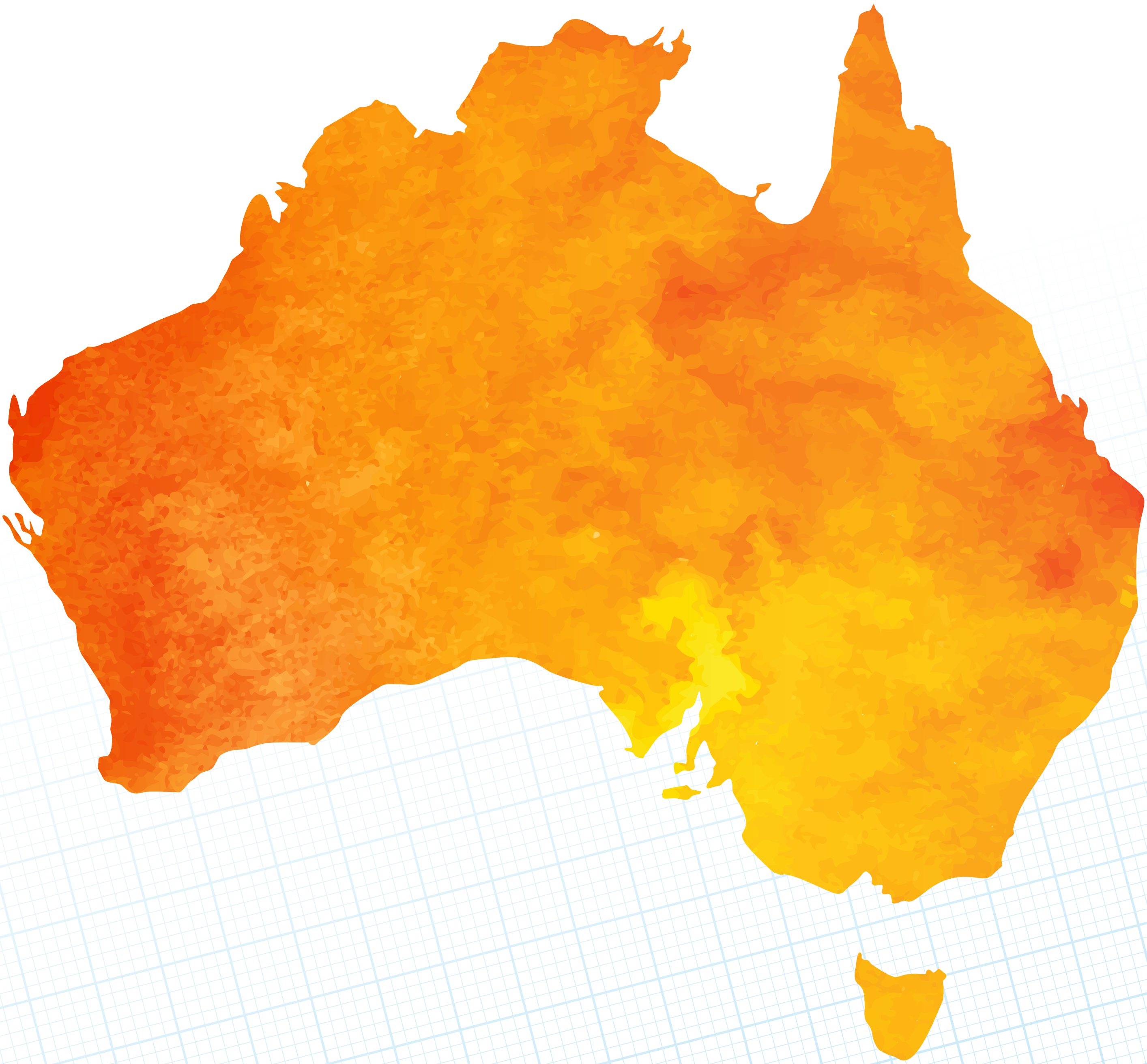
AUSTRALIAN COMMISSION ON SAFETY AND QUALITY IN HEALTH CARE

Australian Government
Australian Institute of Health and Welfare

The Third Australian Atlas of Healthcare Variation

2018



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Contents

Foreword

Australia enjoys one of the best healthcare systems in the world, yet this *Third Australian Atlas of Healthcare Variation* highlights many inequities in the way health care is currently delivered. Variation can be a sign that some people are missing out on the care they need or are not receiving appropriate care. The Atlas shows underuse of evidence-based care and overuse of inappropriate care.

