

Challenges in interpreting the mortality impact of COVID-19

David Leon

London School of Hygiene & Tropical Medicine

HSE University, Moscow

UiT the Arctic University of Norway

Webinar 24 April 2020

International Laboratory for Population and Health, HSE University

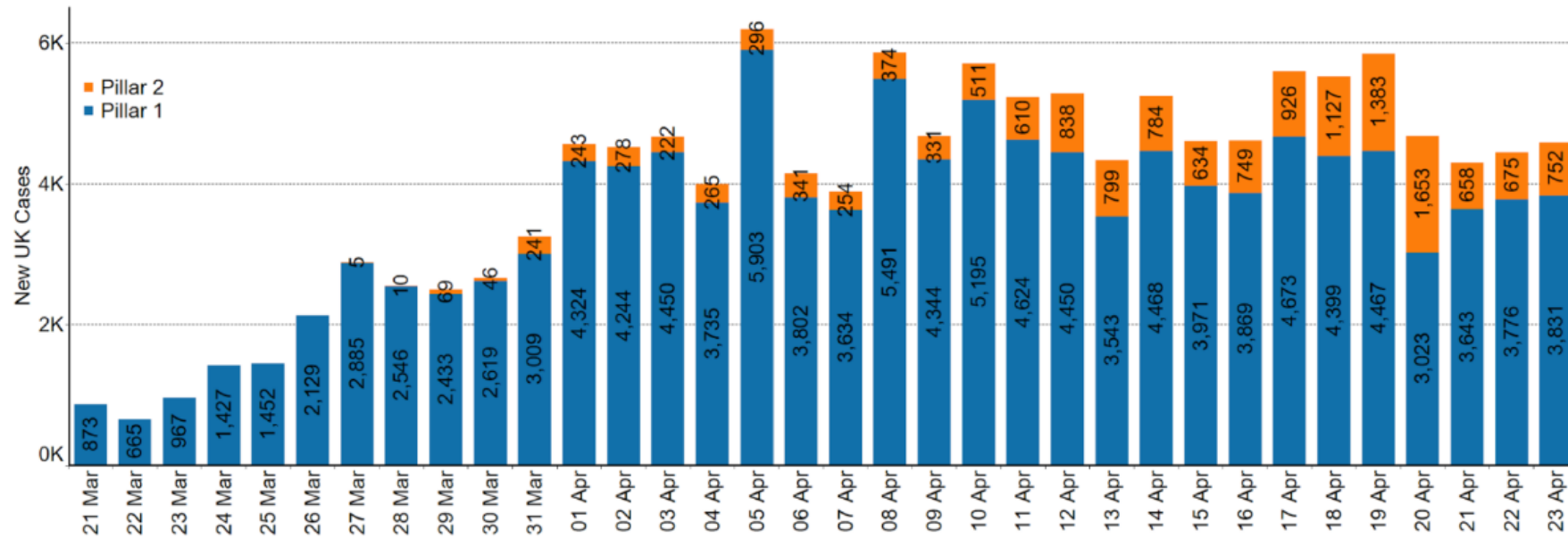


STAY HOME > PROTECT THE NHS > SAVE LIVES



New Cases (UK)

Cases are reported when lab tests are completed. This may be a few days after initial testing. Testing capacity is increasing, which is resulting in a greater number of observed cases, therefore there are likely many more cases than currently recorded here. Pillar 1: swab testing in PHE labs and NHS hospitals for those with a medical need and the most critical workers and their families. Pillar 2: swab testing for key workers and their households.

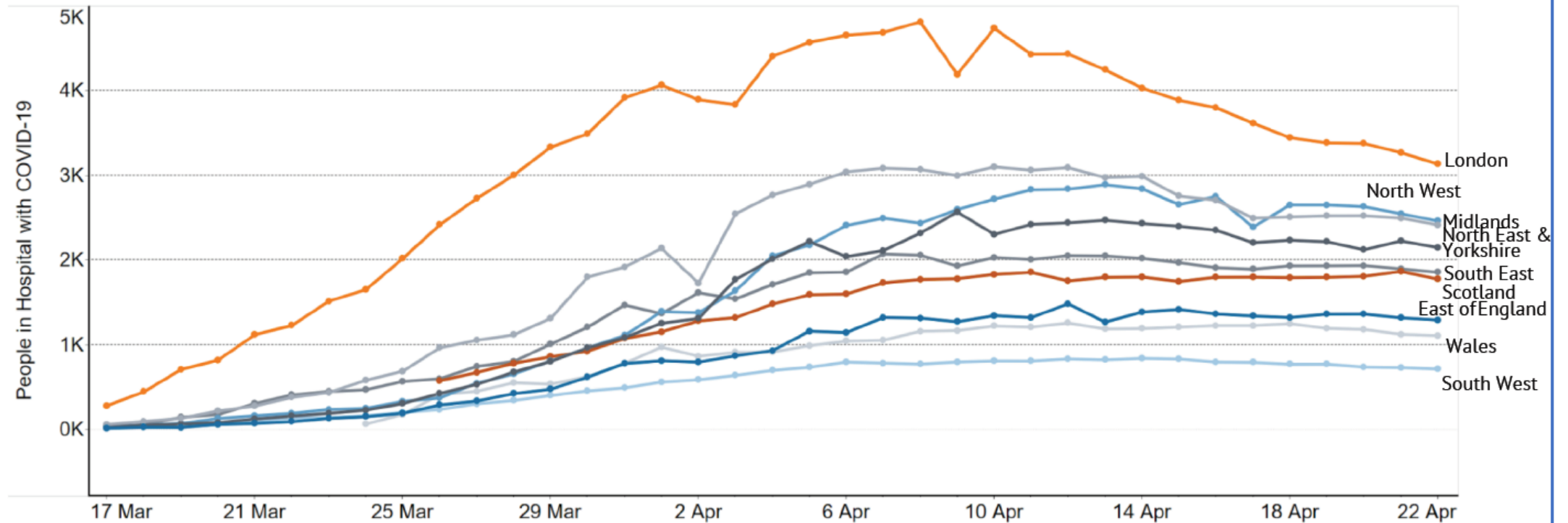


Source: Department of Health and Social Care.

STAY HOME > PROTECT THE NHS > SAVE LIVES

People in Hospital with COVID-19 (Great Britain)

Over the last 24 hours, the number of people in GB hospitals with confirmed COVID-19 has fallen and is 10% lower than one week prior.

