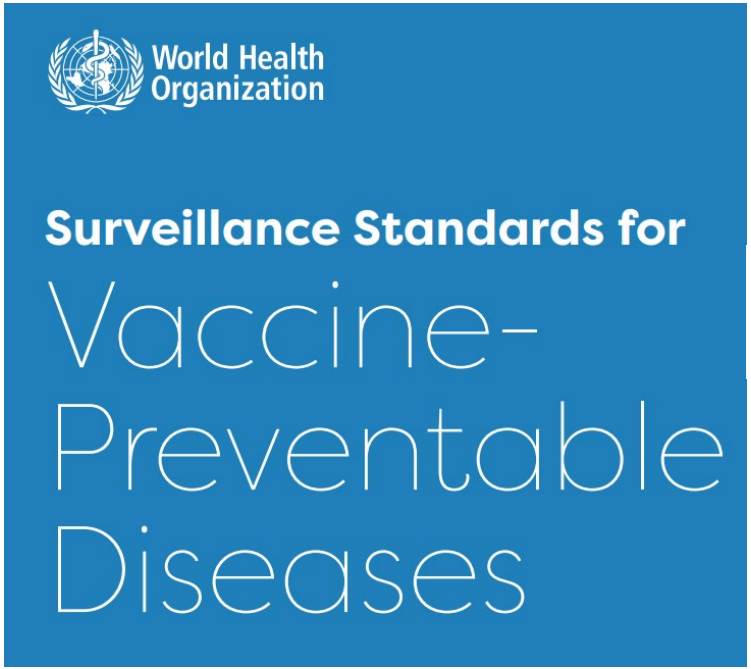
Measuring immunisation program performance

Surveillance
Coverage
Effectiveness

Talk Structure

- VPD surveillance
  - High resource settings
  - Lower resource settings
  - Stage of programme
- Vaccine coverage
  - High resource settings
  - Lower resource settings
- Vaccine performance



Acknowledgements

We are grateful to the >175 colleagues from 47 organizations who developed VPD-specific chapters and/or contributed to the preparation of this document by reviewing drafts and providing constructive comments, including the following (in alphabetical order):

David Durrheim, University of Newcastle, Australia

Kristine Macartney, National Centre for Immunisation Research and Surveillance, Australia

Peter McIntyre, National Centre for Immunisation Research and Surveillance, Australia

SURVEILLANCE OBJECTIVE	EXAMPLES
Monitoring disease elimination or eradication efforts	Polio eradication; measles and neonatal tetanus (NT) elimination
Detection of outbreaks and new pathogens	Meningococcal outbreaks; pandemic or highly virulent influenza virus
Evidence for new vaccine introduction or optimizing vaccine schedules	Pneumococcal, rotavirus disease burden for vaccine introduction decisions; changing schedules for tetanus or pertussis vaccine
Evaluation of immunization programme performance and defining the need for supplementary immunization	Vaccination history of measles cases can help identify geographic areas and age groups with low vaccination coverage to inform targeting of future measles vaccine campaigns
Vaccine effectiveness, impact on disease burden, or both	Test-negative case-control studies of vaccine effectiveness
Changes in disease strains or types	Seasonal influenza vaccine formulation; pneumococcal serotype replacement after pneumococcal conjugate vaccine (PCV) introduction

Priorities for VPD surveillance

- Global
  - Eradication target
    - included in IHR (international health regulations) eg polio
  - Pandemic potential
- Regional
  - Elimination target eg measles, rubella
  - Epidemic potential

High income settings

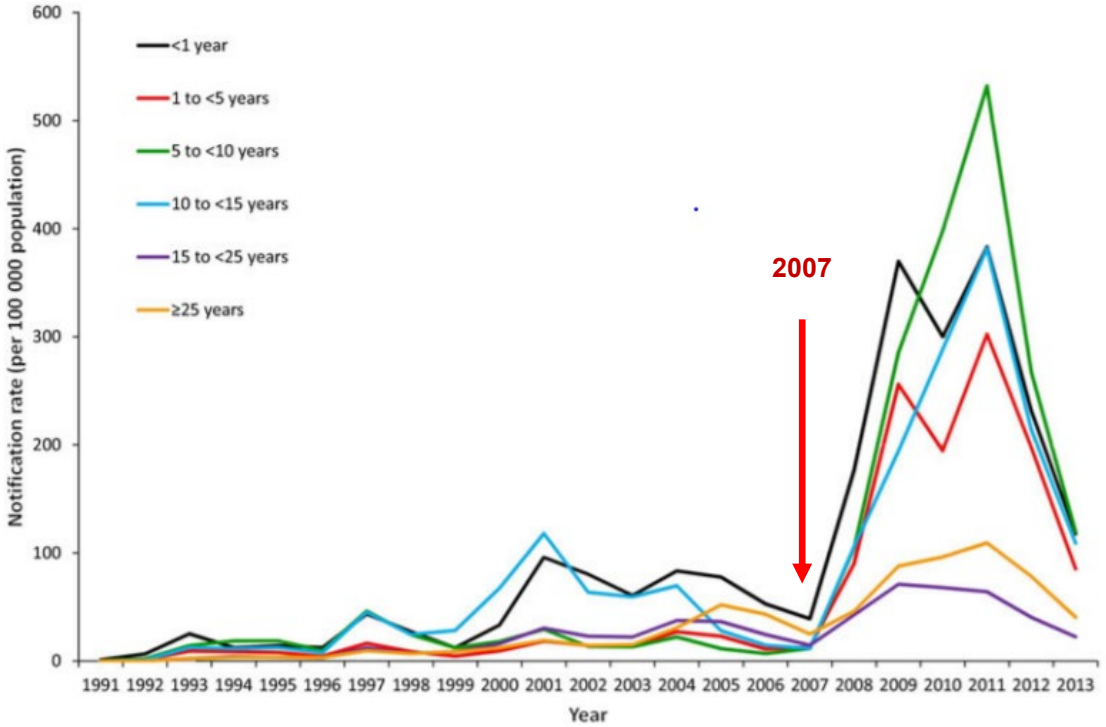
Strengths and limitations of surveillance systems?

Characteristic	Disease notifications	Active hospital surveillance	Hospital discharge diagnosis	Death registration
Case ascertainment	x	✓	x	x
Universal coverage	✓	x	✓	✓
Timely	✓	✓	x	x
Specific (lab confirmed)	✓	✓	x	x
Affected by:				
Case definition changes	✓	x	x	x
Testing changes	✓	x	x	x



