HDRUK Health Data Research UK

Improving our health through data science

The impact of real-time high-resolution spatial health surveillance of COVID19 linked health data at scale

23rd June 2021

Dr Laura North, Dr Joe Hollinghurst and Dr Rich Fry

on behalf of the SAIL HDRUK COVID Team:

Prof Ronan Lyons, Ashley Akbari, Gareth Davies, Rowena Griffiths, Jane Lyons, and Fatemah Torabi

Swansea University Prifysgol Abertawe | Medical School Ysgol Feddygaeth

SAIL DATABANK

ADR WALES Data-driven change

Population Data Science at Swansea University

Analysis of linked de-identified data of the impact of COVID19 on the Welsh population using the Secure Anonymised Information Linkage (SAIL) system: A One Wales Approach

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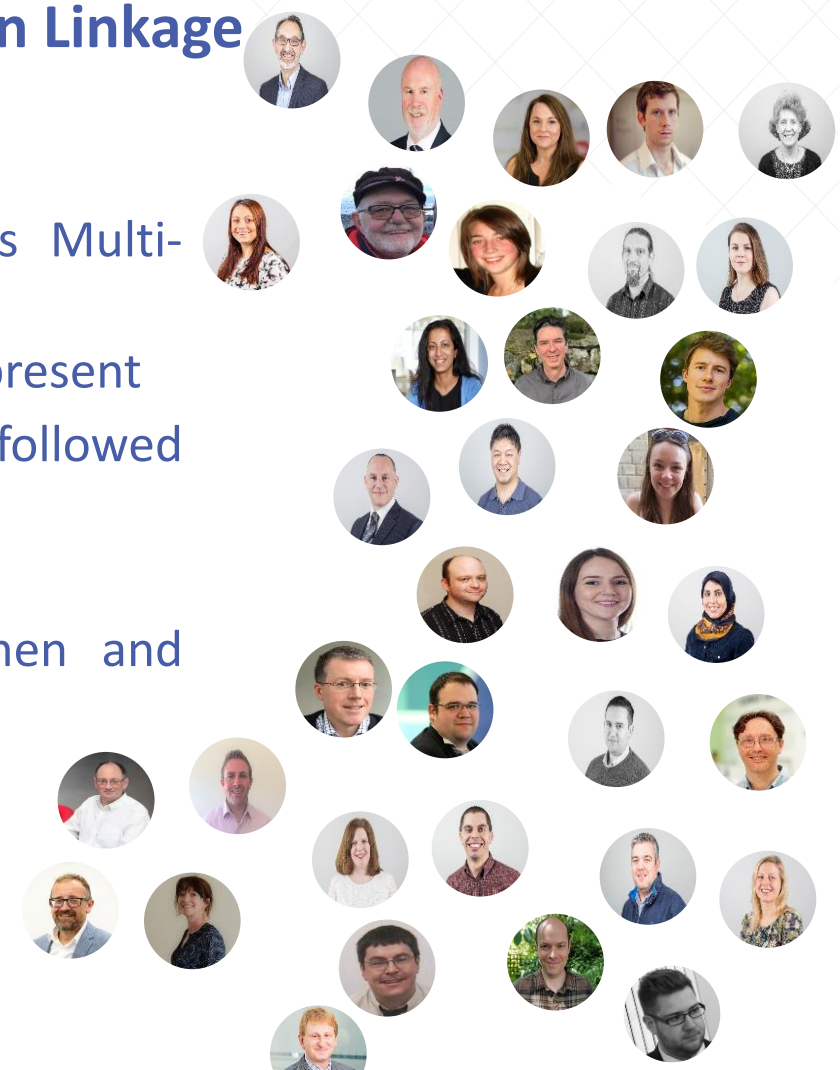


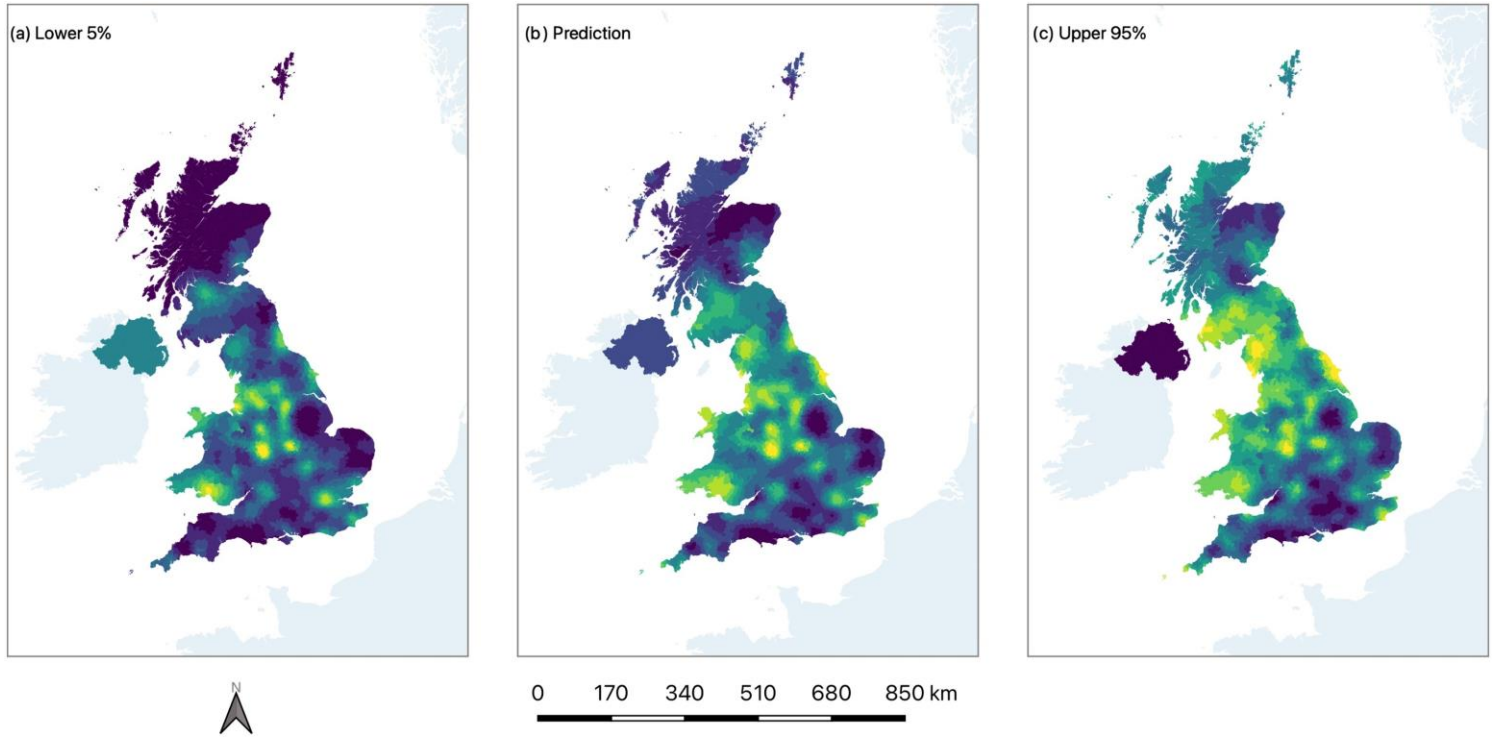
Creation of two total population linked cohorts derived from Wales Multi-morbidity Cohort:

- C20 - all alive and known to NWIS on 1st January 2020 followed up to present
- C16 – all alive and known to NHS Wales (NWIS) on 1st January 2016 followed up to end December 2019 – counterfactual cohort
- Research now supported by a grant from the Medical Research Council
- Enhanced data collection in care homes, schools, pregnant women and teenagers
- ***Advanced Spatial Analytics***
- Direct reporting to Welsh Government TAG and to SAGE
- https://bmjopen.bmj.com/content/10/10/e043010.info

