cases Incidence Rate Case-Fatality Ratio Testing Rate Hospitalization Rate

188

countries/regions

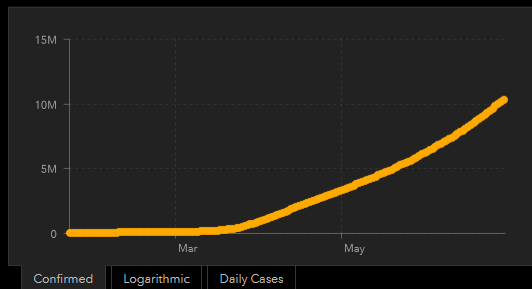
Lancet Inf Dis Article: Here, Mobile Version: Here. Lead by JHU CSSE, Technical Support: Esri Living Atlas team and JHU APL, Financial Support: JHU and NSF. Click here to donate to the CSSE dashboard team, and other JHU COVID-19 Research Efforts. FAQ. Read more in this blog, Contact US.

Global Deaths 509,706

- 129,545 deaths US
- 58,314 deaths Brazil
- 43,660 deaths United Kingdom
- 34,744 deaths Italy
- 29,816 deaths France
- 28,346 deaths Spain
- 27,121 deaths Mexico

US State Level Deaths, Recovered

- 31,403 deaths, 70,435 recovered New York US
- 14,992 deaths, 30,163 recovered New Jersey US
- 8,094 deaths, recovered Massachusetts US
- 6,902 deaths, recovered Illinois US
- 6,614 deaths, 67,070 recovered Pennsylvania US
- 6,161 deaths, 51,099 recovered Michigan US
- 5,983 deaths, recovered California US



Last Updated at (M/D/YYYY) 6/30/2020 2:33:53 p.m.

# Magnitude of the epidemic

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$$\text{Total number of cases} = \frac{\text{number of cases detected outside China}}{\text{probability any one case will be detected outside China}}$$

where the probability any one case will be detected overseas ( $p$ ) is given

$$p = \text{daily probability of international travel} \times \text{mean time to detection of a case}$$

The daily probability of travel is calculated by:

$$= \frac{\text{daily probability of international travel} \times \text{daily outbound international travellers from Wuhan}}{\text{catchment population of Wuhan airport}}$$

Finally, the mean time to detection can be approximated by:

$$\begin{aligned} \text{mean time to detection} \\ = \text{incubation period} + \text{mean time from onset of symptoms to detection} \end{aligned}$$



## 17 January 2020 Report 1

	Baseline	Smaller catchment	Shorter detection window
Exported number of confirmed cases	3	3	3
Daily international passengers travelling out of Wuhan International Airport	3,301	3,301	3,301
Effective catchment population of Wuhan International Airport	19 million	11 million	19 million
Detection window (days)	10 days	10 days	8 days
Estimated total number of cases (95% CI)	<b>1,723</b> <b>(427 – 4,471)</b>	996 (246 – 2,586)	2,155 (535 – 5,590)

## New virus in China 'will have infected hundreds'

By James Gallagher  
Health and science correspondent

🕒 18 January 2020



Coronavirus pandemic



There were six coronaviruses known to infect people before the latest discovery

The number of people already infected by the mystery virus emerging in China is far greater than official figures suggest, scientists have told the BBC.

There have been **more than 60** confirmed cases of the new coronavirus, but UK experts estimate a figure nearer **1,700**.

Two people are known to have died from the respiratory illness, which appeared in Wuhan city in December.

"I am substantially more concerned than I was a week ago," disease outbreak scientist Prof Neil Ferguson, said.

The work was conducted by the MRC Centre for Global Infectious Disease Analysis at Imperial College London, which advises bodies including the UK government and the World Health Organization (WHO).

17 January 2020  
Report 1

22 January 2020  
Report 2

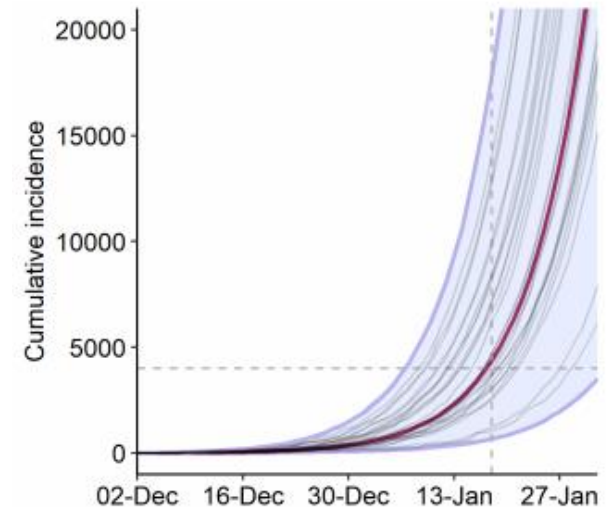
	Baseline	Smaller catchment	Shorter detection window	Baseline	Smaller catchment	Shorter detection window
Exported number of confirmed cases	3	3	3	7	7	7
Daily international passengers travelling out of Wuhan International Airport	3,301	3,301	3,301	3,301	3,301	3,301
Effective catchment population of Wuhan International Airport	19 million	11 million	19 million	19 million	11 million	19 million
Detection window (days)	10 days	10 days	8 days	10 days	10 days	8 days
Estimated total number of cases (95% CI)	<b>1,723 (427 – 4,471)</b>	996 (246 – 2,586)	2,155 (535 – 5,590)	<b>4,000 (1,700 – 7,800)</b>	2,300 (1,000 – 4,500)	5,000 (2,200 – 9,700)

# How have case numbers grown?

Table 1: Best-case, central and worst-case estimates of 2019-nCoV human-to-human  $R_0$  compatible with either 4000 (top half of table) or 1000 (bottom half of table) total cases by 18/01/2020. Values of  $R_0 > 1$  represent self-sustaining human-to-human and are highlighted in red. Baseline estimates highlighted in bold.

Number of cases caused by zoonotic exposure	Assumed total number of cases by 18/01/2020	Best-case $R_0$	Central (median) $R_0$	Worst-case $R_0$
<b>40</b>	<b>4000</b>	<b>2.1</b>	<b>2.6</b>	<b>3.5</b>
80	4000	1.8	2.2	2.7
120	4000	1.7	2.0	2.4
160	4000	1.6	1.8	2.2
200	4000	1.5	1.7	2.0
40	1000	1.4	1.9	2.7
80	1000	1.2	1.5	2.0
120	1000	1.1	1.3	1.7
160	1000	1.0	1.2	1.5
200	1000	0.9	1.1	1.3

Assuming an 8.4 day average generation time



Natsuko Imai, Anne Cori, Iliaria Dorigatti, Marc Baguelin, Christl A. Donnelly, Steven Riley, Neil M. Ferguson  
 WHO Collaborating Centre for Infectious Disease Modelling, MRC Centre for Global Infectious Disease Analysis, J-IDEA, Imperial College London

# Case fatality ratio

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- Proportion of cases who eventually die from the disease;
- Often estimated by using aggregated numbers of cases and deaths at a single time point:

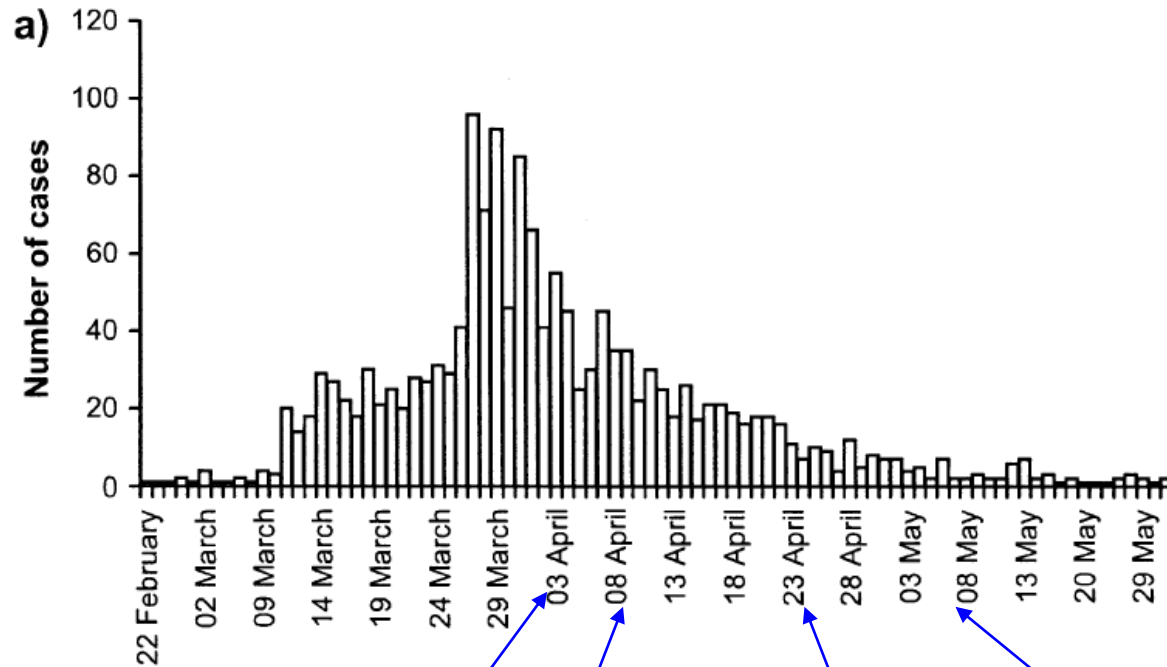
- E.g.: case fatality ratios compiled daily by WHO during the SARS outbreak:

estimate of the case fatality ratio:

number of deaths / total number of cases.