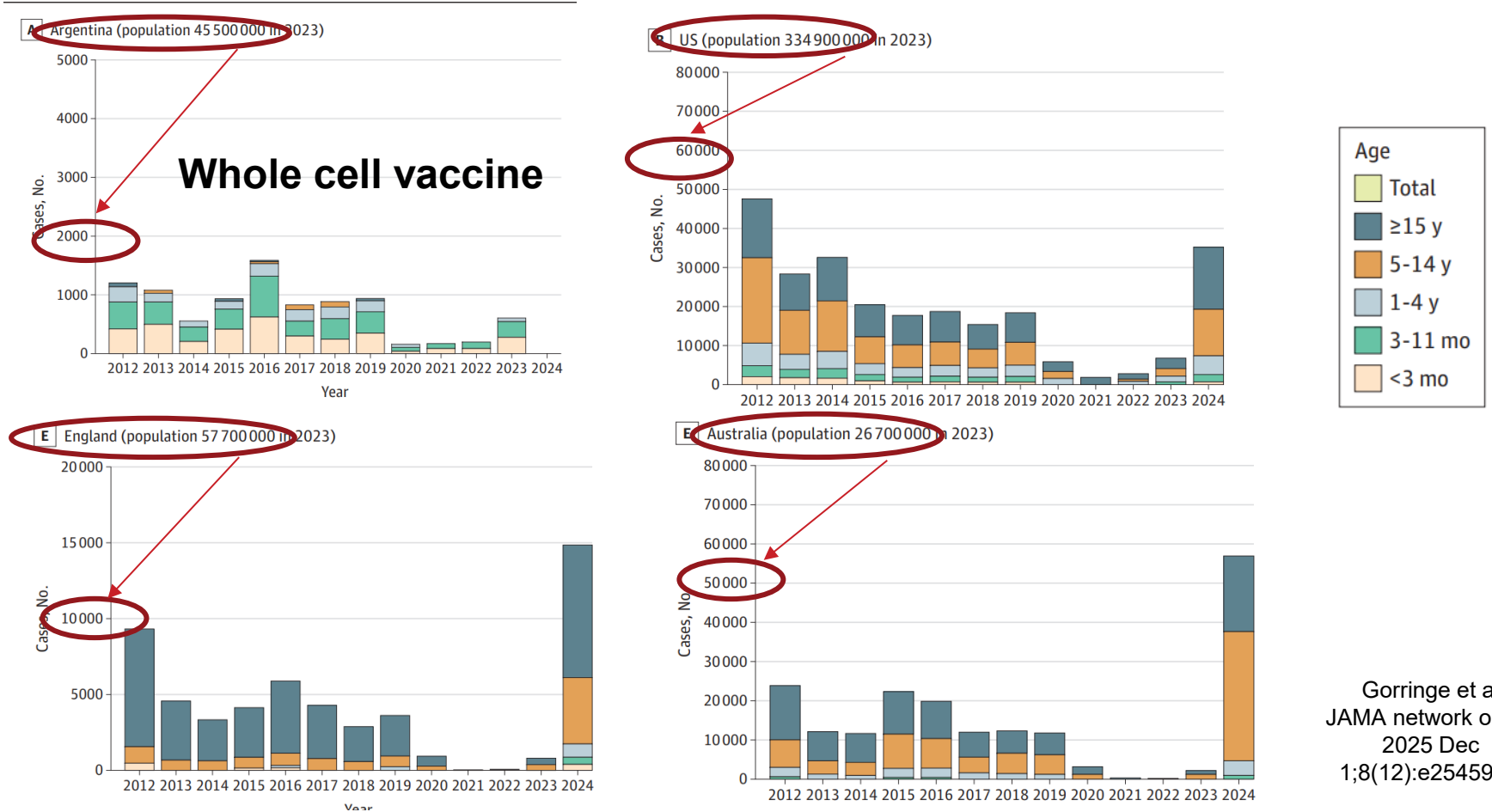
Pertussis

PCR testing for pertussis – Australia



ıual pertussis notification rate per 1 00 000 age-specific population, 1 January 2001 to 31 December 2013,

International pertussis cases pre vs post COVID



Gorringe et al
JAMA network open.
2025 Dec
1;8(12):e2545963.

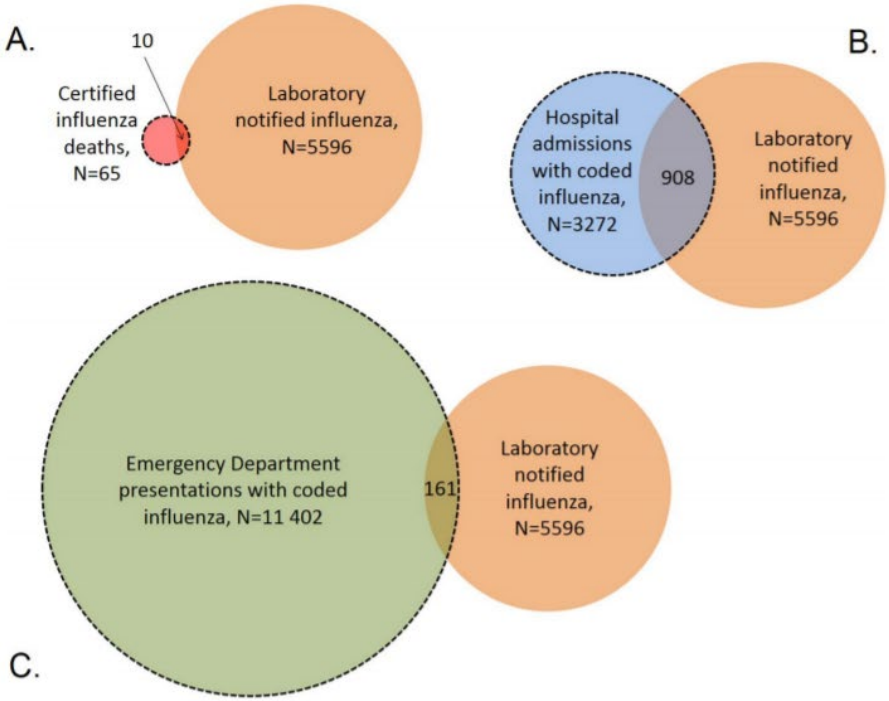
Influenza – challenges of measurement

Influenza – cross tabulating data sources – NSW example

Table 1. D
certified inf

Category
Influenza reco
illness[4]
Age (years)
<15
15–64
≥65

Da
Vit



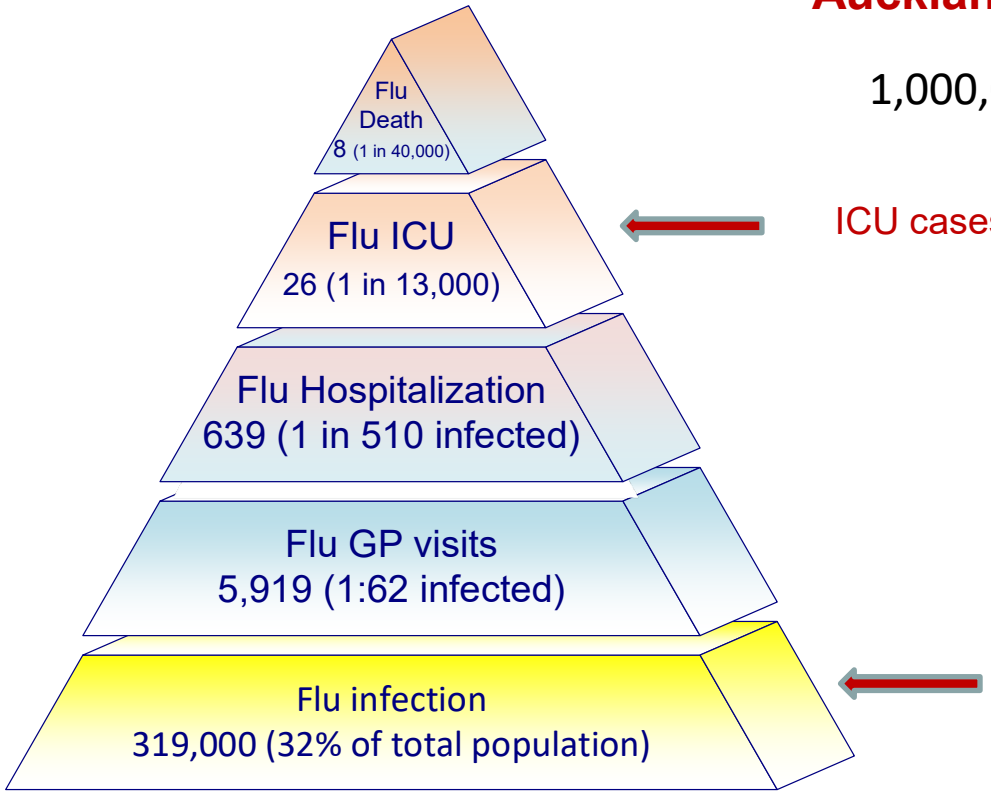
f coded influenza and

ertified
fluenzadeaths[3]
=65

00.0

5
2.3
5.2

Using serosurvey and active surveillance to measure influenza "pyramid" Auckland 2015



