Office for National Statistics

Using innovative data and modelling to inform decision making

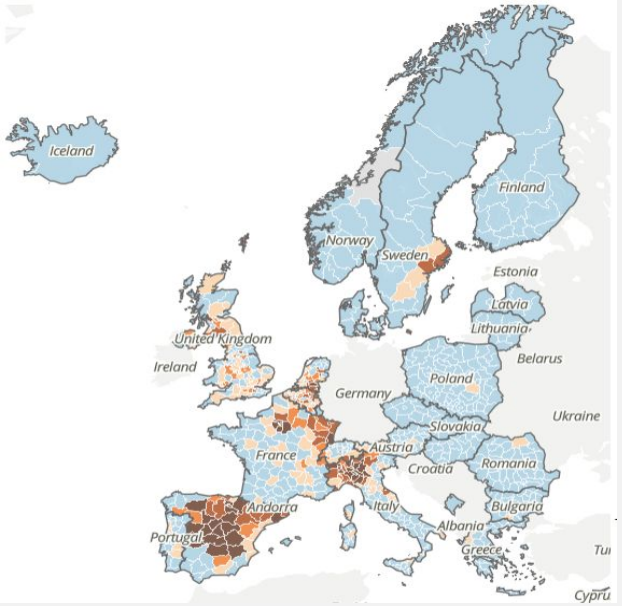
Professor Sir Ian Diamond
National Statistician

27 May 2021

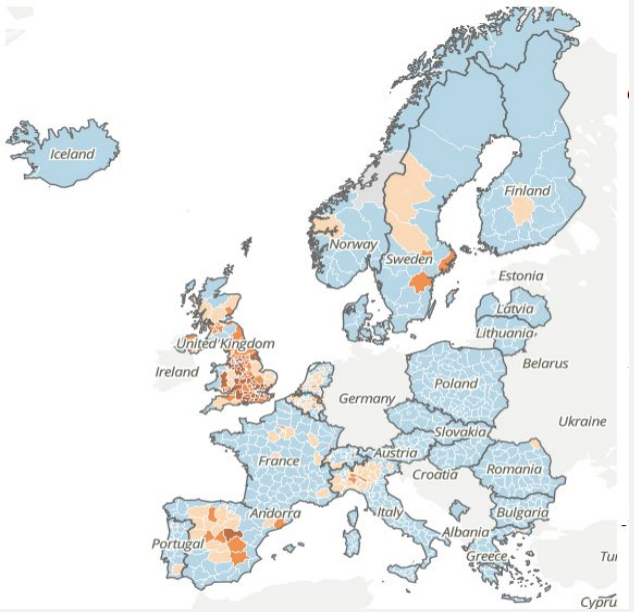
Spatial Data Insights

Comparisons of excess mortality in European countries and regions 2020 – Spring/Summer

6 March 2020



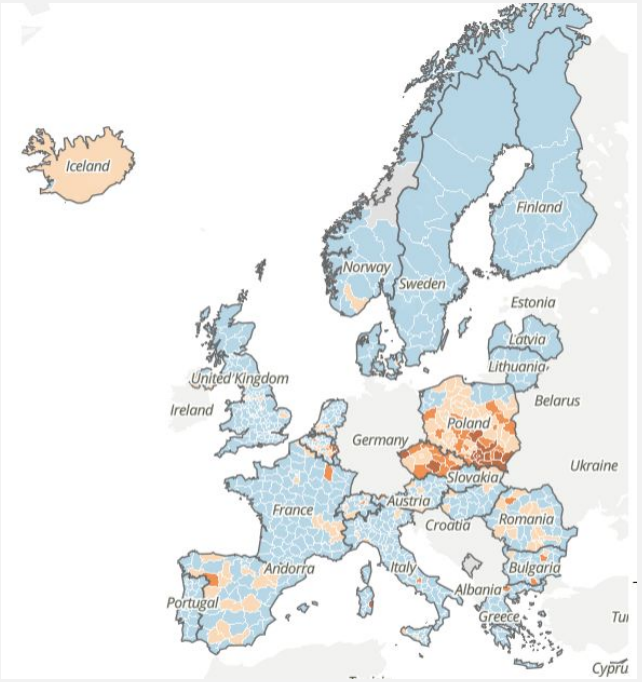
3 April 2020



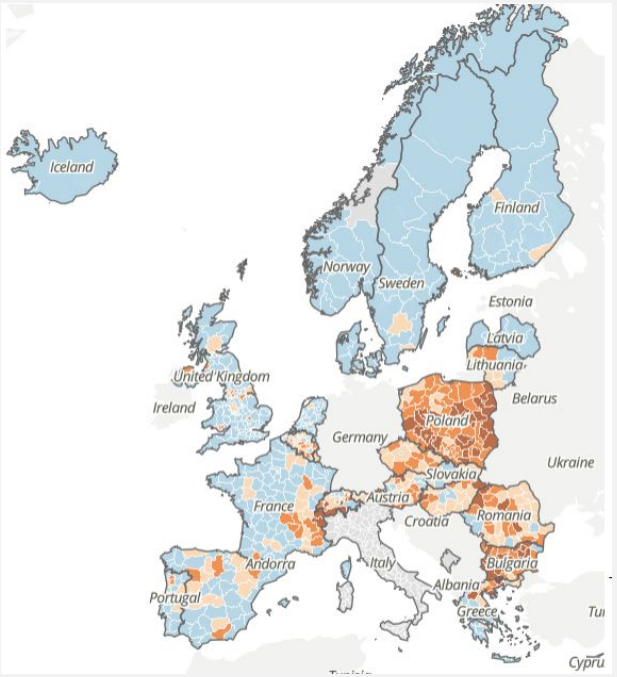
24 April 2020

- Weekly excess mortality rates (rASMRs) show the start of the impact of the COVID-19 pandemic in Northern Italy, how it spreads across Western Europe and to the UK.
- Excess mortality is relatively localised in Italy, France and Spain but much more widespread in the UK with every local area experiencing excess mortality during the spring

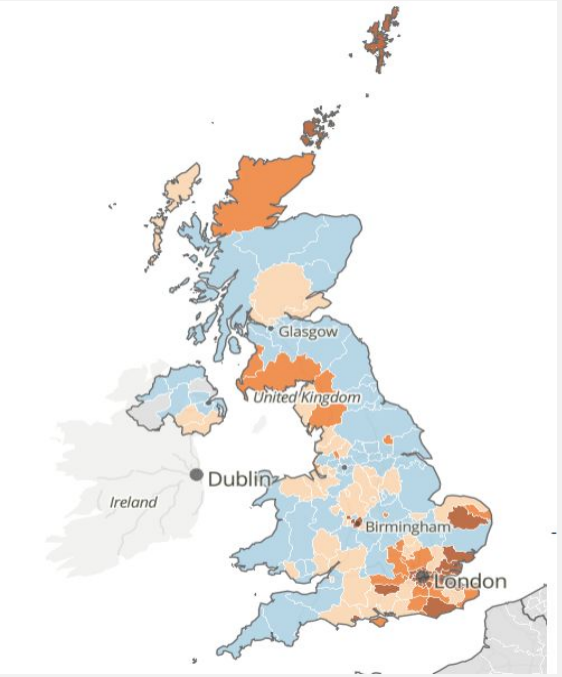
Comparisons of excess mortality in European countries and regions 2020 – Autumn/Winter



23 October 2020



20 November 2020



29 January 2021

- During the autumn and winter months of 2020 Central and Eastern European countries experienced the highest rates of excess mortality.
- UK data for 2021 show a peak in excess mortality rates at the end of January 2021.