- Simple estimates of these reports can be misleading if, at the time of the analysis, the outcome (death or recovery) is unknown for an important proportion of patients.

# Proportion of observations censored in the SARS outbreak



**TABLE 1. Summary of the number of cases and the degree of censoring at different time points for the epidemic of severe acute respiratory syndrome in Hong Kong, 2003**

	Date						
	April 2	April 9	April 16	April 23	April 30	May 7	May 14
No. of cases	925	1,201	1,367	1,489	1,547	1,582	1,607
% of observations censored	85.9	81.2	71.5	51.6	35.1	25.2	17.3

We do not know the outcome (death or recovery) yet.

[Ghani *et al.* *AJE*, 2005]

# Simple methods

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- Method 1:

$$CFR = \frac{D}{C}$$

D = Number of deaths

C = Total number of cases

- Method 2:

$$CFR = \frac{D}{(D + R)}$$

D = Number of deaths

R = Number recovered

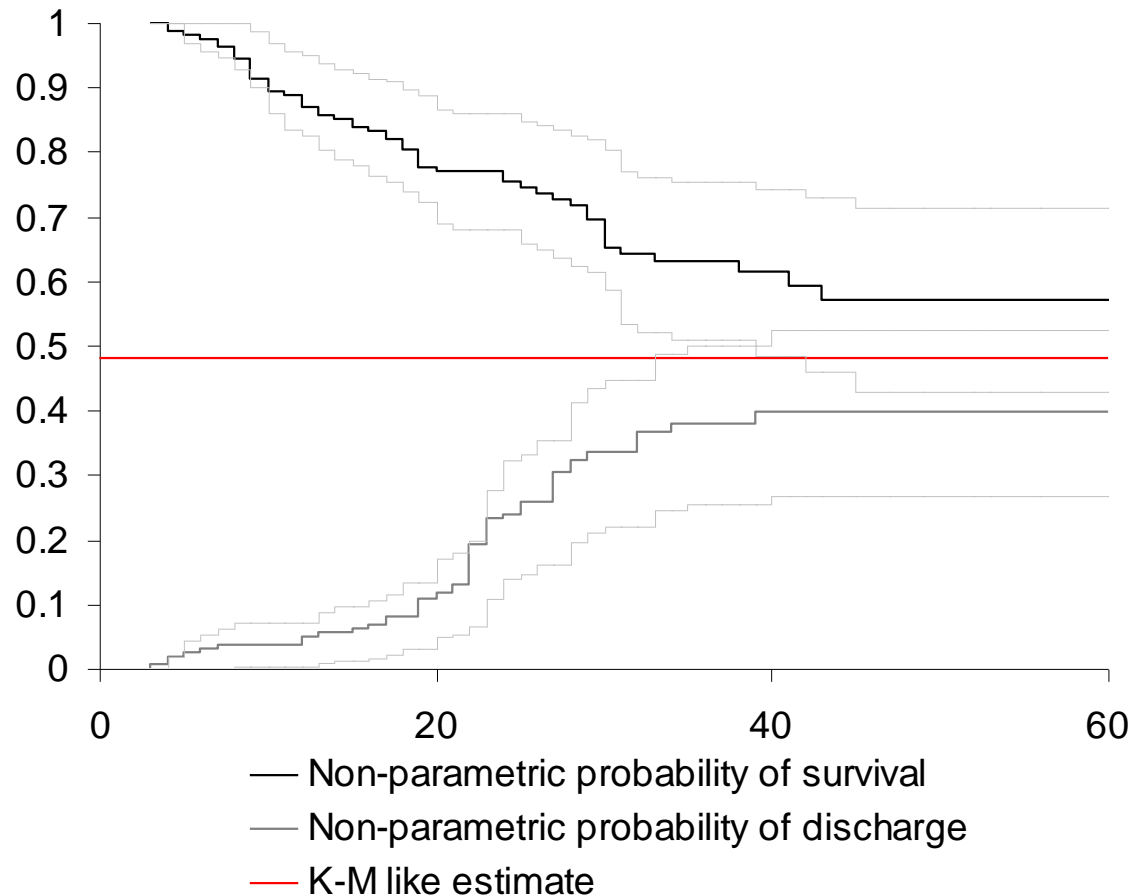
# Adapted Kaplan-Meier method

To extrapolate incomplete survivor functions, assume that death/discharge rate at the tail occurs at the same rate as previously:

$$\theta_0 = \frac{\hat{\theta}_0}{(\hat{\theta}_0 + \hat{\theta}_1)}$$

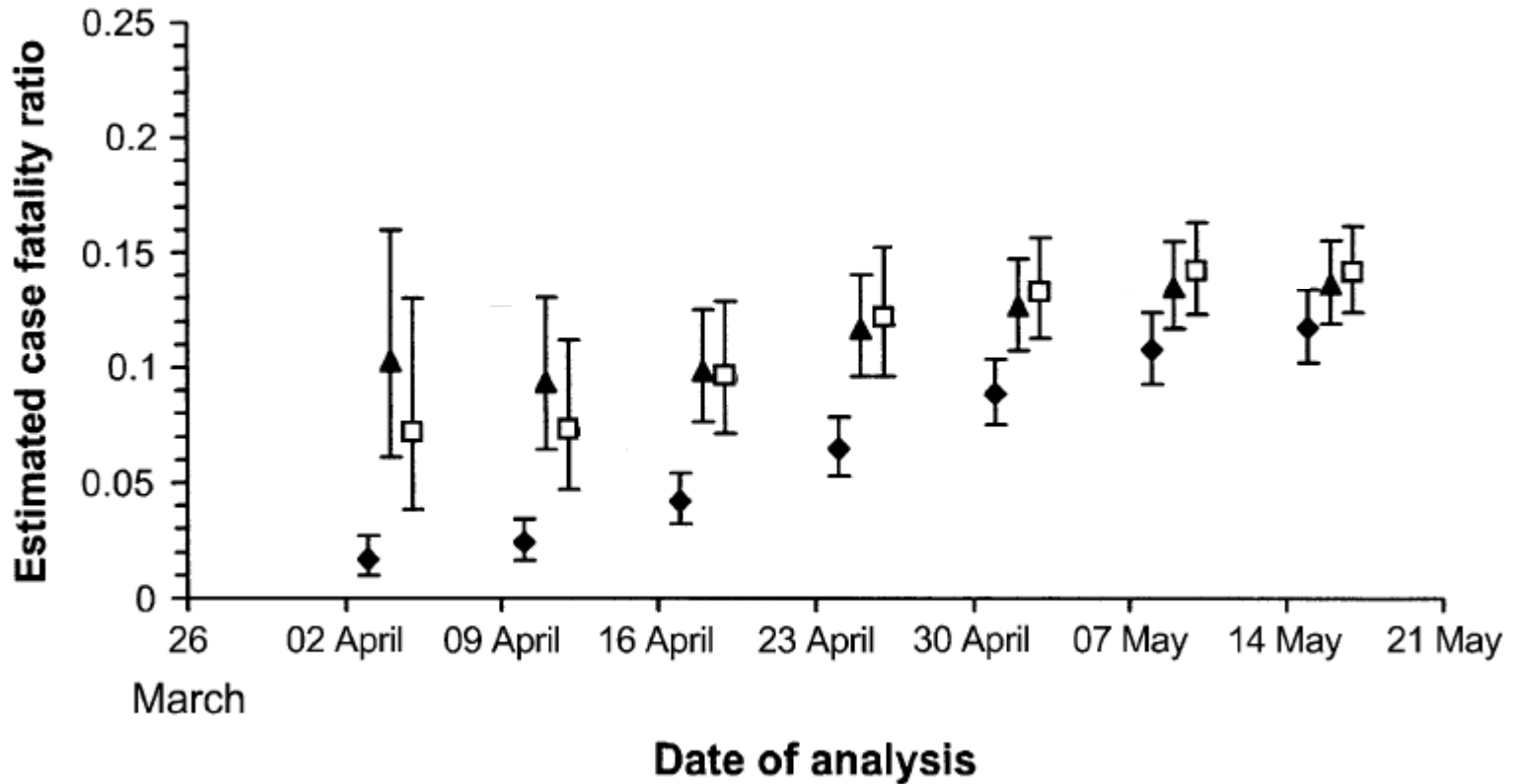
Proba death at the tail

Proba discharge at the tail





# Comparison of the estimates



■ Observed case fatality ratio

◆ Simple estimate 1 (deaths/cases)

