Annual report

Immunisation coverage annual report, 2011

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Abstract

This, the 5th annual immunisation coverage report, documents trends during 2011 for a range of standard measures derived from Australian Childhood Immunisation Register data, and National Human Papillomavirus (HPV) Vaccination Program Register data. The proportion of children 'fully vaccinated' at 12, 24 and 60 months of age was 91.4%, 92.2% and 89.5% respectively. Although pneumococcal vaccine had similar coverage at 12 months to other vaccines, coverage was lower for rotavirus at 12 months (83.8%) and varicella at 24 months (83.9%). By late 2011, the percentage of children who received the 1st dose of DTPa vaccine dose at less than 8 weeks of age was greater than 50% in 3 jurisdictions, the Australian Capital Territory, Victoria, and Queensland and at 70% for New South Wales and Tasmania. Although coverage at 12 months of age was lower among Indigenous children than non-Indigenous children in all jurisdictions, the extent of the difference varied. Overall, coverage at 24 months of age exceeded that at 12 months of age nationally. At 60 months of age, there was a marked variation between individual jurisdictions, ranging from coverage 8% lower in Indigenous children in South Australia to 6% higher in the Northern Territory. As previously documented, vaccines recommended for Indigenous children only (hepatitis A and pneumococcal polysaccharide vaccine) had suboptimal coverage at 60% and 68%, respectively. On-time receipt (before 49 months of age) of vaccines by Indigenous children at the 60-month milestone age improved between 2010 (18%) and 2011 (19%) but the disparity in on-time vaccination between Indigenous and non-Indigenous children increased at all 3 age milestones. The percentage of vaccine objectors in 2011 (1.7%) increased from 2007 when it was 1.1%. Coverage data for the 3rd dose of HPV from the national HPV register in the school catch up program was 71% but was substantially lower for the catch-up program for women outside school (39%–67%), although this was an improvement from 2010. *Commun Dis Intell* 2013;37(4):E291–E312.

Keywords: immunisation coverage, immunisation delay, small area coverage reporting, human papilloma virus vaccine

Introduction

This is the 5th annual immunisation coverage report, with the 1st report being in 2007.[1,2,3] It consolidates regular reports produced by the National Centre For Immunisation Research and Surveillance[4–16] using Australian Childhood Immunisation Register (ACIR) data and highlights important trends and significant issues over the preceding 12 months. It follows the format of the previous reports, providing a detailed summary for 2011. It includes vaccination coverage at standard milestone ages, coverage for vaccines not included in standard coverage assessments, timeliness of vaccination, coverage for Indigenous children and data for small geographic areas on vaccination coverage and prevalence of vaccine objectors. This report also includes data on adolescents who are not on the ACIR, from previously published sources. Readers are referred to the 2007 report for a more detailed explanation of the background to this series of annual reports and the range of analyses presented.[1] This report uses the long-standing international practice of reporting at key milestone ages, to measure coverage against national targets and to track trends over time. From July 2011, 13vPCV replaced 7vPCV on the National Immunisation Program (NIP) for all Australian children at 2, 4 and 6 months of age. In addition, a single supplementary dose of 13vPCV was funded for children aged 12–35 months who had not received a dose of 13vPCV or 10vPCV in their primary course. This 'supplementary dose' was available from October 2011 through to end of September 2012. It was also available through the NIP to medically at-risk and Indigenous children on the 3+1 schedule, to be given at least 2 months after the booster dose.

Incentives for vaccination and reporting to the Australian Childhood Immunisation Register up to December 2011

The ACIR makes information payments (up to $6) to all immunisation providers. Additional payments to general practitioners (GPs) for the provision of data to the ACIR have been in place since its inception in 1996. In the 2008–09 Budget one of the components of the General Practice Immunisation Incentives Scheme (GPII), the Service Incentive Payment (SIP), was discontinued effective from 1 October 2008. SIP payments of $18.50 had

previously been made to GPs for reporting all required vaccines on the NIP, at 6, 12, 18 months and 60 months.[17] However, the GPII Outcomes Payments, which pays practices that achieve levels of full immunisation amongst patients of 90% or greater, were maintained. The vaccines/antigens required for full immunisation in assessment for the outcomes payment in 2011 were the same as in recent years, i.e. diphtheria, *Haemophilus influenzae* type b (Hib), hepatitis B, measles, mumps, pertussis, polio, rubella and tetanus. Vaccines included in the NIP in 2011 but not required for the completed schedule assessment for provider payments were: meningococcal C vaccine (Men C); pneumococcal conjugate vaccine (PCV); and rotavirus vaccine. Varicella vaccine was also not included for coverage assessment but eligible providers received an information and SIP payment[1] (up to October 2008) for reporting, as varicella vaccine was the only vaccine required for completion of the 18-month schedule point. While the ACIR records vaccines available under the NIP only for Indigenous children in Queensland, the Northern Territory, Western Australia and South Australia (hepatitis A and 23vPPV) and vaccines not included in the NIP such as Bacille Calmette–Guérin, reporting of these does not attract a GPII payment.

In July 2004, the means test required to qualify for the Maternity Immunisation Allowance (MIA) was removed. This payment of $233 per child in 2008, was intended to provide motivation both to complete immunisation and for parents to prompt their provider to notify any outstanding reports to the ACIR before the child reached 24 months of age. In the 2008–09 budget, in addition to the changes mentioned above, it was announced that the MIA payment would be paid in 2 equal amounts of $167, with eligibility for the 2nd payment assessed between 48 and 60 months of age. This came into effect in January 2009, through a change in the National Due and Overdue Rules for Childhood Immunisation for all children born from 1 January 2005 onwards. This change stated that a child was due for their 48-month vaccinations at 48 months and overdue at 49 months of age, instead of overdue at 60 months of age. In July 2012, the MIA payment was ceased and the immunisation status of children aged 12, 24 and 60 months was linked to the existing Family Tax Benefit Part A supplement.

Table 1 shows the Australian National Immunisation Program Schedule for 2011.

Table 1: Australian National Immunisation Program Schedule in 2011

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		Rotavirus*	
12 months			Hib		MMR		Hep A†		Men C		
18 months						VZV	Hep A†‡	23vPPV†			
24 months							Hep A‡	23vPPV‡			
48 months		DTPa		Polio	MMR						
Adolescent vaccines											
12 years	Hep B§	dTpa				VZV§					HPV‖
15 years		dTpa								Flu¶,**	23vPPV††
Adult vaccines											
≥ 50 years										Flu¶,**	23vPPV¶
65 years										Flu**	23vPPV

* 3rd dose of rotavirus vaccine at 6 months is dependent on vaccine brand used in state or territory

† Aboriginal and Torres Strait Islander children in Western Australia and the Northern Territory

‡ Aboriginal and Torres Strait Islander children in Queensland and South Australia

§ Catch-up only

‖ Females only

¶ For Aboriginal people only

** Annual vaccination, all aged ≥6 months with medical risk factors, non-Aboriginal adults ≥65 years

†† Aboriginal adults with medical risk factors

Methods

The Australian Childhood Immunisation Register

The ACIR was established on 1 January 1996, by incorporating demographic data from Medicare for all enrolled children under the age of 7 years.[5] Participation in the ACIR is opt-out so it constitutes a nearly complete population register, as approximately 99% of children are registered with Medicare by 12 months of age.[5] Children not enrolled in Medicare can also be added to the ACIR via a supplementary number. Since 2001, immunisations given overseas may be recorded if a provider endorses their validity. Data are transferred to the ACIR when a recognised immunisation provider supplies details of an eligible immunisation either automatically from medical practice software or through the Internet using the Medicare Australia web site or by submitting paper encounter forms. The existence of medical contraindications and conscientious objection to immunisation is also recorded on the ACIR. All vaccination records for a child remain on the register indefinitely, but no new immunisation encounter records are added after the 7th birthday.

Immunisations recorded on the register must be given in accordance with the guidelines issued by the National Health and Medical Research Council as stated in *The Australian Immunisation Handbook*.[18] Notifications falling outside these guidelines or duplicate notifications prompt an enquiry with the provider and, if their validity cannot be established, they are rejected.

Measuring immunisation coverage using the Australian Childhood Immunisation Register

The cohort method has been used for calculating coverage at the population level (national and state or territory)[19] since the ACIR's inception. Cohort immunisation status is assessed at 12 months of age (for vaccines due at 6 months), 24 months of age (for vaccines due at 12 months), and 60 months of age (for vaccines due at 48 months). A minimum 3-month lag period is allowed for late notification of immunisations to the register, but only immunisations given on or before a child's 1st, 2nd or 5th respective birthdays are considered.[19] If a child's records indicate receipt of the last dose of a vaccine that requires more than 1 dose to complete the series, it is assumed that earlier vaccinations in the sequence have been given. This assumption has been shown to be valid.[7,8]

Three-month birth cohorts are used for time trend analyses, while 12-month wide cohorts are used for other analyses in this report such as for small area coverage analysis and mapping of coverage estimates. The 12-month wide cohorts used in this report are children born between 1 January and 31 December 2010 for the 12-month milestone age; children born between 1 January and 31 December 2009 for the 24-month milestone age; and children born between 1 January and 31 December 2006 for the 5-year (60-month) milestone age.

The proportion of children designated as being 'fully immunised' is calculated using the number of children completely immunised with the vaccines of interest by the designated age as the numerator, and the total number of Medicare-registered children in the age cohort as the denominator. 'Fully immunised' at 12 months of age was defined as a child having a record on the ACIR of a 3rd dose of the combined DTPa-hepB-IPV-Hib vaccine. 'Fully immunised' at 24 months of age was defined as a child having a record on the ACIR of a 3rd dose of the combined DTPa-hepB-IPV-Hib vaccine, a 4th dose of *Haemophilus influenzae* type b (PRP-T) vaccine, and a 1st dose of a measles, mumps and rubella-containing (MMR) vaccine. 'Fully immunised' at 60 months of age was defined as a child having a record on the ACIR of a 4th dose of combined DTPa-IPV vaccine, and a 2nd dose of an MMR-containing vaccine.

Immunisation coverage estimates were also calculated for individual NIP vaccines, including the 6 NIP vaccines not routinely reported in *Communicable Disease Intelligence* (CDI) and not part of 'fully immunised' calculations at 12 and 24 months of age. They were: a 3rd dose of PCV and 2nd or 3rd dose of rotavirus vaccine by 12 months of age; a 1st dose of varicella vaccine and a 1st dose of Men C vaccine by 24 months of age; a 2nd dose of hepatitis A vaccine in Indigenous children by 30 or 36 months of age; and a dose of 23vPPV vaccine in Indigenous children by 36 months of age.

