

Annual Immunisation Coverage Report 2018

November 2019



Contents

List of tables	2
List of figures	3
Vaccine abbreviations	4
Abstract	5
Introduction	6
Results	7
'Fully vaccinated' coverage	7
Coverage by individual vaccines/antigens	8
Coverage estimates by Indigenous status	8
Hepatitis A vaccine coverage for Indigenous children	10
Pneumococcal vaccine coverage for Indigenous children	10
Influenza vaccine coverage for all children aged 6 months to <5 years	10
Timeliness of vaccination	11
Small area coverage analysis	15
Discussion	19
Overall findings	19
Improvements by individual vaccine	19
Comparing Indigenous and non-Indigenous coverage	19
A focus on timeliness	20
Conclusions	20
Appendix	21
References	36

List of tables

Table 1:	Vaccination coverage estimates (%) by age assessment milestone and vaccine/antigen, Australia, 2017 versus 2018	Page 7
Table 2:	Vaccination coverage estimates (%) by age assessment milestone, vaccine/antigen and Indigenous status, Australia, 2017 versus 2018	Page 9
Table 3:	'Fully vaccinated' coverage estimates assessed at earlier (9, 15, 21, 51) and standard (12, 24, 60 months of age - shaded) milestones*, by Indigenous status and remoteness of area of residence, [†] Australia, 2018	Page 14
Table 4:	'Fully vaccinated' coverage estimates assessed at earlier (9, 15, 21, 51) and standard (12, 24, 60 months - shaded) age milestones*, by socio-economic status of area of residence, [†] Australia, 2018	Page 15
Table A1:	Australian NIP Schedule for children aged <5 years in 2018	Page 21
Box 1:	Significant changes in childhood immunisation policy, immunisation incentives and coverage calculation algorithms, Australia, 2014 to 2018	Page 21
Table A2:	Vaccinations required to be deemed fully vaccinated by each assessment milestone	Page 23
Table A3:	'Fully vaccinated' coverage at the age milestones of 12 months, 24 months and 60 months, by Primary Health Network, 2018*	Page 34
Table A4:	'Fully vaccinated' coverage estimates assessed at earlier (9, 15, 21, 51) milestones*, by Primary Health Network, 2018 [†]	Page 35

List of figures

Figure 1:	Recorded coverage of seasonal influenza vaccine in Indigenous children aged 6 months to <5 years, by jurisdiction, 2017 versus 2018, Australia	Page 10
Figure 2:	Recorded coverage of seasonal influenza vaccine* in non-Indigenous children aged 6 months to <5 years, by jurisdiction, 2017 versus 2018, Australia	Page 11
Figure 3:	Cumulative percentage of children vaccinated with the second dose of DTPa-containing vaccine* by age in months and Indigenous status, Australia, 2018	Page 12
Figure 4:	Cumulative percentage of children vaccinated with the second dose of PCV* by age in months and Indigenous status, Australia, 2018	Page 12
Figure 5:	Cumulative percentage of children vaccinated with the second dose of rotavirus vaccine* by age in months and Indigenous status, Australia, 2018	Page 13
Figure 6:	Coverage of 13-valent pneumococcal conjugate vaccine at 12 months of age (2 or 3 doses) by Statistical Area 3, Australia and major capital cities, 2018	Page 16
Figure 7:	Coverage of 2 doses of measles-mumps-rubella (MMR)-containing vaccine at 24 months of age by Statistical Area 3, Australia and major capital cities, 2018	Page 17
Figure 8:	Coverage of 4 doses of diphtheria-tetanus-acellular pertussis (DTPa)-containing vaccine at 24 months by Statistical Area 3, Australia and major capital cities, 2018	Page 18
Figure A1:	Trends in 'fully vaccinated' coverage estimates by quarter, Australia, 2009 to 2018	Page 25
Figure A2:	Trends in vaccination coverage estimates at 12 months of age, by vaccine/antigen* and quarter, Australia, 2009 to 2018	Page 26
Figure A3:	Trends in vaccination coverage estimates at 24 months of age by vaccine/antigen* and quarter, Australia, 2009 to 2018	Page 27
Figure A4:	Trends in vaccination coverage estimates at 60 months of age by vaccine/antigen* and quarter, Australia, 2009 to 2018	Page 28
Figure A5:	Trends in 'fully vaccinated' coverage at 12 months of age by Indigenous status and quarter, Australia, 2009 to 2018	Page 29
Figure A6:	Trends in 'fully vaccinated' coverage at 24 months of age by Indigenous status and quarter, Australia, 2009 to 2018	Page 30
Figure A7:	Trends in 'fully vaccinated' coverage at 60 months of age by Indigenous status and quarter, Australia, 2009 to 2018	Page 31
Figure A8:	Trends in coverage estimates for hepatitis A* vaccine for Indigenous children by jurisdiction, † Australia, 2009 to 2018	Page 32
Figure A9:	Trends in coverage estimates for pneumococcal* vaccine for Indigenous children by jurisdiction, † Australia, 2009 to 2018	Page 33

Vaccine abbreviations

13vPCV	13-valent pneumococcal conjugate vaccine
23vPPV	23-valent pneumococcal polysaccharide vaccine
DTPa	diphtheria-tetanus-acellular pertussis (children aged under 10 years formulation)
Flu	influenza
Hep A	hepatitis A
Hep B	hepatitis B
Hib	<i>Haemophilus influenzae</i> type b
MenACWY	meningococcal ACWY
MenC	meningococcal C-containing
MMR	measles-mumps-rubella
MMRV	measles-mumps-rubella-varicella
PCV	pneumococcal conjugate vaccine
PPV	pneumococcal polysaccharide vaccine
PRP-OMP	<i>Haemophilus influenzae</i> type b conjugate (meningococcal outer membrane conjugate)

Abstract

We analysed Australian Immunisation Register data for children aged <5 years, focusing on changes in coverage at key milestone ages (12, 24 and 60 months) between 2017 and 2018, while also documenting longer term trends. 'Fully vaccinated' coverage increased at the 12- and 60-month milestones to 93.9% and 94.0%, respectively, but, in the context of additional antigens required, decreased to 90.1% at 24 months. Following the move to a 2-dose rotavirus vaccine schedule across Australia from mid-2017, rotavirus vaccine coverage increased from 86.8% to 90.9%. In 2018, most jurisdictions funded influenza vaccine for non-Indigenous children aged 6 months to <5 years; the National Immunisation Program has funded influenza vaccine for Aboriginal and Torres Strait Islander children and medically at-risk children since 2015 and 2010, respectively. Recorded influenza vaccine coverage in Aboriginal and Torres Strait Islander children doubled from 14.9% to 31.4% and in non-Indigenous children increased fivefold from 5.0% to 25.9% in 2018. We examined timeliness of 'fully vaccinated' coverage at earlier milestones (3 months after due date of last scheduled vaccine) of 9, 15, 21 and 51 months, by area of residence. For all children, coverage among those living in the least advantaged residential area quintile was 3–4% lower than that for those in the most advantaged quintile at the 9-, 15- and 21-month milestones. Importantly, although Aboriginal and Torres Strait Islander children had lower coverage for the second dose of measles-mumps-rubella vaccine at 24 months (91.8% versus 93.1% for non-Indigenous), coverage increased to 98.5% at 60 months; coverage was also high in non-Indigenous children at 96.2%, above the 95% target critical to measles control. These data demonstrate continuing improvements in immunisation coverage and suggest potential new coverage targets for earlier protection in the first 2 years of life.

Keywords: vaccination coverage, vaccination timeliness, Aboriginal and Torres Strait Islander vaccination coverage, influenza vaccination.

Introduction

This is the 12th annual Australian immunisation coverage report, with reports now covering the years 2007–2018.^{1–11} This report complements other reports that provide data on vaccination coverage in Australia^{12–14} by highlighting important trends in and their relationship to relevant policy and program changes. The report includes detailed analyses of coverage data for children aged <5 years for the calendar year 2018, with a particular focus on changes from 2017. It also shows trend data from 2009 onwards.

This report uses the longstanding international practice of reporting at key milestone ages to measure coverage against national targets and to track trends over time. National vaccination coverage and timeliness for 2018 was measured using Australian Immunisation Register (AIR) data as at 31 March 2019. Cohort vaccination status was assessed for ‘fully vaccinated’ and individual vaccines at the standard milestones – 12 months of age (for vaccines due at 6 months), 24 months of age (for vaccines due at 6, 12 and 18 months) and 60 months of age (for vaccines due at 48 months), including by Aboriginal and Torres Strait Islander (hereafter respectfully referred to as Indigenous) status and at small area level (Primary Health Network [PHN] and Australian Bureau of Statistics Statistical Area 3 [SA3]). Coverage for vaccines included on the National Immunisation Program (NIP) specifically for Indigenous children was assessed using appropriate milestones/cohorts and for relevant jurisdictions. Timeliness of vaccination was assessed by calculating ‘on-time’ vaccination (within 30 days of recommended age) for selected vaccine doses, by Indigenous status, and ‘fully vaccinated’ coverage at earlier milestones (9, 15, 21 and 51 months) by socioeconomic status and remoteness of area of residence. A more detailed description of the methods used in this report is provided in the [Appendix](#).

The NIP schedule for children aged <5 years in 2018 is summarised in Appendix [Table A1](#). Important recent changes to vaccination policy, the incentive payment system and ‘fully vaccinated’ coverage algorithms are shown in Appendix [Box 1](#). The most important change occurred in July 2018, when the schedule for 13-valent pneumococcal conjugate vaccine (13vPCV) changed from 2, 4 and 6 months of age to 2, 4 and 12 months of age. Consequently, the coverage assessment algorithm for ‘fully vaccinated’ at the 12-month milestone was amended to require either 2 or 3 doses of 13vPCV (rather than 3 doses as previously), and for ‘fully vaccinated’ at the 24-month milestone to require 3 doses of 13vPCV (not previously included at this milestone). Also in July 2018, meningococcal ACWY conjugate vaccine was funded for all children at 12 months of age, replacing the combined *Haemophilus influenzae* type b (Hib) and meningococcal C (MenC)-containing vaccine, with the Hib component moved to 18 months of age as a monovalent vaccine.

While 2018 represents the second full year of data for the expanded whole-of-life AIR, adult and adolescent vaccination data from the AIR are not included in this report. Adult AIR data are presented in a separate report, which assesses data completeness. Adolescent data will be presented in a future report after transition of human papillomavirus (HPV) vaccination data from the National HPV Vaccination Program Register and state and/or territory school-based systems to AIR is complete.

Results

Coverage at 12, 24 and 60 months of age

'Fully vaccinated'

'Fully vaccinated' coverage (incorporating all vaccines/antigens included in the relevant assessment algorithm – refer to [Detailed methods](#) section in Appendix) increased slightly between 2017 and 2018 at both 12 months of age (from 93.8% to 93.9%) and 60 months (from 93.3% to 94.0%), but decreased marginally at 24 months (from 90.2% to 90.1%) (refer to [Table 1](#)). Longer term trends in 'fully vaccinated' coverage are shown in [Figure A1](#) in the Appendix. 'Fully vaccinated' coverage estimates for 2018 at the three age milestones are also provided by Primary Health Network (PHN) in Appendix [Table 3](#). For the 60-month age milestone, 'fully vaccinated' coverage ranged from a low of 91.5% in the Northern Sydney PHN to a high of 97.5% in the Western NSW PHN.

Table 1: Vaccination coverage estimates (%) by age assessment milestone and vaccine/antigen, Australia, 2017 versus 2018

Vaccine/antigen	Milestone age	2017 (%)	2018 (%)
Fully vaccinated*	12 months [†]	93.8	93.9
	24 months [‡]	90.2	90.1
	60 months [§]	93.3	94.0
Diphtheria, tetanus, acellular pertussis	12 months [†] (dose 3)	94.7	94.7
	24 months [‡] (dose 4)	92.4	92.8
	60 months [§] (dose 4 or 5)	93.7	94.1
Polio	12 months [†] (dose 3)	94.7	94.6
	24 months [‡] (dose 3)	96.3	96.4
	60 months [§] (dose 4)	93.7	94.2
<i>Haemophilus influenzae</i> type b	12 months [†] (dose 3)	94.5	94.5
	24 months [‡] (dose 4)	94.7	94.7
	60 months [§] (dose 4)	95.6	95.9
Hepatitis B	12 months [†] (dose 3)	94.3	94.3
	24 months [‡] (dose 4)	95.7	95.9
	60 months [§] (dose 4)	96.0	96.4
Measles, mumps, rubella	12 months	N/A	N/A
	24 months [†] (dose 1)	95.3	95.4
	24 months [‡] (dose 2)	93.0	93.0
	60 months [§] (dose 2)	95.7	96.3
Varicella	12 months	N/A	N/A
	24 months [†] (dose 1)	92.6	92.8
	60 months [§] (dose 1)	94.6	95.1
Meningococcal C-containing	12 months	N/A	N/A
	24 months [†] (dose 1)	95.0	95.1
	60 months [§] (dose 1)	96.1	96.4
Pneumococcal conjugate	12 months [†] (dose 2 or 3)	94.2	95.7
	24 months [‡] (dose 3)	95.4	95.7
	60 months [§] (dose 3)	93.1	93.9
Rotavirus	12 months [†] ^{**} (dose 2 or 3)	86.8	90.9
	24 months	N/A	N/A
	60 months	N/A	N/A

* Refer to Appendix for details of 'fully vaccinated' assessment algorithms; coverage estimates in this table are calculated using 12-month-wide cohorts and may differ slightly from estimates published elsewhere using rolling annualised cohorts.

[†] Cohort born 1 January 2016 – 31 December 2016 (2017 estimate) and 1 January 2017 – 31 December 2017 (2018 estimate).

[‡] Cohort born 1 January 2015 – 31 December 2015 (2017 estimate) and 1 January 2016 – 31 December 2016 (2018 estimate).

[§] Cohort born 1 January 2012 – 31 December 2012 (2017 estimate) and 1 January 2013 – 31 December 2013 (2018 estimate).

^{||} Dose 3 in 2017. Dose 2 or 3 in 2018.

^{**} Dose 2 or 3 in 2017 depending on jurisdiction. Dose 2 in 2018 for all jurisdictions.

N/A Not applicable (vaccine either not given prior to this milestone, or contraindicated after previous milestone)

Source: Australian Immunisation Register, data as at 31 March 2018 for 2017 estimates and 31 March 2019 for 2018 estimates.