1,000,000 people over one season

ICU cases - almost all tested

Serosurvey: 32% influenza seroC

- Of seroconverters:
  - 24% influenza-like illness (ILI)
- Of ILI with PCR confirmed influenza
  - 26% visited a GP

Huang et al SHIVERS cohort study JID 2019; 209:347

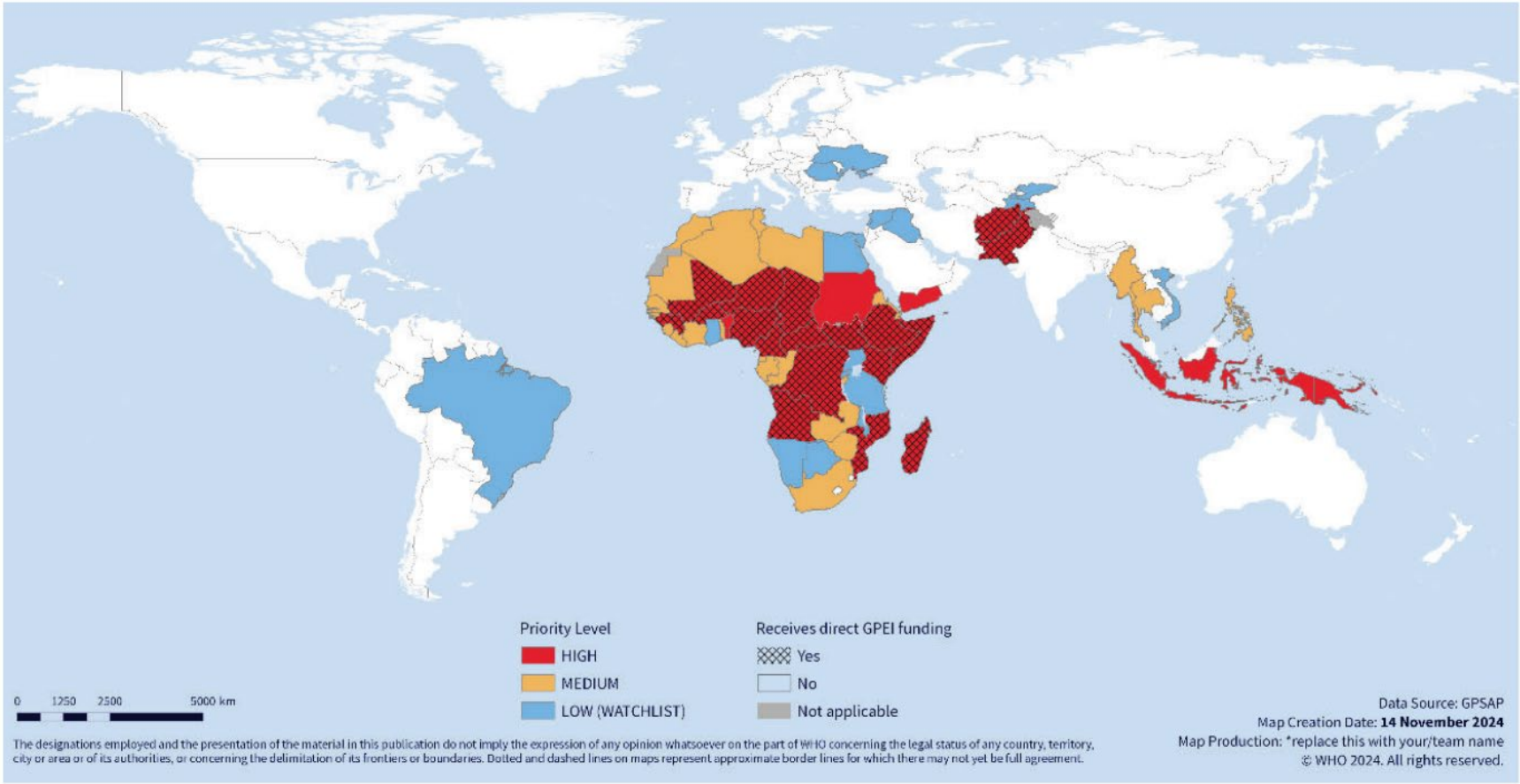
Moving towards elimination

- Enhanced surveillance
  - sensitive case definition to identify all suspected cases
  - detailed investigation of each suspect case

- Increasing need for
  - laboratory confirmation
  - characterise circulating strains
  - rapidly detect and fully investigate all outbreaks

Polio – target Eradication

Fig. 2. Countries and territories prioritized by the GPEI Surveillance Group



Sensitivity of polio surveillance – global recommendations 2025

- Highly sensitive – continuously affected by poliovirus
  - Active and passive AFP surveillance
  - Environmental surveillance (EV)
  - Immunocompromised VPDV surveillance (iVPDV)

- Very sensitive – current outbreak or high risk of importation
  - Similar to HS but may be periodic or prioritised

- Sensitive
- Mix of strategies: AFP, ES, enteroviral surveillance (All in place in Aus/NZ except iVPDV)

Polio Bulletin

2026 Issue No. 9 - September 2026 (as of 29 September 2026)

Country/area	2024	2025										
				Classification						Indicators		
								Pending				
	Total reported AFP cases	Total expected AFP cases <15 years of age [1]	Total reported AFP cases	Confirmed wild poliovirus	Vaccine-derived poliovirus (VDPV)	Polio-compatible	Discarded (Non-polio)	Total	> 90 days [2] # (%)	Non-polio AFP rate	Stool adequacy [3]	Timeliness of investigation [4]
										≥ 1	≥ 80%	≥ 80%
Australia	96	48	75	0	0	0	75	0	0 (0.0%)	1.56	56%	99%
Brunei Darussalam	3	1	2	0	0	0	2	0	0 (0.0%)	2.16	50%	100%
Cambodia	30	139	40	0	0	0	40	0	0 (0.0%)	0.86	95%	95%
China	5568	2326	5072	0	1	0	5071	0	0 (0.0%)	2.18	96%	100%
China, Hong Kong SAR	13	8	12	0	0	0	12	0	0 (0.0%)	1.59	83%	100%
China, Macao SAR	1	1	3	0	0	0	3	0	0 (0.0%)	3.13	100%	100%
Indonesia	5464	2002	4579	0	0	0	4543	36	36 (0.8%)	6.86	92%	96%
Japan	50	138	38	0	0	0	37	1	0 (0.0%)	0.27	58%	95%
Lao People's Democratic Republic	30	68	36	0	1	0	35	0	0 (0.0%)	1.58	64%	92%
Malaysia	271	81	193	0	0	0	193	0	0 (0.0%)	2.37	88%	96%
Mongolia	3	11	4	0	0	0	4	0	0 (0.0%)	0.36	0%	75%
New Zealand	10	10	13	0	0	0	13	0	0 (0.0%)	1.34	23%	46%
Papua New Guinea	52	124	277	0	5	3	269	0	0 (0.0%)	6.71	56%	87%
Philippines	837	344	855	0	0	0	810	44	38 (4.4%)	2.48	73%	99%
Republic of Korea	95	52	60	0	0	0	60	0	0 (0.0%)	1.15	83%	98%
Singapore	5	6	3	0	0	0	3	0	0 (0.0%)	0.52	100%	100%
Viet Nam	221	666	0	-	-	-	-	-	-	0.00	-	-
Pacific island countries and areas	16	11	14	0	0	0	14	0	0 (0.0%)	1.33	50%	100%
Total	**12 765**	**6036**	**11 276**	**0**	**7**	**3**	**11 184**	**81**	**74 (0.7%)**	**2.79**	**91%**	**98%**

Measles surveillance indicators – WPRO

- Annualized discarded non-measles rate per 100 000 > 2
- Second level units with ≥ 2 discarded cases per 100 000
- Suspected cases with adequate investigation
- Suspected cases with adequate specimens for laboratory confirmation [1]

- Adequate specimen defined as blood specimen collected within 28 days of rash onset or other specimen (throat swab, nasopharyngeal swab, cerebrospinal fluid, urine) collected within 5 days of rash onset; excludes epidemiologically-linked cases

