

Health Statistics Branch

Analysis prepared by the Statistical Analysis and Linkage Team

An estimate of the extent of under-registration of births in Queensland

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1 Introduction / Background to Problem

The Queensland Perinatal Data Collection (PDC) contains data on all births in Queensland, and is maintained by the Health Statistics Branch, Queensland Health. The collection contains information on obstetric, delivery and perinatal outcomes, and is the major source used to report perinatal statistics for the Queensland population. While the number of births collected within the system should theoretically equal the number of births registered with Births, Deaths and Marriages (BDM) in the Department of Justice and Attorney-General, Queensland Government, this is not the case. The reasons for the discrepancies are not well understood, and have not been evaluated in the past.

1.1 Queensland Perinatal Data Collection

The PDC contains information about all live births in Queensland and all stillbirths of at least 400g birth weight or 20 weeks gestation. The data is maintained and disseminated by the Health Statistics Branch, Queensland Health for national reporting purposes, for use in state and national key performance indicators, to assist with service planning and for research into perinatal and obstetric care and outcomes.

The Queensland Perinatal Data Collection Manual states that:

The Perinatal Data Collection Form (MR63D) is required to be completed (or in the case of hospitals providing electronic extracts, an extract is required) by all public hospitals, private hospitals, and private midwifery or medical practitioners who deliver babies outside hospitals, for all births occurring in Queensland (Queensland Health, 2013).

The information relating to a baby is collected up until the baby is discharged from the birth admission or up until the baby reaches 28 days of age, and the completed form is to be submitted to the Statistical Collections and Integration Team, Health Statistics Branch within 35 days of the birth of a baby (Queensland Health, 2013). Although various validation rules and monitoring tools are in place to assure the reliability of the data, the quality and the timeliness of the information is dependent on the personnel responsible for the completion and submission of the paper form or electronic extracts of the data.

1.2 Birth Registration Data

The Queensland Department of Justice and Attorney-General maintains a register of all births (live, and after April 1989, still born of at least 20 weeks gestation or 400g birth weight) which occur in Queensland, or on ships or aircraft that are travelling to Queensland. Birth registration in Queensland is required by law and requires both parents of the child to sign the registration form and lodge it within 60 days of the birth. In the event of multiple births, a separate form must be completed for each child.

In addition, a birth that takes place outside of Australia may be registered in Queensland if the parents of the child intend to live in Queensland, the child is less than 18 months of age and resident in Queensland at the time of registration, and the birth is not already registered in another state or country (OQPC, 2012).

When a birth takes place at home, the registration form must be accompanied by written advice from the attending midwife (if present), or otherwise the health professional consulted after the

birth. Any other persons present at the birth are also required to sign a declaration stating their presence at the birth.

2 Overview

2.1 Objective

The objective of this report is to summarise the extent of under-registration of births in Queensland, and where possible, to identify possible reasons for under-enumeration.

3 Methodology

3.1 Sources of the data and the number of records with matches

The draft version of the Master Linkage File (MLF), a file containing person identifiers for various administrative data collections (including PDC and birth registration data) managed by the Health Statistics Branch (HSB), Queensland Health was used as the primary source of information for the analyses. The MLF is further discussed in section 3.2.

Data where the recorded date of birth of the baby was between 1 July 2010 and 30 June 2012 were extracted from this file where the source was either PDC or birth registration data. Further matching exercises were conducted for records without a match. Table 1 summarises the total number of records extracted from each database by year, and, in parentheses, the number of records where a valid match to the other collection was found. Note that 44 PDC records were matched to multiple birth registration records, which are suspected duplicate birth registrations. While PDC records were only counted once, both of the duplicated birth registration records were counted so that the number of birth registrations with a validly matching PDC record could be quantified.

Overall, for the two years investigated, approximately 3,000 PDC records were without a valid birth registration record.

