Using data linkage for vaccine safety surveillance: methods, learnings and impact

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27/09/24

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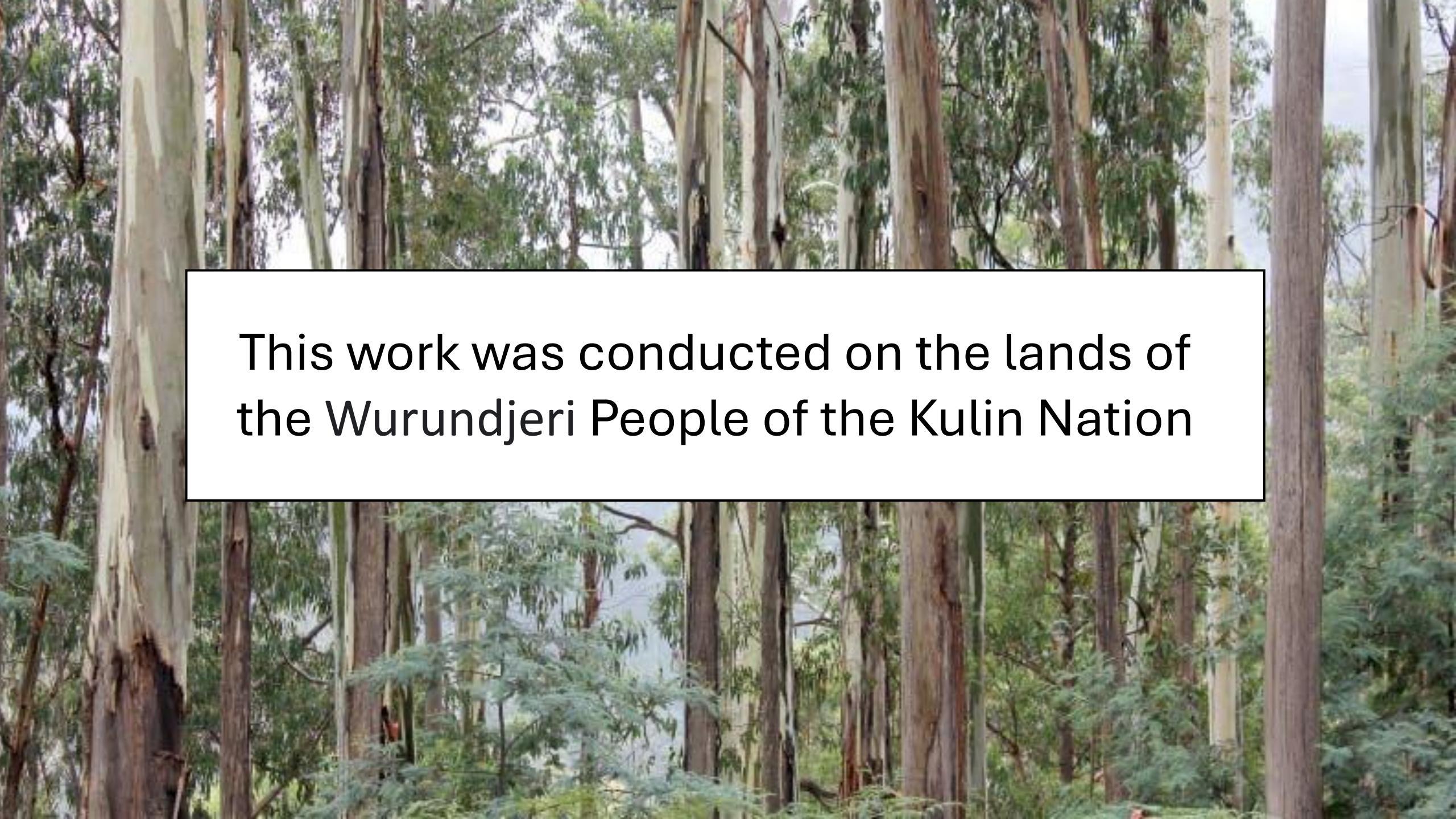
WCE

WORLD CONGRESS OF EPIDEMIOLOGY 2024



This work was conducted on the lands of the Wurundjeri People of the Kulin Nation

