Abstract: Introduction: This annual report documents trends in immunisation coverage in NSW for children, adolescents and the elderly, up to and including data for 2015. Methods: Data from the Australian Childhood Immunisation Register, the NSW School Vaccination Program and the NSW Population Health Survey were used to calculate various measures of population coverage, and vaccination timeliness for Aboriginal and non-Aboriginal children. Results: ‘Fully immunised’ coverage has increased marginally from 2014 for children at 12, 24 and 60 months of age. Greater than 92% coverage has been reached for children at 12 and 60 months of age. Whilst ‘fully immunised’ coverage at 24 months of age was 89.5%, coverage for individual vaccines due at this age was greater than 94%, except for the second dose of the measles, mumps and rubella vaccine (91.8%) and the varicella vaccine (91.5%). Delayed receipt of vaccines was still an issue for Aboriginal children. Coverage for adolescent vaccinations remained relatively stable between 2014 and 2015 for most vaccines apart from varicella vaccine coverage, which increased by more than 20%. Influenza and pneumococcal vaccination in the elderly has also remained stable between 2014 and 2015; however, pneumococcal vaccination estimates are substantially lower than the influenza coverage estimates. Conclusion: This report documents trends in immunisation coverage in NSW across the age spectrum. Data provided in this report reflect continued successful delivery of the vaccination program in New South Wales, while identifying some areas for improvement. Completion of the recommended immunisation schedule at the earliest appropriate age should be the public health goal at both the state and local health district level where high levels of vaccine coverage at milestone ages have been achieved.

Introduction
This series of New South Wales (NSW) Annual Immunisation Coverage Reports provides important information on trends and issues in immunisation coverage to facilitate the monitoring of NSW immunisation programs.

This report uses the longstanding international practice of reporting coverage at key milestone ages to measure coverage against national benchmarks and to track trends over time. It is adapted from annual national immunisation reports published since 2009.1 High levels of reporting to the Australian Childhood Immunisation Register (ACIR) are maintained by a system of incentive payments for immunisation providers and parents/guardians.2 However, changes to immunisation policy, the incentive payment system and changes to the ‘fully immunised’ coverage algorithms may have an impact on reported vaccination coverage. Some recent changes are highlighted in Box 1 and are also referred to in this report.

The ACIR was established on 1 January 1996 by incorporating demographic data from Medicare on all enrolled children aged less than 7 years.3 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.2 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 website or by submitting paper encounter forms. The existence of medical contraindications and conscientious objection to immunisation was also recorded on the ACIR. As of 1 January 2016 conscientious objection will no longer be a valid reason for

10.1071/NA16003
vaccination exemption and hence data for this will no longer be available.4 Up to 31 December 2015 all vaccination records for a child remained on the register indefinitely, but no new immunisation encounter records were added after the 7th birthday.2 From 1 January 2016 the register changed and now includes records of vaccinations given up to less than 20 years of age.5

Table 1 presents the NSW Immunisation Program in 2015. During 2015 the only change to the childhood Program from 2014 was the addition of the annual seasonal influenza vaccine for Aboriginal and Torres Strait Islander children aged 6 months to less than 5 years.

**Methods**

**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/territory)3 since the inception of the ACIR. 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 and 18 months),
and 5 years of age (for vaccines due at 4 years). A 3-month
lag period is allowed for the late notification of immunisa-
tions to the ACIR.6 If a child’s record indicates receipt of
the last dose of a vaccine that requires more than one dose
to complete the series, it is assumed that earlier vaccina-
tions in the sequence have been given. This assumption has
been shown to be valid.7,8

The proportion of children designated as ‘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 third dose of the combined DTPa-hepB-IPV-Hib vaccine and a third dose of
13-valent pneumococcal conjugate vaccine. ‘Fully immu-
nised’ at 24 months of age was defined as a child having a
record on the ACIR of a third dose of the combined DTPa-
hepB-IPV-Hib vaccine, a fourth dose of Haemophilus
influenzae type b (PRP-T) vaccine (if given before 11.5
months of age), a second dose of a measles, mumps and
rubella (MMR)-containing vaccine, a first dose of varicella-
containing vaccine and a first dose of meningococcal
C-containing vaccine. ‘Fully immunised’ at 60 months of
age was defined as a child having a record on the ACIR of a
fourth dose of a DTPa-IPV-containing vaccine, and a second
dose of an MMR-containing vaccine.

Immunisation coverage estimates were also calculated at
the 12-month milestone for the second dose of rotavirus
vaccine, a National Immunisation Program vaccine not
included in calculations for incentive payments and ‘fully
immunised’ status.
Timeliness
Delayed vaccination was categorised as 1–≤2 months delay, greater than 2–≤6 months delay or a delay of 7 months and greater. All children included in the analysis were old enough to potentially experience delays in immunisation greater than 6 months for immunisations assessed at 24 months of age or earlier. Timeliness of different vaccines and doses was also compared by plotting the cumulative percentage receiving each vaccine dose by age.

Local health districts
Immunisation coverage estimates and vaccination delay estimates are presented in this report by NSW local health district (LHD). LHDs were introduced in January 2011, replacing area health services. There are 15 LHDs in NSW – eight in metropolitan NSW and seven in rural and regional NSW.

Aboriginal status
Indigenous status on the ACIR is recorded nationally as ‘Indigenous’, ‘non-Indigenous’ or ‘unknown’, as reported by the child’s carer to Medicare, or by the immunisation provider to the ACIR. For this report, two categories of children were considered: ‘Aboriginal’ (Indigenous) and ‘non-Aboriginal’ (non-Indigenous). Children with unknown Aboriginal status were presumed to be ‘non-Aboriginal’.