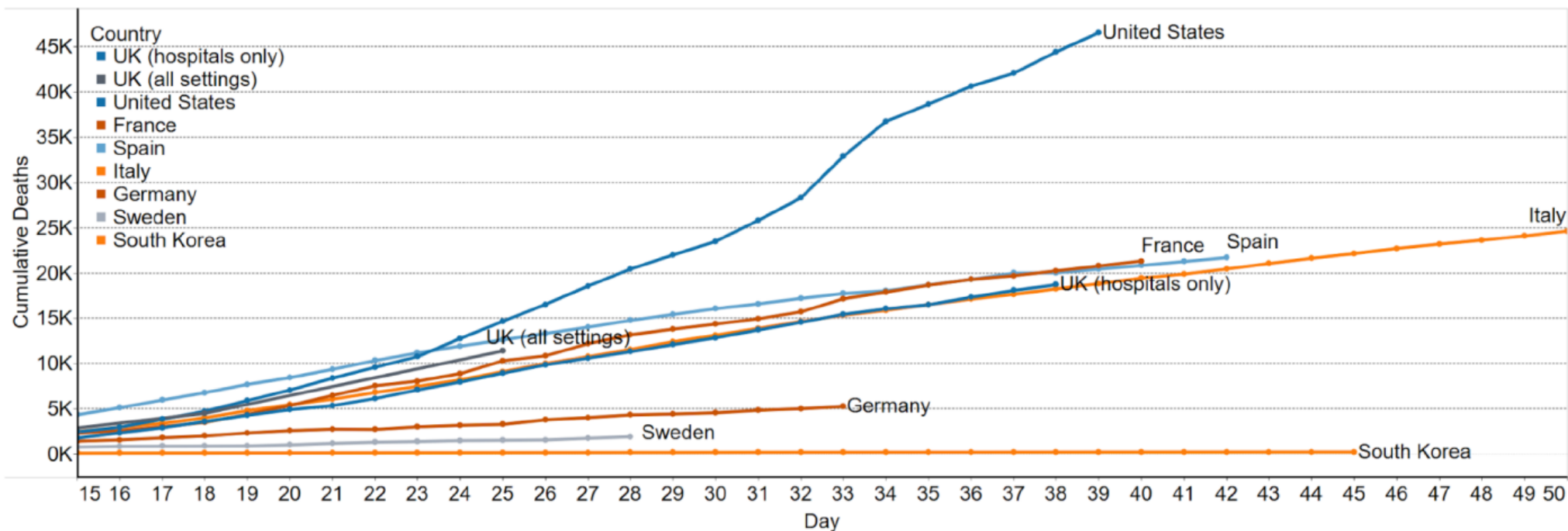


Source: NHSE, Welsh Gov., Scottish Gov.

STAY HOME > PROTECT THE NHS > SAVE LIVES

Global Death Comparison

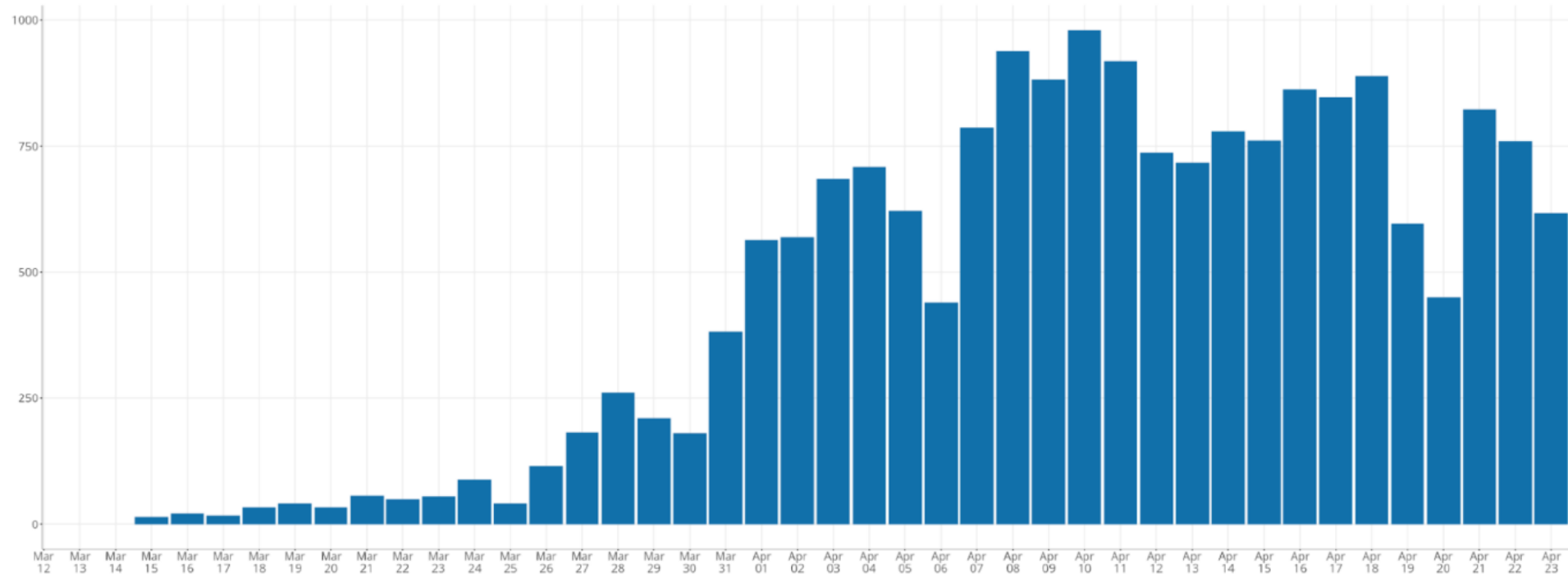
Country data is aligned by stage of the outbreak. Day 0 equals the first day 50 cumulative deaths were reported.



Source: ONS, NRS, NISRA, Public Health England, Johns Hopkins University. The figures on deaths relate in almost all cases to patients who have died in hospital and who have tested positive for COVID-19. Slight differences in reporting in devolved administrations may mean that they include a small number of deaths outside hospital. ONS, NRS and NISRA reporting of UK deaths for all settings is based on information from death certificates, and therefore lags daily hospital data. International reporting procedures and lags are unclear, so may not be comparing like-for-like.

STAY HOME > PROTECT THE NHS > SAVE LIVES

Daily COVID-19 Deaths in Hospital (UK)



Source: Public Health England. UK deaths are reported when paperwork is filed, rather than time of death. The figures on deaths relate in almost all cases to patients who have died in hospital and who have tested positive for COVID-19. Slight differences in reporting in devolved administrations may mean that they include a small number of deaths outside hospital.

What deaths are being announced each day?

- Only deaths occurring in hospital
- A “COVID-19 death” defined as having tested positive at time of death
- As reported directly from hospitals to the National Health Service (NHS) : *not through Office for National Statistics*
- Count of deaths reported to the NHS in a 24 hour period up to 5pm the previous day
- This count includes deaths occurring over a wide range of previous days – due to inevitable delays in reporting mechanism

What can trends in hospital deaths from COVID-19 tell us about the progress and peak of the pandemic? An analysis of death counts from England announced up to 20 April 2020

David A Leon*¹ , Christopher I Jarvis¹ , Anne Johnson² , Liam Smeeth¹ , Vladimir M Shkolnikov³

¹ Faculty of Epidemiology & Population Health, London School of Hygiene & Tropical Medicine, Keppel St, London WC1E 7HT UK

² UCL Institute of Global Health, Mortimer Market Centre, Off Capper Street, London WC1E 6JB UK

³ Laboratory of Demographic Data, Max Planck Institute for Demographic Research, Konrad-Zuse-Str. 18057 Rostock, Germany

