BHF Data Science Centre CVD-COVID-UK: Cardiovascular Reproducible research and projects

September 2022

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CVD-COVID-UK / COVID-IMPACT programme

The British Heart Foundation Data Science Centre is a partnership between Health Data Research UK (HDR UK) and the British Heart Foundation (BHF).

- **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.
- **COVID-IMPACT** is an expansion of this approach to address research questions looking at the impact of COVID-19 on other health conditions and their related risk factors.
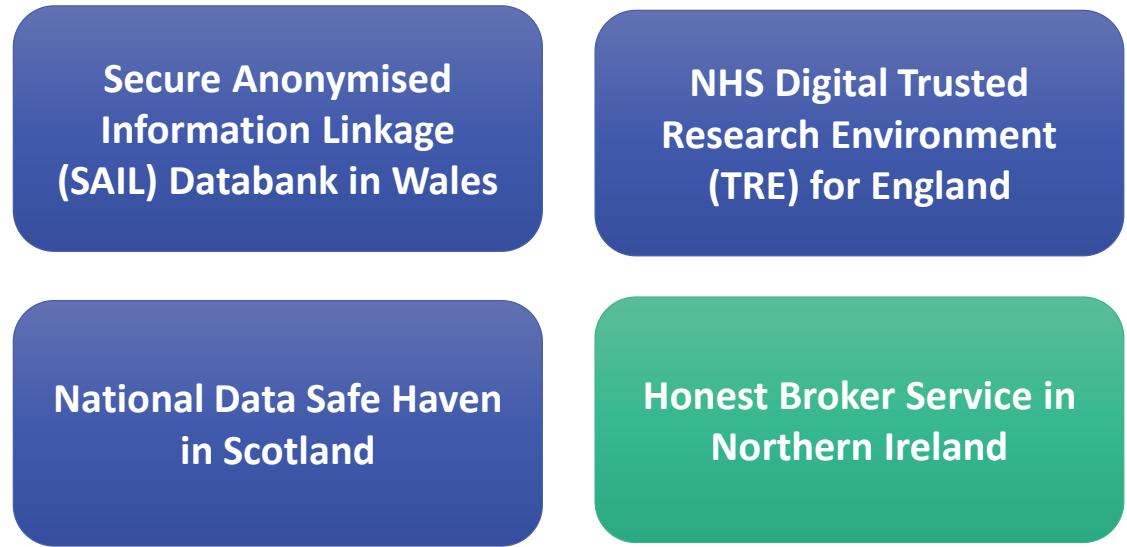
View an overview of BHF Data Science Centre here:
https://www.hdruk.ac.uk/helping-with-health-data/bhf-data-science-centre/

View an overview of by the CVD-COVID-UK/COVID-IMPACT projects here:
https://www.hdruk.ac.uk/projects/cvd-covid-uk-project/
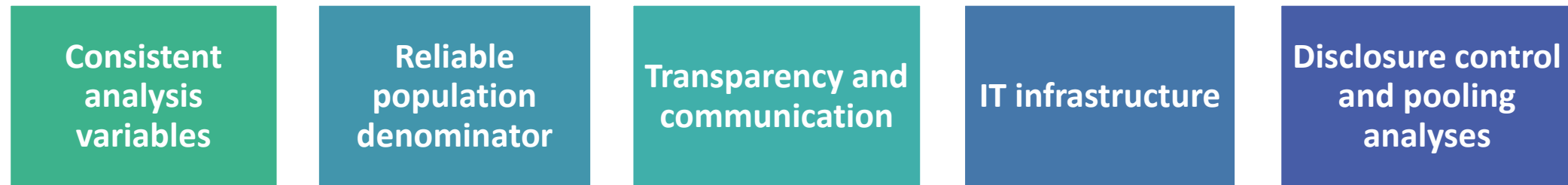
CVD-COVID-UK / COVID-IMPACT programme

Through the CVD-COVID-UK consortium, anonymised individual-level data from UK nations (England, Scotland and Wales) have been accessed on > 65 million individuals, and further work is ongoing to enable access to Northern Ireland data

Secure Anonymised Information Linkage (SAIL) Databank in Wales

NHS Digital Trusted Research Environment (TRE) for England

National Data Safe Haven in Scotland

Honest Broker Service in Northern Ireland

View research outputs produced by the CVD-COVID-UK/COVID-IMPACT consortium here:
https://www.hdruk.ac.uk/wp-content/uploads/2022/06/220617-CVD-COVID-UK-COVID-IMPACT-Research-Outputs.pdf