MRC Medical Research Council · British Heart Foundation · Chief Scientist Office · EPSRC Engineering and Physical Sciences Research Council · ESRC Economic & Social Research Council · Ymchwil Iechyd a Gofal Cymru Health and Care Research Wales · HSC Public Health Agency Research and Development · NHS National Institute for Health Research · wellcome

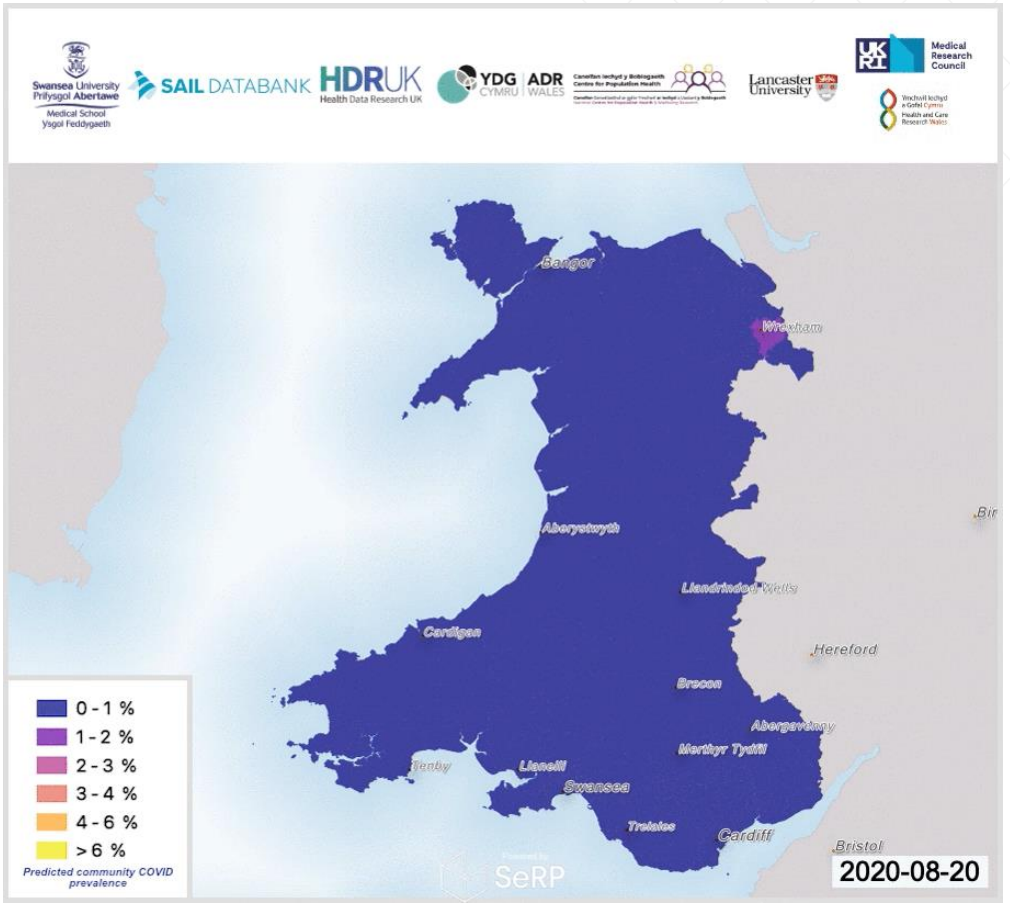
Predicting community prevalence

- HDRUK Network Linkup with BREATHE, ZOE and geospatial expertise to develop high-resolution mapping of prevalence across the UK. April ➔ Present International Journal of Medical Informatics : https://doi.org/10.1016/j.ijmedinf.2021.104400
- First UK wide scale mapping of prevalence at community level – before testing data was available. Weekly updates to Welsh and Scottish Gov. Importantly shows intra-authority variation



Models adapted for COVID-19 testing data

- Using objective measures of COVID test outcomes (PCR tests) – linked to homes
- Able to develop high resolution models of COVID spread
- Importantly able to visualise change over time
- Directly informed Welsh Government decision making processes on lockdowns and fire break via Technical Advisory Cell (Welsh SAGE equivalent)
- Used in public media briefings by First Minister Mark Drakeford and Health Minister Vaughan Gething to help explain some of the decisions around lockdown and firebreaks
- Demonstrated to the general public how their anonymised data was being used – widely reported in the media



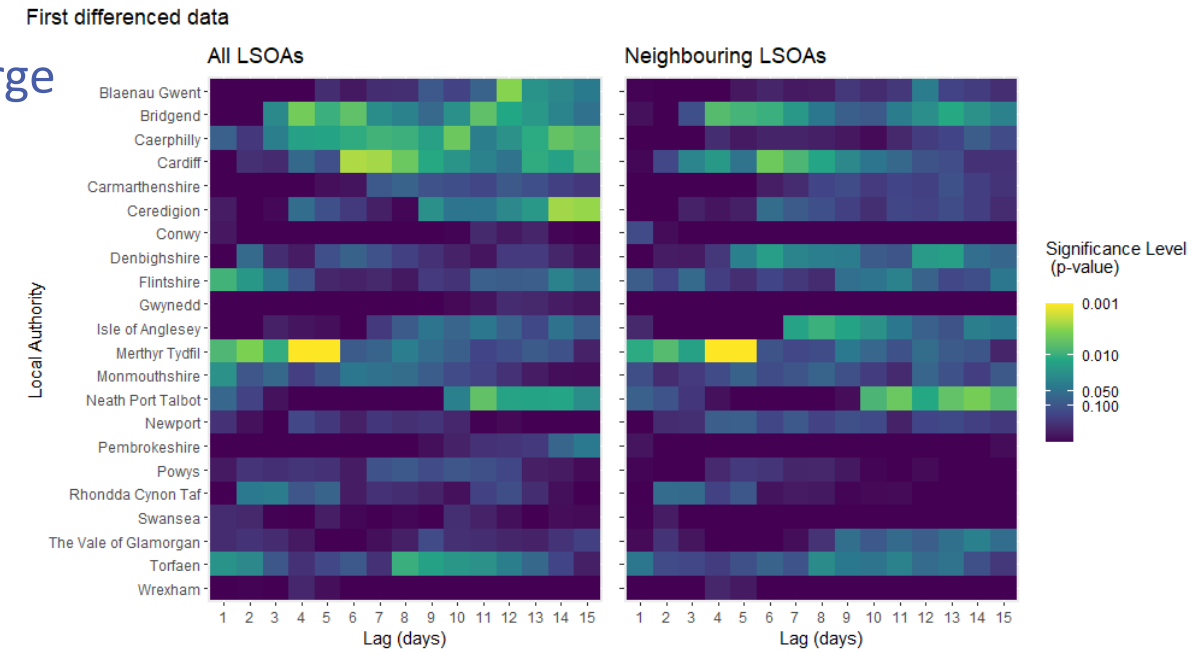
Geographical linkages

SAGE SCWG, TAC, Welsh Government Task and Finish Group

- Enhanced Care Home Index – total care home linkage plus enhanced variables to capture lived environments (e.g. Floor space, linked care homes, shared space, services offered, access to primary and secondary care)
- Initial analysis: excess mortality (all cause)
- Hospital discharge analyses : small effect of discharge
- Impacts of vaccines on CH population

Ongoing work:

- Looking at COVID specific mortality
- Change in resident population characteristics
- Impact of community prevalence on outbreaks
- Impact on specialist care settings (e.g. dementia)
- Care home workforce analysis



https://doi.org/10.1093/ageing/afaa207

Modelling school transmission in primary and secondary educational settings

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TAG, Welsh Government Task and Finish Groups