Measles – HIC example

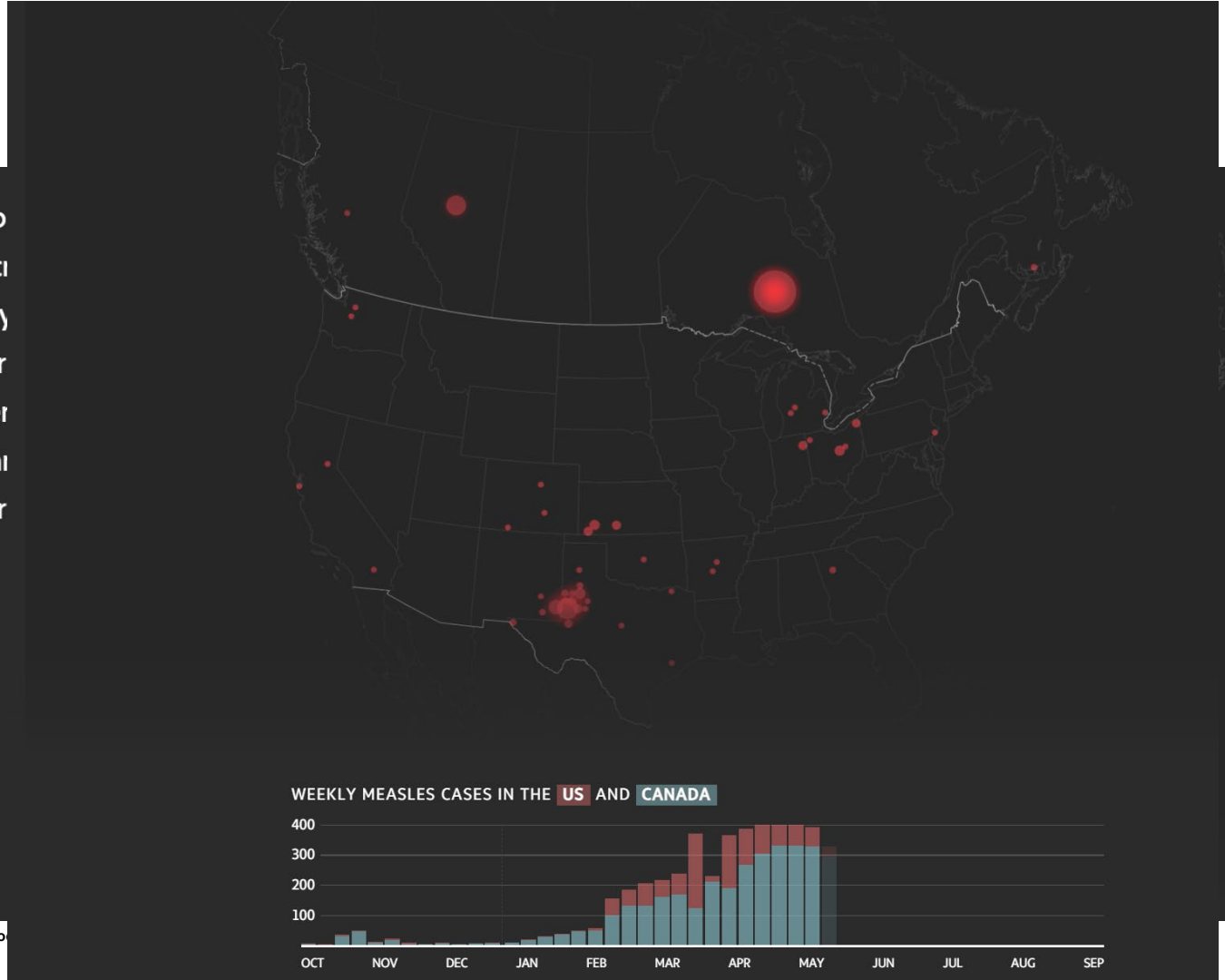
Ottawa

Cite this as: *BMJ* 2025;391:r2428
http://doi.org/10.1136/bmj.r2428
Published: 18 November 2025

How a wedding lost the Americas its measles-free status

Carolyn Brown

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Coverage assessment

Prof Meru Sheel

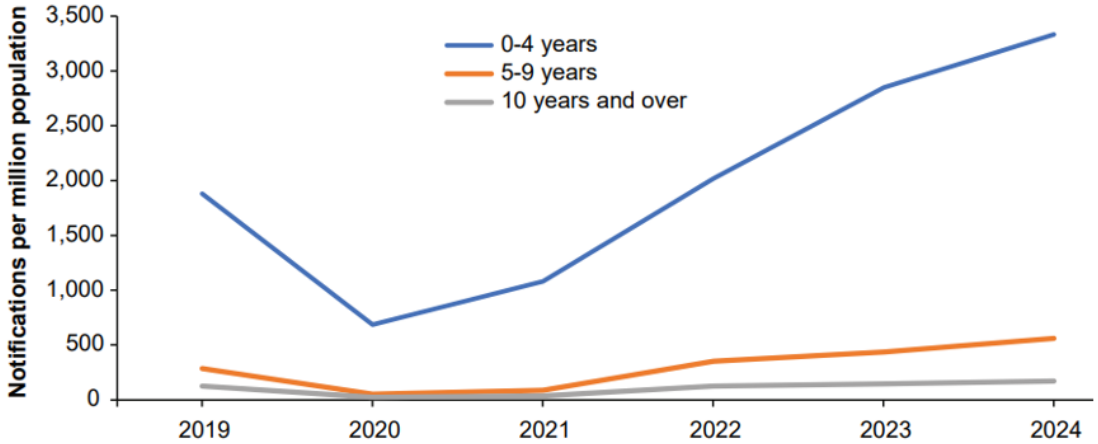
Discuss at your table

The Minister of Health's office has received a media enquiry asking why rotavirus notifications in children under 5 years have increased 3-fold from 2020 to 2024 – is the vaccine not working?

Your surveillance team is asked to prepare a briefing for a Ministerial response.

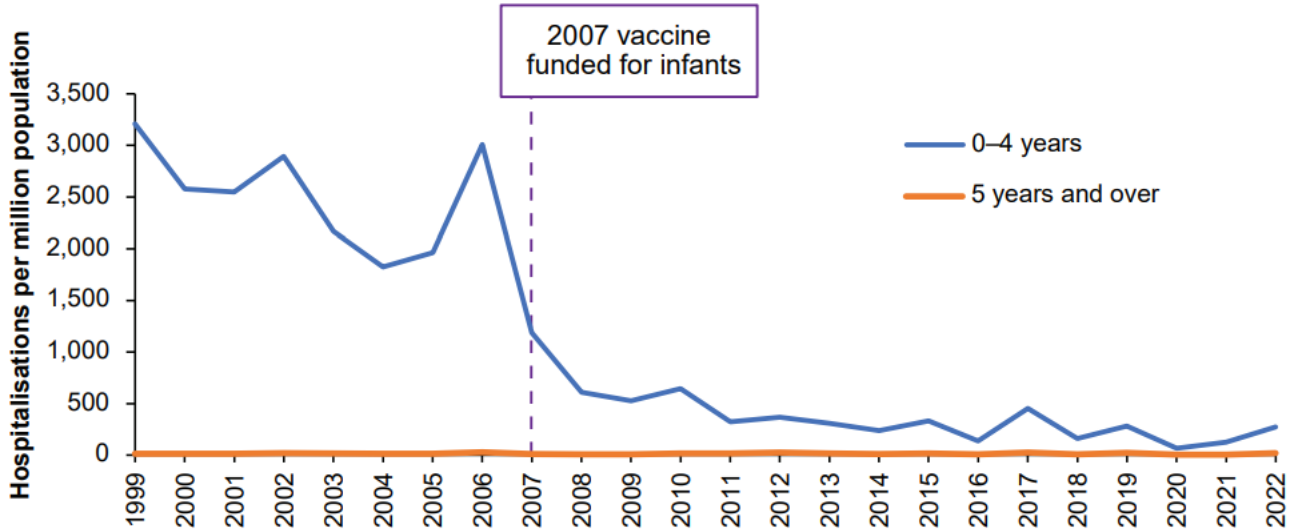
What do you need to know?