Results

Coverage by individual vaccines/antigens

Coverage for individual vaccines/antigens at 12 months of age increased between 2017 and 2018, from 94.2% to 95.7% for pneumococcal conjugate vaccine (PCV) and from 86.8% to 90.9% for rotavirus vaccine (not included in the 'fully vaccinated' algorithm), but remained similar for diphtheria-tetanus-acellular pertussis (DTPa) vaccine, hepatitis B (hepB) vaccine and polio and Hib (given together in a hexavalent combination vaccine) vaccine at just under 95% (refer to [Table 1](#)). Longer term trends in individual vaccine/antigen coverage at 12 months of age are shown in Appendix [Figure A2](#).

Coverage for vaccines/antigens at the 24-month age assessment milestone either remained the same or increased slightly between 2017 and 2018, with 2018 coverage ranging from 92.8% for varicella vaccine and the fourth dose of DTPa vaccine, due at 18 months of age, to 96.4% for the third dose of polio vaccine, due at 6 months of age (refer to [Table 1](#)). Coverage for the third dose of PCV, included in the 24-month age assessment milestone for the first time in July 2018, reached 95.7% in 2018, while coverage for measles-mumps-rubella (MMR) vaccine reached 93.0 for dose 2 and 95.4% for dose 1 (dose 2 included in the 'fully vaccinated' algorithm). Longer term trends in individual vaccine/antigen coverage at 24 months of age are shown in Appendix [Figure A3](#).

Coverage for individual vaccines/antigens included in the 'fully vaccinated' algorithm at the 60-month age milestone increased slightly between 2017 and 2018: from 93.7% to 94.1% for the fourth (or fifth) dose of DTPa vaccine and from 93.7% to 94.2% for the fourth dose of polio vaccine (refer to [Table 1](#)). Coverage for vaccines/antigens not included in the 'fully vaccinated' algorithm at the 60-month also increased, reaching 96.4% for hepB vaccine and PCV, 95.9% for Hib vaccine, 95.4% for MMR vaccine and 95.1% for varicella vaccine. Longer term trends in individual vaccine/antigen coverage at 60 months of age are shown in Appendix [Figure A4](#).

Coverage estimates by Indigenous status

'Fully vaccinated'

Between 2017 and 2018, 'fully vaccinated' coverage for Indigenous children increased marginally from 92.3 to 92.4% at 12 months of age and from 96.3% to 96.4% at 60 months, but decreased from 88.4% to 87.8% at the 24-month milestone (refer to [Table 2](#)).

The disparity in 'fully vaccinated' coverage between Indigenous and non-Indigenous children remained the same at 12 months of age in 2018 compared with 2017 (1.6 percentage points), but increased at 24 months from 1.9 to 2.5 percentage points (refer to [Table 2](#)). Notably, 'fully vaccinated' coverage at 60 months of age continues to be higher in Indigenous than in non-Indigenous children (2.5 percentage points in 2018) (refer to [Table 2](#)).

Trends in 'fully vaccinated' coverage estimates by Indigenous status are shown in Appendix [Figure A5](#), [Figure A6](#) and [Figure A7](#).

Coverage by individual vaccines/antigens

Between 2017 and 2018, coverage for individual vaccines/antigens in Indigenous children increased for PCV (from 92.5% to 95.8%) and rotavirus vaccine (from 83.5% to 86.7%) at the 12-month milestone, but remained largely unchanged for other vaccines/antigens at the three milestones (refer to [Table 2](#)).

Although 2018 vaccination coverage in Indigenous children was lower than in non-Indigenous children for all individual vaccines/antigens except PCV at 12 months of age, it was higher at 24 months for polio vaccine, Hib vaccine, hepB vaccine, PCV and MenC-containing vaccines, and at 60 months for all vaccines/antigens (refer to [Table 2](#)). Coverage in Indigenous children was particularly high for MenC-containing, hepB, the second dose of MMR (all 98.5%) and Hib (98.3%), all by 60 months of age.

Results

Table 2: Vaccination coverage estimates (%) by age assessment milestone, vaccine/antigen and Indigenous status, Australia, 2017 versus 2018

Vaccine/antigen	Milestone age	Indigenous (%)		Non-Indigenous (%)	
		2017	2018	2017	2018
Fully vaccinated*	12 months [†]	92.3	92.4	93.9	94.0
	24 months [‡]	88.4	87.8	90.3	90.3
	60 months [§]	96.3	96.4	93.1	93.9
Diphtheria, tetanus, acellular pertussis	12 months [†] (Dose 3)	92.5	92.5	94.9	94.8
	24 months [‡] (Dose 4)	90.3	90.6	92.5	92.9
	60 months [§] (Dose 4 or 5)	96.5	96.5	93.5	94.0
Polio	12 months [†] (Dose 3)	92.5	92.5	94.8	94.8
	24 months [‡] (Dose 3)	97.1	97.2	96.3	96.4
	60 months [§] (Dose 4)	96.4	96.4	93.6	94.1
<i>Haemophilus influenzae</i> type b	12 months [†] (Dose 3)	92.5	92.5	94.7	94.6
	24 months [‡] (Dose 4)	95.7	95.2	94.7	94.7
	60 months [§] (Dose 4)	98.3	98.3	95.5	95.8
Hepatitis B	12 months [†] (Dose 3)	92.5	92.6	94.5	94.4
	24 months [‡] (Dose 3)	97.1	97.1	95.6	95.8
	60 months [§] (Dose 3)	98.5	98.5	95.9	96.3
Measles, mumps, rubella	12 months	N/A	N/A	N/A	N/A
	24 months [‡] (Dose 1)	96.6	96.6	95.2	95.3
	24 months [†] (Dose 2)	91.9	91.8	93.0	93.1
	60 months [§] (Dose 2)	98.4	98.5	95.6	96.2
Varicella	12 months	N/A	N/A	N/A	N/A
	24 months [‡] (Dose 1)	91.1	91.1	92.7	92.9
	60 months [§] (Dose 1)	97.1	97.2	94.5	95.0
Meningococcal C-containing	12 months	N/A	N/A	N/A	N/A
	24 months [‡] (Dose 1)	96.4	96.4	94.9	95.1
	60 months [§] (Dose 1)	98.4	98.5	96.0	96.3
Pneumococcal conjugate	12 months ^{†**} (Dose 2 or 3)	92.5	95.8	94.3	95.7
	24 months [‡] (Dose 3)	96.5	96.8	95.3	95.6
	60 months [§] (Dose 3)	95.6	96.0	93.0	93.9
Rotavirus	12 months ^{†***} (Dose 2 or 3)	83.5	86.7	89.5	91.2
	24 months	N/A	N/A	N/A	N/A
	60 months	N/A	N/A	N/A	N/A

* Refer to Appendix for details of 'fully vaccinated' assessment algorithms; coverage estimates in this table are calculated using 12-month-wide cohorts and may differ slightly from estimates published elsewhere using rolling annualised cohorts.

† Cohort born 1 January 2016 – 31 December 2016 (2017 estimate) and 1 January 2017 – 31 December 2017 (2018 estimate).

‡ Cohort born 1 January 2015 – 31 December 2015 (2017 estimate) and 1 January 2016 – 31 December 2016 (2018 estimate).

§ Cohort born 1 January 2012 – 31 December 2012 (2017 estimate) and 1 January 2013 – 31 December 2013 (2018 estimate).

|| Dose 3 in 2017. Dose 2 or 3 in 2018.

** Dose 2 or 3 in 2017 depending on jurisdiction. Dose 2 in 2018 for all jurisdictions.

N/A Not applicable (vaccine either not given prior to this milestone, or contraindicated after previous milestone)

Source: Australian Immunisation Register, data as at 31 March 2018 for 2017 estimates and 31 March 2019 for 2018 estimates.

Results

Hepatitis A vaccine coverage for Indigenous children

Coverage for the second dose of hepatitis A vaccine by 30 months of age, for the combined four jurisdictions where it is funded for Indigenous children (Northern Territory, Queensland, South Australia and Western Australia), increased slightly from 71.3% in 2017 to 72.4% in 2018. Longer term trends in hepatitis A vaccine coverage (refer to Appendix [Figure A8](#)) show the highest levels consistently in the Northern Territory (83.8% in the December 2018 quarter).

Pneumococcal vaccine coverage for Indigenous children

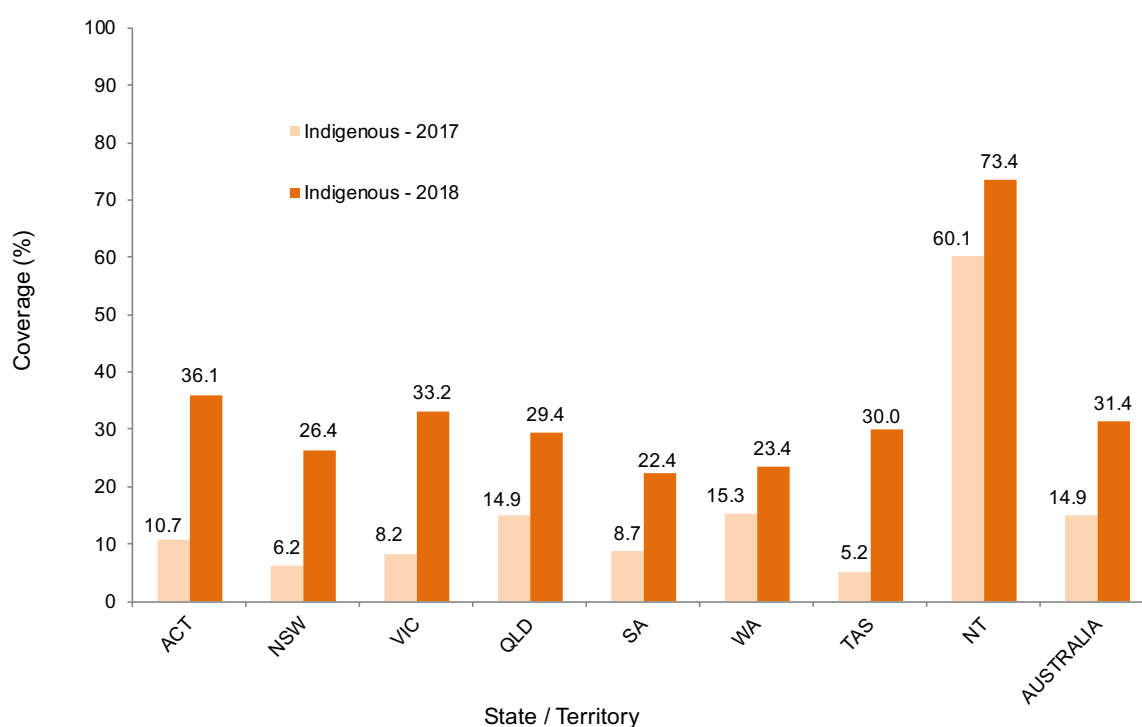
Coverage for the additional fourth dose of PCV by 30 months of age, for the combined four jurisdictions where it is funded for Indigenous children (Northern Territory, Queensland, South Australia and Western Australia), decreased marginally from 71.7% in 2017 to 71.4% in 2018. Longer term trends in PCV fourth dose coverage (refer to Appendix [Figure A9](#)) show the highest levels consistently in the Northern Territory (86.0% in the December 2018 quarter).

Influenza vaccine coverage for all children aged 6 months to <5 years

Overall national recorded influenza vaccine coverage in children aged 6 months to <5 years increased markedly between 2017 (5.6%) and 2018 (26.2%). In Indigenous children aged 6 months to <5 years, coverage more than doubled from 14.9% in 2017 to 31.4% in 2018 (refer to [Figure 1](#)), but varied substantially by jurisdiction.

In 2018, coverage was highest in the Northern Territory at 73.4%, with three other jurisdictions above 30% (Australian Capital Territory, Victoria and Tasmania at 36.1%, 33.2% and 30.0%, respectively) (refer to [Figure 1](#)). For non-Indigenous children aged 6 months to <5 years, there was also substantial variation in recorded coverage by jurisdiction in 2018, being highest in the Australian Capital Territory at 44.4% with four other jurisdictions above 25% (Tasmania, Victoria, New South Wales and Queensland at 30.8%, 28.9%, 25.6% and 25.1%, respectively) (refer to [Figure 2](#)).

Figure 1: Recorded coverage of seasonal influenza vaccine* in Indigenous children aged 6 months to <5 years, by jurisdiction, 2017 versus 2018, Australia



* Any influenza vaccine dose

ACT = Australian Capital Territory; NSW = New South Wales; NT = Northern Territory; QLD = Queensland; SA = South Australia; TAS = Tasmania; VIC = Victoria; WA = Western Australia

Source: Australian Immunisation Register, data as at 31 March 2019.

Figure 2: Recorded coverage of seasonal influenza vaccine* in non-Indigenous children aged 6 months to <5 years, by jurisdiction, 2017 versus 2018, Australia



* Any influenza vaccine dose

ACT = Australian Capital Territory; NSW = New South Wales; NT = Northern Territory; QLD = Queensland; SA = South Australia; TAS = Tasmania; VIC = Victoria; WA = Western Australia

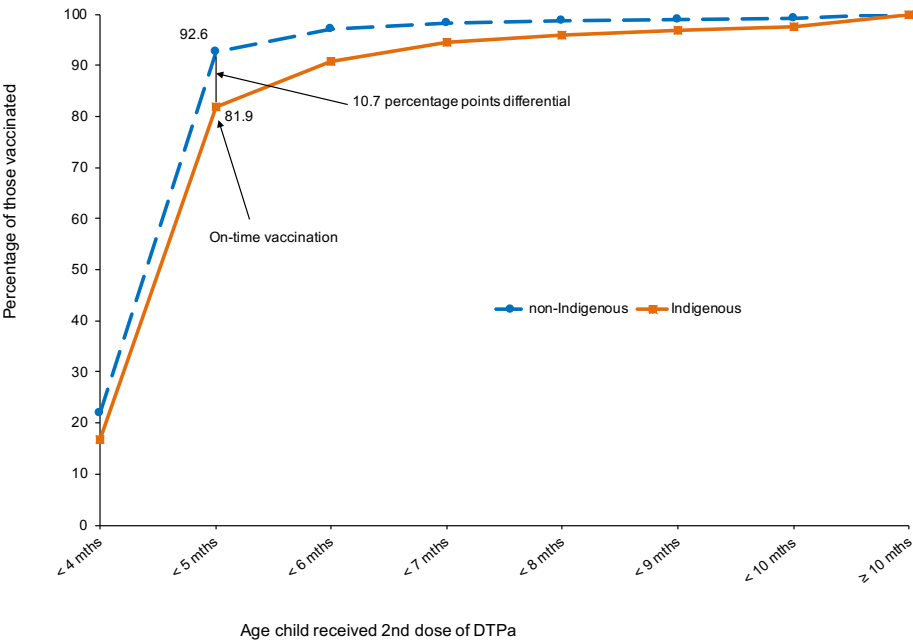
Source: Australian Immunisation Register, data as at 31 March 2019.

