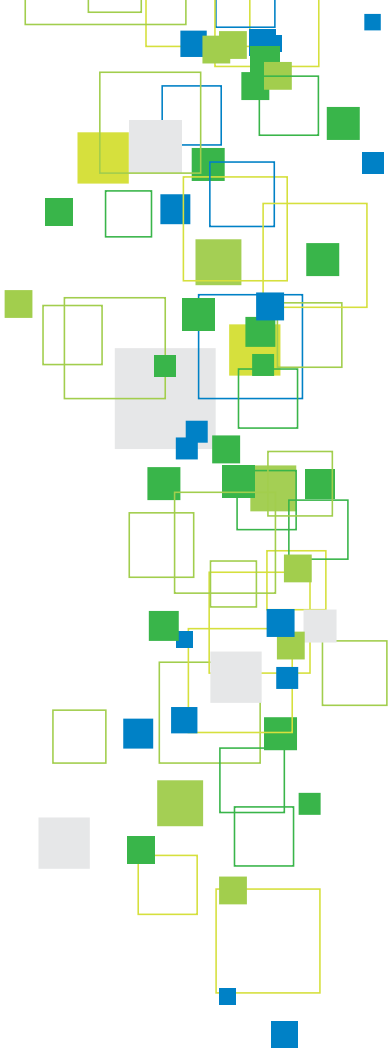

National Health Performance Authority

Healthy Communities:

Immunisation rates for children in 2011–12

Technical Supplement

nhpa

National Health Performance **Authority**

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Please note that there is potential for minor revisions of data in this report.
Please check **www.nhpa.gov.au** for any amendments.

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About the Authority

The National Health Performance Authority (the Authority) is an independent body that provides locally relevant and nationally consistent information on the performance of hospitals and other health care organisations. The Authority was set up under the *National Health Reform Act 2011* and commenced full operations in 2012.

Under the terms of the Act, the Authority monitors, and reports on, the performance of Local Hospital Networks, public and private hospitals, primary health care organisations and other bodies that provide health care services.

The Authority's reports provide timely and impartial information that allows all Australians to fairly compare their local health care organisations against their peers.

The reports let people see, for the first time, how their local health care organisations measure up against comparable organisations across Australia.

The Authority's activities are guided by a document called the *Performance and Accountability Framework* agreed by the Council of Australian Governments (COAG). The framework contains 48 indicators that form the basis for the Authority's reports.

The Authority's role includes reporting on the performance of health care organisations against the 48 indicators in order to identify both high-performing Local Hospital Networks, Medicare Locals and hospitals (so effective practices can be shared), and Local Hospital Networks and Medicare Locals that perform poorly (so that steps can be taken to address problems).

The Authority releases reports on a quarterly basis, and also publishes performance data on the MyHospitals website and on **www.nhpa.gov.au**

The Authority consists of a Chairman, a Deputy Chairman and five other members, appointed for up to five years. Members of the Authority are:

- Ms Patricia Faulkner AO (Chairman)
- Mr John Walsh AM (Deputy Chairman)
- Dr David Filby PSM
- Prof Michael Reid
- Prof Bryant Stokes AM RFD
- Prof Paul Torzillo AM
- Prof Claire Jackson (acting member).

The conclusions in this report are those of the Authority. No official endorsement from any Minister, department of health or health care organisation is intended or should be inferred.

Summary

This technical supplement summarises methods used to calculate descriptive statistics and performance indicators presented in *Healthy Communities: Immunisation rates for children in 2011–12*. Due to the complexity of the methods used, this supplement is targeted at individuals with technical expertise in the creation of health information.

The supplement is organised in four sections. The first part of the supplement presents information about the data source for the publication, the Australian Childhood Immunisation Register, including its limitations. The second part outlines the geography levels used in the report. It defines Medicare Local catchments and Statistical Areas Level 3. The third section describes how results have been confidentialised and what to consider when interpreting the data in *Healthy Communities: Immunisation rates for children in 2011–12*. The appendix outlines the method of postcode allocation where otherwise unallocated postcodes could not be used in the analysis **(page 6)**, i.e. those in remote areas of the Northern Territory.