Changes to immunisation policy and changes to the 'fully immunised' coverage algorithms have had an impact on vaccination coverage presented in this report. In December 2007, the coverage algorithm for immunisations due at 48 months of age was changed to assess children at 60 months, not 72 months of age. In January 2009, changes were made to the overdue rules so that children were classified as overdue for pre-school boosters at 49 months instead of the previous 60 months of age. This applied to parental and provider incentive payments. In March 2009, a recommendation was made by the Australian Technical Advisory Group on Immunisation (ATAGI) to parents and immunisation providers to consider bringing the 1st dose of DTPa forward to 6 weeks of age to

provide earlier protection against pertussis infection. From the September 2009 coverage assessment date onwards, changes were made in the coverage calculation algorithms that tightened the rules regarding receipt of Hib and hepatitis B vaccines for children aged 12 and 24 months of age. Prior to September 2009, if a child aged 12 months of age had a record on the ACIR of a 2nd or 3rd dose of any child Hib vaccine, he or she was considered 'fully vaccinated'. From September 2009, a child needed a record on the ACIR of a 3rd dose of any Hib vaccine or a 2nd dose of either PedvaxHIB or Comvax to be assessed as 'fully vaccinated'. Prior to September 2009, if a child aged 12 months of age had a record on the ACIR of a 2nd or 3rd dose of any hepatitis B vaccine, he or she was considered 'fully vaccinated'. From September 2009, a child needed a record on the ACIR of a 3rd dose of any hepatitis B vaccine or a 2nd dose of either Engerix B (paediatric), Comvax, or HBVAX II (paediatric), to be assessed as 'fully vaccinated'. In October 2009, a recommendation was made by the Australian Technical Advisory Group on Immunisation that the 4th dose of DTPa containing vaccine can be given from 42 months of age instead of the previously recommended 48 months of age.

Timeliness

Age-appropriate immunisation was defined as receipt of a scheduled vaccine dose within 30 days of the recommended age. For example, a child who received the 1st dose of DTPa (due at 60 days of age) when he or she was more than 90 days of age was classified as late for that dose. For descriptive purposes, we categorised the outcome measure for each dose as either vaccine dose 'no delay', 'delay of between 1 to 6 months', or 'delay greater than 6 months'. Doses received 'too early' (more than 30 days prior to when it was due), and doses never administered or recorded were excluded. Timeliness is measured in 12-month birth cohorts. Children included in the timeliness analysis were assessed at 1–2 years after doses were due, to allow time for late vaccinations to be recorded. 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 also compared by plotting the cumulative percentage receiving each vaccine dose by age, with the proportion ever immunised set at 100%.

Remoteness status

The area of residence of children was defined as accessible or remote using the Accessibility/ Remoteness Index of Australia (ARIA), which was developed by the then Department of Health and Aged Care, and proposed as the national standard measure of remoteness for inclusion in the Australian Bureau of Statistics (ABS) 2001 census.[20] For the timeliness analysis, we defined the 2 ARIA categories with most restricted access to services as 'remote' (approximately 2.6% of the Australian population) and all other areas as 'accessible'.

Indigenous status

Indigenous status on the ACIR is recorded as 'Indigenous', 'non-Indigenous' or 'unknown', as reported by the child's carer to Medicare, or by the immunisation provider to the ACIR. This report considers 2 categories of children: 'Indigenous' and 'non-Indigenous': children with unknown Indigenous status were presumed to be 'non-Indigenous'. Coverage estimate time trends are presented from 2004 only, due to poor rates of reporting of Indigenous status prior to then.[21]

Small area coverage

Coverage was calculated for ABS-defined Statistical Subdivisions (SSD),[22] chosen because each is small enough to show differences within jurisdictions but not too small to render maps unreadable. Maps were created using version 10 of the MapInfo mapping software[23] and the ABS Census Boundary Information. As postcode is the only geographical indicator available from the ACIR, the ABS Postal Area to Statistical Local Area Concordance 2006 was used to match ACIR postcodes to SSDs, in order to create a SSD field for each child in the relevant study cohorts.[24]

Vaccine objection / no vaccines recorded

A child must be registered with Medicare before their parent(s) can lodge an official objection to immunisation. Parents can also object to immunisation and also object to lodging any official objection to the ACIR. This report uses the percentage of children with no vaccines recorded on the ACIR as a proxy measure of the number of these children.[16] Some children with no vaccines recorded on the ACIR are officially registered as 'vaccine objectors' and some are not registered as such. Registered vaccine objectors are eligible for parent incentive payments even if their children are unvaccinated. The proportion of vaccine objectors and children with no vaccines recorded by region were calculated from the cohort of children registered with Medicare, and born between 1 January 2005 and 31 December 2010. At the time of data extraction on 31 March 2012, they were between 12 and 72 months of age. This cohort was chosen when calculating proportions so that children under the age of 12 months

were not included, to allow sufficient time for registration of objection and exclude infants late for vaccination.

Human papillomavirus vaccine coverage

The human papillomavirus (HPV) vaccination program is listed on the NIP Schedule, funded under the Immunise Australia Program, and delivered to girls through an ongoing school-based program usually in the first year of secondary school. From 2007 to 2009 there was a time-limited catch-up program delivered through schools, general practices and community immunisation services for girls up to age 26. Immunisation against HPV is achieved with a course of 3 doses of vaccine, over a 6 month period. Data on the National HPV Vaccination Program are provided by the National HPV Vaccination Program Register, which is operated by the Victorian Cytology Service. The purpose of this legislated register is to support the implementation of the vaccination program and to provide data for monitoring and evaluation.[25] States and territories provide data to the Register from their school based programs. Doses administered in general practice or by community providers outside of the school program are notified on a voluntary basis, with a notification payment provided only to GPs during the 2007–2009 catch up program. The World Health Organization proposes using 15 years as the reference age for HPV vaccination coverage for the purposes of international comparison. Data on HPV coverage as notified to the HPV Register was obtained from the Immunise Australia web site.[26]

Coverage in the elderly

As there has not been an Adult Vaccination Survey (AVS)[27] undertaken in Australia since 2009, no data are presented in this 2011 report on influenza and pneumococcal (23vPPV) vaccination coverage in the elderly. The next AVS is planned for 2014.

Results

Coverage estimates

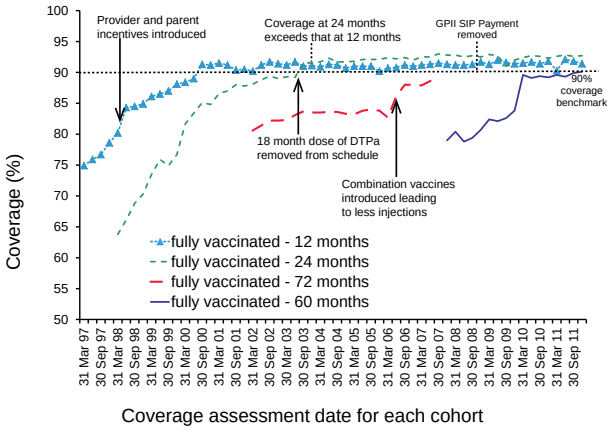
Overall

Nationally and for most jurisdictions, 'fully immunised' coverage and coverage for all individual vaccines (except rotavirus and varicella vaccines) for the 12-month and 24-month age groups exceed the 1993 Immunise Australia Program's target of 90% (Tables 2 and 3). However, coverage in Western Australia was below this target for hepatitis B and 'fully immunised' at 12 months of age. Recorded national 'fully immunised' coverage for the 60-month age group is marginally below the target, at 89.5% for all vaccines, and lower in particular jurisdictions such as Queensland, South Australia, and Western Australia (Table 4). For individual vaccines for this age group, coverage is below 90.0% for all vaccines in the Northern Territory, South Australia, and Western Australia and over 90% in all other jurisdictions.

There is a clear trend of increasing vaccination coverage over time for all age groups assessed, with the 2 youngest age cohorts having the highest coverage (Figure 1). The proportion 'fully immunised' at 12 months of age increased steadily from 75% for the 1st cohort in 1997 to 91.4% by 31 December 2011. At the 24-month milestone, 'fully immunised' coverage estimates also increased steadily from 64% for the 1st cohort to 92.2% by December 2011. 'Fully immunised' coverage estimates assessed at 72 months of age, for vaccines due at 48 months, were first reported in *CDI* in 2002, and increased steadily from 80.6% in early 2002 to 87.3% in late 2007, including a noticeable increase in June 2006, corresponding with the introduction of combination vaccines. However, from the beginning of 2008, when the assessment age was changed from 72 months to 60 months, 'fully immunised' coverage was substantially lower at 80.7% in December 2008, related to delayed immunisation. However, during 2009 and 2010, coverage for this age group rose substantially. Coverage calculated at 60 months was largely unchanged during the latter half of 2011 at 89.5% (Figure 1).

Coverage estimates for the 24-month age group increased substantially and suddenly in September 2003 to 91.6%, following the removal from the immunisation schedule of the 4th dose of DTPa (due at 18 months of age) from this quarter onwards (Figure 1). Coverage estimates for the

Figure 1: Trends in 'fully immunised' vaccination coverage estimates, Australia, 1997 to 2011, by age cohort



By 3-month birth cohorts born between 1 January 1996 and 31 December 2010. Coverage assessment date was 12 months after the last birth date of each cohort.

Source: Australian Childhood Immunisation Register.

Table 2: Percentage of children in 2011 vaccinated by 12 months of age, by vaccine and state or territory*

Vaccine	State or territory								
	ACT	NSW	NT	Qld	SA	Tas.	Vic.	WA	Aust.
Total number of children	5,110	96,942	3,692	61,789	19,468	6,058	71,943	31,551	296,553
Diphtheria, tetanus, pertussis (%)	94.2	92.1	91.7	91.8	92.1	92.4	93.1	90.5	92.1
Poliomyelitis (%)	94.1	92.1	91.7	91.7	92.1	92.4	93.1	90.4	92.1
Haemophilus influenzae type b (%)	93.8	91.7	91.3	91.5	91.8	92.2	92.7	90.1	91.8
Hepatitis B (%)	93.3	91.6	91.4	91.4	91.8	92.2	92.5	89.7	91.6
Fully immunised† (%)	92.9	91.3	91.3	91.2	91.6	92.0	92.2	89.5	91.4
Rotavirus (%)	89.0	86.5	84.0	80.9	84.0	87.1	83.5	77.5	83.8
PCV (%)	93.2	91.3	91.3	91.1	91.4	91.7	92.1	89.2	91.3

* For the birth cohort born in 2010

† 'Fully immunised' – 3 doses of a diphtheria (D), tetanus (T) and pertussis-containing (P) vaccine, 3 doses of polio vaccine, 2 or 3 doses of PRP-OMP-containing *Haemophilus influenzae* type b (Hib) vaccine or 3 doses of any other Hib vaccine, and 2 or 3 doses of Comvax hepatitis B vaccine or 3 doses of all other hepatitis B vaccines.