Timeliness of vaccination

The difference in the percentage of children with on-time receipt (within 30 days of the recommended age) of the second dose of DTPa between Indigenous and non-Indigenous children was 10.7 percentage points in 2018 (refer to [Figure 3](#)). The differential narrows with increasing age, with only a 1.6 percentage points differential at 9 months of age (refer to [Figure 3](#)).

The on-time vaccination differential for the second dose of PCV between Indigenous and non-Indigenous children in 2018 was similar at 10.4 percentage points, also narrowing to a 1.4 percentage points differential at 9 months of age (refer to [Figure 4](#)).

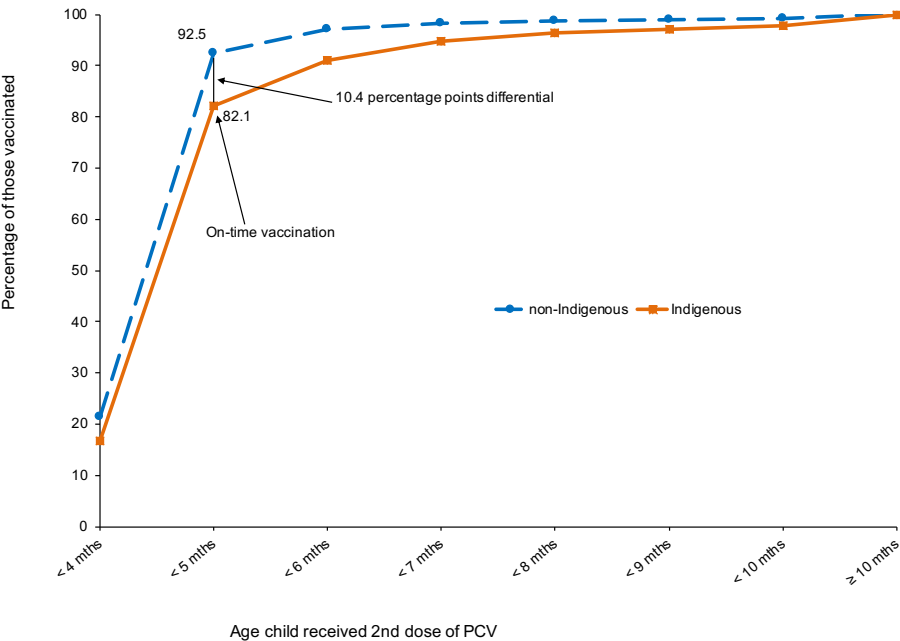
Figure 3: Cumulative percentage of children vaccinated with the second dose of DTPa-containing vaccine* by age in months and Indigenous status, Australia, 2018



* Shown as cumulative percentage vaccinated (number of children who received vaccine dose at particular age / total number of children who received the vaccine dose, expressed as a percentage).
DTPa = diphtheria (D), tetanus (T) and acellular pertussis-containing (Pa) vaccine
Cohort born in 2016.

The on-time vaccination differential for the second dose of rotavirus vaccine between Indigenous and non-Indigenous children in 2018 was lower than that for DTPa vaccine and PCV at 5.9 percentage points, narrowing rapidly with increasing age to only 0.2 percentage points at 6 months of age (refer to [Figure 5](#)).

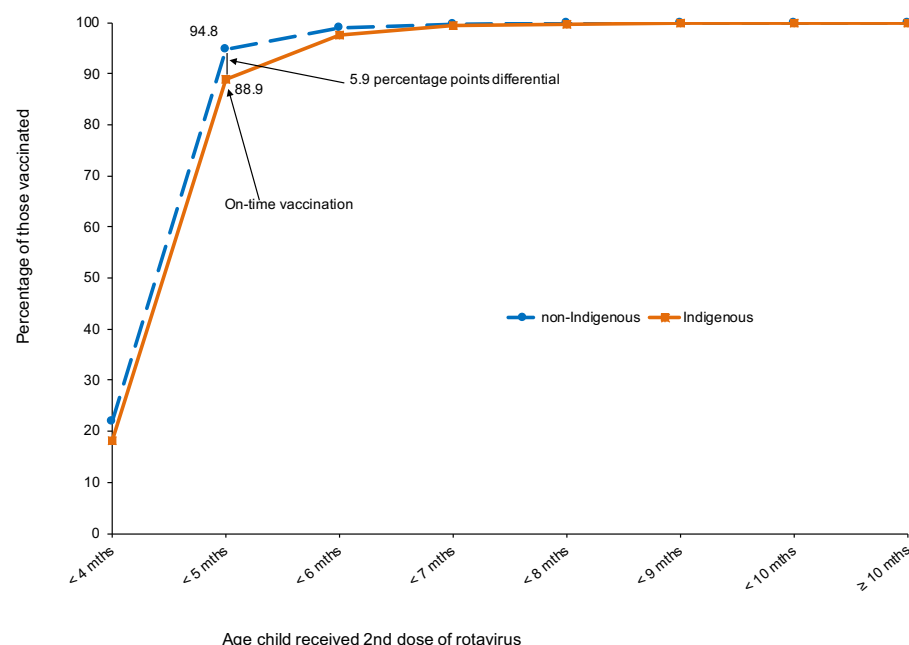
Figure 4: Cumulative percentage of children vaccinated with the second dose of PCV* by age in months and Indigenous status, Australia, 2018



* Shown as cumulative percentage vaccinated (number of children who received vaccine dose at particular age / total number of children who received the vaccine dose, expressed as a percentage).
PCV = pneumococcal conjugate vaccine
Cohort born in 2016.

Results

Figure 5: Cumulative percentage of children vaccinated with the second dose of rotavirus vaccine* by age in months and Indigenous status, Australia, 2018



* Shown as cumulative percentage vaccinated (number of children who received vaccine dose at particular age / total number of children who received the vaccine dose, expressed as a percentage). Cohort born in 2016.

Trends in on-time receipt of the first, second and third doses of DTPa vaccine, and the first and second doses of MMR vaccine from 2008 to 2017 by Indigenous status can be found in our 2017 report.¹¹

Tables 3 and 4 present 'fully vaccinated' coverage estimates assessed 3 months after last vaccine dose due, that is, earlier than the standard assessment milestones to capture aspects of timeliness, along with the standard 12-month, 24-month and 60-month milestones. For all four of the earlier assessment milestones, 'fully vaccinated' coverage in 2018 was lower in Indigenous children residing in 'Remote' and 'Very Remote' areas than in those residing in 'Major Cities' and 'Inner and Outer Regional' areas, with the greatest coverage differential at 21 months (refer to Table 3). Coverage at the standard milestones was higher and the disparity lower between Indigenous children in 'Remote' and 'Very Remote' compared with 'Major Cities' and 'Inner and Outer Regional' areas. In non-Indigenous children, substantial differences in 'fully vaccinated' coverage were only found for vaccines assessed at 21 months (3–4 percentage points higher for children residing in 'Major Cities' and 'Inner and Outer Regional' compared with 'Remote' and 'Very Remote') (refer to Table 3). There was a substantial increase in 'fully vaccinated' coverage for vaccines due at 48 months when assessed at 60 months versus when assessed at 51 months. This occurred for both Indigenous and non-Indigenous children, and across all Remoteness categories (refer to Table 3).

Results

Table 3: ‘Fully vaccinated’ coverage estimates assessed at earlier (9, 15, 21, 51 months) and standard (12, 24, 60 months of age - shaded) milestones,* by Indigenous status and remoteness of area of residence,† Australia, 2018

Indigenous status	Remoteness category	9 mo (%)‡	12 mo (%)‡	15 mo (%)§	21 mo (%)§	24 mo (%)§	51 mo (%)	60 mo (%)
Indigenous	Major Cities	86.0	92.6	86.2	81.6	88.8	85.3	96.4
	Inner and Outer Regional	85.6	92.5	85.9	79.3	88.3	85.1	96.9
	Remote and Very Remote	82.4	91.9	82.4	72.2	83.9	82.9	95.6
Non-Indigenous	Major Cities	91.2	94.1	88.6	85.8	89.9	85.7	93.6
	Inner and Outer Regional	91.3	94.2	90.0	86.5	91.3	87.0	94.7
	Remote and Very Remote	91.4	94.6	89.0	82.4	88.7	84.8	94.1
All children	Major Cities	91.1	94.0	88.5	85.7	89.9	85.6	93.7
	Inner and Outer Regional	90.6	94.0	89.6	85.7	91.0	86.8	94.9
	Remote and Very Remote	87.7	93.5	86.3	78.2	86.8	84.0	94.7

* Coverage algorithm used for 9/21/51 months milestones same as for 12/24/60, respectively; algorithm used for 15 months same as that for 24 months but excludes doses due at 18 months; for further detail of algorithms, refer to Appendix.

† Accessibility/Remoteness Index of Australia (ARIA++).

‡ Cohort born 1 January 2017 – 31 December 2017.

§ Cohort born 1 January 2016 – 31 December 2016.

|| Cohort born 1 January 2013 – 31 December 2013.

mo = months

When stratified by the socioeconomic status of the area of residence, in 2018, children residing in areas included in the most advantaged (fifth) quintile had more than 3 percentage points higher ‘fully vaccinated’ coverage than children in the least advantaged (first) quintile for the youngest three early assessment ages (9, 15 and 21 months; [Table 4](#)). However, this gap decreased at the 51 months age point, where coverage in the most advantaged quintile was only 1.6 percentage points higher than that in the least advantaged quintile (refer to [Table 4](#)). Coverage at the standard milestones was higher, and the disparity between the most and least advantaged quintiles lower, with a particularly substantial increase in ‘fully vaccinated’ coverage for vaccines due at 48 months when assessed at 60 months versus assessed at 51 months, across all socioeconomic status categories (refer to [Table 4](#)).

Results

Table 4: ‘Fully vaccinated’ coverage estimates assessed at earlier (9, 15, 21, 51 months) and standard (12, 24, 60 months - shaded) age milestones,* by socio-economic status of area of residence,† Australia, 2018

SEIFA quintile	9 mo (%)*	12 mo (%)*	15 mo (%)*	21 mo (%)*	24 mo (%)*	51 mo (%)*	60 mo (%)*
First (least advantaged)	88.9	92.9	86.5	83.0	88.1	84.8	93.5
Second	90.6	93.8	89.0	85.5	90.5	86.0	94.2
Third	91.0	94.0	88.5	85.5	90.0	85.7	93.9
Fourth	91.4	94.4	89.2	86.3	90.4	86.4	94.0
Fifth (most advantaged)	92.2	94.9	90.1	87.2	91.3	86.4	94.4
All	90.9	93.9	88.7	85.5	90.1	85.9	94.0

* Coverage algorithm used for 9/21/51 months milestones same as for 12/24/60, respectively; algorithm used for 15 months same as 24 months but excludes doses due at 18 months.

† SEIFA Index of Economic Resources

‡ Cohort born 1 January 2017 – 31 December 2017.

§ Cohort born 1 January 2016 – 31 December 2016.

|| Cohort born 1 January 2013 – 31 December 2013.

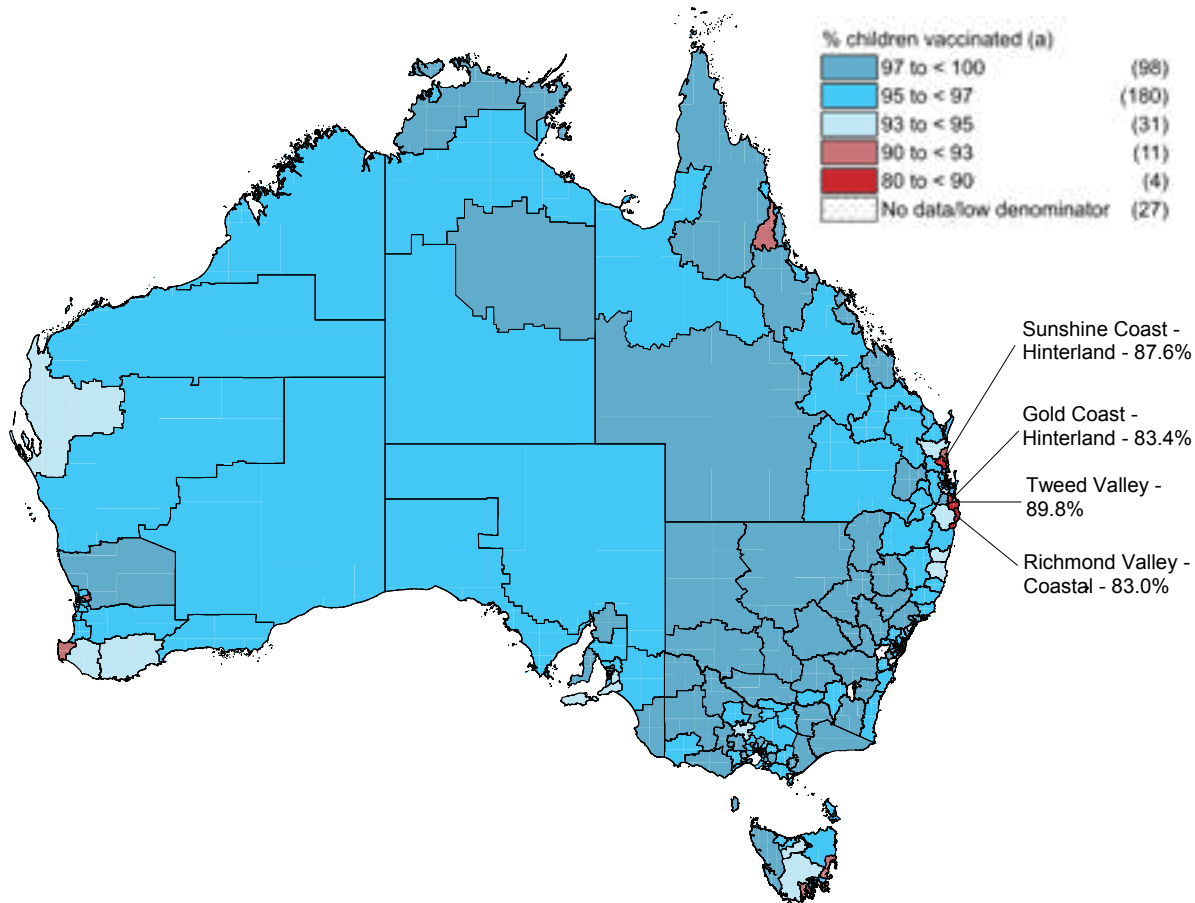
mo = months

‘Fully vaccinated’ coverage estimates assessed at 9, 15, 21 and 51 months of age in 2018, by PHN, are shown in **Table A4** in the Appendix.