Healthy Communities: Immunisation rates for children in 2011–12 publishes statistics about immunisation rates for children as defined by legislation, *A New Tax System (Family Assistance) Act 1999*.

The report provides the **percentages** of all children and Aboriginal and Torres Strait Islander children who have been fully immunised for children aged:

- 1 year
- 2 years
- 5 years.

The **numbers** of children not fully immunised are also reported for each age.

Measures of immunisation rates for children

The *Healthy Communities: Immunisation rates for children in 2011–12* report presents information about percentages of all children, and percentages of Aboriginal and Torres Strait Islander children, who are fully immunised. Results are displayed in multiple formats to facilitate understanding of immunisation rates at various geographic dispersions across Australia.

This information is reported for 61 Medicare Local catchments and more than 300 geographical areas at Statistical Area Level 3 (SA3). Information is provided online at **www.nhpa.gov.au** at Statistical Area Level 3 and post-code level. All data have been aggregated for geographic areas using protocol that respect confidentiality **(page 5)**.

Definitions of fully immunised are established by legislation; *A New Tax System (Family Assistance) Act 1999*. The definitions are:

- Fully immunised at 1 year means that a child aged 12 months to less than 15 months received their 3rd vaccination for diphtheria, tetanus, whooping cough (DTPa) and polio (IPV) and either their second or third vaccination (dependent on the type of vaccine used) for hepatitis B (hepB) and *Haemophilus influenzae* type b (Hib), all prior to the age of 1 year.

- Fully immunised at 2 years means that a child aged 24 to less than 27 months received their third or fourth vaccination (dependent on the type of vaccine used) for diphtheria, tetanus, whooping cough (DTPa) and *Haemophilus influenzae* type b (Hib), their third vaccination

for polio (IPV) and hepatitis B and their first vaccination for measles, mumps and rubella (MMR), all prior to the age of 2 years.

- Fully immunised at 5 years means that a child aged 60 to less than 63 months received their fourth or fifth vaccination (dependent on the type of vaccine used) for diphtheria, tetanus and whooping cough (DTPa), their fourth vaccination for polio (IPV) and their second vaccination for measles mumps and rubella (MMR), all prior to the age of 5 years.

It is assumed that all previous vaccinations were received. Research published by others has assessed the validity of this assumption[1] **(The methods for calculation can be found in Box 1 on page vi)**.

1. Hull BP, Lawrence GL, MacIntyre CR, McIntyre PB. Estimating immunisation coverage: is the 'third dose assumption' still valid? *Communicable Diseases Intelligence* 2003; 7(3):357–361.

Box 1: Immunisation rates for children

Description: The percentage of children fully immunised.

Data source: Data were supplied by the Australian Government Department of Health and Ageing sourced from the Australian Childhood Immunisation Register (ACIR) for 2011–2012. The data are extracted quarterly with reports run for a previous quarter's data at the end of the next quarter. For example, the reports as at 30 September were produced on 31 December. Data were supplied 14/01/2013.

Numerator: Number of children in the population fully immunised for each age defined as:

- Fully immunised at 1 year means that a child aged 12 months to less than 15 months received their 3rd vaccination for diphtheria, tetanus, whooping cough (DTPa) and polio (IPV) and either their second or third vaccination (dependent on the type of vaccine used) for hepatitis B (hepB) and *Haemophilus influenzae* type b (Hib), all prior to the age of 1 year.
- Fully immunised at 2 years means that a child aged 24 months to less than 27 months received their third or fourth vaccination (dependent on the type of vaccine used) for diphtheria, tetanus, whooping cough (DTPa) and *Haemophilus influenzae* type b (Hib), their third vaccination for polio (IPV) and hepatitis B and their first vaccination for measles, mumps and rubella (MMR), all prior to the age of 2 years.
- Fully immunised at 5 years means that a child aged 60 months to less than 63 months received their fourth or fifth vaccination (dependent on the type of vaccine used) for diphtheria, tetanus and whooping cough (DTPa), their fourth vaccination for polio (IPV) and their second vaccination for measles mumps and rubella (MMR), all prior to the age of 5 years.

