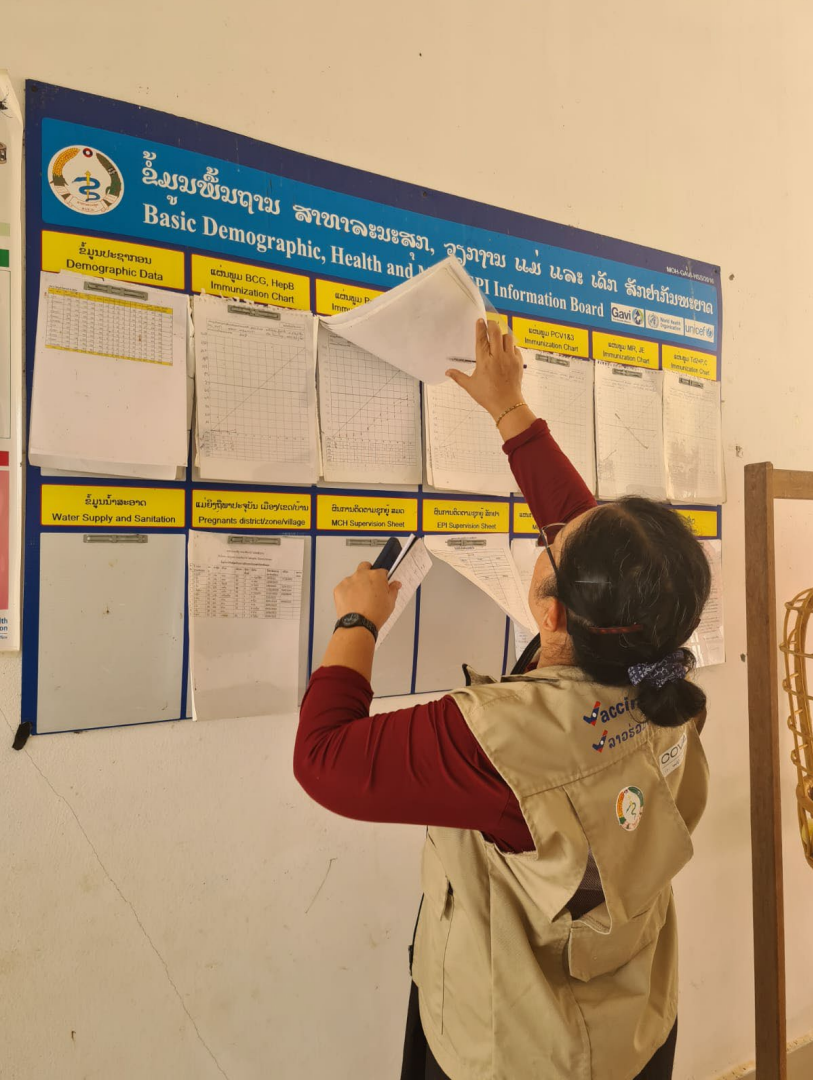


Coverage monitoring

Professor Meru Sheel

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Declaration of Interests

- Co-Chair Immunization Agenda 2030 SP7 (Research and Innovation)
- Immunization and Vaccine Implementation Research Advisory Committee (IVIRAC)
- Immunization Agenda 2030 Data Use and Strengthening Working Group
- WHO Public Health And Emergency Response Workforce
- Chair, Australian Regional Immunisation Alliance (ARIA)
- Board Director, Global Health Security Network Pty Ltd

Presenting in personal capacity

Overview

01 **Monitoring immunisation programs**

Coverage · Disease surveillance · Supply chain

02 **Electronic Immunisation Registries**

03 **Australia and HICs**

04 **LMICs (eg Lao PDR)**



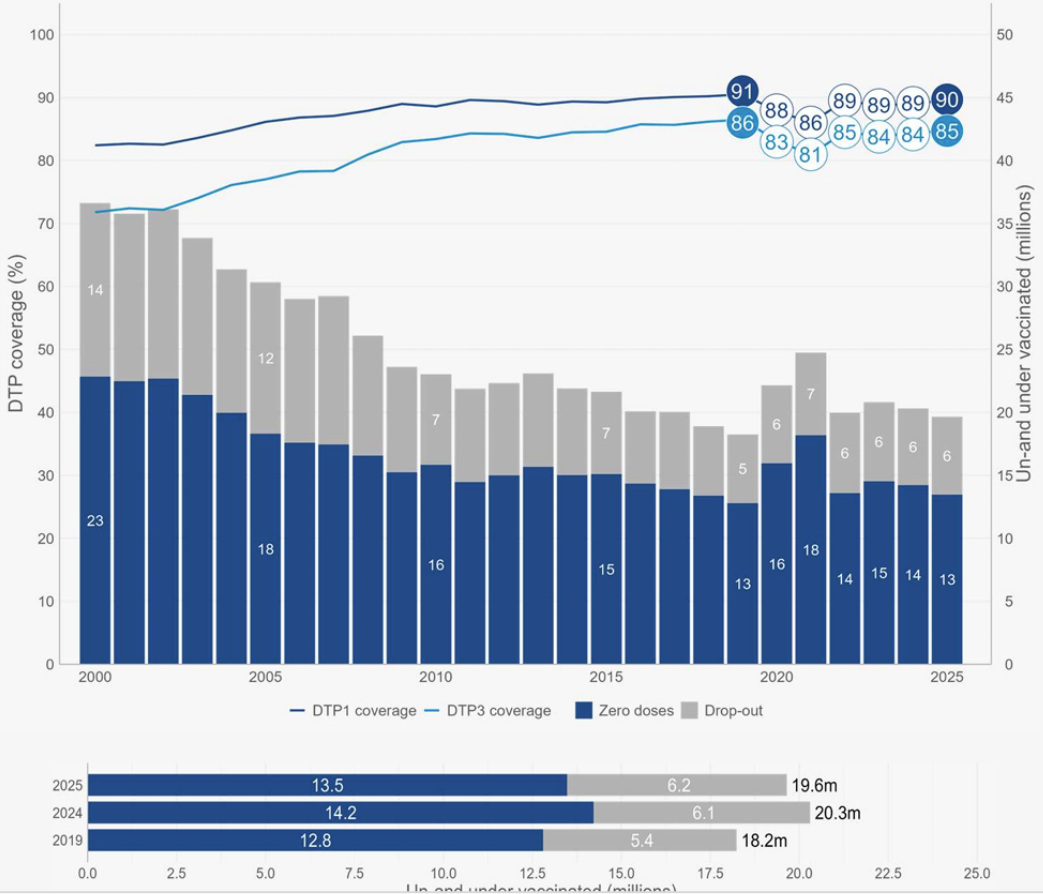
2025 DTP* coverage remains below the 2019 baseline

In 2025 programmes slightly improved the DTP coverage vs. 2024, but are still below 2019 levels, which is the baseline for Immunization Agenda 2030 targets.