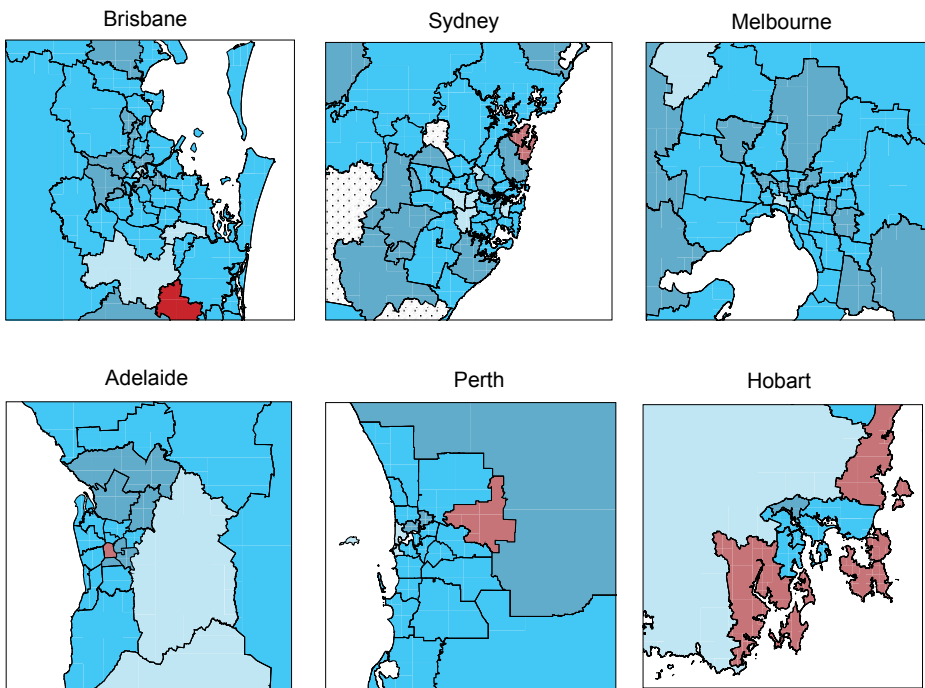
Small area coverage analysis

Vaccination coverage in Australia in 2018 varied within jurisdictions and major capital cities, with coverage in some areas substantially below the national averages, especially the north coast region of NSW and the Gold Coast region of Queensland (refer to **Figures 6–8**). Most Statistical Area 3 (SA3)–level areas in Australia (276/324; 85.2%) had coverage of 95% or higher for the third dose of PCV (refer to **Figure 6**), with two areas above 99% coverage (‘Broken Hill and Far West’ and ‘Lower Murray’). Fifty-three Statistical Area 3 (SA3) in Australia (16.4%) had coverage of 95% or higher for the second dose of MMR-containing vaccine. However, there were 33 SA3s in Australia that had coverage below 90% (10.2%), well below the level required to achieve herd immunity (refer to **Figure 7**). Thirty-eight Statistical Area 3 (SA3) in Australia (11.7%) had coverage of 95% or higher for the fourth dose of DTPa vaccine. However, there were also 38 SA3s in Australia that had coverage below 90% (11.7%) (refer to **Figure 8**).

Figure 6: Coverage of 13-valent pneumococcal conjugate vaccine at 12 months of age (2 or 3 doses) by Statistical Area 3, Australia and major capital cities, 2018



Major capital cities

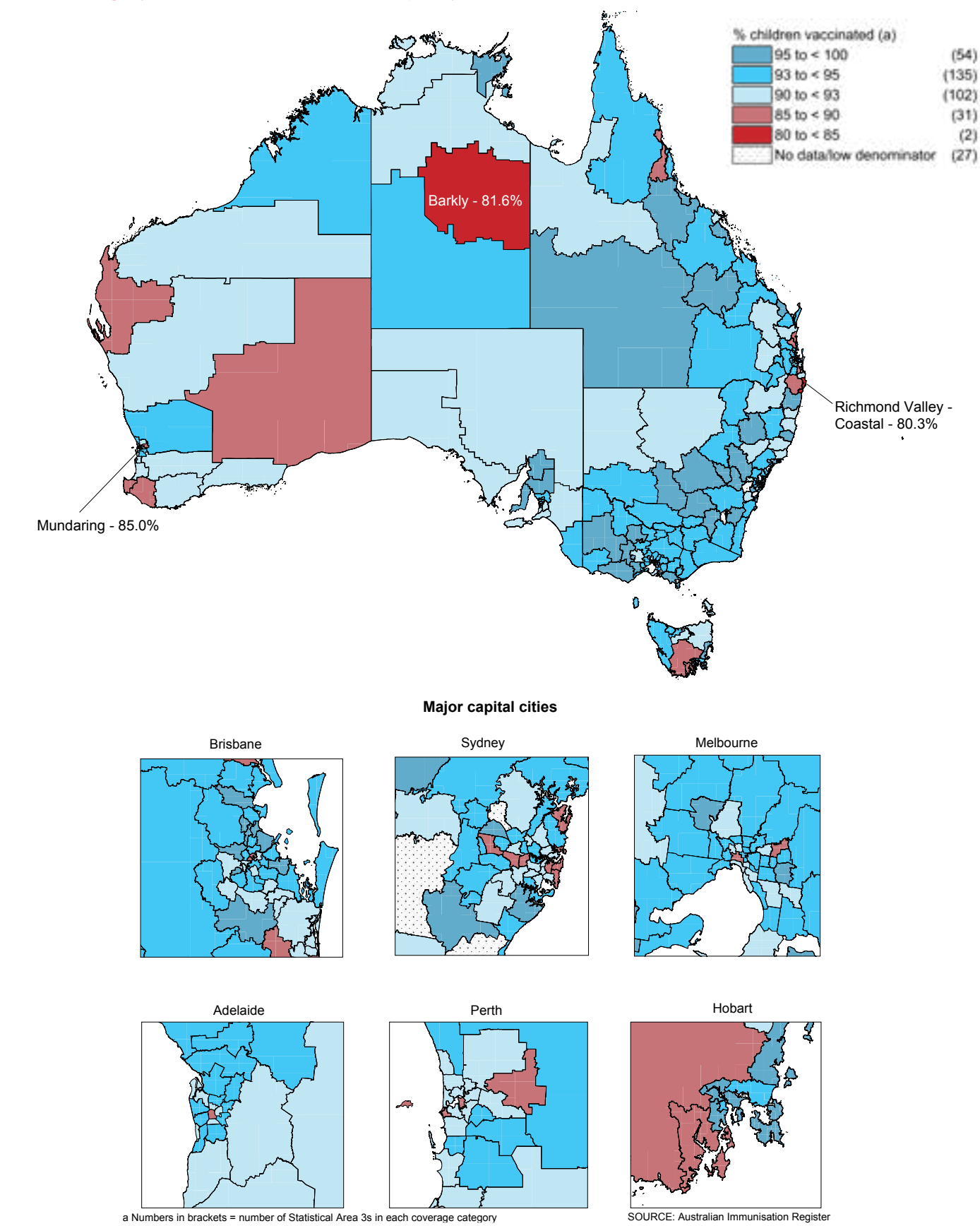


a Numbers in brackets = number of Statistical Area 3s in each coverage category

SOURCE: Australian Immunisation Register

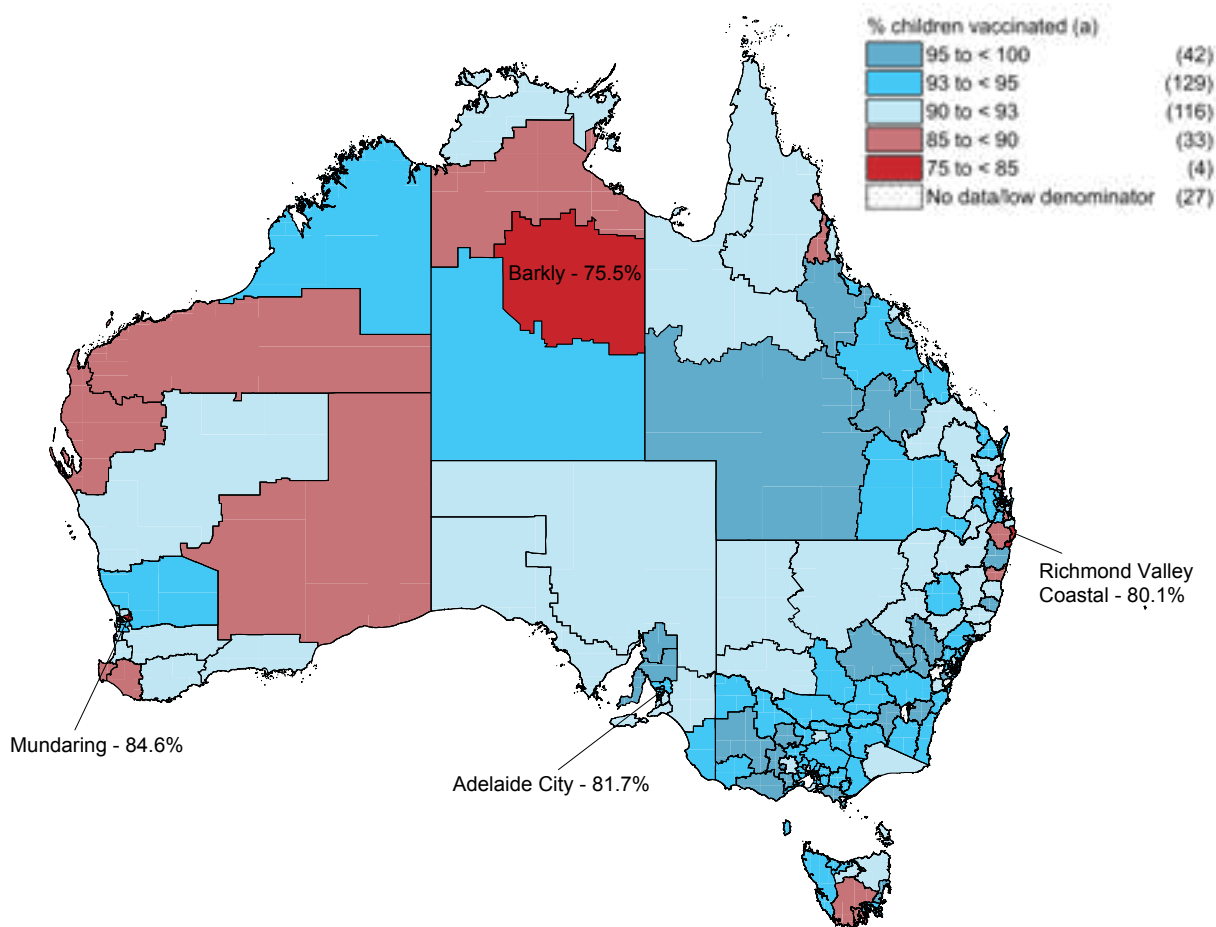
Results

Figure 7: Coverage of 2 doses of measles-mumps-rubella (MMR)-containing vaccine at 24 months of age by Statistical Area 3, Australia and major capital cities, 2018

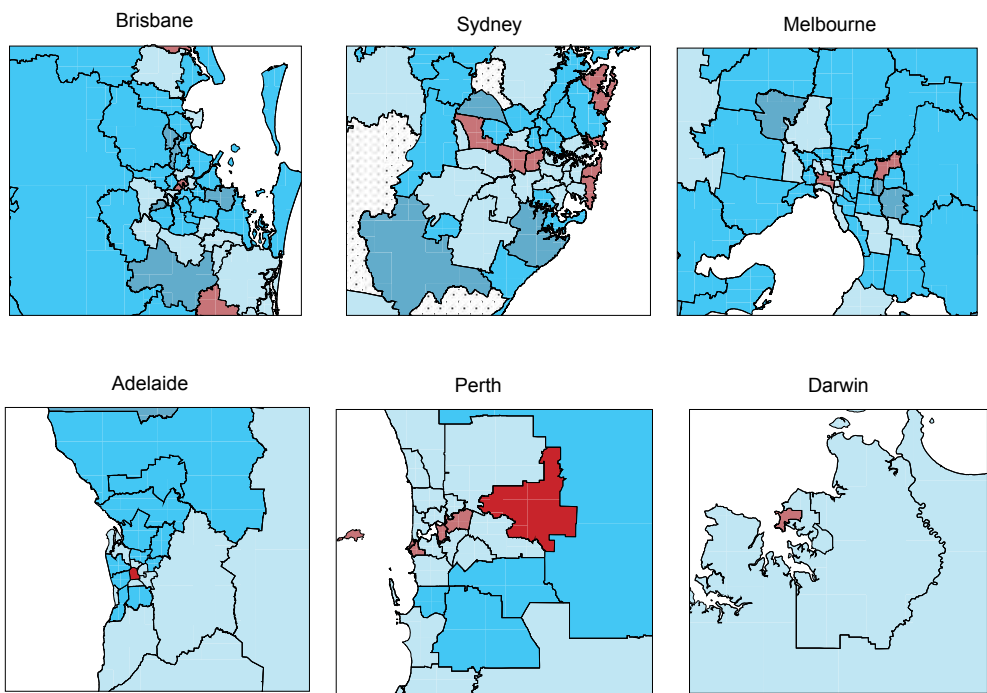


Results

Figure 8: Coverage of 4 doses of diphtheria-tetanus-acellular pertussis (DTPa)-containing vaccine at 24 months by Statistical Area 3, Australia and major capital cities, 2018



Major capital cities



a Numbers in brackets = number of Statistical Area 3s in each coverage category

SOURCE: Australian Immunisation Register

Discussion

Overall findings

Our report shows that ‘fully vaccinated’ coverage in Australia increased between 2017 and 2018 at the 12-month and 60-month age assessment milestones, reaching 93.9% and 94.0%, respectively, in 2018. True coverage is likely to have been higher, given under-reporting to the AIR,^{15,16} making it close to or even slightly above the national coverage target of 95%. The increases in coverage at these milestones over recent years have been potentially influenced by a range of measures, in particular the federal government ‘No Jab No Pay’ policy (implemented from 1 January 2016) and ‘No Jab No Play’ policies implemented in some states.