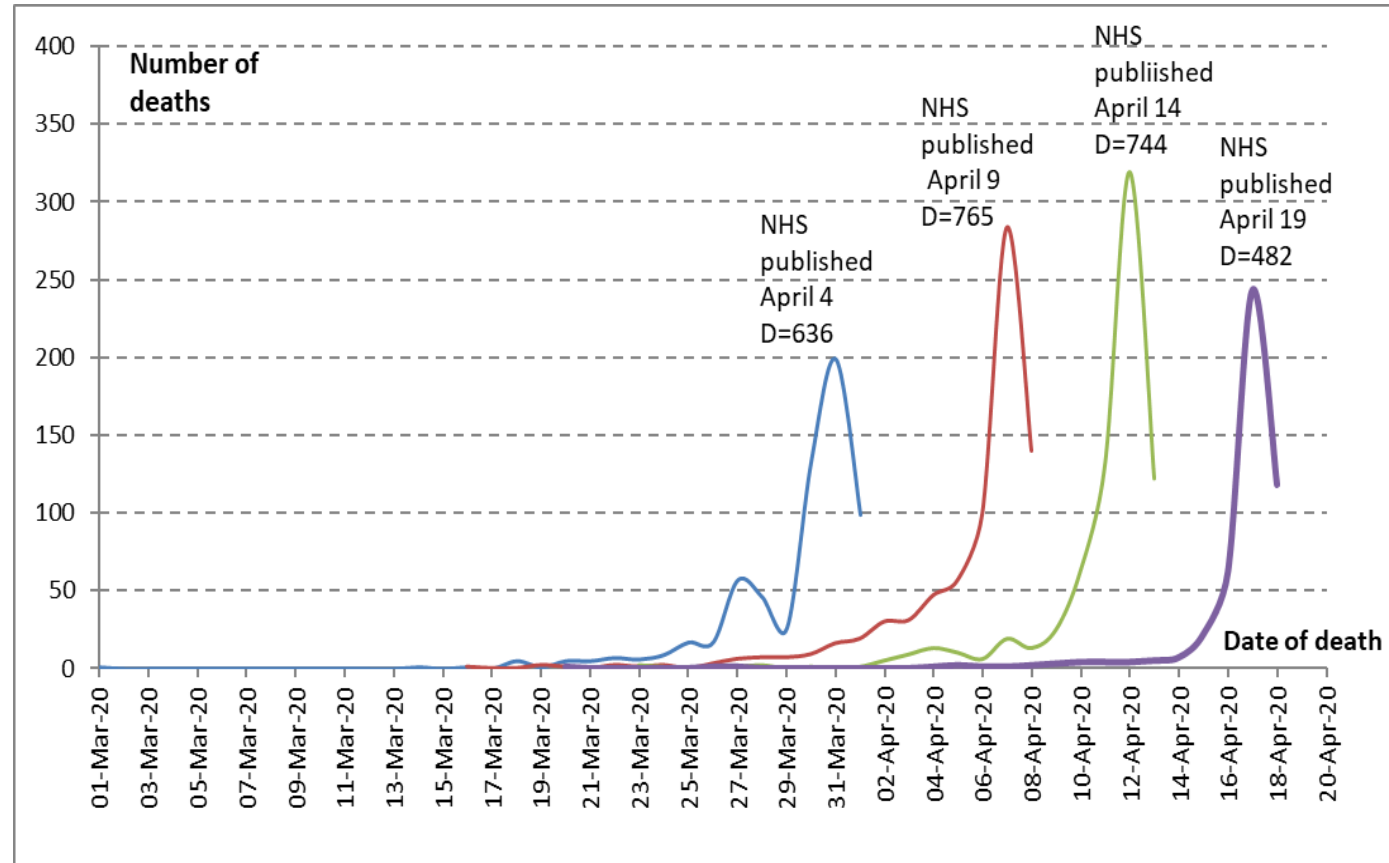
* corresponding author david.leon@lshtm.ac.uk

Abstract

Background Reporting of daily hospital COVID-19 deaths in the UK are promoted by the government and scientific advisers alike as a key metric for assessing the progress in the control of the epidemic. These data, however, have certain limitations, among which one of the most significant concerns the

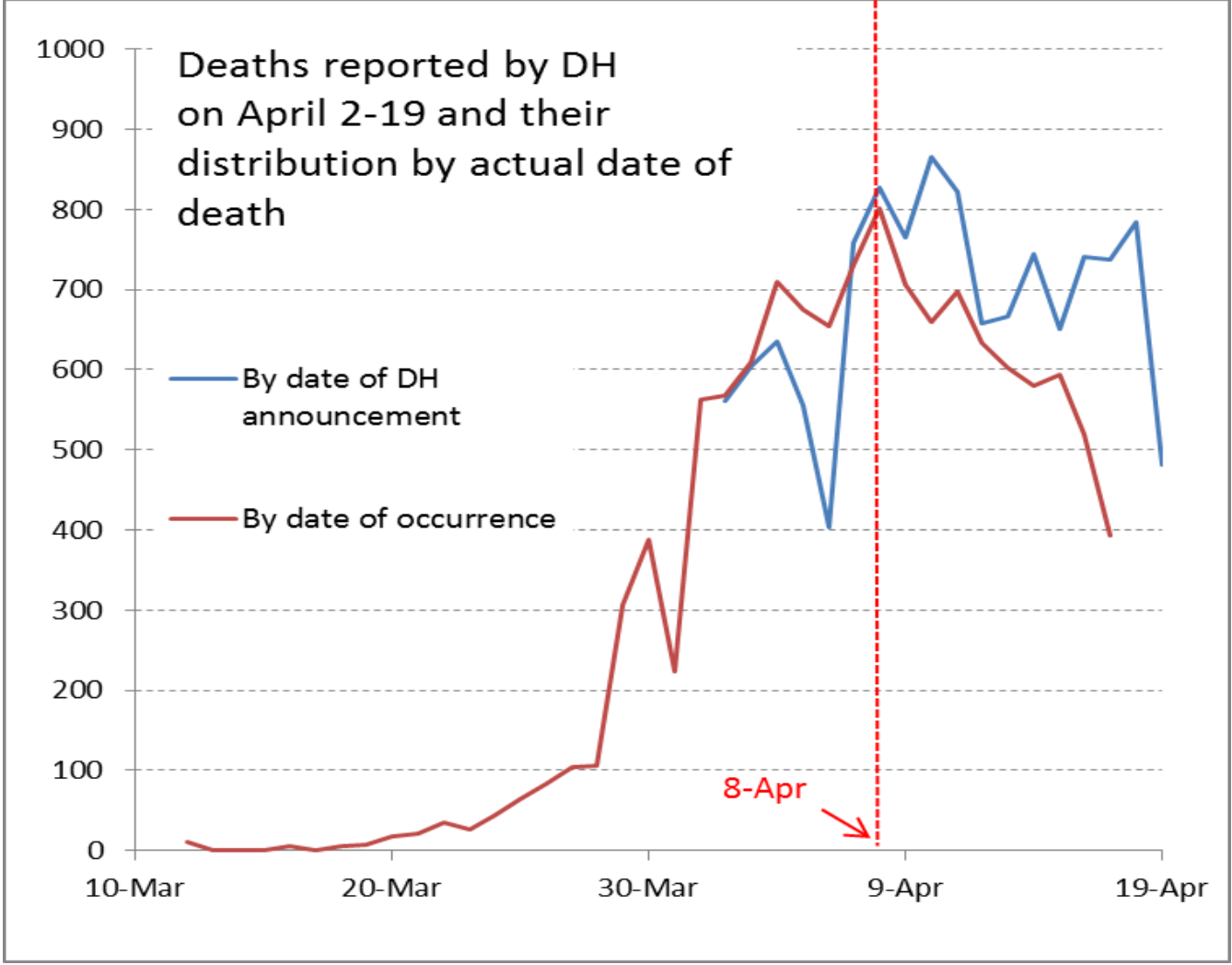
COVID-19 reported death counts. Do they show temporal changes correctly?