There are 674,000 more "Zero Dose Children" now than in 2019, but 745,000 fewer than in 2024.

The majority (69%) of children not fully vaccinated with a DTP-containing vaccine were “Zero-Dose”, i.e. never reached by routine immunization at all. Nearly a third (31%) of those not fully DTP vaccinated had “dropped out”, i.e. started but did not finish 3-doses, so were known to the programme.

**DTP: a vaccine containing diphtheria, tetanus and pertussis antigens*



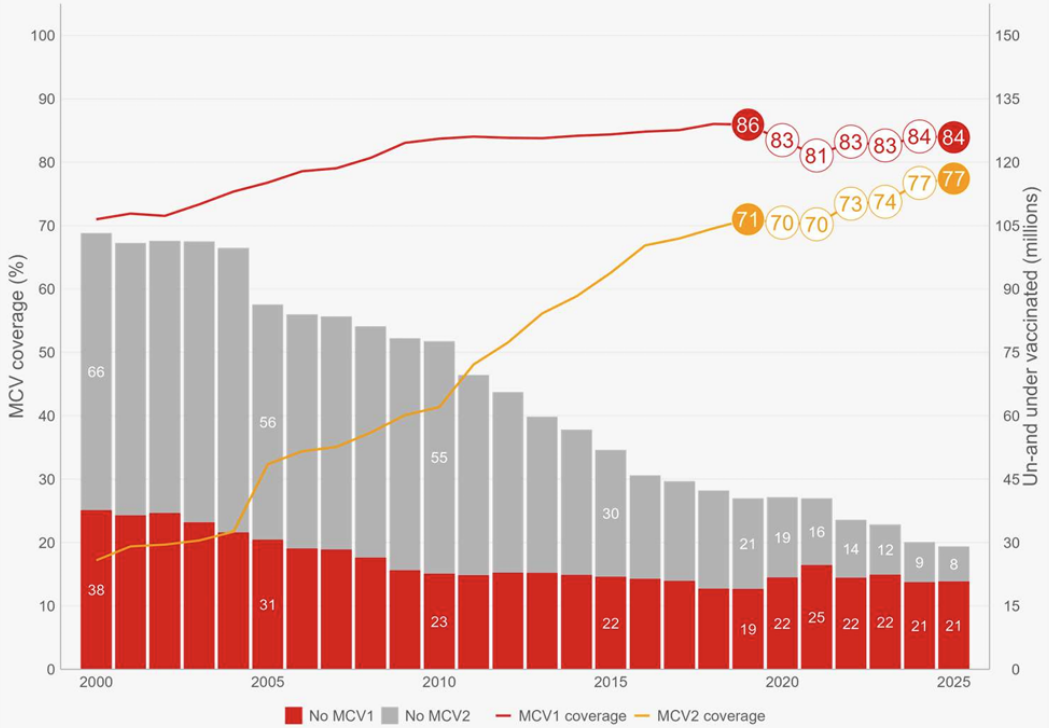
2025 MCV* coverage also remains below the 2019 baseline

Measles vaccination with at least one dose is also struggling to regain its 2019 level. There are still 1.8Mn more children unvaccinated for measles than in 2019, 173,000 more than in 2024.

Coverage with the 2nd dose of measles vaccine keeps improving as countries that introduced this dose recently are strengthening their 2nd year-of-life platform.

2 countries have yet to introduce the 2nd dose in the national schedule: The Central African Republic and Gabon.

**MCV: a vaccine containing measles antigens, like MR or MMR.*



Vaccination coverage

Coverage = percentage of population with all specified vaccine(s) by particular ages

01

Helps measure impact of vaccine program

02

If population coverage is sufficient to interrupt transmission

03

Areas of low vaccine uptake

WUENIC method

WHO/UNICEF Estimates of National Immunization Coverage

Administrative data

Countries report the doses given (numerator) and the target population (denominator) through the annual WHO/UNICEF Joint Reporting Form.

Official government estimates

Some countries give their own adjusted figure when they think the administrative data is biased.

Household surveys

These include DHS, MICS and EPI cluster surveys, using vaccination cards and caregiver recall.

Contextual information

This covers vaccine stock-outs, programme disruptions, changes to schedules or denominators, and comments from local experts.

Rule based and not a statistical model

Burton, Anthony, Monasch, Roeland, Lautenbach, Barbara, Gacic-Dobo, Marta, Neill, Maryanne et al. (2009). WHO and UNICEF estimates of national infant immunization coverage: methods and processes. Bulletin of the World Health Organization, 87(7), 535 - 541. World Health Organization. https://doi.org/10.2471/BLT.08.053819

Monitoring coverage - administrative and survey methods

Routine administrative method

Advantages:

- Based on data necessary for service provision Timely management monitoring tool
- Provides data at local level

Disadvantage / Limitations:

- Denominator (target population may be projected based on old/poor census data)
- Transcription or calculation errors
- Incomplete reporting
- May include vaccination conducted outside the target group
- May not include private sector

Survey method

Advantages:

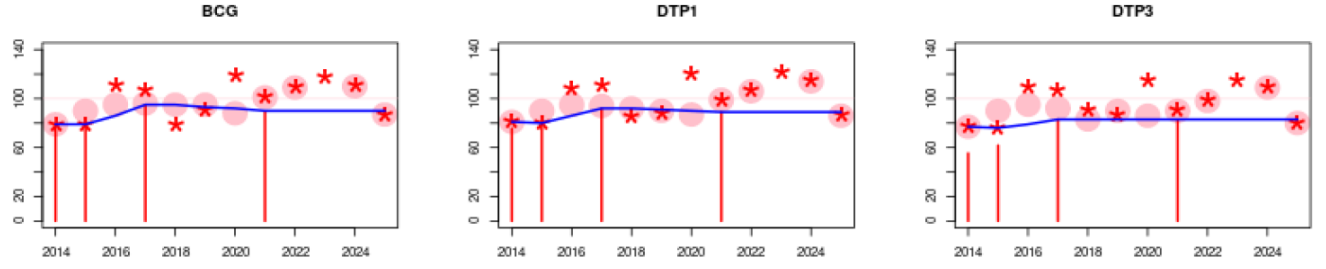
- Estimate of coverage can be obtained if the denominator is unknown.
- Provides additional information on social economical status, maternal characteristics, sex, etc of reached and unreached children
- Vaccinations given by the private sector reflected
- Allows assessing timeliness (among those with cards)