However, ‘fully vaccinated’ coverage at the 24-month milestone decreased slightly to 90.1% in 2018, several percentage points below coverage at 12 and 60 months of age. The disparity is most likely due to the increased number of antigens now required to be classified as ‘fully vaccinated’ at 24 months, including vaccine doses due at 6 and 12 months as well as the three vaccines (DTPa, Hib and measles-mumps-rubella-varicella [MMRV]) now scheduled at 18 months of age, which is only 6 months prior to the assessment time point. Historically, the 18-month schedule point was associated with lower coverage in the 1990s (when a fourth dose of whole cell pertussis-containing vaccine [DTPw] was given) and more recently because of monovalent varicella vaccine and then MMRV.¹⁷ In contrast, only one vaccine (DTPa-polio) is scheduled at 48 months and assessed at 60 months, with a 12-month period between due date and assessment date. It may be opportune to consider whether a broader definition of ‘fully vaccinated’ at this milestone, with inclusion of more vaccines/antigens, is indicated.

Improvements by individual vaccine

Coverage for individual vaccines/antigens included in the ‘fully vaccinated’ assessment algorithms was generally similar or slightly higher in 2018 than in 2017. However, PCV coverage at the 12-month milestone increased by 1.5 percentage points to 95.7%, attributable to the algorithm requiring 2 or 3 rather than 3 doses of PCV. Coverage for rotavirus vaccine, which is not included in the ‘fully vaccinated’ algorithm because of the strict upper age limits for vaccine administration, increased by 4.1 percentage points to 90.9% in 2018, the first time it has reached over 90%. This is likely due to all jurisdictions using the Rotarix vaccine, which requires 2 rather than 3 doses, from mid-2017. Coverage has previously been shown to be higher in jurisdictions using a 2-dose as opposed to 3-dose schedule.¹⁷

In the context of 95% targets, which are particularly critical to measles control, coverage at 24 months of age in 2018 was 95.4% for the first dose of MMR vaccine, and while coverage was slightly lower for the second dose of MMR vaccine at 93.0%, it increased to 96.3% by 60 months.

Comparing Indigenous and non-Indigenous coverage

‘Fully vaccinated’ coverage in Indigenous children in 2018 (96.4%) remained higher than in non-Indigenous children at the 60-month milestone – by 2.5 percentage points. ‘Fully vaccinated’ coverage in Indigenous children at the 12-month milestone increased slightly to 92.2%, but remained 1.6 percentage points lower than that in non-Indigenous children. At the 24-month milestone, ‘fully vaccinated’ coverage in Indigenous children decreased by 0.6 percentage points between 2017 and 2018 to 87.8%, with the gap compared with non-Indigenous children widening from 1.9 to 2.5 percentage points lower. This highlights timeliness issues among Indigenous children as coverage of individual vaccines/antigens due at 6 or 12 months with no further doses (MenC-containing, polio and hepB vaccines) was over 96% at 24 months. We also noted that although coverage in 2018 for the second dose of MMR and varicella vaccine (now given as MMRV vaccine at 18 months) in Indigenous children was 91–92% at 24 months, it was over 97% at 60 months. This pattern is consistent with long-standing vaccination timeliness issues among Indigenous children.¹⁷

Coverage for vaccines funded under the NIP for Indigenous children only, either nationally (influenza) or in certain jurisdictions (hepatitis A and PCV dose 4), remained suboptimal in 2018, although coverage in the Northern Territory was substantially higher than in other jurisdictions for all these vaccines. National coverage for hepatitis A vaccine and the fourth dose of PCV was 71% and 72%, respectively. Recorded influenza vaccination coverage in Indigenous children aged 6 months to <5 years more than doubled nationally to 31.4% in 2018. This increase was almost certainly due to the introduction of state/territory-funded influenza vaccination programs for all children in this age group in all jurisdictions except the Northern Territory in 2018 (Western Australia having had a program in place since 2008),¹⁸ associated with a five-fold increase in recorded coverage in non-Indigenous children nationally, from 5.0% in 2017 to 25.9% in 2018. Universal vaccination programs are known to generally achieve higher coverage than programs limited to specific subgroups, as they circumvent the issues of provider and parent awareness and suboptimal identification of Indigenous people that are barriers to high coverage in Indigenous-specific programs.^{19,20}

Discussion

A focus on timeliness

We examined a broad range of timeliness indicators in this report. The traditional measure of vaccination receipt within 30 days of the NIP schedule recommended age showed some improvement in 2018, with difference between Indigenous and non-Indigenous children in on-time coverage for second dose due at 4 months of age decreasing for DTPa vaccine (from 11.1 to 10.7 percentage points) and PCV (from 11.1 to 10.4 percentage points). The difference in on-time coverage for the second dose of rotavirus vaccine was lower than that for DTPa vaccine and PCV in 2018, at 5.9 percentage points.

In addition, we examined ‘fully vaccinated’ coverage at earlier milestones 3 months after the due date of the last scheduled vaccine, with a focus on remoteness and socioeconomic status of area of residence. ‘Fully vaccinated’ coverage in Indigenous children in remote areas was several percentage points lower than that for Indigenous children in major cities and regional areas, with the greatest differential at the 21-month assessment milestone. This disparity is likely due to greater logistic issues in providing and accessing vaccination in remote areas. Likewise, ‘fully vaccinated’ coverage at the earlier assessment time points was several percentage points lower for children living in areas in the most socioeconomically disadvantaged quintile compared with those in the least disadvantaged quintile, also consistent with access issues.^{21,22} While coverage improved substantially across the board by 60 months of age, the current ‘fully vaccinated’ assessment algorithm at this milestone may not be optimal, given that it includes only vaccines due at 48 months.

Conclusions

This report demonstrates continuing improvements across a range of immunisation indicators in Australia in 2018. However, some issues with timeliness persist, particularly in Indigenous and socioeconomically disadvantaged children. As younger children are generally more vulnerable to severe disease, and Indigenous and socioeconomically disadvantaged children even more so, equitable coverage of vaccination at the earliest appropriate age, in line with the NIP schedule, should be a public health goal for countries such as Australia where high levels of overall vaccine coverage at standard milestone ages have been achieved. New coverage targets for earlier protection in the first 2 years of life may be indicated, along with a review of current ‘fully vaccinated’ assessment algorithms, particularly at the 60-month milestone.

Appendix

Table A1: Australian NIP Schedule for children aged <5 years in 2018

Age	Vaccine					
	Childhood vaccines					
Birth	Hep B					
2 months	Hep B	DTPa	Hib	Polio	13vPCV	Rotavirus
4 months	Hep B	DTPa	Hib	Polio	13vPCV	Rotavirus
6 months	Hep B	DTPa	Hib	Polio	13vPCV*	Flu†
12 months				MMR	Men C	Hep A‡
18 months		DTPa	Hib		MMRV	Hep A‡
24 months						Flu†
48 months		DTPa		Polio		23vPPV§

* Aboriginal and Torres Strait Islander children living in the Northern Territory, Western Australia, Queensland and South Australia, and children with specified underlying medical conditions that predispose them to invasive pneumococcal disease.

† Annual vaccination - all Aboriginal and Torres Strait Islander children aged 6 months to <5 years, all children aged ≥6 months with medical risk factors, Aboriginal and Torres Strait Islander people aged ≥15 years, non-Indigenous adults aged ≥65 years.

‡ Aboriginal and Torres Strait Islander children – doses at 12 months and 18 months of age in the Northern Territory, Western Australia, Queensland and South Australia.

§ Medically at-risk children.

Box 1: Significant changes in childhood immunisation policy, immunisation incentives and coverage calculation algorithms, Australia, 2014 to 2018

July 2018 - Schedule for routine childhood vaccination with 13vPCV changed from 2, 4 and 6 months of age to 2, 4 and 12 months of age. Vaccination coverage assessment algorithm for 'fully vaccinated' at the 12-month milestone amended to require either 2 or 3 doses of pneumococcal conjugate vaccine. Vaccination coverage assessment algorithm for 'fully vaccinated' at the 24-month milestone amended to require 3 doses of pneumococcal conjugate vaccine. Meningococcal ACWY conjugate vaccine funded for all children at 12 months of age, replacing combined Hib and MenC-containing, with the Hib dose moved to 18 months and given as monovalent Hib vaccine.

July 2017 - Queensland, South Australia, Victoria and Western Australia changed from 3-dose RotaTeq® rotavirus vaccine schedule to 2-dose Rotarix® schedule. Coverage for the second dose of MMR-containing vaccine no longer assessed at 60 months of age.

December 2016 - Vaccination coverage assessment algorithm for 'fully vaccinated' at the 24-month milestone amended to require 4 doses of DTPa-containing vaccine.

March 2016 – Booster dose of DTPa vaccine funded at 18 months of age.

January 2016 - New immunisation requirements for federal government family assistance payments ('No Jab, No Pay') come into effect. Only parents of children (aged <20 years, up from <7 years previously) who are 'fully vaccinated' or on a recognised catch-up schedule are eligible to receive the Child Care Benefit, Child Care Rebate and/or the Family Tax Benefit Part A end-of-year supplement. Children with medical contraindications or natural immunity for certain diseases continue to be exempt from the requirements; however, objection on non-medical grounds is no longer a valid exemption.

March 2015 – Seasonal influenza vaccine funded for Aboriginal and Torres Strait Islander children aged 6 months to <5 years.

December 2014 – Vaccination coverage assessment algorithm for 'fully vaccinated' at the 24-month milestone amended to require 1 dose of MenC vaccine and 1 dose of varicella vaccine, along with the second dose of MMR vaccine instead of the first dose as previously. Second dose of MMR vaccine remained in the coverage assessment algorithm for the 60-month milestone age.

Appendix

Detailed methods

The Australian Immunisation Register (AIR)

The Australian Childhood Immunisation Register (ACIR) was established on 1 January 1996 by incorporating demographic data from Medicare on all enrolled children aged <7 years.²⁴ On 30 September 2016, the ACIR expanded to become AIR to collect data on vaccinations given from birth to death.²⁵ All people registered with Medicare are automatically added to AIR. Participation in AIR is 'opt-out' and so constitutes a nearly complete population register for Australian residents.²⁴ Persons not enrolled in Medicare can also be added to AIR via a supplementary number. Data are transferred to AIR when a recognised immunisation provider supplies details of an eligible vaccination. This could occur via medical practice management software, through direct data entry on the AIR website or by submitting paper encounter or history forms. High levels of reporting to AIR for child vaccinations are maintained by a system of incentive payments for immunisation providers and carers. These have been discussed in detail elsewhere.^{1,6}

Coverage estimates

This report details national vaccination coverage using AIR data as at 31 March 2019. The cohort method has been used for calculating coverage at the population level (national and state/territory) since the ACIR's inception.²⁶ Cohort vaccination status was assessed at 12 months of age (for vaccines due at 6 months), 24 months of age (for vaccines due at 6, 12 and 18 months) and 60 months of age (for vaccines due at 48 months). A minimum 3-month lag period was allowed for late notification of vaccinations to AIR, but only vaccines given on or before a child's first, second or fifth birthday, respectively, were included in coverage calculations.²⁶ If a child's records indicated receipt of the last dose of a vaccine that required more than 1 dose to complete the series, it was assumed that earlier vaccines in the sequence had been given. This assumption has been shown to be valid in the past.^{27,28}

Three-month-wide birth cohorts were used for most of the time-trend analyses, with children aged 12 to <15 months for the 12-month assessment age, children aged 24 to <27 months for the 24-month assessment age and children aged 60 to <63 months for the 60-month assessment age. Either 3-month or 12-month wide cohorts were used for all other analyses in this report. The 12-month-wide cohorts used in this report were children born between 1 January 2017 and 31 December 2017 for the 12-month milestone; between 1 January 2016 and 31 December 2016 for the 24-month milestone; and between 1 January 2013 and 31 December 2013 for the 60-month (5-year) milestone.

The proportion of children 'fully vaccinated' was calculated using the number of children completely vaccinated with the vaccines of interest by the designated age as the numerator and the total number of children registered on AIR in the relevant age cohort as the denominator. Definitions of 'fully vaccinated' coverage are provided in **Table A2** – the definitions for the 12-, 24- and 60-month milestones have been nationally agreed for the purpose of standardised reporting, with our definitions for the 9-, 15-, 21- and 51-month milestones based on these for purposes of timeliness analysis (refer to **Table A2**).

Vaccination coverage estimates were also calculated for individual NIP vaccines/antigens, including the three NIP vaccines given in early childhood but not routinely reported on and not part of 'fully vaccinated' calculations at 12, 24 and 60 months of age. These are a second dose of rotavirus vaccine by 12 months of age; a second dose of hepatitis A vaccine in Indigenous children by 30 months of age; and a fourth dose of 13vPCV in Indigenous children by 30 months of age. The proportion of children vaccinated with the relevant vaccine/antigen and dose was calculated using the number of children vaccinated with the relevant vaccine/dose by the designated age as the numerator and the total number of children registered on AIR in the relevant age cohort as the denominator. Influenza vaccination coverage for children aged 6 months to <5 years was calculated by dividing the number of children with at least one dose of influenza vaccine recorded on AIR in a calendar year by the total number of children in the 6 months to <5 years age group registered on AIR the relevant calendar year, by Indigenous status and jurisdiction.

Appendix

Table A2: Vaccinations required to be deemed fully vaccinated by each assessment milestone

Milestone	Vaccinations
9 months/12 months (Cohort born 1 January 2017 – 31 December 2017)	3rd dose DTPa (given at 6 months) 3rd dose IPV (given at 6 months) 3rd dose HepB (given at 6 months) 3rd dose Hib (given at 6 months) 2nd or 3rd dose 13vPCV (given at 4 or 6 months)*
15 months (Cohort born 1 January 2016 – 31 December 2016)	3rd dose DTPa (given at 6 months) 3rd dose IPV (given at 6 months) 3rd dose HepB (given at 6 months) 4th dose Hib (given at 12 months)† 3rd dose 13vPCV (given at 6 months) 1st dose MenC (given at 12 months) 1st dose MMR (given at 12 months)
21 months/24 months (Cohort born 1 January 2016 – 31 December 2016)	4th dose DTPa (given at 18 months) 3rd dose IPV (given at 6 months) 3rd dose HepB (given at 6 months) 4th dose Hib (given at 12 or 18 months)‡ 1st dose MenC (given at 12 months) 1st dose Varicella (given at 18 months) 2nd dose MMR (given at 18 months) 3rd dose 13vPCV (given at 6 months)
51 months/60 months (Cohort born 1 January 2013 – 31 December 2013)	4th or 5th dose DTPa (given at 48 months) 4th dose IPV (given at 48 months)

* 3rd dose given at 6 months of age included for cohort born 1 January 2017 – 31 March 2017 as 13vPCV given as 2-, 4- and 6-month schedule; 2nd dose given at 4 months of age included for cohort born 1 April 2017 – 31 December 2017 as 13vPCV given as 2-, 4- and 12-month schedule.