Small area coverage
Coverage was calculated for the Australian Bureau of Statistics (ABS)-defined SA3s (statistical area level 3), which form part of the new Australian Statistical Geography Standard (ASGS).9 SA3s were chosen as areas to be mapped because they provide more detail than LHDs but are not too small to render maps unreadable (population sizes for a year-wide birth cohort of children for SA3s in NSW range from 110 to 2799 children). SA3s with a population size for a year-wide birth cohort of children less than 26 were excluded from any mapping due to the imprecision of any coverage estimates calculated for these areas. Maps were created using MapInfo mapping software10 and the ABS Census Boundary Information. As postcode is the only geographical indicator on the ACIR, the ABS Postal Area to SA3 Concordance 2011 was used to match ACIR residential postcodes of the children to SA3s.11

Vaccine objection status
Up until the end of 2015 parents who objected to vaccination could lodge a conscientious objection to immunisation form with the ACIR. These rendered them eligible for relevant federal government family assistance payments despite their children not being vaccinated. Other parents who do object to immunisation may not necessarily register an objection. Among children recorded as not fully immunised on the ACIR, three subgroups were examined, defined by the following information recorded on the ACIR: (1) registered vaccine objection and no vaccines recorded on the ACIR; (2) registered vaccine objection and at least one vaccine recorded on the ACIR; and (3) no registered vaccine objection and no vaccines recorded on the ACIR (some, but not all, of whom may be unvaccinated due to unregistered objection). Proportions of children in these subgroups were calculated for all LHDs from the cohort of children registered with Medicare and born between 1 January 2009 and 31 December 2014. At the time of data extraction these children were aged between 1 year and less than 7 years. This cohort was chosen for calculating proportions so that children under the age of 1 year were not included, to allow sufficient time for registration of objection.

Coverage in the elderly and adolescents
Influenza and pneumococcal vaccination coverage estimates in the elderly were from the 2015 NSW Population Health Survey. This is a rolling random digit-dailed telephone survey, with vaccination status determined from patient recall at the time of the interview. Influenza and pneumococcal vaccination coverage estimates are based on 4849 and 4721 respondents in NSW, respectively.12 Coverage for vaccines given to adolescents was collected from the NSW School Vaccination Program. Vaccination status is recorded by school immunisation teams and the counts of children vaccinated are collated by LHDs and NSW Health. The denominator is the school population, start of year enrolments. The coverage rates may underestimate true vaccination coverage as they represent only those vaccinations received through the school program and do not include doses received from general practitioners or other immunisation providers.13

Summary of results
Coverage (all children)
- Overall in NSW ‘fully immunised’ coverage measured at the 12-month milestone was 92.8% during 2015 (Table 2).
- ‘Fully immunised’ coverage in NSW measured at the 24-month milestone increased marginally from 2014 to 89.6% (Table 3).
- NSW coverage at the 5-year milestone also increased marginally in 2015 to 93.1% (Table 4).
- The overall trend in NSW ‘fully immunised’ coverage at each of the 12, 24 and 60-month milestones has continued improving (Figure 1).
- For all LHDs in NSW, ‘fully immunised’ coverage at 12 months of age increased in 2015 from the previous year. Coverage for all individual vaccines (except rotavirus) was greater than 93% in NSW overall (Figure 2) and greater than 92% for all LHDs except Mid North Coast and Northern NSW (Table 2).
For all LHDs ‘fully immunised’ coverage at 24 months of age increased in 2015. At this milestone, ‘fully immunised’ coverage for Mid North Coast, Northern NSW, Northern Sydney, South Eastern Sydney, South Western Sydney, Southern NSW, Sydney and Western NSW remained below 90%, whilst in the Central Coast, Murrumbidgee, Network with Victoria and Western NSW, ‘fully immunised’ coverage at 24 months of age increased above 92% (Table 3).

- Coverage in NSW for all individual vaccines (except the second dose of MMR and varicella) at the 24-month milestone was greater than 94% (Table 3, Figure 3) and greater than 92% for all LHDs except for Northern NSW (Table 3).

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Local Health District</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>CC</td>
</tr>
<tr>
<td>Diphtheria, tetanus, pertussis</td>
<td>95.1</td>
</tr>
<tr>
<td>Poliomyelitis</td>
<td>95.1</td>
</tr>
<tr>
<td>Haemophilus influenzae type b</td>
<td>95.0</td>
</tr>
<tr>
<td>Hepatitis B</td>
<td>95.0</td>
</tr>
<tr>
<td>Rotavirus</td>
<td>90.3</td>
</tr>
<tr>
<td>13vPCV</td>
<td>94.7</td>
</tr>
<tr>
<td>Fully immunised</td>
<td>94.7</td>
</tr>
<tr>
<td>Total number of children</td>
<td>4026</td>
</tr>
</tbody>
</table>

**Table 3. Percentage of children immunised at 24 months of age**, by vaccine for each local health district in NSW, compared with NSW and Australia, 2015

*Coverage for rotavirus in NSW increased marginally in 2015 to 88.7%. Increases were seen in all LHDs except Western NSW. Coverage for rotavirus remained lower than other vaccines as catch-up cannot be given once infants turn 15 weeks (dose 1) and 25 weeks (dose 2) of age.*

*For all LHDs ‘fully immunised’ coverage at 24 months of age increased in 2015. At this milestone, ‘fully immunised’ coverage for Mid North Coast, Northern NSW, Northern Sydney, South Eastern Sydney, South Western Sydney, Northern Sydney remained below 90%, whilst in the Central Coast, Murrumbidgee, Network with Victoria and Western NSW, ‘fully immunised’ coverage at 24 months of age increased above 92% (Table 3).*

*Coverage in NSW for all individual vaccines (except the second dose of MMR and varicella) at the 24-month milestone was greater than 94% (Table 3, Figure 3) and greater than 92% for all LHDs except for Northern NSW (Table 3).*

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*bCC: Central Coast; FW: Far West; HNE: Hunter New England; IS: Illawarra Shoalhaven; MN: Mid North Coast; MM: Murrumbidgee; NBM: Nepean Blue Mountains; NV: Network with Victoria; NN: Northern NSW; NS: Northern Sydney; SES: South Eastern Sydney; SWS: South Western Sydney; SN: Southern NSW; SYD: Sydney; WN: Western NSW; WS: Western Sydney; NSW: New South Wales.