Comparisons of excess mortality in European countries and regions 2020

- By the end of June the UK had the highest cumulative excess mortality rate, by 18 December it was the 8th highest.
- For those aged under 65, though, the UK had one of the highest cumulative excess mortality rates by 18 December

26 June order	Country	rcASMR (%) 26 June
1	England	7.3
2	UK	6.7
3	Spain	5.9
4	Scotland	5.3
5	Belgium	3.5
6	Italy	3.4
7	Wales	2.6
8	Sweden	2.3
9	Northern Ireland	2.2
10	Netherlands	1.9
11	France	0.0
12	Austria	-1.0
13	Portugal	-1.5
14	Cyprus	-1.9
15	Poland	-2.3

18 Dec order	Country	rcASMR (%) 18 Dec
1	Poland	11.6
2	Spain	10.6
3	Belgium	9.7
4	Bulgaria	8.9
5	Czechia	8.4
6	Slovenia	8.2
7	England	7.8
8	UK	7.2
9	Austria	5.7
10	Scotland	5.7
11	Northern Ireland	5.0
12	Netherlands	4.4
13	Wales	4.1
14	Portugal	3.7
15	France	2.6

18 Dec order	Country	rcASMR (%) Ages 0-64
1	Bulgaria	12.3
2	England	8.7
3	UK	7.7
4	Scotland	7.7
5	Wales	5.0
6	Northern Ireland	4.1
7	Spain	3.7
8	Iceland	2.3
9	Poland	1.3
10	Portugal	1.0
11	Czechia	1.0
12	Estonia	0.2
13	Lithuania	-0.7
14	Cyprus	-1.1
15	Malta	-1.3

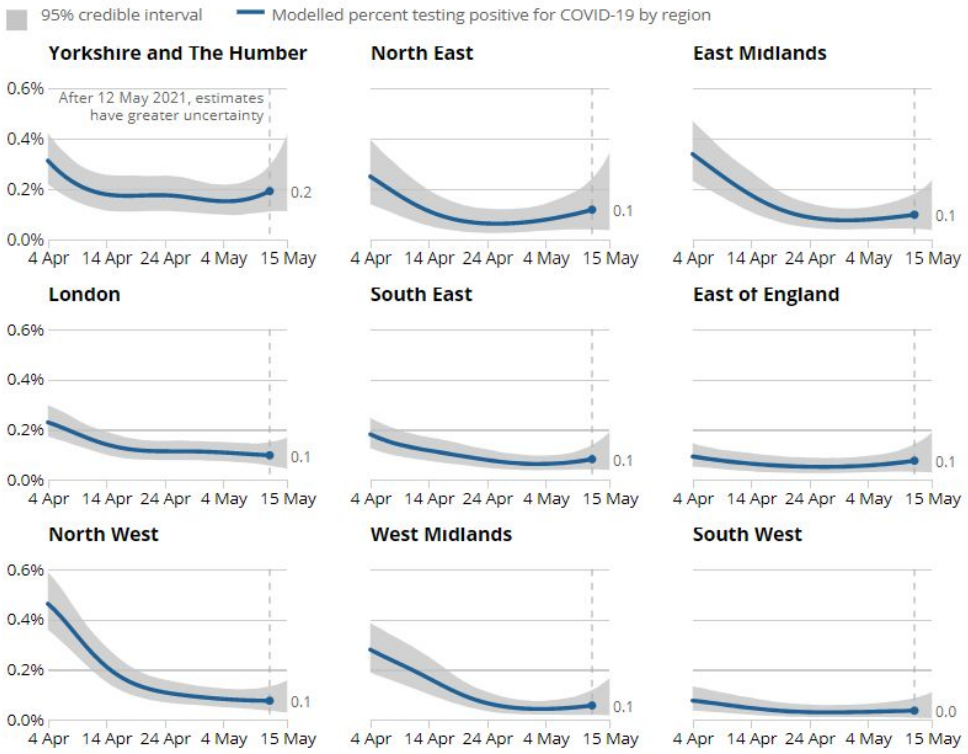
COVID-19 Regional Infections

COVID-19 Infection Survey – England Regions, Wales, Scotland and Northern Ireland

- The analysis is conducted over a six-week period, which means specific positive cases move into and then out of the sample. This causes variability between estimates over time, which is expected given the lower number of positive tests within each region, compared with England as a whole.
- This analysis can be used for identifying differences in numbers of positive cases between different regions.
- Previously, regional analysis has informed decision making regarding tier system restrictions.

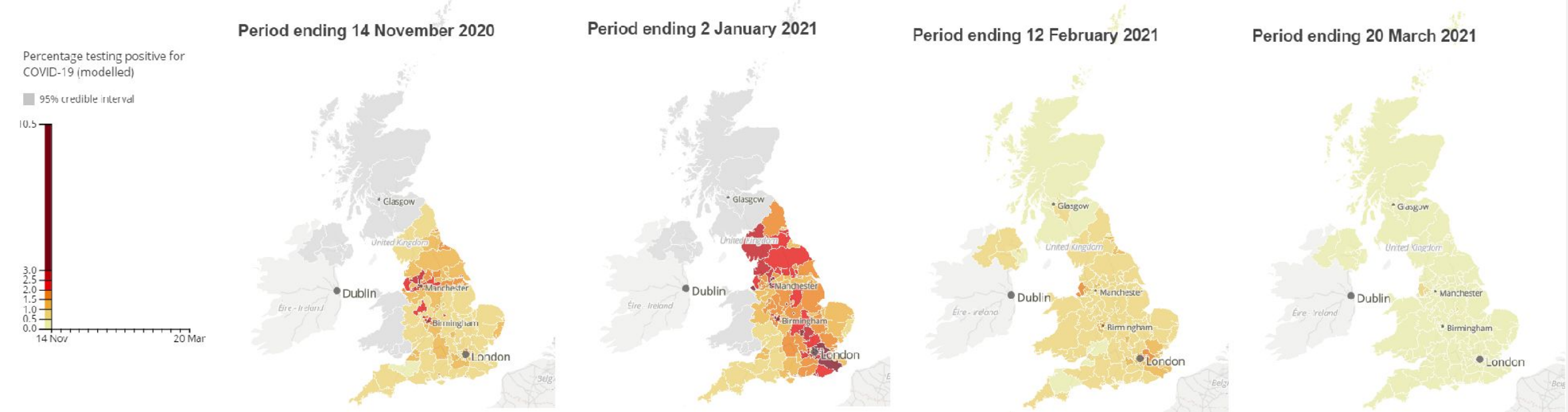
Figure 2: There were early signs of an increase in the percentage of people testing positive in the North East, Yorkshire and The Humber and the South East in the week ending 15 May 2021

Estimated percentage of the population testing positive for the coronavirus (COVID-19) on nose and throat swabs, daily, by region since 4 April 2021, England



COVID-19 Sub-regional Infections

COVID-19 Infection Survey – Sub-regions for all UK countries



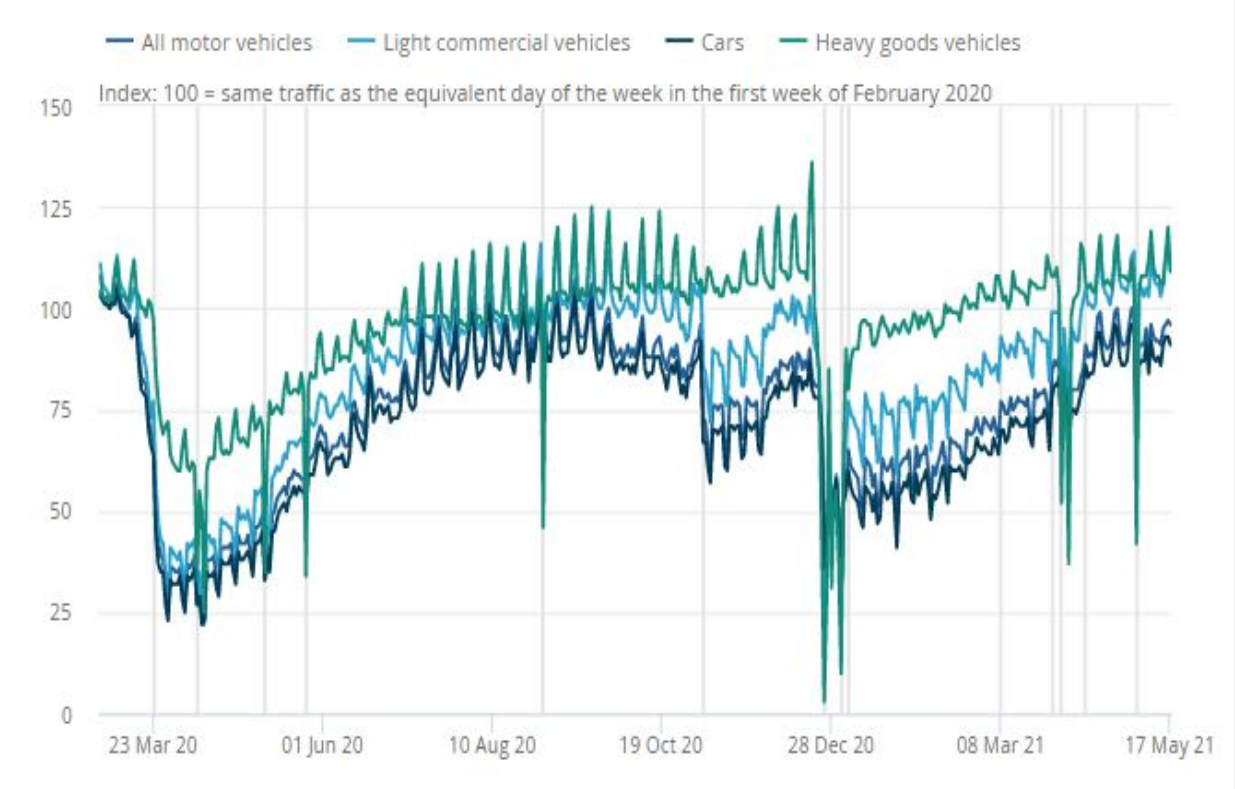
- Sub-regional estimates are obtained from a spatial-temporal MRP model. This is on a similar basis to the dynamic Bayesian MRP model used for national and regional trend analysis.
- This analysis can be used for identifying differences in numbers of positive cases between different sub-regions of the UK.
- Sub-regional analysis has informed decision making regarding more localised restrictions in addition to the use of regional analysis.