Rotavirus notifications - AIHW



Source: AIHW analysis of National Notifiable Disease Surveillance System data extracted on 16 January 2025.

Rotavirus hospitalisations 1999 - 2022



Source: AIHW analysis of National Hospital Morbidity Database.

Measuring vaccine impact

Trends

Care with interpreting trends

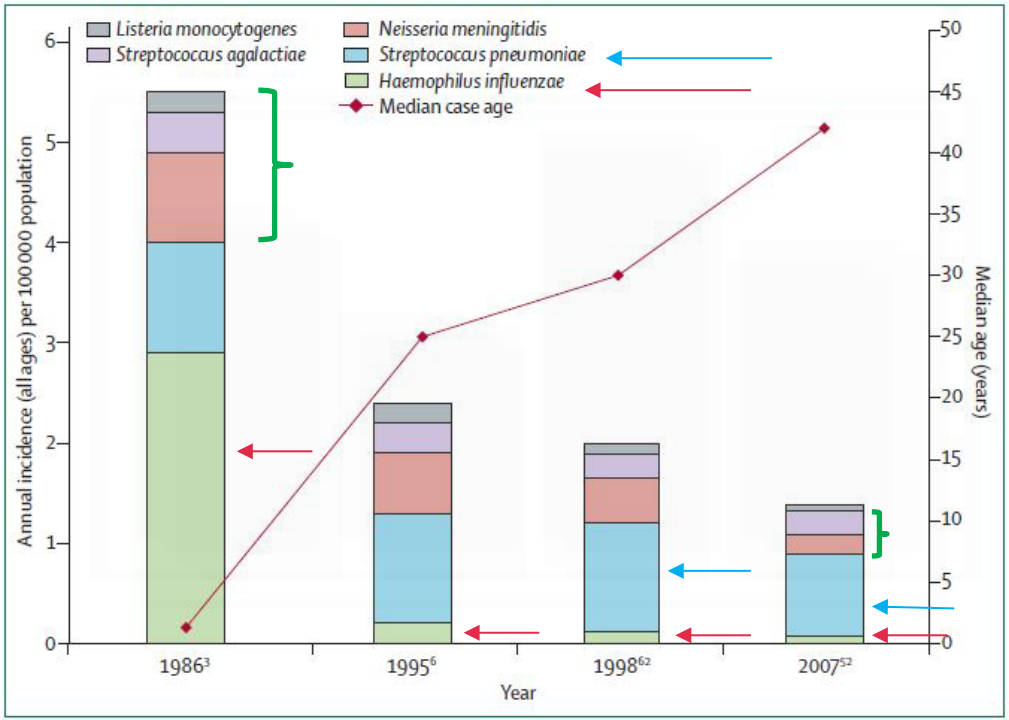
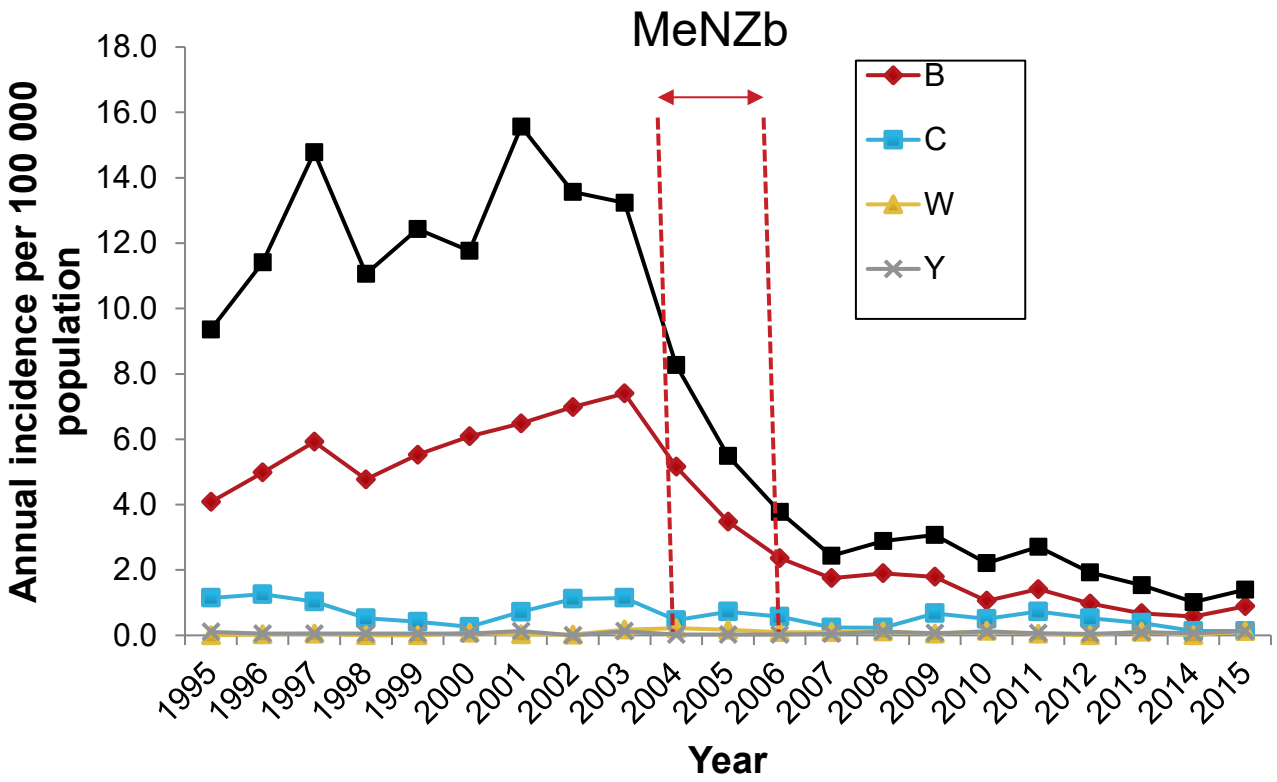


Figure 2: Prevalence of bacterial meningitis in the USA attributable to *Haemophilus influenzae*, *Streptococcus pneumoniae*, *Neisseria meningitidis*, *Streptococcus agalactiae*, and *Listeria monocytogenes*, 1986–2007[3,6,52]

Notified meningococcal disease by serogroup 1995-2015 - NZ



A Prospective Study of the Effectiveness of the New Zealand Meningococcal B Vaccine

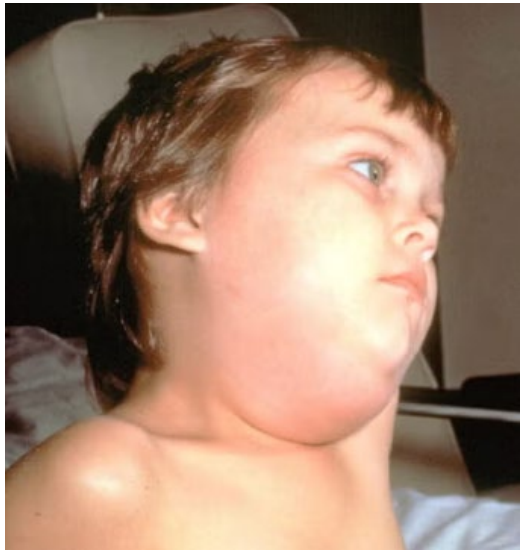
American Journal of Epidemiology
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Vol. 166, No. 7
DOI: 10.1093/aje/kwm147
Advance Access publication July 5, 2007

TABLE 1. Significant factors in modeling meningococcal disease rates (score statistics) in New Zealand, 2001–2006