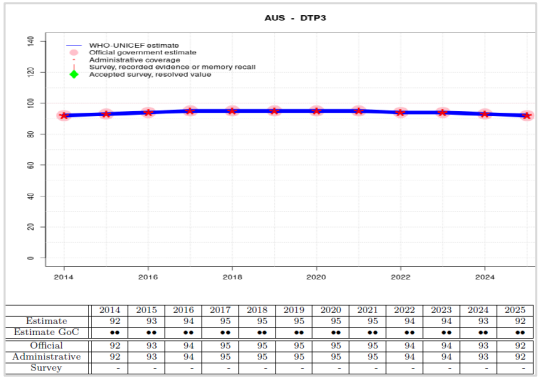
Disadvantage / Limitations:

- Bias – selection, information and sampling error
  - Provides information on the previous birth year's cohort.
  - Immunization card availability and quality
  - Reliance on recall in absence of card
  - Representativeness
- Interviewer interaction
- Length or complexity of the questionnaire may compromise accuracy
- Resource intensive

Cutts et al 2016 Vaccine. https://pubmed.ncbi.nlm.nih.gov/27349841/
Adapted from WHO, Dr Jan Grevendonk

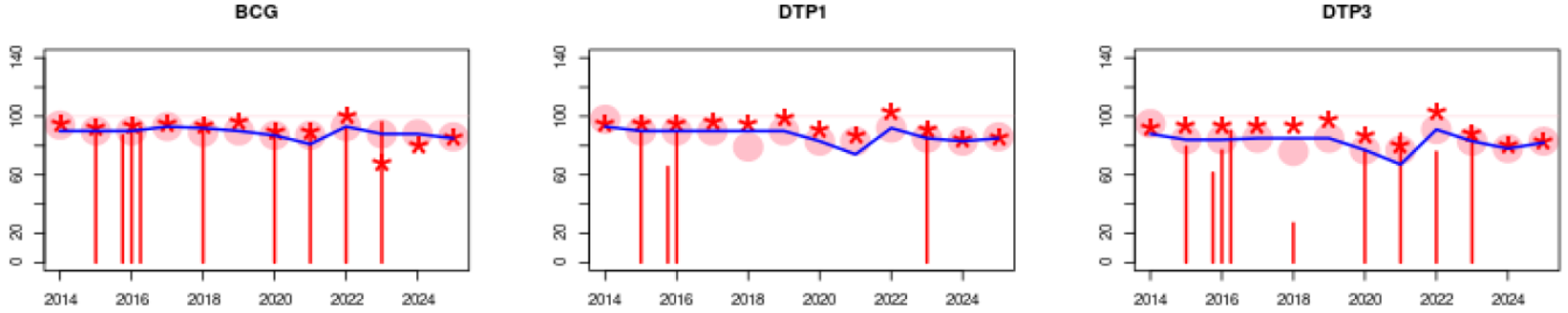
Timor-Leste: WHO and UNICEF estimates of immunization coverage: 2025 revision

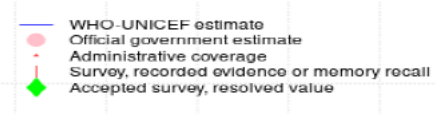




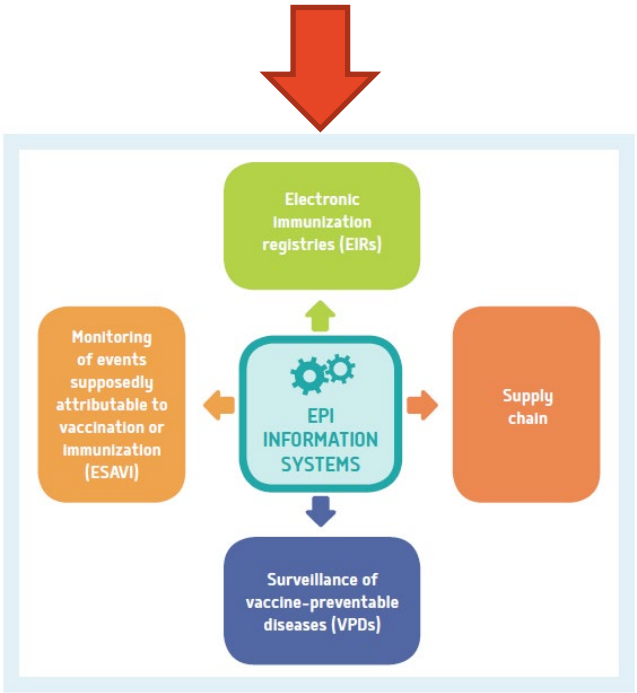
	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Estimate	92	93	94	95	95	95	95	95	94	94	93	92
Estimate GoC	••	••	••	••	••	••	••	••	••	••	••	••
Official	92	93	94	95	95	95	95	95	94	94	93	92
Administrative	92	93	94	95	95	95	95	95	94	94	93	92
Survey	-	-	-	-	-	-	-	-	-	-	-	-

Indonesia: WHO and UNICEF estimates of immunization coverage: 2025 revision





Electronic Immunisation Registries



A confidential, digital, population-based information system that contains data on vaccine doses administered to individuals

- Allows for the monitoring of vaccination coverage by provider, vaccine, dose, age, target group, and geographical area
- Facilitates monitoring of individuals receiving immunization

Pan American Health Organization. Electronic Immunization Registry: Practical Considerations for Planning, Development, Implementation and Evaluation. Washington, D.C.: PAHO; 2017.
Dolan, S. B. et al. (2019). Redefining vaccination coverage and timeliness measures using electronic immunization registry data in low- and middle-income countries. Vaccine, 37(13), 1859–1867. https://doi.org/10.1016/j.vaccine.2019.02.017

Other types of immunisation registries

- Immunization registries can also be paper-based or non-individualised

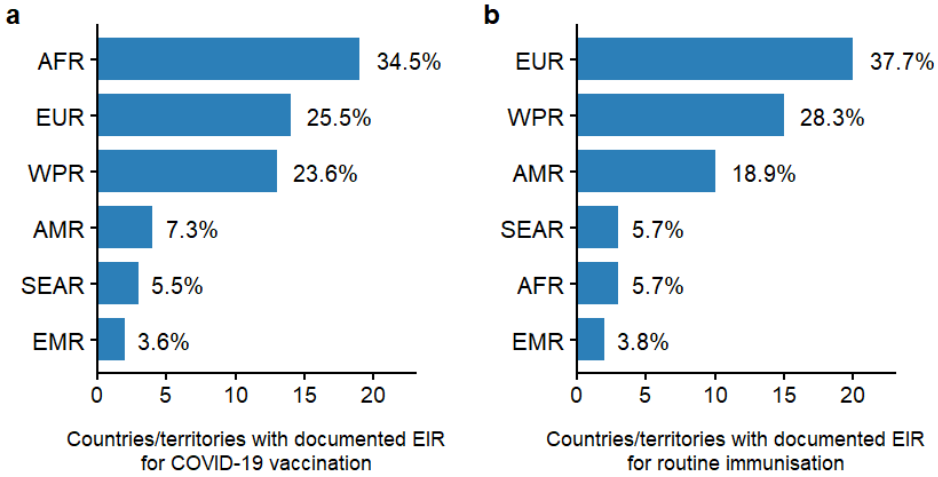
- Paper-based records
  - Difficult to analyze and share
  - Risk of errors (no data validation)
  - Discrepancies between records e.g. between individual and facility
  - Risk of loss or damage