Table 1: Number of records included for linkage from each collection, 2010/11 – 2011/12

Year	PDC	Birth registration
2010/11	62,059 (60,510)	60,722 (60,540)
2011/12	62,525 (60,694)	60,901 (60,739)
Total	124,584 (121,204)	121,623 (121,279)

3.2 Master Linkage File

The MLF is a database containing records from various administrative data collections “linked” via unique person identifiers. The database is managed by the HSB, Queensland Health. The collections currently incorporated in the database include Queensland Hospital Admitted Patient Data Collection (QHAPDC), Queensland Death Registration data, Queensland Birth Registration data and PDC. The scope of the MLF is being expanded to include collections such as Queensland Birth Notifications, Queensland Emergency Department Information System, and Queensland Ambulance Service data.

In preparing the MLF, both deterministic and probabilistic methods of linkage are used, using demographic information such as name, date of birth and addresses as well as administrative information such as patient unit record number, where applicable. When linking data for past years,

a year's worth of data is extracted at a time from each collection, and is linked to the records within the same year as well as to the data previously linked.

In defining the extraction period for this analysis, the date used for PDC and birth registrations are both the date of birth of the baby (i.e. not the registration date for the birth registration data).

While the PDC collects names, addresses and date of birth of the mother, it does not collect names of the babies. Thus, the linkage for the PDC baby records to other collections is often heavily reliant on the information recorded for the mother, and the date of birth and the facility of birth of the baby. Most of the decisions for linkage are automatically made via the linkage program used by HSB (ChoiceMaker), however some of the "grey" matches are reviewed manually by staff within the HSB. This is often required when the data does not provide enough information to make a decision on whether two (or more) episode-level records belong to the same individual. In order to minimize avoidable false positive matches, various quality assurance exercises are incorporated in the development of the MLF. This includes checking for multiple birth registration records assigned to a PDC record (and vice-versa).

4 Output & Analysis

4.1 Features of the dataset

The final dataset for births between 1 July 2010 and 30 June 2012 included 124,584 births from the PDC (122,527 mother records). 7,476 (6.0%) birth records belonged to Indigenous[†] mothers, while 8,651 baby records (6.9%) were recorded as Indigenous. 1,202 (1.0%) births were to non-Queensland resident mothers, and 28,829 (23.1%) were to non-Australian born mothers. In total, 3,380 births (2.7%) could not be linked to the birth registration data.

4.2 Under-registration

3,380 (2.7%) of PDC records could not be linked to the registration data. There were significant differences in linkage between Indigenous mothers (15-18% under-registration) and non-Indigenous mothers (1.8% under-registration) (Table 2). Remote and very remote geographical areas also had high rates of under-registration (Table 3), however, this effect was only found for births to Indigenous mothers in these areas, with no obvious differences in under-registration by remoteness for non-Indigenous mothers (Table 4). There was a slight differential by the marital status of the mother (Table 5). Also younger non-Indigenous mothers were less likely to register births, while the proportion was constantly high across all age groups for Indigenous mothers (Table 6, Table 7). Hospital and Health Services (HHS) of mothers' usual residence with high proportions of Indigenous population also showed high rates of under-registration (Table 8).

Although the proportion of under-registration for Indigenous mothers was higher than that of non-Indigenous mothers across all HHSs, variations were observed for both Indigenous and non-Indigenous mothers between HHSs (Table 9) which suggests that Indigenous status may not be the only factor contributing to the under-registration of births.

[†] The term Indigenous is used when referring to Aboriginal and Torres Strait Islander people collectively

Table 2: Under-registration of births by Indigenous status of mother, Queensland 2010/11-2011/12

Indigenous status	Linked to RG data			
	N	Y	Total	%N
Aboriginal	971	4,586	5,557	17.5
Torres Strait Islander	178	950	1,128	15.8
Both Aboriginal and Torres Strait Islander	122	669	791	15.4
Non-Indigenous	2,108	114,980	117,088	1.8
Not stated	1	19	20	5.0
Total	3,380	121,204	124,584	2.7

Table 3: Under-registration of births by ARIA+, births to Queensland resident mothers only, Queensland 2010/11-2011/12

ARIA+, Queensland residents	Linked to RG Data			
	N	Y	Total	%N
Major city	1,398	73,262	74,660	1.9
Inner regional	728	24,268	24,996	2.9
Outer regional	739	19,145	19,884	3.7
Remote	184	1,965	2,149	8.6
Very remote	286	1,407	1,693	16.9
Total	3,335	120,047	123,382	2.7