▲ Simple estimate 2

□ KM-like method

deaths/(deaths+recoveries)

# Misinterpretation of the trend

**CNN.com/HEALTH**

SEARCH

The Web  CNN.com

Search

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- World
- U.S.
- Weather
- Business at CNNMoney
- Sports at SI.com
- Politics
- Law
- Technology
- Science & Space
- Health**
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- Special Reports
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- Video
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- SEARCH
- Web  CNN.com
- Search Powered by **YAHOO!**

## SARS becoming deadlier: Officials

Friday, April 25, 2003 Posted: 12:41 AM EDT (0441 GMT)

**HONG KONG, China -- As China takes drastic steps to contain the SARS virus, Hong Kong officials say the disease is proving more deadly than first thought.**

Global concern is mounting over the rising death rate as authorities clamor to contain the virus, quarantining people, sealing off hospitals, closing schools and installing heat scanners at airports.

Officials in the former British colony of Hong Kong -- the hardest-hit area along with China -- on Thursday revised the death rate from SARS to 7.2 percent from 5 percent.

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**The New York Times**

**Health**

WORLD U.S. N.Y. / REGION BUSINESS TECHNOLOGY SCIENCE HEALTH SPORTS OPINION

FITNESS & NUTRITION HEALTH CARE POLICY MENTAL HEALTH

## Death Rate From Virus More Than Doubles, Varying Sharply by Country

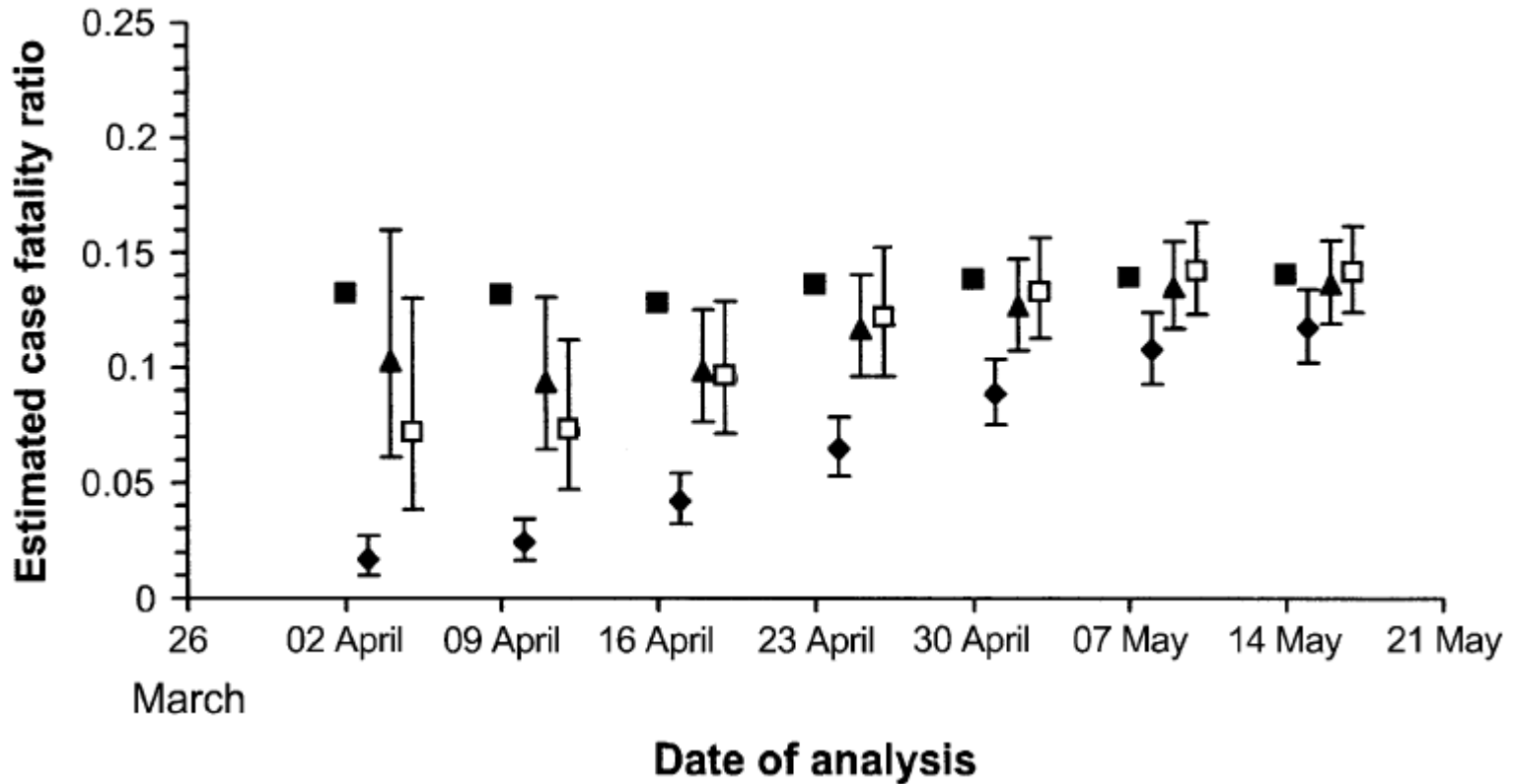
By LAWRENCE K. ALTMAN

Published: April 22, 2003

The death rate from severe acute respiratory syndrome has more than doubled, to 5.6 percent, since the epidemic was first detected in mid-March, causing deep concern among health officials.

Although the overall death rate, according to World Health Organization statistics, has hovered around 4 percent in the last three weeks, it has varied widely among the 26 countries, plus Hong Kong, with cases of the disease, known as SARS.

# Comparison of the estimates



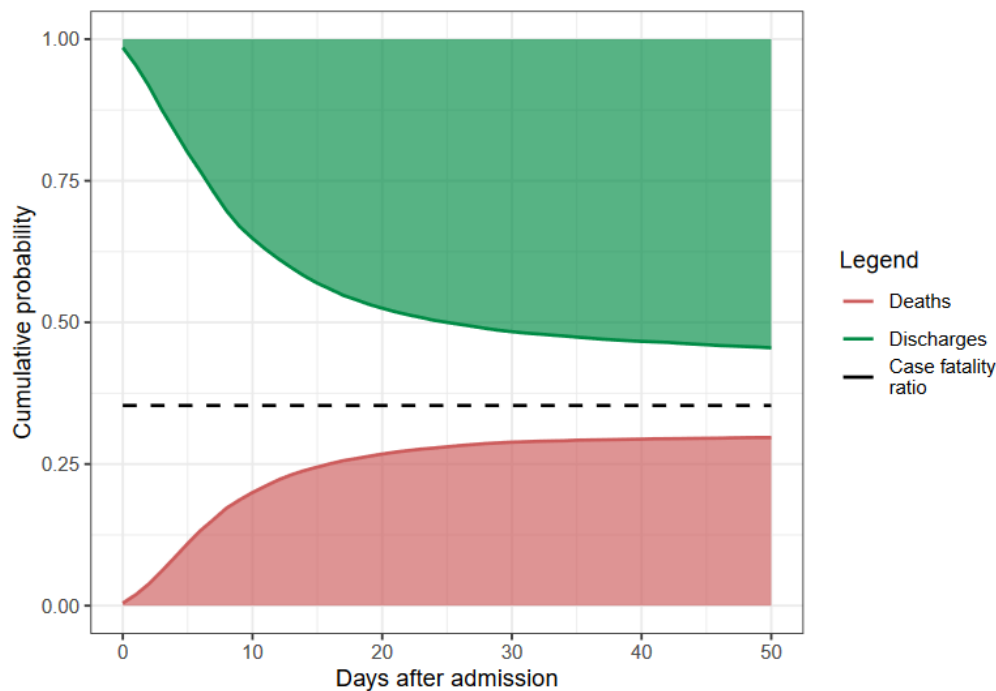
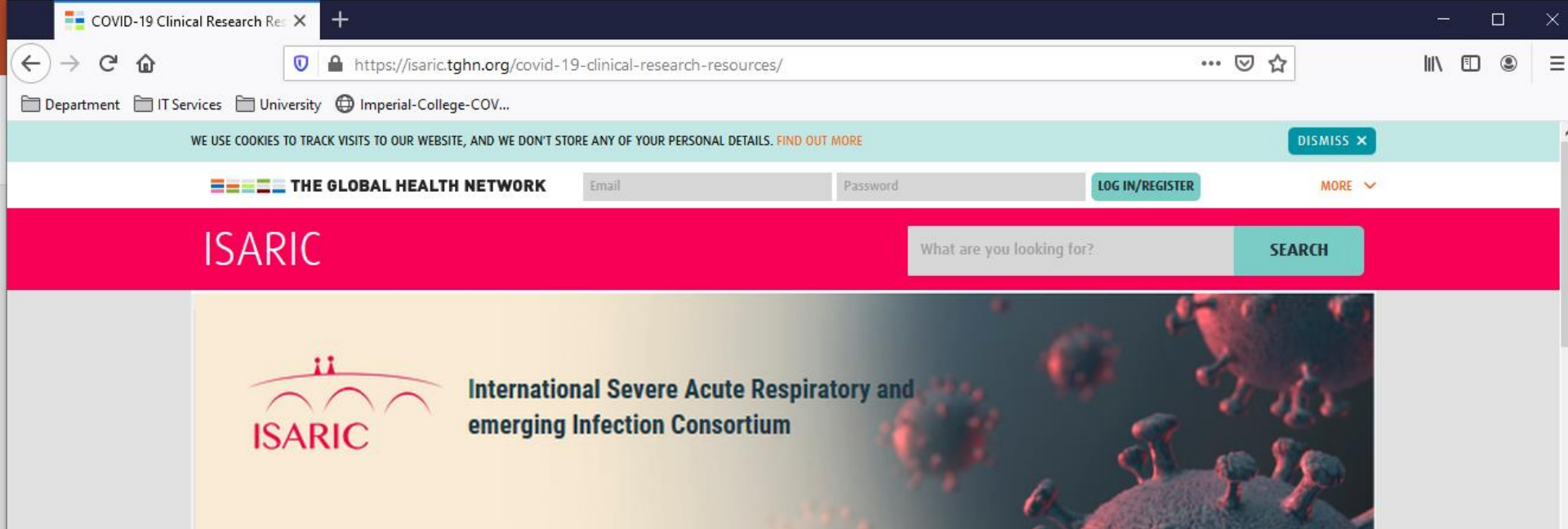
■ Observed case fatality ratio