*cThree doses of the combined DTPa-hepB-IPV-Hib vaccine plus 13vPCV. The third dose assumption is applied.

Source: Australian Childhood Immunisation Register, data as at 31 March 2016.
### Table 4. Percentage of children immunised at 5 years of age, by vaccine for each local health district in NSW, compared with NSW and Australia, 2015

<table>
<thead>
<tr>
<th>Disease</th>
<th>CC</th>
<th>FW</th>
<th>HNE</th>
<th>IS</th>
<th>MN</th>
<th>MM</th>
<th>NBM</th>
<th>NV</th>
<th>NN</th>
<th>NS</th>
<th>SES</th>
<th>SWS</th>
<th>SN</th>
<th>SYD</th>
<th>WN</th>
<th>WS</th>
<th>NSW</th>
<th>Australia</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
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<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>Diphtheria, tetanus, pertussis</td>
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<td>97.1</td>
<td>96.1</td>
<td>95.0</td>
<td>92.9</td>
<td>96.4</td>
<td>95.2</td>
<td>95.1</td>
<td>88.7</td>
<td>91.7</td>
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<tr>
<td>Poliomyelitis</td>
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<td>97.1</td>
<td>96.1</td>
<td>95.0</td>
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<td>96.3</td>
<td>95.2</td>
<td>95.3</td>
<td>88.7</td>
<td>91.8</td>
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<tr>
<td>Measles–mumps–rubella</td>
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<td>97.1</td>
<td>96.2</td>
<td>94.9</td>
<td>92.8</td>
<td>96.2</td>
<td>95.0</td>
<td>95.8</td>
<td>88.8</td>
<td>91.4</td>
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<td>92.5</td>
<td>96.4</td>
<td>93.3</td>
<td>93.7</td>
<td>93.2</td>
</tr>
<tr>
<td>Fully immunised&lt;sup&gt;c&lt;/sup&gt;</td>
<td>94.3</td>
<td>96.6</td>
<td>95.7</td>
<td>94.5</td>
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<td>94.4</td>
<td>94.7</td>
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<td>91.9</td>
<td>96.1</td>
<td>92.6</td>
<td>93.1</td>
<td>92.6</td>
</tr>
<tr>
<td>Total number of children</td>
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<td>4888</td>
<td>2656</td>
<td>3190</td>
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<td>3955</td>
<td>14462</td>
<td>100926</td>
<td>312424</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<sup>a</sup>Cohort born 1 January 2010 – 31 December 2010.

<sup>b</sup>CC: Central Coast; FW: Far West; HNE: Hunter New England; IS: Illawarra Shoalhaven; MN: Mid North Coast; MM: Murrumbidgee; NBM: Nepean Blue Mountains; NV: Network with Victoria; NN: Northern NSW; NS: Northern Sydney; SES: South Eastern Sydney; SWS: South Western Sydney; SN: Southern NSW; SYD: Sydney; WN: Western NSW; WS: Western Sydney; NSW: New South Wales.

<sup>c</sup>A fourth dose of combined DTPa-IPV vaccine, and a second dose of a measles–mumps–rubella (MMR)-containing vaccine.

Source: Australian Childhood Immunisation Register, data as at 31 March 2016.

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**Figure 1. Trends in *fully immunised*<sup>a,b,c,d,e</sup> vaccination coverage, NSW, 2000–2015.**

<sup>a</sup>A third dose of the combined DTPa-hepB-IPV-Hib vaccine up until July 2013.

<sup>b</sup>A third dose of the combined DTPa-hepB-IPV-Hib vaccine and a third dose of pneumococcal conjugate vaccine since July 2013.

<sup>c</sup>A third dose of the combined DTPa-hepB-IPV-Hib vaccine, a fourth dose of *Haemophilus influenzae* type b (PRP-T) vaccine, and a first dose of a measles, mumps and rubella (MMR)-containing vaccine.

<sup>d</sup>From July 2014, 24-month algorithm changed to also include a second dose of MMR, a first dose of MenC and a first dose of varicella.

<sup>e</sup>A fourth dose of combined DTPa-IPV vaccine, and a second dose of an MMR-containing vaccine by 6 years of age up to December 2007.

<sup>f</sup>A fourth dose of combined DTPa-IPV vaccine, and a second dose of an MMR-containing vaccine by 5 years of age since January 2008.

Source: Australian Childhood Immunisation Register, data as at 31 March 2016.
In NSW during 2015, the majority of the fourth dose of Haemophilus influenzae type b vaccine and the dose of meningococcal C vaccine was given as the combined vaccine Menitorix/C210 given at 12 months of age (92.7%).

In 2015, coverage at 24 months of age for the first dose of MMR was 94.4% (Table 3). Coverage for the second dose of MMR and the dose of varicella increased to greater than 90% for all LHDs except for Northern NSW and the Mid North Coast. The majority of the second dose of MMR and the dose of varicella was given as the combined MMRV vaccine (either Priorix Tetra® or ProQuad®) at 18 months (90.2%).