Data harmonisation between Trusted Research Environments

- *Data harmonisation* is the process of making data and statistics more comparable, consistent and coherent.
- Data harmonisation enables efficient collaborative research at a national or global scale using data from different Trusted Research Environments (TREs), for example between SAIL and NHS Digital TRE for England.

| Consistent analysis variables | Reliable population denominator | Transparency and communication | IT infrastructure | Disclosure control and pooling analyses |

Some challenges for data harmonisation between Trusted Research Environments

To overcome these challenges for harmonising Electronic Health Records (EHRs) from the SAIL Databank for Wales and the NHS Digital TRE for England, we adopted a four-layer process for the CVD-COVID-UK projects within SAIL, aiming to optimise reusability and reproducibility.

Four-layer reproducible data preparation process for Wales

# Four-layer reproducible data preparation process for Wales
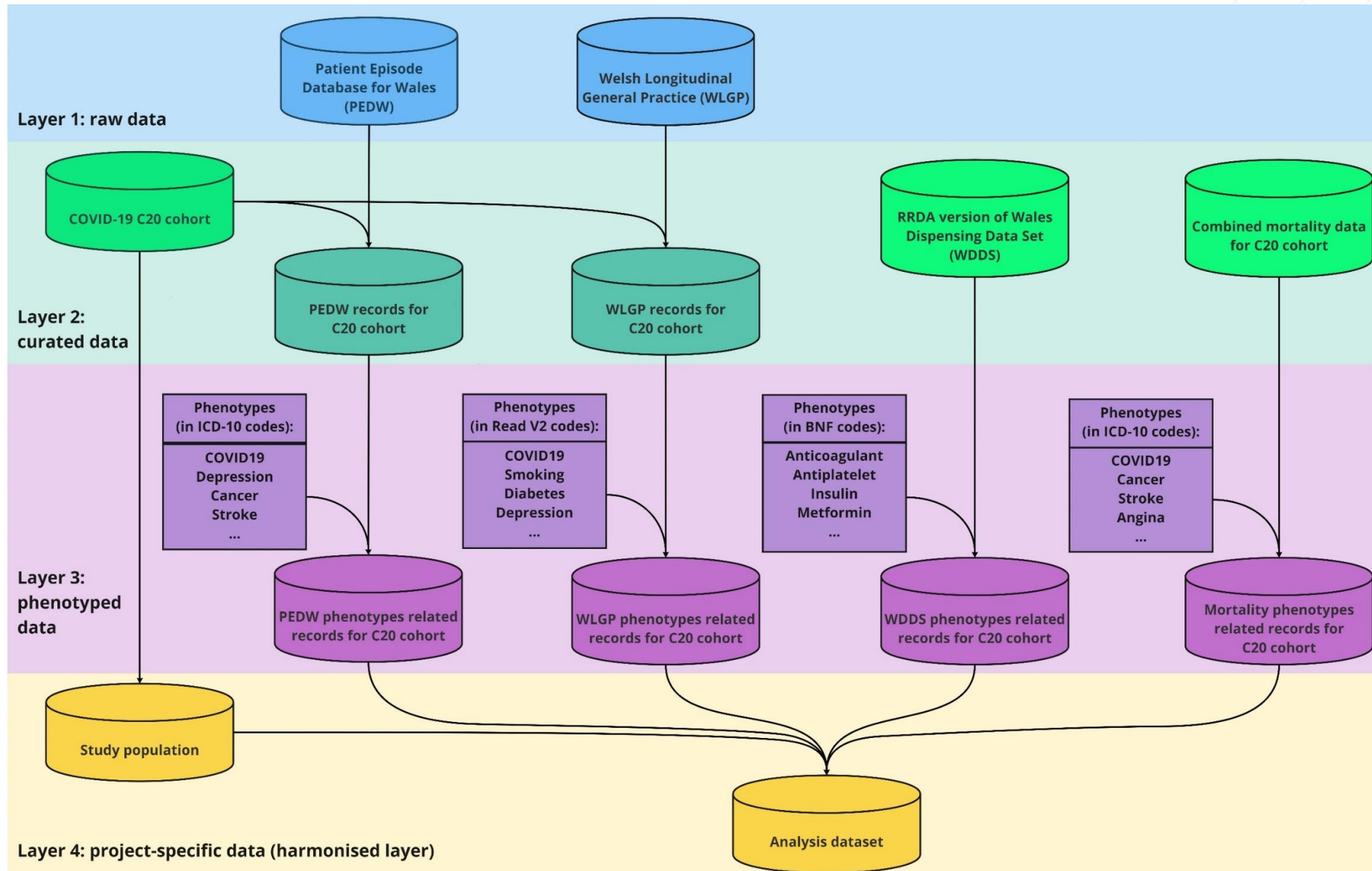
Categories of harmonised variables for population of Wales

> Using linked individual-level EHR, demographic and administrative data, approximately 100 variables have been harmonised for the population of Wales.