Table 3: Percentage of children in 2011 vaccinated by 24 months of age, by vaccine and state or territory*

Vaccine	State or territory								
	ACT	NSW	NT	Qld	SA	Tas.	Vic.	WA	Aust.
Total number of children	5,149	98,290	3,790	62,626	19,785	6,455	72,551	32,025	300,671
Diphtheria, tetanus, pertussis (%)	95.4	94.5	95.2	94.5	94.6	95.1	95.2	93.3	94.6
Poliomyelitis (%)	95.4	94.4	95.2	94.5	94.6	95.1	95.2	93.2	94.5
Haemophilus influenzae type b (%)	95.4	94.7	94.8	94.4	94.4	95.6	95.1	93.4	94.6
Hepatitis B (%)	94.3	94.0	94.8	94.0	94.0	94.9	94.6	92.6	94.0
Measles, mumps, rubella (%)	94.7	93.7	94.8	93.9	93.7	95.0	94.5	92.6	93.9
Fully immunised† (%)	92.9	92.0	92.8	92.4	92.2	93.7	92.9	90.6	92.2
Varicella (%)	87.1	82.8	85.7	86.7	83.2	84.1	84.3	80.7	83.9
MenC (%)	94.2	93.3	94.4	93.6	93.6	95.0	94.1	91.8	93.5

* For the birth cohort born in 2009.

† Fully immunised' – 3 or 4 doses of a DTPa-containing vaccine, 3 doses of polio vaccine, 3 or 4 doses of PRP-OMP-containing Hib vaccine or 4 doses of any other Hib vaccine, 3 or 4 doses of Comvax hepatitis B vaccine or 4 doses of all other hepatitis B vaccines, and 1 dose of a measles, mumps and rubella-containing (MMR) vaccine.

Table 4: Percentage of children vaccinated by 60 months of age, 2011, by vaccine and state or territory*

Vaccine	State or territory								
	ACT	NSW	NT	Qld	SA	Tas.	Vic.	WA	Aust.
Total number of children	4,928	96,218	3,497	61,704	19,403	6,462	71,939	31,653	295,804
Diphtheria, tetanus, pertussis (%)	91.9	90.1	89.4	90.4	87.5	91.2	91.5	86.6	90.0
Poliomyelitis (%)	91.9	90.1	89.5	90.4	87.5	91.3	91.6	86.6	90.0
Measles, mumps, rubella(%)	91.6	90.0	89.4	90.2	87.3	91.2	91.4	86.5	89.9
Fully immunised (%)	91.2	89.6	88.9	89.9	86.9	90.7	91.0	85.9	89.5

* For the birth cohort born in 2006.

† 'Fully immunised' – 4 or 5 doses of a DTPa-containing vaccine, 4 doses of polio vaccine, and 2 doses of an MMR-containing vaccine.

12-month age group have, however, remained steady over the past 10 years, fluctuating around the 91% level.

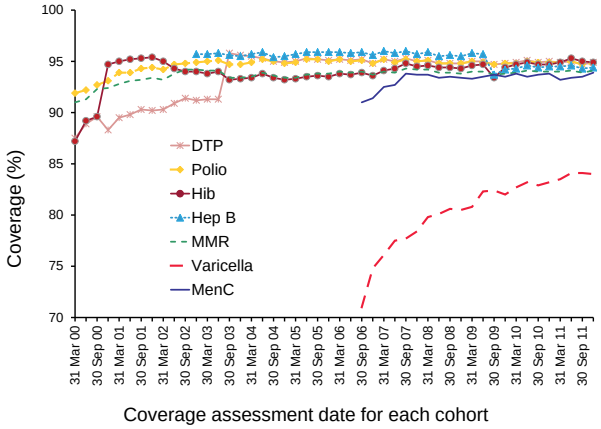
Individual vaccines

DTPa and polio coverage at 12 months of age remained relatively stable from the latter part of 2001 until 2011 (Figure 2). Coverage for the Hib and hepatitis B vaccines at 12 months of age (prior to the change in algorithm to measure coverage that occurred in the latter half of 2009) are becoming similar to those for DTPa and polio in the last 2 cohorts of 2009 and all of 2010 and 2011 and to more accurately reflect the situation (Figure 2). Coverage for PCV rose steadily from below 90% in mid-2007 to be just below that for all other vaccines due at this age at around 91%, except for rotavirus vaccine. Rotavirus vaccine coverage rose steeply from late 2008 from below 70% to almost 84% in late 2011 (Figure 2).

For most of the study period, at 24 months of age, hepatitis B coverage was higher than for all other vaccines at just under 95%, due to the different coverage algorithm described above (Figure 3). Coverage was lowest for MMR and Hib, the only vaccines that have a 12-month dose used in calculations, but in 2011 coverage is similar for all vaccines at around 94%–95%, except for varicella vaccine.

There was a marked increase in coverage for individual vaccines at 60 months of age following the change in the due or overdue rules in January 2009, with coverage increasing to levels similar to when coverage was assessed at 72 months of age

Figure 3: Trends in vaccination coverage estimates for individual vaccines at 24 months of age (DTP, polio, Hib, hepatitis B, measles, MMR, meningococcal C, and varicella),* Australia, 1999 to 2011

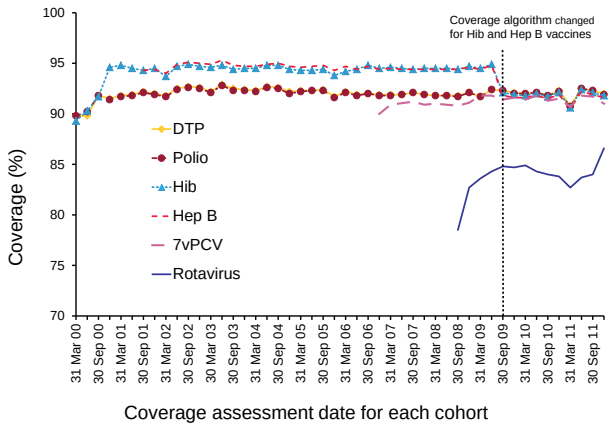


* 3rd or 4th dose of DTP, 3rd dose of polio, 3rd or 4th dose of Hib, 2nd or 3rd dose of Hep B, 1 dose of MMR, meningococcal C, and varicella.

By 3-month birth cohorts born between 1 January 1997 and 31 December 2009. Coverage assessment date was 24 months after the last birth date of each cohort.

Source: Australian Childhood Immunisation Register.

Figure 2: Trends in vaccination coverage estimates for individual vaccines at 12 months of age (DTP, polio, Hib, hepatitis B, 7-valent pneumococcal, and rotavirus),* Australia, 1999 to 2011

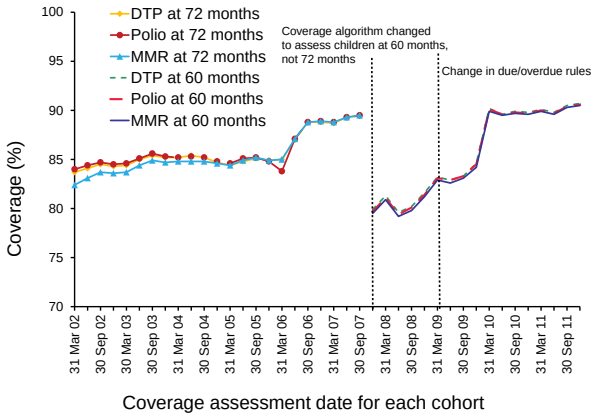


* 3rd dose of DTP, polio, and 7-valent pneumococcal, 2nd or 3rd dose of Hib, Hep B, and rotavirus.

By 3-month birth cohorts born between 1 January 1999 and 31 December 2010. Coverage assessment date was 12 months after the last birth date of each cohort.

Source: Australian Childhood Immunisation Register.

Figure 4: Trends in vaccination coverage estimates for individual vaccines (DTP, polio, and MMR)* at 60 months of age (6 years prior to December 2007), Australia, 2002 to 2011



* 4th dose of DTP and polio, 2nd dose of MMR

By 3-month birth cohorts born between 1 January 1996 and 31 December 2006. Coverage assessment date was 72 months after the last birth date of each cohort up to December 2007 and then 60 months after the last birth date of each cohort.

Source: Australian Childhood Immunisation Register.

(Figure 4). Coverage for all individual vaccines is at 90% in 2011 (Table 4), probably related, in part, to completed immunisation by 48 months of age being introduced in 2009 as a requirement for GP incentive payments.

Coverage estimates for Indigenous children

Immunisation coverage is lower for Indigenous children than non-Indigenous, particularly at 12 months and 60 months, with little or no difference at 24 months of age (Table 5). The difference in coverage at 12 months of age has been relatively consistent for the past 4 years.[1,2,3] The coverage differential between Indigenous and non-Indigenous children for individual vaccines varies, with coverage at 24 months of age for most vaccines being almost identical for both groups and greater among Indigenous children for Hib, hepatitis B, MMR and meningococcal C vaccines.

The proportion of children 'fully immunised' by 24 months of age has consistently remained higher than at 12 months and 60 months of age (Figure 5). As for non-Indigenous children, coverage at 60 months of age for Indigenous children increased following the change in due or overdue rules. Coverage at the end of 2011 was higher at 60 months than at 12 months.

Although coverage was lower among Indigenous children in all jurisdictions, the extent of the difference varied, reaching a 15 percentage point differential in South Australia and a 9 percentage

Table 5: Vaccination coverage estimates, 2011, by age, vaccine and Indigenous status

Vaccine	Milestone age	Indigenous	Non-Indigenous
DTP	12 months*	85.3	92.5
	24 months†	94.2	94.6
	60 months‡	87.3	90.1
Polio	12 months*	85.3	92.4
	24 months†	94.1	94.6
	60 months‡	87.3	90.1
Hib	12 months*	85.2	92.1
	24 months†	94.8	94.6
	60 months‡	N/A§	N/A§
Hep B	12 months*	85.3	92.0
	24 months†	94.1	94.0
	60 months‡	N/A§	N/A§
MMR	12 months*	N/A§	N/A§
	24 months†	94.7	93.8
	60 months‡	87.5	90.0
Varicella	12 months*	N/A§	N/A§
	24 months†	82.1	84.0
	60 months‡	N/A§	N/A§
Meningococcal C	12 months*	N/A§	N/A§
	24 months†	94.3	93.4
	60 months‡	N/A§	N/A§
PCV	12 months*	85.2	91.6
	24 months†	N/A§	N/A§
	60 months‡	N/A§	N/A§
Rotavirus	12 months*	71.1	84.8
	24 months†	N/A§	N/A§
	60 months‡	N/A§	N/A§

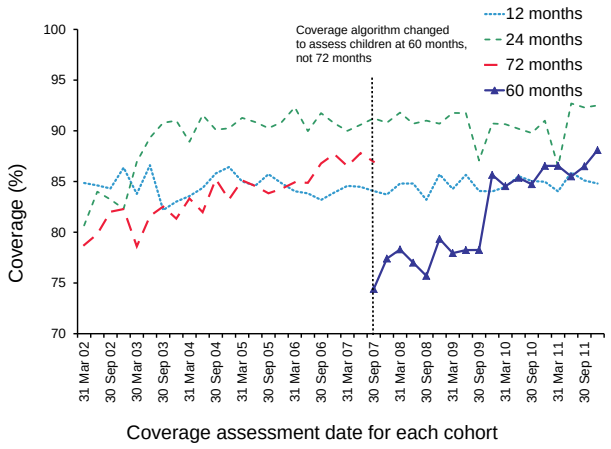
* Birth cohort born 1 January – 31 December 2010.