Behavioural Data Insights

Office for National Statistics

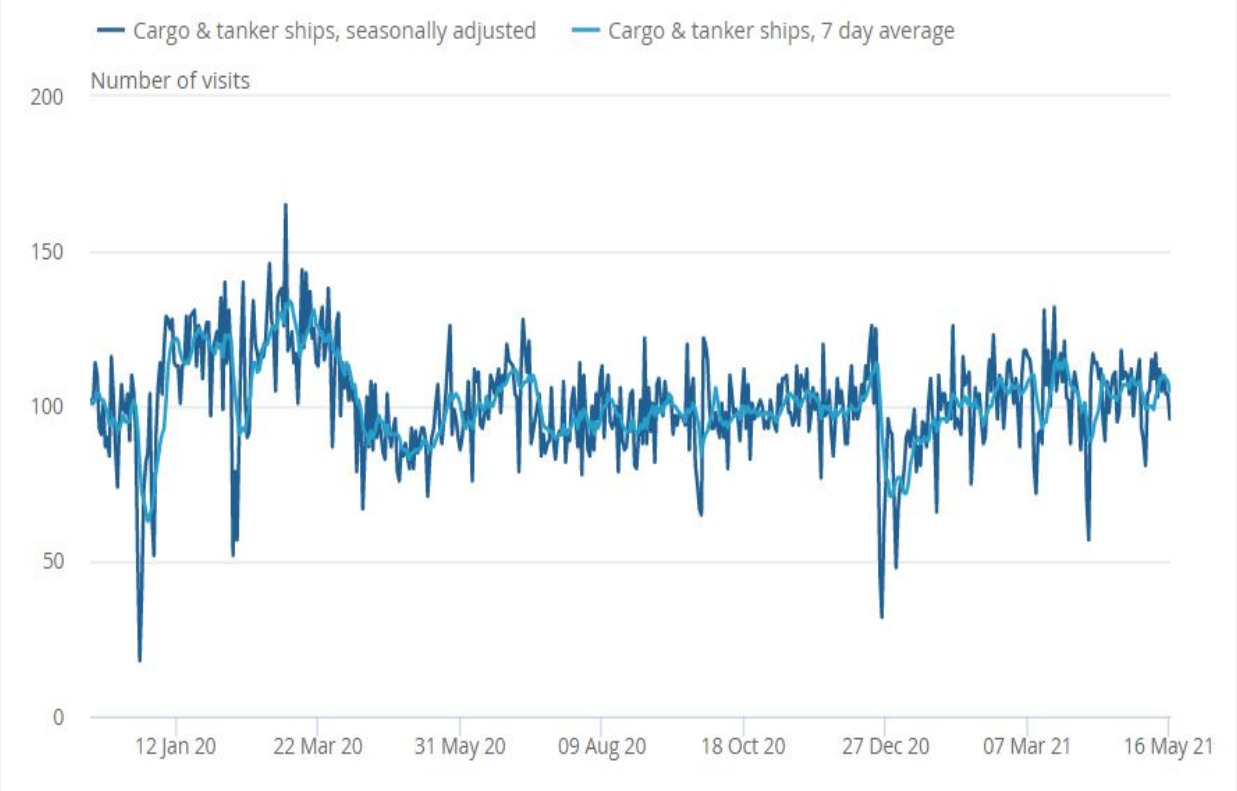
Road traffic and shipping

The volume of motor vehicle traffic on Monday 17 May 2021 was at 96% of the level seen in the first week of February 2020 suggesting a return to pre-pandemic levels.



Source: Department for Transport Road traffic statistics MI

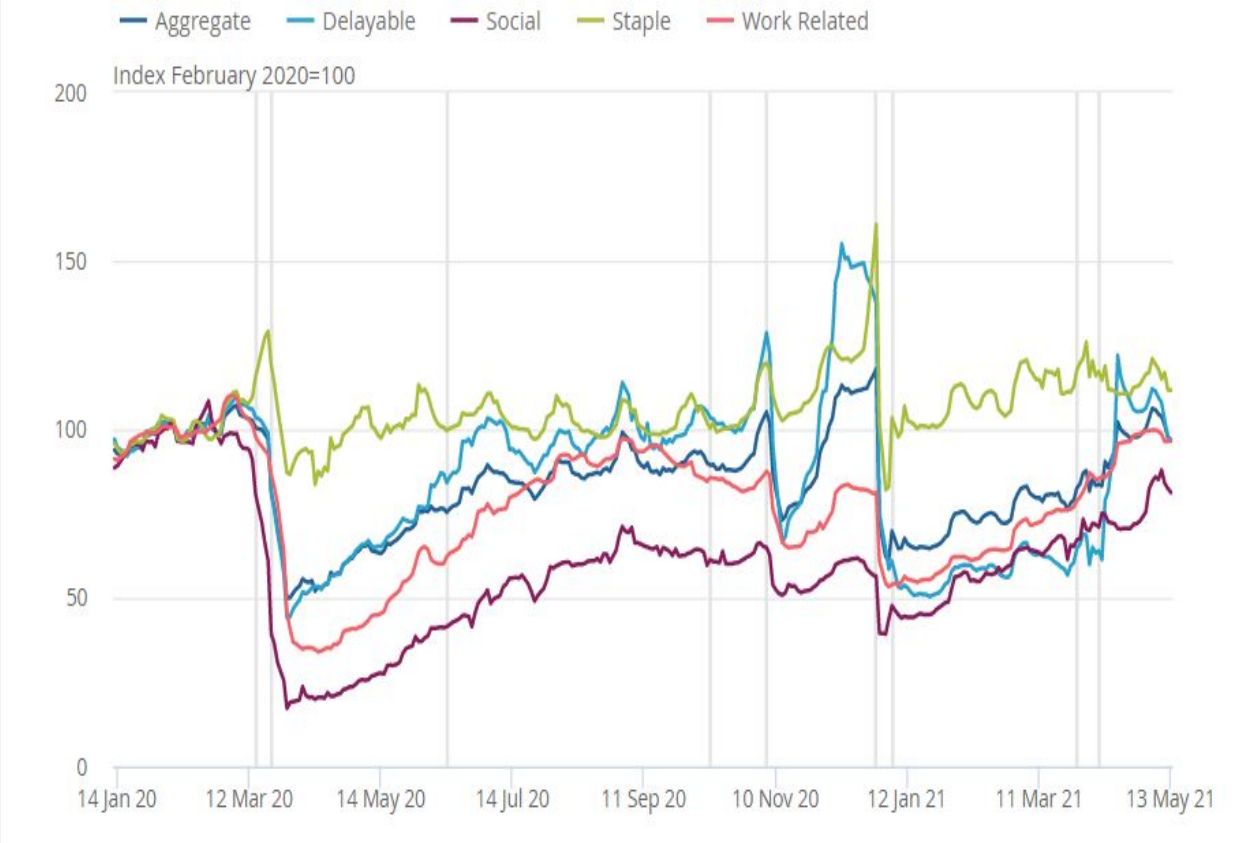
There was an average of 105 cargo and tanker ship visits in the week ending 16 May 2021, broadly unchanged from the previous week (103) and the equivalent week in 2019 (102) which further suggests a return to pre-pandemic levels.



Source: ExactEarth. UN Global Platform

Card data and online job vacancies

Since the substantial fall in spending at the beginning of the year, the aggregate CHAPS-based indicator of debit and credit card purchases has gradually increased.



Source: ONS and Bank of England calculations

The proportion of UK online job adverts on 14 May 2021 was at 114% of its February 2020 average level.