Table 4: Under-registration of births by ARIA+ and Indigenous status of the mother, births to Queensland resident mothers only, Queensland 2010/11-2011/12

ARIA+, Queensland residents	Not linked to RG Data	
	Indigenous (%)	Non-Indigenous (%)
Major city	10.9	1.6
Inner regional	13.1	2.3
Outer regional	17.6	1.8
Remote	23.4	1.6
Very remote	27.1	1.6
Total	16.9	1.8

Table 5: Under-registration of births by marital status of the mother, Queensland 2010/11-2011/12

Marital status	Linked to RG Data			
	N	Y	Total	%N
Never Married	969	13,866	14,835	6.5
Married/de-facto	2,271	105,559	107,830	2.1
Widowed	2	58	60	3.3
Divorced	13	455	468	2.3
Separated	118	1,245	1,363	8.7
Unknown	7	21	28	25.0
Total	3,380	121,204	124,854	2.7

Table 6: Under-registration of births by age of the mother, Queensland 2010/11-2011/12

Age of mother	Linked to RG Data			
	N	Y	Total	%N
< 20 years	397	6,028	6425	6.2
20 – 24 years	991	20,088	21,079	4.7
25 – 29 years	953	35,260	36,213	2.6
30 and above	1,039	59,828	60,867	1.7
Total	3,380	121,204	124,584	2.7

Table 7: Under-registration of births by age of the mother and Indigenous status, Queensland 2010/11-2011/12

Age of mother	Not linked to RG Data	
	Indigenous (%)	Non-Indigenous (%)
< 20 years	15.5	3.6
20 – 24 years	18.4	3.0
25 – 29 years	17.4	1.8
30 and above	16.0	1.3
Total	17.0	1.8

Table 8: Under-registration of births by Hospital and Health Service of usual residence of the mother, births to Queensland resident mothers only, Queensland 2010/11-2011/12

HHS, Queensland residents	Linked to RG Data			
	N	Y	Total	%N
Cairns And Hinterland	361	6,660	7,021	5.1
Cape York	109	371	480	22.7
Central Queensland	177	6,327	6,504	2.7
Central West	7	356	363	1.9
Darling Downs	253	7,313	7,566	3.3
Gold Coast	185	11,736	11,921	1.6
Mackay	81	5,153	5,234	1.5
Metro North	405	23,277	23,682	1.7
Metro South	626	29,760	30,386	2.1
North West	157	1,120	1,277	12.3
South West	34	853	887	3.8
Sunshine Coast	156	7,769	7,925	2.0
Torres Strait-Northern Peninsula	121	441	562	21.5
Townsville	259	6,662	6,921	3.7
West Moreton	241	7,819	8,060	3.0
Wide Bay	163	4,430	4,593	3.5
Total	3,335	120,047	123,382	2.7

Table 9: Under-registration of births by Hospital and Health Service of usual residence of the mother and Indigenous status of the mother, births to Queensland resident mothers only, Queensland 2010/11-2011/12

HHS, Queensland residents	Not linked to RG Data	
	Indigenous %	Non-Indigenous %
Cairns and Hinterland	18.1	2.0
Cape York	33.5	1.8
Central Queensland	13.0	1.9
Central West	10.6	0.6
Darling Downs	18.6	2.1
Gold Coast	6.6	1.5
Mackay	8.1	1.2
Metro North	11.5	1.5
Metro South	10.6	1.8
North West	28.8	1.6
South West	11.1	2.3
Sunshine Coast	12.4	1.7
Torres Strait - Northern Peninsula	22.9	9.1
Townsville	20.0	1.5
West Moreton	10.7	2.6
Wide Bay	11.5	3.1
Total	16.9	1.8

Variations were observed by the country of birth of the mother. For babies born to mothers who were born in countries in the Melanesia region, approximately 4.3% of births were not registered (Table 10)[‡]. High proportions of un-registered births were observed for babies born to mothers born in the Polynesia region and New Zealand compared to mothers born in other regions. However babies born to Australian-born mothers had one of the highest under-registration rates, driven by the high proportion among babies born to Indigenous mothers.