† Birth cohort born 1 January – 31 December 2009.

‡ Birth cohort born 1 January – 31 December 2006.

§ Not included in coverage estimates for that group.

Figure 5: Trends in 'fully immunised' vaccination coverage estimates for Indigenous children in Australia, 2002 to 2011, by age cohorts



point differential in Western Australia (Table 6). By age 24 months, the coverage disparity between Indigenous and non-Indigenous children ranged from 4 percentage points higher in the Northern Territory to 5 percentage points lower in South Australia (Table 6).

At 60 months of age, there was large variation between individual jurisdictions, ranging from coverage 8 percentage points lower in Indigenous children in South Australia to 6 percentage points higher in the Northern Territory, compared to non-Indigenous children (Table 6).

Coverage for National Immunisation Program vaccines not routinely reported elsewhere

Pneumococcal conjugate vaccine and rotavirus

7vPCV was first added to the NIP in January 2005 and was replaced in July 2011 by 13vPCV for all Australian children at 2, 4 and 6 months of age. Since coverage was first calculated for this vaccine in early 2006, it has remained high, with a slight increase from 89% to 91.3% (Figure 2). Coverage is greater than the 1993 Immunise Australia Program target of 90% in all jurisdictions except for Western Australia where it is very close to 90% (Table 2).

Rotavirus vaccine was added to the NIP in July 2007, so coverage for 2 or 3 doses (depending on vaccine) at 12 months of age could be calculated only from the December 2008 quarter onwards. Rotavirus coverage was lower nationally (Figure 2), and had greater variation between

Table 6: Percentage of children fully immunised by 12 months, 24 months and 60 months of age, 2011, by Indigenous status and state or territory

	State or territory								
	ACT	NSW	NT	Qld	SA	Tas.	Vic.	WA	Aust.
12 months – fully immunised (%)*									
Indigenous	86.7	86.7	89.8	84.8	77.6	91.9	85.4	80.6	85.2
Non-Indigenous	93.1	91.5	92.2	91.7	92.1	92.0	92.3	90.0	91.7
12 months – fully immunised (incl rotavirus & PCV) (%)									
Indigenous	79.7	75.0	74.3	65.5	64.7	82.5	68.0	59.1	69.0
Non-Indigenous	87.0	83.8	85.3	83.5	85.4	83.6	84.2	79.7	83.6
24 months – fully immunised (%)†									
Indigenous	91.9	91.7	95.2	92.9	87.8	94.0	90.9	90.4	92.2
Non-Indigenous	92.9	92.0	91.2	92.4	92.4	93.6	92.9	90.6	92.2
24 months – fully immunised (incl varicella & MenC) (%)									
Indigenous	84.9	78.0	85.9	82.9	72.3	82.3	76.6	74.7	79.9
Non-Indigenous	85.2	80.9	82.5	85.4	82.1	82.6	82.7	79.0	82.3
60 months – fully immunised (%)‡									
Indigenous	90.3	86.1	92.2	88.8	79.0	90.2	86.9	81.6	86.8
Non-Indigenous	91.2	89.8	86.5	89.9	87.1	90.8	91.1	86.2	89.6

* 'Fully immunised' – 3 doses of a diphtheria (D), tetanus (T) and pertussis-containing (P) vaccine, 3 doses of polio vaccine, 2 or 3 doses of PRP-OMP-containing *Haemophilus influenzae* type b (Hib) vaccine or 3 doses of any other Hib vaccine, and 2 or 3 doses of Comvax hepatitis B vaccine or 3 doses of all other hepatitis B vaccines.

† 'Fully immunised' – 3 or 4 doses of a DTPa-containing vaccine, 3 doses of polio vaccine, 3 or 4 doses of PRP-OMP-containing Hib vaccine or 4 doses of any other Hib vaccine, 3 or 4 doses of Comvax hepatitis B vaccine or 4 doses of all other hepatitis B vaccines, and 1 dose of a measles, mumps and rubella-containing (MMR) vaccine.

‡ 'Fully immunised' – 4 or 5 doses of a DTPa-containing vaccine, 4 doses of polio vaccine, and 2 doses of a MMR-containing vaccine.

jurisdictions compared to other vaccines given at 2, 4 and 6 months, which may be due to the strict upper age limits for this vaccine. Reported coverage in 2011 for 2 doses of Rotarix® or 3 doses of Rotateq® vaccine at 12 months of age varied from 77.5% in Western Australia (Rotateq®) to 87.1% and 89% in Tasmania and the Australian Capital Territory (both Rotarix®) respectively (Table 2).

Meningococcal C and varicella

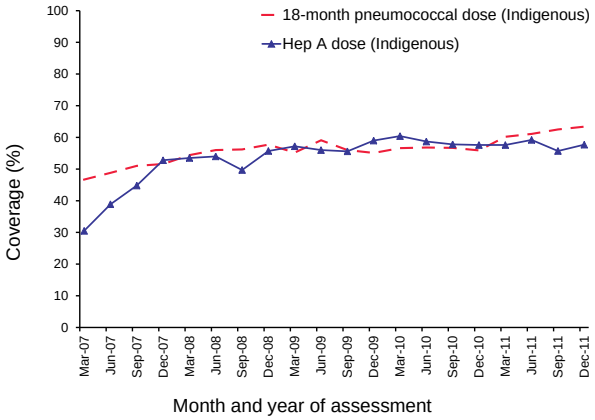
Meningococcal C vaccine was added to the NIP in January 2003. Since coverage was first calculated for this vaccine in early 2006, it has remained at high levels, with an increase over 2 years from 88% to almost 94% (Figure 3). There was little variation in 2011 by jurisdiction with all jurisdictions experiencing coverage levels greater than 91% and some, the Northern Territory and Tasmania, approaching or at 95% (Table 3).

Varicella vaccine was added to the NIP in November 2005. Reported coverage for this vaccine has consistently been 10 to 15 percentage points lower than that for all the other vaccines assessed at the 24-month milestone, being 84% for the latest assessment in 2011 (Figure 3). This is probably partly due to the shorter time varicella has been on the NIP and the age of administration (18 months). The 18-month schedule point was historically associated with lower coverage when there was an 18-month pertussis booster prior to 2003. Between 2003 and 2005, there was a gap of over 2 years when no vaccine was administered at 18 months. Also there is a shorter time period to catch up for varicella vaccination (6 months) compared with other vaccines. Reported varicella vaccine coverage in 2011 also shows considerable variation by jurisdiction from 80.7% in Western Australia to 87.1% in the Australian Capital Territory (Table 3). Data are also available from the ACIR on the number of reports from GPs stating that children born since May 2004 have natural immunity to varicella and do not require varicella vaccination. Reports of natural immunity to varicella total greater than 20,000 since May 2004 (not shown), corresponding to approximately 1.1% of the cohort. It is likely that there is under-reporting of presumed natural immunity by GPs but this is unlikely to fully account for lower varicella coverage.

Hepatitis A and 23vPPV

Hepatitis A vaccine was available in Australia prior to the inception of the ACIR in 1996 and has been included on the NIP for Indigenous children in the Northern Territory, South Australia, Western Australia, and in Queensland since November 2005, but was used earlier than this in north Queensland. Since March 2007, coverage of 2 doses of hepatitis A vaccine for Indigenous children by 30 months of age in Western Australia and the Northern Territory and 36 months of age in Queensland and South Australia has increased from 31% to 58% in December 2011 (Figure 6). An additional 8% of children had received 1 dose of hepatitis A vaccine by 18 or 24 months of age, putting national coverage for at least 1 dose of hepatitis A vaccine for 2012 at 66% in Indigenous children compared with 58% for 2 doses (Table 7). There is a variation in reported hepatitis A vaccine coverage by jurisdiction, from a low of 33% in South Australia to a high of 81.2% in the Northern Territory (Table 7).

Figure 6: Trends in coverage estimates for hepatitis A* and pneumococcal polysaccharide (23vPPV) vaccines for Indigenous children, Australia, 2007 to 2011



* Two doses assessed at 30 months for Western Australia and the Northern Territory. Two doses assessed at 36 months for Queensland and South Australia.

Table 7: Vaccination coverage* for hepatitis A and 23vPPV, Northern Territory, Queensland, South Australia and Western Australia, 2011, by state or territory

	Vaccine type	
State or territory	Hep A	23vPPV
NT	81.2 (84.6)	83.7
Qld	53.1 (62.0)	62.8
SA	33.0 (52.7)	47.6
WA	55.5 (66.5)	54.9
Aust	57.7 (66.0)	63.4

* For the last 3-month cohorts assessable in 2011.

† Indigenous only: 2 doses by 30 months of age for Western Australia and the Northern Territory (1 dose by 18 months of age), 2 doses by 36 months of age for Queensland and South Australia (1 dose by 24 months of age).

‡ Indigenous only: 1 dose by 36 months of age.

The 23vPPV has been recommended for Indigenous children in the Northern Territory, South Australia, Western Australia, and Queensland as a booster at 18–24 months of age since 2001. Coverage has gradually increased from 47% in March 2007 to 63% in December 2011 (Figure 6). From 2010 to 2011, coverage increased by 7 percentage points. There is a large variation in 23vPPV coverage by jurisdiction from a low of 48% in South Australia to a high of 84% in the Northern Territory (Table 7).

Timeliness of immunisation

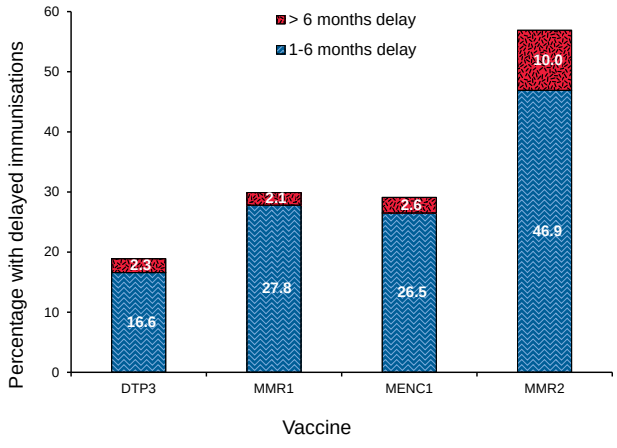
Timeliness has been examined for vaccines requiring both multiple doses (DTPa, 7vPCV and MMR) and a single dose (Men C) at 12 and 24 months of age.

Since 2004, the proportion of children with timely receipt of the 3rd dose of DTP vaccine has remained at 88% (not shown). Across the 5-year period, 2004 to 2008, timely receipt of 1 dose of MMR rose 3 percentage points, although estimated coverage by 24 months of age remained stable at almost 94% (not shown).

