A re-evaluation of immunisation coverage estimates from the Australian Childhood Immunisation Register

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Abstract

Immunisation coverage reporting using data from the Australian Childhood Immunisation Register is likely to underestimate immunisation uptake. Since 1997, several initiatives have been introduced to improve both immunisation uptake and notification of immunisation encounters. These initiatives seemed likely to have changed previous coverage estimates. Re-calculation of immunisation coverage estimates for the previously reported cohorts was undertaken. This used current Australian Childhood Immunisation Register data - especially the immunisation history form and the impact of catch-up immunisations - to evaluate delayed reporting. Previous coverage estimates published in *Communicable Diseases Intelligence* were shown to be at least 2% to 4% below estimates based on data now held by the Australian Childhood Immunisation Register, with greater differences observed in particular jurisdictions. *Commun Dis Intell* 2000;24:161-164.

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Introduction

The Australian Childhood Immunisation Register (ACIR) was implemented in 1996, with the first coverage estimates published in *Communicable Diseases Intelligence (CDI)* in March 1998.[1] Subsequent reports have shown a progressive increase in coverage, especially in jurisdictions such as Western Australia and the Northern Territory where initial estimates were disproportionately low. Coverage appears likely to still be underestimated, as a result of non-reporting or delayed reporting.[2] Since 1997, and as part of the Immunise Australia program, several initiatives have been introduced to improve both immunisation uptake and notification of immunisation encounters to the Health Insurance Commission (HIC). These initiatives include the Commonwealth Childcare Rebate scheme (with the accompanying Immunisation History Form), the Childcare Assistance scheme and the General Practice Immunisation Incentives scheme. The Immunisation History Form and improvements in data transmission to the ACIR seemed likely to have changed previous coverage estimates. The cohort method of reporting immunisation coverage does not allow for assessment of 'catch-up' immunisation occurring after the assessment age of 12 months.[1] Re-analysis of earlier immunisation coverage estimates, using current ACIR data, was undertaken to evaluate changes in coverage and to measure the impact of 'catch-up' immunisations.

Methods

Coverage estimates for the first milestone vaccines at 12 months of age for three separate 3-month birth cohorts born early 1996, early 1997 and late 1997 were taken from *CDI* reports in 1998[1,3] and 1999.[4] Coverage estimates for these birth cohorts were re-calculated by the same algorithm originally applied but using ACIR data as of 30 June 1999. This allowed measurement of changes in coverage due to late notifications, with the proportion of the change due to Immunisation History Form notifications (related to the Child Care Rebate scheme) identified separately. To evaluate catch-up immunisation, coverage estimates for these birth cohorts were re-calculated, assessing at the age of 24 months rather than 12 months. This allowed any first milestone immunisations given up to two years of age to be included. Full immunisation against pertussis was defined as receipt of a total of three pertussis-containing vaccines by 24 months. A similar analysis was also undertaken for receipt of Measles-Mumps-Rubella (MMR) vaccine by 24 months and 36 months.

As the differences in coverage estimates are presumed to be due to late notifications, the mean and median notification lag time was also examined. Lag-time was calculated as the number of days between the date of the immunisation encounter and the date of processing at the HIC. The lag time was calculated for the first three doses of Diphtheria-Tetanus-Pertussis (DTP) for two separate cohorts. To evaluate possible factors influencing the proportion of late notifications, differences in lag times were examined by method of notification, state or territory and provider type between the two time periods.

Results

For the first cohort (born 1 Jan 1996 to 31 March 1996) coverage estimates at 12 months, after including late notifications, increased in absolute terms by 3.9% for Australia as a whole (Table 1). Much of this increase

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Table 1. Re-calculation of immunisation coverage estimates – first three doses of DTP for birth cohort 1 (1 January 1996 to 31 March 1996); assessment date 31 March 1997.

	State or Territory								
	ACT	NSW	NT	Qld	SA	Tas	Vic	WA	Aust
Initial coverage: *CDI* report 30 November 1997	80.3	74.8	64.8	80.7	79.1	77.6	82.7	66.5	77.4
NCIRS report: 30 June 1999[1]	84.4	80.5	66.0	83.2	83.1	80.8	85.3	73.4	81.3
Absolute change in coverage due to late notifications	4.1	5.7	1.2	2.5	4.0	3.2	2.6	6.9	3.9
% due to history form[2]	2.6	4.3	2.7	1.7	2.7	2.4	2.2	4.0	3.0
NCIRS report: 30 June 1999[1] assessed at 24 months[3]	86.9	83.3	70.8	87.0	86.4	85.3	88.2	76.7	84.5
Change in coverage due to late encounters	2.5	2.8	4.8	3.8	3.3	4.5	2.9	3.3	3.2

1. Coverage estimates allowing for late notifications.
2. % Coverage calculated at 30 June1999 due to Immunisation History Form notifications .
3. Coverage estimates allowing for late notifications and late encounters.