- Non-individualised can allow analysis of doses etc but are prone to various errors



Paper-based registry maintained by Tonga Ministry of Health since 1970s

Use of electronic immunisation registries (EIRs) among countries and territories with documented EIRs, by WHO region,



In Western Pacific Region

- Vietnam
- Vanuatu
- Solomon Islands
- Samoa
- Papua New Guinea
- Mongolia
- FSM
- Lao PDR
- Cambodia
- Indonesia

- Data not validated. Status might be incomplete or outdated

Manuscript under review

Strengths and weaknesses of EIRs

Strengths

- Individual record of vaccinations with demographic information
- Easily accessible electronically
- Linkage of records across facilities
- Improved data quality due to built-in validity checks
- Support real-time operational feedback

But EIRs are only as good as the data which is entered…

- Data may be incompletely or erroneously entered
- Data only representative of individuals and populations who are seen at services using EIR
- The system takes time to mature to realise the full benefits
- Relies on adequate allocation of resources – financial, human and infrastructure

Dolan, S. B. et al. (2019). Redefining vaccination coverage and timeliness measures using electronic immunization registry data in low- and middle-income countries. *Vaccine*, *37*(13), 1859–1867. https://doi.org/10.1016/j.vaccine.2019.02.017

The Australian Immunisation Register "AIR"

- Mature system – established over 30 years ago
- Maintained by Services Australia on behalf of Australian Government Department of Health
- Limited data fields captured:
  - Vaccine, dose number, date, batch number
  - Age, sex, Indigenous status, postcode of residence
  - Provider type e.g. hospital, clinic
  - Exemptions where a vaccine is contraindicated
- Many strengths but also areas for improvement and learning…

National Immunisation Program
A joint Australian, State and Territory Government Initiative

Australian Immunisation Register (AIR)

PROFESSIONAL PRACTICE & INNOVATION ARTICLES

The Australian Immunisation Register (AIR)

Insights from working with AIR data

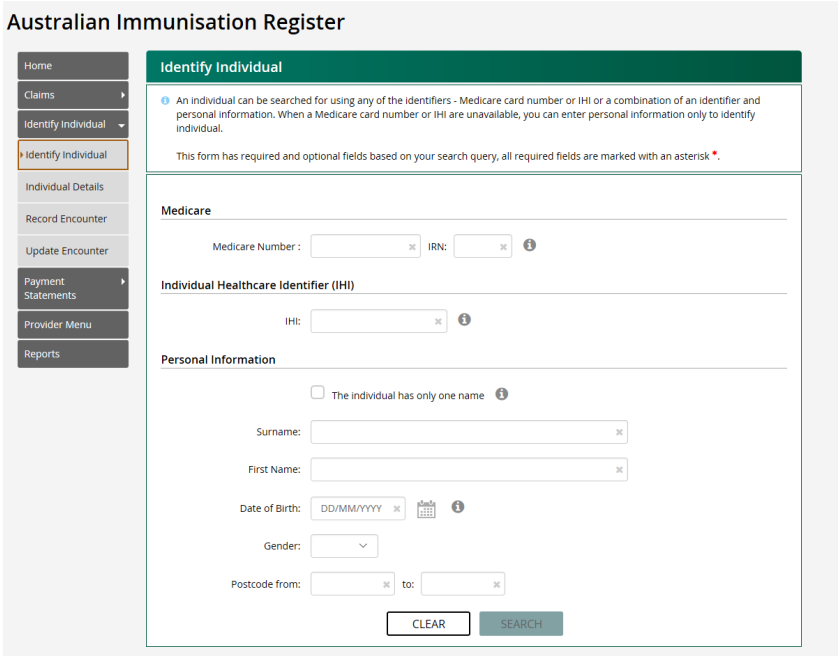
Brynley P Hull, Alexandra Hendry, Frank Beard, Aditi Dey

Authors and Affiliations >

Health Information Management Journal 55(1):p 173-182, January 2026. | **DOI:** 10.1177/18333583251343479

https://www.health.gov.au/sites/default/files/documents/2021/05/australian-immunisation-register-fact-sheet.pdf

Example: Australian Immunisation Register - Identify individuals



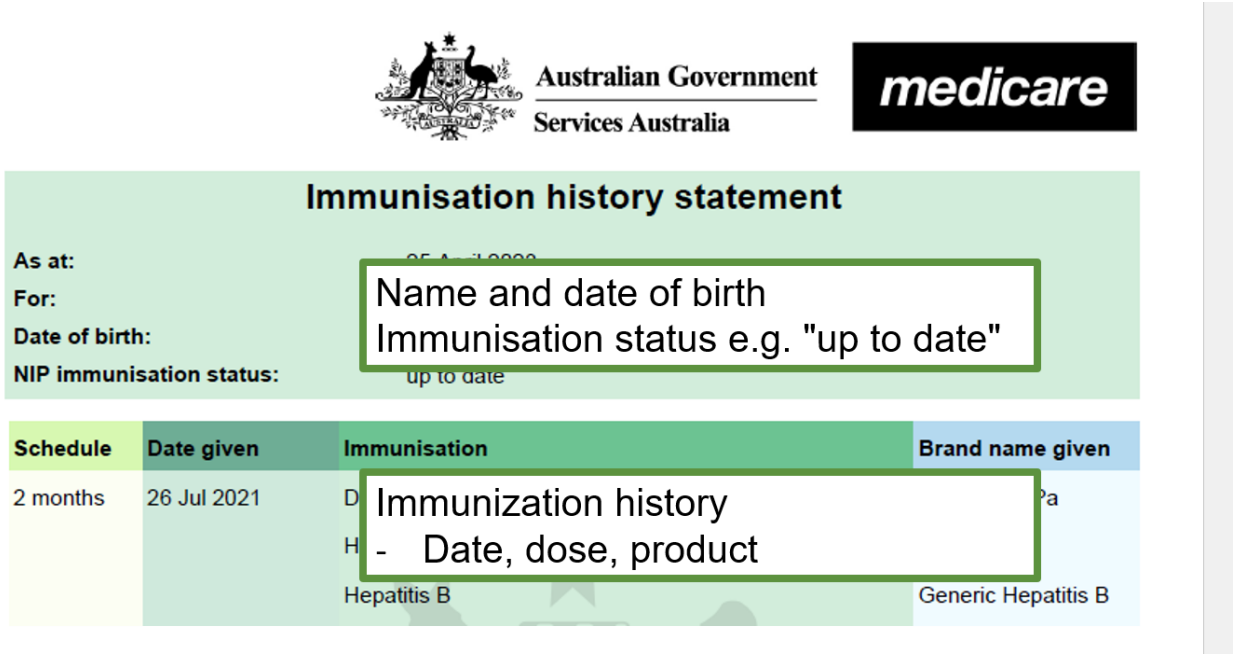
← Patient healthcare number

← Name

← Date of birth

← Postcode of residence

Example: Australian Immunization Register - Immunisation history statement



Australian Government
Services Australia

medicare

Immunisation history statement

As at:
For:
Date of birth:
NIP immunisation status: up to date

Name and date of birth
Immunisation status e.g. "up to date"