As demonstrated in previous studies, the proportion of children with vaccination delay increased with older age (Figure 7). The greatest proportion with any delay was seen with the 2nd dose of MMR vaccine with 57% of doses given late and 10% given more than 6 months late. This analysis is for doses due in 2009 allowing up to 3 years for capturing delayed doses, as explained in the methods. This is a considerable improvement on the 2010 report where the corresponding figures were 65% and 24%. Further improvements are expected in future analyses that reflect more recent improvements in timely receipt of the 2nd dose of MMR (Figure 4).

For the 3rd dose of DTPa, there was greater delay for Indigenous children than non-Indigenous children, with a 22% differential in on-time vaccination at < 7 months of age (Figure 8). The same pattern was found for timeliness of the 1st dose of MMR, but with a smaller differential in on-time vaccination at < 13 months of age of 13% (Figure 9). Although Indigenous children had only slightly lower coverage than non-Indigenous chil-

Figure 7: Vaccination delay for cohorts born in 2009 (DTP3, MMR1, MENC1) and 2005 (MMR2)



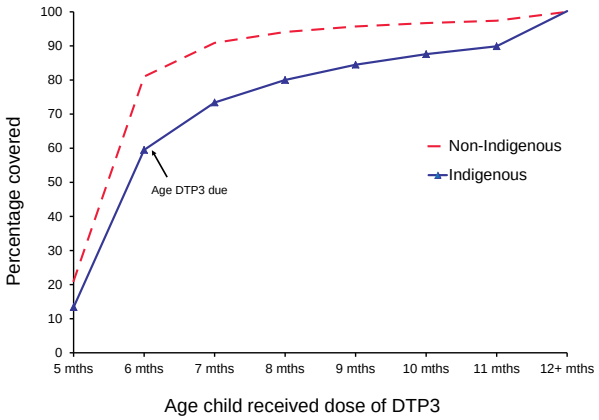
DTP3 = 3rd dose of a diphtheria (D), tetanus (T) and pertussis-containing (P) vaccine

MMR1 = 1st dose of a measles, mumps and rubella vaccine

MENC1 = 1st dose of a meningococcal C vaccine

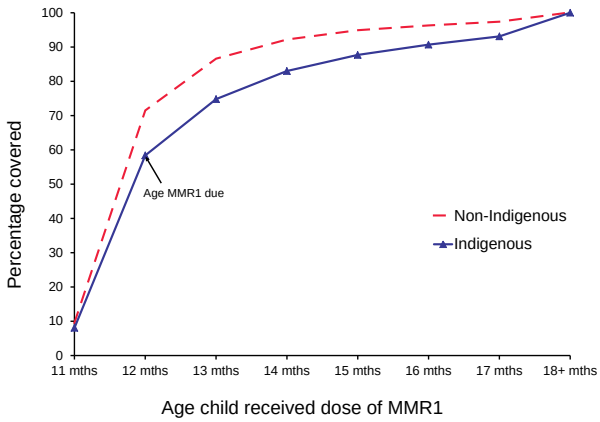
MMR2 = 2nd dose of a measles, mumps and rubella vaccine

Figure 8: Timeliness* of the 3rd dose of DTP vaccine (DTP3) for the cohort born in 2009, by Indigenous status



* Percentage covered = number of children who received vaccine dose at particular ages/the total number of children who received the vaccine dose

Figure 9: Timeliness* of the 1st dose of MMR vaccine (MMR1) for the cohort born in 2009, by Indigenous status



* Percentage covered = number of children who received vaccine dose at particular ages/the total number of children who received the vaccine dose.

dren by 24 months of age, they were more likely to have delayed vaccination and this differential in on-time vaccination between Indigenous and non-Indigenous continues to increase (the corresponding differential for the 1st dose of MMR from the 2010 report was 11%).

Vaccination with the 3rd dose of DTPa and the 1st dose of MMR was delayed by more than 1 month for 29%–38% of Indigenous children and 16%–29% of non-Indigenous children (Table 8). The proportion with long delays (i.e. greater than 6 months) was 2 to 4 times higher in Indigenous children than in non-Indigenous children, with no great differences between accessible and remote areas or vaccines. Delays of 1 to 6 months were also more frequent for Indigenous children, although less marked, especially for the 1st dose of MMR. The proportion with short delays was greater among Indigenous children residing in remote areas than in accessible areas for the 3rd dose of DTP vaccine (37% versus 29%), but not for the 1st dose of MMR.

Vaccination delay for Indigenous children by jurisdiction was measured for the 3rd dose of PCV, with greater delays in Western Australia (45.8%) and the Northern Territory (41.5%) (Figure 10). The proportion of children with long delays in South Australian Indigenous children increased from the previous report in 2010 (from 5.8% to 6.2%) but decreased in Indigenous children from the Northern Territory (6.9% to 4.4%). There were no important differences in vaccination delay for non-Indigenous children by jurisdiction (not shown).

In contrast to earlier reports, analysis of timeliness of immunisation for a vaccine due at 48 months of age, the 2nd dose of MMR, showed a large difference in delay in receiving this vaccine for non-Indigenous children and Indigenous children, with a 11.0% differential at 51 months of age (Figure 11). However, timeliness for both groups was improved from the previous report in 2010.

Figure 10: Vaccination delay for Indigenous children for the 3rd dose of pneumococcal conjugate vaccine for the cohort born in 2009, by state or territory

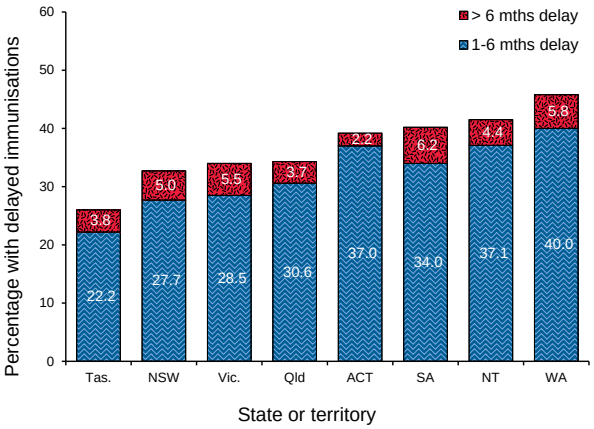
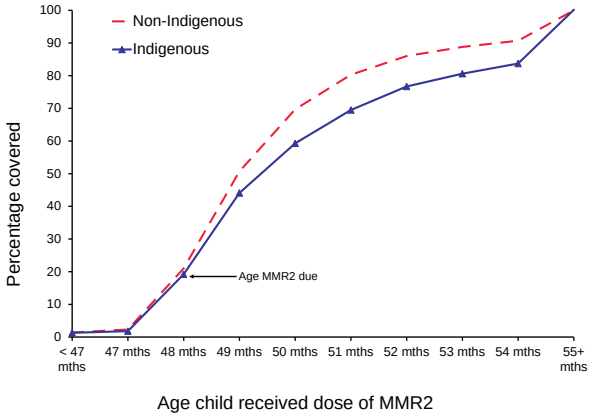


Figure 11: Timeliness* of the 2nd dose of MMR vaccine (MMR2) for the cohort born in 2005, by Indigenous status



* Percentage covered = number of children who received vaccine dose at particular ages/the total number of children who received the vaccine dose.

Table 8: Vaccination delay for the cohort of children born in 2009, Australia, by Indigenous and remoteness status

Vaccine dose	Indigenous status	Remoteness	1–6 months delay %	> 6 months delay %
DTP3	Indigenous	Accessible	29.2	8.7
		Remote	37.2	7.1
	Non-Indigenous	Accessible	15.9	2.0
		Remote	15.7	1.9
MMR1	Indigenous	Accessible	37.8	5.4
		Remote	36.3	3.9
	Non-Indigenous	Accessible	27.3	2.0
		Remote	28.7	1.5

In response to a pertussis epidemic and to provide early protection to young infants, it was recommended by the ATAGI in March 2009, and promoted in that year during epidemics in New South Wales and Tasmania (later in other jurisdictions), that immunisation providers give the 1st dose of DTPa vaccine at 6 weeks of age instead of 8 weeks of age. Prior to this, very few children received the vaccine dose at less than 8 weeks of age, but for New South Wales and Tasmania the percentage rose over the 2 years with more than 60% of children receiving the dose prior to 8 weeks of age in December 2010 (Figure 12). By late 2011, this percentage was greater than 50% in 3 jurisdictions, the Australian Capital Territory, Victoria, and Queensland and at 70% for New South Wales and Tasmania.

Small area coverage

Immunisation coverage in Australia in 2011 varied substantially within jurisdictions, with some areas substantially below the national averages, potentially putting them at risk of outbreaks (Figures 13–15). In particular, there are 12 Statistical Subdivisions with coverage at 60 months of age below 85% (Figure 15).

The proportions of children whose parents are recorded as vaccine objectors, and the proportion of children with no vaccines recorded are presented by SSD in Figures 16 and 17, respectively. No vaccines recorded may represent either non-immunisation (parents refusing any vaccines) or, and probably much less commonly, non-reporting by a provider. The percentage of children with no vaccines recorded nationally (3.0%) is greater than those recorded as vaccine objectors (1.7%) but the percentage of vaccine objectors has increased from 2007 when it was 1.1%. The map of the proportion of vaccine objectors (Figure 16) shows pockets of high levels of objection within jurisdictions in 2011, particularly in coastal areas of South East Queensland, northern New South Wales, the Mount Lofty Ranges region in South Australia, and south west Western Australia, which also appear with low coverage in Figures 13–15. These areas have had consistently high levels of objection over many years.

The map of the proportion of children with no vaccines recorded (Figure 17) shows some additional areas not evident from, but usually adjacent to, maps of official conscientious objection. Children with no vaccines recorded and children who have parents who register as a conscientious objector are not mutually exclusive groups. Only 30% of children with no vaccines recorded were registered vaccine objectors, whilst 45% of vaccine objectors have vaccines recorded on the ACIR (not shown). Areas with low coverage that do not have high proportions of official vaccine objection nor high levels of no vaccines recorded are more likely to reflect access issues.

