Technical note

Introduction

This technical note provides information on the methods used for data extraction and analysis for two women's health indicators (time series analyses). These indicators are reported as part of the *Australian Atlas of Healthcare Variation*, which provides statistics at a local level identifying variation across Australia.

Activity rates are presented by local areas using Statistical Area Level 3 (SA3) geography defined by the Australian Bureau of Statistics (ABS), as well as Primary Health Network (PHN) areas defined by the Australian Government Department of Health and Aged Care, at state and territory, and national levels.

The Australian Commission on Safety and Quality in Health Care and the Australian Institute of Health and Welfare (AIHW) developed the specifications for each indicator. These can be found on the AIHW Metadata Online Registry (METeOR) at https://meteor.aihw.gov.au/content/780576 and https://meteor.aihw.gov.au/content/781186.

The specifications include details such as:

- the data source
- inclusions and exclusions (description of items included and excluded, and relevant data source codes)
- the numerator (what is being measured) and denominator (in what population)
- computation (the calculation that shows how the numerator and denominator relate)
- disaggregation (the way or ways in which the data are analysed and presented)
- data suppression rules (rules that set out what cannot be presented for reasons of confidentiality and/or reliability).

The AIHW conducted the data extraction and analysis.

The data source used in these Women's Health time series analyses was the National Hospital Morbidity Database (NHMD).

National Hospital Morbidity Database

The National Hospital Morbidity Database (NHMD) is a comprehensive dataset containing records for all episodes of admitted patient care from almost all hospitals in Australia. This includes all public and private acute and psychiatric hospitals, freestanding day hospital facilities, and alcohol and drug treatment centres. Hospitals operated by the Australian Defence Force and corrections authorities, and hospitals in Australia's offshore territories are not in scope but some are included. The data elements included in the NHMD are based on the Admitted Patient Care National Minimum Data Set (APC NMDS).

Data are collected at each hospital from patient administrative and clinical record systems and forwarded to the relevant state or territory health authorities. The data are provided to the AIHW for national collation annually. The NHMD includes episodes of care for admitted patients discharged (separated) between 1 July and 30 June for each financial year.

The counting unit for the NHMD is a 'separation'. Separation refers to a completed episode of admitted patient care, which can be a total hospital stay (from admission to discharge, transfer or death) or a portion of a hospital stay, beginning or ending in a change of type of care (for example, from acute care to rehabilitation). In this report, separations are referred to as 'hospitalisations'.

A record is included for each hospitalisation, not for each patient. Patients hospitalised more than once in the financial year have more than one record in the NHMD.

Analyses are based on the place of usual residence of the patient (patient residence) and not the location of the hospital where procedures were performed. If the patient residence was unknown or invalid, or could not be allocated to an SA3, PHN, or state or territory, the record was included in the total for Australia only.

Analyses in this report have not been adjusted to account for the under-identification of First Nations people in the data sources used. Data by Indigenous status should be interpreted with caution because First Nations people are under-enumerated in health data, and there is variation in the under-enumeration among states and territories, and by different data sets.

A patient's age calculated in NHMD data is their age in years on the date they were admitted to hospital.

Records with unknown or invalid age or sex were excluded from NHMD data as they could not be age standardised (see Analysis methods).

Records for which the overall nature of care was *'newborn care with unqualified days only'*, *'posthumous organ procurement'* or *'hospital boarder'* were excluded from the analysis.

The NHMD does not include non-admitted patient care provided in outpatient clinics or emergency departments. If patients in these settings are admitted to hospital subsequently, the care provided to them as admitted patients is included in the NHMD.

NHMD data in this report comprise hospitalisations in:

- 2013–14 to 2021–22 for Endometrial Ablation hospitalisations
- 2014–15 to 2021–22 for Hysterectomy hospitalisations.

For Endometrial Ablation hospitalisations, the annual number of hospitalisations is not sufficient for reliable reporting at a local level and so 3-years of data (2013–14 to 2015–16, 2016–17 to 2018–19 and 2019–20 to 2021–22) are combined for analysis. In this case, rates are based on the number of hospitalisations over three years and the summed population over three years. This method differs from the calculation of an average annual rate. However, the rates from both methods will generally be the same, or very similar, particularly for areas with low proportional population change between years.