Schedule	Date given	Immunisation	Brand name given
2 months	26 Jul 2021	D… H… Hepatitis B	…Pa… Generic Hepatitis B

Immunization history
- Date, dose, product

Coverage in Australia

- Measured using the Australian Immunisation Register (AIR)
- The '**cohort method**' - used by **WHO**
- Cohorts of children, adolescents or adults are defined by date of birth in **3-month wide or 12-month wide cohort**
  - eg. children born between 1st Jan and 31st Mar 2023
- Vaccination status of adolescent and adult cohorts assessed at various ages based on the scheduled age for the vaccine being assessed

Vaccination status of childhood cohorts assessed at 3 key milestone ages:

12 months
For vaccines given at 6 months of age

24 months
For vaccines given at 12 and 18 months of age

60 months
For vaccines given at 48 months

Examples of vaccinations required to be deemed fully vaccinated by each assessment milestone, 2024

Milestone	Vaccinations
9 months/12 months (Cohort born 1 January 2023–31 December 2023)	Dose 3 DTPa (due at 6 months) Dose 3 polio (due at 6 months) Dose 3 HepB (due at 6 months) Dose 3 Hib (due at 6 months)* Dose 2 or 3 13vPCV (due at 4 or 6 months)
15 months (Cohort born 1 January 2022–31 December 2022)	Dose 3 DTPa (due at 6 months) Dose 3 polio (due at 6 months) Dose 3 HepB (due at 6 months) Dose 3 Hib (due at 6 months)* Dose 3 or 4 13vPCV (due at 6 or 12 months) Dose 1 meningococcal C-containing vaccine (due at 12 months) Dose 1 MMR (due at 12 months)
21 months/24 months (Cohort born 1 January 2022–31 December 2022)	Dose 4 DTPa (due at 18 months) Dose 3 polio (due at 6 months) Dose 3 HepB (due at 6 months) Dose 4 Hib (due at 18 months)* Dose 1 meningococcal C-containing vaccine (due at 12 months) Dose 1 varicella (due at 18 months) Dose 2 MMR (due at 18 months) Dose 3 or 4 13vPCV (due at 6 or 12 months)
51 months/60 months (Cohort born 1 January 2019–31 December 2019)	Dose 4 or 5 DTPa (due at 48 months) Dose 4 polio (due at 48 months)

* Children who had Comvax, Generic HIB and/or PedvaxHIB recorded on the AIR only require dose 2 Hib to be deemed fully vaccinated by 12 months and dose 3 or 4 to be deemed fully vaccinated by 24 months. Children who had ActHIB, Hexaxim, Hiberix, HibTITER, Infanrix Hexa, Menitorix, Pediacel, ProHIBit and Poliacel recorded on the AIR only require dose 3 if it was given at over 15 months of age to be deemed fully vaccinated by 24 months

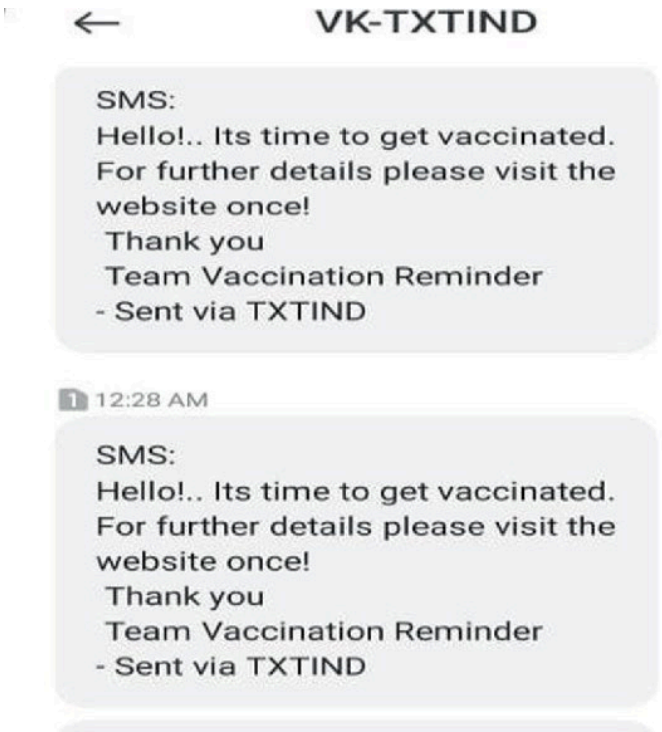
DTPa = diphtheria-tetanus-pertussis paediatric formulation; Hep B = hepatitis B; Hib = *Haemophilus influenzae* type b; 13vPCV = 13-valent pneumococcal conjugate vaccine; MMR = measles-mumps-rubella

https://ncirs.org.au/immunisation-coverage-data-and-reports/annual-immunisation-coverage-report-2024-summary