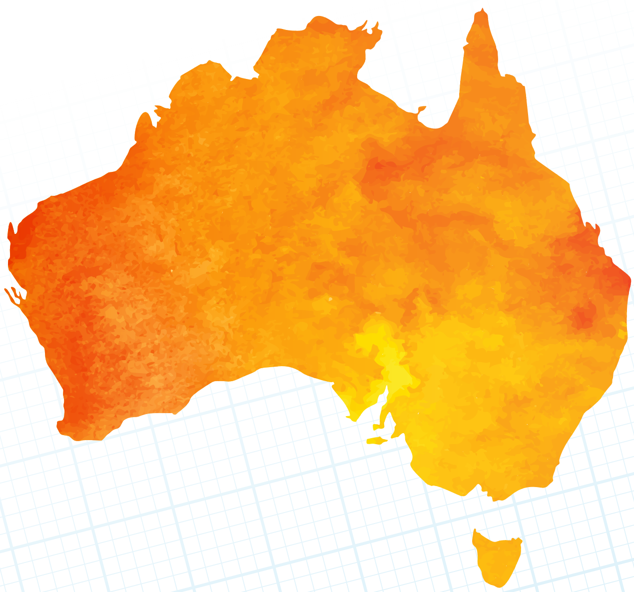
In addition to highlighting the improvements needed in healthcare delivery, the Atlas provides specific recommendations for achieving them. The recommendations in the Atlas series require action from many groups, including clinicians, policymakers, clinical colleges and the Australian Commission on Safety and Quality in Health Care (the Commission) itself. This call to action is ambitious, but the potential for real improvement is enormous. We must grasp this opportunity with both hands.

I would like to thank the Australian Institute of Health and Welfare, and the Australian, state and territory health departments for partnering with the Commission to produce this Atlas, and to acknowledge the many clinicians, consumers, clinical colleges and societies, and policymakers from all Australian governments who have collaborated with the Commission on this work. Their insights have been invaluable in helping us to understand the patterns in the Atlas data, and have provided the foundations for important and achievable recommendations.

Professor Villis Marshall AC
Chair

Australian Commission on Safety and Quality in Health Care

11 December 2018



Overview

This *Third Australian Atlas of Healthcare Variation* explores the extent to which healthcare use in Australia varies depending on where people live. It uses maps of variation in care, derived from information routinely gathered by the health system, to show how healthcare use differs across the country and to raise important questions about why this variation might be occurring. The aim is to prompt further investigation into whether the observed variation reflects differences in people's healthcare needs, in the informed choices they make about their treatment options, or in other factors. Variation for these reasons is both expected and desirable. But when variation in the use of health services is due to other factors – such as differences in access to care or in appropriateness of care – it is unwarranted variation and represents an opportunity for the health system to improve. This improvement may involve increasing awareness of, or access to, treatment options that produce better outcomes for patients, or reducing the use of investigations or delivery of treatments with little or uncertain benefit.

Exploring variation in care is one way of identifying whether people in different parts of Australia are being offered appropriate care – that is, care that optimises benefits and minimises harms, and is based on the best available evidence. A key requirement for delivering appropriate care is accessible information about the benefits and risks of treatment options, so clinicians and consumers can make fully informed decisions.

Overview

The Atlas examines variation in 13 new significant clinical items according to where consumers live, and presents further data for seven items examined in the first Atlas. The Atlas also provides examples of work by a number of groups to improve appropriate care in clinical areas analysed in the first and second Atlases.[1,2] Major change in health care often takes longer than the short period since the first Atlas was published in 2015[1] and the second Atlas in 2017[2], but swift action from some states and territories, and other organisations shows what can be achieved with focused effort. Although it is too early to expect these interventions to have made a major impact on data for the items that have been re-analysed, in some cases the concerning findings in the first Atlas show no sign of improvement – and even a worsening situation. Concerted and coordinated effort is needed from all levels to ensure the delivery of appropriate health care to Australians.