More information on the APC NMDS for 2013–14 to 2021–22 is available at:

- https://meteor.aihw.gov.au/content/index.phtml/itemId/491555 (2013–14)
- https://meteor.aihw.gov.au/content/index.phtml/itemId/535047 (2014–15)
- https://meteor.aihw.gov.au/content/index.phtml/itemId/588909 (2015–16)
- https://meteor.aihw.gov.au/content/index.phtml/itemId/612171 (2016–17)
- https://meteor.aihw.gov.au/content/index.phtml/itemId/641349 (2017-18)

- https://meteor.aihw.gov.au/content/index.phtml/itemId/676382 (2018-19)
- https://meteor.aihw.gov.au/content/index.phtml/itemId/699728 (2019-20)
- https://meteor.aihw.gov.au/content/index.phtml/itemId/713850 (2020-21)
- https://meteor.aihw.gov.au/content/index.phtml/itemId/728439 (2021-22)

The data quality statements for the NHMD for 2013–14 to 2017–18 are available at:

- https://meteor.aihw.gov.au/content/index.phtml/itemId/611030 (2013-14)
- https://meteor.aihw.gov.au/content/index.phtml/itemId/638202 (2014-15)
- https://meteor.aihw.gov.au/content/index.phtml/itemId/723825 (2015–16)
- https://meteor.aihw.gov.au/content/index.phtml/itemId/724186 (2016–17)
- https://meteor.aihw.gov.au/content/index.phtml/itemId/724188 (2017–18).

For later years, the information about the quality of the NHMD data can be found: About the data - Australian Institute of Health and Welfare (aihw.gov.au)

Components of NHMD analysis

Diagnoses and procedures

Hospital diagnosis and procedure data in this report were reported to the NHMD by states and territories using several editions of the *International statistical classification of diseases and related health problems, tenth revision, Australian modification* (ICD-10-AM), incorporating the *Australian classification of health interventions*. The eighth edition was used for 2013–14 and 2014–15, ninth edition for 2015–16 and 2016–17, tenth edition for 2017–18 and 2018–19, and the eleventh edition for 2019–20, 2020–21 and 2021–22.

The comparability of the coded diagnosis and procedure data can be affected by variations in the quality of the coding, and by state-specific coding standards. This should be taken into account when comparing across states and territories.

Indigenous status

For NHMD data, hospitalisations for Aboriginal and Torres Strait Islander (First Nations) people are compared with hospitalisations for other Australians. Other Australians comprise people who were reported as not of First Nations origin, and people for whom information on Indigenous status was not reported.

Patient funding status

NHMD data are presented separately for hospitalisations according to the funding status of the patient. This reflects the funding arrangements for the patient's hospitalisation, not the sector of the hospital to which they were admitted. Hospitalisations were categorised by funding status of patients – public or private – based on three data elements:

- 'source of funding' (https://meteor.aihw.gov.au/content/index.phtml/itemId/649391)
- 'patient election status' (https://meteor.aihw.gov.au/content/index.phtml/itemId/326619)
- 'hospital sector' (https://meteor.aihw.gov.au/content/index.phtml/itemId/269977).

Hospitalisations for publicly funded patients comprise those for whom the patient funding source was:

- Health service budget (not covered elsewhere)
- Health service budget (due to eligibility under a Reciprocal Health Care Agreement)
- Health service budget (no charge raised as a result of a hospital decision) AND in a public hospital
- Other hospital or public authority (contracted care) AND a patient election status of 'public' (regardless of hospital sector).

Hospitalisations for privately funded patients comprise those for whom the patient funding source was:

- Health service budget (no charge raised as a result of a hospital decision) AND in a private hospital
- Other hospital or public authority (contracted care) AND a patient election status of 'private' (or not reported)
- Department of Veterans' Affairs
- Department of Defence
- Correctional facility
- Private health insurance
- Workers compensation
- Motor vehicle third-party personal claim
- Other compensation (for example, public liability, common law, medical negligence)
- Self-funded
- Other funding source
- Not known.

Analysis methods

Australian population

All indicators used estimated resident population data from the Australian Bureau of Statistics (ABS) in the denominator.