On-time vaccination

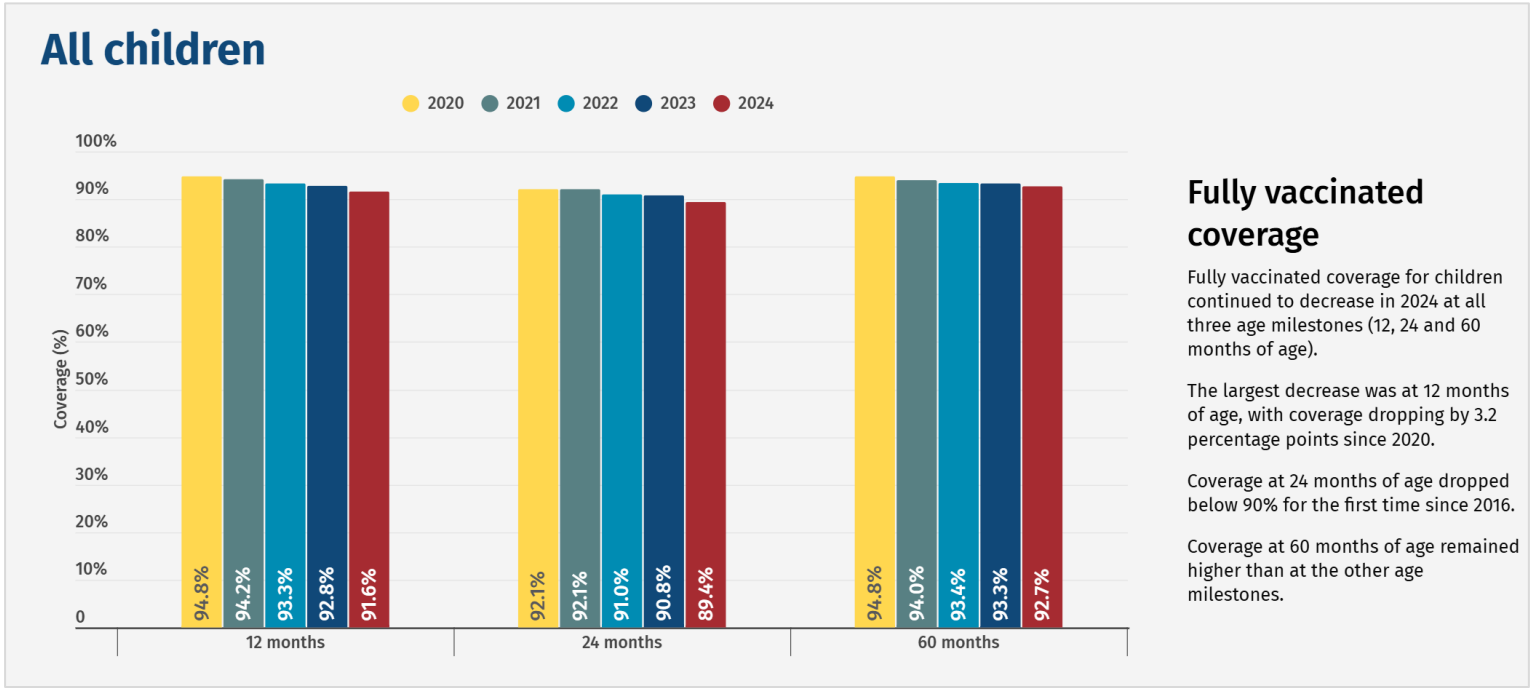
- **On-time vaccination** = receipt of the scheduled vaccine dose **within 30 days** of the recommended age

- **On-time coverage** - measured in 3-month-wide birth cohorts, defined by the quarter and year that the children in each cohort were due to receive the vaccine dose being assessed
    - Trend analysis also uses 3-month wide birth cohorts



AIR Strengths	Weaknesses
• Captures almost all the population (registration linked to Medicare) • Links to some health information systems e.g. immunization provider systems • Supports reminders for those who maybe overdue • Supports safety monitoring for individuals • Allows the provision of vaccine certificates and immunisation history statements	• Lacks a unique individual identifier • Not actively linked with key health information systems but improving (Person Level Integrated Data Asset, PLIDA). • May not capture records from non-citizens/residents • Lacks data on risk factors such as pregnancy or comorbidity or disability, ethnicity, country of birth

Examples of Coverage Reports



Fully vaccinated coverage

Fully vaccinated coverage for children continued to decrease in 2024 at all three age milestones (12, 24 and 60 months of age).

The largest decrease was at 12 months of age, with coverage dropping by 3.2 percentage points since 2020.

Coverage at 24 months of age dropped below 90% for the first time since 2016.

Coverage at 60 months of age remained higher than at the other age milestones.

https://ncirs.org.au/immunisation-coverage-data-and-reports/annual-immunisation-coverage-report-2024-summary

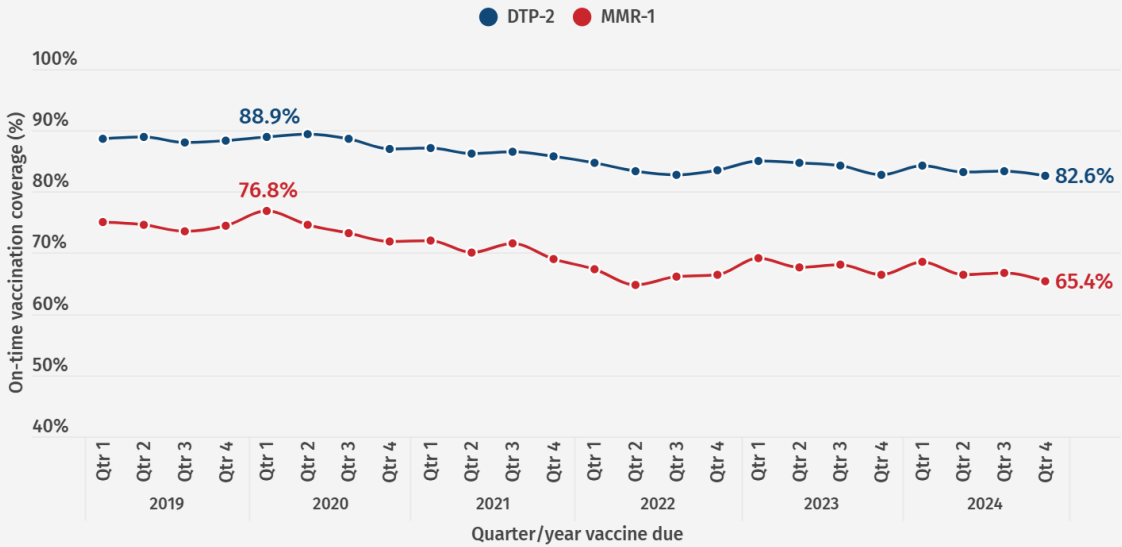
Levels of on-time vaccination

On-time vaccination

Levels of on-time vaccination (i.e. within 30 days of the recommended age) remained lower in young children than before the COVID-19 pandemic.

In the last quarter of 2024, on-time coverage of the second dose of DTP-containing vaccine was 6.3 percentage points lower than in the first quarter of 2020.