> The reproducible approach for data harmonisation described is being used in CVD-COVID-UK projects.
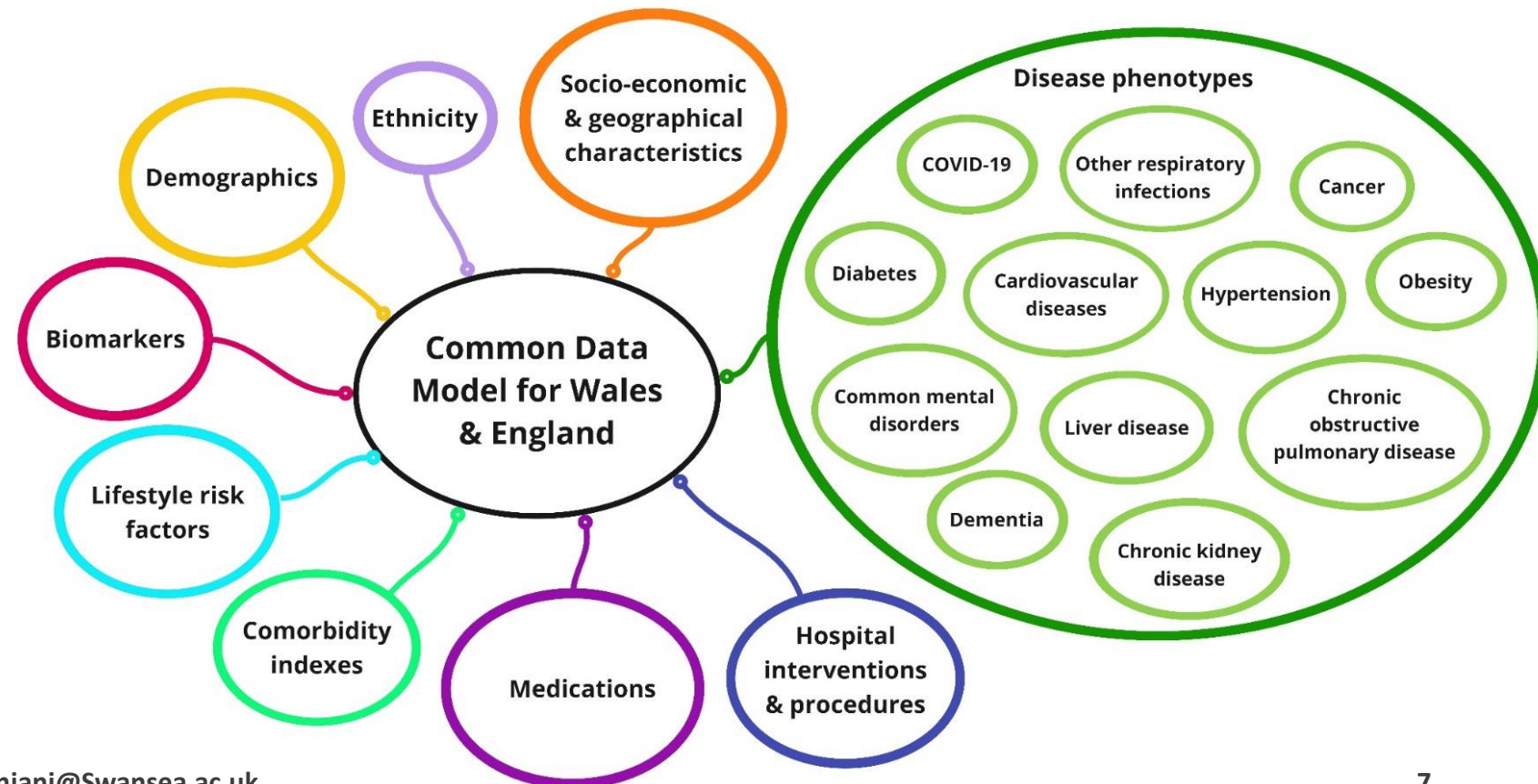
The key benefits of the four-layer reproducible method