Factor	df	Chi-square	*p* value
Region	3	13.68	<0.005
Age	3	30.96	<0.0001
Ethnicity	2	44.76	<0.0001
Deprivation	1	27.22	<0.0001
Year	5	43.01	<0.0001
Quarter	3	59.51	<0.0001
Vaccinated	1	25.67	<0.0001
Deprivation by age	3	9.02	0.03
Age by ethnicity	6	33.49	<0.0001
Region by deprivation	3	10.37	0.02

After adjustment for other predictors
3.7 x higher incidence in unvaccinated
Estimated VE = 73%

Disease outbreaks – mumps and diphtheria in Australia





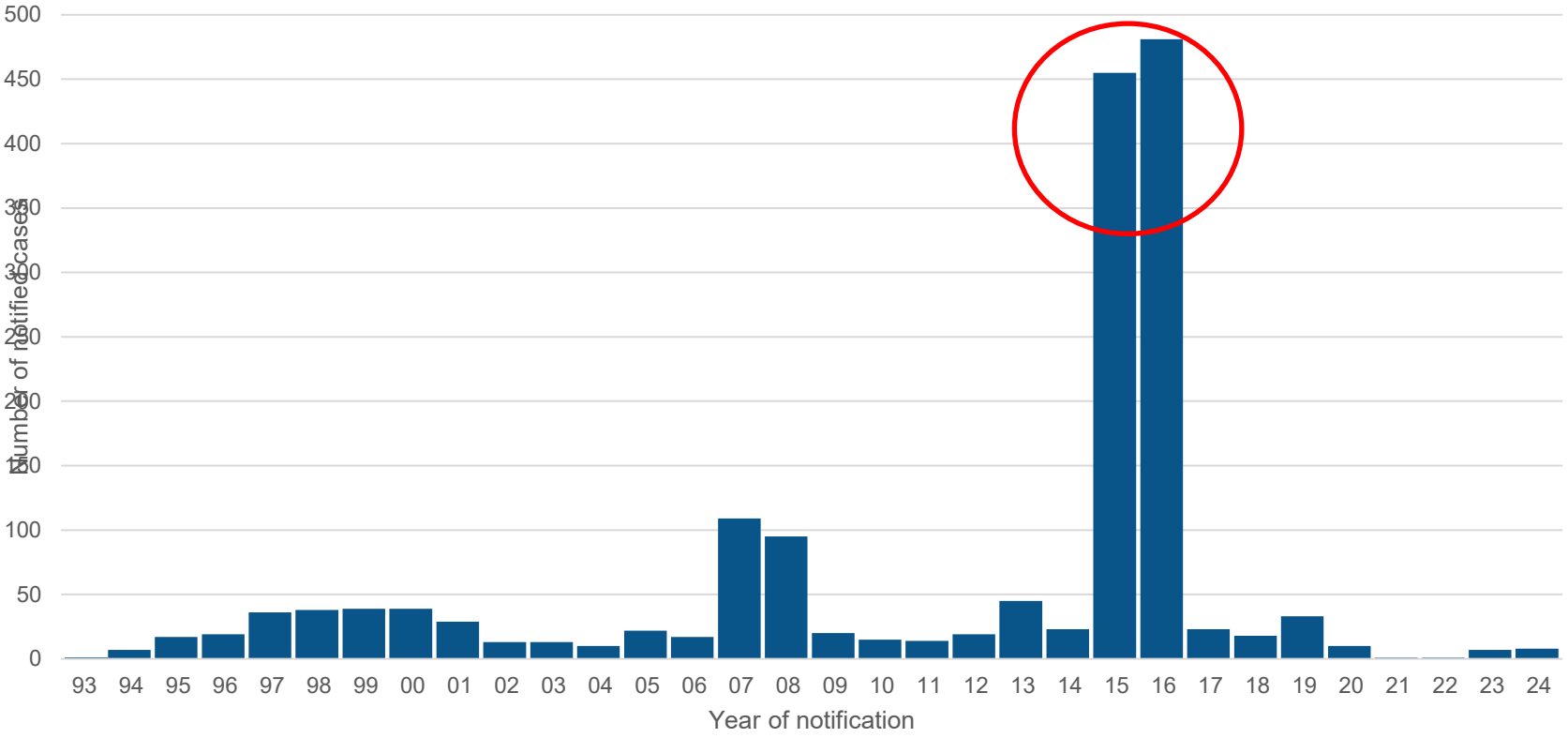
Mumps in Western Australia

- Australia's largest state covering 1/3
- Population 2.9 million, 2.6 million in Perth