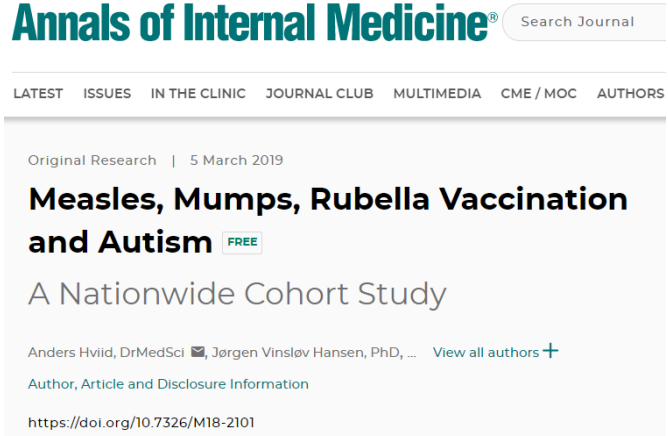
On-time coverage of the first dose of MMR vaccine was 11.4 percentage points lower in the last quarter of 2024 than in the first quarter of 2020.



https://ncirs.org.au/immunisation-coverage-data-and-reports/annual-immunisation-coverage-report-2024-summary

Nordic countries

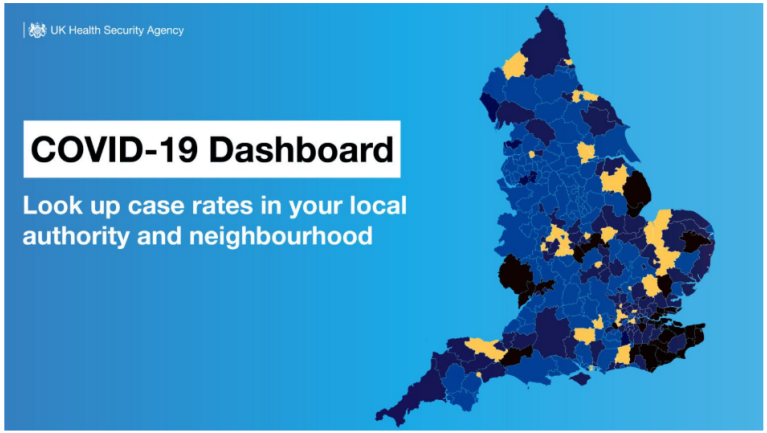
- Most advanced
- Unique identifier
- Norwegian SYSVAK (established 1995)
- Danish vaccination register (established 2013)
- Finnish national vaccination register (established 2009)
- Based on unique PIN issued at birth or immigration
- Facilitates linkage to other national health registers
- Eg MMR/autism cohort study (657,461 children) linking data on autism diagnoses and risk factors



Immunisation registries in Europe and Elsewhere: https://www.eurosurveillance.org/upload/site-assets/imgs/Immunisation%20registers%20in%20Europe%20and%20elsewhere.pdf

How UKHSA's COVID-19 Dashboard worked during the pandemic

Blog Editor, 16 December 2021 - Coronavirus (COVID-19), Data blog



This post was published in 2021 and refers to the COVID-19 Dashboard UKHSA published at that time. The information is now of historic interest only. The current UKHSA Data Dashboard can be found here.

Every day at 4pm the latest coronavirus data - setting out daily cases, testing and vaccination levels, as well as deaths and hospitalisations - is published on the COVID-19 Dashboard. In addition to reporting UK and national data, the

ELSEVIER

International Journal of Medical Informatics
Volume 170, February 2023, 104974

Monitoring the COVID-19 immunisation programme through a national immunisation Management system – England's experience

Elise Tessier [a], Michael Edelstein [b], Camille Tsang [a], Freja Kirsebom [a], Charlotte Gower [a], Colin N.J. Campbell [a], Mary Ramsay [a], Joanne White [a], Nick Andrews [b], Jamie Lopez-Bernal [a], Julia Stowe [a]

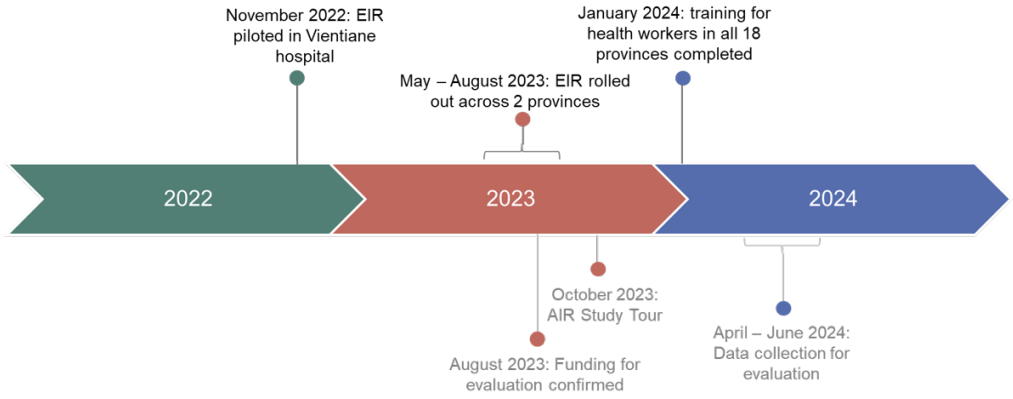
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Lao EIR



Early and ongoing evaluations provide insights on strengths and challenges of EIR implementation, facilitating successful transition from paper-based to digital systems

npj | digital public health

Article

https://doi.org/10.1038/s44482-026-00018-6

Strengthening Immunisation Data Systems: a mixed-method evaluation of the Lao Electronic Immunisation Registry

Check for updates

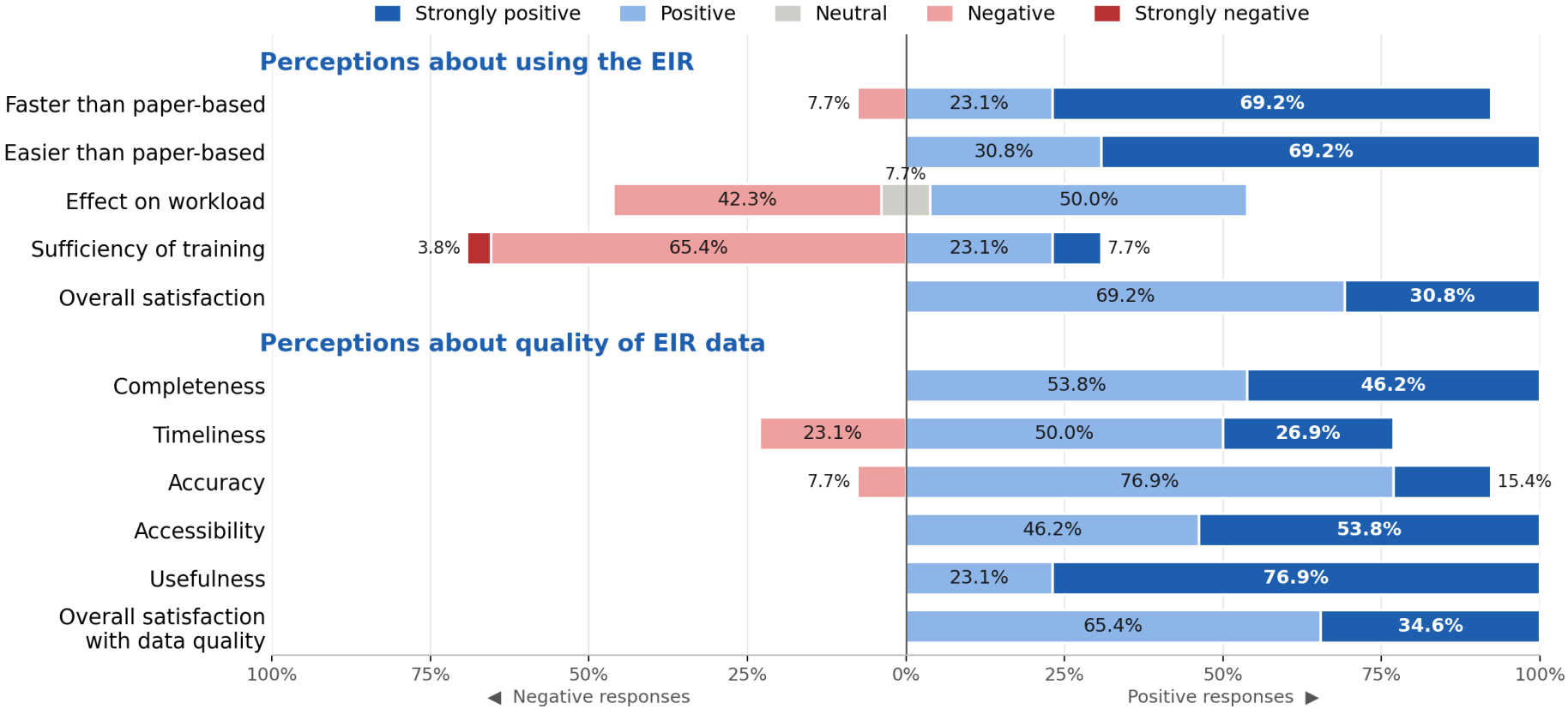
Cyra Patel[1,2], Praveena Gunaratnam[1,2,9], Gemma Saravanos[4,5,9], Mathida Thongseng[1], Amy Vassallo[1], Niramonh Chanlivong[1], Adeline Tinessia[1], Chansay Pathammavong[6], Kongxay Phounphenghack[6], Sisouveth Norasingh[6,7], Dheeraj Bhatt[7], Shukhrat Rakhimdjanov[7], M. Carolina Danovaro-Holliday[8] & Meru Sheel[1,2,4]