Adverse Events Following Immunisation (AEFI) surveillance in Victoria, Australia

Spontaneous surveillance –
reporting via SAEFVIC platform

Active surveillance – solicited
reports via text and email

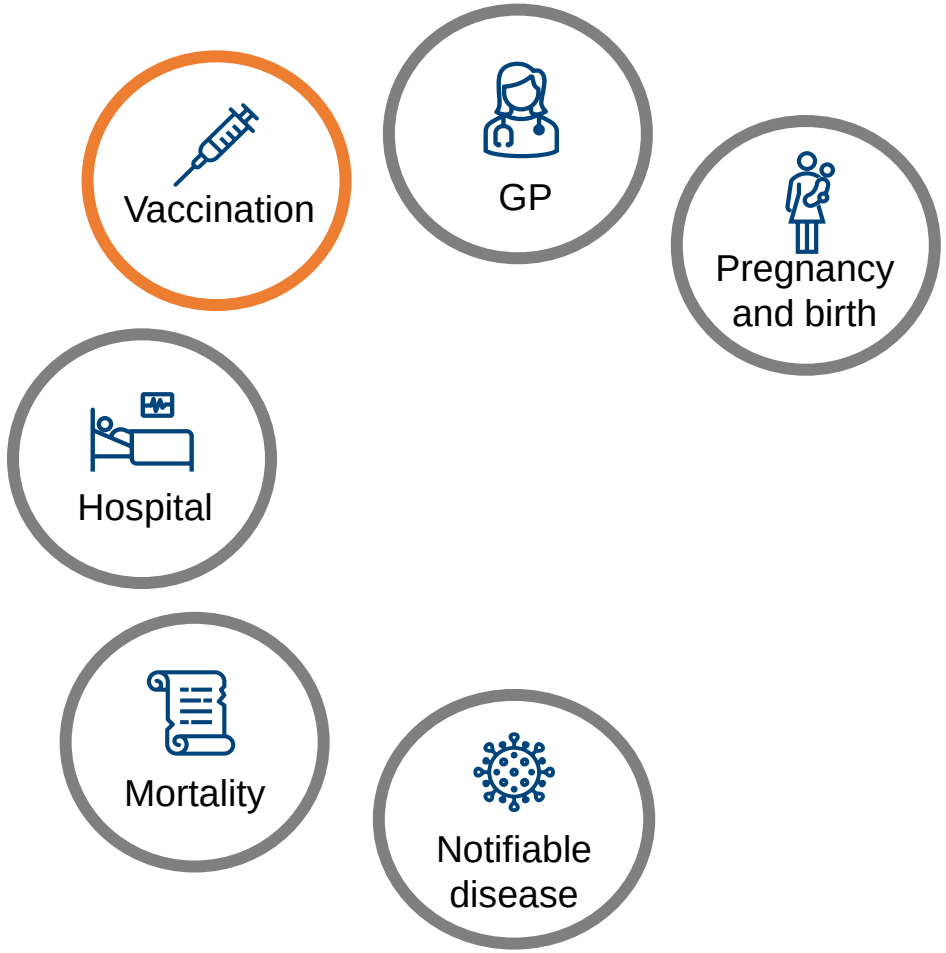
AusVaxSafety
An NCIRS led collaboration

VACCINE SAFETY HEALTH LINK
VSHL

- Wider population
- Lower data bias
- Relatively hands-free
- Cost effective

Centre for Health Analytics

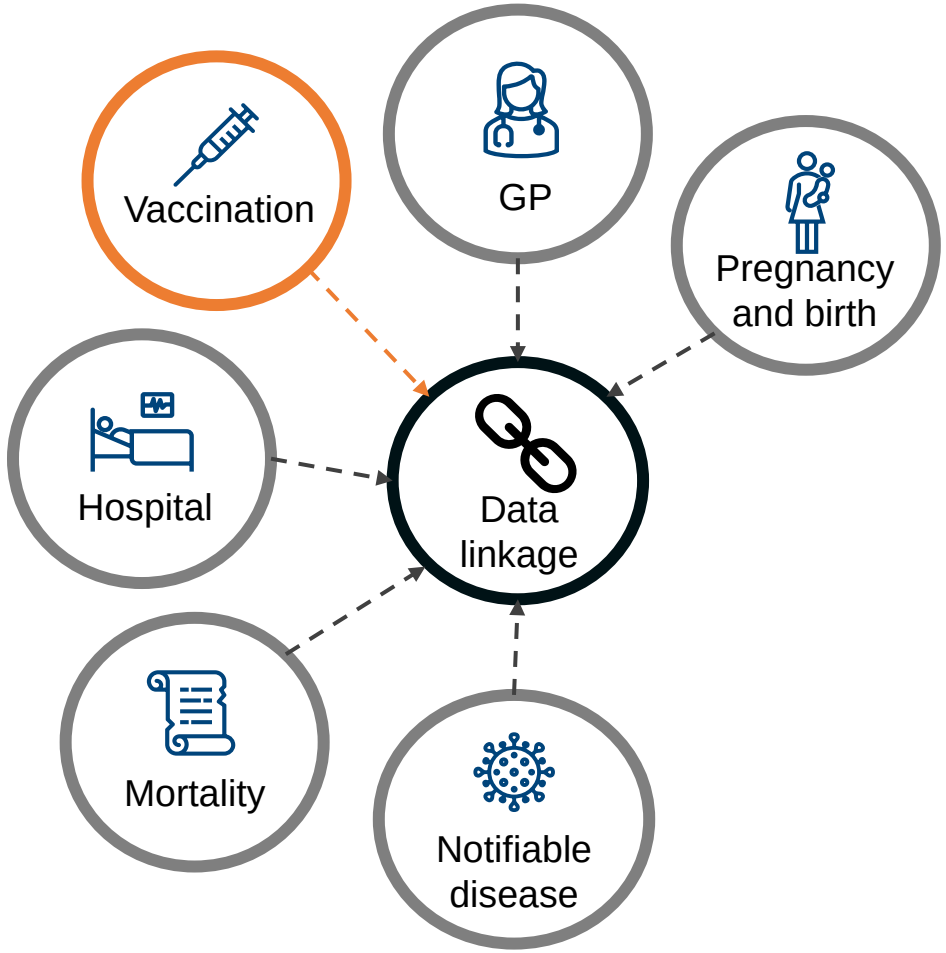
VSHL Design



Steps of data linkage:

