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# A HISTORY OF ADOLESCENT SCHOOL-BASED VACCINATION IN AUSTRALIA

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## Abstract

As adolescents have become an increasingly prominent target group for vaccination, school-based vaccination has emerged as an efficient and effective method of delivering nationally recommended vaccines to this often hard to reach group. School-based delivery of vaccines has occurred in Australia for over 80 years and has demonstrated advantages over primary care delivery for this part of the population. In the last decade school-based vaccination programs have become routine practice across all Australian states and territories. Using existing records and the recollection of experts we have compiled a history of school-based vaccination in Australia, primarily focusing on adolescents.

Key words: immunization, vaccination, adolescent, school vaccination

## Introduction

Many developed countries, including Australia, now recommend routine vaccination of adolescents. This provides protection against future disease risk, boosts existing but waning immunity, and forms part of catch-up programs for those who may not have been adequately vaccinated as children.<sup>1,2</sup> To attain high vaccine uptake and to contribute to disease control, efficient and effective ways of delivering vaccines to this often hard to reach group are needed.<sup>3</sup> Schools have long served as sites to successfully deliver one-off mass vaccination of children and adolescents, both in Australia and overseas.<sup>4-6</sup> Over the last two decades, school-based vaccination programs have been developed in each Australian state and territory to routinely deliver adolescent vaccines on the National Immunisation Program (NIP). This approach has demonstrated significant advantages over delivery through general practitioners (GPs) alone.<sup>7,8</sup> However it has not been uniformly introduced nationally due to the differences in political support and the legislative and public health systems across the states and territories.

Managed at a state or territory level, current school-based vaccination programs in Australia offer nationally recommended and Australian Government funded vaccines to adolescents in specific school grades using local teams of trained vaccination providers. State and territory governments primarily fund service delivery, although the Australian Government has provided funding for the delivery

of some vaccines. Vaccines are routinely offered to eligible students in targeted school grades, typically late primary school or early secondary school and are not mandated for school entry. Participation is voluntary, and written parental consent is required for each course of vaccine.

Much of the historical literature about vaccination in Australia omits detail on school-based delivery. There is currently no single complete account of the evolution of adolescent school-based vaccination in Australia as there is for childhood vaccination.<sup>9,10</sup> As part of a review of adolescent school-based vaccination in Australia information on the evolution of each state or territory school-based vaccination program was obtained through interview with representatives from eight jurisdictional health departments. Where possible, formal written records were identified to supplement and verify the information provided at the time of interview. This information was used to compile the following historical account of school-based vaccination in Australia, primarily focusing on adolescent programs though including relevant national catch-up campaigns targeting younger school-aged children.

### Pre-1970s

One of the earliest recorded national school-based vaccination programs in Australia provided the diphtheria–tetanus toxoid (dT) vaccine from 1932 to 1936.<sup>11</sup> This was followed by the introduction of the bacille Calmette-Guerin (BCG) vaccine, delivered through schools in some jurisdictions from the late 1940s to the mid-1980s. The Northern Territory was the only jurisdiction to continue routinely offering this until 1990 (Table 1).<sup>12,13</sup> Some states and territories also used schools to deliver polio vaccine during the 1950s and 1960s as part of larger mass vaccination programs.

### 1970s to the late- 1990s

The national schoolgirl rubella vaccination program commenced in 1970–71 to vaccinate females prior to, but as close as possible to potential pregnancy with a view to reducing the incidence of congenital rubella. The vaccine was offered to one cohort of girls aged 10–14 years and delivered in school grades 6, 7 or 8 in all jurisdictions except Queensland.<sup>9,14</sup> From 1993–94 to 1997, the schoolgirl rubella program was replaced by the routine vaccination of both boys and girls with the combined measles-mumps-rubella (MMR) vaccine.<sup>14</sup> This program set the scene for

a more consistent adoption of school-based vaccination in some states and territories. Although some continued with the school-based approach to deliver adult diphtheria–tetanus vaccine (ADT) and oral polio vaccine (OPV) to adolescents, more than 25 years elapsed before the next major national school-based vaccination program was implemented (Table 1).