Figure 12: The percentage of children who received their 1st dose of DTP/Hexa vaccine at age 6 to < 8 weeks, January 2009 to December, 2011 by state or territory and month of receipt

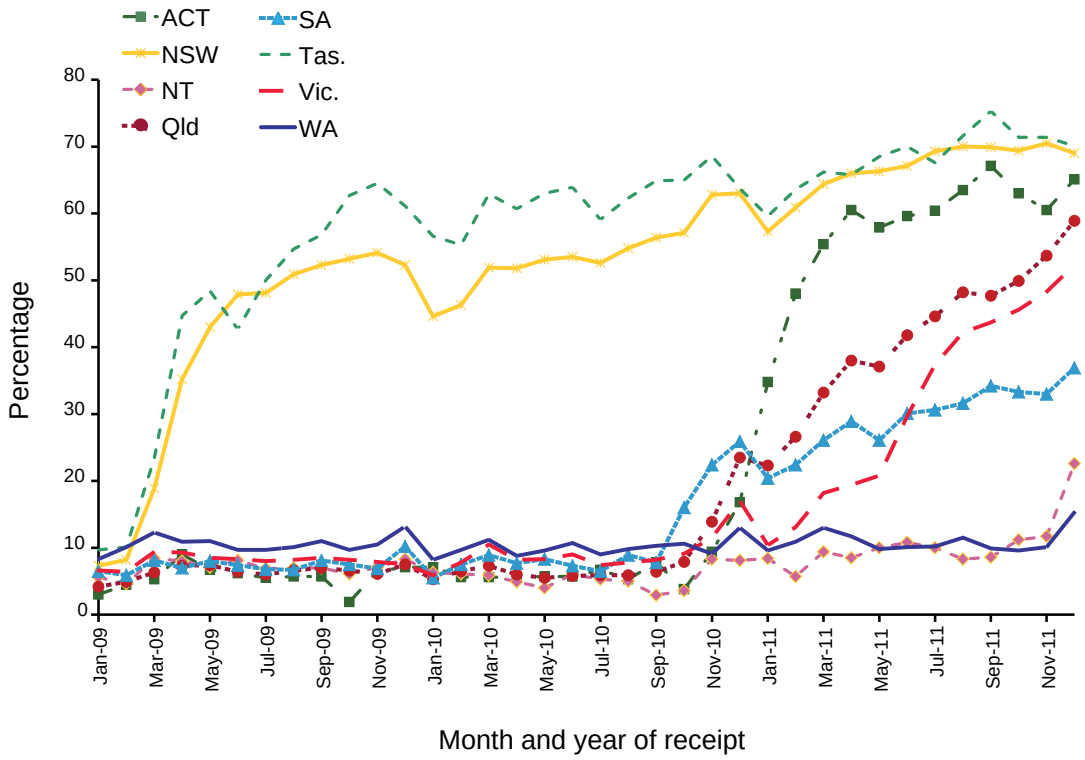
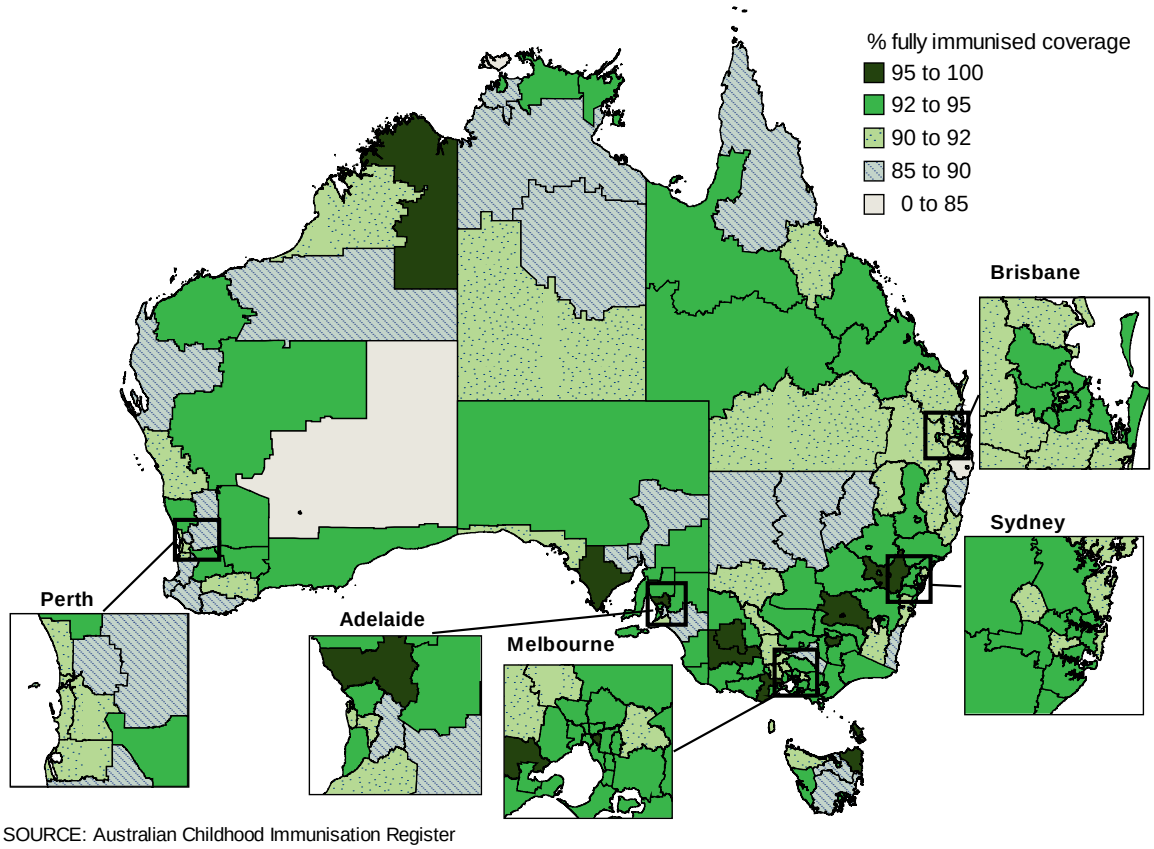
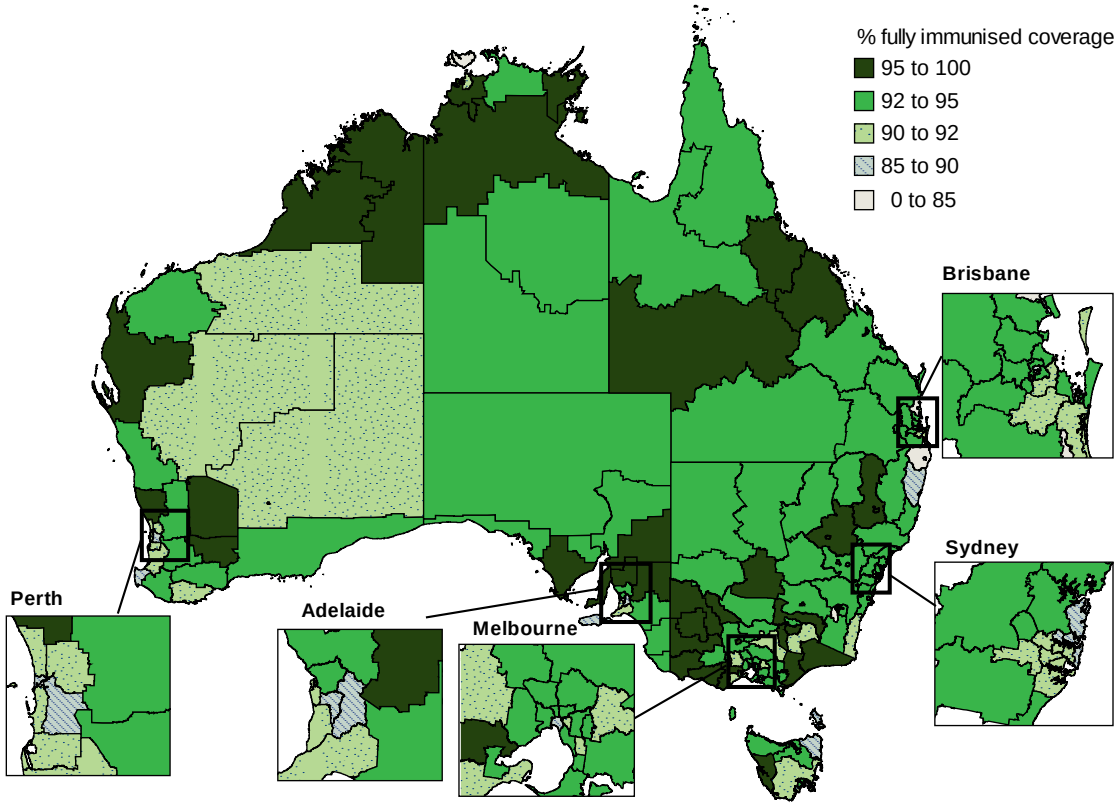


Figure 13: 'Fully immunised' coverage at 12 months of age, 2011, Australia, by Statistical Subdivision



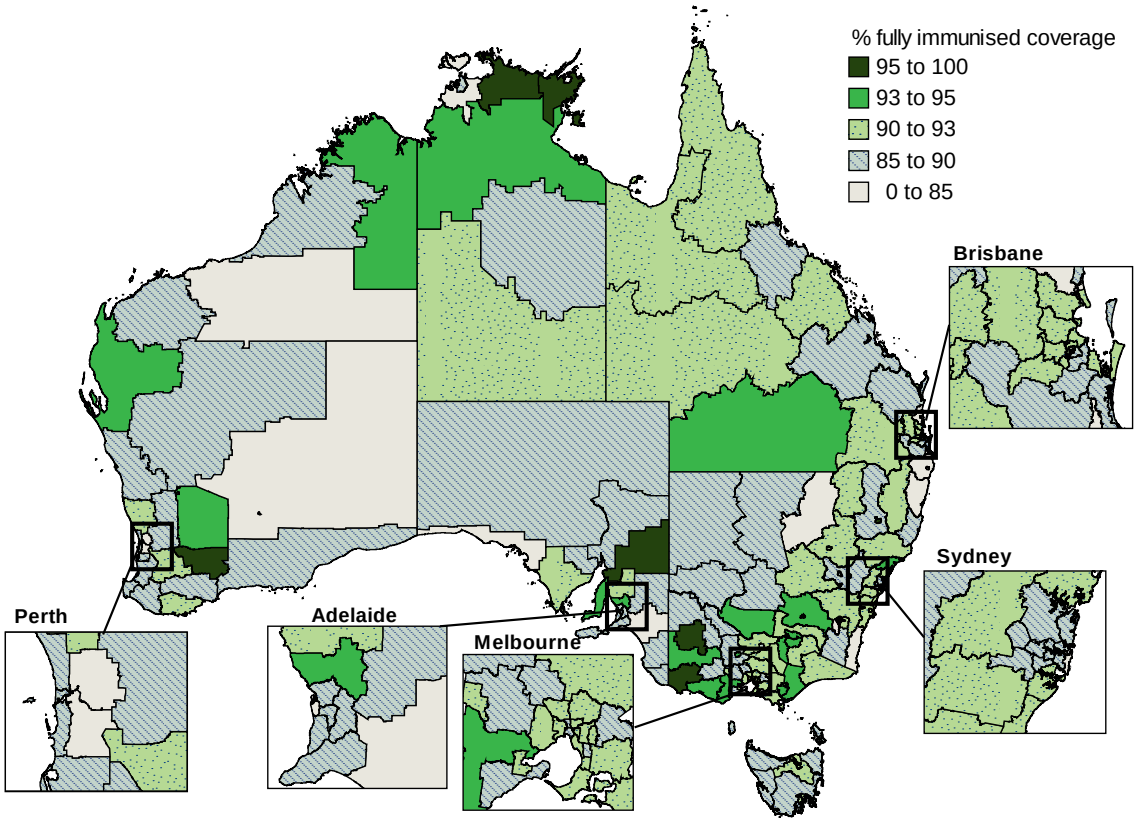
SOURCE: Australian Childhood Immunisation Register