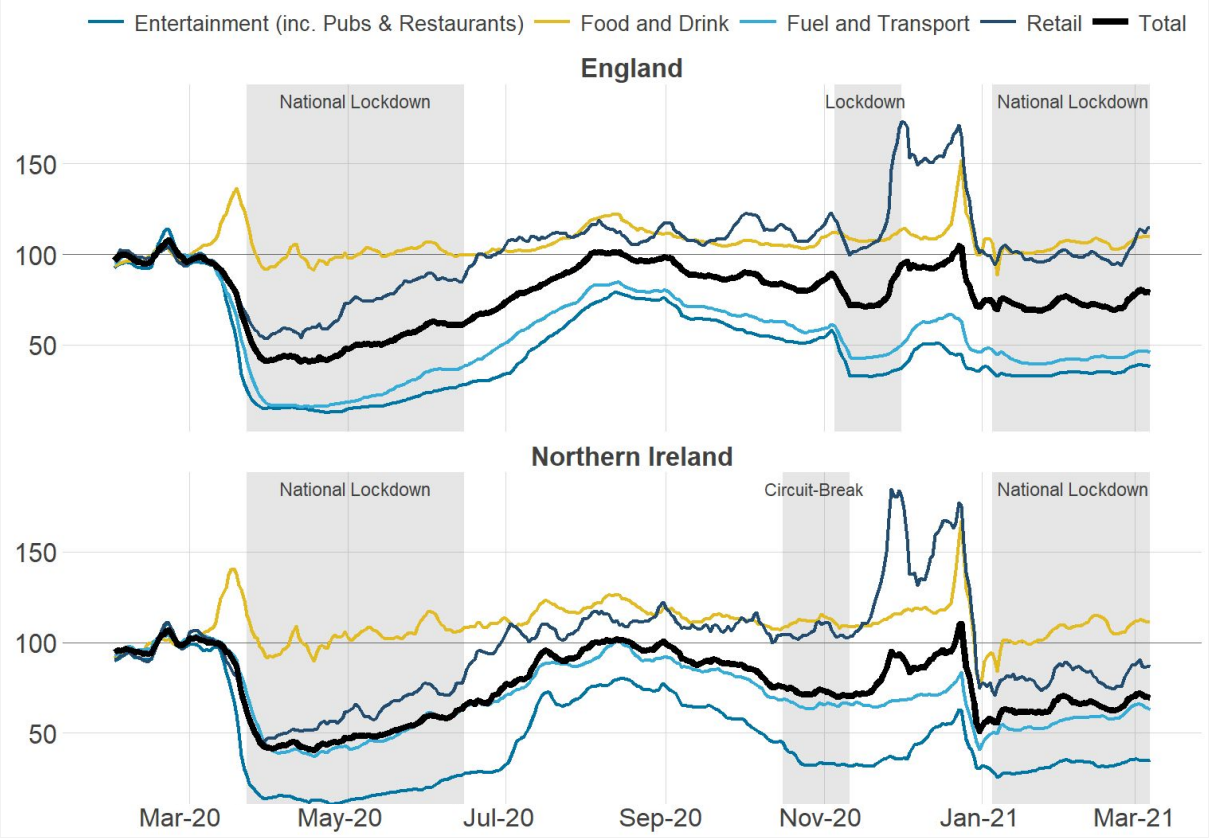
Source: Adzuna

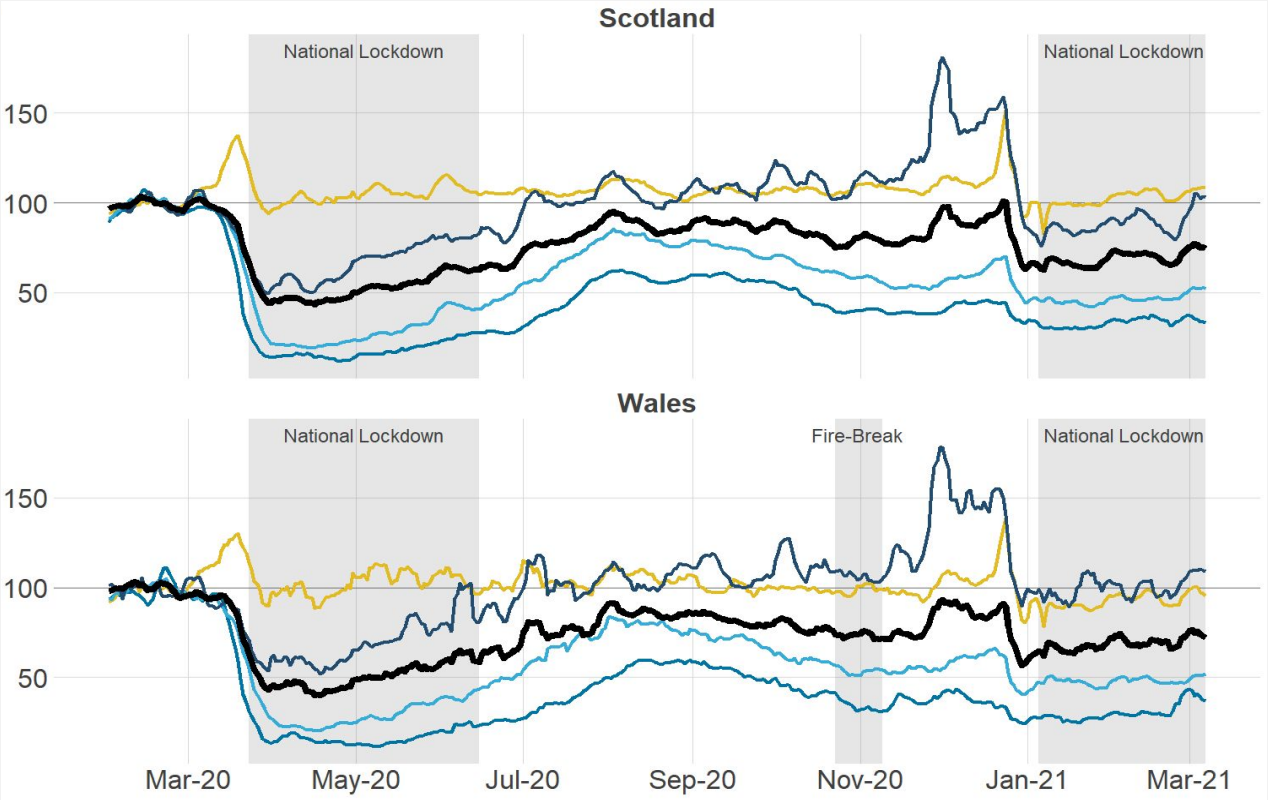
Office for National Statistics

Financial transactions data show consumer spending is increasingly resilient to lockdown restrictions

Daily total expenditure by sector and UK nations

Seven-day rolling average of adjusted indexed values (100 = day of week average February 2020)