For each age it is assumed that earlier vaccinations in the series have been given.

Denominator: Number of children who turned each age as at 31 March 2012 in the eligible population i.e. those children who are registered on the ACIR.

Computation: 100 × (Numerator ÷ Denominator).

Disaggregation: By Medicare Local catchment, Statistical Area Level 3 geography and postcode.

Additional notes

Invalid records are excluded from the numerator and denominator. Examples of invalid records are records where postcodes reported are not valid, the record has an incomplete address, or there has been a return to sender flag on the child's record.

Postcodes from the immunisation data were validated using 2011 postcodes lookup tables from the Australian Post Office Website. There were 24 reported postcodes identified as invalid. These postcodes had 105 immunisation records for 2011–12 which were excluded from the report. These excluded records equate to less than 0.3% of the total population included in this report.

Data source

The Australian Childhood Immunisation Register

Data for the *Healthy Communities: Immunisation rates for children in 2011–12* report were sourced from the Australian Childhood Immunisation Register (ACIR) through the Australian Government Department of Health and Ageing.[2]

The ACIR commenced on 1 January 1996 and is administered by the Department of Human Services (Medicare). It is the primary means of determining the percentage of children who have been vaccinated. There have been three unpublished external reviews of the ACIR (1997, 2000 and 2003) that have informed enhancements to its functionality and features.[3] However, enhancements and improvements to the Register are ongoing, often as a result of advice from the National Immunisation Committee Data Subcommittee.

Commonwealth, state and territory, and local Governments, use the ACIR to monitor population immunisation levels and services, and to identify regions at risk during disease outbreaks.[4]

The ACIR data also:

- enables immunisation providers and parents or guardians to check the immunisation status of a child, regardless of where the child was immunised
- enables the register to generate milestone and optional immunisation history statements, which tell parents and guardians of their child's recorded immunisation history
- can be used to help determine a parent's or guardian's eligibility for some Australian Government family assistance payments
- provides information for the delivery of payments and feedback reports to eligible immunisation providers.[4]

Recognised immunisation providers submit immunisation data daily to the register via:

- the electronic Medicare on-line claiming facility
- secure internet facilities
- manual processes using a designated form.[4]

These data are collected and reported for children up to their seventh birthday. The ACIR includes children who may or may not have a Medicare enrolment.

Medicare enrolment data are maintained on the ACIR through nightly data transfers.

Immunisation notifications that do not comply with Australian Childhood Immunisation Due and Overdue Rules, or which are duplicate notifications, prompt an enquiry to the provider. Where the validity of a notification cannot be established these notifications are rejected.[4]

As of 2001, immunisations administered overseas that are endorsed by a recognised Australian provider can be submitted to the ACIR. The ACIR maintains records of children with medical contraindications to immunisation and identifies where parents lodge a conscientious objection to immunisation.

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2. Australian Government. Department of Human Services. (2013) Australian Childhood Immunisation Register [Online.] Available at: **http://www.humanservices.gov.au** Accessed 28/02/2013
3. Hull BP, Shelley LD, McIntyre PB. The Australian Childhood Immunisation Register – A model for universal immunization registers? *Vaccine* 2009; (27): 5054-5060.
4. Department of Human Services (2013) Australian Childhood Immunisation Register [Online] Available at: **http://www.humanservices.gov.au** Accessed 28/02/2013

Limitations

The ACIR is said to have a nearly complete population of children, with 99% of children registered with Medicare by 12 months of age and for children 2 years of age ACIR records exceed official population estimates.[5]

There are a number of children who are listed on multiple Medicare cards resulting in them having more than one Medicare number. All children registered with the ACIR have a single identification number in the register and, where it is known that children are listed on multiple Medicare cards, they are identified using this number for recording and monitoring their immunisations. For the analyses for the report, the postcode used is the one linked to the latest processed Medicare record for each child. This means there may be some duplication of child records, however, this has been minimised where possible.[5]

5. Hull BP, Shelley LD, McIntyre PB. The Australian Childhood Immunisation Register – A model for universal immunization registers? *Vaccine*, 2009; (27): 5054-5060.