Following a recommendation of the Australian Technical Advisory Group on Immunisation (ATAGI), hepatitis B catch-up vaccination commenced in 1998–99 for all adolescents aged 10–16 years.<sup>15</sup> Three doses of the vaccine were incorporated into existing school-based vaccination programs in some jurisdictions, although in Western Australia, New South Wales and most areas of Queensland the vaccine was initially provided by GPs.<sup>16,17</sup> The Northern Territory had provided universal infant hepatitis B vaccination from 1990 hence, most school children already received the vaccine. Consequently, a one-off catch-up program for all school students was implemented during 1998–99.<sup>18</sup>

#### **National school-based vaccination campaigns from the late 1990s to early 2000s**

School-based vaccination developed further in the late 1990s and early 2000s when the Australian Government funded all jurisdictions to deliver two ‘whole of school’ vaccination programs. The first of these was the National Measles Control Campaign in 1998; a catch-up campaign for all primary school students (5–12 years of age).<sup>19</sup> One-off funding for this program from the Australian Government saw the establishment of state/territory coordinated school-based vaccination programs in some jurisdictions and the enhancement of existing programs in others. This was followed in 2003 by the National Meningococcal C Vaccination Program, targeting all children aged 1 to 19 years.<sup>20</sup> The catch-up component of the program was delivered in both primary and secondary schools in two phases; students aged 15 to 19 years (grades 9 to 12); and students aged 6 to 14 years (pre-school to grade 8), plus any students aged 15 to 19 years who had missed being vaccinated in phase one. In addition to funding the vaccine, the Australian Government provided time-limited funds to support school-based delivery of the catch-up program in all states and territories.

#### **Routine school-based vaccination from early 2000s**

As more evidence of the success of school-based vaccination emerged and the number of vaccines recommended for ongoing delivery to adolescents grew, school-based vaccination programs were established or re-established in more states and territories. In 2000, the nationally recommended cohort for receipt of the adolescent catch-up dose

of hepatitis B was revised to include only 10 to 13 year olds, and from 2000–04 jurisdictions shifted to a two dose schedule.<sup>10</sup> Hepatitis B vaccine is now provided routinely in all jurisdictions, either in the last year of primary school or the first year of secondary school. However it is currently scheduled to cease around the time when the first age-cohort eligible for the universal birth dose enters secondary school.

The availability of an adult formulation of diphtheria-tetanus-acellular pertussis vaccine (dTpa),<sup>21,22</sup> and the recognition of increasing pertussis incidence in adolescents prompted the addition of dTpa vaccine to the NIP in November 2003.<sup>23</sup> This replaced the previously recommended ADT booster dose for 15 to 17 year olds. The Australian Government funded all states and territories to provide school-based delivery of the vaccine from 2004.<sup>24</sup> In some jurisdictions the implementation simply involved the replacement of ADT with dTpa in existing school-based programs; in others it required establishment or re-establishment of these programs (Table 1). The vaccine continues to be offered in later secondary school grades, though more recently there has been a recommendation for it to be offered at a younger age (11 to 13 years) in either the last year of primary school (grade 6 or 7) or first year of secondary school (grade 7 or 8).<sup>25</sup>

In 2005, varicella vaccine was included on the funded NIP schedule at 18 months and as a catch-up for non-immune adolescents aged 10 to 13 years.<sup>26</sup> From 2006 the adolescent dose was delivered through existing jurisdiction-wide school-based vaccination programs in all states and territories except Queensland.<sup>27</sup> The catch-up dose of varicella vaccine for adolescents is currently scheduled to cease after 2015, when the first cohort eligible for the infant dose will reach the age at which the adolescent catch-up dose is currently offered.

By the mid-2000s all states and territories except Queensland had established routine jurisdiction-wide school-based vaccination programs. In Queensland, nationally recommended adolescent vaccines were predominantly delivered through general practitioners, although routine school-based vaccination programs operated in some local government areas and health service districts. Time-limited statewide school-based vaccination occurred to deliver Australian Government funded national vaccination campaigns until 2007 when the statewide school-based vaccination program commenced in the state.<sup>8</sup>

The most recent addition to the routine school-based vaccination program in Australia came with the National Human Papillomavirus (HPV) Vaccination Program. From April 2007 the quad-