1. Much easier replication of code (whether revisiting an old project, making revisions following peer review, or extending the research).
2. Transparency (easier to check the results of the research, reducing the risk of error)
3. Increasing transferability of learning & enabling new studies to start quicker (similar initial data cleaning processes across projects for data sources in Layer 2, availability of all phenotypes created in Layer 3 for all new studies to use).
4. Reusability of methods used for generating harmonised project-specific data in Layer 4 for future projects.
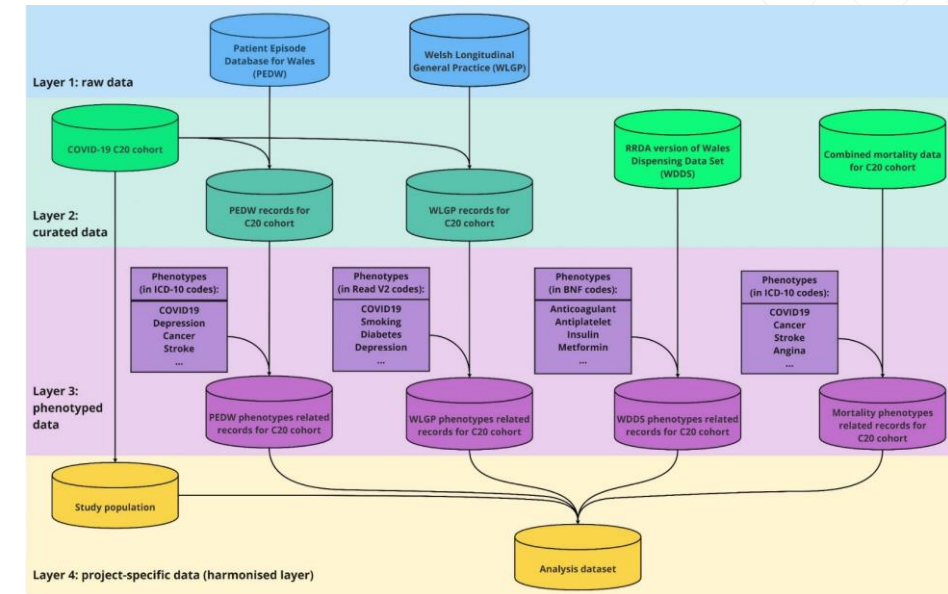
Applications of the reproducible harmonisation approach for CVD-COVID-UK projects

Association of COVID-19 with arterial and venous vascular diseases: a population-wide cohort study of 48 million adults in England and Wales

Rochelle Knight, Venexia Walker, Samantha Ip, Jennifer A Cooper, Thomas Bolton, Spencer Keene, Rachel Denholm, Ashley Akbari, Hoda Abbasizanjani, Fatemeh Torabi, Efosa Omigie, Sam Hollings, Teri-Louise North, Renin Toms, Emanuele Di Angelantonio, Spiros Denaxas, Johan H Thygesen, Christopher Tomlinson, Ben Bray, Craig J Smith, Mark Barber, George Davey Smith, Nishi Chaturvedi, Cathie Sudlow, William N Whiteley, Angela Wood, Jonathan A C Sterne, for the CVD-COVID-UK/COVID-IMPACT consortium and the Longitudinal Health and Wellbeing COVID-19 I

doi: https://doi.org/10.1101/2021.11.22.21266512

Risk of myocarditis and pericarditis following BNT162b2 and ChAdOx1 COVID-19 vaccinations

Samantha Ip, Fatemeh Torabi, Spiros Denaxas, Ashley Akbari, Hoda Abbasizanjani, Rochelle Knight, Jennifer Cooper, Rachel Denholm, Spencer Keene, Thomas Bolton, Sam Hollings, Efosa Omigie, Teri-Louise North, Arun Karthikeyan Suseeladevi, Emanuele Di Angelantonio, Kamlesh Khunti, Jonathan A C Sterne, Cathie Sudlow, William Whiteley, Angela Wood, Venexia Walker the British Heart Foundation Data Science Centre (Health Data Research UK) CVD-COVID-UK/COVID-IMPACT Consortium and the Longitudinal Health and Wellbeing and Data and Connectivity UK COVID-19 National Core Studies

doi: https://doi.org/10.1101/2022.03.06.21267462

Investigating the effects of renin-angiotensin system drugs on COVID-19 outcomes in over 6 million antihypertensive users from England and Wales

Venexia Walker, Tom Palmer, Hoda Abbasizanjani, David Moreno Martos, Clea Du Toit, Raymond Carragher, Sam Hollings, Huan Wang, Sandosh Padnababhan, Richard Martin, John Macleod, Rupert Payne, Ashley Akbari, Neil Davies, Jonathan Sterne

Comparing the long-term risk of CVD events in Welsh patients after coronavirus infection with other respiratory infections

(only in Wales)

Federated analysis for SAIL and NHS-D TRE for England

➤ Using harmonised data, the same analytical pipeline was applied within each TRE, and results were combined via meta-analysis across nations.