Geography levels

Immunisation statistics are presented in the report by Medicare Local catchment and by the Australian Bureau of Statistics (ABS) Statistical Area Level 3 (SA3), based on a child's current address postcode in the ACIR. Addresses are generally drawn from Medicare records held by the Department of Human Services.

Statistics in this report have been compiled by applying geographic concordances to the ACIR aggregate statistics at the current child address postcode level. This has led to several technical methodological decisions to produce results for this report.

Where postcodes overlapped Medicare Local catchment or SA3 boundaries, numbers of children were attributed to a Medicare Local catchment or SA3 based on the percentage of the population of each postcode in each Medicare Local catchment or SA3. Further, in the postcode to SA3 geographical correspondence file obtained from the ABS, the factors for a number of postcodes either did not equal or sum to one. This was due to boundary misalignment between the original postcode and other boundaries.

In many instances, counts of children were apportioned between multiple Medicare Local catchments or SA3s. National totals may not correspond to the sums of lower-level statistics due to rounding. Additionally, rounding of figures was performed at the end of calculations to avoid truncation error.

A small number of postcodes do not map to an SA3 such as postcodes for post offices and delivery centres. The NHPA reviewed all such postcodes and devised a method to allocate children to appropriate SA3s where the percentage of children in that postcode was greater than or equal to ten per cent of the total SA3 population. More information about this method is provided in **Appendix 1**.

In the SA3 statistics that summarise children fully immunised and children not fully immunised by postcodes, those postcodes that were not mapped to an SA3 were assigned to a single row containing unallocated and confidential data. Those numbers were generally low.

Medicare Local catchments

Medicare Locals are a new nationwide network of primary health care organisations established to coordinate primary health care delivery and tackle local health care needs and service gaps. They have been established by the Australian Government to drive improvements in primary health care and ensure that services are better tailored to meet the needs of local communities. For this report, statistical information is presented using the boundaries of Medicare Local catchments as released by the Department of Health and Ageing **(see www.yourhealth.gov.au/internet/yourhealth/publishing.nsf/content/medilocals-lp-1)**.

Statistical Areas Level 3

Statistical Areas Level 3 (SA3s) are geographical areas defined in the ABS Australian Statistical Geography Standard (ASGS). The aim of SA3s is to create a standard framework for the analysis of ABS data at the regional level through clustering groups of smaller areas called SA2s that have similar regional characteristics. There are 333[6] SA3s covering the whole of Australia without gaps or overlaps and they are designed to provide a regional breakdown of Australia. SA3s generally have a population of between 30,000 and 130,000 people (however, there are approximately 50 with less than 30,000 people and 35 with greater than 130,000 as at 30 June 2011). In the major cities, they represent the area serviced by a major transport and commercial hub. They often closely align to large urban local government areas (e.g. Parramatta, Geelong). In regional areas, they represent the area serviced by regional cities with a population over 20,000 people. In outer regional and remote areas, they represent areas which are widely recognised as having a distinct identity and have similar social and economic characteristics (e.g. Macedon Ranges in Victoria, Southern Highlands in NSW). There are a small number of "zero SA3s". These have an effective design population of zero and represent very large National Parks close to the outskirts of major cities **(http://www.abs.gov.au/ausstats/abs@.nsf/0/E7369D1FCE596315CA257801000C64E5?opendocument)**.

Geographical correspondences

Geographical correspondences (sometimes referred to as concordances or mapping files) can be used where the location information in an original survey, census or administrative data is not available at the geographical area required for analysis and reporting. They are a mathematical method for reassigning data from one geographical area (for example, a postcode of a patient's address in a Medicare enrolment record) to a new geographical area (for example, Medicare Local catchment or Statistical Area Level 3 geographical areas).

In 2012, the Authority commissioned the ABS to compile several correspondences to convert data from other geographic levels to Medicare Local catchment geographic level using Medicare Local boundaries and names that were available at the time.

6. There are 18 additional SA3 codes (special purpose codes) to allow reporting of non-geographic categories of data at state/territory level, for example counts of people enumerated in the census on long distance trains, buses, aircraft and long haul road transport vehicles, off-shore oil rigs and drilling platforms and on board vessels in Australian waters in or between Australian Ports and people who have no fixed address such as travellers who move across Australia. These special purpose SA3 codes are not used when converting geographic postcode data to SA3s or Medicare Local catchments.