† 4th dose included only for cohort born 1 January 2016 – 30 June 2016 as 4th dose Hib changed from 12 months of age to 18 months of age as of 1 July 2018.

‡ 4th dose given at 12 months of age for cohort born 1 January 2016 – 30 June 2016 and at 18 months of age for cohort born 1 July 2016 – 31 December 2016.

DTPa = diphtheria-tetanus-pertussis (acellular) paediatric formulation

IPV = inactivated polio vaccine

Hep B = hepatitis B

Hib = *Haemophilus influenzae* type b

PCV = pneumococcal conjugate vaccine

MenC = meningococcal C-containing

MMR = measles-mumps-rubella

Appendix

Timeliness of vaccination

On-time vaccination was defined as receipt of a scheduled vaccine dose within 30 days of the recommended age. For example, a child who received the first dose of DTPa vaccine (due by 60 days of age under the NIP but recommended from as early as 6 weeks of age) when they were more than 90 days of age was classified as late for that dose. On-time vaccination was measured in 12-month birth cohorts, with children included in the analysis assessed at up to 3 years after doses were due, to allow time for very late vaccinations to be assessed. Therefore, cohorts assessed for timeliness are not the same as those assessed for coverage milestones. The interval between doses was not evaluated. Timeliness of different vaccines and doses was compared by plotting the cumulative percentage receiving each vaccine dose by age in months.

'Fully vaccinated' coverage estimates were also assessed at 3 months after last vaccine dose due, that is, earlier than the standard assessment milestones to capture aspects of timeliness, by remoteness and socioeconomic status of area of residence. The definitions of 'fully vaccinated' coverage used are provided in [Table A2](#).

Remoteness status

The area of residence of children was defined as 'Major cities', 'Inner regional', 'Outer regional', 'Remote' and 'Very remote' using the Accessibility/Remoteness Index of Australia (ARIA++).²⁹ ARIA++ is a continuous varying index with values ranging from 0 (high accessibility) to 15 (high remoteness), and is based on road distance measurements from over 12,000 populated localities to the nearest Service Centres in five categories based on population size. For analysis in this report, we combined the two 'Regional' categories ('Inner Regional' and 'Outer Regional') into one category and the two 'Remote' categories ('Remote' and 'Very Remote') into one category. ARIA Accessibility/Remoteness categories were assigned to each child using their current recorded postcode of residence on AIR.

Socio-economic status

Vaccination coverage and timeliness were assessed by socio-economic status using the ABS Socio Economic Indexes for Areas (SEIFA) Index of Economic Resources.³⁰ The SEIFA index category was assigned for each individual using their recorded postcode of residence on AIR. For this analysis we compared vaccination coverage for children living in postcodes classified as being in the top quintile of all postcodes with regard to economic resources with vaccination coverage for children living in postcodes classified as being in the bottom quintile of postcodes with regard to economic resources.

Small area analysis

SA3

Analysis of coverage was undertaken at small area level using the ABS-defined Statistical Area 3 (SA3), 31 chosen because each is small enough to show differences within jurisdictions but not too small to render maps unreadable. For both privacy and precision reasons, SA3s with denominators of less than 26 children were not included in any small area analysis. Maps were created using version 15 of the MapInfo mapping software³² and the ABS Census Boundary Information. As postcode is the only geographical indicator available from AIR, the ABS Postal Area to SA3 Concordance 2011 was used to match AIR postcodes to SA3s.³³

PHN

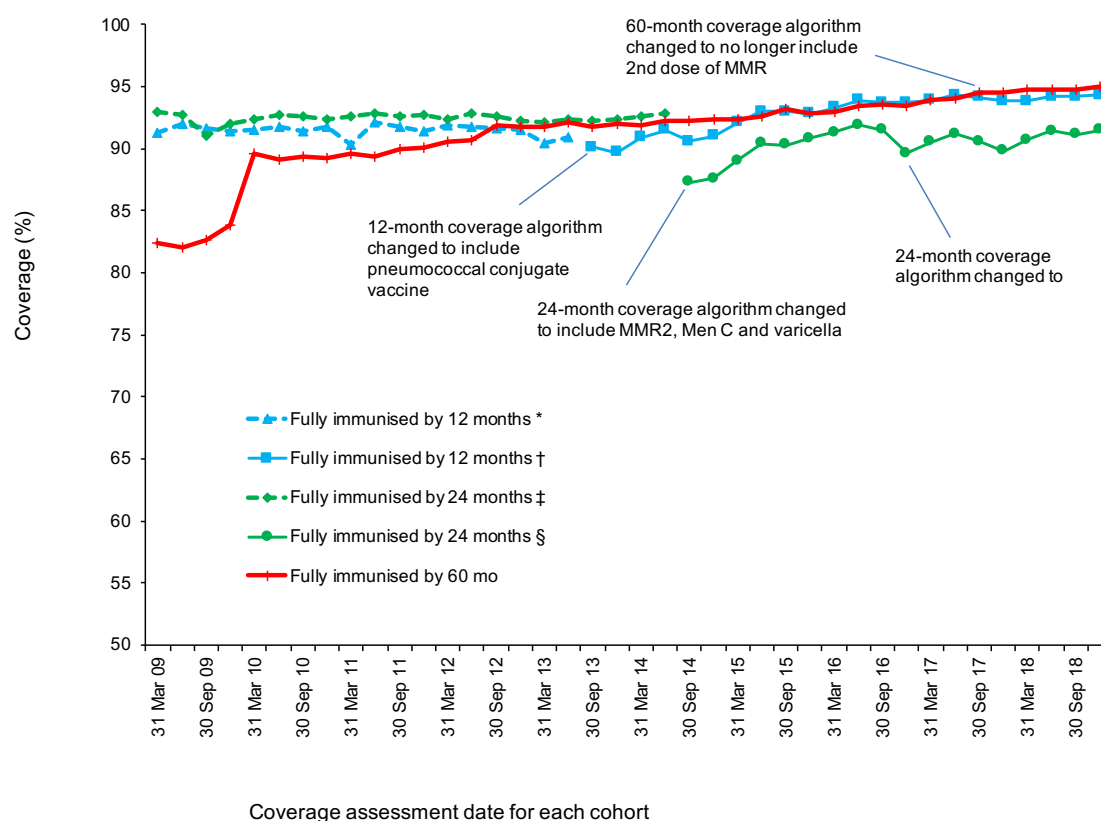
Analysis of coverage was also undertaken at the primary health network (PHN) level. PHNs are organisations that work to improve coordination of healthcare in their area, with the boundaries defined by the Australian Government Department of Health. There are 31 PHNs in Australia.

Indigenous status

Indigenous status on AIR is recorded as 'Indigenous', 'non-Indigenous' or 'unknown', as reported by the person (or parent/carer) to Medicare. Indigenous status as recorded in provider vaccination notifications to AIR do not override the data on Indigenous status in the Medicare database, emphasising the importance of vaccine recipients or parents/carers ensuring Medicare details are correct. For this report individuals whose Indigenous status was not specified (less than 1%) were classified as non-Indigenous for the purposes of analysis. While Indigenous status is available in AIR, other parameters such as country of birth, ethnicity and medical condition (including pregnancy) are not.

Appendix

Figure A1: Trends in 'fully vaccinated' coverage estimates by quarter, Australia, 2009 to 2018



By 3-month birth cohorts born between 1 January 2008 and 31 December 2017. Coverage assessment date was 12, 24 or 60 months after the last birth date of each cohort. Vaccination coverage estimates are calculated by quarter and may differ slightly from estimates published elsewhere using rolling annualised data.

* Coverage algorithm before 1 July 2013

† Coverage algorithm from 1 July 2013

‡ Coverage algorithm before 1 July 2014

§ Coverage algorithm from 1 July 2014

MMR2 – second dose of MMR vaccine

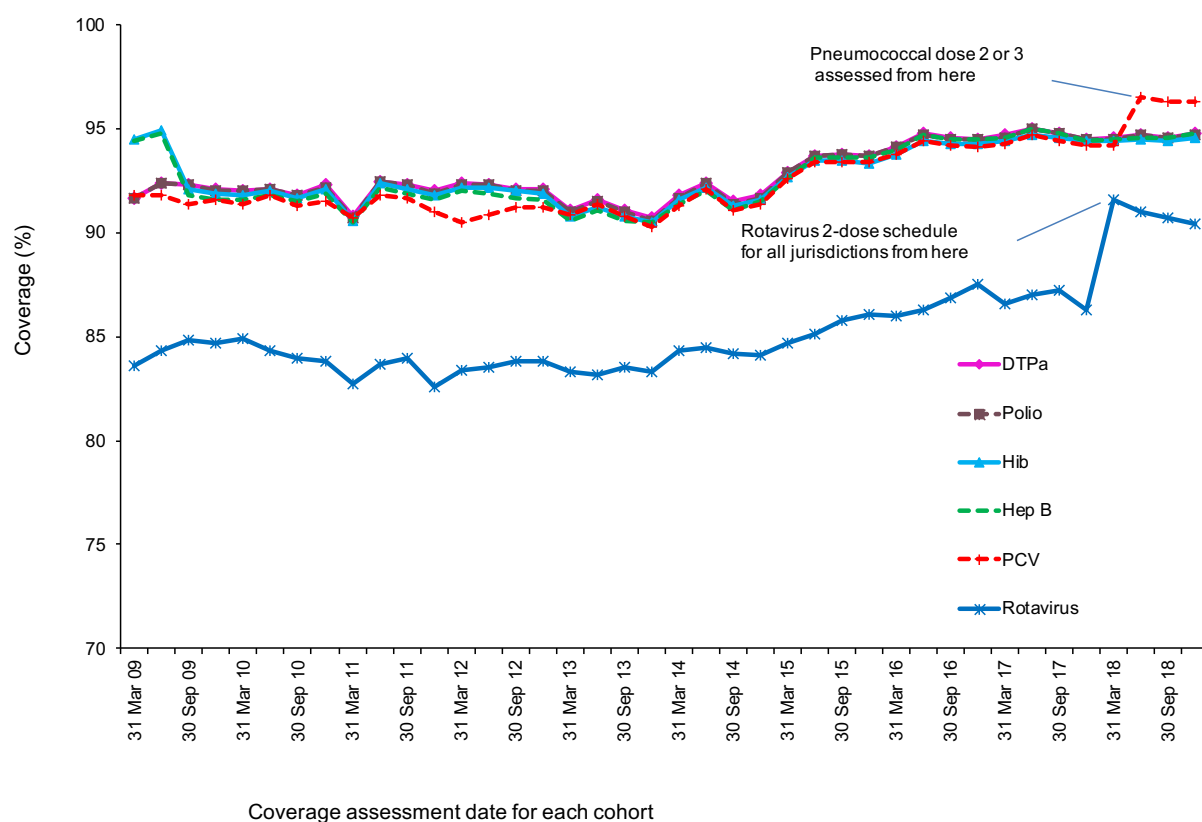
MenC – meningococcal C-containing

DTPa – diphtheria-tetanus-acellular pertussis

Source: Australian Immunisation Register, data as at 31 March 2019.

Appendix

Figure A2: Trends in vaccination coverage estimates at 12 months of age, by vaccine/antigen* and quarter, Australia, 2009 to 2018



By 3-month birth cohorts born between 1 January 2008 and 31 December 2017. Coverage assessment date was 12 months after the last birth date of each cohort. Vaccination coverage estimates are calculated by quarter and may differ slightly from estimates published elsewhere using rolling annualised data.

* Third dose of DTPa vaccine, polio vaccine and PCV, second or third dose of Hib and rotavirus vaccines, and third dose of hepatitis B vaccine.

DTPa = diphtheria-tetanus-acellular pertussis

Hib = *Haemophilus influenzae* type b

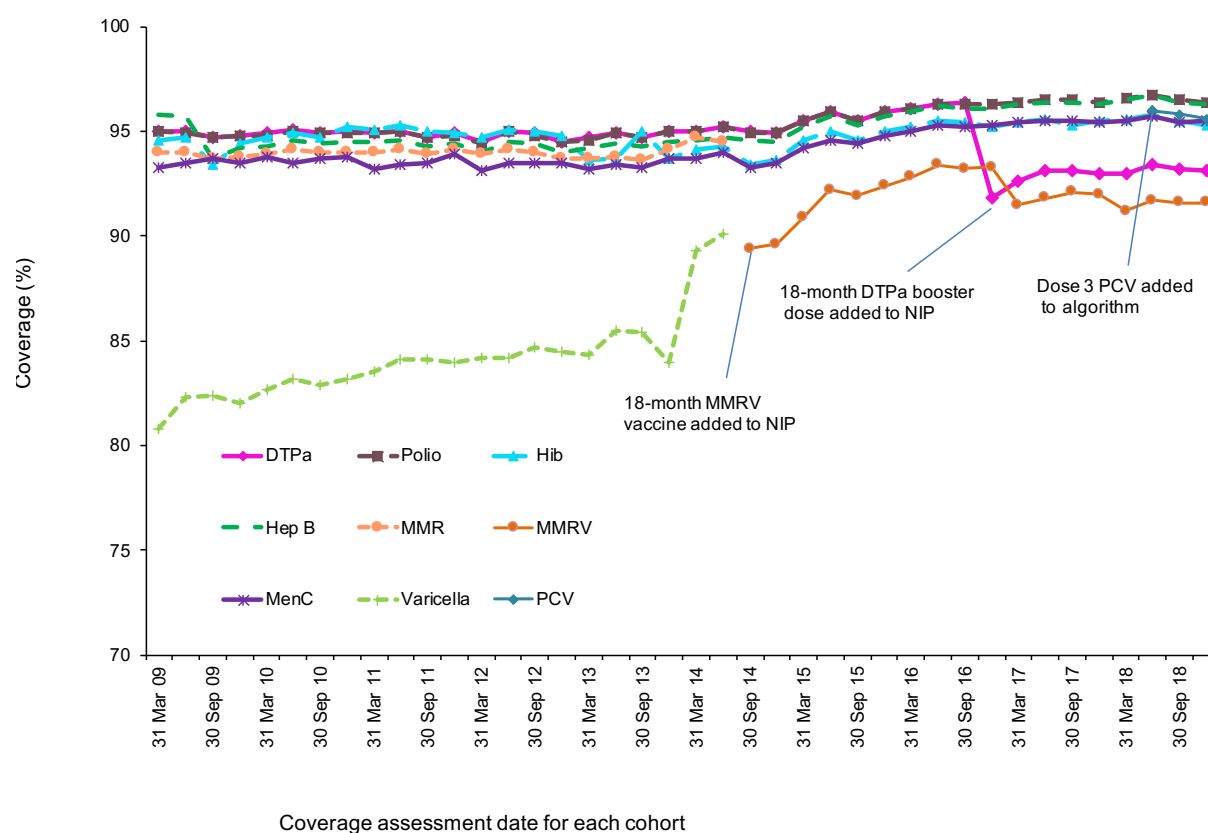
Hep B = hepatitis B

PCV = pneumococcal conjugate vaccine

Source: Australian Immunisation Register, data as at 31 March 2019.