Coverage of the second dose of MMR at the 24 month milestone increased from 2014 by over 2 percentage points to 91.8% (Table 3). Coverage at 5 years of age remained higher at 93.7% (Table 4). The differential between the two milestone estimates decreased from 3.4 to 1.9 percentage points.

Varicella coverage at 24 months of age continued to increase in NSW and was above 90% in all LHDs except for Mid North Coast and Northern NSW.

‘Fully immunised’ coverage and coverage for all individual vaccines for the 5-year milestone in NSW was greater than 93% (Table 4, Figure 4) and greater than 90% in all LHDs except Northern NSW (Table 4).

### Indigenous coverage

In 2015, ‘fully immunised’ coverage was lower for Aboriginal children than non-Aboriginal children at the 12-month milestone (92.0% versus 92.9%) and the 24-month milestone (88.9% versus 89.6%) but was higher (95.6% versus 93.0%) for Aboriginal children at the 60-month milestone (Table 5).

‘Fully immunised’ coverage for Aboriginal children at the 12-month milestone was lower compared to non-Aboriginal children in most LHDs apart from Northern NSW, Northern Sydney and South Eastern Sydney where ‘fully immunised’ coverage was higher for Aboriginal children. Coverage in the Central Coast and Mid North Coast was similar for Aboriginal and non-Aboriginal children.
Figure 3. Trends in vaccination coverage estimates by vaccine at 24 months of age, third dose of DTPa (fourth dose – pre September 2003), third dose of polio, third dose of hepatitis B, fourth dose of Hib, second dose of MMR (first dose – pre July 2014), one dose of varicella and one dose of men C, NSW 2000–2015.

By 3-month birth cohorts born between 1 January 1998 and 31 December 2013. Coverage assessment date was 24 months after the last birth date of each cohort.

DTPa: diphtheria–tetanus–pertussis (acellular) – paediatric formulation
Hep B: hepatitis B
Hib: Haemophilus influenzae type b
Men C: meningococcal C
MMR: measles–mumps–rubella
MMRV: measles–mumps–rubella–varicella

Source: Australian Childhood Immunisation Register, data as at 31 March 2016.

Figure 4. Trends in vaccination coverage estimates by vaccine, fourth dose of DTPa and polio and second dose of MMR at 5 years of age (6 years up to December 2007), NSW, 2002–2015.

By 3-month birth cohorts born between 1 January 1996 and 31 December 2010. 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.

DTPa: diphtheria–tetanus–pertussis (acellular) – paediatric formulation
MMR: measles–mumps–rubella

Source: Australian Childhood Immunisation Register, data as at 31 March 2016.
Table 5. Percentage of children fully immunised at 12 months\(^a\), 24 months\(^b\) and 5 years of age\(^c\), by Aboriginal status for each local health district in NSW, compared with NSW and Australia, 2015

<table>
<thead>
<tr>
<th>Child age and Aboriginal status</th>
<th>CC %</th>
<th>FW %</th>
<th>HNE %</th>
<th>IS %</th>
<th>MN %</th>
<th>MM %</th>
<th>NBM %</th>
<th>NV %</th>
<th>NN %</th>
<th>NS %</th>
<th>SES %</th>
<th>SWS %</th>
<th>SN %</th>
<th>SYD %</th>
<th>WN %</th>
<th>WS %</th>
<th>NSW %</th>
<th>Australia %</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>12 months – fully immunised(^a)</strong></td>
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<tr>
<td>Aboriginal</td>
<td>94.6</td>
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<td>90.8</td>
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<td>91.6</td>
<td>95.0</td>
<td>94.4</td>
<td>100.0</td>
<td>94.6</td>
<td>92.0</td>
<td>90.1</td>
<td>90.7</td>
<td>88.9</td>
<td>88.4</td>
<td>92.0</td>
<td>89.6</td>
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<tr>
<td>Non-Aboriginal</td>
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<td>94.7</td>
<td>95.1</td>
<td>90.7</td>
<td>95.2</td>
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<td><strong>24 months – fully immunised(^b)</strong></td>
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<td>Aboriginal</td>
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<td>Non-Aboriginal</td>
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<td><strong>5 years – fully immunised(^c)</strong></td>
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<tr>
<td>Aboriginal</td>
<td>96.7</td>
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<td>95.6</td>
<td>94.4</td>
</tr>
<tr>
<td>Non-Aboriginal</td>
<td>94.2</td>
<td>95.7</td>
<td>95.5</td>
<td>94.5</td>
<td>92.0</td>
<td>95.7</td>
<td>94.4</td>
<td>94.4</td>
<td>87.7</td>
<td>90.8</td>
<td>91.0</td>
<td>93.9</td>
<td>93.5</td>
<td>91.8</td>
<td>96.3</td>
<td>92.5</td>
<td>93.0</td>
<td>92.5</td>
</tr>
</tbody>
</table>

\(^a\)Cohort born 1 January 2014 – 31 December 2014: three doses of the combined DTPa-hepB-IPV-Hib vaccine plus 13vPCV. The third dose assumption is applied.

\(^b\)Cohort born 1 January 2013 – 31 December 2013: three or four doses of a DTP-containing vaccine, three doses of polio vaccine, three or four doses of PRP-OMP containing Hib vaccine or four doses of any other Hib vaccine, three or four doses of Comvax® hepatitis B vaccine or four doses of all other hepatitis B vaccines, and two doses of a measles–mumps–rubella (MMR)-containing vaccine, one dose of a varicella vaccine and one dose of a meningococcal C vaccine.

\(^c\)Cohort born 1 January 2010 – 31 December 2010: four or five doses of a DTP-containing vaccine, four doses of polio vaccine, and two doses of an MMR-containing vaccine.