Interpreting the results

Confidential results

Results are not reported where the eligible population is less than or equal to 25 children.

Interpret with caution

Although results are reported where the eligible population is between 26 and 100 children, these results should be interpreted with caution as small data errors can lead to material movements in results. For example, if one occasion of immunisation for a child is not reported in an area where there are 100 children in the eligible population, the results will be under-reported by 1 per cent. This could lead to the geographical area being placed in a lower range for their result.

Internal migration

Within Australia, a large number of people move homes on a regular basis. There is no requirement for them to update their Medicare records in a timely manner, and it is likely that this impacts on the currency of addresses, specifically affecting the currency of children's postcodes in the ACIR. No examination of this impact has been undertaken for this report.

Immigration

There is a possibility that data may not be reported for some children who were immunised overseas and have not yet attended an Australian immunisation provider to facilitate updating the ACIR or who are currently living overseas but are registered with the ACIR.[7] No assessment has been undertaken of any impact on this report.

Indigenous identification

The identification of Aboriginal and Torres Strait Islander peoples in Commonwealth data sets is a complex area, requiring coordination across many points of data collection. Unfortunately, these processes are not always robust and, as identification as an Aboriginal or Torres Strait Islander person is voluntary, the data are often not complete and do not identify every person who may be of Aboriginal or Torres Strait Islander descent. No assessment has been done on the completeness of identification within the ACIR for the purposes of this report.

7. Hull BP, Shelley LD, McIntyre PB. The Australian Childhood Immunisation Register – A model for universal immunization registers? *Vaccine*. 2009; (27): 5054-5060

Appendix 1

Unallocated postcodes

Medicare Local catchment and SA3 statistics in this report have been compiled by applying geographical correspondence files to statistics at the postcode level. However, the geographical correspondence files only contain postcodes that correspond to delivery areas, and do not include postcodes that relate to post office boxes. Therefore, some postcodes are left unallocated and this can result in a significant undercount in some areas. This was found to be a particular problem in the Northern Territory, where around 15% of children's addresses registered in the ACIR were post office boxes. In order to overcome this undercount, methods have been developed to enable postcode allocation to SA3s and Medicare Locals which provides for more accurate reporting of all children enrolled in the ACIR in the Northern Territory.

To validate these methods, it was hypothesised that if the ABS Estimated Resident Population for ages 0-4 years (as at June 2011) was highly correlated with the ACIR registered population of 1, 2 and 5 years in 2011–12, this would indicate a strong predictive model. This was shown to be the case at SA3 level (R^2 = 99.6%; **Figure 1, page 7**).