The interpretation of data in this Atlas, and discussions of what can be done to improve care, have benefited from extensive consultation by the Australian Commission on Safety and Quality in Health Care (the Commission). Clinicians, consumers, policymakers, epidemiologists and researchers have helped us identify the likely drivers of variation and the changes that are needed to address unwarranted variation. The Commission is grateful for their insights.

This Atlas has been produced in partnership with the Australian Institute of Health and Welfare, which has contributed enormous expertise in its analysis and understanding of the data and data sources. The Australian, state and territory health departments have also been pivotal partners in providing data, and in working with the Commission to interpret findings and find potential avenues for improvements in healthcare delivery.

What has the Atlas series taught us?

The Atlas data cannot tell us which portion of the observed variation in healthcare use is unwarranted, but there are two recurring patterns that suggest that healthcare delivery is not matching patient need:

- Some groups with the highest burden of disease have the lowest rate of a related investigation or treatment, indicating that barriers to appropriate access should be investigated
- In some areas, there are markedly higher rates of care, raising concern about the degree of benefit gained or potential harms.

When local areas with similar characteristics have markedly different rates of use of an intervention, with no obvious explanation, differences in clinical and consumer decision-making and system factors should be explored. In addition, when rates of an intervention known to be harmful or ineffective are found to be high, urgent action is clearly needed.

This Atlas, the third in a series, has found eight consistent themes, which are discussed below.

Reducing harm

This third Atlas includes a report on early planned caesarean section without a medical or obstetric indication. Short-term adverse effects from planned caesarean section before 39 weeks' gestation are well established, and more recent research has shown concerning long-term developmental effects for children, such as poorer educational outcomes.[3-8] For this reason, the Commission has included the topic in this Atlas, despite data limitations that preclude the more detailed mapping and analysis presented for other items.

Australian states and territories have recently begun routinely collecting data on the main reason for caesarean section; the quality of data was sufficient for publication for four states only. As reported in this Atlas, the percentage of planned caesarean sections without obstetric or medical indication performed at less than 39 weeks' gestation ranged from 42% to 60% in 2015. Even if these figures are an overestimate due to data characteristics, these rates are a call to action to reduce caesarean section before 39 weeks' gestation without a medical or obstetric indication. It is crucially important that prospective parents are given clear information about the short-term and long-term risks that are now known to accompany early planned caesarean section so that they can give fully informed consent for this procedure. Improving data collection on this topic is also a matter of urgency to allow monitoring and a more complete picture of planned early birth in Australia.

The potential for harm, and a lack of benefit, has also been highlighted in previous Atlas topics – for example, lumbar spinal fusion. The second Atlas found that the rate of hospitalisation for lumbar spinal fusion varied about seven-fold between local areas across Australia.[2] Guidelines from the United Kingdom National Institute for Health and Care Excellence (NICE) noted that some studies report that approximately 20% of patients who undergo lumbar spinal fusion experience short- to medium-term complications.[9] High-quality evidence is lacking on outcomes from lumbar spinal fusion.[10-13] The NICE guidelines recommend against treating patients with low back pain using spinal fusion except within the context of a clinical trial that could help clarify whether, and for whom, this procedure is of benefit.[9] The Commission recommended a clinical quality registry for spinal fusion, to promote evidence-based care.

Improving equity in health care

A disturbing pattern of inequity has emerged from all three Atlases. For example, despite higher rates of bowel cancer, people in areas of lower socioeconomic status (SES) have lower rates of colonoscopy than people living in areas of higher SES. Despite higher rates of cataract, Aboriginal and Torres Strait Islander Australians have lower rates of cataract surgery than other Australians. And, despite higher rates of heart disease, people living in regional areas have lower rates of cardiac stress tests and imaging than people in major cities.[14]

Conversely, where the patterns in the Atlas do follow known differences in the burden of disease, they underscore the need to do better to prevent chronic disease by addressing risk factors, and to prevent serious complications in people who have developed disease. People in lower SES groups have higher rates of chronic conditions such as diabetes, heart disease and chronic obstructive pulmonary disease (COPD).[14] The second Atlas showed that potentially preventable hospitalisations for heart failure and diabetes complications were approximately 1.5 times as high in the lowest compared with the highest SES areas of major cities.[2] For COPD, potentially preventable hospitalisations were twice as high in the lowest compared with the highest SES areas of major cities.[2] The Atlas has made many recommendations for improving health care for under-served groups with specific conditions, but models of care and prevention need to be rethought to address health inequities in a systematic way.