Distributions of the COVID-19 deaths reported by NHS on Apr 4-19, 2020 in England and Wales by actual date of death



Source : Leon, Jarvis, Johnson, Smeeth, Shkolnikov. Submitted MedRxiv

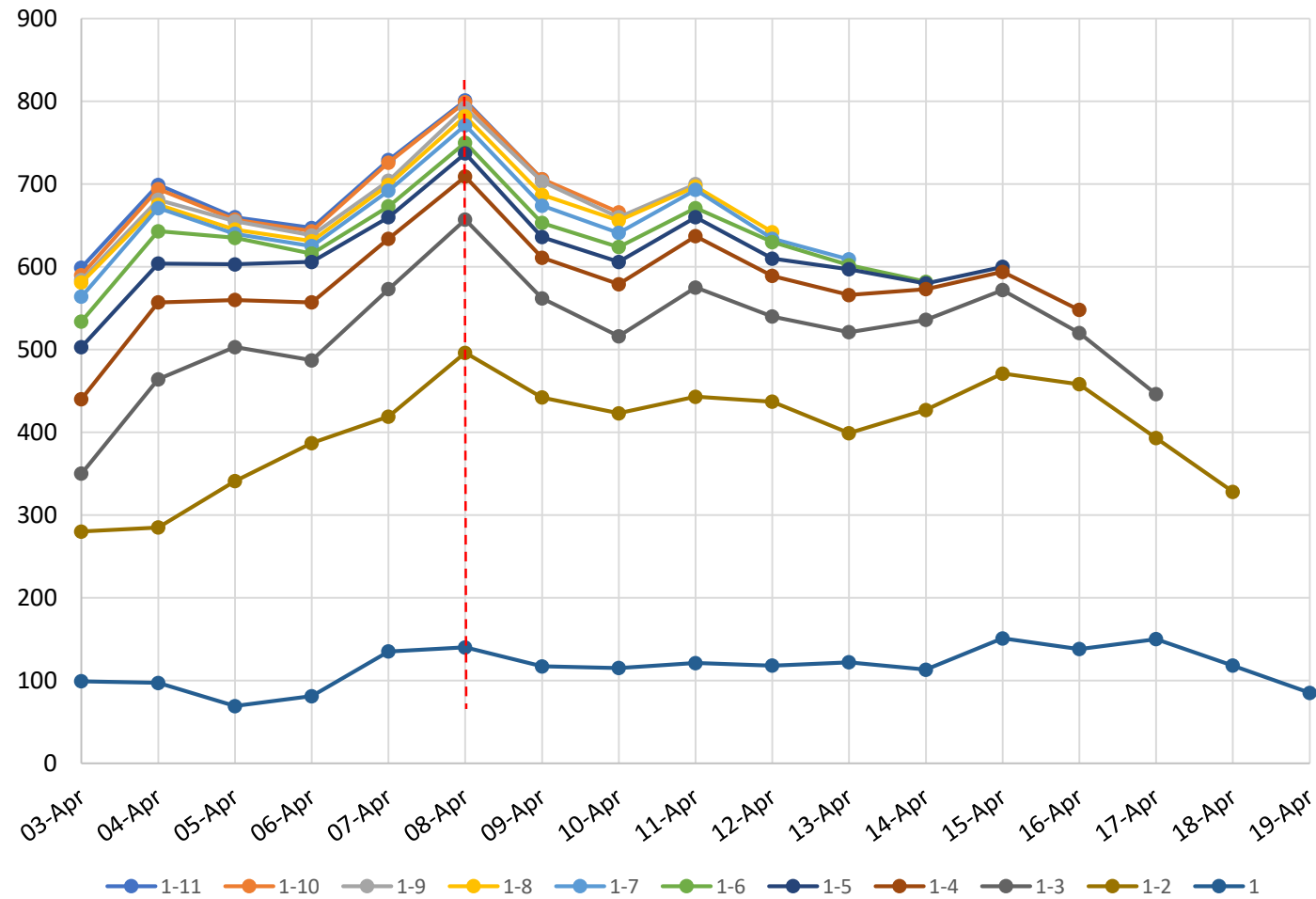
COVID-19 death counts. Deaths by date of reporting vs. date of death



Source : Leon, Jarvis, Johnson, Smeeth, Shkolnikov. Submitted MedRxiv

Stratifying by period of delay

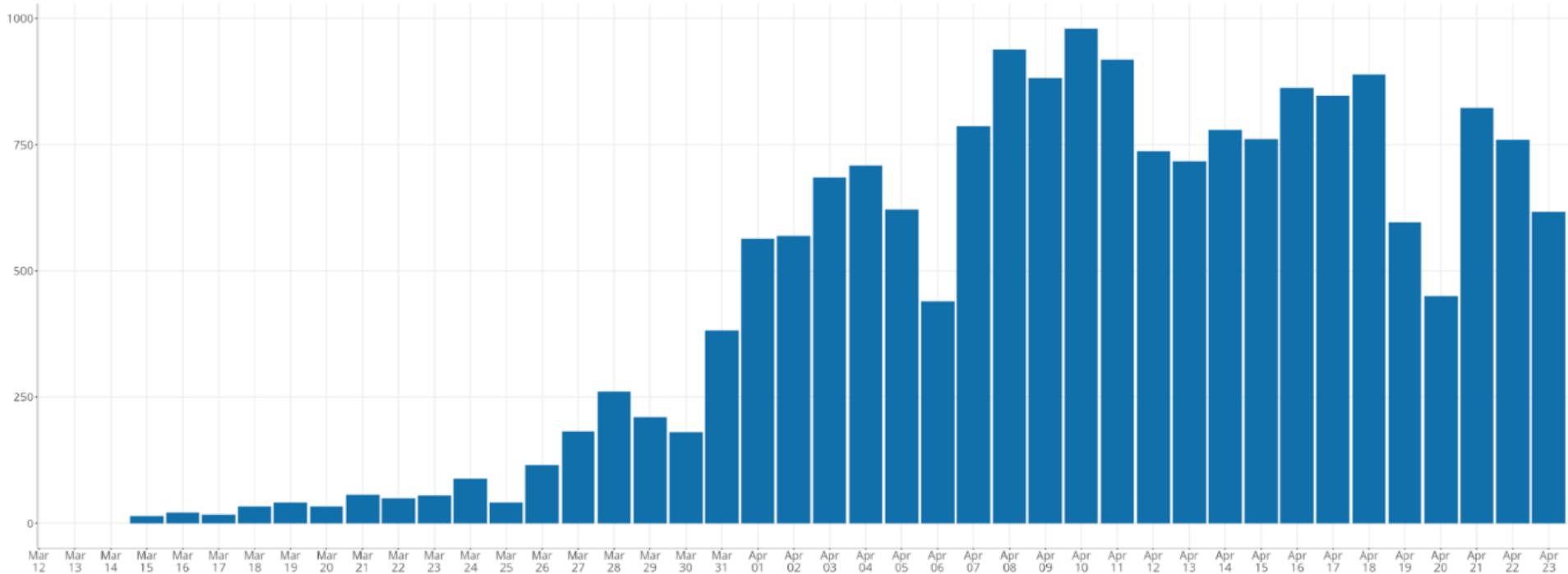
COVID-19 hospital deaths by date of occurrence cumulated over days of delay, all ages