1) Standardisation
2) Enrichment

VSHL Design

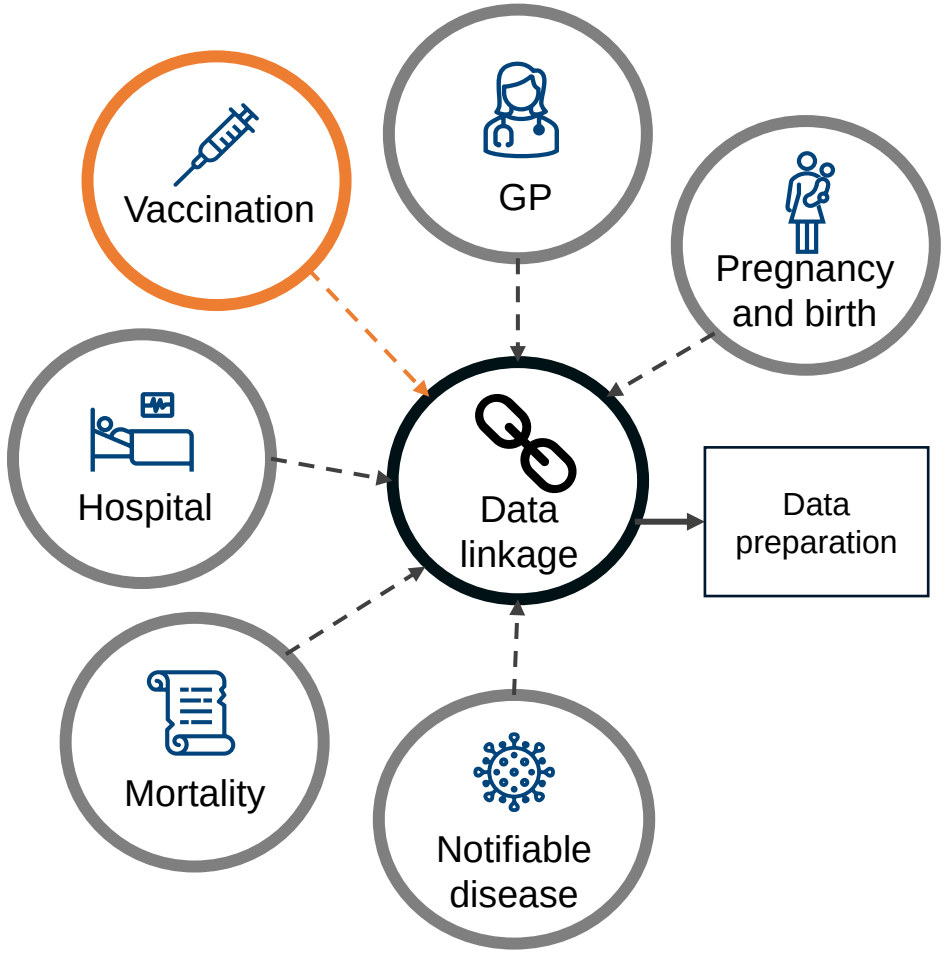


Steps of data linkage:

1) Standardisation
2) Enrichment
3) Linkage using deterministic and probabilistic methods

Completed at the Centre for Victorian Data Linkage (CVDL) using privacy preserving methods