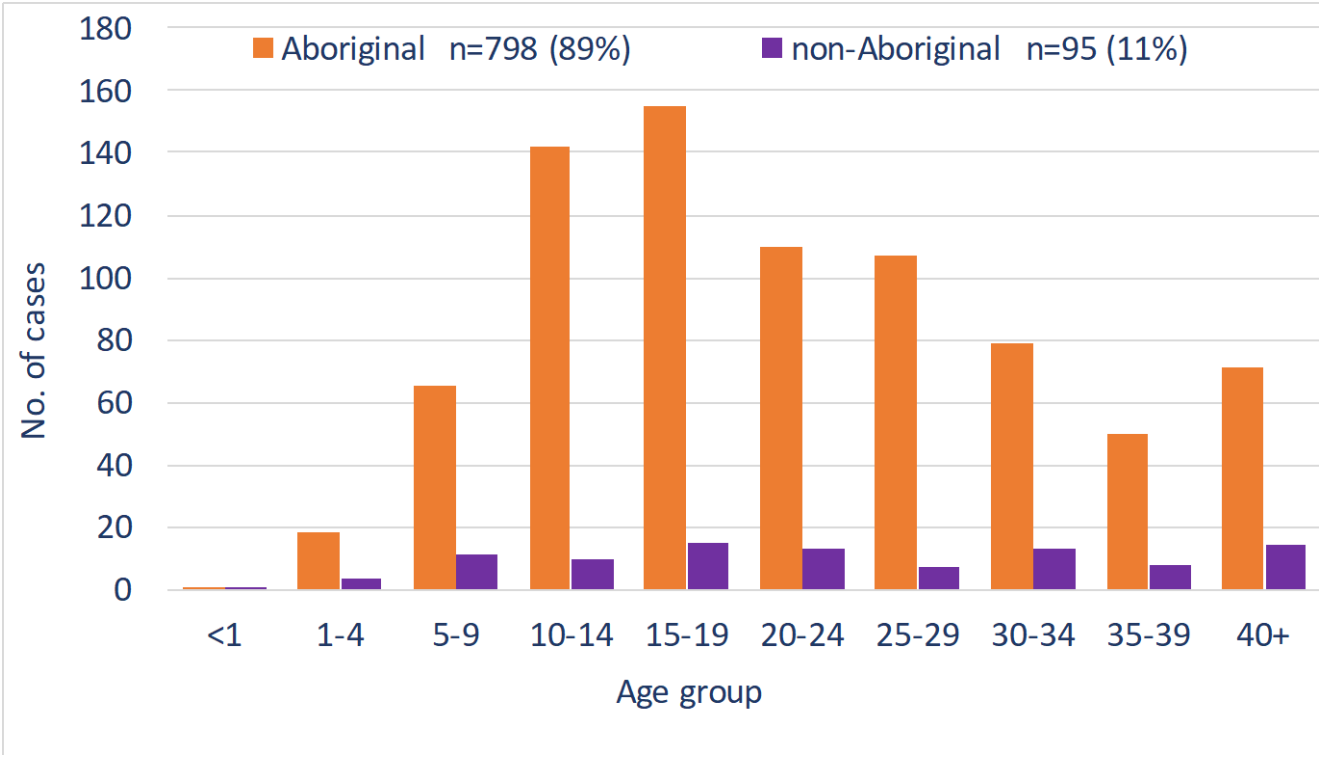




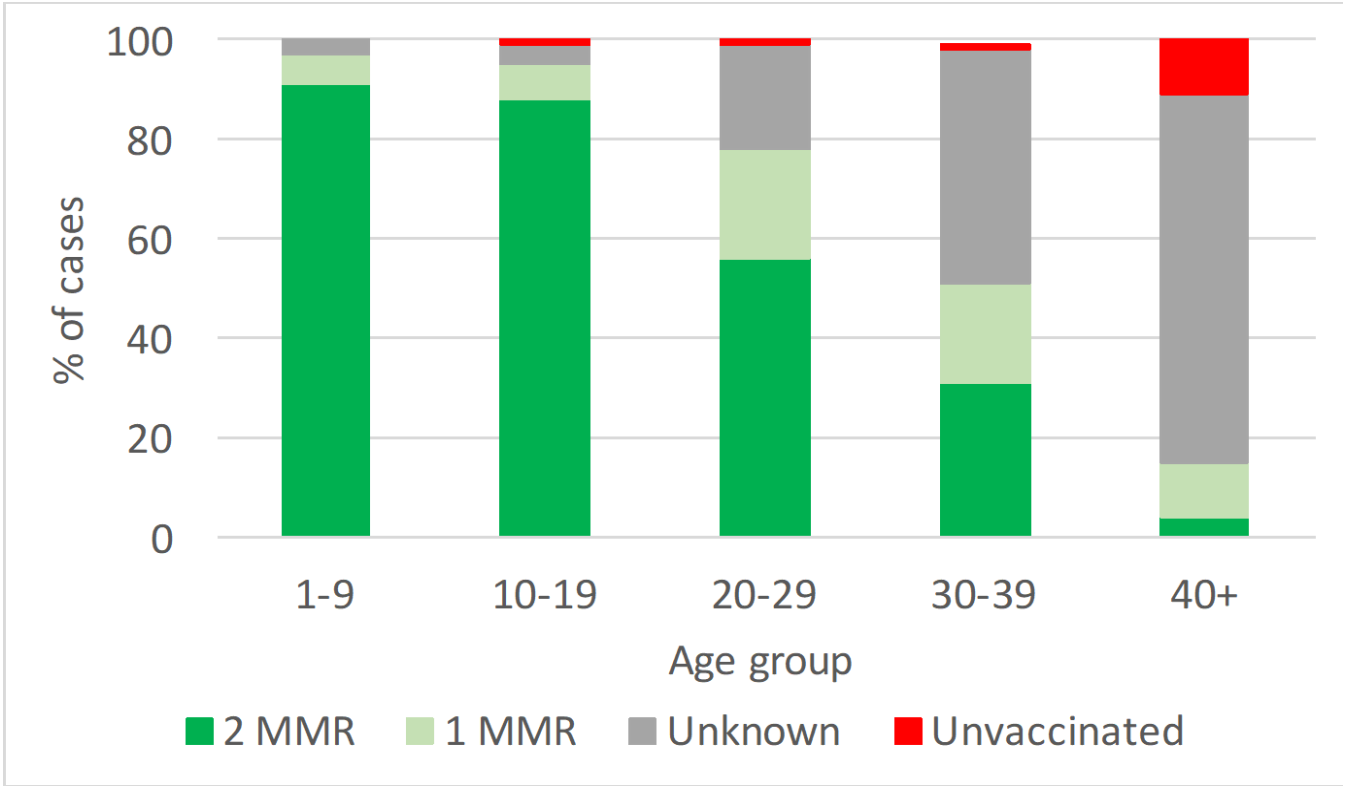
Mumps notifications in Western Australia 1993-2024



Age distribution & Aboriginal status of outbreak cases



Vaccination status of outbreak cases (%) by age group





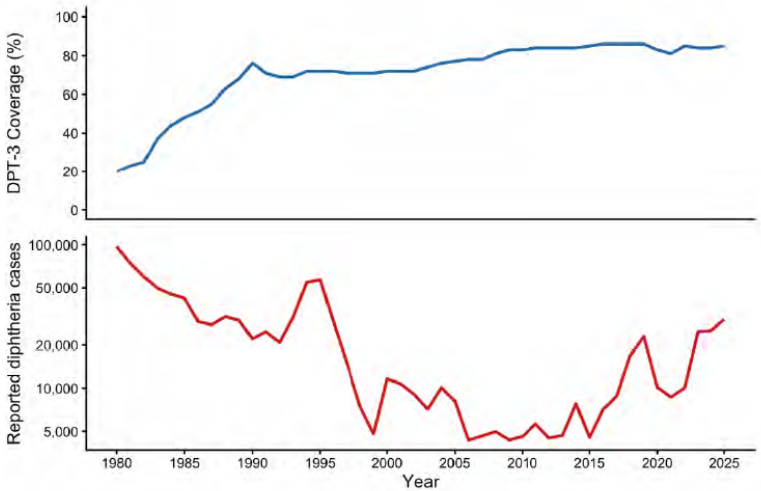


Global diphtheria

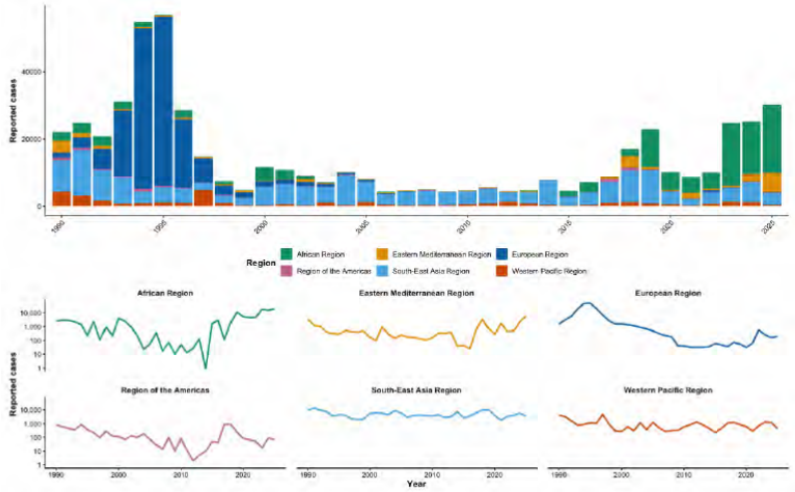
Despite 85% global DTP3 coverage, reported* diphtheria cases reached a 25-year high in 2025 (>30,000 cases and >1,300 deaths)

The Africa and Eastern Mediterranean Regions currently account for the highest number of reported cases

Global trends in reported coverage with the third dose of diphtheria-tetanus-pertussis-containing vaccine (DTP3) and reported* diphtheria cases, 1980–2025.



Trends in reported* diphtheria cases by WHO region, 1990–2025.