Source : Leon, Jarvis, Johnson, Smeeth, Shkolnikov. Submitted MedRxiv

STAY HOME > PROTECT THE NHS > SAVE LIVES

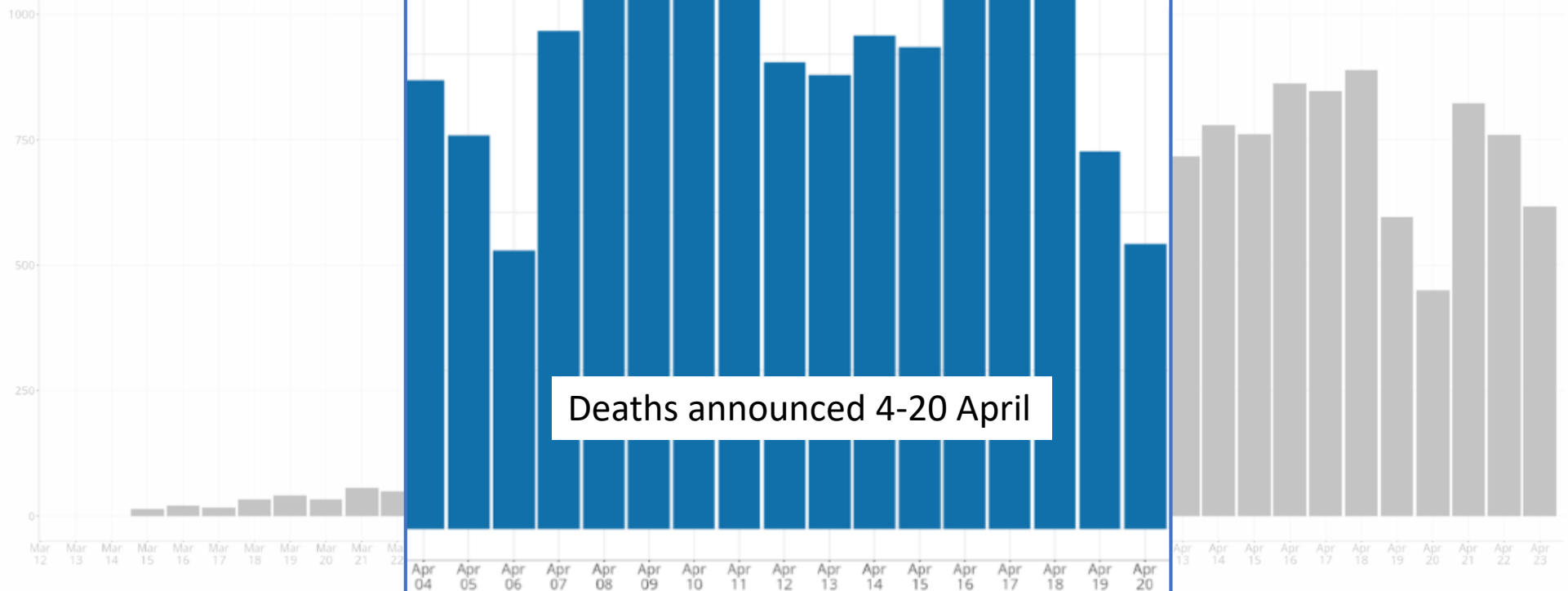
Daily COVID-19 Deaths in Hospital (UK)



Source: Public Health England. UK deaths are reported when paperwork is filed, rather than time of death. The figures on deaths relate in almost all cases to patients who have died in hospital and who have tested positive for COVID-19. Slight differences in reporting in devolved administrations may mean that they include a small number of deaths outside hospital.

STAY HOME - PROTECT THE NHS - SAVE LIVES

Daily COVID-19 Deaths

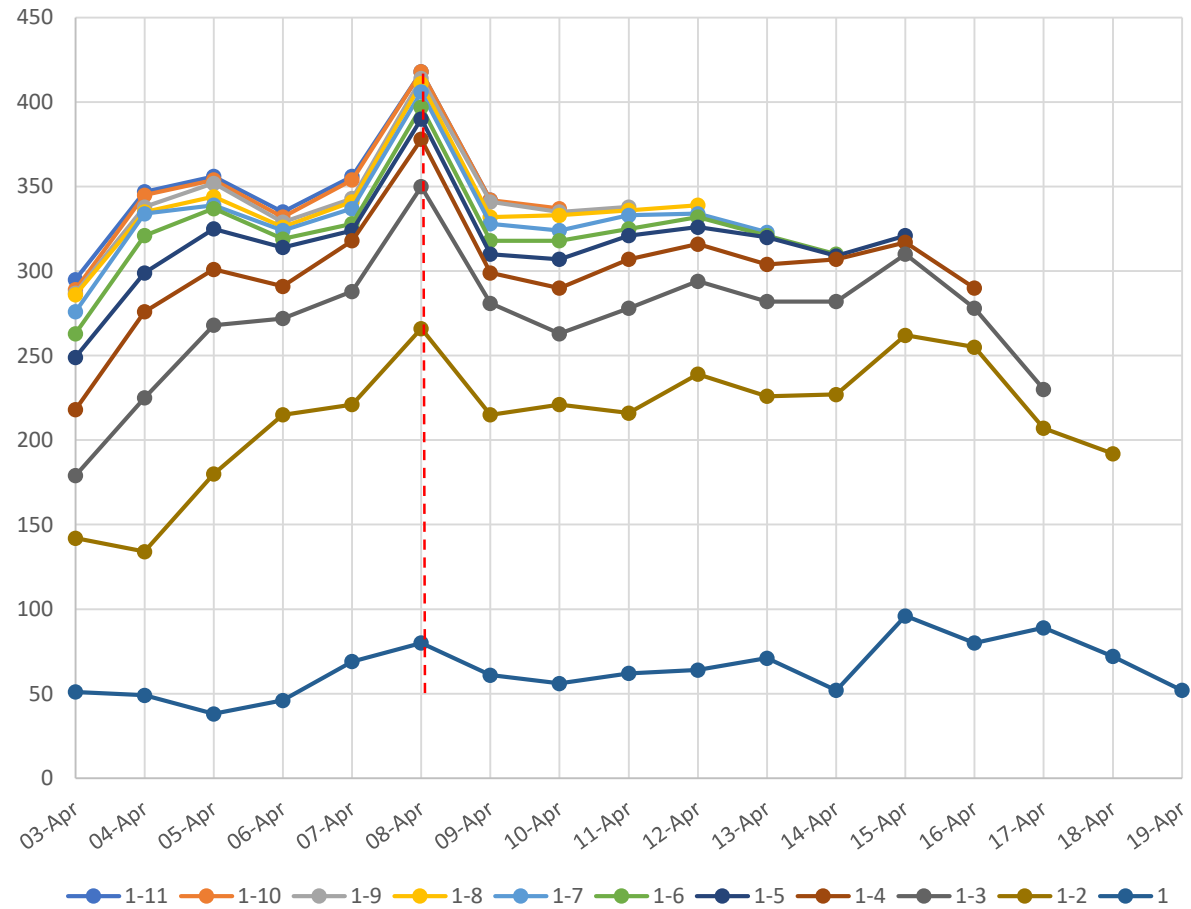


Deaths announced 4-20 April

Source: Public Health England. UK deaths are reported as the sum of all deaths from COVID-19, including deaths from all cases to patients who have died in hospital and who have tested positive for COVID-19. Slight differences in reporting in devolved administrations may mean that they include a small number of deaths outside hospital.