Population estimates as at 30 June in the relevant year were used as the denominator for indicators based on NHMD data for 2013–14 to 2021–22. For example, population estimates as at 30 June 2017 were used for 2017–18. Where three years of data were combined, for example 2016–17, 2017–18 and 2018–19, the denominator was the sum of the population estimates as at 30 June 2016, 30 June 2017, and 30 June 2018.

Indigenous status

The population estimates for First Nations people were based on the 2016 Census-based population estimates. For 2016 and earlier, population estimates (2016) and back cast estimates were used. For 2017 onwards, series B population projections were used. More information on series B is available at www.abs.gov.au/statistics/people/aboriginal-and-

torres-strait-islander-peoples/estimates-and-projections-aboriginal-and-torres-strait-islander-australians/latest-release#frequently-asked-questions.

The population estimates for other Australians was derived by subtracting the population estimates for First Nations people from the Australian population estimates.

Age standardisation

This report presents age-standardised rates. Age standardisation is a method to remove the influence of age when comparing populations with different age structures. For this report, the Australian estimated resident population as at 30 June 2001 for females was used as the standard population. Both indicators used specific age ranges. Therefore, only the relevant age groups were included in age-standardisation calculations. Standardised rates based on different age groups and/or standard populations are not directly comparable.

Five-year age groups were used from 15 years to 85 and over years (except the age group of 65 years and over was the highest used in standardisation for Indigenous status analysis).

The age standardisation method used was from the general age standardisation formula for populations available at https://meteor.aihw.gov.au/content/index.phtml/itemId/327276.

Geography levels

This report presents data based on the ABS Australian Statistical Geography Standard (ASGS) 2016 SA3 geography, which incorporates the Territory of Norfolk Island for the first time. There are 340 spatial SA3s covering Australia without gaps or overlaps. SA3s generally have a population of between 30,000 and 130,000 people and comprise clusters of whole SA2s (https://meteor.aihw.gov.au/content/index.phtml/itemId/659727). These areas were grouped by PHN area, state or territory, remoteness and socioeconomic status to assist comparisons. For more information on ASGS 2016, see https://meteor.aihw.gov.au/content/index.phtml/itemId/659352.

Allocation to an SA3 was based on the patient residence, not the place where they received the service.

Application of geography levels to the NHMD

For 2013–14 to 2016–17, SA2s in the NHMD were collected using the ASGS 2011. For 2017–18, the ASGS 2016 was used. The accuracy of the information on geography (SA2 or other) could vary across and within states and territories, depending on the methods of allocation used by the hospital and the level of detail on the patient's address captured at the service level.

When Statistical Local Area (SLA) or postcode was used, ABS correspondences were used to identify the corresponding SA2 2011 (2013–14 to 2016–17) or SA2 2016 (2017–18). Where a geographic unit overlapped SA2 boundaries, records were randomly allocated to the SA2s, according to the proportion of the unit (postcode or SLA) population in the SA2s. This is standard practice for the NHMD. Because of the random allocation, individual records in SA2s might not be accurate or reliable; however, the overall distribution of records by SA2 is considered useful.

For 2013–14 to 2016–17, the SA2 2011 was aggregated to SA3 2011. The number of hospitalisations at SA3 2011 was mapped to SA3 2016 using an ABS correspondence. Where

an SA3 2011 overlapped SA3 2016 boundaries, the number of hospitalisations was apportioned across the SA3s 2016, according to the proportion of the population of SA3 2011 in the SA3s 2016.

Time series

Data were re-run for selected hospitalisation indicators presented in the first and second Atlases for the time series analyses in this report to allow robust comparison of rates over time. Since the first Atlas was published, in November 2015, there have been a number of minor changes to data specifications, updates to NHMD datasets, and changes to improve data analysis as listed in Table 1. The results reported in this time series report are those that should be used for monitoring change over time for 2 indicators from the second Atlas.

Table 1. Changes in analysis methods for time series of hospitalisation indicators

Report	Age-standardised	Age-sex standardised	Postcode to SA3	SA2 to SA3	ASGS 2011	ASGS 2016	Population estimate
First Atlas	✓		✓		✓		30 June
Second Atlas		✓		✓	✓		30 June
Third Atlas		✓		✓		✓	30 June
Fourth Atlas		✓		✓		✓	31 December*
Women's Health time series	✓			✓		✓	30 June

* Estimated from average of 30 June estimated residential populations from the relevant years.