➤ For each project, protocol, codes and phenotypes are available on project's GitHub repository.
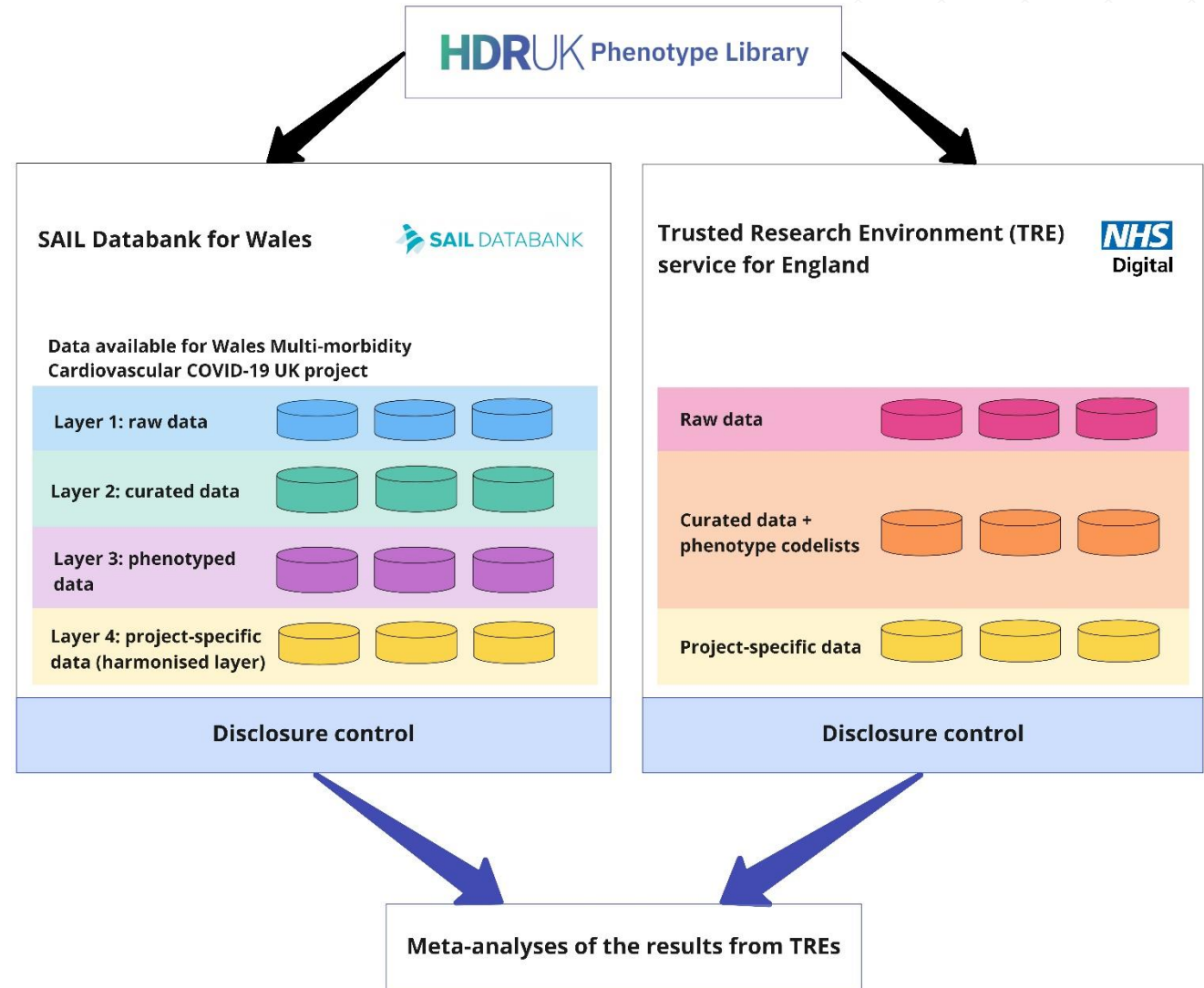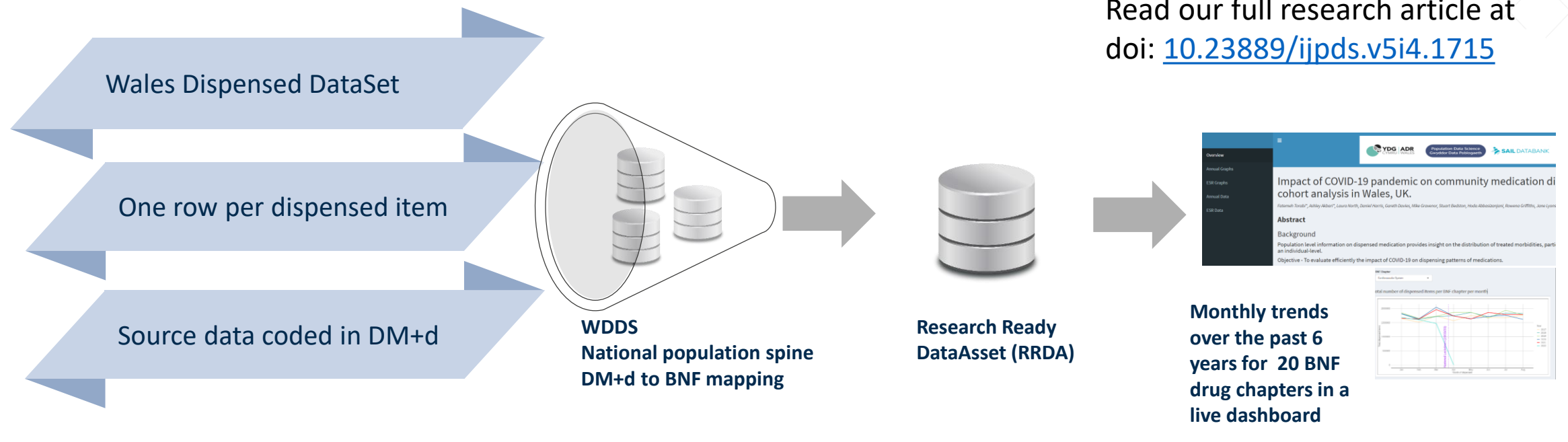
Harmonising electronic health record data for reproducible research: challenges and lessons learnt in a UK-wide COVID-19 research collaboration