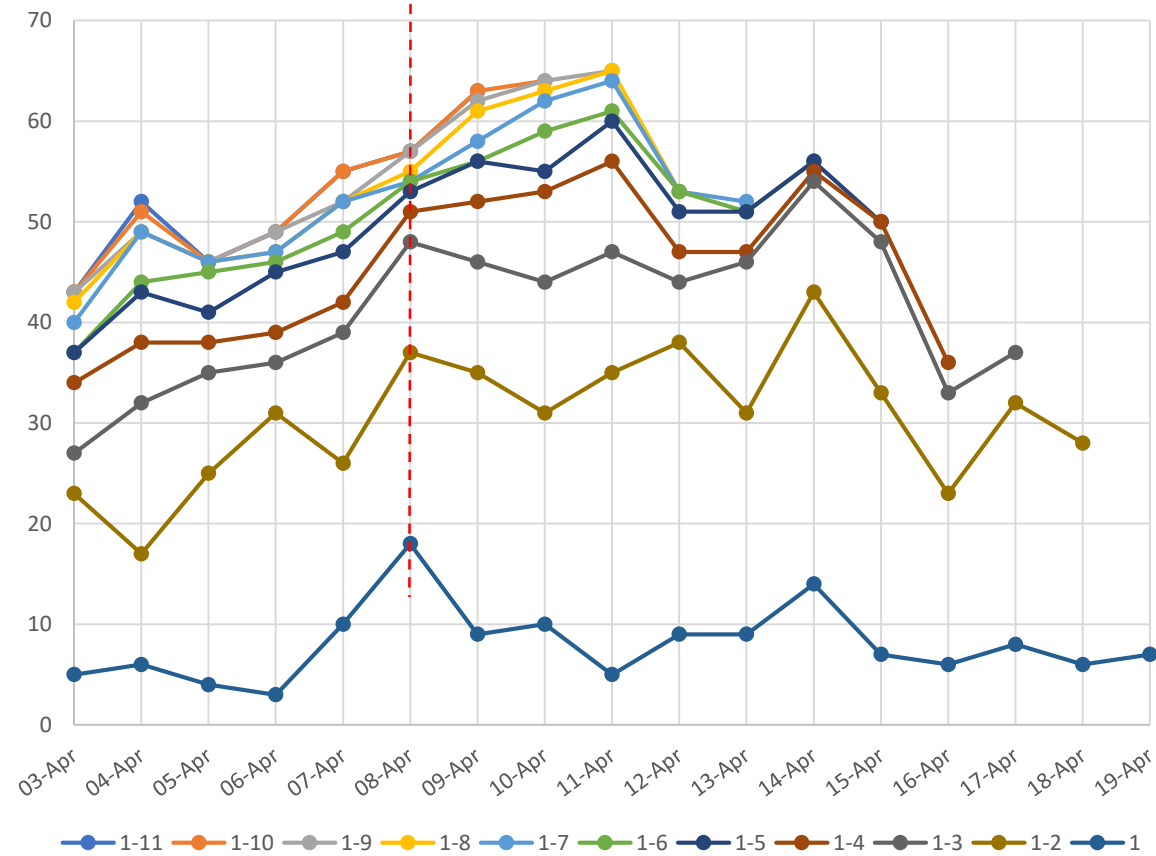
Effects vary by age

COVID-19 hospital deaths by date of occurrence cumulated over days of delay, 80+ years



Source : Leon, Jarvis, Johnson, Smeeth, Shkolnikov. Submitted MedRxiv

COVID-19 hospital deaths by date of occurrence cumulated over days of delay, age 40-59 years



Source : Leon, Jarvis, Johnson, Smeeth, Shkolnikov. Submitted MedRxiv

Comparison of age distribution of COVID-19 patients in critical care with COVID-19 hospital deaths

Age	ICNARC* to 16 th April		ICNARC* deaths to 16 th April		Hospital deaths to 16 th April		% hospital deaths in Critical care
	N	%	N	%	N	%	%
16-39	411	7%	50	3%	96	1%	52%
40-59	2194	39%	370	25%	958	8%	39%
60-79	2788	50%	976	65%	4922	40%	20%
80+	181	3%	103	7%	6412	52%	2%
	5574	100%	1499	100%	12388	100%	12%

* Intensive Care National Audit & Research Centre

See : <https://www.icnarc.org/DataServices/Attachments/Download/d55b170d-b784-ea11-9125-00505601089b>

Excess deaths

Weekly excess deaths

- Number of (all cause) deaths observed per week minus the number of deaths expected based in that week based on previous years
 - Is basis for EuroMOMO – set up 6 years ago for monitoring influenza epidemics in 20+ European countries : **but they do not share data**
- Most robust and directly comparable metric for international comparisons of impact of COVID-19 pandemic : **assessing different national strategies**
 - Does not depend upon COVID-19 testing regimes etc.
- Provides indication of NET effect of pandemic
 - Pandemic will have direct and indirect negative effects PLUS some positive effects on mortality

COVID-19: a need for real-time monitoring of weekly excess deaths

The first-line epidemiological response to coronavirus disease 2019 (COVID-19) requires estimation of key parameters, including case fatality risk, and reproduction number to monitor

experience of previous non-pandemic years. This approach allows for the assessment of the total mortality effects of the pandemic in different places. Crucially, the counts would be of deaths by all causes combined, thus side-stepping issues of what is or is not a death attributable to COVID-19. Unfortunately, most countries do not publish such statistics and those



Published Online
April 22, 2020
[https://doi.org/10.1016/S0140-6736\(20\)30933-8](https://doi.org/10.1016/S0140-6736(20)30933-8)

Source : Leon DA, Shkolnikov VM, Smeeth L, Magnus P, Pechholdová M, Jarvis CI. COVID-19: a need for real-time monitoring of weekly excess deaths. The Lancet 2020.

COVID-19: a need for real-time monitoring of weekly excess deaths

The first-line epidemiological response to coronavirus disease 2019 (COVID-19) requires estimation of key parameters, including case fatality rate and reproduction number to monitor

We therefore urge all national authorities who can collate counts of weekly deaths to expedite the publication of these data and place them in the public domain. The dissemination of this information should be done within 3–4 weeks of the period of observation. At a minimum, tabulations by sex and 5-year age groups are essential.

Source : Leon DA, Shkolniko
monitoring of weekly excess deaths. The Lancet 2020.