\(^d\)CC: Central Coast; FW: Far West; HNE: Hunter New England; IS: Illawarra Shoalhaven; MN: Mid North Coast; MM: Murrumbidgee; NBM: Nepean Blue Mountains; NV: Network with Victoria; NN: Northern NSW; NS: Northern Sydney; SES: South Eastern Sydney; SWS: South Western Sydney; SN: Southern NSW; SYD: Sydney; WN: Western NSW; WS: Western Sydney; NSW: New South Wales.

Source: Australian Childhood Immunisation Register, data as at 31 March 2016.
• At the 24-month milestone, ‘fully immunised’ coverage for Aboriginal children was lower in half of the NSW LHDs. ‘Fully immunised’ coverage at this milestone in the Far West was similar for Aboriginal and non-Aboriginal children, but higher for Aboriginal children in the Central Coast, Mid North Coast, Network with Victoria, Northern NSW, Northern Sydney and South Western Sydney.

• At the 60-month milestone, ‘fully immunised’ coverage was higher for Aboriginal than non-Aboriginal children in all LHDs except Western NSW.

• Coverage estimates for all individual vaccines were lower in Aboriginal children at 12 months of age (Table 6). Coverage estimates for individual vaccines were higher in Aboriginal children at 24 months of age, except for the second dose of MMR and the varicella vaccine. Coverage estimates for all individual vaccines were higher in Aboriginal children at 60 months of age (Table 6).

**Timeliness**

• For the third dose of DTPa and the second dose of MMR vaccines, there were greater delays in immunisation for Aboriginal children than non-Aboriginal children in NSW and for most LHDs (Tables 7 and 8).

• The majority of delayed vaccination fell into the 1–≤2 months delay category for both Aboriginal and non-Aboriginal children in all LHDs.

• For DTPa coverage measured at the 12-month milestone, the disparity in ‘on time vaccination’ between Aboriginal and non-Aboriginal decreased from the 2014 report by 3.6 percentage points to 13.6% (Figure 5), due to improved timeliness of DTPa vaccination for Aboriginal children. The disparity in ‘on time vaccination’ for the second dose of MMR due at 18 months of age remained steady in 2015 at 12.4% (Figure 6).

• During 2015, the percentage of children in NSW who received their first dose of hexavalent combination vaccine 1.0

---

Table 6. Vaccination coverage estimates by age, vaccine antigen and Aboriginal status in NSW, 2015

<table>
<thead>
<tr>
<th>Disease</th>
<th>Milestone age</th>
<th>Aboriginal</th>
<th>Non-Aboriginal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diphtheria–tetanus–pertussis</td>
<td>12 months</td>
<td>92.1</td>
<td>94.0</td>
</tr>
<tr>
<td></td>
<td>24 months</td>
<td>96.8</td>
<td>95.7</td>
</tr>
<tr>
<td></td>
<td>5 years</td>
<td>96.1</td>
<td>93.6</td>
</tr>
<tr>
<td>Poliomyelitis</td>
<td>12 months</td>
<td>92.1</td>
<td>93.9</td>
</tr>
<tr>
<td></td>
<td>24 months</td>
<td>96.8</td>
<td>95.6</td>
</tr>
<tr>
<td></td>
<td>5 years</td>
<td>96.1</td>
<td>93.6</td>
</tr>
<tr>
<td><em>Haemophilus influenzae</em> type b</td>
<td>12 months</td>
<td>92.1</td>
<td>93.6</td>
</tr>
<tr>
<td></td>
<td>24 months</td>
<td>95.3</td>
<td>94.0</td>
</tr>
<tr>
<td></td>
<td>5 years</td>
<td>NI</td>
<td>NI</td>
</tr>
<tr>
<td>Hepatitis B</td>
<td>12 months</td>
<td>92.1</td>
<td>93.6</td>
</tr>
<tr>
<td></td>
<td>24 months</td>
<td>96.8</td>
<td>95.1</td>
</tr>
<tr>
<td></td>
<td>5 years</td>
<td>NI</td>
<td>NI</td>
</tr>
<tr>
<td>Measles–mumps–rubella</td>
<td>12 months</td>
<td>NI</td>
<td>NI</td>
</tr>
<tr>
<td></td>
<td>24 months b Dose 1</td>
<td>96.0</td>
<td>94.3</td>
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<td></td>
<td>24 months b Dose 2</td>
<td>91.0</td>
<td>91.8</td>
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<td></td>
<td>5 years</td>
<td>96.1</td>
<td>93.6</td>
</tr>
<tr>
<td>Meningococcal C</td>
<td>12 months</td>
<td>NI</td>
<td>NI</td>
</tr>
<tr>
<td></td>
<td>24 months</td>
<td>96.1</td>
<td>94.3</td>
</tr>
<tr>
<td></td>
<td>5 years</td>
<td>NI</td>
<td>NI</td>
</tr>
<tr>
<td>Varicella</td>
<td>12 months</td>
<td>NI</td>
<td>NI</td>
</tr>
<tr>
<td></td>
<td>24 months</td>
<td>90.4</td>
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<tr>
<td></td>
<td>5 years</td>
<td>NI</td>
<td>NI</td>
</tr>
<tr>
<td>Pneumococcal conjugate vaccine</td>
<td>12 months</td>
<td>92.2</td>
<td>93.4</td>
</tr>
<tr>
<td></td>
<td>24 months</td>
<td>NI</td>
<td>NI</td>
</tr>
<tr>
<td></td>
<td>5 years</td>
<td>NI</td>
<td>NI</td>
</tr>
<tr>
<td>Rotavirus</td>
<td>12 months</td>
<td>85.1</td>
<td>88.9</td>
</tr>
<tr>
<td></td>
<td>24 months</td>
<td>NI</td>
<td>NI</td>
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<tr>
<td></td>
<td>5 years</td>
<td>NI</td>
<td>NI</td>
</tr>
</tbody>
</table>

*a*Cohort born 1 January 2014 – 31 December 2014.