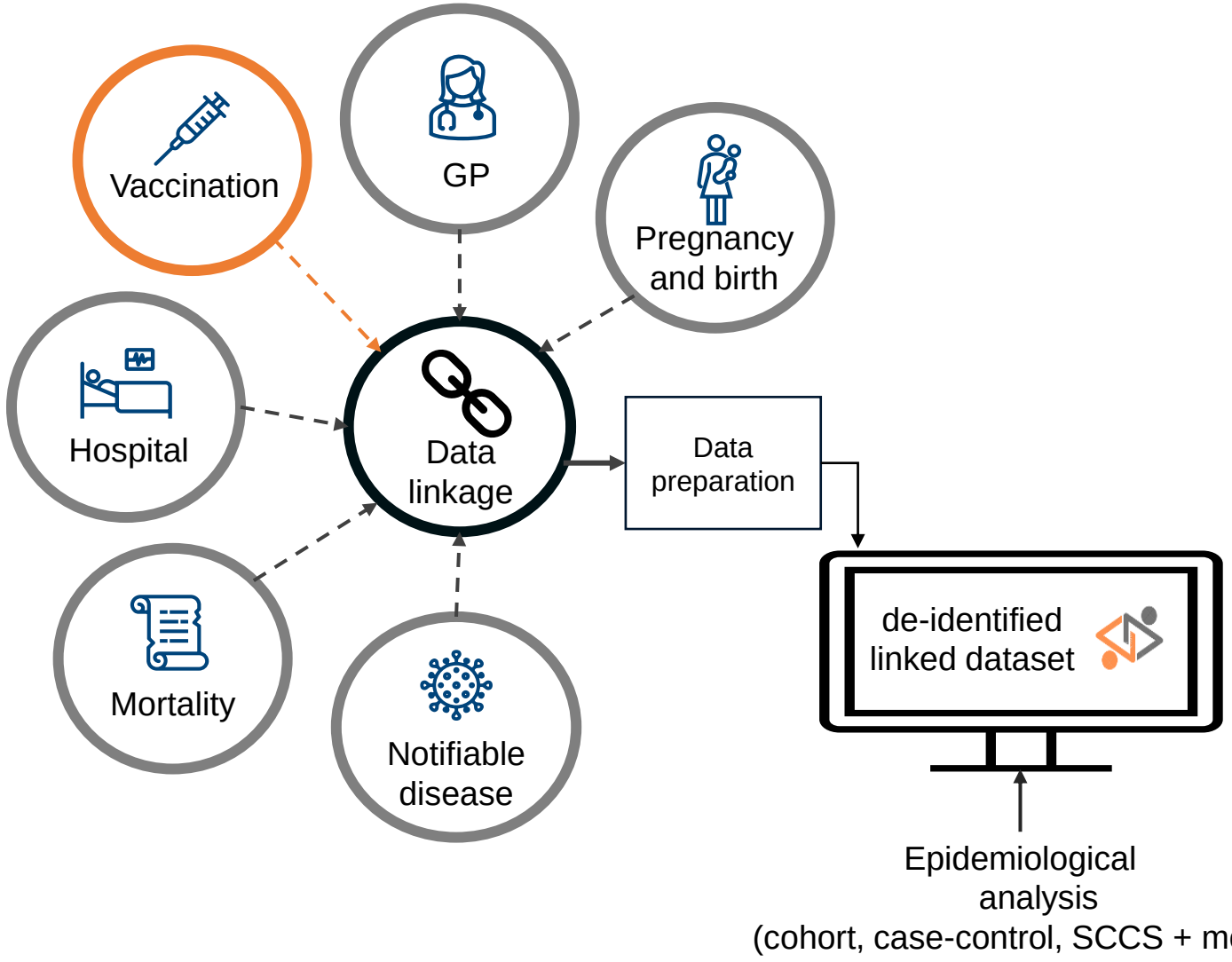
VSHL Design



Steps of data linkage:

1) Standardisation
2) Enrichment
3) Linkage using deterministic and probabilistic methods
4) Quality assurance
5) De-identification and date encryption

VSHL Design



Steps of data linkage:

1) Standardisation
2) Enrichment
3) Linkage using deterministic and probabilistic methods
4) Quality assurance
5) De-identification and date encryption
6) Data upload and warehousing
7) Monthly refresh

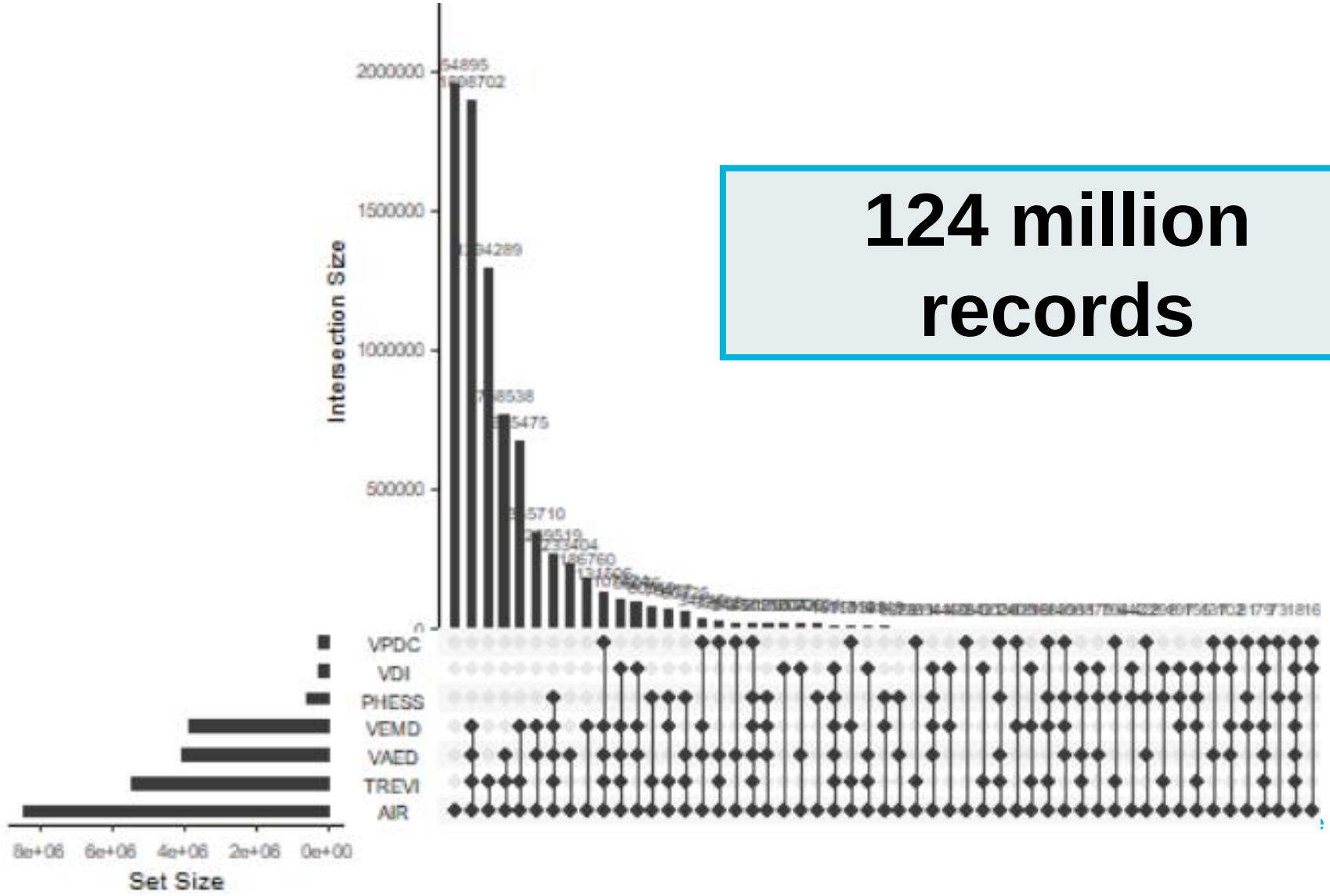
Data availability

Vaccination	Healthcare event: Yes	Healthcare event: No
Yes	AusVaxSafety (An NCIRS led collaboration); SAEFVIC; (when notified); VACCINE SAFETY HEALTH LINK VSHL	VACCINE SAFETY HEALTH LINK VSHL
No	VACCINE SAFETY HEALTH LINK VSHL	VACCINE SAFETY HEALTH LINK VSHL