◆ Simple estimate 1 (deaths/cases)

▲ Simple estimate 2

□ KM-like method

deaths/(deaths+recoveries)

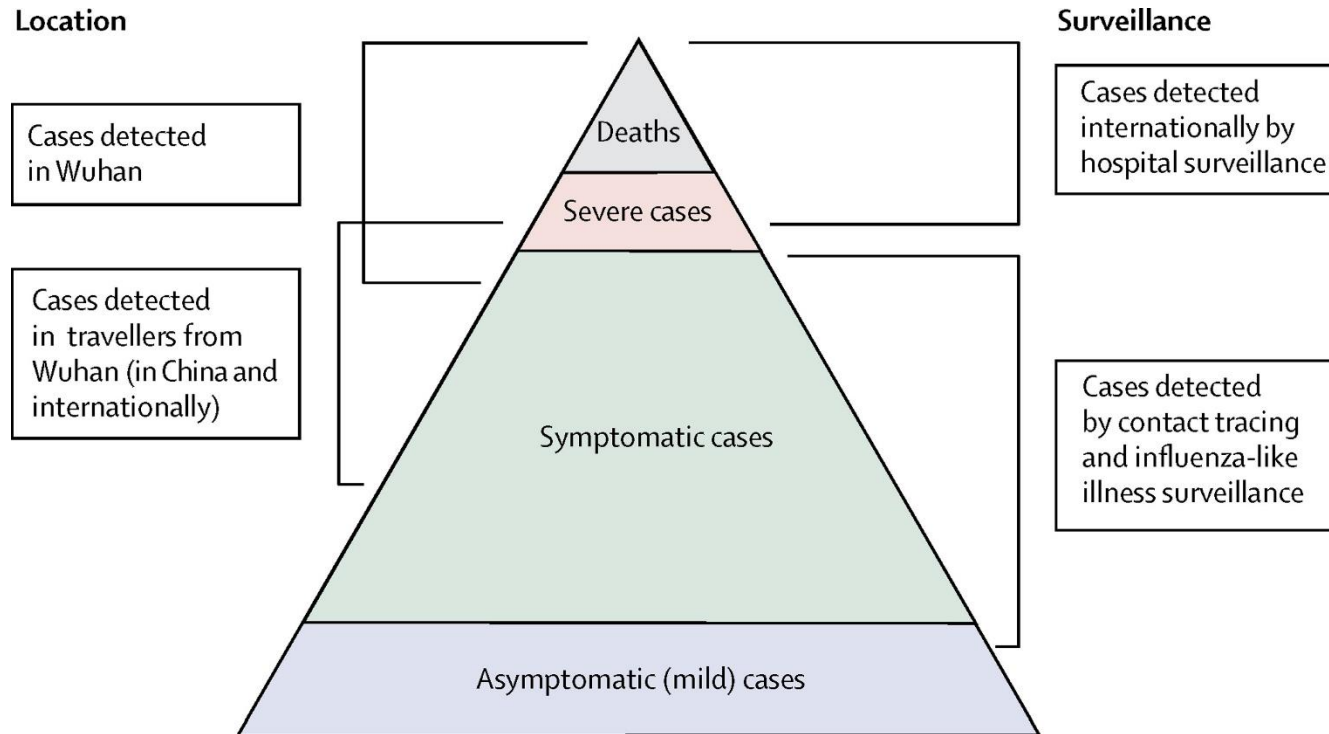


Probabilities of death (red curve) and recovery (green curve).

The black line indicates the case fatality ratio (CFR).

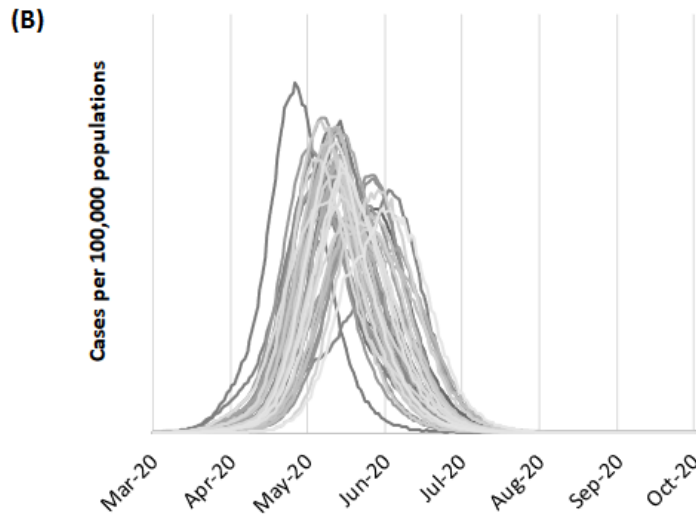
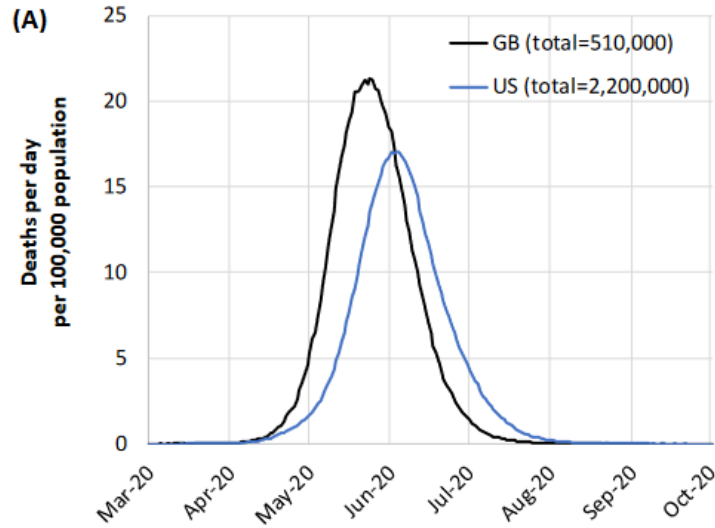
The point estimate of the CFR is 35% (95% CI: 34-36%).