Abbasizanjani H, Torabi F, Bedston S, Bolton T, Davies G, Denaxas S, Griffiths R, Herbert L, Hollings S, Keene S, Khunti K, Lowthian L, Lyons J, Mizani M, Nolan J, Sudlow C, Walker V, Whiteley W, Wood A, Akbari A

SAIL Databank for Wales

Data available for Wales Multi-morbidity Cardiovascular COVID-19 UK project

Layer 1: raw data
Layer 2: curated data
Layer 3: phenotyped data
Layer 4: project-specific data (harmonised layer)

Disclosure control

Trusted Research Environment (TRE) service for England

Raw data
Curated data + phenotype codelists
Project-specific data

Disclosure control

Meta-analyses of the results from TREs

National drug dispensing

Torabi F., Akbari A. et al. 2022

Wales Dispensed DataSet

One row per dispensed item

Source data coded in DM+d

WDDS
National population spine
DM+d to BNF mapping

Research Ready
DataAsset (RRDA)

Read our full research article at
doi: 10.23889/ijpds.v5i4.1715

Impact of COVID-19 pandemic on community medication di
cohort analysis in Wales, UK.

Fatemeh Torabi, Ashley Akbari*, Laura North, Daniel Harris, Gareth Davies, Mike Gravenor, Stuart Bedston, Hoda Abbasizanjani, Rowena Griffiths, Jane Lyons*

Abstract

Background
Population level information on dispensed medication provides insight on the distribution of treated morbidities, part
an individual-level.

Objective - To evaluate efficiently the impact of COVID-19 on dispensing patterns of medications.