Volume

Rich information

Data volume



124 million records

for Health Analytics

Information for action

Used for **8** local investigations

Used for **4** international investigations

Policy

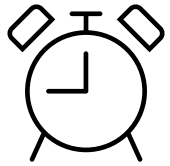
Education

Development

Lessons learned using VSHL

- **Allow enough time**
  - Governance processes
  - Computer processing time with large datasets and many users
  - Virtual machine hours
  - Importing and exporting code/data

Lessons learned using VSHL



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- **Remain flexible**
  - Different variables
  - Encryption

Lessons learned using VSHL

•Allow enough time

- Governance processes
- Computer processing time with large datasets and many users
- Virtual machine hours
- Importing and exporting code/data

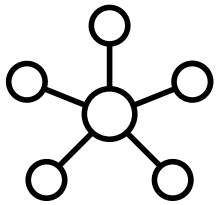
• Remain flexible

- Different variables
- Encryption

•Working with large volumes of data

- Pre-processing in SQL
- Creating a playground of dummy data
- Group chat and regular team meetings.

Lessons learned using VSHL



- **Explore the data limitations**
  - Variable completeness and accuracy
  - Variable agreement
  - Possible data bias with incorrect links

VSHL Impact

- Enabling studies that were previously impossible due to underreporting and reporting bias.
- Recommended changes to vaccine policy or healthcare worker education.
- Rapidly integrated into Victoria's routine vaccine safety processes.
- Collaboration with the Global Vaccine Data Network™ (GVDN) extends impact internationally.
- Learnings applicable beyond the scope of vaccine safety.

Stay in touch!
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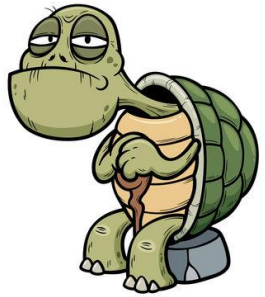
Read the detailed paper about establishing VSHL!

Centre for Health Analytics

Vaccine safety data linkage in Australia

ARC linkage grant
2008-2013

- 18 different agencies
- 21 separate authorisations
- 12 ethics approvals
- **Australian Government approval took 4 years from initial request**
- Linked data arrived 2 years after grant finished



PREVENTABLE DISEASE

Process trumps potential public good: better vaccine safety through linked cross-jurisdictional immunisation data in Australia

Katherine M. Duszynski,[1,2] Nicole L. Pratt,[3] John W. Lynch,[2] Annette Braunack-Mayer,[2,4] Lee K. Taylor,[5] Jesia G. Berry,[1] Vicki Xafis,[2] Jim Buttery,[6,7] Michael S. Gold[1] on behalf of the Vaccine Assessment Using Linked Data (VALID) Working Group

Collaborative Western Australia and Victoria analysis for Guillain Barre Syndrome

Example: self-controlled case series (SCCS) analysis conducted to measure association between adenovirus vector vaccine and Guillain Barre Syndrome.

VIC RI: 2.71 (1.01, 3.86) p<0.0001
WA RI: 1.04 (0.38,2.87) p0.94

Meta-analysis approach

Independent analysis in each state and combine final result

Combined de-identified linelist approach

Each state gets own linelist with exposure and outcome data, de-identifies the linelist and merges to create one large linelist for analysis

Combined linkage approach

Secure repository of data from each state with common unique identifier to create one linelist where exposure and outcome records between jurisdictions can be connected. Analysis is conducted on the one large linelist

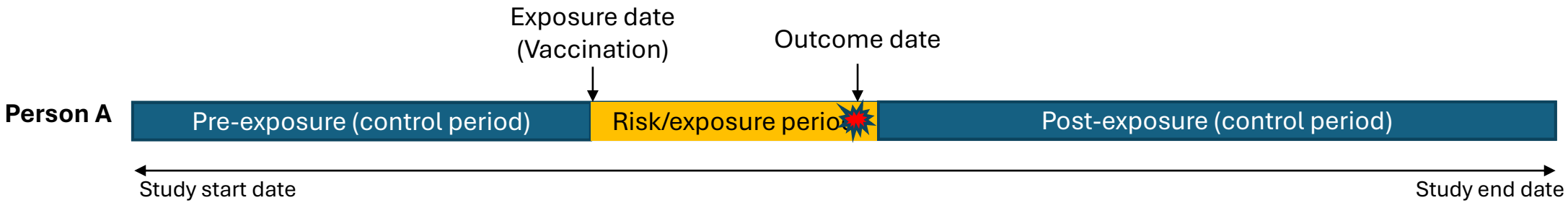
Collaborative meta-analysis approach:
2.45 (1.76,3.41) p<0.0001