Primary Health Network areas

The Primary Health Networks (PHNs) are independent organisations that aim to connect health services across a specific geographic area so that patients, particularly those needing coordinated care, have access to a range of services, including primary health care services, secondary health care services and hospital services. There are 31 PHN areas that cover the whole of Australia.

The number of events at SA3 2016 was mapped to a PHN area (2017) using an ABS correspondence. The correspondence reflects the reconstructed PHN boundaries based on the ASGS 2016. Where an SA3 overlapped PHN boundaries, the number of events was apportioned across the PHN areas, according to the proportion of the SA3 population in the PHN areas.

Tasmania, the Australian Capital Territory and the Northern Territory have only one PHN area. PHN rates may differ from state or territory rates because:

- For the NHMD, populations and hospitalisations are sourced from different data. PHN hospitalisations are based on SA3 of patient residence. State or territory hospitalisations are based on state or territory of patient residence, including records where the SA3 may not be known.

- For Indigenous status by PHN, populations were estimated using a fitted values based on Census counts, followed by Iterative Proportional Fitting of relevant ABS population estimates, together with ABS geographic correspondences.

Remoteness and socioeconomic analysis

SA3s were grouped into remoteness categories and socioeconomic quintiles based on the ABS ASGS 2016 and the ABS Socio-Economic Indexes for Areas (SEIFA) 2016, respectively. Data by SA3 were assigned to remoteness and socioeconomic groups using this method of grouping. Owing to the method used, national data by remoteness and socioeconomic status in this report may differ slightly from equivalent data calculated using the geographic unit (postcode, SLA or SA2) recorded on the individual records. However, it is expected that the overall patterns would be similar. For more information on SEIFA 2016, see https://meteor.aihw.gov.au/content/index.phtml/itemId/695778.

Derived remoteness categories

The ABS ASGS 2016 remoteness categories divide Australia into broad geographic regions that share common characteristics of remoteness for statistical purposes. These categories divide each state and territory into several regions based on their relative access to services.

The following remoteness categories are used:

- Major cities
- Inner regional
- Outer regional
- Remote
- Very remote.

The ABS published a remoteness category for each SA1 available at www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/1270.0.55.005July%202016?OpenDocument. SA1 population was allocated to a remoteness category using the correspondence SA1 to remoteness area, and remoteness category was allocated to an SA3 using the hierarchy of SA1 to SA3 (https://meteor.aihw.gov.au/content/index.phtml/itemId/659750). Total population in each remoteness category was calculated for each SA3. The remoteness category with the largest population was selected for the SA3.

Derived socioeconomic quintiles

There are four indexes in SEIFA 2016 and Index of Relative Socio-Economic Disadvantage (IRSD) 2016 was used for socioeconomic analysis. IRSD 2016 ranks areas in Australia according to relative socioeconomic disadvantage. The index is based on information collected in the 2016 Census on different aspects of disadvantage, such as low income, low educational attainment, and high unemployment. A low score indicates a high proportion of relatively disadvantaged people in an area. For example, an area could have a high proportion of people without educational qualifications or working in low-skill occupations. In contrast, a high score indicates a low proportion of relatively disadvantaged people in an area. It is important to note that the index reflects the overall socioeconomic position of the population in an area, and that the socioeconomic position of individuals in that area may vary.

The ABS published an index value for each SA1 available at www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/2033.0.55.0012016?OpenDocument. SA1s are ranked according to their level of disadvantage (index value) and grouped into 10 equal categories (deciles), with the lowest category reflecting the lowest 10% of areas with the greatest overall level of disadvantage. For each SA3, the deciles were combined to form quintiles and the number of SA1s in each quintile was calculated. The quintile with the largest number of SA1s was selected as the quintile for the SA3.

Combining remoteness and socioeconomic quintiles

When remoteness categories and socioeconomic quintiles are combined, there are 25 combinations to which SA3s can be assigned. Some categories and quintiles were combined to ensure that each of the final 14 combinations contained at least six SA3s for comparison purposes (Table 2).