Figure 14: 'Fully immunised' coverage at 24 months of age, Australia, 2011, by Statistical Subdivision



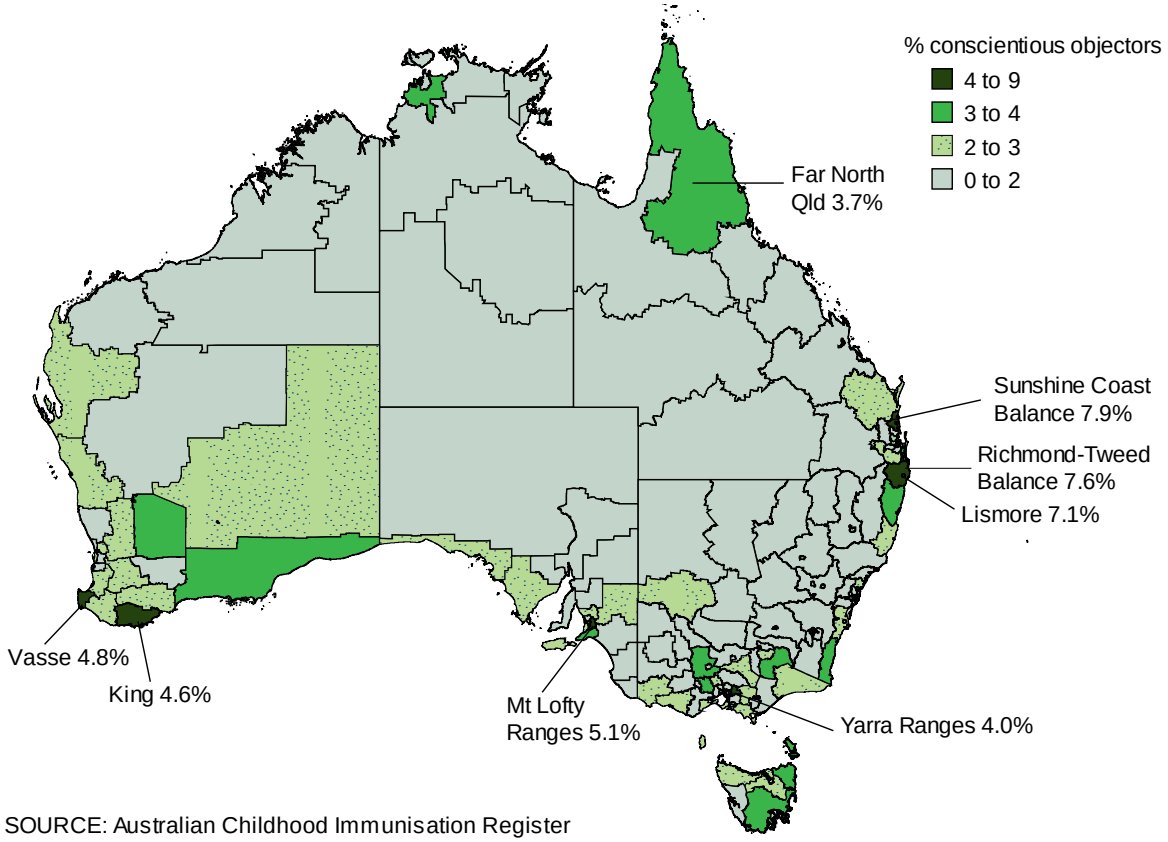
SOURCE: Australian Childhood Immunisation Register

Figure 15: 'Fully immunised' coverage at 60 months of age, Australia, 2011, by Statistical Subdivision



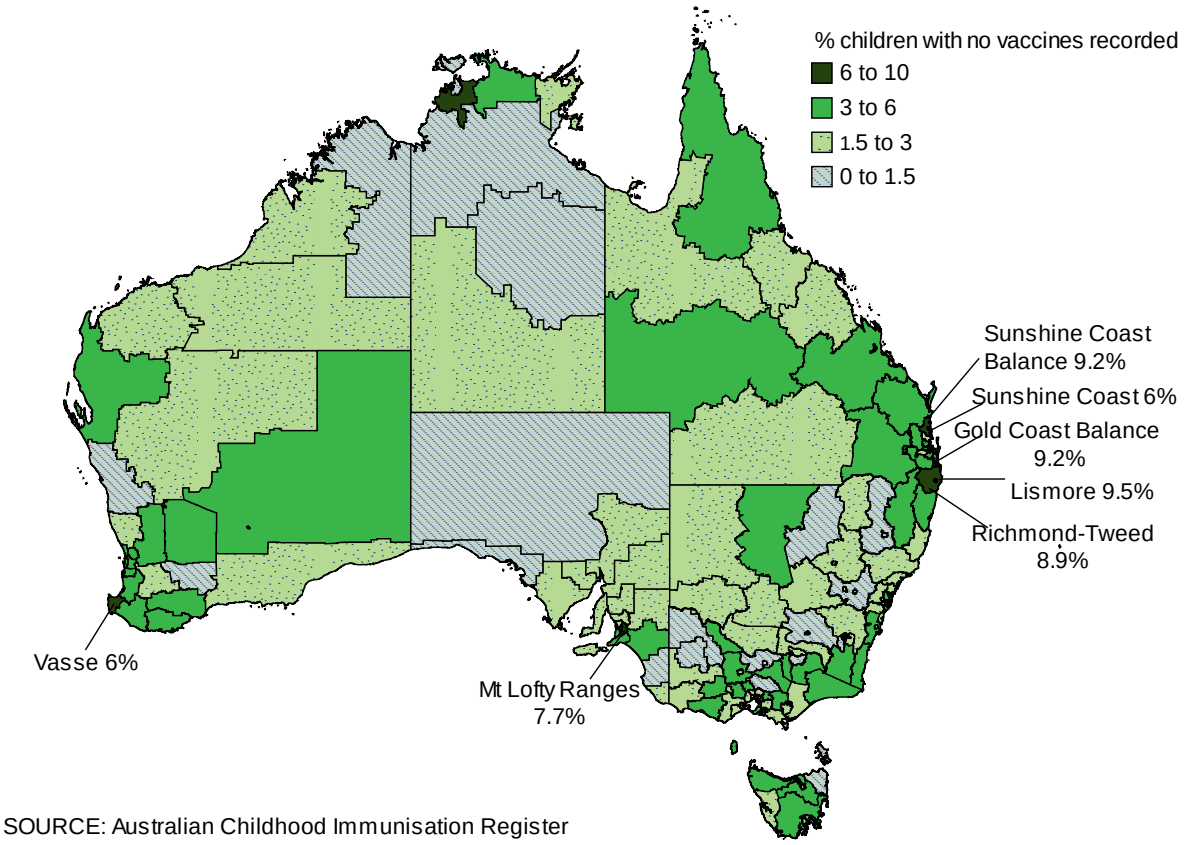
SOURCE: Australian Childhood Immunisation Register

Figure 16: Proportion registered as official conscientious objectors to immunisation, Australia, 2010 (cohort born 1 January 2005 to 31 December 2010)



SOURCE: Australian Childhood Immunisation Register

Figure 17: Proportion of children with no vaccines recorded on the Australian Childhood Immunisation Register, Australia, 2010 (cohort born 1 January 2005 to 31 December 2010)



SOURCE: Australian Childhood Immunisation Register

Provider type

GPs administer the large majority of immunisations in Australia (Figure 18); the proportion given by GPs has increased over the past 11 years by almost 5% (not shown). Local government clinics also administer a substantial proportion of immunisations, especially in some jurisdictions. The only other category of provider administering major numbers of immunisations nationally is community health centres. Regional differences are marked, with immunisations almost entirely administered by GPs in some jurisdictions (New South Wales, Queensland, South Australia, Tasmania and Western Australia), while in others a majority are given by local government (Victoria) and community health clinics (the Northern Territory).

Human papillomavirus vaccine coverage

Vaccination coverage, as notified to the HPV Register, for dose 3 of the HPV vaccine for girls

Table 9: Vaccination coverage for dose 3 of HPV vaccine for girls turning 15 years in 2011, by state or territory

	State or territory								
	ACT	NSW	NT	Qld	SA	Tas.	Vic.	WA	Aust.
HPV	73.2	72.7	79.5	70.2	66.0	64	74.5	64.8	71.2

Source: Human papillomavirus vaccination coverage data. Australian Government. Department of Health and Ageing, February 2013. Available from: http://www.immunise.health.gov.au/internet/immunise/publishing.nsf/Content/immunise-hpv

Includes valid doses and too close doses for Clinically Complete Consumers.

Population is Estimated Resident Population provided by the Australian Bureau of Statistics – Cat 3101.0 Australian Demographic Statistics, Tables 51 to 58: Estimated Resident Population By Single Year of Age by State and Territory, published June 2011.

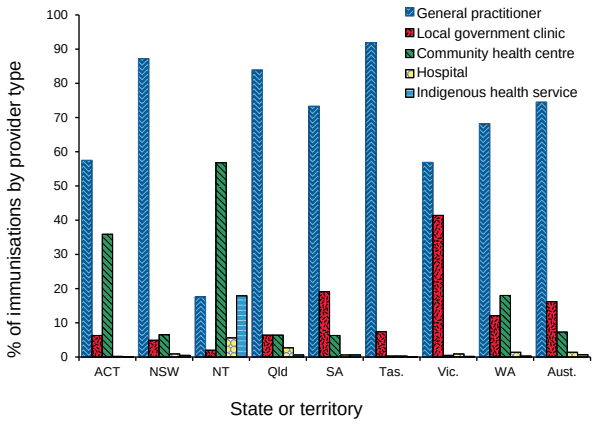
Age is age as at date of Estimated Resident Population estimate.

Coverage is calculated as doses administered and reported to the HPV Register / estimated resident population expressed as a percentage.

Excludes consumers who do not wish their details to be recorded on the HPV Register.

aged 15 years in 2011 is shown in Table 9. For Australia, 71% of girls completed a full course of the vaccine. Coverage varied by jurisdiction from a low of 64% in Tasmania to a high of 79.5% in the Northern Territory. Coverage in all age groups was higher for earlier doses, as high as 81% for the 1st dose in girls aged 14–15 (Figure 19). Coverage was higher in the younger age groups than in the older age groups, with only 39% of girls aged 20–26 years fully vaccinated according to data notified to the Register. HPV coverage by Indigenous status is not available due to limitations in Indigenous status reporting on the HPV Register.