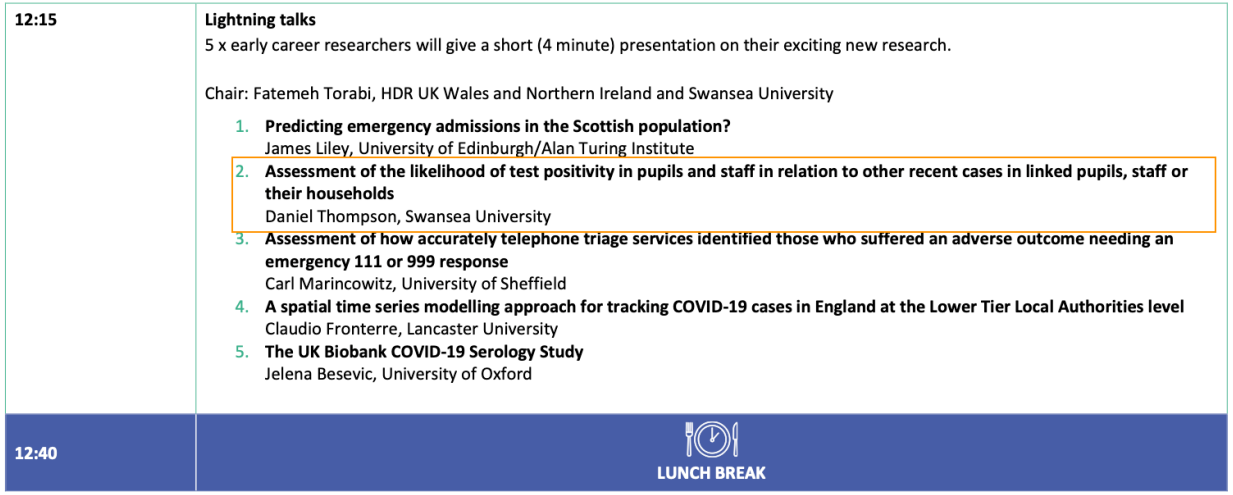
- Mixed Methods approach: Quantitative health and **administrative** data plus **school survey data** linked by location data

Quantitative Data

- Enhanced School Anonymised Linking Field (S-ALF) – school characteristics, size, year groups, building age
- Administrative education data e.g. attendance, school bus usage plus staff information
- Linked to health data and households

Qualitative Data

- HAPPEN survey extended to capture children, parents and teacher views
- Helps understand some of the nuances of the quantitative data



12:15	**Lightning talks** 5 x early career researchers will give a short (4 minute) presentation on their exciting new research. Chair: Fatemeh Torabi, HDR UK Wales and Northern Ireland and Swansea University 1. **Predicting emergency admissions in the Scottish population?** James Liley, University of Edinburgh/Alan Turing Institute 2. **Assessment of the likelihood of test positivity in pupils and staff in relation to other recent cases in linked pupils, staff or their households** Daniel Thompson, Swansea University 3. **Assessment of how accurately telephone triage services identified those who suffered an adverse outcome needing an emergency 111 or 999 response** Carl Marincowitz, University of Sheffield 4. **A spatial time series modelling approach for tracking COVID-19 cases in England at the Lower Tier Local Authorities level** Claudio Fronterre, Lancaster University 5. **The UK Biobank COVID-19 Serology Study** Jelena Besevic, University of Oxford
12:40	**LUNCH BREAK**

TEAM SCIENCE!

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Thanks for listening!

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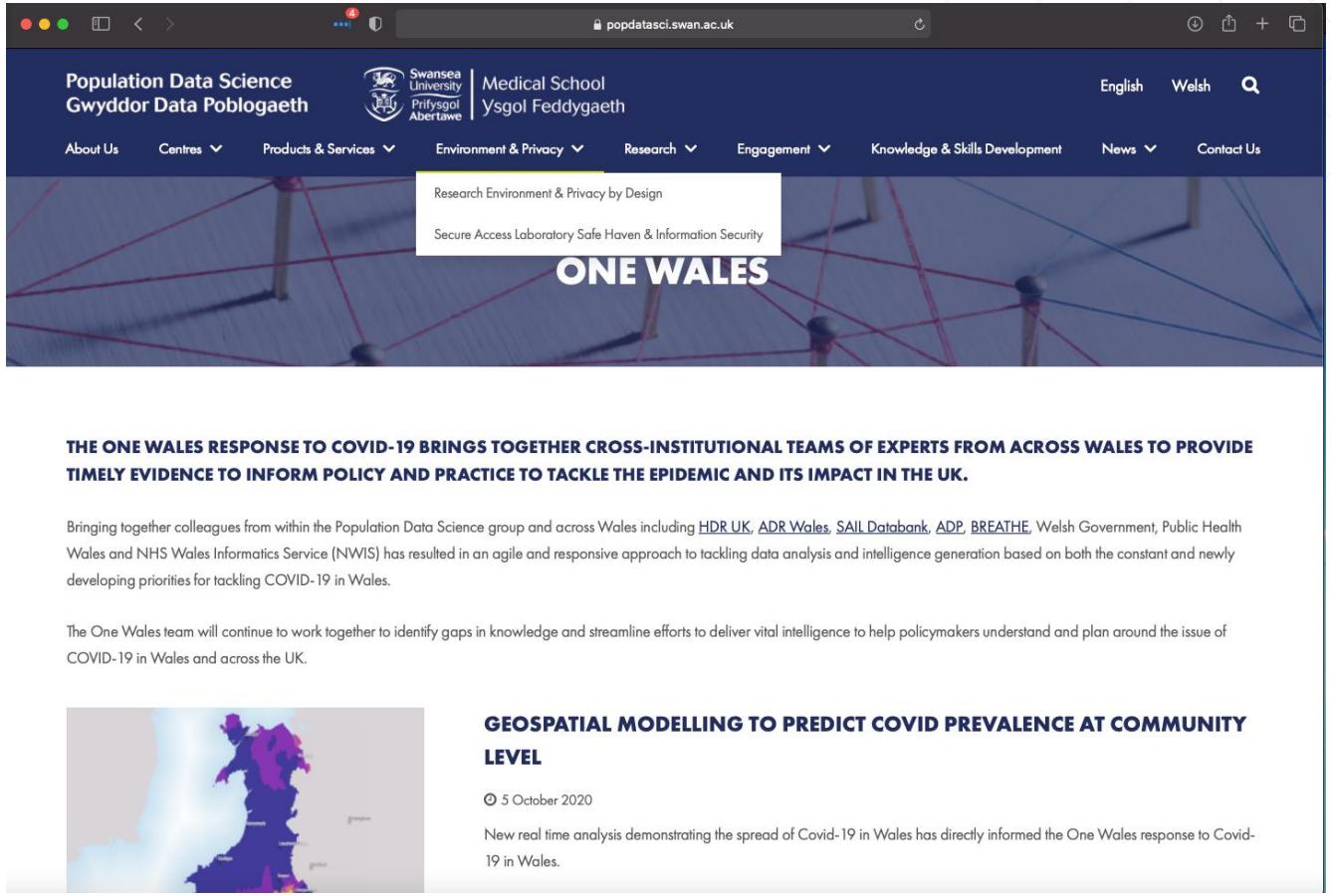
@richfry



https://popdatasci.swan.ac.uk/news/one-wales/

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FAIR use of data at scale
(Findable, Accessible, Interoperable and Reusable)