Table 2. Re-calculation of immunisation coverage estimates – first three doses of DTP for birth cohort 5 (1 January 1997 to 31 March 1997); assessment date 31 March 1998.

	State or Territory								
	ACT	NSW	NT	Qld	SA	Tas	Vic	WA	Aust
Initial coverage: *CDI* report 31 August 1998	84.7	80.9	64.3	85.1	82.7	84.0	84.5	78.7	82.4
NCIRS report: 30 June 1999[1]	89.5	83.3	76.3	87.6	85.3	85.9	86.4	81.8	84.8
Absolute change in coverage due to late notifications	4.8	2.4	12.0	2.5	2.6	1.9	1.9	3.1	2.4
% due to history form[2]	1.7	2.3	1.0	1.1	1.7	2.0	1.9	2.2	1.9
NCIRS report: 30 June 1999[1] assessed at 24 months[3]	90.7	85.6	81.4	90.5	88.3	89.1	89.0	84.7	87.5
Change in coverage due to late encounters	1.2	2.3	5.1	2.9	3.0	3.2	2.6	2.9	2.7

1. Coverage estimates allowing for late notifications.
2. % Coverage calculated at 30 June 1999 due to Immunisation History Form notifications.
3. Coverage estimates allowing for late notifications and late encounters.

Table 3. Re-calculation of immunisation coverage estimates – first three doses of DTP for birth cohort 8 (1 October 1997 to 31 December 1997); assessment date 31 December 1998.

	State or Territory								
	ACT	NSW	NT	Qld	SA	Tas	Vic	WA	Aust
Initial coverage: *CDI* report 31 March 1999	88.1	84.2	80.2	88.6	88.2	87.8	87.2	85.5	86.3
NCIRS report: 30 June 1999[1]	90.3	84.9	81.3	89.2	88.8	89.4	87.7	85.8	86.7
Absolute change in coverage due to late notifications	2.2	0.7	1.1	0.6	0.6	1.6	0.5	0.3	0.4
% due to history form[2]	1.1	1.4	0.2	0.6	1.6	0.9	1.2	1.8	1.2

1. Coverage estimates allowing for late notifications.
2. % Coverage calculated at 30 June 1999 due to Immunisation History Form notifications.

appears to be due to late notifications resulting from Immunisation History Forms, which are used for documentation of immunisation required by the Child Care Rebate scheme. A further 3.2% absolute increase in coverage occurred after allowing for immunisation encounters occurring after 12 months of age. There were differences by jurisdiction, with Immunisation History Forms having a greater effect in some States, most notably New South Wales and Western Australia. Similar patterns were observed in later cohorts, but the absolute changes in coverage estimates were fewer (Tables 2 and 3). Similar changes were also observed in coverage for MMR (Tables 4 and 5).

Mean and median notification lag time varied by method of notification, jurisdiction and provider type and decreased substantially in the period between the two cohorts. In most cases the median lag time was substantially lower than the mean lag time suggesting there were a number of very late notifications. For the 1996 cohort, notification by manual form was the only method associated with a low lag time between encounter and processing (Table 6). However, for the 1997 cohort, all methods of transmission had lower lag times except for Internet transmissions, which had a very substantial mean and median lag time. However, Internet notifications comprised a very small proportion of notifications to the HIC. Notifications from the Northern Territory and Queensland have the longest processing time at the HIC but are entered locally before transmission to the HIC. The lag period for all jurisdictions has also improved over time (Table 7). General Practitioners have low notification lag times except in Queensland where lag times for General Practitioners are substantially higher (Table 8). Immunisations given by Aboriginal health services, community health services and flying doctors take the greatest time to be received by the HIC. Notifications from private hospitals comprised an insignificant proportion of all notifications to the HIC.

Table 4. Re-calculation of first-dose MMR immunisation coverage estimates for birth cohort 1 (1 January 1996 to 31 March 1996); assessment date 31 March 1998 at 24 months.

	State or Territory								
	ACT	NSW	NT	Qld	SA	Tas	Vic	WA	Aust
Initial coverage: *CDI* report 31 August 1998	86.4	80.2	70.5	86.6	82.3	84.4	85.2	76.3	82.5
NCIRS report: 30 June 1999[1]	89.2	83.7	71.4	88.6	85.7	87.2	87.1	80.3	85.1
Absolute change in coverage due to late notifications	2.8	3.5	0.9	2.0	3.4	2.8	1.9	4.0	2.6
% due to history form[2]	2.9	4.6	3.3	1.8	3.3	2.3	2.9	3.7	3.4
NCIRS report: 30 June 1999[1] assessed at 36 months[3]	89.7	85.3	72.9	90.1	87.0	88.6	88.7	82.3	86.7
Change in coverage due to late encounters	0.5	1.6	1.5	1.5	1.3	1.4	1.6	2.0	1.6

1. Coverage estimates allowing for late notifications.
2. % Coverage calculated at 30 June 1999 due to Immunisation History Form notifications.
3. Coverage estimates allowing for late notifications and late encounters.