**Table 1: School-based vaccination programs, Australia, from 1970–2013**

Year commenced	Vaccine	Year ceased	Jurisdiction(s)*	School grade <sup>†‡</sup>		
<b>Measles-mumps-rubella (MMR) containing vaccines</b>						
1971	Monovalent rubella (females only)	1993	NSW, NT, Vic, Tas, WA, ACT	Grade 6 or 7		
1993	MMR	1997	SA	Grade 8		
1994		1997	WA	Grade 7		
		1997	NSW, ACT, Vic, NT	Grade 7 NSW Grade 6 ACT, Vic & NT		
			SA	Grade 8		
			Tas	Grade 6 or 7		
1998	MMR	1998	All	All primary school <sup>19</sup>		
<b>Diphtheria-tetanus-pertussis containing vaccines (ADT, dTpa)</b>						
1980	ADT	2003	ACT	Grade 9		
1994		2000	Vic	Grade 10		
		2003	SA	1994–2001: Grade 10 2002–03: Grade 9		
			Tas	Grade 10		
1996		2003	NT	Grade 10		
1998		2003	WA	Grade 10		
2004	dTpa	Ongoing	NSW§	2004: All secondary school grades 2005: Grade 7 2009–12: Grade 10 2010 onwards: Grade 7		
			SA	2004: Grade 9 2005–06: Grade 8 2008 onwards: Grade 9		
			Qld§	2004–06: Grade 10 2007 onwards: Grade 10		
			NT	2004–Nov 2005: Grade 10 only Nov 2005–07: Grades 8 & 10 2008 onwards: Grade 8		
			WA	2004: Grade 7 & Grades 8–12 2005 onwards: Grade 7		
			Tas, Vic	Grade 10		
			ACT	Grade 9		
<b>Tuberculosis</b>						
1986			Bacillus Calmette-Guerin (BCG)	1990	NT	Grade 9
<b>Oral polio vaccine (OPV)</b>						
1994	OPV <sup>§</sup>	2000	Vic	Grade 10		
		2002	SA, Tas	Grade 10		
		2003	ACT	Grade 9		
1996	OPV	2002	NT	Grade 10		
<b>Hepatitis B (2 and 3 dose schedules)<sup>¶</sup></b>						
1998	Hepatitis B	1999	NT**	First year of school to Grade 10		
			Vic	Grade 7		
			Tas	Grade 6 or 7		

**Table 1 continued: School-based vaccination programs, Australia, from 1970–2013**

Year commenced	Vaccine	Year ceased	Jurisdiction(s)*	School grade†‡
1998/9	Hepatitis B	Ongoing at present††	ACT  SA	1999–00: Grade 6 2001–06: Grade 6 2008–12: Grade 7 Grade 8
<b>Hepatitis B</b>				
2002		Ongoing at present††	WA	Grade 7
2004			NSW§	Grade 7
2007			Qld	Grade 8
<b>Pneumococcal (Aboriginal and Torres Strait Islander only)</b>				
2001	Pneumococcal polysaccharide vaccine, 23 valent (23vPPV)	Ongoing	NT	2001: Grade 10 to 12 2002: Grade 11 or 12 2003 onwards: Grade 10
<b>Meningococcal C</b>				
2003	Meningococcal C	2004	ACT	2003: Grade 6, 9 & 10–12 2004: Pre-school – Grade 5 & Grade 8
		2004	NSW, WA	2003: All secondary school 2004: All primary school
		2004	QLD¶	2003: All secondary school 2004: All primary school & Grade 8
		2005	SA	2003: Grades 9–12 2004: Grades 8–9 2005 All primary school
		2005	Vic, Tas	2003: Grades 9–12 2004–05: Grades 1–9
		2006	NT	2003: Grades 10–11 2004: Pre-school to Grade 9 2005–2006: Any student aged 1–19yrs in 2003–04 not previously vaccinated
<b>Varicella‡‡</b>				
2006	Varicella	2015	NT, SA	Grade 8
		2015	NSW, ACT, Vic, WA	Grade 7
		2015	Tas	Grade 6 or 7
		2015	Qld	2006: Grade 8 <sup>e</sup> 2007 onwards: Grade 8
<b>Human papillomavirus (HPV)</b>				
2007	Quadrivalent HPV vaccine (females only)	Ongoing	NSW, ACT  NT, WA  SA	2007: Grades 7 & 10–12 2008: Grades 7 & 9–10 2009 onwards: Grade 7 2007: Grades 10–12 2008: Grades 7–10 2009 onwards: Grade 7 2007: Grades 8–12 2008 onwards: Grade 8

**Table 1 continued: School-based vaccination programs, Australia, from 1970–2013**

Year commenced	Vaccine	Year ceased	Jurisdiction(s)*	School grade†‡
2013	Quadrivalent HPV vaccine (males) §§	Ongoing	Tas	2007: Grades 7 & 10–12 2008: Grades 7–10 2009 onwards: Grade 7
			Vic	2007: Grade 7, 10–12 2008: Grade 7, 9–10 2009 onwards: Grade 7
			Qld	2007: Grades 10–12 2008: Grades 8–10 2009 onwards: Grade 8
			NSW, ACT, NT, Vic, Tas	2013 & 2014: Grades 7 & 9 2015 onwards: Grade 7 only
			SA	2013: Grades 9 2014: Grades 8 & 9 2015 onwards: Grade 8
			Qld	2013 & 2014: Grades 8 & 10 2015 onwards: Grade 8
			WA	2013: Grades 8, 9 & 10 2014 onwards: Grade 8

\* Abbreviations for each state/territory: ACT = Australian Capital Territory, NSW = New South Wales, NT = Northern Territory, Qld = Queensland, SA = South Australia, Tas = Tasmania, Vic = Victoria and WA = Western Australia.