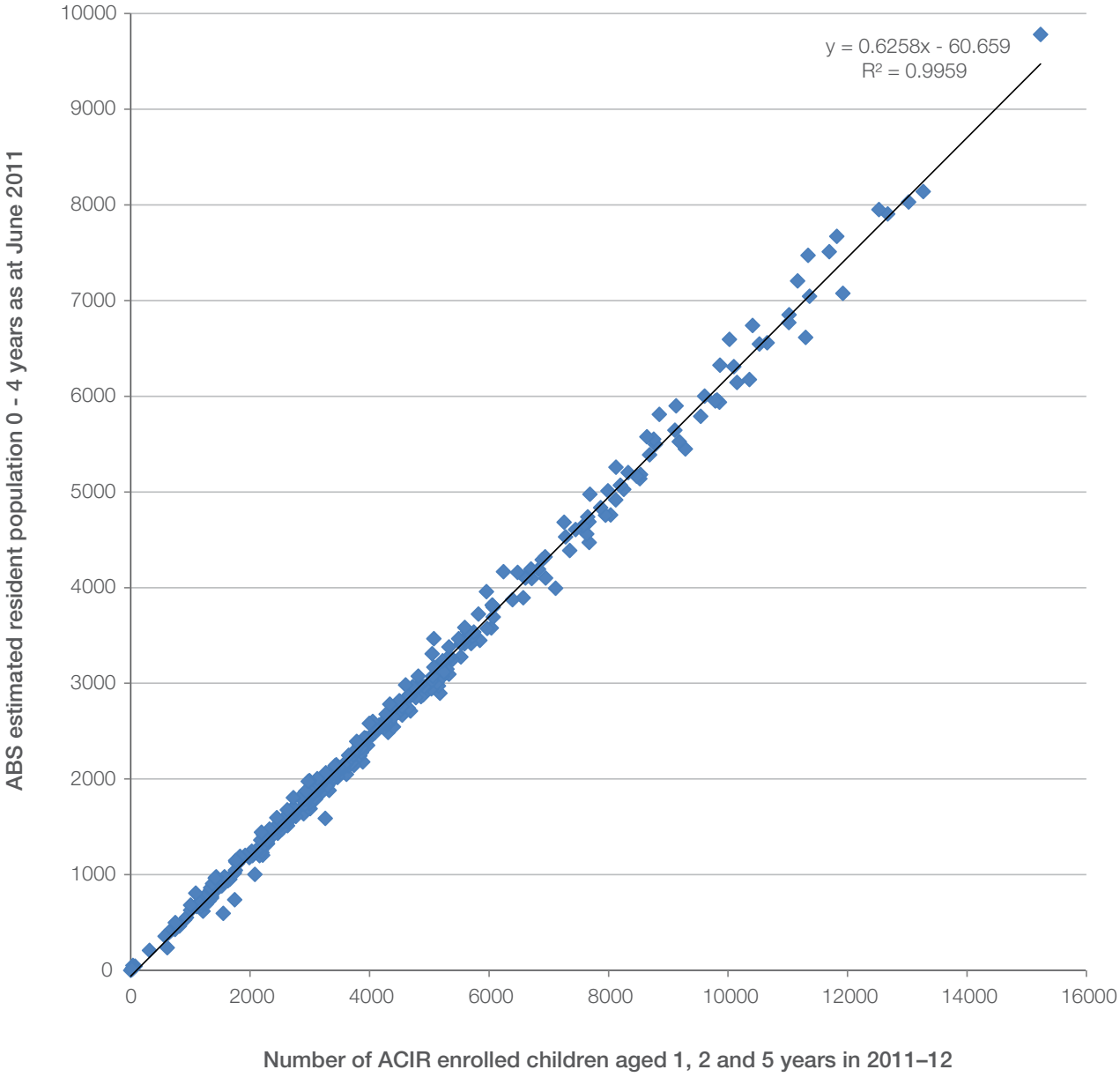
Table 1 below shows the extent to which Northern Territory areas were affected by this undercount including four major outback Northern Territory SA3s surrounding the major centres of Alice Springs, Tennant Creek (Barkly), Katherine and Nhulunbuy (East Arnhem). Enrolments to post office boxes in these regions were allocated to the surrounding SA3 areas.

Also affected by the undercount by more than 10% of the SA3 population are the areas with few Post Offices; Litchfield and Daly-Tiwi-West Arnhem. It is hypothesised that these areas are serviced by post office boxes in the major centres in the region; Darwin and Palmerston.

Table 1: Variation between predicted and actual ACIR enrolled children excluding unallocated postcodes, by SA3, 2011–12

SA3	SA3 Name	ABS estimated population 0–4 yrs as at June 2011	ACIR enrolments 1, 2 and 5 years 2011–12 excluding unallocated postcodes	Predicted ACIR enrolment 2011–12	Variation between predicted and actual ACIR enrolments excluding unallocated postcodes	Variation (%)
70204	East Arnhem	1,550	596	909	313	34.4%
70203	Daly-Tiwi-West Arnhem	1,745	739	1,031	292	28.3%
70202	Barkly	614	236	324	88	27.2%
70201	Alice Springs	3,258	1,587	1,978	391	19.8%
70205	Katherine	2,080	1,003	1,241	238	19.2%
70103	Litchfield	1,215	618	700	82	11.7%

Figure 1: Correlation between ABS estimated resident population 0-4 years as at June 2011 and the number of ACIR enrolled children aged 1, 2 and 5 years in 2011–12, by SA3



The Northern Territory is the only area of Australia containing multiple SA3s with a population undercount of over 10% when post office post codes are excluded. The relative weighting between these areas was used to distribute part of the ACIR enrolled population identified with post office box addresses in Darwin and Palmerston. It was assumed that Darwin City should have a post office box enrolment no higher than other Capital City CBDs of around 7%, and any enrolment beyond this level should be redistributed to the surrounding regions of Litchfield and Daly-Tiwi-West Arnhem.