Table 10: Under-registration of births by country of birth of the mother, Queensland 2010/11-2011/12

Country of Birth	Linked to RG Data			
	N	Y	Total	%N
Australia	3,027	92,728	95,755	3.2
<i>Indigenous[§]</i>	1,269	6,197	7,466	17.0
<i>Non-Indigenous</i>	1,758	86,523	88,281	2.0
<i>Not stated</i>	0	8	8	0.0
New Zealand	170	6826	6996	2.4
Melanesia ^{**}	29	647	676	4.3

[‡] Note that this may include births to non-Queensland resident mothers, who arrived in Australia to receive care at one of the hospitals in Australia. However, the Births, Deaths and Marriages Registration Act 2003 states that if a child is born in Queensland, the birth must be registered.

[§] 10 mothers reported as Aboriginal or Torres Strait Islander person, but born outside of Australia and thus are not counted as Australian born.

^{**} Includes New Caledonia, Papua New Guinea, Solomon Islands and Vanuatu.

Polynesia (excludes Hawaii) ^{††}	33	1,032	1,065	3.1
Other	121	19,971	20,092	0.6
Total	3,380	121,204	124,584	2.7

Variation was also seen by birth status of the baby. Approximately 0.7% of births were recorded as a stillbirth in PDC, and 17.0% of them could not be linked to the registration data. Similarly for births that resulted in neonatal deaths (i.e. born alive but deceased within 28 days of birth), 15.2% of births could not be linked to the registration data (Table 11). Baby records that resulted in stillbirths or neonatal deaths made up approximately 4.3% and 1.8% of the records that failed to link to registration data respectively (Table 11).

Table 11: Under-registration of births by birth status, Queensland 2010/11-2011/12

Birth status	Linked to RG Data			
	N	Y	Total	%N
Stillbirth	144	704	848	17.0
Born alive	3,236	120,500	123,736	2.6
<i>Neonatal death</i>	61	340	401	15.2
<i>Alive after 28-days of birth</i>	3,175	120,160	123,335	2.6
Total	3,380	121,204	124,584	2.7

5 Summary and conclusions

Overall, 2.7% of births recorded in the Queensland Perinatal Data Collection were not able to be found in the Birth Registration data.

- Births to Indigenous mothers had much higher rates of under-registration (17.0%) than births to non-Indigenous mothers (1.8%).
- For births to Indigenous mothers only there were higher rates of under-registration in remote (23.4%) and very-remote (27.1%) areas than in major cities (10.9%) and inner-regional areas (13.1%).
- There was variation in under-registration rates among births to Indigenous mothers by HHS, with the highest rates of under-registration in Cape York, Torres Strait-Northern Peninsula and North West.
- For births to non-Indigenous women, a higher rate of under-registration was observed among younger mothers, but there was no obvious effect by age for births to Indigenous mothers.
- Births to mothers born in certain countries were also slightly less likely to be registered than births to mothers born in Australia, but the magnitude of the difference was much smaller than that observed for births to Indigenous mothers.
- Stillbirths or neonatal deaths were less likely to be registered.
- It is not likely that the differences observed are entirely due to differential quality of identifying variables used to link the two datasets (see Appendix A).

^{††} Includes Cook Islands, Fiji, French Polynesia, Niue, Samoa, Samoa (American), Tokelau, Tonga, Tuvalu, Wallis and Futuna, Pitcairn Islands and Polynesia (excludes Hawaii), nec.

6 References and Related Outputs

Australian Institute of Health and Welfare, Australian Bureau of Statistics. 2012. *National best practice guidelines for data linkage activities relating to Aboriginal and Torres Strait Islander people*. AIHW Cat. No. IHW 74. Canberra: AIHW.

Statistical Collections and Integration. 1 July 2013 - 30 June 2014 Queensland Perinatal Data Collection (PDC) Manual of Instructions for the completion and notification of births to the Perinatal Data Collection. Brisbane: Queensland Health, 2013.

Office of the Queensland Parliamentary Counsel. Births, Deaths and Marriages Registration Act 2003. *Current as at 23 September 2013*. Brisbane, 2013.