# CFR vs IFR



# IFR estimates

Authors	Estimate	When available	Where
Verity <i>et al.</i> Imperial College London	1% (0.5-4)	Posted 10 Feb	<a href="https://www.imperial.ac.uk/media/imperial-college/medicine/mrc-gida/2020-02-10-COVID19-Report-4.pdf">https://www.imperial.ac.uk/media/imperial-college/medicine/mrc-gida/2020-02-10-COVID19-Report-4.pdf</a>
	0.66% (0.39-1.33)	Posted 13 Mar  Pub. 30 Mar	<a href="https://www.medrxiv.org/content/10.1101/2020.03.09.20033357v1">https://www.medrxiv.org/content/10.1101/2020.03.09.20033357v1</a>  <a href="https://www.thelancet.com/pdfs/journals/laninf/PIIS1473-3099(20)30243-7.pdf">https://www.thelancet.com/pdfs/journals/laninf/PIIS1473-3099(20)30243-7.pdf</a>
Chow <i>et al.</i> National Institutes of Health	0.17% (0.05-0.9) first week 0.8% (0.2-4) as of 15 April	Posted 5 May	<a href="https://www.medrxiv.org/content/10.1101/2020.04.29.20083485v1">https://www.medrxiv.org/content/10.1101/2020.04.29.20083485v1</a>
Grewelle & De Leo Stanford	1.04% (0.77-1.38)	Posted 18 May	<a href="https://www.medrxiv.org/content/10.1101/2020.05.11.20098780v1">https://www.medrxiv.org/content/10.1101/2020.05.11.20098780v1</a>
Rosenfeld <i>et al.</i> Institute for Disease Modelling	0.9%	“Results as of May 25”	<a href="https://covid.idmod.org/data/Modeling_countermeasures_for_balanced_reopening_King_County_Washington.pdf">https://covid.idmod.org/data/Modeling_countermeasures_for_balanced_reopening_King_County_Washington.pdf</a>
Wood <i>et al.</i> University of Bath	0.43% (0.23–0.65) China 0.55% (0.30–0.82) UK 0.20% (0.11–0.30) India	Pub. 28 May	<a href="https://www.thelancet.com/journals/laninf/article/PIIS1473-3099(20)30437-0/fulltext">https://www.thelancet.com/journals/laninf/article/PIIS1473-3099(20)30437-0/fulltext</a>



Individual-based simulations of transmission was used to explore scenarios of unmitigated epidemics, mitigated epidemics and suppressed epidemics in the UK and elsewhere.

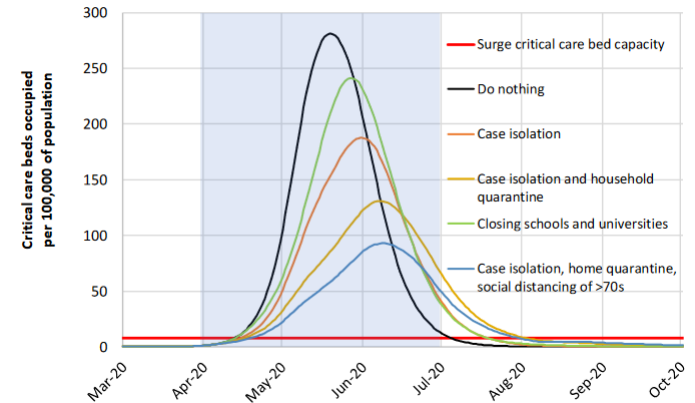
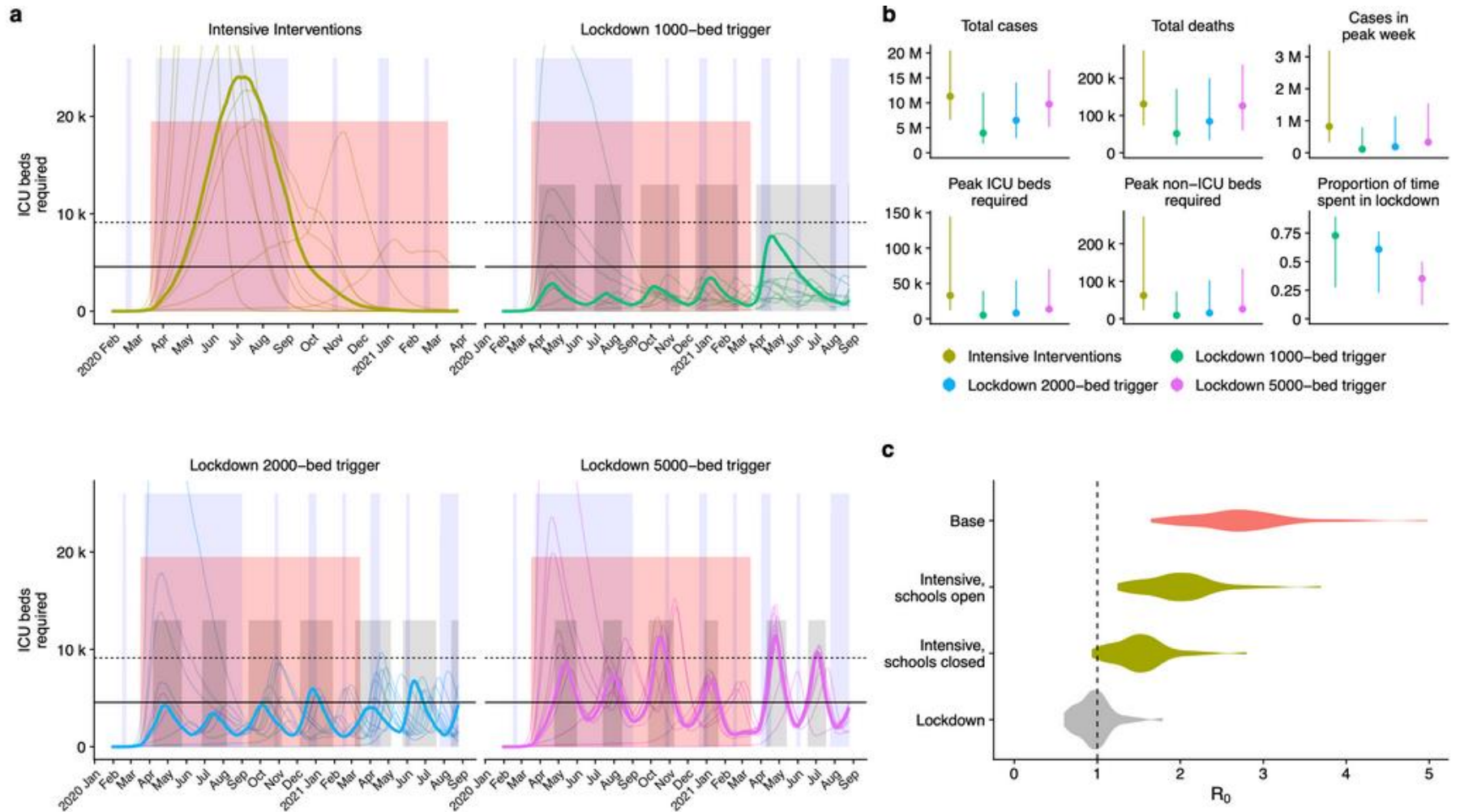
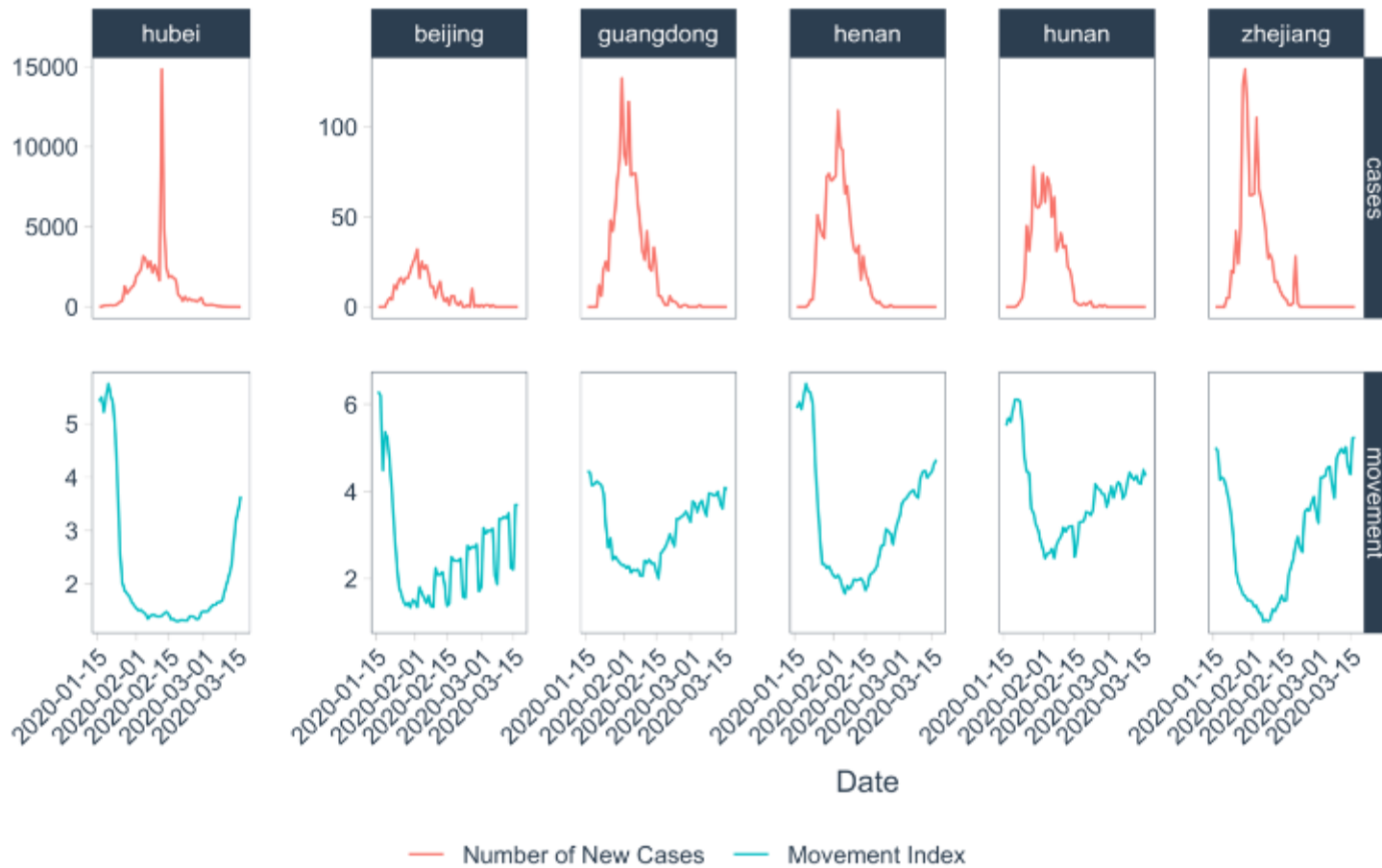