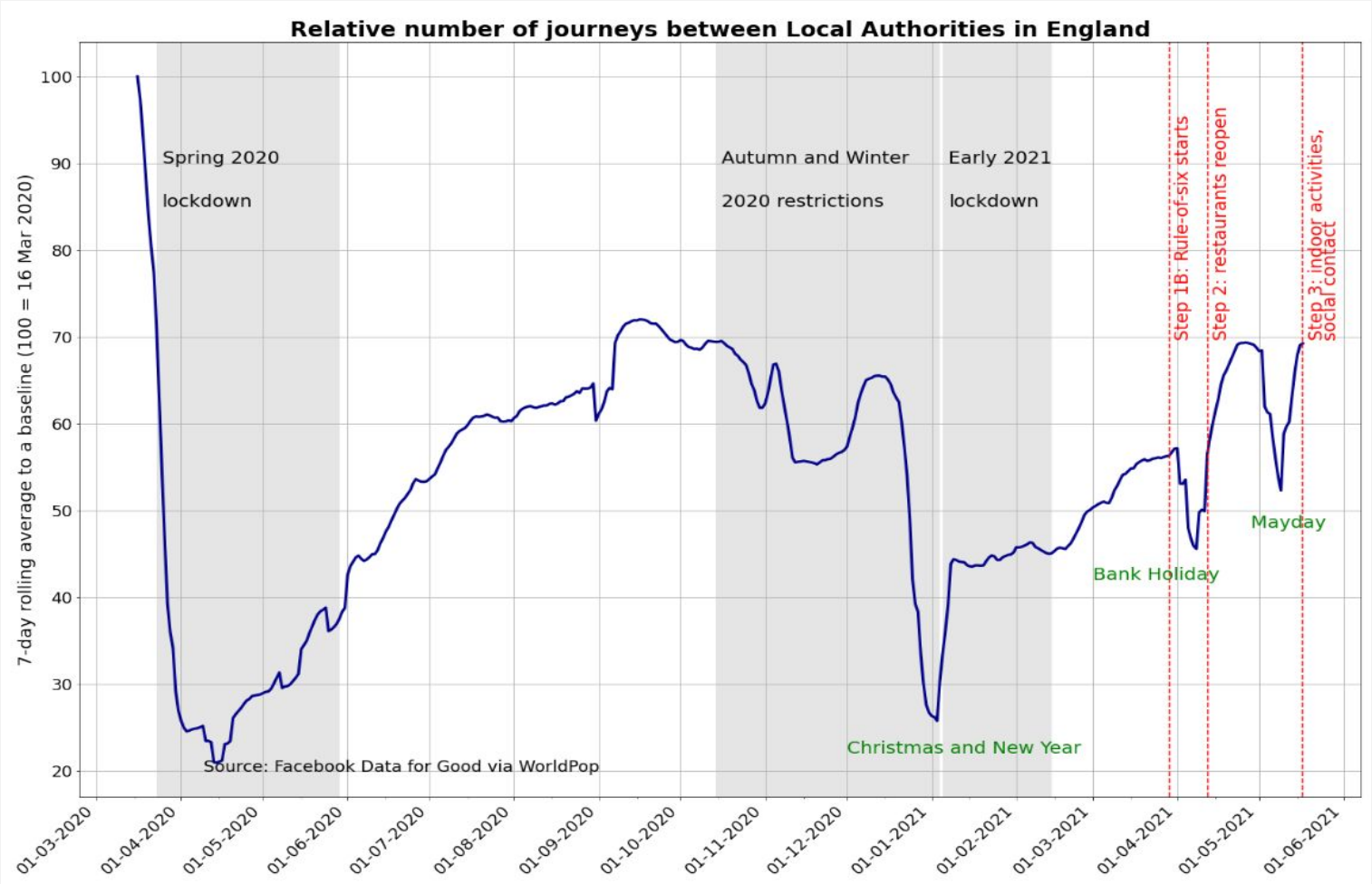


Source: Revolut

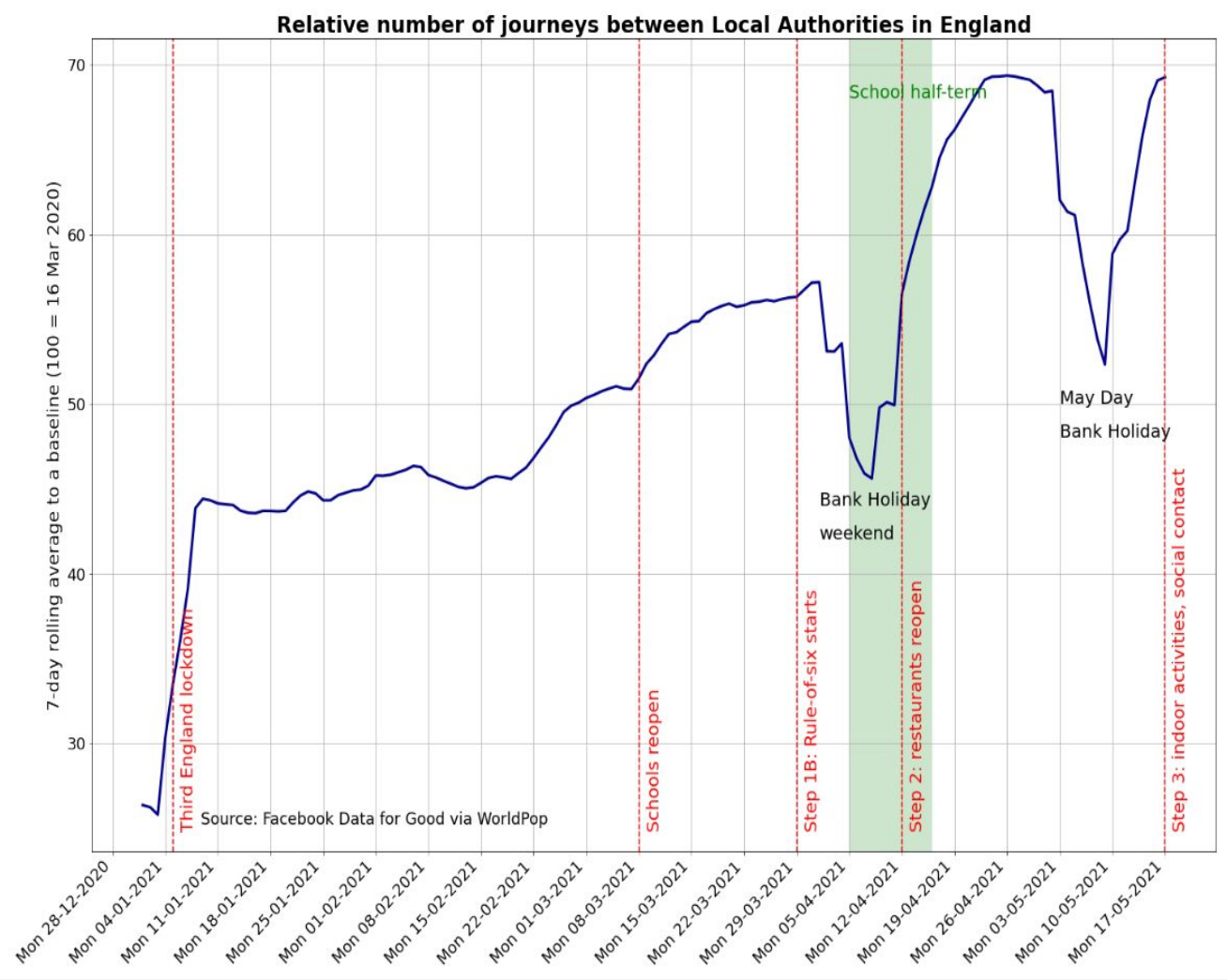
Office for National Statistics

Facebook Mobility

- Full lockdowns have the greatest impact on mobility.
- Restrictions introduced for the period between 5th November and 2nd December only saw a partial drop in mobility – not to the same level as a 'full' lockdown.
- As restrictions lift, mobility increases.



Facebook Mobility



- 29/03/2021: England outdoor rule-of-six began (Step 1B), but no significant impact on mobility could be immediately observed.

- Half-term holiday: schools closed for two weeks between 05/04/2021 and 16/04/2021:

  - The first week was still stay at home, mobility showed a sharp decrease in the period leading to the Bank Holiday weekend.
  - On 12/04/2021 (Step 2), non-essential shops, hairdressers, gyms and outdoor hospitality resumed. Restaurants opened for outdoor dining, causing mobility to go up.

- After Step 2 was introduced, mobility steadily increased to stabilise around 70%, with the exception of the May Day Bank Holiday.

Epidemiological and Health Related Modelling

Office for National Statistics

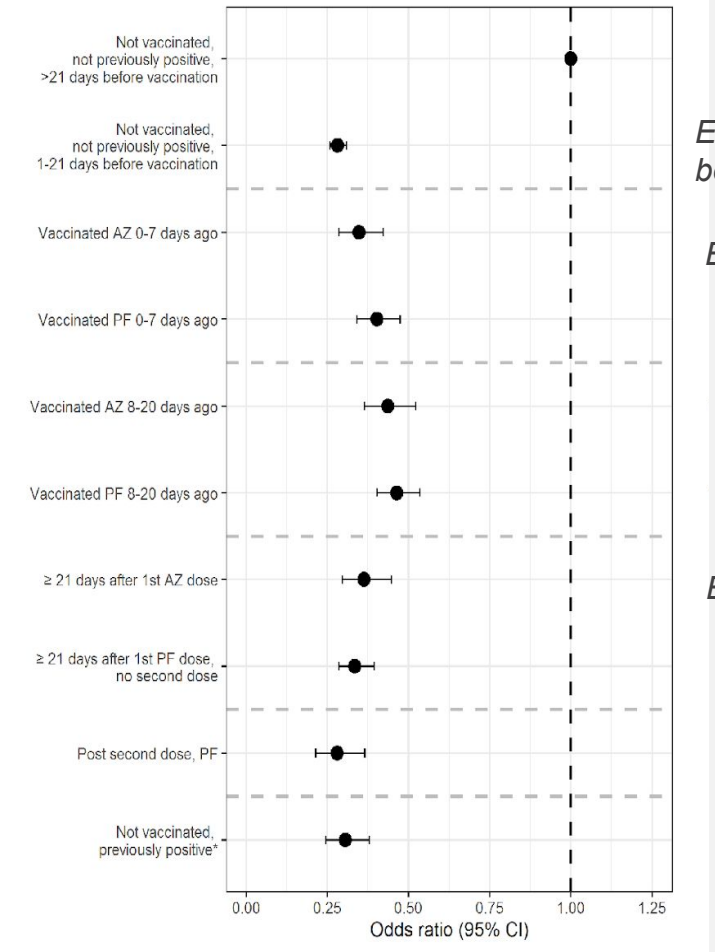
Impact of vaccination on positivity – odds ratios of testing positive (all positives)

- Generalised linear models with a logit link were used with robust standard errors used to account for multiple visits per-participant.