† Ages for each school grade differ between jurisdictions. Approximate ages are as follows: pre-school, 3–6 years; grade 1, 6–7 yrs; grade 2, 7–8 yrs; grade 3, 8–9 yrs; grade 4, 9–10 yrs; grade 5, 10–11 yrs; grade 6, 11–12 yrs; grade 7, 12–13 years; grade 8, 13–14 years; grade 9, 14–15 years; grade 10, 15–16 years; grade 11, 16–17 years; grade 12, 17–19 years.

‡ In South Australia, Western Australia and Queensland grade 7 is the final year of primary school. In all other jurisdictions grade 7 is the first year of secondary school.

§ Year vaccine first routinely provided through state-wide school-based vaccination program. Prior to this, vaccine may have been provided through local government run school-based programs in some areas of the state.

|| Prior to 2007 in Queensland, nationally recommended adolescent vaccines were mainly delivered by general practitioners. However, some local governments and Health Service Districts implemented their own school-based vaccination programs but these were not managed by centrally by Queensland Health. Only those vaccines provided through Queensland-wide school-based vaccination programs including those provided in one-off national mass-vaccination campaigns (e.g. MMR, Meningococcal C) are listed in this table.

¶ Change from 3-dose to 2-dose dose schedule occurred in 2001 in Victoria and in The Australian Capital Territory, 2002 in South Australia and 2003 in Tasmania. All other jurisdictions delivered only 2-dose scheduled through school-based vaccination programs.

\*\* A one-off cohort based catch-up program for all those born since 1982 was run from February 1998 to April 1999. Hepatitis B vaccine is not offered in the NT routine school-based vaccination program as universal infant hepatitis B vaccination commenced in 1990 with at-risk infants vaccinated since 1988.

†† Under review at time of publication.

‡‡ Varicella vaccine is recommended for one cohort of those aged 10–13 years unless they have a clinical history of chicken pox or have already received the vaccine.

rivalent HPV vaccine became freely available to females aged 12 to 26 years with those aged 12 to 18 years primarily vaccinated at school.<sup>28</sup> During 2007–08 a catch-up program for all female secondary school students was delivered using an accelerated schedule with targeted school grades varying across jurisdictions.<sup>29</sup> From 2009 HPV vaccine has been provided routinely to girls aged 12 to 13 years of age in either the last year of primary school (grade 7 or 8) or first year of secondary school (grade 7 or 8). From February 2013 school-based vaccination programs commenced offering HPV vaccine to males aged 12–13 years (grade 7 or 8) on

an ongoing basis. Catch-up for the HPV vaccine series (3 doses) is also being offered to males aged 14 to 15 years until the end of the 2014 school year.

### Impact of school-based vaccine programs in Australia

As part of larger mass vaccination programs, school-based delivery of diphtheria, polio, and tuberculosis vaccines contributed substantially to the rapid decline of these diseases in the mid to late 1900s.<sup>9,11</sup> Although coverage data from early programs is limited, state/territory data from routine school-

based vaccination programs illustrates good uptake (65% to 80%), particularly in late primary school and lower secondary school grades.<sup>24,29,30</sup> Uptake in routine school-based vaccination programs has been consistently higher than that achieved by other strategies to vaccinate adolescents, such as mandates for school entry,<sup>31</sup> or GP delivery.<sup>7,8,16</sup> Evaluations of the impact of several school-based vaccination programs have identified significantly higher levels of immunity in population cohorts vaccinated through these programs compared with those who have not.<sup>32-34</sup> Despite evidence of their success there is still room for improvement in school-based program delivery in Australia. This includes understanding operational factors that optimise uptake and enhancing coverage beyond the current levels to maximise population immunity as disease incidence decreases.

## Conclusion

The foundations for school-based vaccination in Australia have been laid, its success demonstrated and challenges highlighted. This strategy will continue to evolve in response to available evidence and increased availability of, and recommendations for, adolescent vaccines.

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