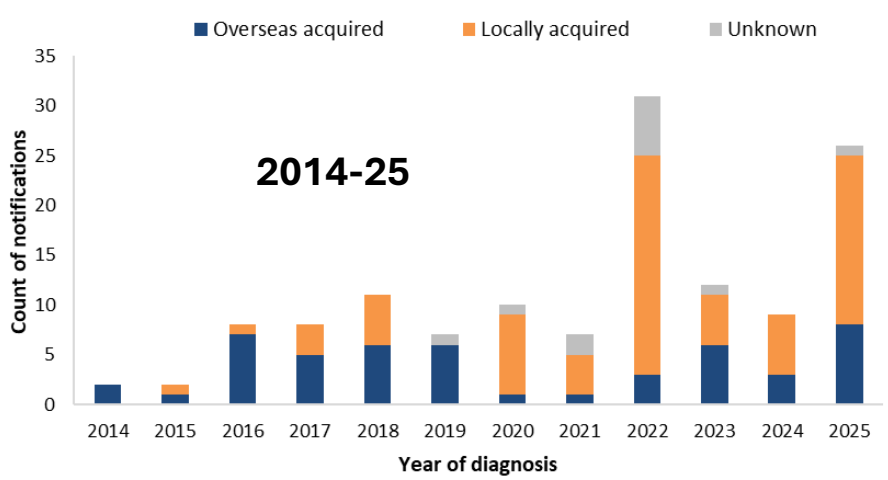
Diphtheria outbreak overview

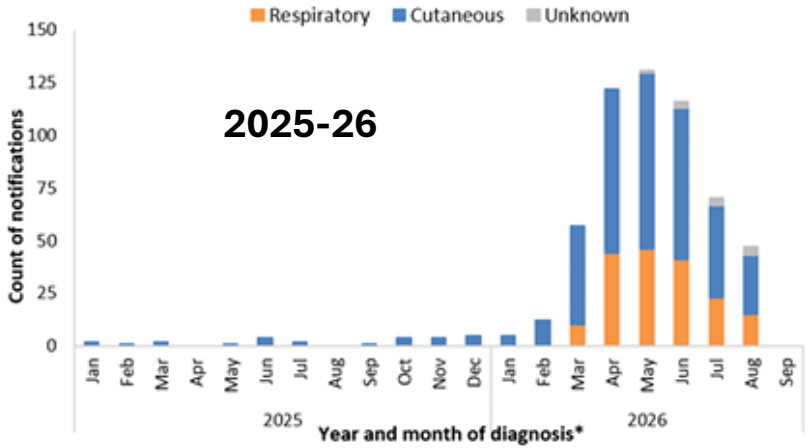
(locally acquired cases)

2014-25

- Sporadic mostly cutaneous
- Most locally acquired from 2020
- Annual maximum 2022 (31)

- **As of 07 Sep 2026:**
  - 560 cases: ~ 1/3 respiratory
  - First Nations mostly remote northern
  - Genomically linked with each other and 2020- 23 clusters in north Queensland.





Australian Government
Department of Health, Disability and Ageing

Australian Centre for Disease Control

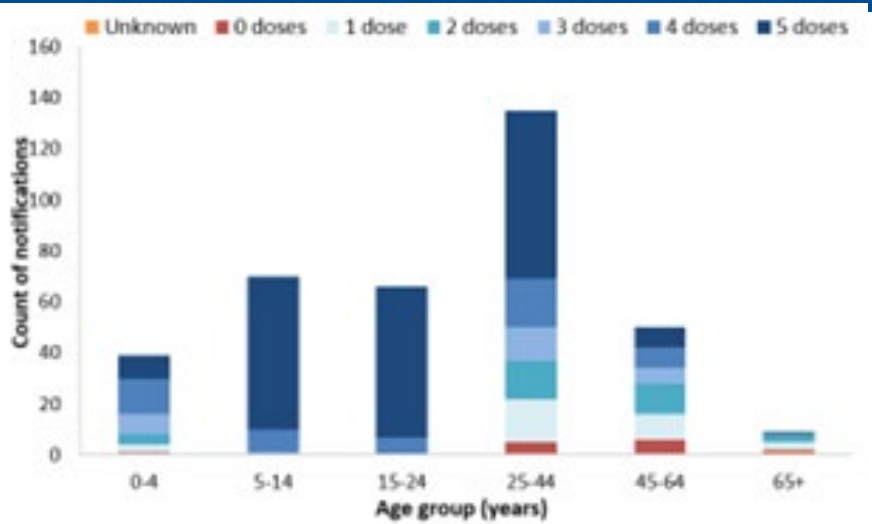
Further details see: Australian CDC - Diphtheria in Australia - Epidemiological updates

Vaccination Status

(2026 cases)

- Highly vaccinated: >=3 doses +/- boosters
  - Cutaneous diphtheria – 78.0%
  - Respiratory diphtheria – 87.2%
- Median years since last dose:
  - Cutaneous diphtheria – 3.6 years
  - Respiratory diphtheria – 6.8 years

Cutaneous diphtheria



Respiratory diphtheria

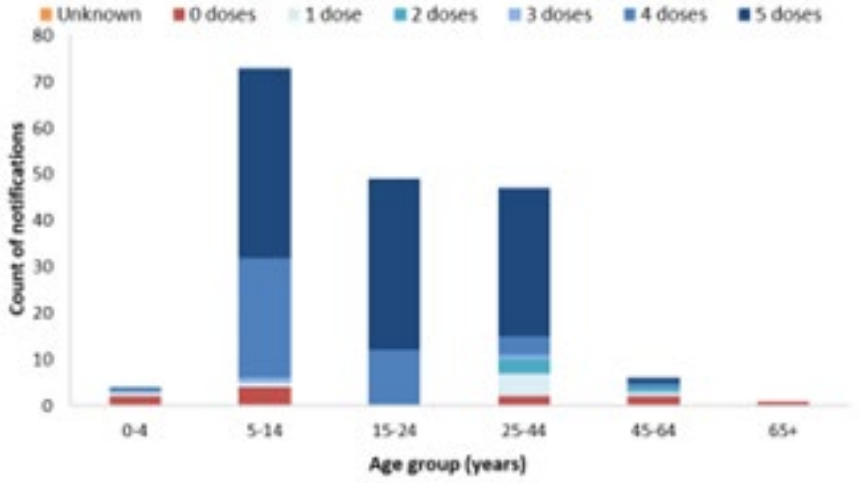
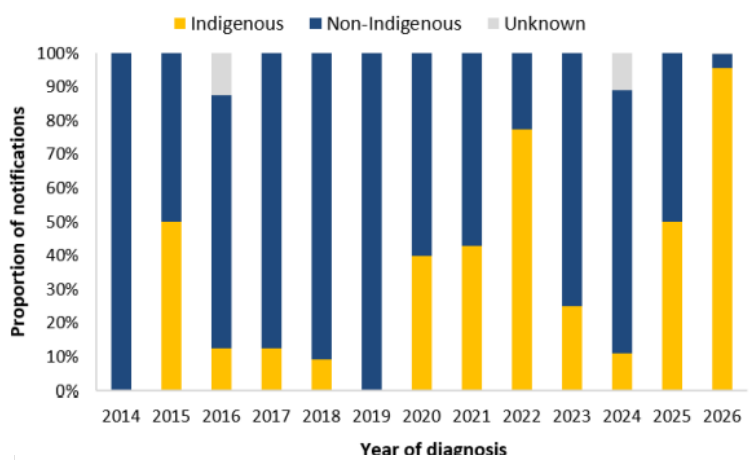
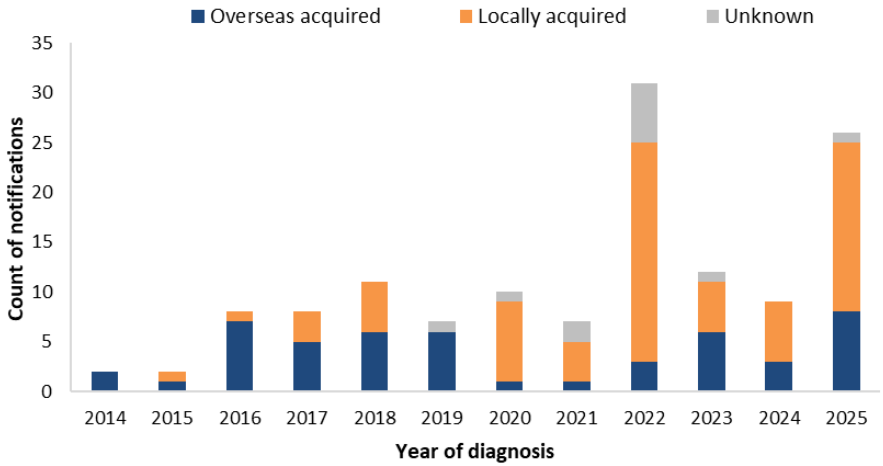


Figure 8: Proportion of diphtheria notifications by Indigenous status, Australia, 1 January 2014 to 10 August 2026





Discuss at your table –
how do we explain this epidemiology?
what are appropriate actions?