Whole-population pandemic response research in the NHS Digital TRE for England

Jonathan Sterne
University of Bristol, UK
HDR UK South West

British Heart Foundation Data Science Centre
Led by Health Data Research UK

University of Bristol

University of Cambridge

UCL

COVID-19 Longitudinal Health & Wellbeing National Core Study

UKRI Medical Research Council

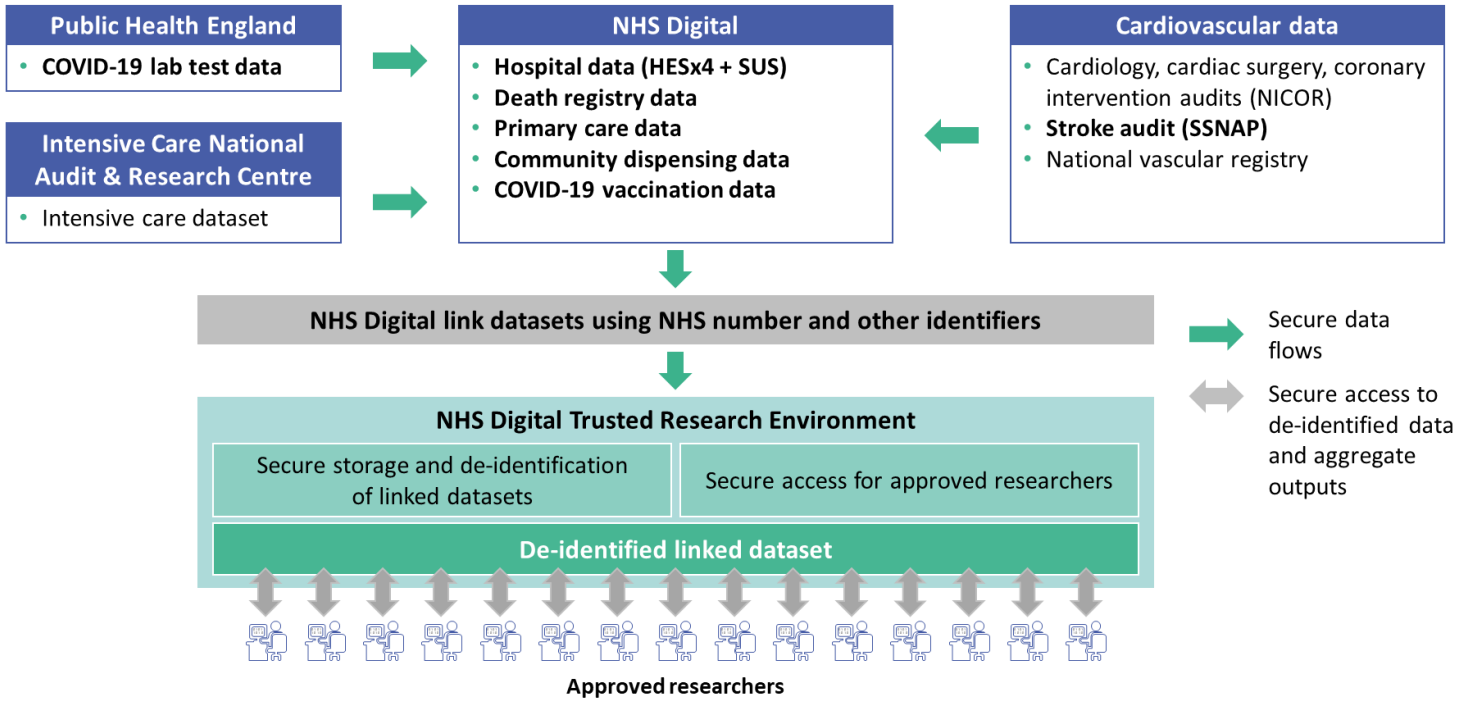
CVD-COVID-UK: building UK-wide infrastructure to accelerate UK-wide research

British Heart Foundation Data Science Centre
Led by Health Data Research UK

Objective – enable whole population research whilst ensuring data security and privacy and maintaining public trust

Design - linked person-level records from national healthcare settings accessible within NHS Digital's new Trusted Research Environment

Participants - 54.4 million people alive on 1st Jan 2020, registered with an NHS general practitioner, comprising ~96% of population



BMJ 2021; 373 doi: https://doi.org/10.1136/bmj.n826

Defining COVID-19 infection and severity: preliminary data from 54 million patients