NI: this vaccine at this age milestone is not included in the calculation of coverage estimates.
vaccine between 6 and less than 8 weeks steadily rose to its highest reported level of 82% (Figure 7). This percentage has been increasing since 2009 when vaccination at 6 weeks was encouraged to provide early protection against whooping cough.

**Small area coverage**
- Coverage by small area (SA3) varied across the state for rotavirus (77.4–97.2%) and pneumococcal conjugate vaccine (83.5–98.8%) measured at the 12-month milestone, and the second dose of MMR (80.3–97.4%) measured at the 24-month milestone (Figures 8–10).

**Vaccine objection status**
- The percentage of children with a registered vaccine objection varied by LHD, from a high of 7.2% in Northern NSW to a low of 0.9% in Western Sydney (Table 9). The percentage of children with no vaccines recorded and with no registered objection also varied by LHD and ranged from 0.8% in the Far West to 2.7% in Sydney (Table 9).

**Adolescent coverage**
- Coverage in adolescents varied by vaccine and dose with coverage for varicella substantially lower than the coverage estimates for the three doses of human

---

**Table 7.** Percentage of children* with vaccination delay for the third dose of DTPa by Aboriginal status for each local health district in NSW, 2015

<table>
<thead>
<tr>
<th>Vaccination delay and Aboriginal status</th>
<th>CC</th>
<th>FW</th>
<th>HNE</th>
<th>IS</th>
<th>MN</th>
<th>MM</th>
<th>NBM</th>
<th>NV</th>
<th>NN</th>
<th>NS</th>
<th>SES</th>
<th>SWS</th>
<th>SN</th>
<th>SYD</th>
<th>WN</th>
<th>WS</th>
<th>NSW</th>
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</thead>
<tbody>
<tr>
<td>1–≤2 months late</td>
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</tr>
<tr>
<td>Aboriginal (%)</td>
<td>13.9</td>
<td>15.8</td>
<td>15.3</td>
<td>18.0</td>
<td>18.2</td>
<td>12.6</td>
<td>21.2</td>
<td>26.5</td>
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<td>15.7</td>
<td>19.7</td>
<td>18.8</td>
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<td>17.2</td>
</tr>
<tr>
<td>Non-Aboriginal (%)</td>
<td>13.6</td>
<td>15.0</td>
<td>10.0</td>
<td>13.3</td>
<td>12.9</td>
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<tr>
<td>Aboriginal (%)</td>
<td>8.0</td>
<td>2.1</td>
<td>7.8</td>
<td>6.1</td>
<td>7.5</td>
<td>8.3</td>
<td>4.2</td>
<td>8.2</td>
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<td>7.0</td>
<td>15.0</td>
<td>9.2</td>
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<tr>
<td>Non-Aboriginal (%)</td>
<td>4.3</td>
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<tr>
<td>Aboriginal (%)</td>
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<td>5.0</td>
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<td>5.3</td>
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<tr>
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<td>2.9</td>
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<td>2.8</td>
<td>2.3</td>
<td>2.2</td>
<td>3.4</td>
<td>2.8</td>
</tr>
</tbody>
</table>

*CC: Central Coast; FW: Far West; HNE: Hunter New England; IS: Illawarra Shoalhaven; MN: Mid North Coast; MM: Murrumbidgee; NBM: Nepean Blue Mountains; NV: Network with Victoria; NN: Northern NSW; NS: Northern Sydney; SES: South Eastern Sydney; SWS: South Western Sydney; SN: Southern NSW; SYD: Sydney; WN: Western NSW; WS: Western Sydney; NSW: New South Wales.

Source: Australian Childhood Immunisation Register, data as at 31 March 2016.

**Table 8.** Percentage of children* with vaccination delay for the second dose of measles–mumps–rubella due at 18 months of age by Aboriginal status for each local health district in NSW, 2015

<table>
<thead>
<tr>
<th>Vaccination delay and Aboriginal status</th>
<th>CC</th>
<th>FW</th>
<th>HNE</th>
<th>IS</th>
<th>MN</th>
<th>MM</th>
<th>NBM</th>
<th>NV</th>
<th>NN</th>
<th>NS</th>
<th>SES</th>
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<th>SN</th>
<th>SYD</th>
<th>WN</th>
<th>WS</th>
<th>NSW</th>
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</thead>
<tbody>
<tr>
<td>1–≤2 months late</td>
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<tr>
<td>Aboriginal (%)</td>
<td>22.3</td>
<td>22.1</td>
<td>21.0</td>
<td>20.2</td>
<td>24.3</td>
<td>21.2</td>
<td>24.2</td>
<td>18.4</td>
<td>25.2</td>
<td>28.1</td>
<td>21.0</td>
<td>26.0</td>
<td>28.9</td>
<td>23.4</td>
<td>23.2</td>
<td>25.5</td>
<td>22.8</td>
</tr>
<tr>
<td>Non-Aboriginal (%)</td>
<td>19.8</td>
<td>18.5</td>
<td>16.0</td>
<td>18.2</td>
<td>21.8</td>
<td>18.3</td>
<td>17.7</td>
<td>17.3</td>
<td>20.4</td>
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<tr>
<td>Aboriginal (%)</td>
<td>8.8</td>
<td>2.1</td>
<td>9.7</td>
<td>7.5</td>
<td>8.2</td>
<td>10.6</td>
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<td>Non-Aboriginal (%)</td>
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<tr>
<td>Aboriginal (%)</td>
<td>2.8</td>
<td>5.3</td>
<td>3.7</td>
<td>5.9</td>
<td>2.6</td>
<td>5.8</td>
<td>4.2</td>
<td>4.1</td>
<td>5.4</td>
<td>3.2</td>
<td>4.0</td>
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<td>4.4</td>
<td>1.3</td>
<td>4.8</td>
<td>4.2</td>
<td>4.0</td>
</tr>
<tr>
<td>Non-Aboriginal (%)</td>
<td>1.8</td>
<td>2.7</td>
<td>1.7</td>
<td>1.7</td>
<td>2.4</td>
<td>1.6</td>
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<td>2.1</td>
<td>1.8</td>
<td>1.4</td>
<td>3.0</td>
<td>2.2</td>
</tr>
</tbody>
</table>