To identify the remaining areas in Australia affected by unallocated post boxes, we allocated the children to the SA3 in which the post office is located, and then calculated the percentage of enrolments with post office box addresses as a proportion of the total SA3 population for each age group. This method was applied to all SA3s to produce lists of areas at each age group that had over 5% of their enrolled population at post office addresses. There were 2 remaining categories of notable results:

- SA3s located of the Central Business District of Australia's largest 6 cities, containing the GPO of that city (Sydney, Melbourne, Brisbane, Adelaide, Perth and Gold Coast). There are many workers in these areas that find it convenient to have their mailing address at a post office near to their workplace, instead of their home address, especially if they have constant employment but often move from rental house to rental house. Therefore these postcodes are difficult to allocate to a local area, and cannot be considered for further analysis.
- SA3s with a major regional/remote centre containing a moderate number of children enrolled at post office boxes were Mildura, Sale (Wellington), Carnarvon (Mid West), Albany and Kalgoorlie (Goldfields). By averaging across all age groups, these centres have closer to 5% than 10% enrolment at post office addresses, and therefore remained unallocated.

These categories highlighted in the tables are as follows:

SA3 in a City Business District
SA3 not in a City Business District

Table 2: Percentages of children aged 1 year with post box address on the ACIR, by SA3, 2011–12

		ACIR enrolled population			
SA3 Code	SA3 Name	Children with post box address (n)	Children with non-post box address (n)	Total children (n)	Post box addresses (%)
30910	Surfers Paradise	25	266	291	8.6
30501	Brisbane Inner	42	476	518	8.1
40101	Adelaide City	10	140	150	6.7
50302	Perth City	74	1038	1112	6.7
21502	Mildura	44	663	707	6.2
11703	Sydney Inner City	116	1749	1865	6.2
20505	Wellington	27	488	515	5.2

Table 3: Percentages of children aged 2 years with post box address on the ACIR, by SA3, 2011–12

SA3 Code	SA3 Name	ACIR enrolled population			Post box addresses (%)
		Children with post box address (n)	Children with non-post box address (n)	Total children (n)	
30501	Brisbane Inner	39	380	419	9.3
30910	Surfers Paradise	27	277	304	8.9
21502	Mildura	64	659	723	8.9
40101	Adelaide City	10	112	122	8.2
50302	Perth City	80	1012	1092	7.3
11703	Sydney Inner City	109	1484	1593	6.8
50805	Mid West	47	709	756	6.2
50901	Albany	40	685	725	5.5

Table 4: Percentages of children aged 5 years with post box address on the ACIR, by SA3, 2011–12

SA3 Code	SA3 Name	ACIR enrolled population			Post box addresses (%)
		Children with post box address (n)	Children with non-post box address (n)	Total children (n)	
30910	Surfers Paradise	36	288	324	11.1
30501	Brisbane Inner	34	335	369	9.2
50302	Perth City	92	921	1013	9.1
21502	Mildura	64	692	756	8.5
11703	Sydney Inner City	93	1087	1180	7.9
40101	Adelaide City	8	104	112	7.1
50803	Goldfields	43	634	677	6.4
50805	Mid West	48	741	789	6.1
20505	Wellington	35	545	580	6
20604	Melbourne City	29	508	537	5.4

Tables 2, 3 and 4 show that, with the exception of one SA3, the impact of unallocated post office boxes in a given SA3 is estimated to be below 10%. This confirms that Northern Territory was the only area of Australia that, due to unallocated post office box postcodes, contained multiple SA3s with a population undercount estimated to be over 10%, which were resolved as described in the methods section.