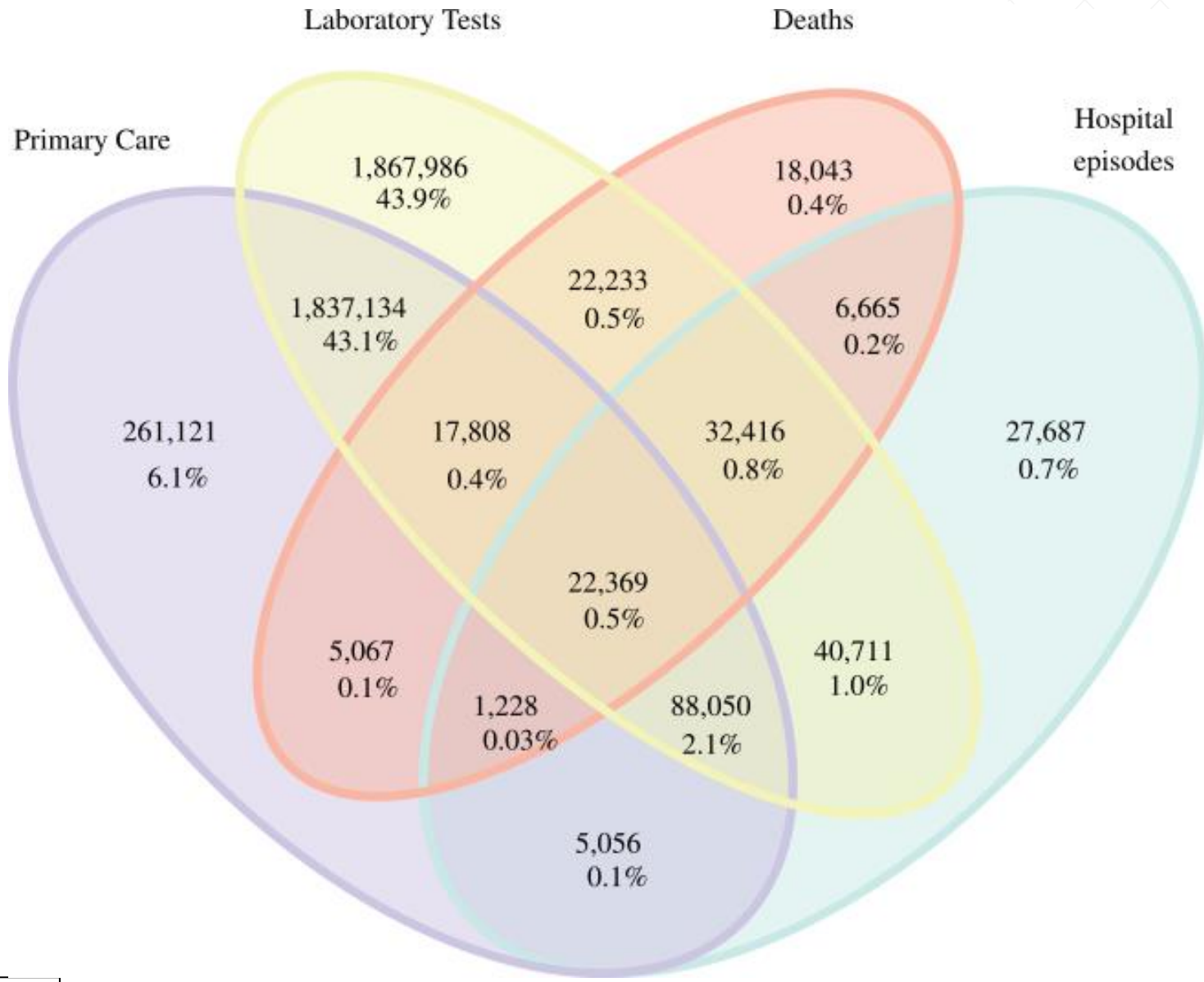
Johan Thygesen

Chris Tomlinson

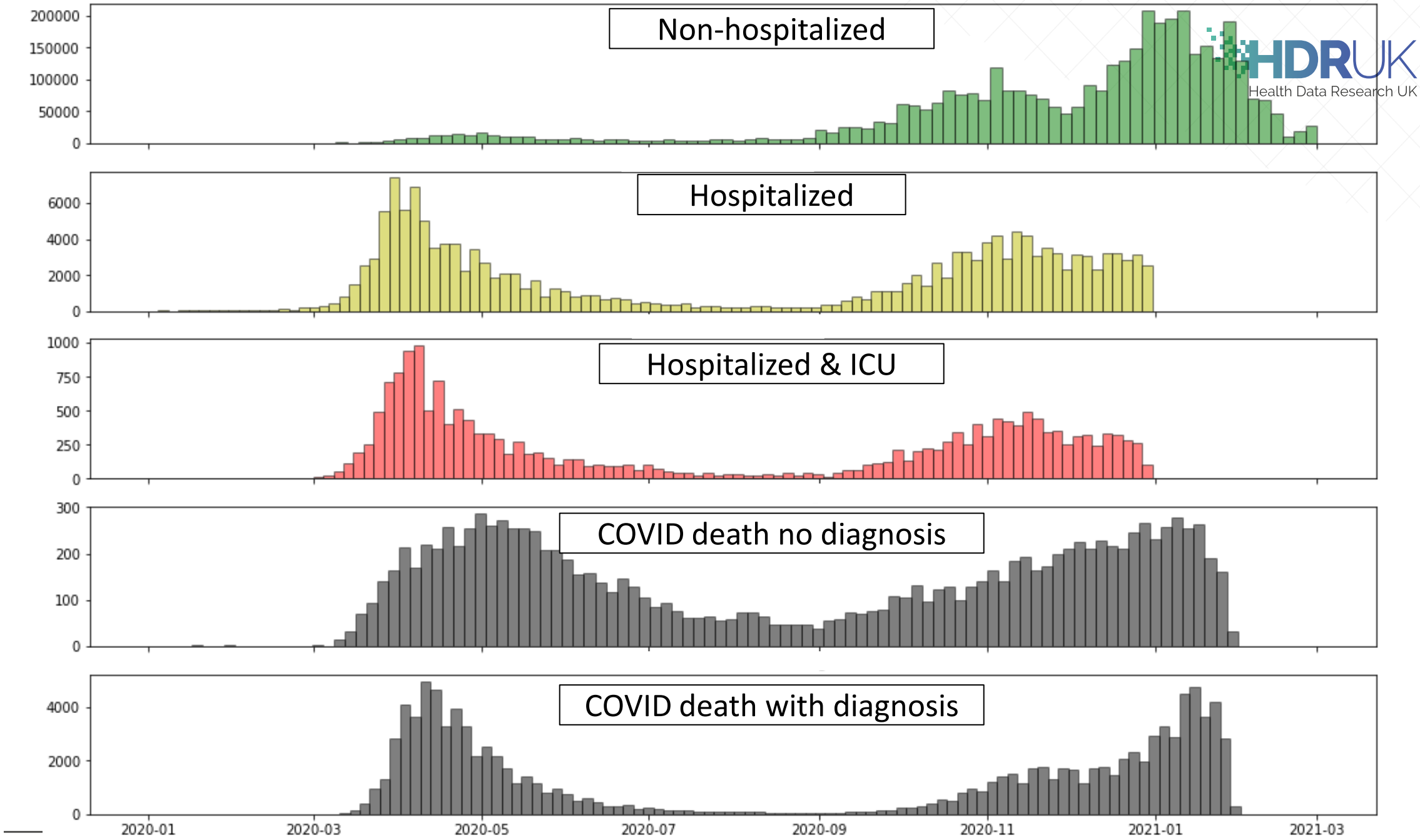
Spiros Denaxas

and many more colleagues

N=4,273,182 COVID-19 infections



January/2020-March/2021



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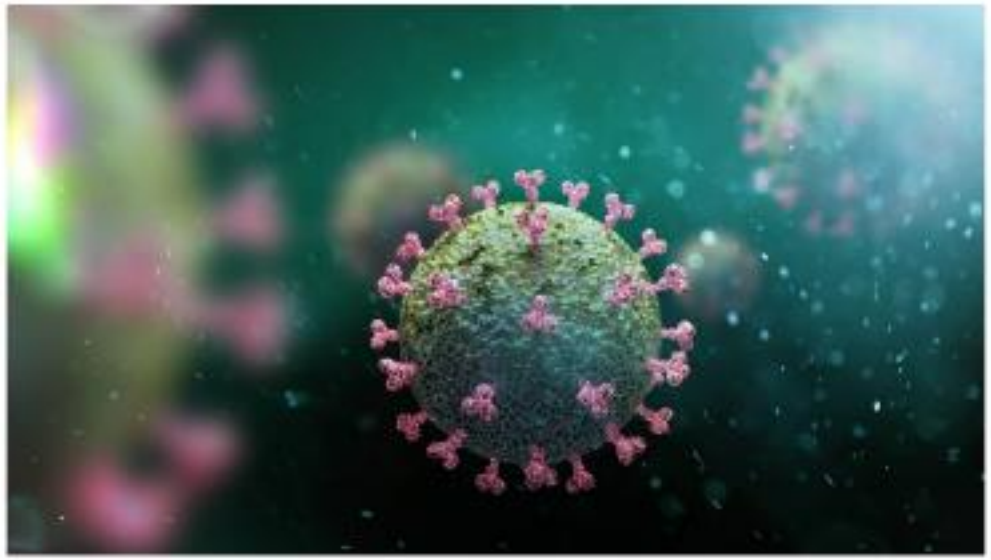
Project

CVD-COVID-UK

CVD-COVID-UK aims to understand the relationship between COVID-19 and cardiovascular diseases such as heart attack, heart failure, stroke, and blood clots in the lungs through analyses of de-identified, linked, nationally collated healthcare datasets across the four nations of the UK.



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The CVD-COVID-UK project, led by Professor Cathie Sudlow, Director of the BHF Data Science Centre, is one of the six National Flagship Projects approved by the NIHR-BHF Cardiovascular Partnership.

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CVD-COVID-UK: Cardiovascular disease and COVID-19

UK-wide linked routine healthcare data to address the impact of cardiovascular diseases on COVID-19 and the impact of COVID-19 on cardiovascular diseases

Study Protocol
Version 1
1 June 2020

OBJECTIVES

To interrogate nationally collated, population level, linked healthcare data across the UK population to address the following questions:

1) What are the effects of cardiovascular diseases, their risk factors and medications on susceptibility to and outcomes from COVID-19 disease?
2) What is the direct impact of SARS-CoV-2 infection on acute cardiovascular complications as well as on medium and longer term cardiovascular risk?
3) What is the indirect impact of the COVID-19 pandemic and the government and NHS response to it on the presentation, diagnosis, management and outcomes of cardiovascular diseases?

Investigating the effects of angiotensin-converting enzyme inhibitors (ACEi) and angiotensin receptor blockers (ARB) on COVID-19 outcomes

Venexia Walker

University of BRISTOL

England

Jonathan Sterne
Jennifer Cooper
Rachel Denholm
Ross Booton
Spiros Denaxas
Tom Palmer
Neil Davies
Richard Martin
Rupert Payne
John Macleod

NHS Digital

Sam Hollings
Efosa Omigie

Scotland

Ray Carragher
Clea du Toit
David Moreno Martos
Sandosh Padmanabhan
Huan Wang
Kim Kavanagh