Monthly trends
over the past 6
years for 20 BNF
drug chapters in a
live dashboard

Semi-supervised pipeline

Direct insights for the
impact of COVID-19 on
dispensing patterns

Enabler of many other
research projects
including CVD BHF
collaboration

Impact of COVID-19 on cardiovascular disease prevention and management in 3 nations

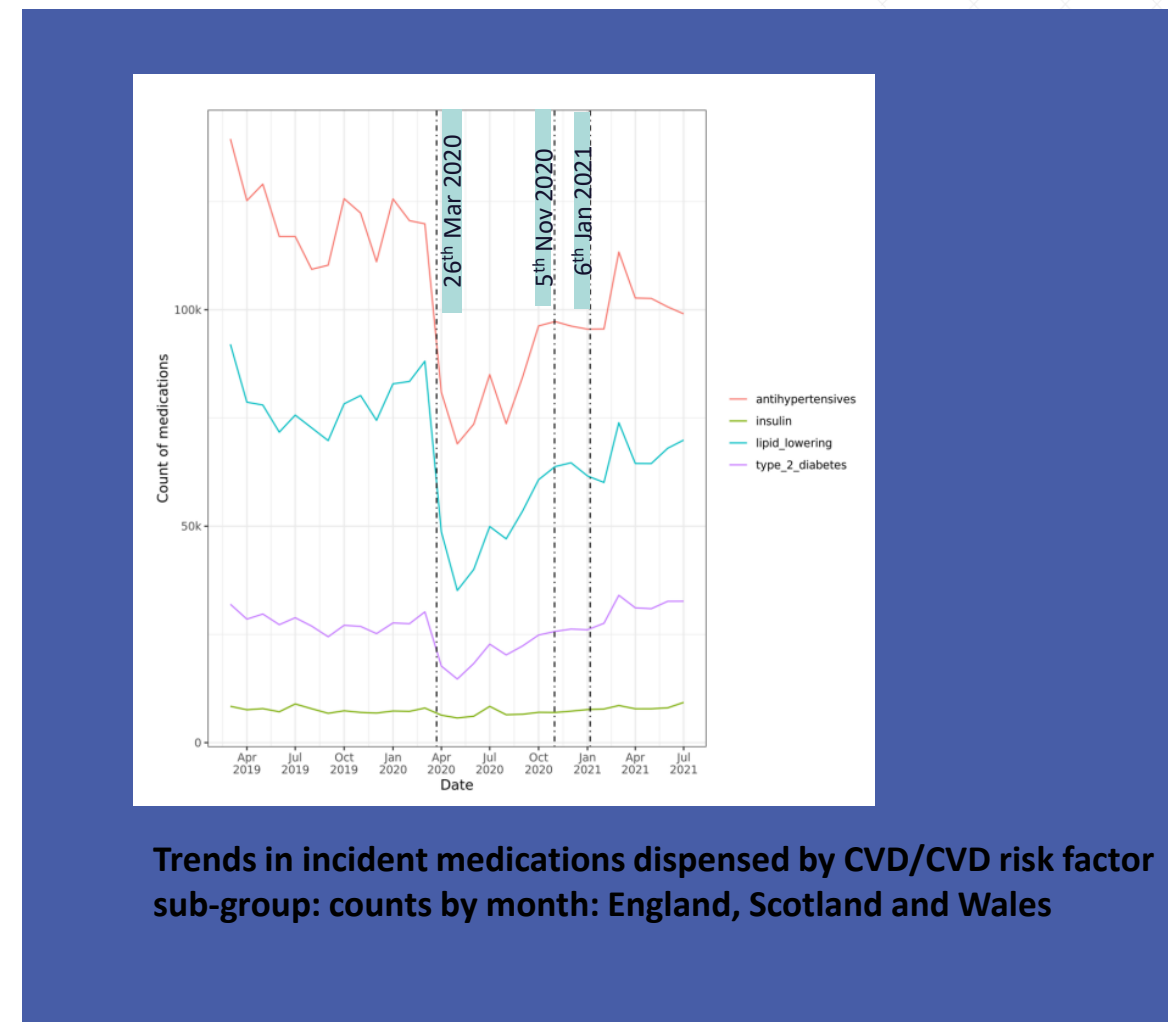Dale et al. 2022

Caroline E Dale, Rohan Takhar, Ray Carragher, Fatemeh Torabi, Michalis Katsoulis, Stephen Duffield, Seamus Kent, [ID] Tanja Mueller, Amanj Kurdi, Stuart McTaggart, [ID] Hoda Abbasizanjani, Sam Hollings, Andrew Scourfield, Ronan Lyons, Rowena Griffiths, Jane Lyons, Gareth Davies, Dan Harris, Alex Handy, Mehrdad Alizadeh Mizani, [ID] Chris Tomlinson, Mark Ashworth, [ID] Spiros Denaxas, [ID] Amitava Banerjee, Jonathan Sterne, Kate Lovibond, Paul Brown, Ian Bullard, Rouven Priedon, Mamas A Mamas, Ann Slee, Paula Lorgelly, Munir Pirmohamed, Kamlesh Khunti, Naveed Sattar, Andrew Morris, Cathie Sudlow, Ashley Akbari, Marion Bennie, Reecha Sofat
doi: https://doi.org/10.1101/2021.12.31.21268587