Although some patterns in Atlas data tell a clear story, in many cases we will need to dig deeper to understand the situation. Often, we do not know what the optimal rate of an intervention is. Even when the use of an intervention appears well matched to need at a population level, the important question is whether the right individuals within the population are receiving the care. Examining variation in patient outcomes using linked data will be vital for gaining a deeper understanding of what is going on in these situations.

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Informing consumers

For many items in the Atlas, well-informed consumers could be powerful agents for improving the appropriateness of care. For example, patient expectations are known to influence prescribing behaviour.[15] Greater knowledge among consumers about the likely risks and benefits of antibiotics for children could significantly improve use of these medicines. Education of consumers about the importance of considering heavy menstrual bleeding as a cause of anaemia in younger women may reduce rates of unnecessary colonoscopy and gastroscopy. Information for prospective parents about the outcomes of elective caesarean section at 39 weeks' gestation compared with earlier gestation, could be an important part of a comprehensive strategy to reduce rates of unnecessary early-term delivery.

Preventing disease more effectively

The need for many of the interventions analysed in the Atlas could be reduced by better prevention. For example, addressing lifestyle-related risk factors such as obesity and smoking could prevent a significant proportion of cardiovascular disease and bowel cancer.[14] A substantial reduction in lifestyle-related risk factors could deliver enormous benefits in reducing burden of disease, as well as reducing expenditure on investigations and treatment for these diseases.

Investigating patterns of clinical management

Several Atlas analyses have shown a pattern of markedly higher healthcare use in some local areas than in others, with no clear clinical indication. For example, the first Atlas reported that the rate of dispensing of medicines for attention deficit hyperactivity disorder (ADHD) in children and young people aged 17 years and under was 75 times higher in the local area with the highest rate compared with the area with the lowest rate – the largest variation seen in the Atlas series.[1] This finding prompted an in-depth study of ADHD medicines use, led by a paediatrician, which concluded that some children who could benefit were missing out, and some may have been over-treated (see the case study on page 295).

Uncertainty about best care because of a lack of evidence can lead to differences in clinical management when more than one treatment option is available. A lack of agreement on the appropriate use of an intervention due to differing interpretations of evidence may also contribute to variation. For example, differing opinions on the role of surgery for lumbar spinal fusion for people with low back pain, given the lack of high-quality evidence on outcomes, may have contributed to variation in use shown in the first and second Atlases.[1,2]

The approach to reducing variation based on differences in clinical management will vary according to the underlying reasons for these differences. Even when there is a strong body of evidence about specific interventions or treatments, finding ways to ensure that evidence is used in practice is challenging. For example, despite the known harms of overuse of antibiotics, and multiple interventions in Australia aimed at improving practice, a recent study showed that general practitioners prescribe antibiotics at 4–9 times the rate expected if guidelines were followed.[16]

Addressing system factors

Characteristics of the local health system can influence rates of use of particular treatments. For example, high rates of antidepressant use in Tasmania, as reported in the first Atlas[1], were thought to be related to a lack of access to psychological services in the state after local investigation. Primary Health Tasmania, the Tasmanian Health Service, and the Department of Health and Human Services worked together to increase access to psychological services where gaps were found (see the case study on page 294).

Improving the usefulness of existing data

The Atlas series has highlighted several opportunities to improve current national data so that more meaningful information can be derived about healthcare use and variation, and appropriateness of care.

The lack of a consistent national approach to hospital admission policies means that it is not possible to accurately identify how many procedures that do not require an overnight stay are undertaken in Australia. This affects a number of commonly performed procedures covered in the Atlas series, such as colonoscopy, gastroscopy and cataract surgery. It seems remarkable that it is not possible to know precisely how many of these types of procedures, which can have a profound impact on people's health and wellbeing, are undertaken in Australia. For services delivered in the community that are requested and reimbursed through the Medicare Benefits Schedule (MBS), clear descriptions about the reason for service provision would enable more focused auditing and review of the services that have been provided. Capturing the reason for service provision would also mean that much more valuable information could be obtained about care provision and how this aligns with community need.