Source: Australian Childhood Immunisation Register, data as at 31 March 2016.
papillomavirus (HPV) vaccine (both females and males) and the dTpa vaccine (Table 10).

- Compared to the first and second doses of HPV vaccine, the third dose was lower in both females and males (Table 10).
- Coverage of each dose of HPV was higher in female Year 7 students than their male counterparts (Figure 11).

- Over the past 5 years there has been an increase in adolescent coverage for most vaccines (Table 10).
- Varicella vaccine is only recommended for children who were not vaccinated in infancy or who have not had the disease. Coverage for this vaccine increased in 2015 by more than 20% compared to 2014 (Table 10).
Figure 7. Age at which children in NSW received their first dose of hexavalent combination vaccine by month of receipt, January 2009–December 2015.

The media release was a message for providers and the public on 10 March 2009 that asked parents and providers to consider bringing the first dose of pertussis-containing vaccine forward to 6 weeks of age to provide earlier protection.


Source: Australian Childhood Immunisation Register, data as at 31 March 2016.

Figure 8. Rotavirus vaccine coverage at 12 months of age, by statistical area level 3, NSW, for the cohort of children born in 2014.

Source: Australian Childhood Immunisation Register, data as at 31 March 2016.
**Coverage in the elderly**

- The proportion of people aged 65 years and over with reported vaccination for influenza in the previous 12 months has remained relatively stable between 2002 and 2015 (Figure 12). In 2015, 71.9% of surveyed adults reported they had received the influenza vaccine in the 12 months prior. Coverage did vary between LHDs and ranged from 67.1% in the Mid North Coast to 77.1% in the Central Coast (Table 11).
- The percentage of people aged 65 years and over with reported pneumococcal vaccination (23-valent pneumococcal polysaccharide vaccine) is lower than influenza coverage and has been decreasing since 2011 (Figure 12), when it was recommended that non-Indigenous adults aged 65 years and over who do not have any condition predisposing them to an increased risk of invasive pneumococcal disease no longer require a repeat dose. It is possible that difficulty in recall may result in underestimation of pneumococcal vaccine uptake. Compared to 2014, pneumococcal coverage did remain stable at 47% in 2015; however, there was variation in reported vaccination between LHDs, ranging from 40.9% in South Western Sydney and 54.1 in Western NSW (Table 11).

**Conclusion**

ACIR data presented in this 2015 report reflects the continued successful delivery of the National Immunisation Program in NSW. This is the first report where the ‘fully immunised’ coverage estimates have increased across each of the three milestones when compared to the previous report. Between 2014 and 2015, the increase in the ‘fully immunised’ estimates for the 12-month milestone is the largest increase that has been observed since the inception of these reports. Recorded vaccination objection remained steady across NSW.

The report identifies some areas for improvement, especially with regard to vaccination coverage in Aboriginal children. Whilst ‘fully immunised’ and individual vaccine coverage has improved for Aboriginal children across NSW, ‘fully immunised’ coverage estimates do remain lower in Aboriginal children compared to non-Aboriginal children at the 12 and 24-month milestones. Encouragingly, at the 60-month milestone, ‘fully immunised’ coverage for Aboriginal children is more than 2.5 percentage points higher than for non-Aboriginal children in NSW, and is in fact over 93% in all LHDs except for South

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*Figure 9. Pneumococcal conjugate vaccine coverage at 12 months of age, by statistical area level 3, NSW, for the cohort of children born in 2014.*

*Source: Australian Childhood Immunisation Register, data as at 31 March 2016.*
Eastern Sydney. Timeliness of vaccination for Aboriginal children remains a concern across NSW; however, clear improvements have been seen since 2014, especially with regards to the DTPa timeliness.

In general, coverage for adolescent vaccinations has increased for most vaccines over the past 5 years with varicella vaccine coverage in Year 7 students having increased by more than 20%.