7 Abbreviations

Mnemonic	Definition
HSB	Health Statistics Branch, QLD Health
MLF	Master Linkage File
PDC	Queensland Perinatal Data Collection
QHAPDC	Queensland Hospital Admitted Patient Data Collection
RG	Registrar-General, Births, Deaths and Marriages, Queensland
SALT	Statistical Analysis and Linkage Team, Health Statistics Branch

Appendix A

A-1 Additional considerations for under-registration

A-1.1 Quality of linkage variables

As the calculation of under-registration is based on the linkage between the datasets, it is possible that the quality of the linkage variables available in the birth registration and PDC data, and thus the data linkage, could be responsible for some of the under-registration found. The MLF is generated using probabilistic techniques to “weight” whether two records are likely to belong to the same individual based on the demographic information available, which relies on the agreement of various data elements (to an extent) and thus, inconsistent recording of multiple details are likely to lead to non-matching of what may be records relating to the same person. Data quality of linkage variables is known to be a particular problem in records of Indigenous people who may have more frequent name changes or aliases, names more prone to mis-spelling, frequent change of address (or may record address as full residential address in one collection and as a community name in other collection), and difficulty recalling exact date of birth (AIHW, 2012).

To try to minimise this issue, a very broad and manual approach was used to link the records where matches were not in the MLF, which included matching records with matching date of birth or names of the mother, facility of birth and date of birth of the baby or address recorded. While this does not resolve the issue of disagreement of information recorded in each collection, it increased the number of matches able to be made where the available information gave some indication that records may relate to an individual person.

A-1.2 Plurality

Another possible reason for missing registrations considered was the plurality of the birth, that is, was there some peculiarity particular to multiple births that caused an issue with the registration process?

Table A-1 shows the proportion of matches by plurality. While differentials existed overall, when restricted to live births, differentials were negligible, confirming the finding in section 4.2 that stillbirths were less likely to be registered. This shows that plurality is unlikely to cause an issue with the registration process.

Table A-1 Plurality of births by match status to registrations, Queensland 2010/11-2011/12.

	All births		Live births only	
	Matched	Unmatched	Matched	Unmatched
Singleton	97.3%	2.7%	97.4%	2.6%
Twin	97.3%	2.7%	97.4%	2.6%
Triplet	94.9%	5.1%	97.2%	2.8%
Quadruplet	75.0%	25.0%	100.0%	0.0%
Quintuplet	70.0%	30.0%	100.0%	0.0%

A-1.3 Late registrations

The extent of under-registration may be influenced by the timing of the analyses. Table A-2 shows the distribution of year of birth (recorded in PDC) versus the year of registration for records where

matches were found^{††}. Approximately 10% of births are not registered in the financial year in which the birth occurs, and late registrations may be received many years after a birth. This means that at any point in time, the number of un-registered births can only describe those that have not yet been received and processed by the Registrar-General's office at that point. This is likely to be more of an issue if linkage and analysis were to be done in real time and it is expected that late registrations would only have a minor impact for the period covered in this report.

Table A-2: Distribution of birth year (based on PDC) and the registration year for those given birth in 2010/11-2011/12 and were registered.

Birth year (PDC)	Registration year			
	2010/11	2011/12	2012/13	2013/14
2010/11	89.9%	9.3%	0.5%	0.3%
2011/12	0.0%	90.2%	9.5%	0.4%

A-2 Registered births not found in PDC

121,623 records were extracted from the registration data for the period of interest. Of these, 344 records did not link to PDC. Of the 344 records that did not link to PDC:

- 3 of them were twin records which were indicated as a singleton birth in the PDC.
- 321 did not have any birth facility recorded. It was suspected that most of these births were home births, as there were only 4 records where birth facility was recorded with dedicated home births facility ID (00998) in the entire registration data set used for the linkage (n = 121,623).

Overall, there were 935 records with missing birth facility information. Home births should be included in the PDC. While the majority of them were found in the PDC, the recording of home births in birth registration data and the mechanism for reporting home births to the Department of Health may require further refinement so that all births are included in State and Commonwealth statistics and reports generated from the PDC.

^{††} If multiple birth registration records were matched to a PDC record, the record with the earliest date of registration was used