The Lao People's Democratic Republic introduced an Electronic Immunisation Registry (EIR) for routine immunisation in 2022. This mixed-methods study evaluated the EIR's implementation to inform its optimisation and use. Data were collected (April–June 2024) using document review, health facility surveys, interviews, workflow observations and data quality assessments. Data were analysed separately and then triangulated to develop recommendations. Among 26 healthcare workers, perceptions were largely positive and all found the EIR easy to use. However, the perceived effect of the EIR on workload was mixed, and training was largely considered insufficient (17/26, 65.4%). Eighteen stakeholder interviews highlighted strong EIR uptake, improved ability to generate reports and identification of under-immunised children, but persistent data gaps, limited data use, staff shortages, reliance on development partners, and the need for stronger government ownership and a long-term roadmap. Data quality assessment of 849,055 vaccination events showed high levels of missing or invalid data. Only 12.46% and 13.45% of births were registered in the EIR within 3 and 7 days, respectively. This evaluation demonstrated that EIR implementation is feasible and acceptable, but barriers, particularly workforce capacity and capability, digital infrastructure, governance, and financing, must be addressed to realise its potential to increase vaccination coverage.

Sydney World Health Organization unicef CLINTON HEALTH ACCESS INITIATIVE ARIA Australian Regional Immunisation Alliance Australian Government Department of Foreign Affairs and Trade THE UNIVERSITY OF SYDNEY

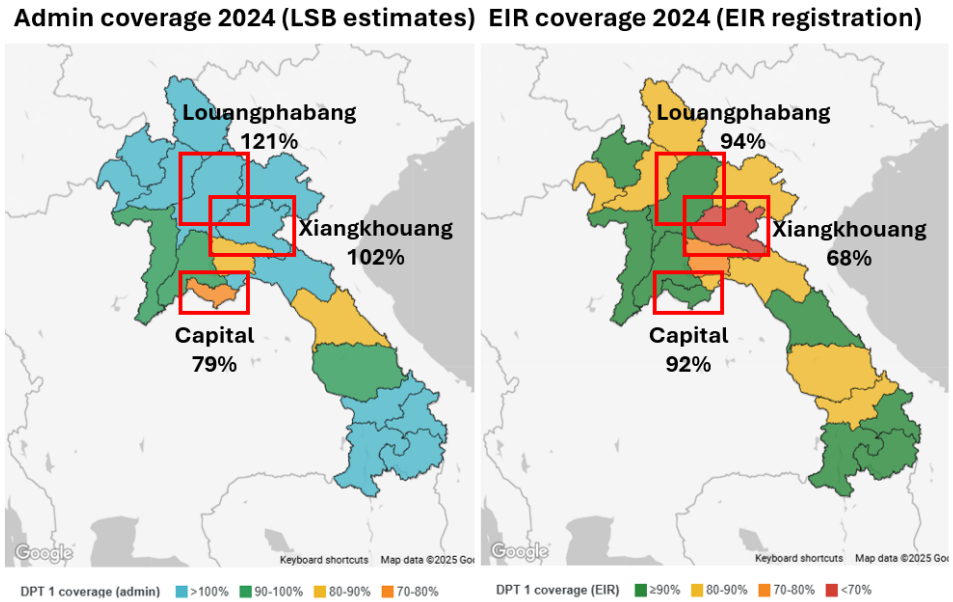
Health workers' perceptions of the Electronic Immunisation Register (EIR)

Survey respondents (n = 26), Vientiane Capital and Vientiane Province, Lao PDR, April 2024



Response options (strongly positive → strongly negative): Much faster / A little faster / Not faster / Much slower; Much easier / Somewhat easier / Not easier / Harder; Reduced workload / Workload stayed the same / Increased workload; Sufficient / Somewhat sufficient / Insufficient / Did not receive training; Very satisfied / Satisfied / Unsatisfied / Very unsatisfied; Very easy / Somewhat easy / Not easy / Very difficult; Very useful / Useful / Not very useful / Not at all useful.
Percentages as reported in the source table (n = 26 for all items); options with 0 respondents have no bar segment. Source: Patel et al., npj Digital Public Health (2026) 1:13, Table 2.

Coverage using EIR registration offer a different analysis to compare with admin data.



- Identification of priority areas

Slide credit: Lao MCHC/ WHO

Summary

- **Coverage monitoring helps track immunisation programs**
- **Various types of data sources can be used to estimate coverage**
- **EIR is a powerful tool for monitoring and storing individual vaccination records to enhance immunisation programs**
    - Enables data-driven decision making
    - Individual and population level benefits
    - But - needs time to reach maturity
    - Requires key elements of the health system to come together
    - Planning and investment essential to unlock the full economic potential
    - Evaluation and interventions can improve and increase the use of EIR

Thank you and questions



THE UNIVERSITY OF SYDNEY