Appendix

Figure A3: Trends in vaccination coverage estimates at 24 months of age by vaccine/antigen* and quarter, Australia, 2009 to 2018



By 3-month birth cohorts born between 1 January 2007 and 31 December 2016. Coverage assessment date was 24 months after the last birth date of each cohort. Vaccination coverage estimates are calculated by quarter and may differ slightly from estimates published elsewhere using rolling annualised data.

* Fourth dose of DTPa (from October 2016), third dose of polio, third or fourth dose of Hib, third dose of hepatitis B, a dose of varicella, second dose of MMR (from September 2014), and first dose of MenC (MenACWY from July 2018)

DTPa = diphtheria-tetanus-acellular pertussis

Hib = *Haemophilus influenzae* type b

Hep B = hepatitis B

MMR = measles-mumps-rubella

MenC = meningococcal C-containing

MenACWY = meningococcal ACWY

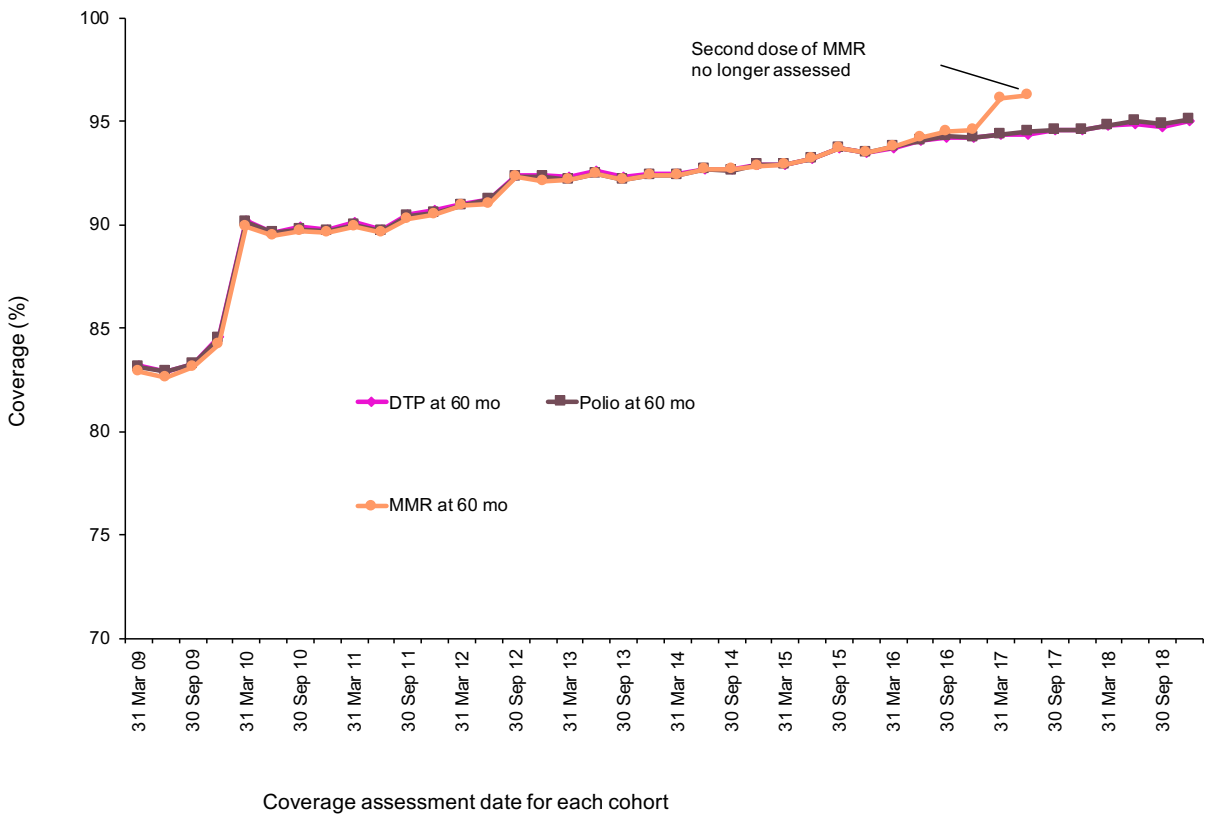
MMRV = measles-mumps-rubella-varicella

PCV = pneumococcal conjugate vaccine

Source: Australian Immunisation Register, data as at 31 March 2019.

Appendix

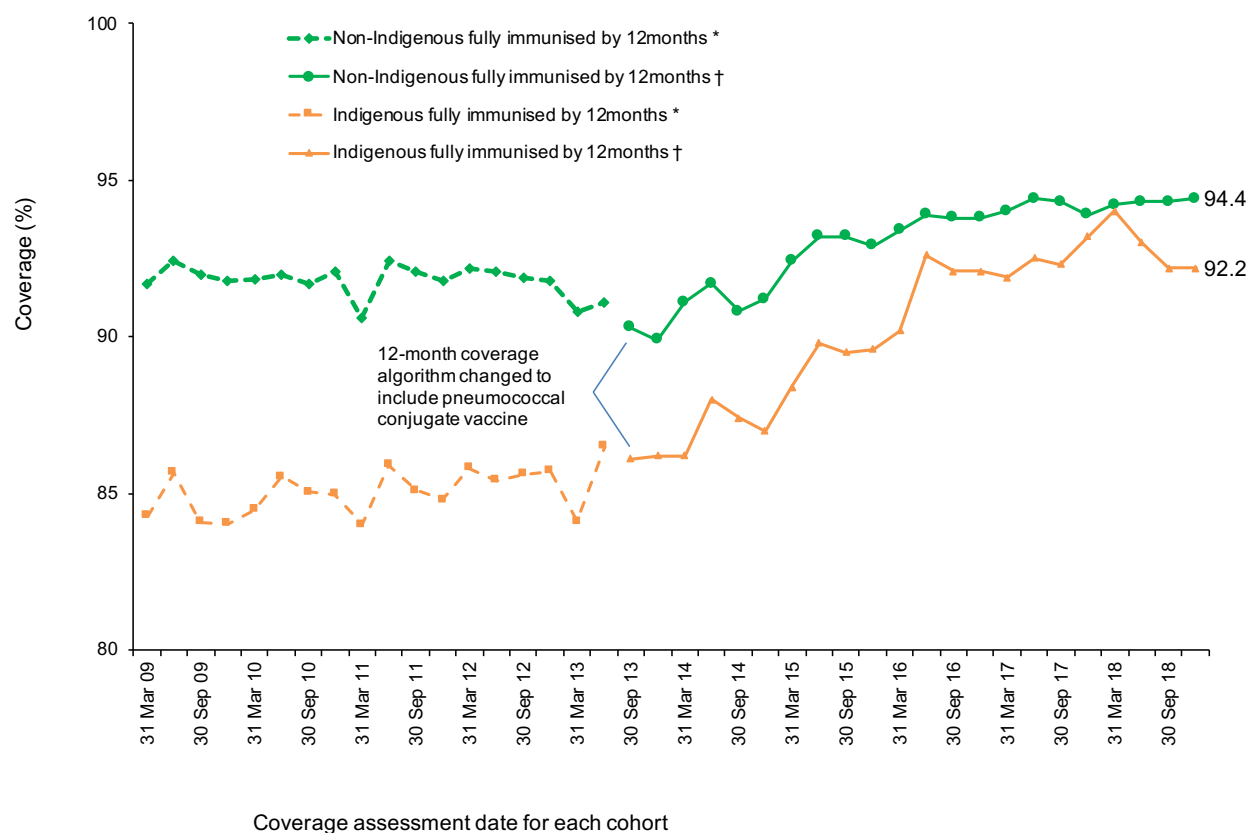
Figure A4: Trends in vaccination coverage estimates at 60 months of age by vaccine/antigen* and quarter, Australia, 2009 to 2018



By 3-month birth cohorts born between 1 January 2004 and 31 December 2013. Coverage assessment date was 60 months after the last birth date of each cohort. Vaccination coverage estimates are calculated by quarter and may differ slightly from estimates published elsewhere using rolling annualised data.
* Fourth or fifth dose of DTPa and fourth dose of polio, second dose of MMR (up until June 2017)
DTPa = diphtheria-tetanus-acellular pertussis
MMR = measles-mumps-rubella
Source: Australian Immunisation Register, data as at 31 March 2019.

Appendix

Figure A5: Trends in 'fully vaccinated' coverage at 12 months of age by Indigenous status and quarter, Australia, 2009 to 2018



Vaccination coverage estimates are calculated using 3-month-wide birth cohorts by quarter and may differ slightly from estimates published elsewhere using rolling annualised data.

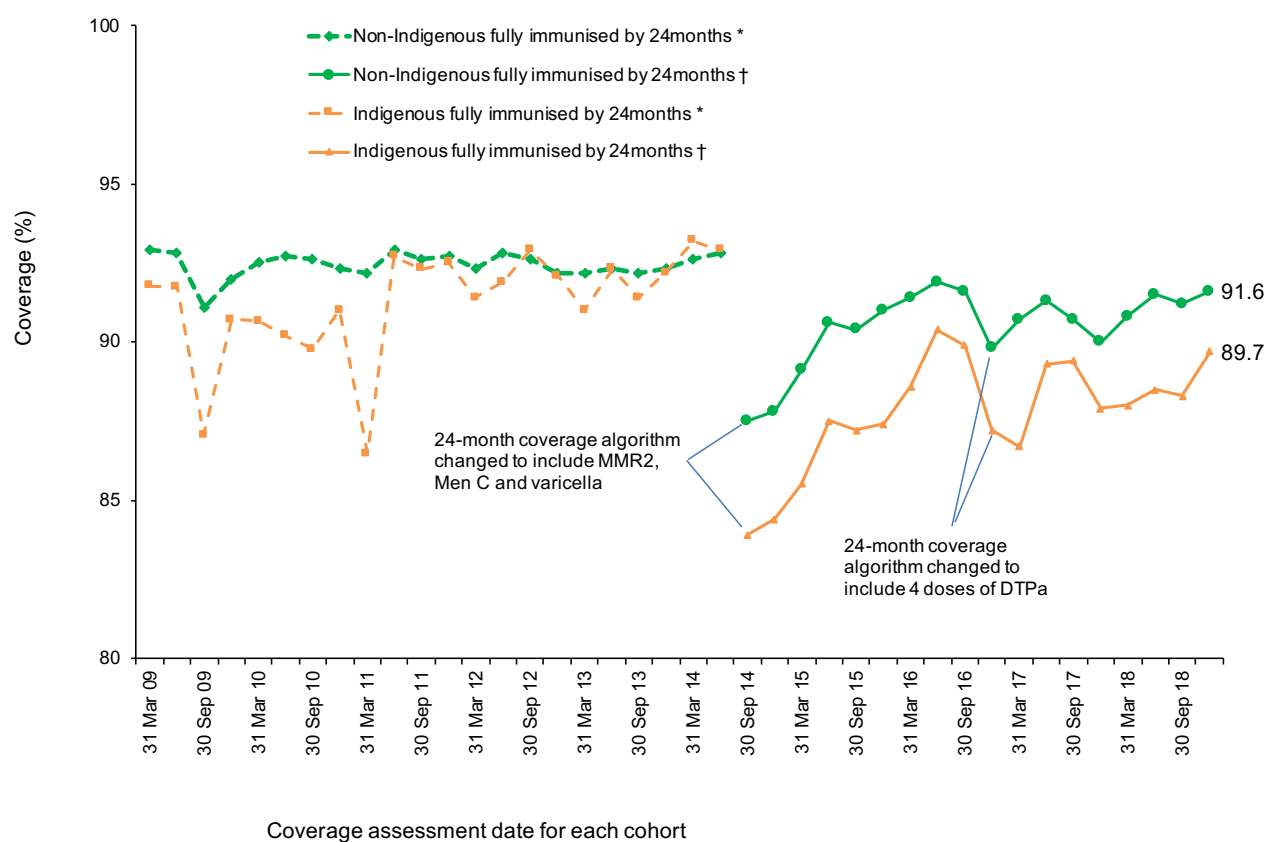
* Coverage algorithm before 1 July 2013

† Coverage algorithm from 1 July 2013

Source: Australian Immunisation Register, data as at 31 March 2019.

Appendix

Figure A6: Trends in 'fully vaccinated' coverage at 24 months of age by Indigenous status and quarter, Australia, 2009 to 2018



Vaccination coverage estimates are calculated using 3-month-wide birth cohorts by quarter and may differ slightly from estimates published elsewhere using rolling annualised data.