Table 2: Number* of SA3s by combined remoteness categories and socioeconomic quintiles

Remoteness	Socioeconomic quintiles				
	1 (Low)	2	3	4	5 (High)
Major cities	29	22	35	41	63
Inner regional	37	23	11	11†	
Outer regional	27	10	10†		
Remote and Very remote	10	9†			

* Two SA3s (Blue Mountains – South and Illawarra Catchment Reserve) were not included because the population in these areas was too small for them to be assigned a socioeconomic quintile.

† Numbers are not in proper columns where socioeconomic quintiles were combined.

In this report, the SA3s in the combined 'Remote' and 'Very remote' areas are labelled 'remote'. The SA3s with the most overall disadvantage are labelled 'low SES (1)', and the SA3s with the least overall disadvantage are labelled 'high SES (5)'. Where socioeconomic quintiles are combined (for example, quintiles 4 and 5), the SA3s with the least overall disadvantage are labelled 'higher SES' (for example, 4+).

Suppression protocol

Rates based on small numbers of events and/or very small populations are more susceptible to random fluctuations and may not provide a reliable representation of activity in that area. For reliability reasons, areas with volatile rates were suppressed (Table 3).

Consequential data suppressions were not applied where the suppressions were done for reliability reasons but applied only to manage confidentiality.

Care should be taken on interpretation of trends from 2019-20 to 2021-22 due to the impact of variable restrictions on the provision of surgery in jurisdictions during COVID periods.

Table 3: Rules for suppression of an area of patient residence

Data source	Numerator	Denominator	Denominator for age groups
NHMD†	• Fewer than 10 (single year and three years of data)	Fewer than 1,000	Fewer than 30

† Additional suppression rules may apply if required by state or territory data custodians.

Data from these suppressions were included in analyses for larger geographic areas – for example, analysis by state and territory, remoteness, and socioeconomic status.

Sensitivity analysis

Most data were age standardised. Several SA3s were consistently suppressed because the population in one or more age groups for standardisation was fewer than 30. The AIHW developed a sensitivity analysis to investigate the volatility of the rates for the affected SA3s. The procedure to conduct the sensitivity analysis is summarised in Box 1.

Box 1: Summary of sensitivity analysis

For each SA3 that was suppressed due to a small (below-threshold) denominator for one or more age groups (affected SA3), the following analysis was undertaken:

1. The numerator was increased by 1 in each group with a small denominator, to generate a simulated rate.

2. All rates, including the simulated rates, were rounded to whole numbers.

3. All publishable rates for non-affected SA3s and the simulated rates for affected SA3s were ranked from lowest to highest and split into 10 categories (deciles).

4. All publishable rates for non-affected SA3s and the actual rates for affected SA3s were ranked from lowest to highest and split into deciles.

5. The decile of the simulated rate (step 3) was compared with the decile of the actual rate (step 4).

6. Steps 1 to 5 were repeated with a decrease in the relevant numerators by 1. Negative numerators were reset to zero before generating a simulated rate.

All affected SA3s were included in the simulation simultaneously, to generate maximum differences between the deciles calculated using the simulated rates and the deciles calculated using the actual rates (the most extreme scenario). This was a conservative method compared with simulation conducted for one affected SA3 at a time.

The volatility of the actual rate for an affected SA3 was not considered to have a material impact on its decile if either of the following conditions was met in each simulation (increasing or decreasing the relevant numerators by 1):

1. There was no difference in the decile for the simulated and actual rates; for example, both simulated and actual rates were in the lowest decile.

2. There was a difference of one decile, and the simulated rate was not on the cusp of the next decile (the decile that would make the difference become two); for example, the actual rate was in the lowest decile and the simulated rate was in the second decile, and not on the cusp of the third decile.

Where the decile for an affected SA3 was considered to be robust against the volatility of the rate, the rate was published with caution, although the rate was considered potentially more volatile than other published rates. The rates with caution were not included in the calculation of the national magnitude of variation, and were presented with an asterisk (tables), as squares or red rectangles (graphs) and dotted areas (maps).

Identification of consistently high and low rate areas

SA3s with consistently high or consistently low rates have been identified. Consistently high or consistently low is defined as those SA3s which fall in the top 10% or bottom 10% of all SA3s for:

- the 5 most recent reporting years for hysterectomy.
- all reporting years for endometrial ablation.