One of the issues with collection of health data in Australia is that information about the health care that patients receive is split across multiple collections, such as hospital statistics, Medicare figures and Pharmaceutical Benefits Scheme datasets. Medicines supplied by Aboriginal health services are not included in these datasets. This issue meant that many important topics proposed for the Atlas series could not be included, and several of the published analyses were limited.

Tracking experiences across these data divides would provide a much more informative picture of healthcare quality. For example, linked data could show whether someone who has a heart attack in a regional area of Australia has the same likelihood of having the recommended investigations and treatment as someone in the city. The data could also show whether, following a heart attack, people have good secondary preventive care, regardless of where they live. Better access to linked data in the future will allow this kind of detailed analysis on a national scale.

Guiding value-based health care

Australians are living longer, and living longer free from disability. However, chronic diseases such as cancer, coronary heart disease and diabetes are becoming increasingly common as a result of a population that is increasing and ageing, as well as social and lifestyle changes. In 2014–15, more than 11 million Australians had at least one of eight selected chronic conditions (arthritis, asthma, back problems, cancer, COPD, cardiovascular disease, diabetes mellitus, or a mental or behavioural condition).[17] This means that demand for health care is growing. The range of tests, technologies and treatments that can be used to investigate and manage health problems is also growing. Although such advances can bring great benefit, they can increase the risk of diagnosing and treating people for conditions that would never have caused them harm (over-diagnosis).[18]

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These factors place pressures on our healthcare system. Total spending on health in Australia was $180.7 billion in 2016–17 – more than two-thirds ($124 billion) of this was government health expenditure.[19] Given the growing demands on the health budget, it is imperative that this money is spent wisely. In a number of the topic areas it has examined, the Atlas series has raised questions about the use of health care and the patterns of use across the country. But, in many clinical areas, it is not currently possible to measure or map the extent to which the care provided and paid for is appropriate; expensive special studies would be needed to provide this information.

This Atlas includes clear recommendations about improving the usefulness of MBS data. The MBS costs more than $23 billion per year.[20] It is wasteful if the data systems that support the MBS are regarded solely as a means of providing for, and reporting on, reimbursement of services. It also means that it is not possible to assess whether spending on care best matches need. Medicare data should be regarded as, and designed as, a means of monitoring our investment in health care, as well as supporting a system to reimburse services provided.

Conclusion

The Atlas series has highlighted many challenges and inequities in health care. It has also suggested reasons for variation, as well as realistic and specific recommendations for change. And it has shown how analysis and presentation of routinely collected data can promote action by organisations and clinical groups to investigate and improve appropriateness of care, and the value Australians receive from their healthcare system.

The ultimate goal of the Atlas is to ensure that Australians get care that gives them the best health outcomes. In the absence of national data on patient outcomes, the Atlas has used processes of care as a proxy. In the future, this work must be complemented by data on outcomes. Linked data hold the key, and increasing capacity in this area must be a priority for the Australian health system.

The maps and commentary in the three editions of the *Australian Atlas of Healthcare Variation* show that there are many opportunities to deliver better health care in this country, by investigating and addressing both underuse and overuse, and by doing more to prevent chronic disease. The challenge now is to ensure that the capacity to routinely monitor and report on appropriateness of care is integrated into the health system so that any need for improvement can be quickly recognised and acted on. In this way, Australia will gain maximum benefit from its investment in its healthcare system, and patients will get the care they need and deserve.

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Clinical Director

11 December 2018

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Chief Executive Officer

11 December 2018

Why measure variation in healthcare use?

Getting the best outcomes for patients and reducing harm are the goals of the Atlas. Where we see substantial variation in use of a particular treatment, it is an alarm bell that should make us stop and investigate whether appropriate care is being delivered.

Variation in itself is not necessarily bad, and it can be good if it reflects health services responding to differences in patient preferences or underlying needs. When a difference in the use of health services does not reflect these factors, it is unwanted variation and represents an opportunity for the health system to improve.

Rates of an intervention that are substantially higher or lower in some areas can highlight:

- Inequity of access to evidence-based care, and the need to deliver services more fairly
- Uncertainty about the intervention's place in therapy, and the need for better data on its benefits and harms
- Gaps in accessible evidence for clinicians, and the need for clinical care standards
- Inadequate system supports for appropriate care, and the need for changes in training or financial incentives.