Figure 1: Unmitigated epidemic scenarios for GB and the US. (A) Projected deaths per day per 100,000 population in GB and US. (B) Case epidemic trajectories across the US by state.

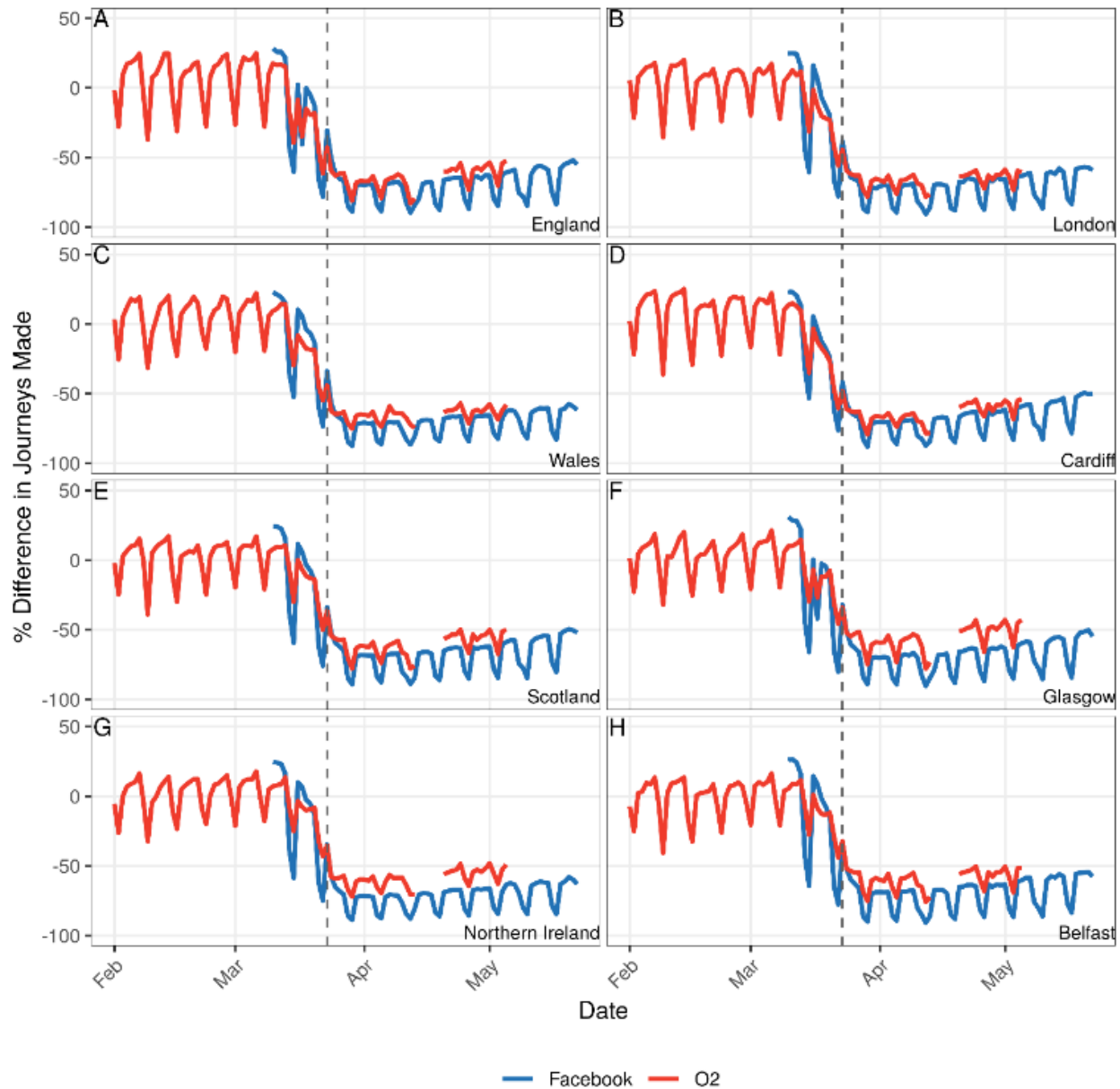


*Figure:* Projected impact of intensive control measures with reactive lockdowns. (a) Dynamics of the epidemic under different triggers for introduction and lifting of lockdowns (median timing of lockdowns shown as grey shaded areas). Bolded lines show ICU bed occupancy in the median run under each scenario. Horizontal guides show the estimated number of ICU beds in the UK as of January 2020 (solid line) and with a hypothetical doubling of capacity (dashed line). Blue shaded regions show school closures, while the pink shaded region shows a background period of intensive interventions. (b) Summary of epidemic runs. (c) Estimated distribution of  $R_0$  under three different interventions: intensive social distancing with schools open and closed, and lockdown.





**Figure 1. Plots of daily new confirmed cases (red line, top row) and daily movement index (Exante Data Inc, NY, blue line, bottom row) for Hubei, Beijing, Guangdong, Henan, Hunan, and Zhejiang. The cyclic movement patterns seen in Beijing and toward the end of February in Zhejiang are the result of decreased travel on weekends.**