The ACIR, the NSW Population Health Survey and monitoring through the NSW School Vaccination Program continue to be very useful tools for administering the National Immunisation Program and monitoring its implementation in NSW.
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</tr>
</thead>
<tbody>
<tr>
<td>HPV dose 1&lt;sup&gt;hc&lt;/sup&gt; – females</td>
<td>87</td>
<td>37 572</td>
<td>87</td>
<td>37 119</td>
<td>86</td>
<td>36 911</td>
<td>86</td>
<td>36 811</td>
<td>81</td>
<td>34 524</td>
</tr>
<tr>
<td>HPV dose 2&lt;sup&gt;hc&lt;/sup&gt; – females</td>
<td>85</td>
<td>36 799</td>
<td>85</td>
<td>36 333</td>
<td>84</td>
<td>35 855</td>
<td>83</td>
<td>35 749</td>
<td>76</td>
<td>32 582</td>
</tr>
<tr>
<td>HPV dose 3&lt;sup&gt;hc&lt;/sup&gt; – females</td>
<td>81</td>
<td>34 892</td>
<td>81</td>
<td>34 594</td>
<td>79</td>
<td>34 090</td>
<td>73</td>
<td>31 562</td>
<td>71</td>
<td>30 426</td>
</tr>
<tr>
<td>HPV dose 1&lt;sup&gt;hc&lt;/sup&gt; – males</td>
<td>84</td>
<td>37 945</td>
<td>83</td>
<td>37 155</td>
<td>80</td>
<td>36 268</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>HPV dose 2&lt;sup&gt;hc&lt;/sup&gt; – males</td>
<td>83</td>
<td>37 213</td>
<td>81</td>
<td>36 424</td>
<td>78</td>
<td>35 406</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>HPV dose 3&lt;sup&gt;hc&lt;/sup&gt; – males</td>
<td>78</td>
<td>35 054</td>
<td>77</td>
<td>34 742</td>
<td>75</td>
<td>33 857</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
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<tr>
<td>Hepatitis B dose 1&lt;sup&gt;c&lt;/sup&gt;</td>
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<td>na</td>
<td>na</td>
<td>na</td>
<td>51</td>
<td>44 933</td>
<td>69</td>
<td>60 925</td>
<td>68</td>
<td>30 426</td>
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<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
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<td>40 233</td>
<td>63</td>
<td>54 948</td>
<td>63</td>
<td>53 517</td>
</tr>
<tr>
<td>dTpa&lt;sup&gt;c&lt;/sup&gt;</td>
<td>86</td>
<td>75 633</td>
<td>84</td>
<td>73 856</td>
<td>81</td>
<td>71 918</td>
<td>81</td>
<td>70 997</td>
<td>77</td>
<td>65 756</td>
</tr>
<tr>
<td>dTpad&lt;sup&gt;d&lt;/sup&gt;</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>67</td>
<td>58 065</td>
<td>66</td>
<td>57 633</td>
<td></td>
</tr>
<tr>
<td>Varicella&lt;sup&gt;e&lt;/sup&gt;</td>
<td>66</td>
<td>58 630</td>
<td>42</td>
<td>37 123</td>
<td>53</td>
<td>46 738</td>
<td>50</td>
<td>43 714</td>
<td>45</td>
<td>38 409</td>
</tr>
<tr>
<td>HPV dose 1&lt;sup&gt;e&lt;/sup&gt; – males</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>74</td>
<td>33 714</td>
<td>70</td>
<td>31 940</td>
<td>na</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>HPV dose 2&lt;sup&gt;e&lt;/sup&gt; – males</td>
<td>na</td>
<td>na</td>
<td>71</td>
<td>32 252</td>
<td>67</td>
<td>30 373</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>HPV dose 3&lt;sup&gt;e&lt;/sup&gt; – males</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>59</td>
<td>26 669</td>
<td>56</td>
<td>25 277</td>
<td>na</td>
<td>na</td>
<td>na</td>
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</tbody>
</table>

*Coverage estimates are for school attendees only and do not include doses administered in general practice.

<sup>b</sup>HPV vaccination coverage includes dose 2 and 3 catch-up vaccination offered to students in Year 8 in Terms 1–2 in 2016 who commenced the three-dose course of HPV vaccine in Year 7 in 2015. Coverage for this cohort is preliminary as data are not yet available for catch-up doses given to students in Terms 3–4 in 2016.

<sup>c</sup>Year 7 school attendees.

<sup>d</sup>Year 9 school attendees – this program ended at the end of 2014.

<sup>e</sup>Year 10 school attendees.

na: not applicable.

HPV: human papillomavirus.


Source: NSW School Vaccination Program.
Figure 11. Trends in human papillomavirus vaccine coverage for adolescents* in NSW, 2011–2015.

*Adolescent school attendees (males and females) in Year 7 at time of vaccination. Coverage estimates are for school attendees only and do not include doses administered in general practice.

HPV: human papillomavirus vaccine

Source: NSW School Vaccination Program.
Table 11. Percentage of adults aged 65 years and over reporting vaccination against pneumococcal disease\(^a\) and influenza\(^b\) for each local health district in NSW, and for NSW, 2015

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>CC</th>
<th>FW</th>
<th>HNE</th>
<th>IS</th>
<th>MNC</th>
<th>MM</th>
<th>NBM</th>
<th>NNSW</th>
<th>NS</th>
<th>SES</th>
<th>SWS</th>
<th>SNSW</th>
<th>SYD</th>
<th>WNSW</th>
<th>WS</th>
<th>NSW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pneumococcal % vaccinated</td>
<td>50.5</td>
<td>53.4</td>
<td>53.0</td>
<td>51.2</td>
<td>46.4</td>
<td>50.1</td>
<td>48.4</td>
<td>48.0</td>
<td>47.1</td>
<td>43.0</td>
<td>40.9</td>
<td>42.9</td>
<td>41.9</td>
<td>54.1</td>
<td>48.2</td>
<td>47.6</td>
</tr>
<tr>
<td>Influenza % vaccinated</td>
<td>77.1</td>
<td>74.9</td>
<td>74.6</td>
<td>73.7</td>
<td>67.1</td>
<td>69.2</td>
<td>67.9</td>
<td>69.3</td>
<td>70.5</td>
<td>70.7</td>
<td>69.9</td>
<td>72.6</td>
<td>69.9</td>
<td>74.0</td>
<td>75.6</td>
<td>71.9</td>
</tr>
</tbody>
</table>

\(^a\)Vaccinated against pneumococcal disease.
\(^b\)Vaccinated against influenza in the last 12 months.

Source: New South Wales Population Health Survey 2015 (SAPHaRI), Centre for Epidemiology and Evidence, NSW Ministry of Health.

References