Looking at how healthcare use varies between people living in different areas, between people with and without socioeconomic disadvantage, and between Aboriginal and Torres Strait Islander Australians and other Australians can show who in our community is missing out. Fundamental changes to address the underlying determinants of ill health, as well as better service delivery for those with existing disease, are needed where these inequities are found.

Overview

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Key findings and recommendations

When variation in healthcare use reflects differences in the clinical needs or preferences of the people receiving care, it is warranted and means that the healthcare system is appropriately responding to population need. But some of the patterns of care in this Atlas, and the high rates of use of some treatments, suggest that greater attention needs to be paid to matching health care to people's needs and minimising harms.

This *Third Australian Atlas of Healthcare Variation* shows that there is an opportunity to improve healthcare delivery to ensure that the best care is available to everybody, regardless of where they live. The Atlas also shows that we need to do better with data availability so that we can gain a comprehensive picture of the patterns of healthcare use in Australia and improve the value obtained from our healthcare system.

This section presents the key findings from the Atlas, and the Commission's recommendations for action.

Key findings and recommendations

1. Neonatal and paediatric health

Early planned caesarean section without medical or obstetric indication

Planned early birth is an important intervention in maternity care, but the timing of birth should be carefully considered to optimise the outcome. There is a growing body of evidence that planned caesarean section before 39 weeks' gestation can increase:

- Short-term risks, including neonatal respiratory problems and the risk of hospitalisation for infections in the first five years of life[1-4]
- Long-term developmental problems, poorer school performance and attention deficit hyperactivity disorder (ADHD).[5-8]

Waiting until 39 weeks' gestation for a planned caesarean section, if there are no medical reasons for earlier birth, is now recommended by several international organisations and some Australian states.

The Atlas found that, in 2015, between 42% and 60% of planned caesarean sections performed before 39 weeks' gestation did not have a medical or obstetric indication, and between 10% and 22% of caesarean sections performed before 37 weeks did not have a medical or obstetric indication. These data have recently begun to be collected routinely in Australia; four states and territories with sufficient data have been reported. Rates were generally higher for privately funded patients than for publicly funded patients.

Antibiotics in children

The rate of antibiotic use in children in Australia is high compared with other similar countries. For example, Australia's use in children aged 0–9 years is three times higher than in Norway and the Netherlands.[9] In many cases, antibiotics are not needed; for example, most upper respiratory tract infections in children are due to viruses, and antibiotics are ineffective for these. Overuse of antibiotics contributes to bacterial resistance, meaning that antibiotics may be less effective in the future for the child and others in the community.[10,11] Emerging research also suggests that changes to the normal gut bacteria caused by antibiotics may increase the risk of chronic disease in children, such as asthma and Crohn's disease.[12-16]

The Atlas found high rates of antibiotic use in children, with more than 3 million antibiotic prescriptions dispensed for children aged 0–9 years in 2016–17.

Inappropriate use of proton pump inhibitor medicines in infants

Proton pump inhibitor (PPI) medicines are sometimes used to treat infants with simple reflux or colicky symptoms, such as irritability or crying[17,18], even though there is evidence that they are not effective in these situations.[19] These medicines reduce the level of stomach acid, and children taking them are more likely to get infections such as gastroenteritis and pneumonia.[20] PPI medicines can also change the gut microbiome, which may increase the child's risk of developing allergies.[13,21]

The Atlas found about a four-fold difference between the lowest and highest state and territory rates in Pharmaceutical Benefits Scheme (PBS) dispensing of PPI medicines for infants aged 1 year and under in Australia.

Data item	Percentage of planned caesarean sections at specified gestational age, without medical or obstetric indication	
	Less than 39 weeks' gestation*	Less than 37 weeks' gestation*
1.1 Early planned caesarean section without medical or obstetric indication	42–60%	10–22%

* Range across the four published states/territories

Data item	Range across local areas* per 100,000	Times difference	Times difference excluding top and bottom 10%	Number during 2016–17
1.2 Antibiotics dispensing in children,† 9 years and under	9,707–159,688	16.5	1.7	3,053,315

* Statistical Area Level 3
† Based on number of PBS prescriptions

Data item	Range across states and territories per 100,000	Times difference	Number during 2016–17
1.3 Proton pump inhibitor medicines dispensing*, 1 year and under	2,195–8,066	3.7	22,810

* Based on number of PBS prescriptions

Key findings and recommendations

1. Neonatal and paediatric health

Recommendations

Early planned caesarean section without medical or obstetric indication

1a. Local Hospital Networks, health service organisations and clinicians to have systems in place to obtain fully informed patient consent for planned caesarean section by providing prospective parents with comparative information on the short- and long-term risks of planned early-term caesarean section without a medical or obstetric indication.