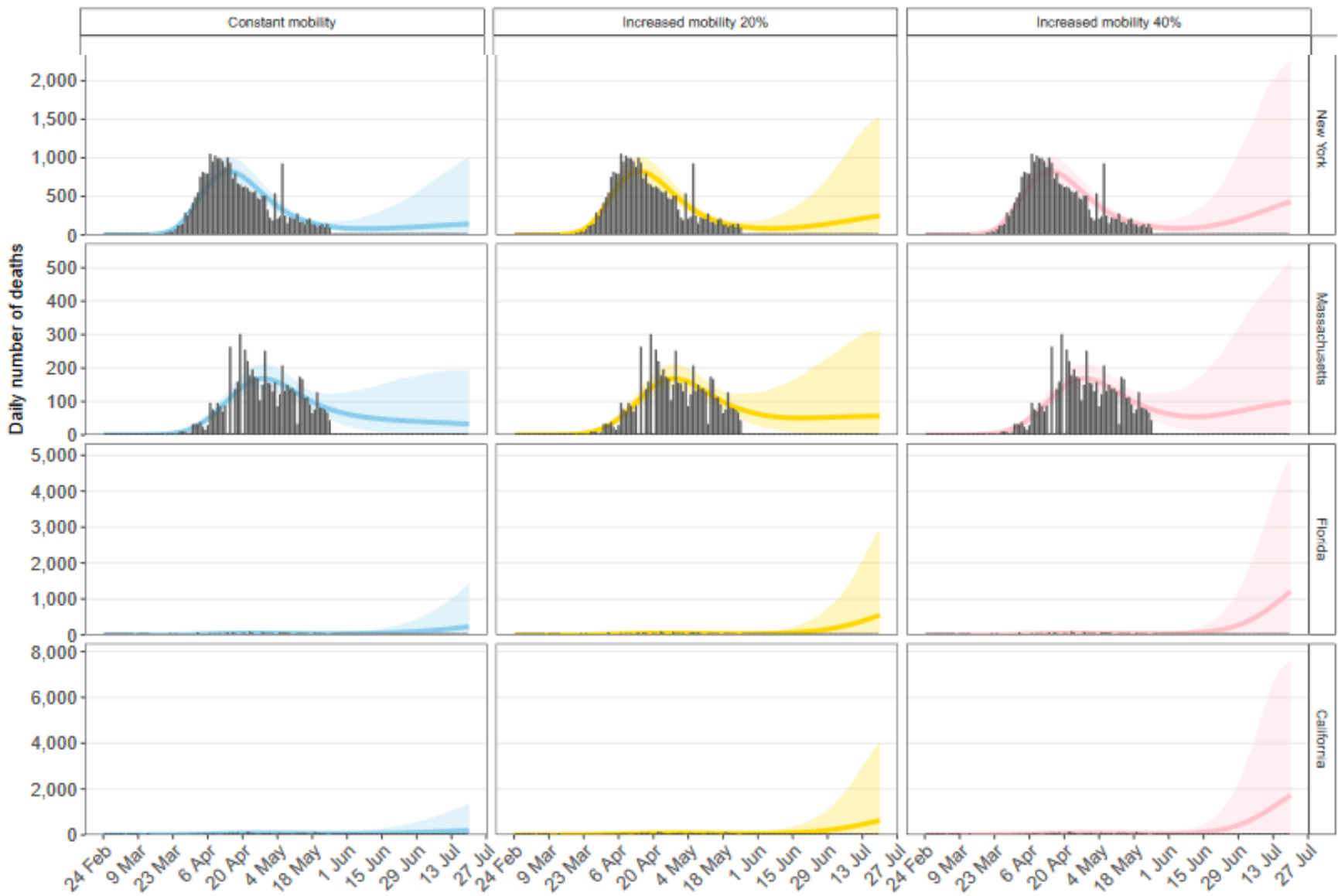
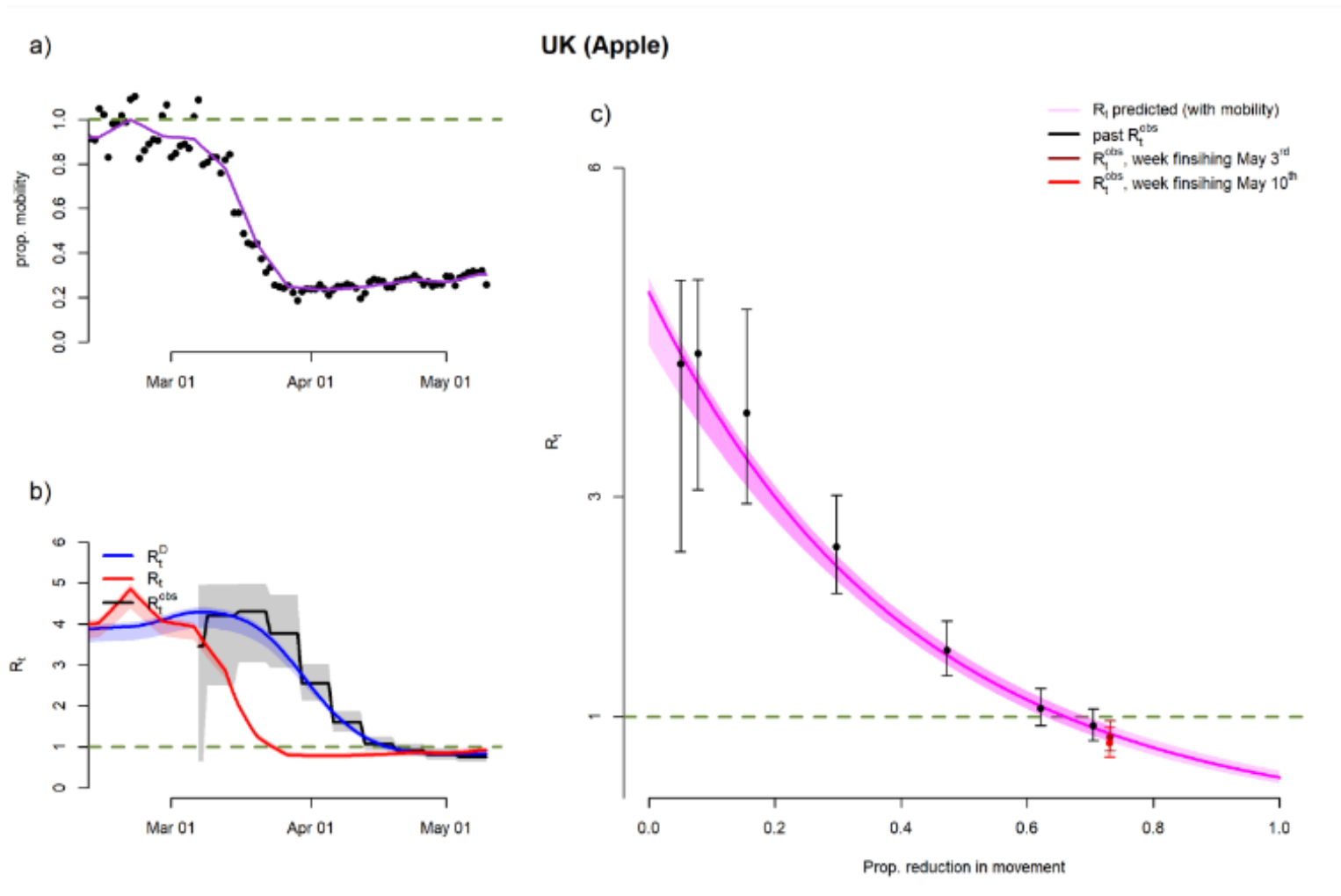


Figure 8: State-level scenario estimates of deaths for Washington, New York, Massachusetts, Florida and California. The



**Figure 1:** Relationship between mobility and transmission. **a)** Smoothed Apple mobility (purple line) and daily mobility (aggregated and scaled over the data streams). **b)** Estimated daily reproduction number for new

# Looking forward... more data

**JOHNS HOPKINS UNIVERSITY & MEDICINE** **CORONAVIRUS RESOURCE CENTER**

Home Maps & Trends Testing Tracing News & Information COVID-19 Basics Videos & Live Events

World Map U.S. Map Critical Trends

COVID-19 Dashboard by the Center for Systems Science and Engineering (CSSE) at Johns Hopkins University (JHU)

**Total Confirmed**  
**10,424,992**

Confirmed Cases by Country/Region /Sovereignty

- 2,683,000 US
- 1,368,195 Brazil
- 646,929 Russia
- 566,840 India
- 313,470 United Kingdom
- 282,365 Peru
- 275,999 Chile
- 248,970 Spain
- 240,436 Italy
- 227,662 Iran
- 220,657 Mexico
- 209,337 Pakistan
- 201,522 France
- 198,613 Turkey
- 195,391 Germany

188 countries/regions

**Global Deaths**  
**509,706**

- 129,545 deaths US
- 58,314 deaths Brazil
- 43,660 deaths United Kingdom
- 34,744 deaths Italy
- 29,816 deaths France
- 28,346 deaths Spain
- 27,121 deaths Mexico

**US State Level Deaths, Recovered**

- 31,403 deaths, 70,435 recovered New York US
- 14,992 deaths, 30,163 recovered New Jersey US
- 8,094 deaths, recovered Massachusetts US
- 6,902 deaths, recovered Illinois US
- 6,614 deaths, 67,070 recovered Pennsylvania US
- 6,161 deaths, 51,099 recovered Michigan US
- 5,983 deaths, recovered California US

Cumulative Confirmed Cases Active Cases Incidence Rate Case-Fatality Ratio Testing Rate Hospitalization Rate

Confirmed Logarithmic Daily Cases

Lancet Inf Dis Article: [Here](#), Mobile Version: [Here](#).  
Lead by JHU CSSE, Technical Support: [Esri Living Atlas team](#) and JHU APL, Financial Support: JHU and NSF. Click [here](#) to donate to the CSSE dashboard team, and other JHU COVID-19 Research Efforts. [FAQ](#). Read more in this [blog](#). [Contact US](#).