Combined linelist approach:
2.18 (1.55,3.07) <0.0001

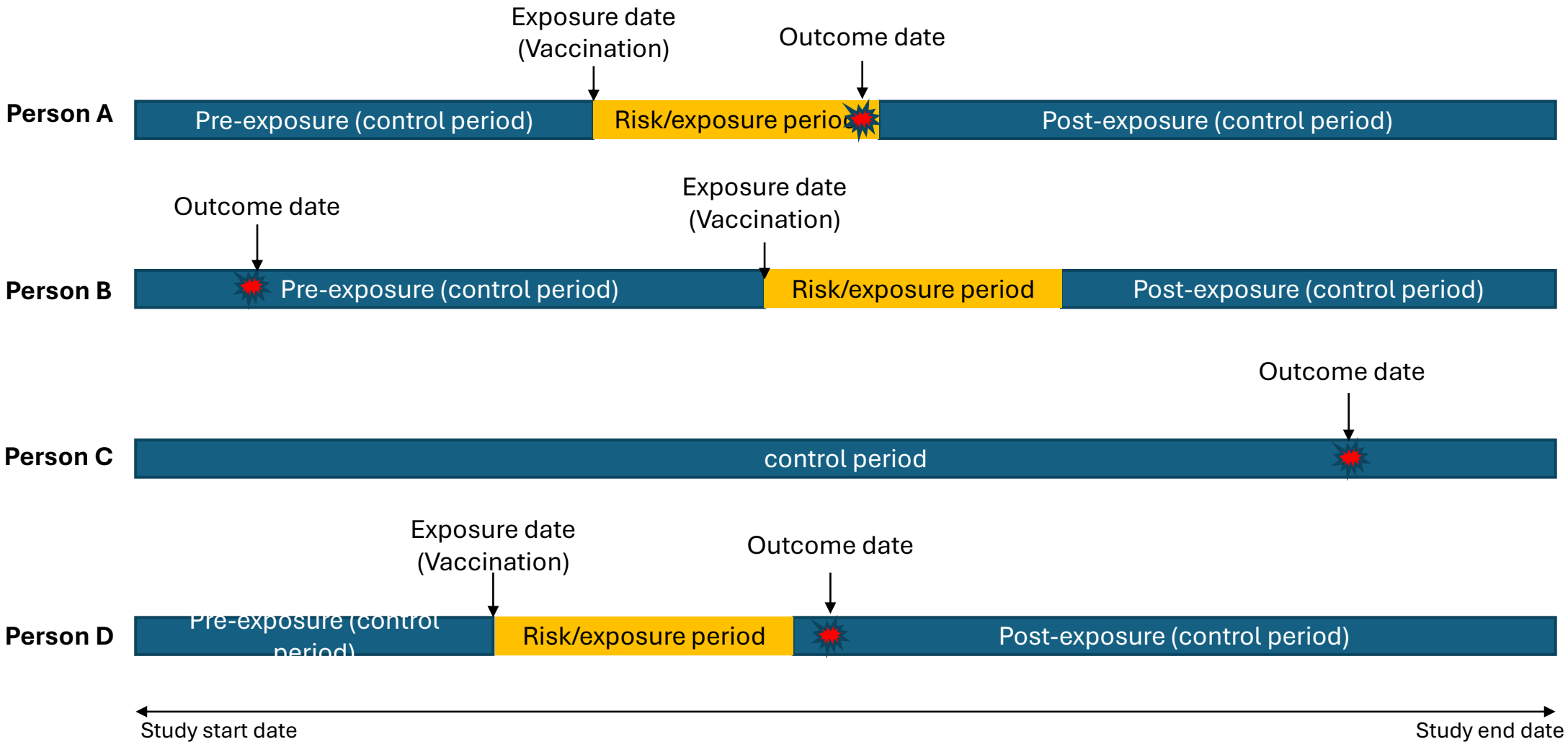
Not testing

Self-controlled case series (SCCS)

For every person with the outcome in study period

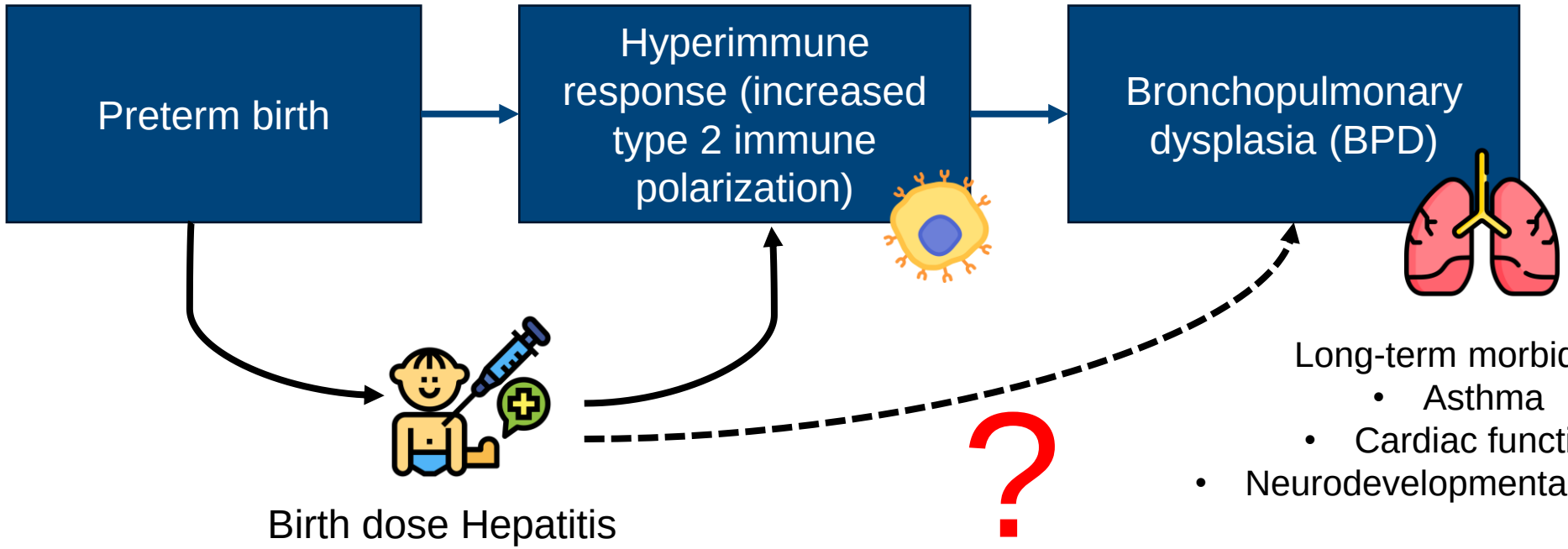


Self-controlled case series (SCCS)