Wales

Ashley Akbari
Hoda Abbasizanjani
Fatemeh Torabi

… and many others from the CVD-COVID-UK consortium

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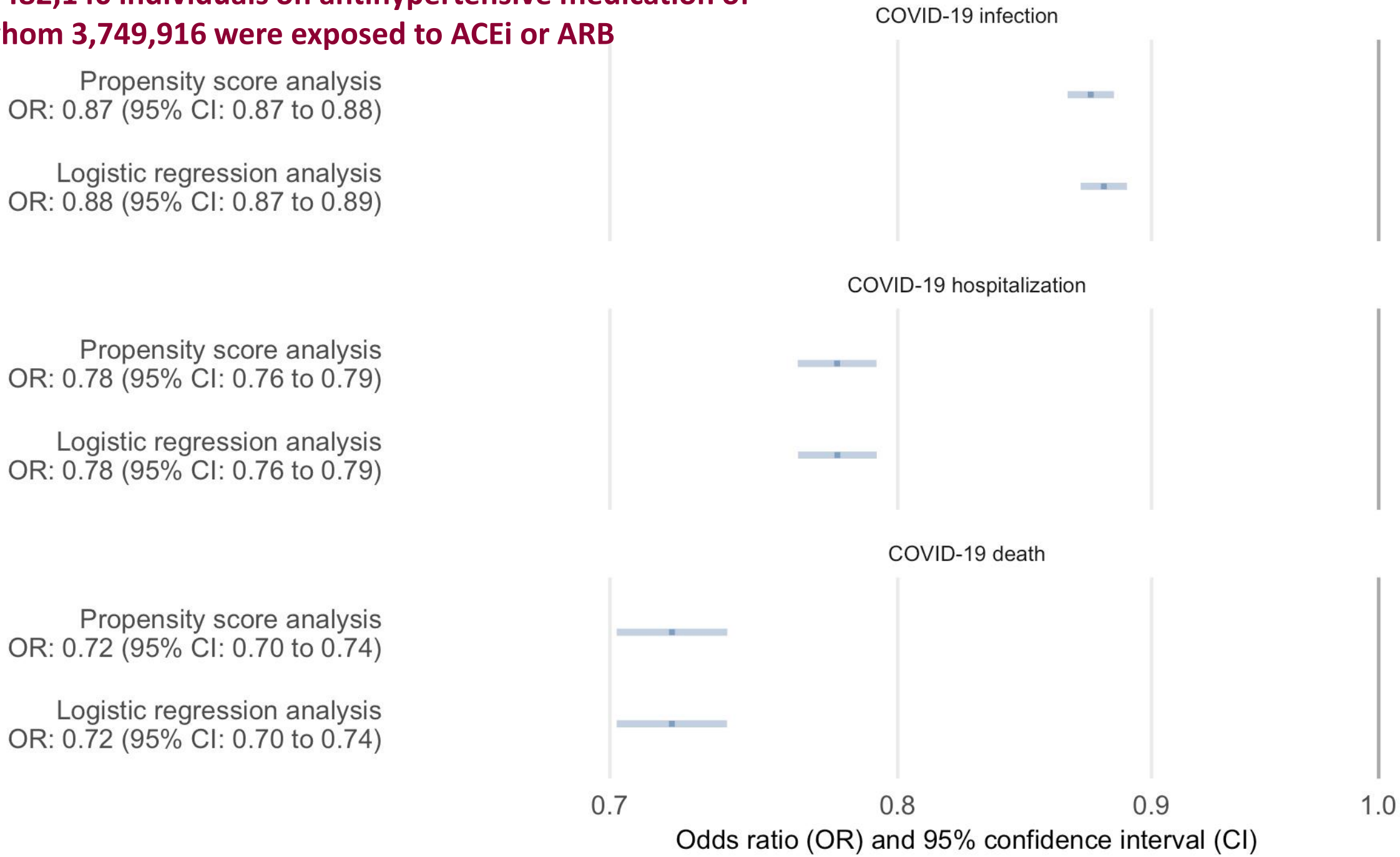
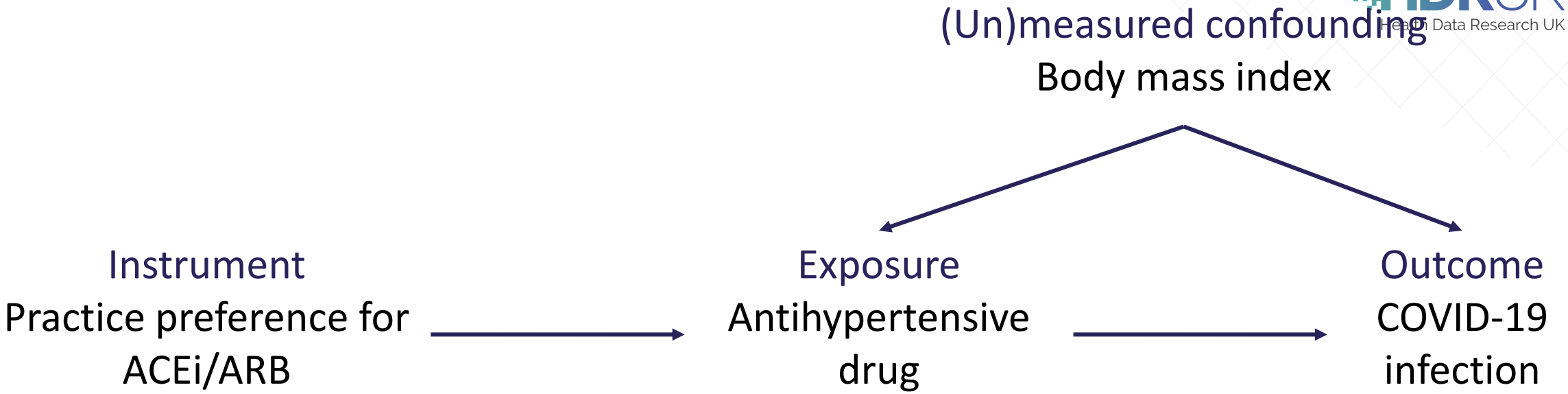
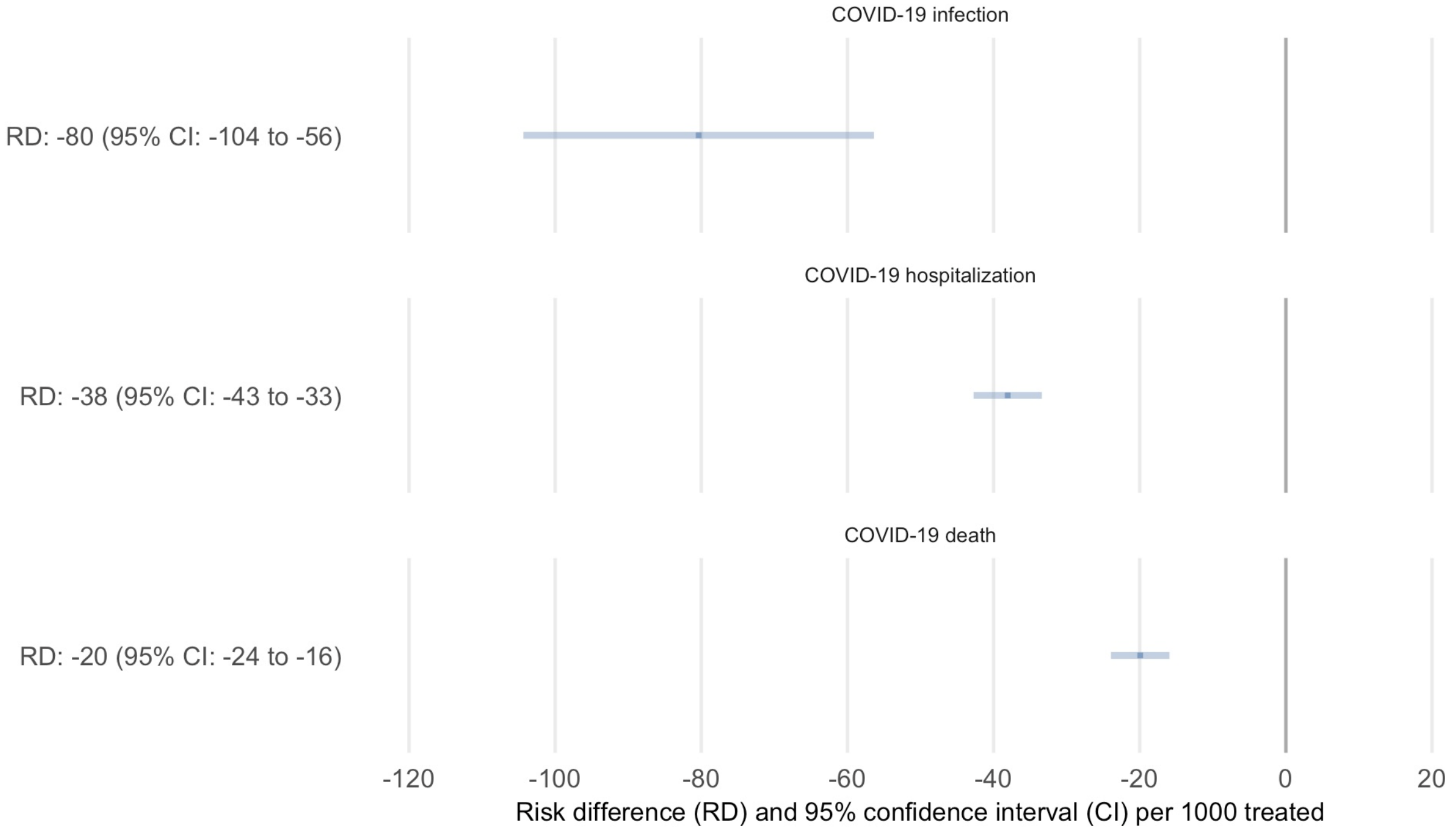
British Heart Foundation
Data Science Centre
Led by Health Data Research UK