Figure 18: Proportion of immunisations on the Australian Childhood Immunisation Register given by various provider types from 1 January to 31 December 2011, by state or territory

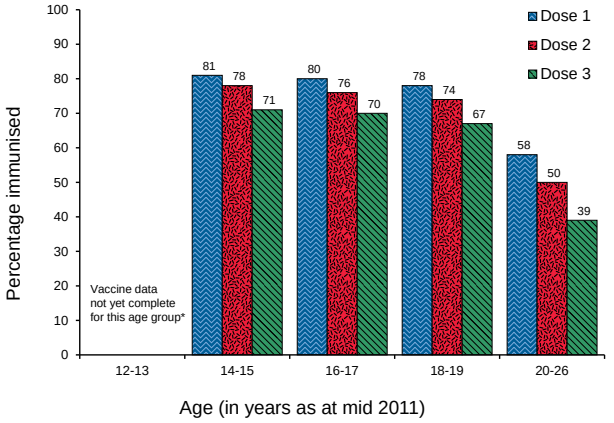


Discussion

These data show that 1993 Immunise Australia Program coverage targets (90%) were reached for children both 12 and 24 months of age in 2011. However, this is not the case for children 60 months of age where coverage, whilst much improved, is below the target in some jurisdictions.

'Fully immunised' coverage at 24 months of age exceeded that at 12 months of age, and this is likely related to the longer time available for late vaccinations to be assessed due to the exclusion of varicella vaccine at 18 months from the calculation of 'fully vaccinated', and also the absence of any other vaccines administered between those ages. There may also be an impact of immunisation incentives. National coverage for vaccines due at 48 months of age improved considerably during 2011 approaching 90% for all 4 cohorts. This increase is due to improved timeliness of vaccination, and is probably related to the change to the overdue rules

Figure 19: Human papillomavirus vaccination coverage for females, Australia, April 2007 and June 2012, by dose number



* In some states those aged 12–13 in 2011 were not eligible for vaccination until 2012. Notification of 2012 doses to the Register is in progress. Data will be published with the 2012 HPV vaccination coverage update.

Source: Human papillomavirus vaccination coverage data. Australian Government. Department of Health and Ageing, February 2013. Available from: http://www.immunise.health.gov.au/internet/immunise/publishing.nsf/Content/immunise-hpv

Technical notes:

12–13 years – School program – routinely vaccinated in 2011 and 2012

14–15 years – School program– routinely vaccinated in 2009 and 2010

16–17 years – Vaccinated in school catch up program 2007–2009

18–19 years – Vaccinated in school catch up program 2007–2009

20–26 years – Vaccinated in GP/community catch up program 2007–2009

Includes valid doses and too close doses for Clinically Complete Consumers

Population is Estimated Resident Population provided by the Australian Bureau of Statistics – Cat 3101.0 Australia Demographic Statistics, Tables 51 to 58.: Estimated Resident Population By Single Year of Age by State and Territory, published 2011.

Age is age as at date of Estimated Resident Population estimate

Coverage is calculated as doses administered and reported to the HPV Register/ estimated resident population expressed as a percentage

Excludes consumers who do not wish their details to be recorded on the HPV Register

in January 2009, where children became overdue for their pre-school boosters at 49 months of age instead of the previous 60 months. This change had an impact on eligibility for child care benefits for parents and outcome payments for providers. It was accompanied by a letter from Medicare Australia advising parents of the change, and the follow-up of overdue children by local health authorities. It is possible that the splitting of the

Maternity Immunisation Allowance at that time could have had an impact in these data, as it applies to children turning 48 months from 2011 onwards.

There is earlier evidence that immunisation incentives to providers positively impacted on coverage estimates.[15] However, the initial analyses in this report provide no evidence of a reduction in coverage associated with the removal of SIP payments in October 2008, while coverage at 60 months has increased following the due and overdue rules changes. However, more analysis is required to examine the impact of these changes in more detail.

A number of vaccines that are included in the NIP are not included when calculating 'fully immunised' status or in eligibility for incentive payments. Coverage estimates for PCV and meningococcal C vaccines are comparable with estimates for vaccines that are included in 'fully vaccinated' calculations, but estimates for varicella and rotavirus are still substantially lower. During 2011, there were only slight changes in coverage for varicella (from 83% to 83.9%) and rotavirus vaccine (from 85% to 84%). For rotavirus vaccines, strict upper age limits for administration may explain lower coverage, whilst varicella is the only vaccine due at 18 months, and this milestone was historically problematic and lapsed for a 2 year period (2003–2005). The implications also vary. In the case of rotavirus vaccine, coverage of 80% or greater has been associated with substantial herd immunity and decreases in rotavirus hospitalisations in Australia and elsewhere.[28,29] In contrast, modelling studies suggest that low coverage with varicella vaccine may result in a shift of disease to older age groups with higher disease severity.[29] This has changed from July 2013 with the inclusion of PCV, Men C, and varicella (as MMRV) in the algorithms used to calculate fully immunised coverage at 12 and 24 months of age.

Coverage for vaccines recommended for Indigenous children only (i.e. hepatitis A and 23vPPV) remained sub-optimal during 2011 but increased substantially for the 23vPPV vaccine (nationally, from 56% to 63%). The extent of under-reporting to the ACIR for these vaccines is unknown but may be more than for 'universal' vaccines, given the lack of incentive payments for notification to the ACIR. However, lower coverage for vaccines targeted at Indigenous people has been a relatively consistent finding using a range of different methods for both children[14] and adults.[31] Both a lack of provider knowledge about the recommendations for high risk groups, and poor identification of Indigenous children by immunisation providers are likely to be important contributing factors. Differences in schedules between jurisdictions may also contribute. During 2011, coverage for both vaccines was still higher in the Northern Territory and Western Australia, which give the vaccines 6 months younger (hepatitis A, 12 and 18 months, 23vPPV 18 months), than in South Australia (18 and 24, and 24 months). However, coverage for both vaccines in 2011 for Queensland was similar to that in Western Australia even though the vaccines are given at 6 months older in Queensland. The presence of other vaccines on the schedule at the same age may assist achieving higher coverage at 12 months and 18 months of age. Failure to receive a 2nd dose by 6% of children also contributed to the low coverage for hepatitis A vaccine. However, a protective antibody response after 1 dose is expected from a majority of children.[32]

Although coverage data reveal that most children eventually complete the scheduled vaccination series by the 24-month milestone, many still do not do so in a timely manner. On-time vaccination in 2011 as measured in this report for vaccines assessed at 12 and 24 months of age has improved only marginally. However, timeliness cannot be measured in the most recent cohort, as time must be allowed for late vaccination to be received. Poorer timeliness in Indigenous children has been noted previously in infants. Timeliness has improved markedly at 60 months of age for both Indigenous and non-Indigenous children. However, as coverage and timeliness of vaccines assessed at 60 months of age has improved, the disparity in timeliness between Indigenous and non-Indigenous children has increased, as improvements in non-Indigenous children were not fully duplicated in Indigenous children. Delayed vaccination is a concern, especially for diseases where multiple vaccine doses are required for protection and the disease risk among young infants is significant (e.g. pertussis). Immunisation at the earliest appropriate age should be a public health goal for countries such as Australia where high levels of vaccine coverage at milestone ages have been achieved.

The ACIR has shown the rapid uptake of new vaccines and consistently high coverage for all vaccines, unlike some other developed countries.[33,34] In comparison with similar countries, reported coverage at 12 months of age is higher,[33] and, with almost 2% of children not vaccinated due to parental objection, targeting of on time vaccination is required to significantly improve the current levels of greater than 91% 'fully immunised' at 12 months of age. Areas of low coverage have been identified in many remote areas and areas containing higher proportions of vaccine objectors. Further vaccination coverage estimates in small areas has been provided by the National Health Performance Authority for children in 2011–12.[35]

Coverage data for HPV from the national HPV register reflect a successful school-based program

with lower coverage for the catch-up program.[36,37] Under-notification to the HPV Register of doses administered in general practice and the community contributes to the apparently lower coverage in women currently aged over 20 years, with independent coverage estimates from population surveys in this age group suggesting under-notification of around 5%–15%.[37,38] The approximate 10% drop in coverage between dose 1 and 3 may also reflect under-notification of doses missed in school and caught up in general practice but not notified to the register, as well as demonstrating the challenges in delivering a three dose vaccination course to adolescents.

Australia's HPV vaccination program remains the most broadly targeted program in the world, with no other country having provided a free catch up program up to the age of 26 years. The coverage achieved in the program has been sufficient to result in demonstrable decreases in HPV prevalence in young women,[39] genital warts[40] and cervical abnormalities.[41]

Unfortunately, coverage data are not available for Indigenous adolescents. For adults, data are only available from the Aboriginal and Torres Strait Islander Health Survey, last conducted in 2004/05.[42]

Data provided in this report reflect continuing successful delivery of the NIP in Australia, while identifying some areas for improvement. Coverage for varicella and rotavirus vaccines is below that for other vaccines, and is low in some small geographic areas. Timeliness of vaccination could be improved, particularly for Indigenous infants, and coverage for vaccines recommended only for Indigenous infants is lower than for other vaccines. From July 2013, varicella and other NIP vaccines (meningococcal C and pneumococcal conjugate vaccines) will be included in coverage assessments for 'fully immunised', and thereby in eligibility for provider and parent incentives.[43] It will be important to evaluate the impact of this change in coming years and given the encouraging improvements in timely coverage seen with the changes to reimbursement introduced in 2009 for the 48-month milestone, this promises to have a favourable impact especially for varicella vaccine where high coverage is crucial to long-term outcomes of the program.

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Abbreviations

7vPCV	7-valent pneumococcal conjugate vaccine
10vPCV	10-valent pneumococcal conjugate vaccine
13vPCV	13-valent pneumococcal conjugate vaccine
23vPPV	23-valent pneumococcal polysaccharide vaccine
ABS	Australian Bureau of Statistics
ACIR	Australian Childhood Immunisation Register
ARIA	Accessibility/Remoteness Index of Australia
ATAGI	Australian Technical Advisory Group on Immunisation
AVS	Adult Vaccination Survey
DTP	diphtheria-tetanus-pertussis
DTPa	Diphtheria-tetanus-pertussis (acellular) (child formulation)
DTP/Hexa	Diphtheria-tetanus-pertussis-inactivated polio-Hib-hepatitis B vaccine
GP	general practitioner
GPII	General Practice Immunisation Incentives Scheme
HBVAX II	hepatitis B (paediatric) vaccine
Hep A	hepatitis A virus
Hep B	hepatitis B virus
Hib	*Haemophilus influenzae* type b
HPV	human papillomavirus
IPV	inactivated poliovirus vaccine
MenC	meningococcal C conjugate vaccine
MIA	Maternity Immunisation Allowance
MMR	measles-mumps-rubella
MMRV	measles-mumps-rubella-varicella
NIP	National Immunisation Program
PCV	pneumococcal polysaccharide vaccine
PRP-D	*Haemophilus influenzae* type b polysaccharide conjugated to diphtheria toxoid
PRP-OMP	*Haemophilus influenzae* type b polysaccharide conjugated to the outer membrane protein of *Neisseria meningitidis* vaccine
PRP-T	*Haemophilus influenzae* type b polysaccharide conjugated to tetanus toxoid
SIP	Service Incentive Payment
SSD	Statistical subdivisions
VZV	Varicella-zoster virus

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