Table 5. Re-calculation of first-dose MMR immunisation coverage estimates for birth cohort 3 (1 July 1996 to 30 September 1996); assessment date 30 September 1998.

	State or Territory								
	ACT	NSW	NT	Qld	SA	Tas	Vic	WA	Aust
Initial coverage: *CDI* report 21 January 1999	85.9	83.0	77.4	89.5	83.9	84.8	86.9	80.6	85.0
NCIRS report: 30 June 1999[1]	89.3	84.7	76.5	91.0	86.3	87.5	88.2	82.9	86.5
Absolute change in coverage due to late notifications	3.4	1.7	-0.9	1.5	2.4	2.7	1.3	2.3	1.5
% due to history form[2]	3.2	3.4	2.0	1.5	2.8	2.4	2.5	3.1	2.7

1. Coverage estimates allowing for late notifications.
2. % Coverage calculated at 30 June 1999 due to Immunisation History Form notifications.

Table 6. Mean and median notification lag time by method of notification (number of days)[1]

Method of notification	Birth cohort: 1 January to 31 March 1996		Birth cohort: 1 January to 31 March 1997	
	Mean	Median	Mean	Median
Manual voucher	52	20	88	24
Disk	134	36	88	27
Scanned voucher	176	70	52	21
Electronic transmission	181	93	107	47
Internet	na[2]	na	534	512

1. NB: history form notifications and notifications later then 2 years excluded. This is because the number of extremely delayed notifications will be greater for the earlier cohort as more time is available from when an encounter occurs to when it is processed at HIC.
2. Not applicable.

Table 7. Mean and median notification lag time by jurisdiction (number of days)[1]

State	Birth cohort: 1 January to 31 March 1996		Birth cohort: 1 January to 31 March 1997	
	Mean	Median	Mean	Median
ACT	92	31	73	23
NSW	63	21	56	22
NT	356	387	266	224
Qld	202	94	99	36
SA	56	20	54	21
Tas	60	20	49	20
Vic	62	28	74	28
WA	112	25	73	22

1. NB: history form notifications and notifications later then 2 years excluded. This is because the number of extremely delayed notifications will be greater for the earlier cohort as more time is available from when an encounter occurs to when it is processed at HIC.

Table 8. Mean notification lag time by provider type (number of days)[1]

Provider type	Birth cohort: 1 January to 31 March 1996		Birth cohort: 1 January to 31 March 1997	
	Mean	Median	Mean	Median
General Practitioner	61	22	57	22
Council	69	29	81	30
State Health Dept.	111	57	56	20
Public Hospital	150	27	89	26
Aboriginal Health Service	176	78	148	51
Private Hospital	197	175	83	35
General Practitioner, Qld	202	95	95	35
Community Health Service	215	104	120	33
Flying doctor	362	423	187	136

1. NB history form notifications and notifications later then 2 years excluded. This is because the number of extremely delayed notifications will be greater for the earlier cohort as more time is available from when an encounter occurs to when it is processed at HIC.

Discussion

This analysis demonstrates that the immunisation coverage estimates originally reported by the ACIR in *CDI* require modification. The increases in coverage found are largely due to Immunisation History Form notifications arising from requirements of the Childcare Rebate scheme introduced in April 1998. The other initiatives introduced during 1998 may also have contributed to the increases in coverage, as not all the increase was due to history forms. Previous coverage estimates published in *CDI* underestimated the 'true' level of immunisation coverage in Australia by at least 2-4%, with greater differences observed in particular jurisdictions. Greater underestimation occurred in earlier estimates, with an overall increase of 3.9% in DTP coverage in the first cohort, declining to 2.4% in the fifth cohort and 0.4% in a 3-month period, or a maximum of 1.6% over 12 months, for the eighth cohort. Similarly, the change in MMR coverage estimates has declined over time. This trend correlates with the reduction in notification lag times shown in Tables 6-8. The data on lag times should be treated with caution as the processing date may not be the date the HIC first received the notification. The processing date is the date the record was last amended by a data entry operator. If there was a problem with the notification it may have been amended a number of times, so jurisdictions - or provider types - that have more problems with 'incorrect' notifications will have artificially greater lag times. The longer lag times for Queensland General Practitioners are likely to be due to transmission delays following local data entry rather than truly delayed notification.

This analysis also gives some indication of the amount of catch-up immunisation occurring. This is not included in routine coverage reports but does impact on the coverage estimates used for the General Practice Immunisation Incentives (GPII) program.[2] Overall, an additional 2.7-3.2% of children had received a third dose of DTP vaccine by 24 months. Although some of these children would still not have been classified as fully immunised at the two year milestone, three doses constitutes full pertussis immunisation in many countries and receipt of three or more doses is an important public health target. Similarly, an additional 1.6 % of children had received a dose of MMR vaccine between 24 and 36 months of age. Although every effort should be made to promote timely immunisation, these data represent catch-up immunisation of some 1,700 children Australia-wide. This is an important indicator of immunisation activity.

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