5,482,140 individuals on antihypertensive medication of whom 3,749,916 were exposed to ACEi or ARB





Instruments must satisfy three assumptions: (1) relevance - the instrument must associate with the exposure; (2) independence - the instrument and the outcome must have no common causes; and (3) the exclusion restriction - the instrument must only affect the outcome through the exposure.


COVID-19 infection
RD: -80 (95% CI: -104 to -56)
COVID-19 hospitalization
RD: -38 (95% CI: -43 to -33)
COVID-19 death
RD: -20 (95% CI: -24 to -16)
-120
-100
-80
-60
-40
-20
0
20
Risk difference (RD) and 95% confidence interval (CI) per 1000 treated

Project

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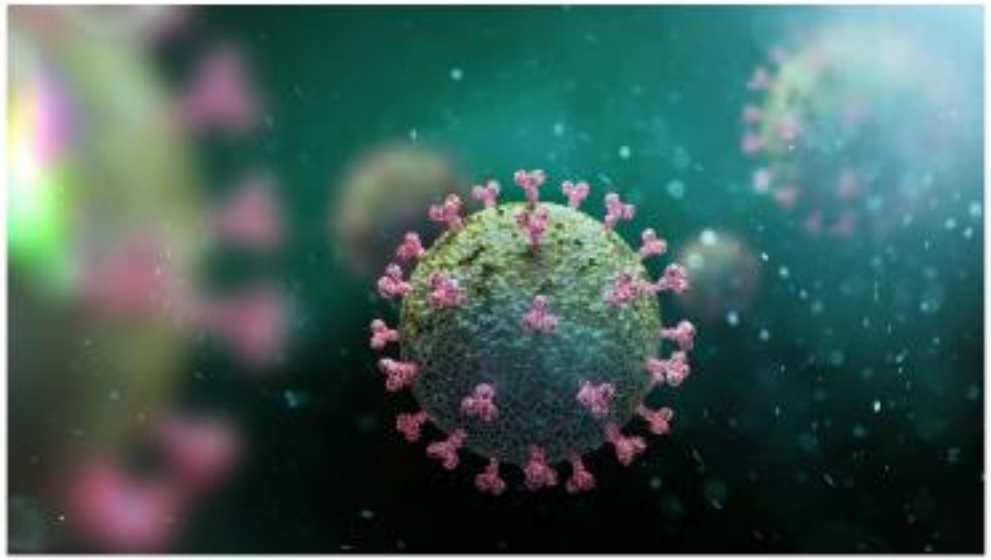

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COVID-19 vaccines and thrombotic events

Analyses conducted in the NHS Digital Trusted Research Environment for England (~54 million people)

Multi-institutional, inter-disciplinary team: Will Whiteley, Cathie Sudlow, Angela Wood, Jonathan Sterne, Tom Bolton, Jennifer Cooper, Spiros Denaxas, Rachel Denholm, Sam Hollings, Samantha Ip, Spencer Keene, Venexia Walker and others

Protocol on GitHub

Cox models, follow-up from 8 Dec 2020 to mid March 2021, exposure split pre and post-vaccination, control for baseline but not time-varying confounding

COVID-19 vaccines and thrombotic events

Adjusted hazard ratios (95% CIs) 0-28 and ≥28 days after vaccination, vs pre vaccination

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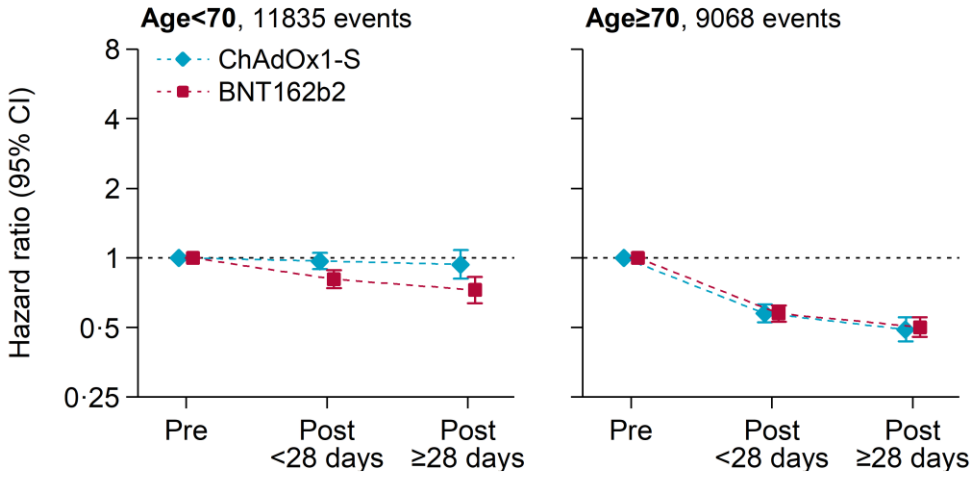
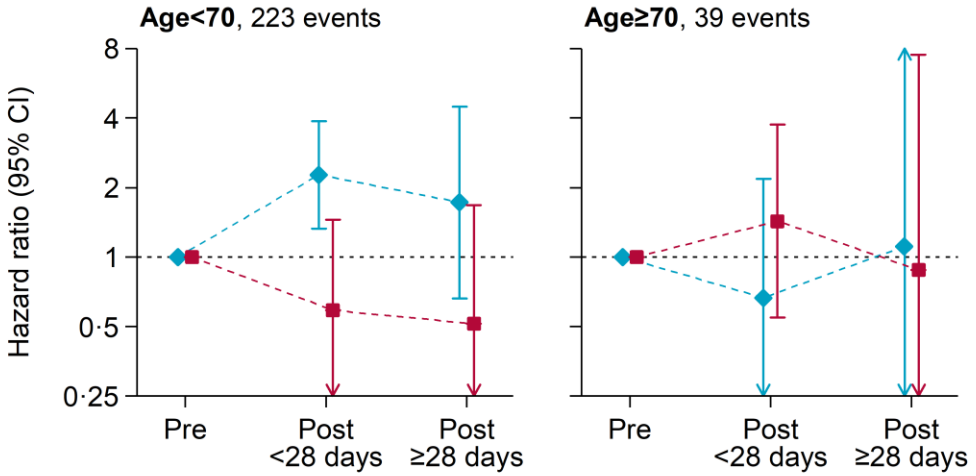
COVID-19 LONGITUDINAL HEALTH & WELLBEING NATIONAL CORE STUDY