Summary of our findings:

- Management of key CVD risk factors as proxied by incident use of CVD medicines has not returned to pre-pandemic levels in the UK.
- Novel methods to identify and treat individuals who have missed treatment are urgently required to avoid large numbers of additional future CVD events, further adding indirect cost of the COVID-19 pandemic.

Trends in incident medications dispensed by CVD/CVD risk factor sub-group: counts by month: England, Scotland and Wales

UK level dashboard of medicines utilisation and COVID-19 impact

Ongoing development on 3 nation

3-nation harmonisation

Collaborative development

Patient and population review

Deployment
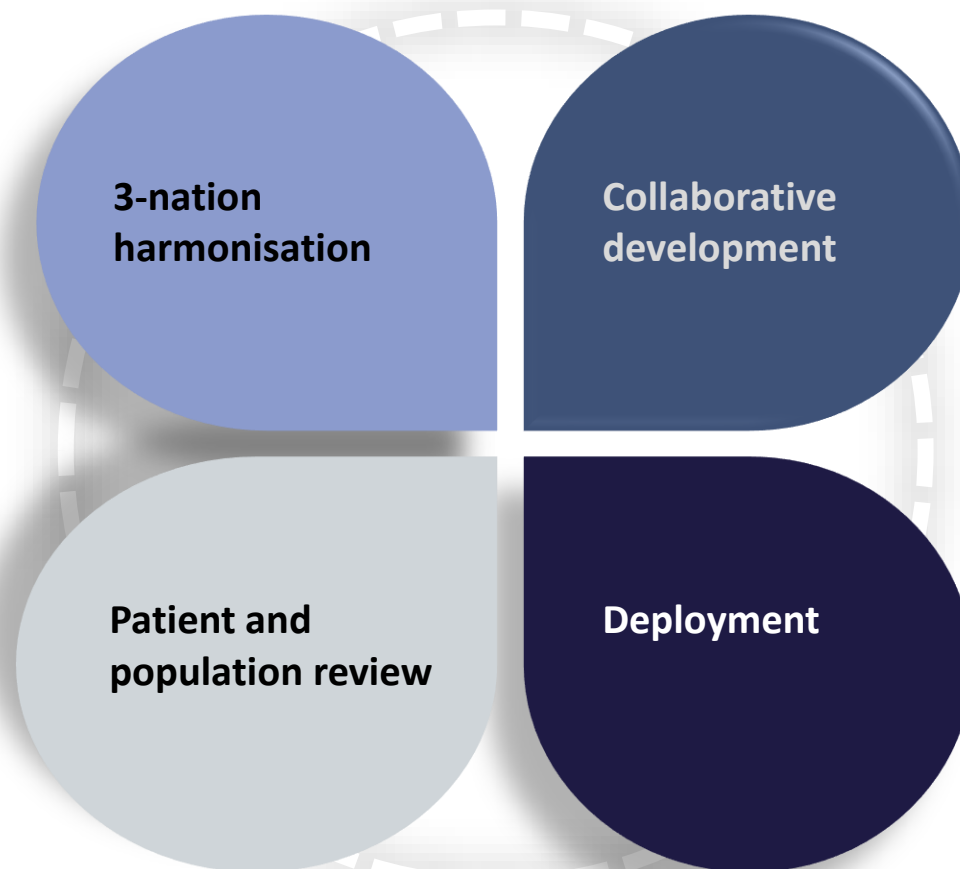
Sodium Valproate in women of child baring age

- Sodium Valproate (SV) licensed in the UK in 1972 for treatment of epilepsy and bipolar disorder
- Cumberlege report in 2021 highlighted the evidence around harmfulness of SV
- If taken during pregnancy, can cause physical and neurodevelopmental disorders in children
- Foetal Valproate Spectrum Disorder (FVSP)

Our approach

More to come:

Evaluation of polypharmacy across the UK and the impact of COVID-19 on the management of conditions

https://www.immdsreview.org.uk/downloads/IMMDSReview_Web.pdf

Thank you