Last Updated at (M/D/YYYY)  
**6/30/2020 2:33:53 p.m.**

# Looking forward... more code

The screenshot shows a web browser displaying the GitHub repository page for 'mrc-ide/COVID19\_CFR\_submission'. The page features a dark navigation bar at the top with the GitHub logo, navigation links (Why GitHub?, Team, Enterprise, Explore, Marketplace, Pricing), a search bar, and 'Sign in' and 'Sign up' buttons. Below the navigation bar, the repository name is displayed along with statistics: 17 Watchers, 62 Stars, and 26 Forks. A secondary navigation bar includes 'Code', 'Issues 3', 'Pull requests 0', 'Actions', 'Projects 0', 'Security 0', and 'Insights'. A large banner for 'Join GitHub today' is present, with a 'Sign up' button and a 'Dismiss' button. Below the banner, the repository description reads: 'Repository for all scripts required to replicate the CFR analysis for paper submission.' A summary bar shows 27 commits, 1 branch, 0 packages, 0 releases, 3 contributors, and MIT license. A 'Branch: master' dropdown and 'New pull request' button are visible. A 'Find file' button and a 'Clone or download' button are also present. The file list includes:

File Name	Description	Commit Time
<a href="#">R_scripts</a>	updated readme with more detailed instructions on running scripts. De...	27 days ago
<a href="#">data</a>	added URLs for all deaths	2 months ago
<a href="#">output</a>	uploaded final results after long MCMC runs	3 months ago
<a href="#">source</a>	changed isfinite call to std::isfinite. Thanks to Rob Meekings for fi...	2 months ago
<a href="#">.gitignore</a>	first commit	3 months ago
<a href="#">COVID19_CFR_submission.Rproj</a>	first commit	3 months ago
<a href="#">LICENSE</a>	updated readme and added LICENSE file	3 months ago
<a href="#">README.md</a>	updated readme with more detailed instructions on running scripts. De...	27 days ago
<a href="#">Severity_FINAL_preprint.pdf</a>	uploaded paper preprint	3 months ago

# Looking forward... more open reviews

Evidence of initial success for C X +

https://wellcomeopenresearch.org/articles/5-81

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RESEARCH ARTICLE

Check for updates

## Evidence of initial success for China exiting COVID-19 social distancing policy after achieving containment [version 1; peer review: 2 approved]

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Author details



This article is included in the Coronavirus (COVID-19) collection.

## Abstract

**Background:** The COVID-19 epidemic was declared a Global Pandemic by WHO on 11 March 2020. By 24 March 2020, over 440,000 cases and almost 20,000 deaths had been reported worldwide. In response to the fast-growing epidemic, which began in the Chinese city of Wuhan, Hubei, China imposed strict social distancing in Wuhan on 23 January 2020 followed closely by similar measures in other provinces. These interventions have impacted economic productivity in China, and the ability of the Chinese economy to resume without restarting the epidemic was not clear.

**Methods:** Using daily reported cases from mainland China and Hong Kong SAR, we estimated transmissibility over time and compared it to daily within-city movement, as a proxy for economic activity.

**Results:** Initially, within-city movement and transmission were very strongly correlated in the five mainland provinces most affected by the epidemic and Beijing. However, that correlation decreased rapidly after the initial sharp fall in transmissibility. In general, towards the end of the study period, the correlation was no longer apparent, despite substantial increases in within-city movement. A similar analysis for Hong Kong shows that intermediate levels of local activity were maintained while avoiding a large outbreak. At the very end of the study period, when China began to experience the re-introduction of a small number of cases from Europe and the United States, there is an apparent up-tick in transmission.

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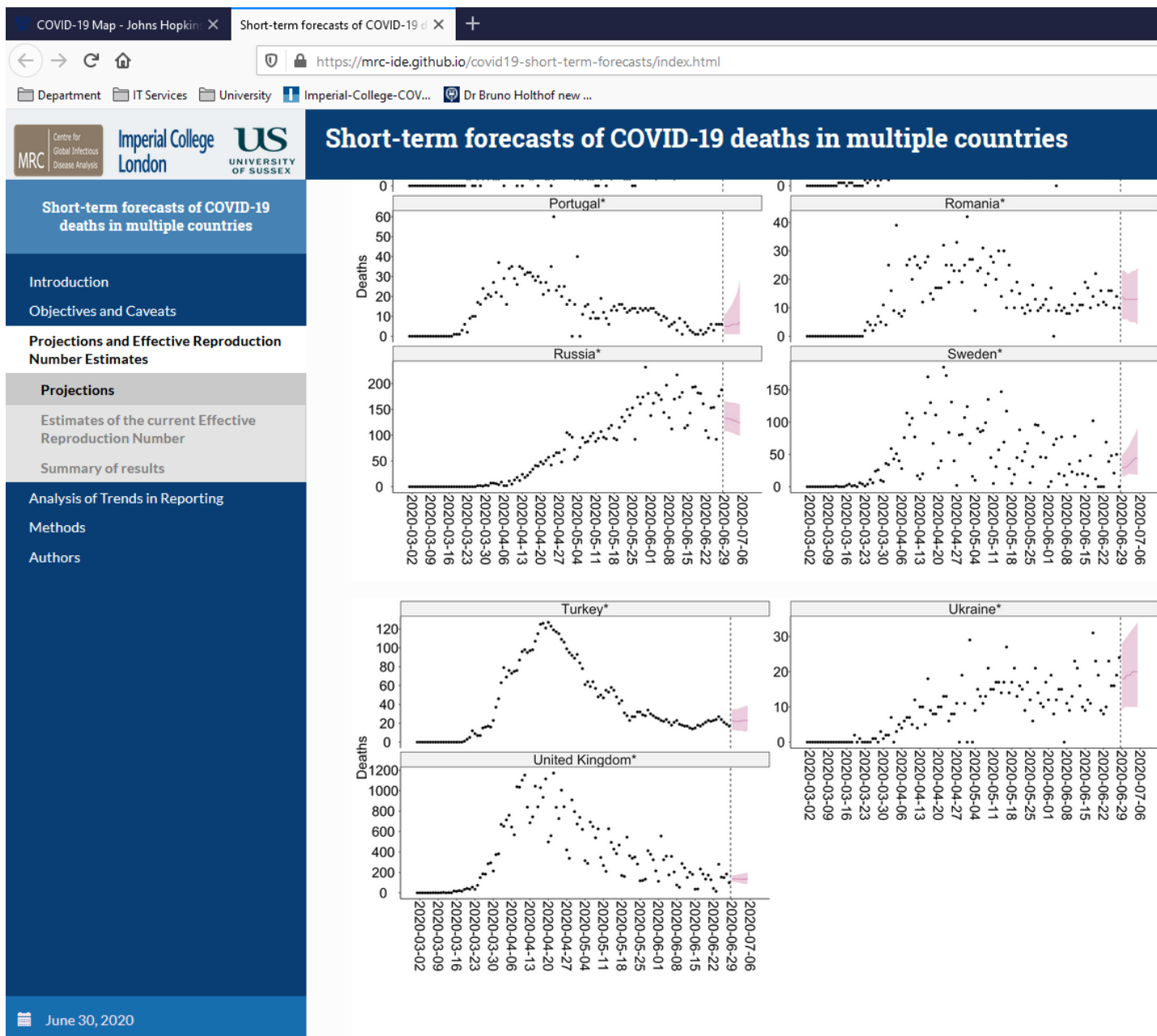
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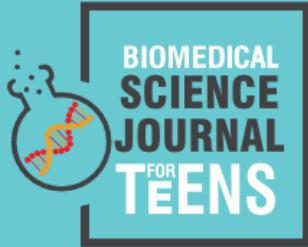
# Looking forward... more updates





# Looking forward... more public engagement

APRIL 2020



BIOMEDICAL  
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## How can we help stop the COVID-19 pandemic?

### Authors:

Neil Ferguson, Daniel Laydon,  
Gemma Nedjati-Gilani, and others

### Associate Editor:

Elitsa Panayotova



## Abstract

The new coronavirus has already claimed the lives of hundreds of thousands of people. Different countries are taking different measures in the fight against this new threat. Many people are staying at home. But is it worth it? That's what we wanted to find out.

We created a computer model that helps us assess the effect of different measures against COVID-19. We checked for the

impact on people's health and the state of the healthcare systems in two countries: the UK and the US. We found that social distancing of the whole population, not just the elderly, would have the most beneficial effect. The combination of this measure with others would be even better.

## Introduction

Tired of staying at home and hearing about the new *coronavirus*? Perhaps you wonder: is it even worth it? What is the purpose behind it? In just a few months, the new virus has spread around most of the world and claimed the lives of hundreds of thousands of people. With so many lives

We set out to compare these two strategies. Which one will result in fewer deaths? Which one will relieve the healthcare systems?

*“When I am no longer even a memory, just a name, I hope my voice may perpetuate the great work of my life. God bless my dear old comrades of Balaclava and bring them safe to shore.”*

*Florence Nightingale (1820-1910)*



# A man for our time

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*Sir Austin Bradford Hill*  
*(1897 – 1991)*

*“All scientific work is incomplete—whether it be observational or experimental.*

*All scientific work is liable to be upset or modified by advancing knowledge.*

*That does not confer upon us a freedom to ignore the knowledge we already have, or to postpone the action that it appears to demand at a given time.”*