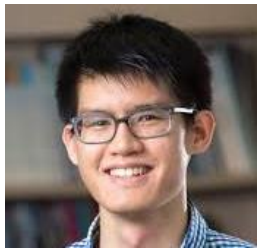


Study background

VSHL Example



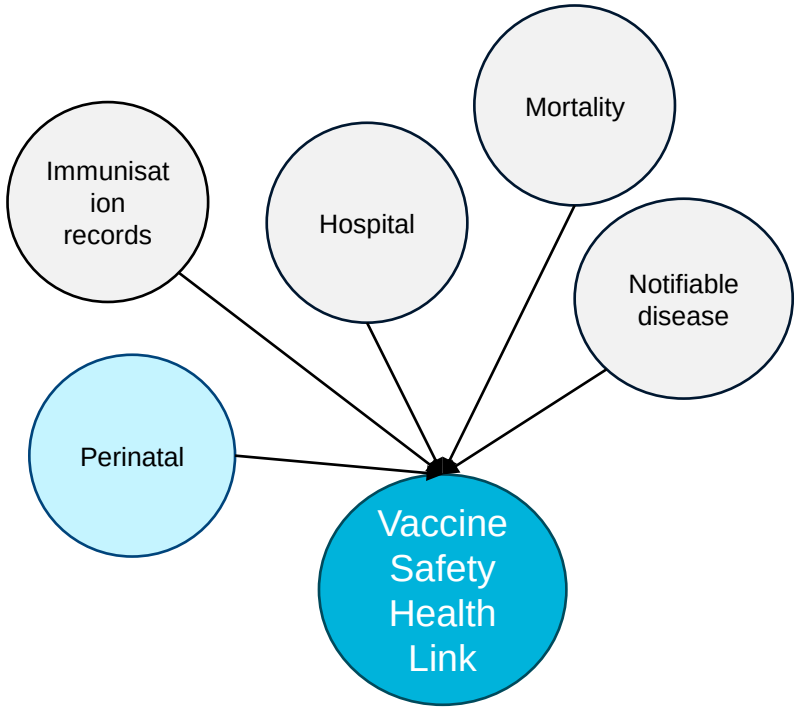
Lao et al. 2022



Study methods

VSHL Example

Step 1) Cohort – preterm infants born alive at <29 weeks gestation between 2017 and 2021 as per the Victorian Perinatal Data Collection

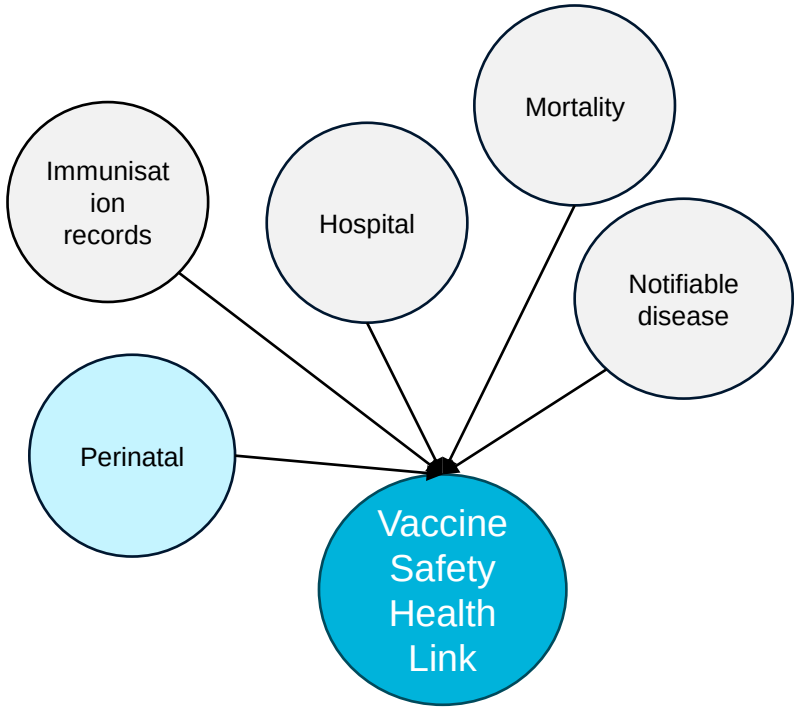


Identifier	Gestation	Date of birth encrypted
Infant A	26	15 May 2020
Infant B	24	17 Feb 2017
Infant C	28	2 Sep 2019
Infant D	28	3 Oct 2019

Study methods

VSHL Example

Step 2) Exposure – HBVV vaccination less than 24 hours as per the Victorian Perinatal Data Collection