- The model adjusted for confounding factors such as time and age including an interaction between vaccine exposure group and age
- Odds of a new SARS-CoV-2 infection (with or without symptoms) were reduced by 65% (95% CI 40 to 60%) for this 21 or more days since first dose but before receiving a second dose compared with the control group.

- No evidence of difference in the likelihood of infection between the Oxford-AstraZeneca and Pfizer-BioNTech vaccines.

- There was no evidence of a difference in odds of testing positive between individuals having received two vaccine doses and those not vaccinated but with evidence of prior positivity.



Effect due to behaviour

Effect primarily due to behaviour

Effect due to behaviour and biology

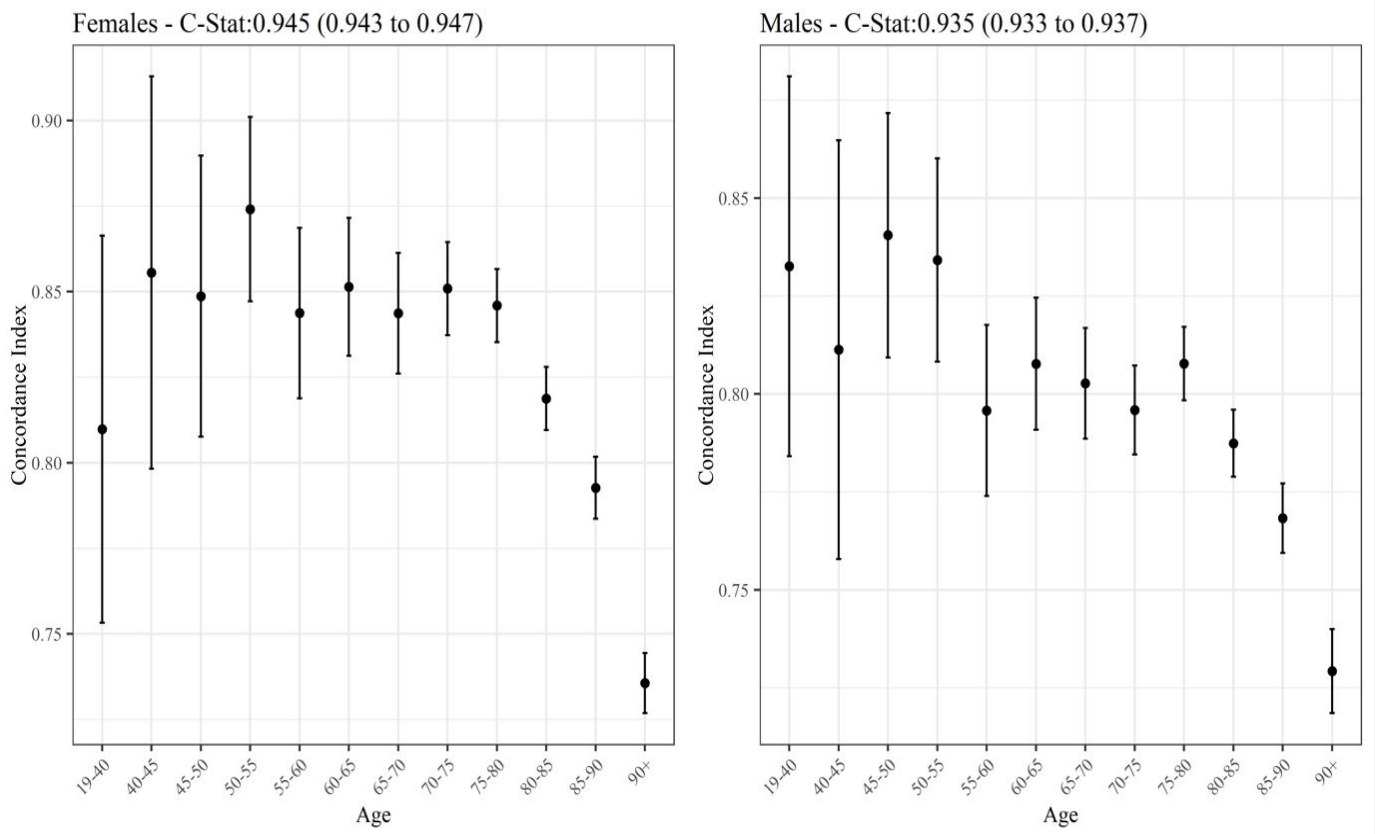
Effect primarily due to biology

Office for National Statistics

ONS Validation of the QCovid risk model

- New risk prediction model
- Aims:
  - guide healthcare practitioners
  - Inform vaccination prioritisation
- ONS commissioned by CMO to validate of the model
- Model performs well out of sample
- Validation led to the algorithm to be used in healthcare

Harrell's C statistic by age group for men and women

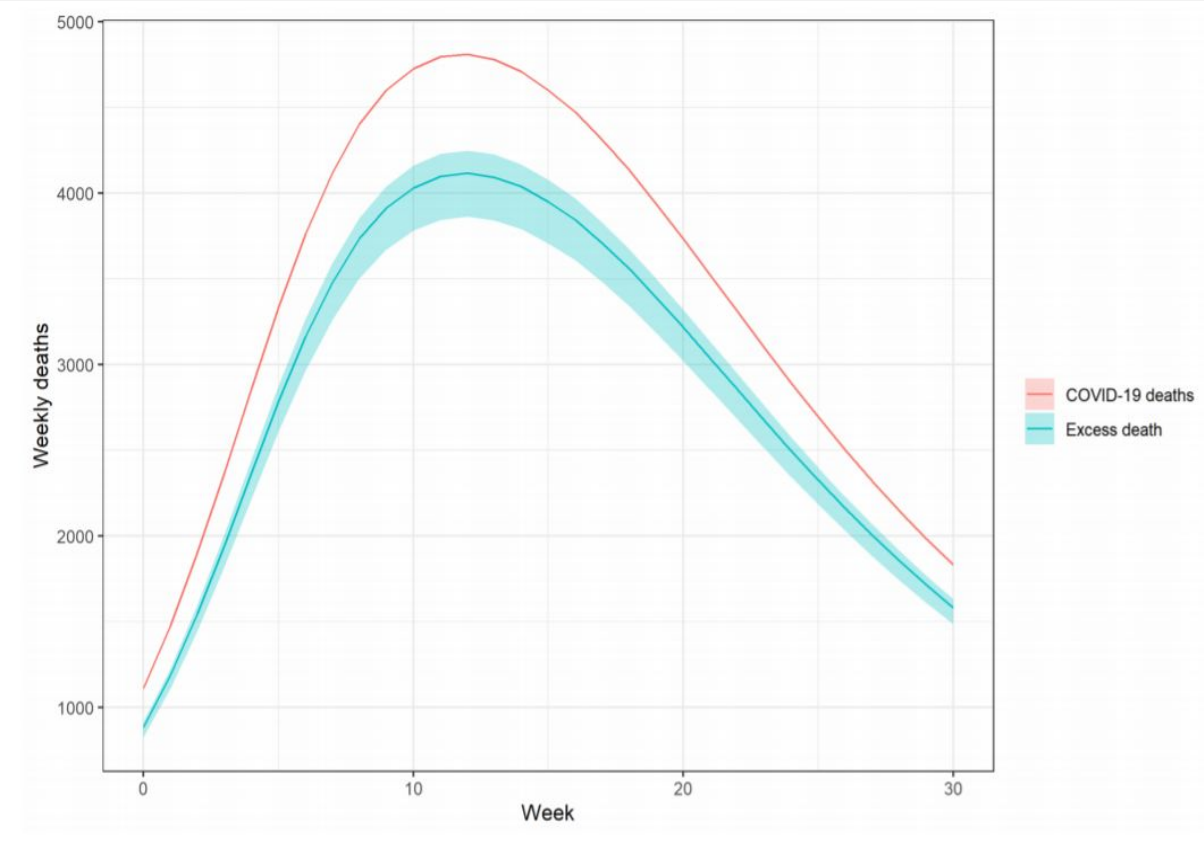


Office for National Statistics

Preprint (accepted by Lancet Digital Health)

COVID-19 excess death modelling

- Microsimulation modelling of mortality rates with and without COVID-19 for different ages and sexes
- Mortality rates with COVID-19 estimated using hazard rates for individuals with different numbers of comorbidities. Central estimate of COVID-19 mortality matches individual of same age with 2 comorbidities
- Inputs are COVID-19 deaths per week in a given scenario provided by SPI-M and agreed by SAGE
- Here, an excess death is any occurring >12 months earlier with COVID-19 than without
- Difference in age at death allows calculation of years of life lost, and converting into QALYs lost