Any venous thrombosis

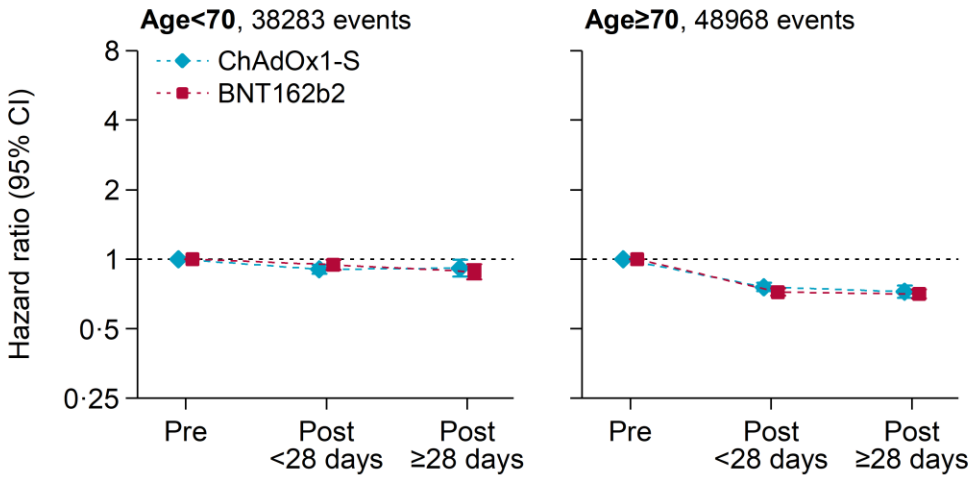


Intracranial venous thrombosis

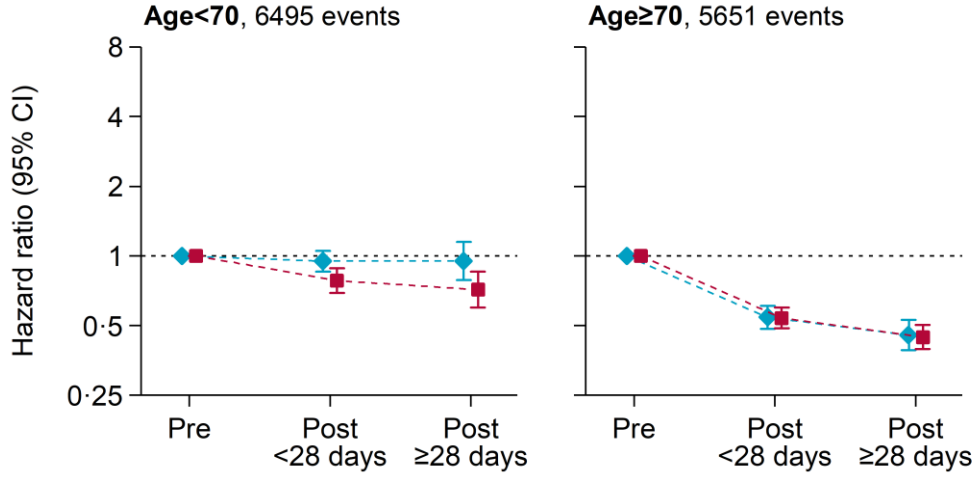


ChAdOx1-S
BNT162b2

Any arterial thrombosis



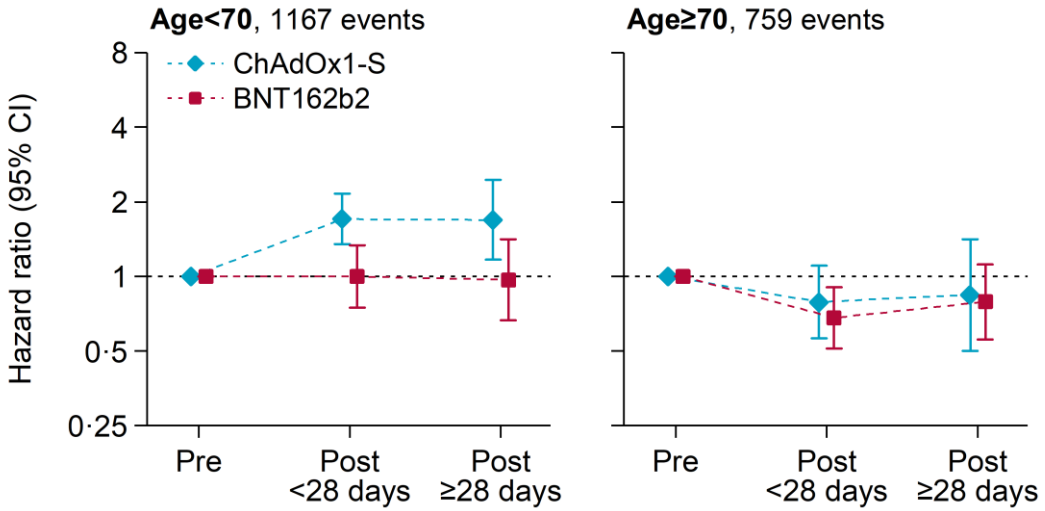
Pulmonary embolism



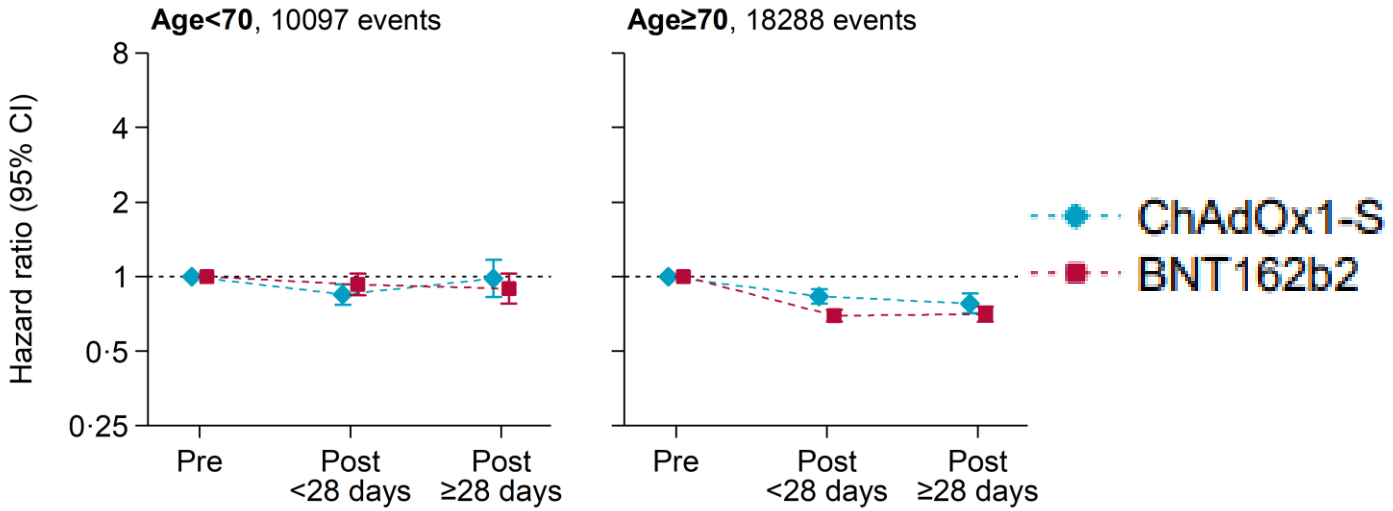
COVID-19 vaccines and thrombotic events

Fully adjusted hazard ratios (& 95% CIs):
pre vaccination (HR=1), 0-28 days, ≥28 days)

Thrombocytopenia



Lower limb fracture



COVID-19 Longitudinal Health and Wellbeing National Core Study

Research Themes

Reflections on whole-population pandemic response research

Unprecedented collaboration across multiple institutions, accessing unprecedentedly large and detailed datasets

— Essential to retain public understanding of and consent for the use of these data for research in the public interest, during and after the pandemic

- Collaborative team science approach is crucial
- Trusted Research Environments (in England) were developed as part of the pandemic response:
  - Substantial computational resources required, and these may not be scalable as the number of users increases
  - Need to explain how patient confidentiality is protected through disclosure controls, and minimise the
  - For FAIR use, we need to integrate open science approaches in all aspects of the NHS Digital TRE for England

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