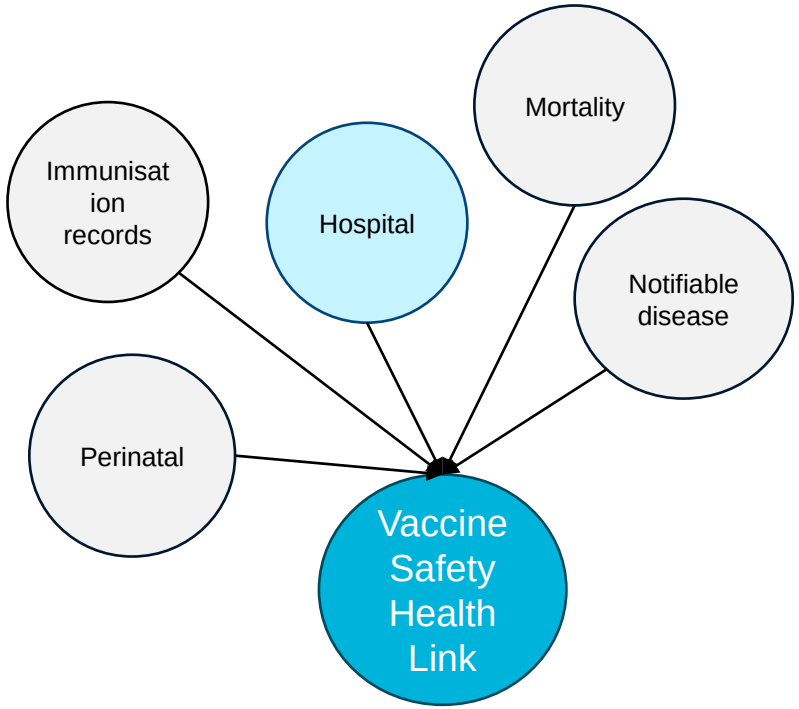
Identifier	Gestation	Date of birth encrypted	Vaccination status
Infant A	26	15 May 2020	1
Infant B	24	17 Feb 2017	0
Infant C	28	2 Sep 2019	1
Infant D	28	3 Oct 2019	1

Study methods

VSHL Example

P27.1, P27.8, P27.9 ICD-10-AM codes. Assigned where supplemental oxygen is required at 36 weeks gestation corrected.

Step 3) Outcome – Bronchopulmonary dysplasia ICD-10-AM code as per the Victorian Admitted Episodes Dataset

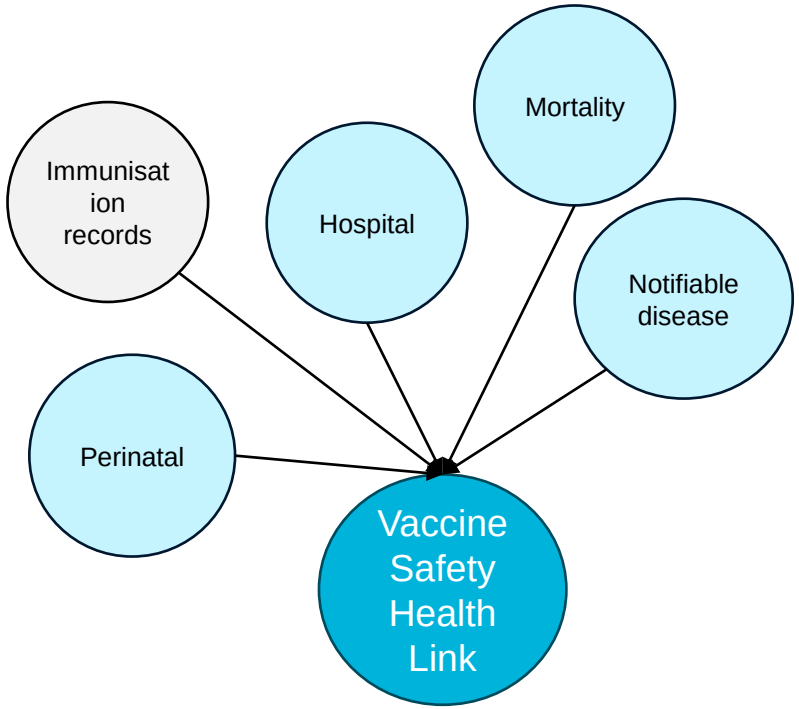


Identifier	Gestation	Date of birth encrypted	Vaccination status	BPD status
Infant A	26	15 May 2020	1	1
Infant B	24	17 Feb 2017	0	0
Infant C	28	2 Sep 2019	1	0
Infant D	28	3 Oct 2019	1	1

Study methods

VSHL Example

Step 4) Confounders – Identified via directed acyclic graph in consultation with neonatologists



					Confounders					
Identifier	**Gestation**	**Date of birth encrypted**	**Vaccination status**	**BPD status**	**A**	**B**	**C**	**D**	**E**	**F**
Infant A	26	15 May 2020	1	1	x	x	x	x	x	x
Infant B	24	17 Feb 2017	0	0	x	x	x	x	x	x
Infant C	28	2 Sep 2019	1	0	x	x	x	x	x	x
Infant D	28	3 Oct 2019	1	1	x	x	x	x	x	x

Study results

VSHL Example

		BPD		
		Yes	No	Total
Hepatitis B vaccine	Yes	155	151	**306**
	No	317	195	**512**
	Total	**472**	**346**	**818**

Unadjusted relative risk *0.81 (0.67,0.98)*
Adjusted relative risk *0.83 (0.69,1.00)*

No evidence of increased risk of BPD in preterm infants who received HBVV birth dose compared to those who did not

Study impact

VSHL Example

- National importance to address this question about risks of HBVV timing in pre-term infants
- Victoria with the Vaccine Safety Health Link is uniquely placed to investigate this potential association – large sample of real-world data.
- Findings support existing World Health Organization recommendations to immunise all infants against hepatitis B within 24 hours of birth
- Findings have been communicated to researchers and neonatologists. Helps address local practice.