Office for National Statistics

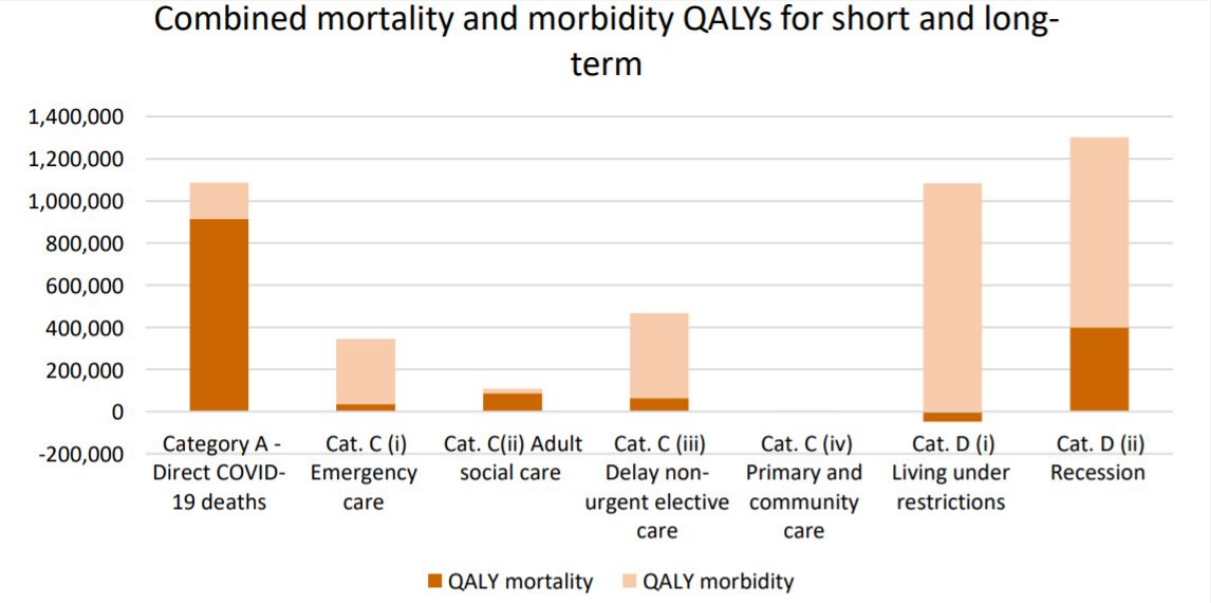
COVID-19 excess death modelling

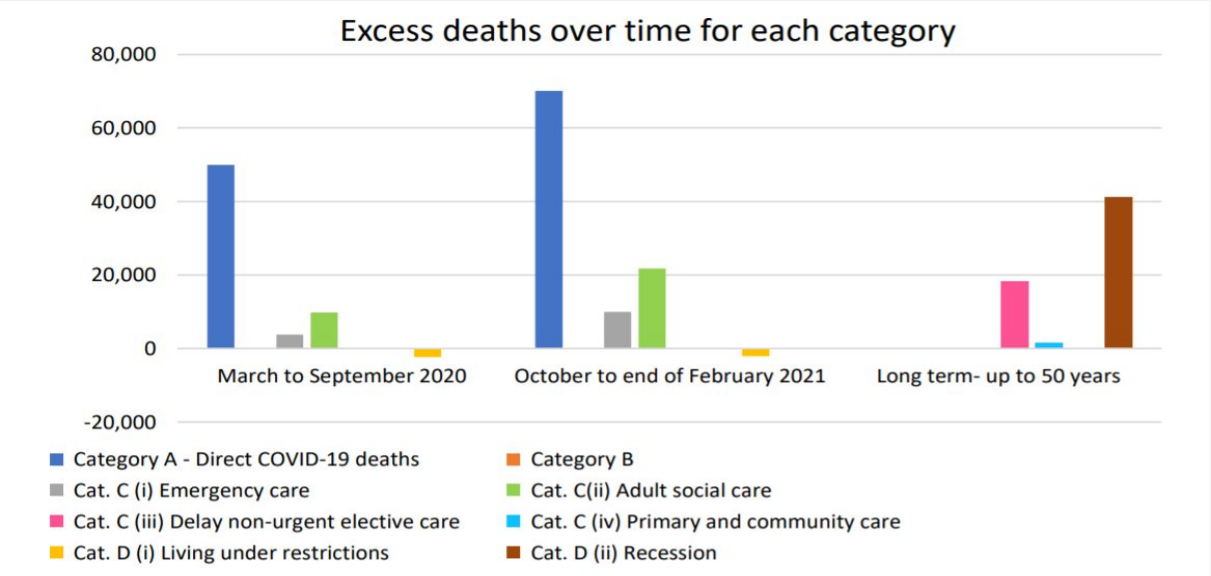
The previous analysis represents just one source of harm caused by COVID-19

Collaborative analysis by DHSC and ONS for SAGE estimated excess deaths and morbidity impacts of COVID-19 across several categories:

A. Directly due to contracting COVID-19
B. COVID-19 outcomes worsened due to breaches in healthcare capacity
C. Changes to other health and social care services, such as delays to elective procedures
D. Wider impacts, such as due to government restrictions on behaviour and social / economic impacts of those