Published Online
April 22, 2020
[https://doi.org/10.1016/S0140-6736\(20\)30933-8](https://doi.org/10.1016/S0140-6736(20)30933-8)

a need for real-time

MPIDR Online Meeting. April 20, 2020

Data sources for quantification of the
COVID-19 pandemic and an introduction to
the Short-Term Mortality Fluctuations
database (STMF)

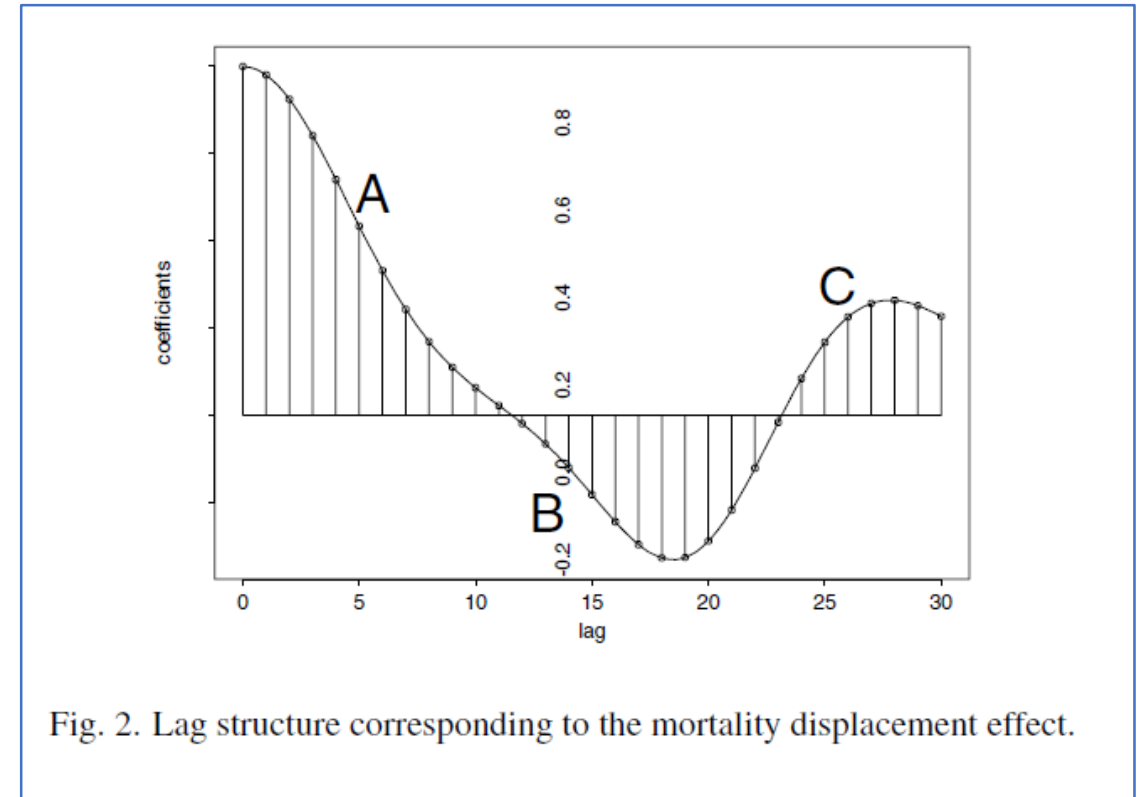
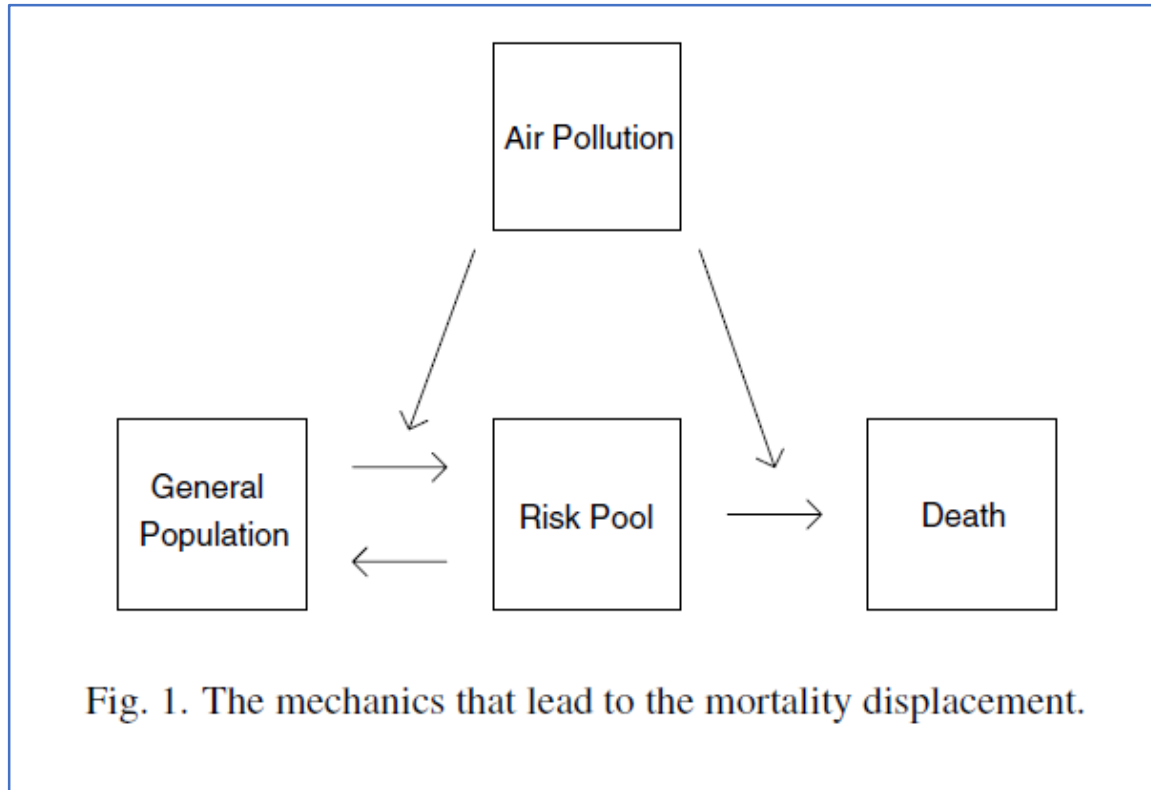
Vladimir M. Shkolnikov, Dmitry Jdanov, Ainhoa
Alustiza Galarza, Inna Danilova, David A. Leon