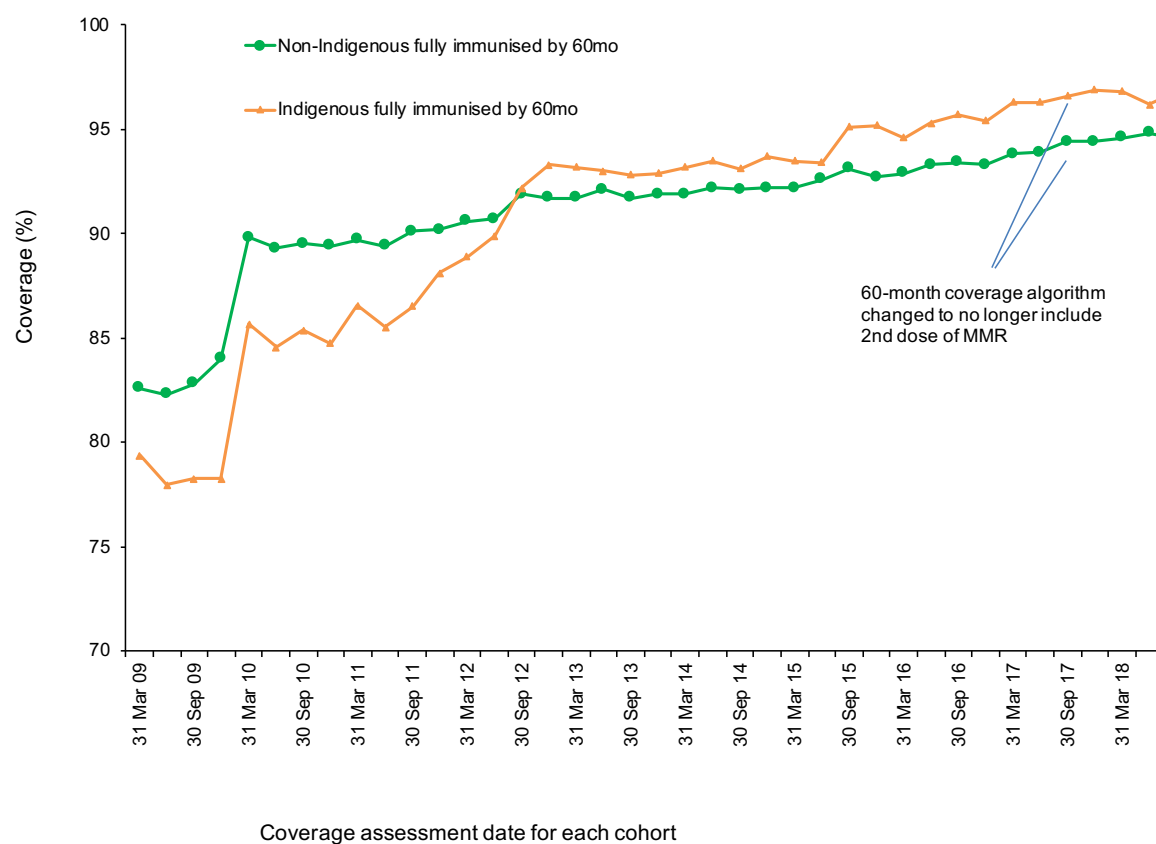
* Coverage algorithm before 1 July 2014.

† Coverage algorithm from 1 July 2014.

Source: Australian Immunisation Register, data as at 31 March 2019.

Appendix

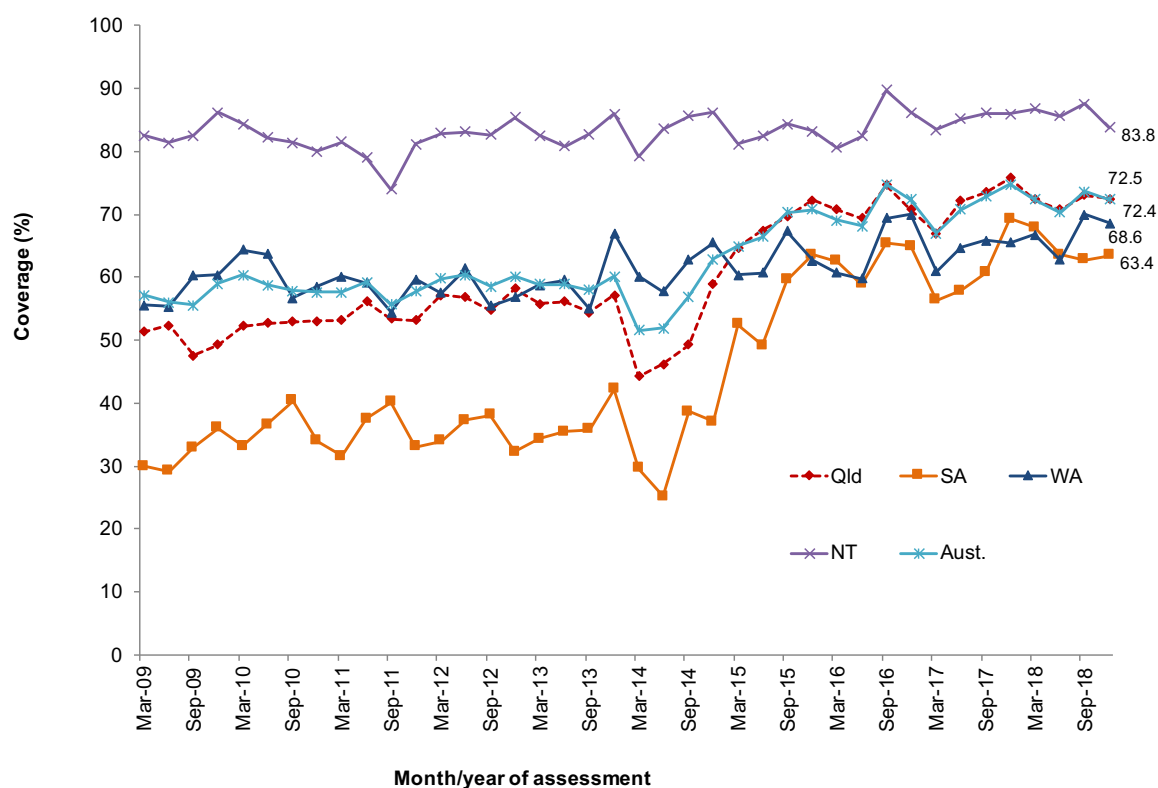
Figure A7: Trends in 'fully vaccinated' coverage at 60 months of age by Indigenous status and quarter, Australia, 2009 to 2018



Vaccination coverage estimates are calculated using 3-month-wide birth cohorts by quarter and may differ slightly from estimates published elsewhere using rolling annualised data.
Source: Australian Immunisation Register, data as at 31 March 2019.

Appendix

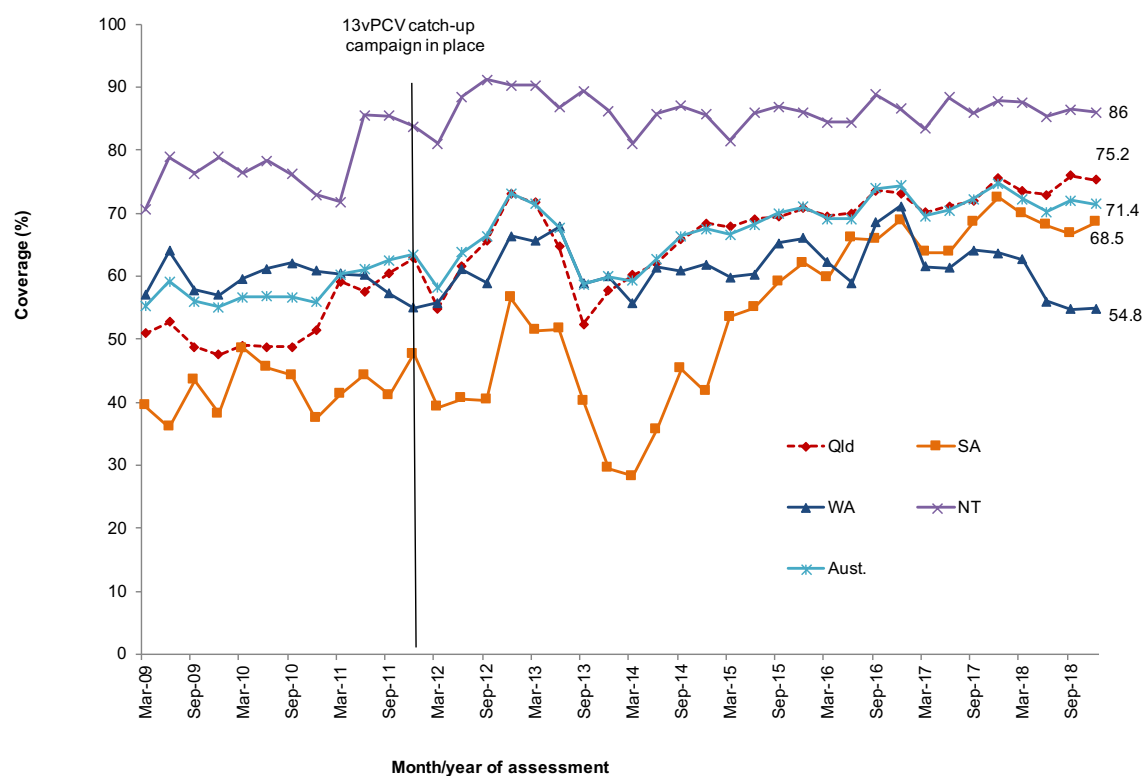
Figure A8: Trends in coverage estimates for hepatitis A* vaccine for Indigenous children by jurisdiction,† Australia, 2009 to 2018



Vaccination coverage estimates are calculated using 3-month-wide birth cohorts by quarter.
 * 18-month dose assessed at 30 months of age in all four jurisdictions.
 † Northern Territory (NT), Queensland (Qld), South Australia (SA) and Western Australia (WA) only.
 Aust. = Australia
 Source: Australian Immunisation Register, data as at 31 March 2019.

Appendix

Figure A9: Trends in coverage estimates for pneumococcal* vaccine for Indigenous children by jurisdiction,† Australia, 2009 to 2018



Vaccination coverage estimates are calculated using 3-month-wide birth cohorts by quarter.

* 12-month booster dose assessed at 30 months of age in all four jurisdictions.

† Northern Territory (NT), Queensland (Qld), South Australia (SA) and Western Australia (WA) only.

13vPCV = 13-valent pneumococcal conjugate vaccine

Aust. = Australia

Source: Australian Immunisation Register, data as at 31 March 2019.

Appendix

Table A3: 'Fully vaccinated' coverage at the age milestones of 12 months, 24 months and 60 months, by Primary Health Network, 2018*

Primary Health Network	12 months (%)†	24 months (%)‡	60 months (%)§
Western NSW	96.0	93.0	97.5
Western Victoria	96.0	93.9	96.8
Gippsland	94.6	92.9	96.7
Western Queensland	93.3	88.6	96.4
Hunter New England and Central Coast	95.3	92.8	96.2
Murray	94.2	91.8	96.2
Nepean Blue Mountains	94.8	92.4	96.2
South Eastern NSW	94.9	92.9	95.7
Murrumbidgee	95.6	93.5	95.4
South Western Sydney	94.0	89.9	95.1
Tasmania	93.8	90.3	95.0
Country SA	93.9	89.9	94.9
Darling Downs and West Moreton	94.2	91.4	94.8
Northern Queensland	94.5	91.2	94.8
Eastern Melbourne	94.6	90.7	94.7
South Eastern Melbourne	94.3	90.6	94.5
North Western Melbourne	94.1	89.6	94.1
Australian Capital Territory	95.7	92.1	94.0
Adelaide	94.3	90.4	93.8
Western Sydney	92.9	87.8	93.7
Brisbane North	94.8	91.4	93.7
Central Queensland, Wide Bay, Sunshine Coast	92.7	90.6	93.6
Brisbane South	94.1	90.9	93.5
Country WA	92.5	82.5	93.5
Perth South	93.4	88.0	92.8
Northern Territory	93.5	87.4	92.4
Perth North	93.8	87.4	92.1
Gold Coast	92.4	89.5	91.8
Northern Sydney	93.7	89.0	91.5
Central and Eastern Sydney	93.5	88.5	91.3
North Coast	89.5	87.6	91.0

* Data sorted by the '60 months' column (highest to lowest)

† Cohort born 1 January 2017 – 31 December 2017

‡ Cohort born 1 January 2016 – 31 December 2016

§ Cohort born 1 January 2013 – 31 December 2013

Appendix

Table A4: 'Fully vaccinated' coverage estimates assessed at earlier (9, 15, 21, 51) milestones,* by Primary Health Network, 2018†

Primary Health Network	9 months (%)‡	15 months (%)§	21 months (%)§	51 months (%)
Western Victoria	92.9	91.8	90.1	90.0
Gippsland	91.1	90.6	88.9	89.8
Murray	90.7	90.1	87.0	89.3
Nepean Blue Mountains	92.7	91.1	88.2	88.4
Murrumbidgee	93.1	91.4	89.2	88.3
Hunter New England and Central Coast	92.7	91.4	88.5	88.2
Western NSW	92.5	91.8	88.2	88.1
Australian Capital Territory	94.2	91.6	89.0	88.0
South Eastern NSW	92.1	91.2	88.8	87.9
Tasmania	90.8	90.4	85.9	87.4
Darling Downs and West Moreton	90.9	88.7	85.6	87.3
Eastern Melbourne	91.6	90.3	87.4	87.1
South Eastern Melbourne	90.9	88.8	86.6	87.0
North Western Melbourne	90.5	87.9	85.8	86.7
Northern Queensland	90.5	89.3	84.6	86.3
South Western Sydney	90.5	88.3	85.1	86.3
Brisbane North	92.5	90.2	87.4	86.2
Country SA	90.4	89.3	84.0	86.2
Brisbane South	91.4	88.8	86.8	85.9
Adelaide	91.1	89.0	85.4	85.6
Central Queensland, Wide Bay, Sunshine Coast	89.4	88.9	85.0	85.6
Western Sydney	89.6	86.2	83.3	84.9
Western Queensland	88.5	89.0	79.7	84.0
Country WA	86.6	83.5	75.1	83.7
Perth South	89.5	87.1	82.8	83.6
Central and Eastern Sydney	91.3	87.7	84.9	83.3
Gold Coast	89.0	86.9	84.2	83.3
Northern Sydney	92.0	87.9	85.8	82.8
North Coast	86.4	85.7	82.0	82.7
Perth North	90.2	87.2	82.3	82.3
Northern Territory	88.6	85.1	80.2	81.1

* Coverage algorithm used for 9/21/51 months milestones same as for 12/24/60, respectively; algorithm used for 15 months same as 24 months but excludes doses due at 18 months; for further detail of algorithms, refer to Appendix.

† Data sorted by the '<51 months' column (highest to lowest)

‡ Cohort born 1 January 2017 – 31 December 2017

§ Cohort born 1 January 2016 – 31 December 2016

|| Cohort born 1 January 2013 – 31 December 2013

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