All required swift, robust and novel methods for estimating impacts of COVID-19

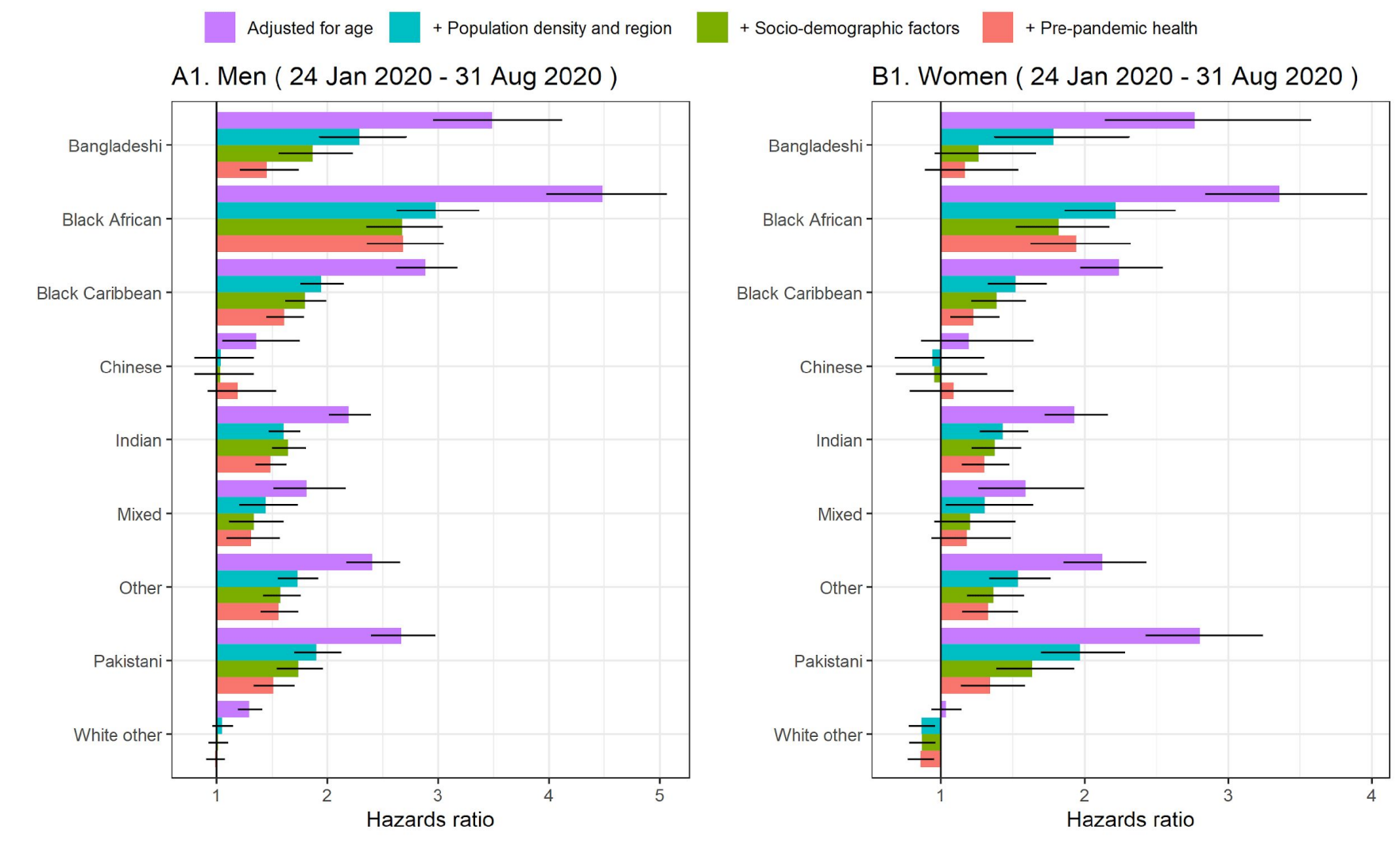




Office for National Statistics

Ethnic differences in COVID-19 mortality

Hazard ratios for COVID-19 related death for ethnic minority groups, Wave 1

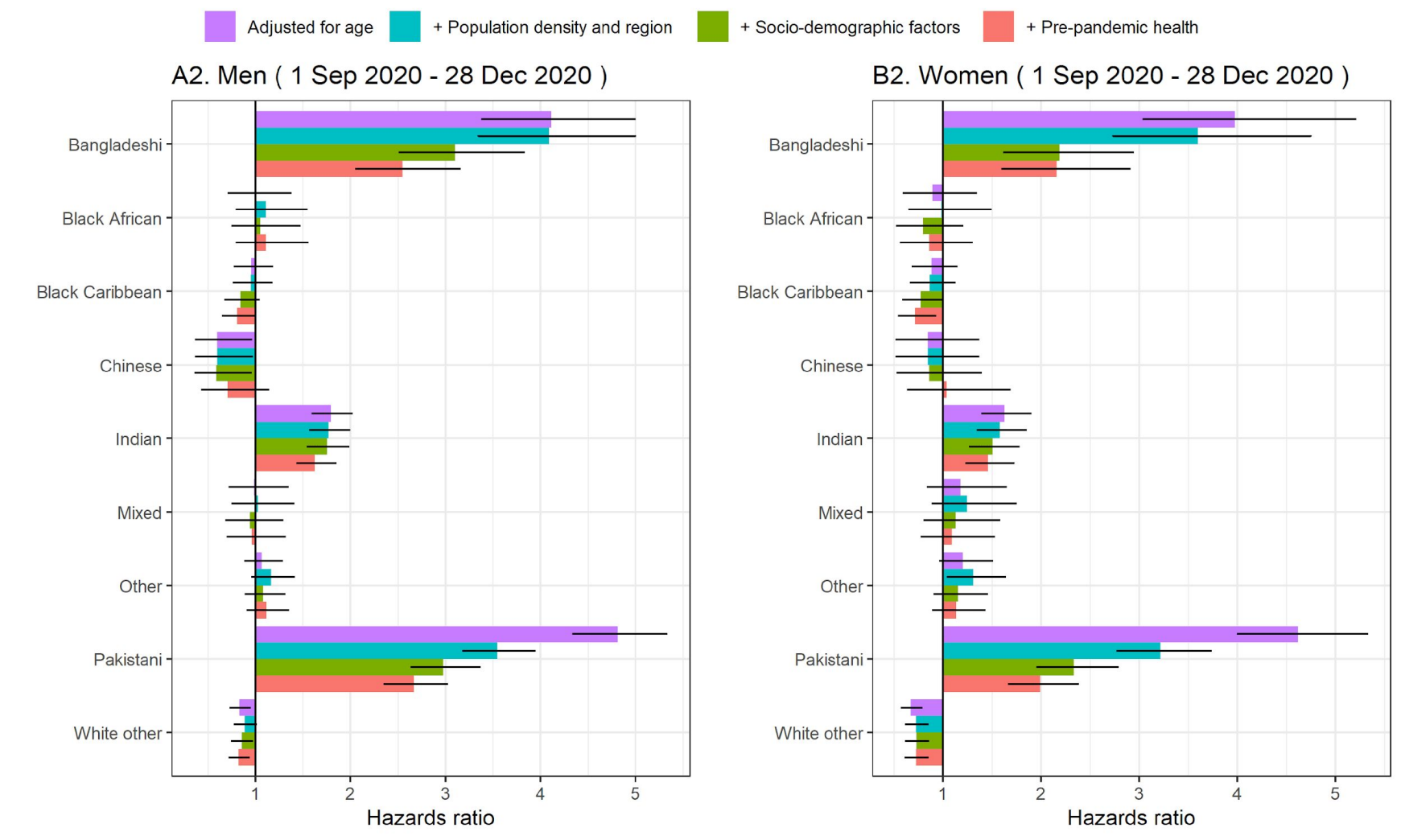


Office for National Statistics

First ONS release ; Paper on Wave 1

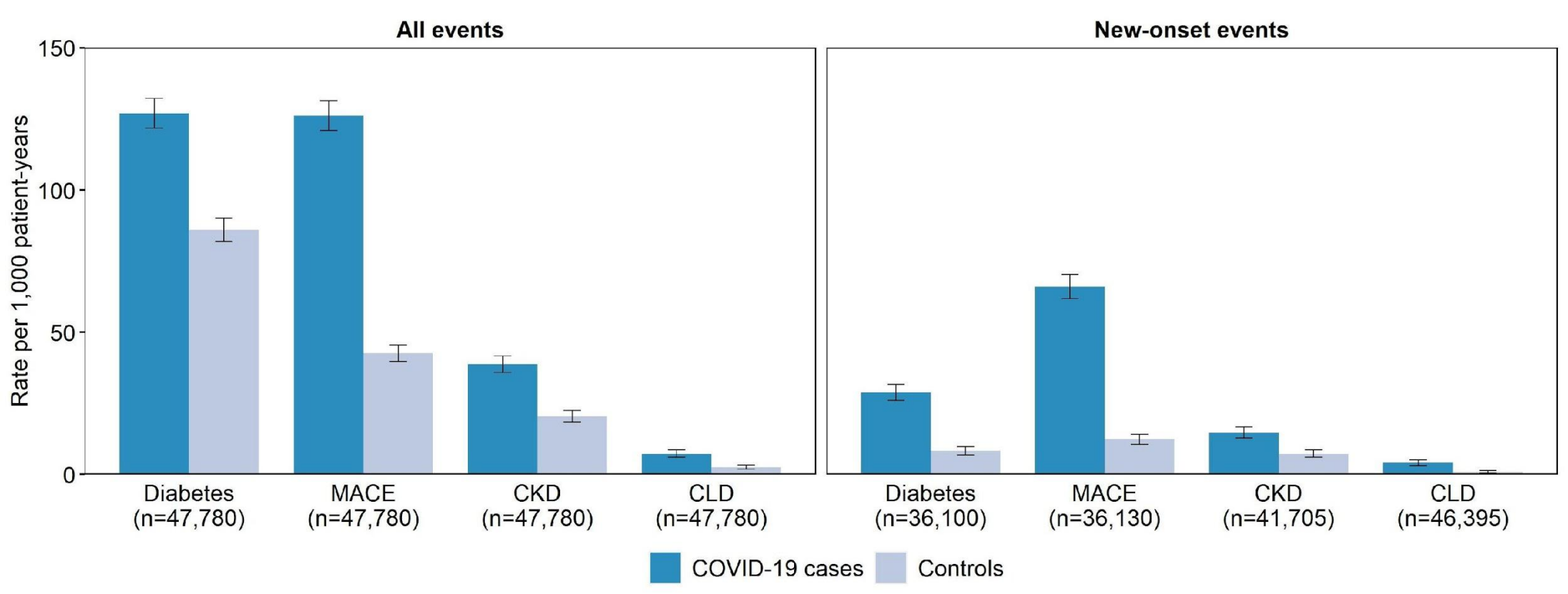
Preprint on comparison of W1 & W2 (accepted by European Journal of Epidemiology)

Hazard ratios for COVID-19 related death for ethnic minority groups Wave 2



Multi-organ impairment following COVID-19 hospitalisation

Rates of adverse events in discharged COVID-19 patients in England compared with matched controls



- Sources: HES to Aug 2020, GPES to Sep 2020, death registrations to Sep 2020
- Diabetes includes both type 1 and type 2; MACE: major adverse cardiovascular event (a composite of heart failure, myocardial infarction, stroke and arrhythmia); CKD: chronic kidney disease stages 3-5, including dialysis and kidney transplant; CLD: chronic liver disease
- Matching variables: age, sex, ethnicity, region, IMD quintile, smoking status, pre-existing conditions (hypertension, MACE, respiratory disease, CKD, CLD, diabetes, cancer)

Source: Ayoubkhani et al. 2021. Available at: https://www.bmj.com/content/372/bmj.n693

Office for National Statistics

Using innovate data and modelling to inform decision making

Professor Sir Ian Diamond
National Statistician

Do you have questions?

27 May 2021