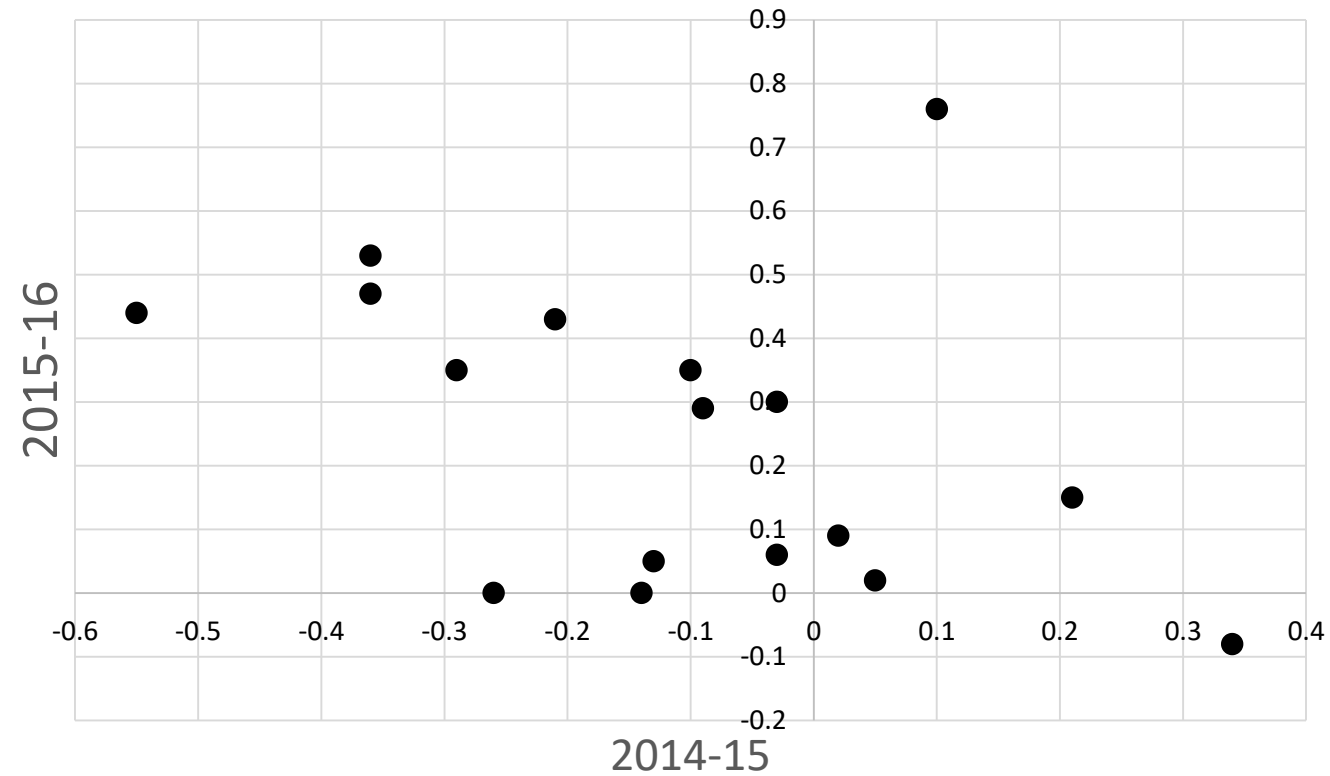
Negative effects of pandemic on mortality

- Direct effects on mortality
 - Premature mortality
 - Accelerating deaths of those who are already near end of life

Harvesting effects



Change in life expectancy in consecutive years by country



Source : Ho JY, Hendi AS. Recent trends in life expectancy across high income countries: retrospective observational study. BMJ 2018; 362: k2562

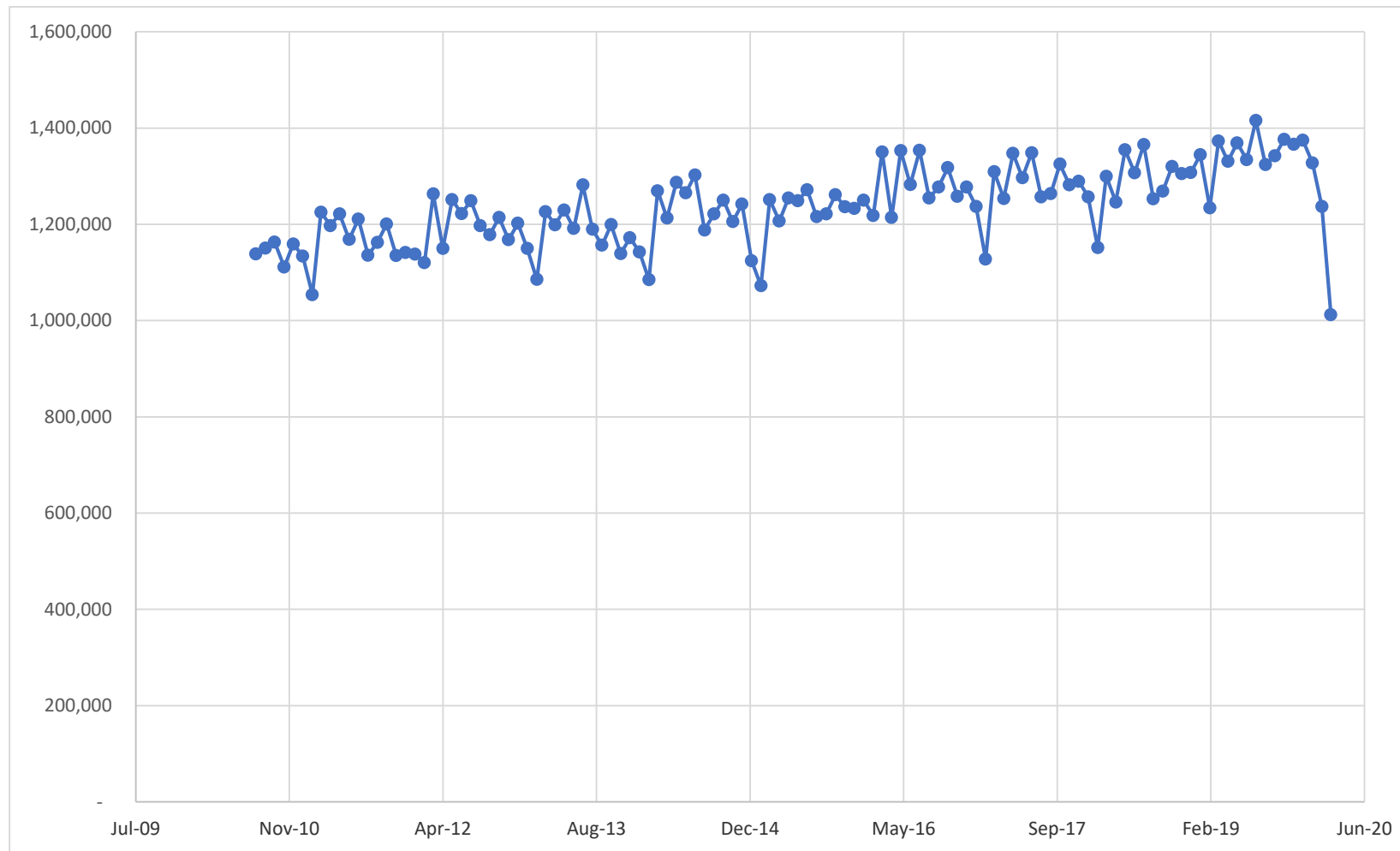
Negative effects of pandemic on mortality

- Direct effects on mortality
 - Premature mortality
 - Accelerating deaths of those who are already near end of life

Negative effects of pandemic on mortality

- Direct effects on mortality
 - Premature mortality
 - Accelerating deaths of those who are already near end of life
- People unwilling to attend emergency departments even if sick > deaths from MI, stroke, sepsis etc and other medical emergencies

Monthly attendance at accident and emergency departments August 2010 – March 2020, England



Negative effects of pandemic on mortality

- Direct effects on mortality
 - Accelerating deaths of those who are already near end of life
 - Premature mortality
- People unwilling to attend emergency departments even if sick > deaths from MI, stroke, sepsis etc and other medical emergencies
- Medium / longer term effects
 - Cancellation in many routine and elective operations including for example stents for blocked arteries, and scaling back chemotherapy for cancer
 - Delayed diagnosis of cancer and other serious conditions
 - Interruption in screening for cervical and breast cancer
 - Increased alcohol consumption and reduced exercise

Effect of damage to the economy on mortality

- ? Reduction in resources available for health and welfare services
- ? Increased “deaths of despair” due to impoverishment and unemployment

Positive effects of pandemic on mortality

- Reduction in fatal transport and industrial injuries
- Reduction in effects of air pollution

Importance of countries who
have not had a substantial
COVID outbreak

Thank you