1b. The Medicare Benefits Schedule (MBS) Review Taskforce to review item 16519 (Management of labour and birth by any means including caesarean section), and ensure that item descriptors align with current clinical evidence and support a gestation period of at least 39 weeks unless there are medical or obstetric indications.

1c. Relevant colleges to initiate a joint project to develop evidence-based guidance, education and consumer information on early planned caesarean section without a medical or obstetric indication. This guidance should emphasise the need to ensure that potential risks for both mother and baby are discussed with the prospective parents.

1d. Local Hospital Networks and health service organisations to have systems in place, as part of their clinical governance processes, for regular review and reporting of rates of early planned caesarean section without a medical or obstetric indication, and for addressing unwarranted variation.

1e. All states and territories to ensure consistent, routine collection and reporting of data on gestational age for planned caesarean section without a medical or obstetric indication to improve the quality of data collections. This should include reporting of gestational age in days to allow more in-depth understanding of the distribution of births occurring before 39 weeks.

1f. The National Health and Medical Research Council to consider funding research to identify the effects of gestational age and delivery method on childhood development.

1g. The Commission to investigate the potential to include early planned caesarean section without a medical or obstetric indication in the national list of hospital-acquired complications, given the evidence about potential short- and long-term risks.

Inappropriate use of proton pump inhibitor medicines and antibiotics in children

1h. The Pharmaceutical Benefit Advisory Committee to recommend PBS streamlined authority required listings for PPI medicines that have Therapeutic Goods Administration-approved indications in infants and children, such as gastro-oesophageal reflux disease.

1i. NPS MedicineWise to ensure that its public education campaigns highlight the potential harms of inappropriate antibiotic use in children, and provide advice for parents on managing coughs, colds, earaches and sore throats without the use of antibiotics.

1j. The Commission, as part of the Antimicrobial Use and Resistance in Australia Surveillance System, to monitor antibiotic use in children in hospitals and the community.

1k. The National Health and Medical Research Council to consider funding research into approaches to reduce antibiotic overuse in children, particularly in acute respiratory infections when antibiotics are most commonly prescribed.

2. Gastrointestinal investigations and treatments

Colonoscopy

Most colonoscopies are performed to detect bowel cancer. Australia's National Bowel Cancer Screening Program recommends colonoscopy for people who have a positive faecal occult blood test.

The Atlas found low rates of hospitalisation for colonoscopy in the following groups, raising concerns about their access to colonoscopy services:

- Aboriginal and Torres Strait Islander Australians
- People living in outer regional and remote areas
- People living in areas of low socioeconomic status.

Strategies to increase participation in the National Bowel Cancer Screening Program and follow-up colonoscopy for those with a positive screening test will drive more appropriate care. Addressing preventable risk factors, such as physical inactivity, obesity, smoking, heavy alcohol consumption and poor diet, which account for 51% of Australia's bowel cancer burden[22], would reduce the rate of bowel cancer and lead to better use of healthcare services.

Inappropriate rates of gastroscopy

Gastroscopy is used predominantly to investigate upper gastrointestinal symptoms such as heartburn and dyspepsia. It is also used to exclude a diagnosis of cancer.[23-25] Rates of gastroscopy in Australia rose by 3% per year between 2008 and 2017[26], despite low and relatively stable rates of oesophageal and stomach cancers.[27]

The Atlas found that the rate of hospitalisation for gastroscopy varies up to seven-fold between local areas in Australia. The pattern of use suggests overuse of gastroscopy. Lower rates of gastroscopy in outer regional and remote areas may reflect either appropriate use or a lack of access to gastroscopy in these areas. The lower rates for Aboriginal and Torres Strait Islander Australians warrant further investigation.

The Atlas found that, in 2016–17, 274,559 gastroscopies and colonoscopies were performed during the same hospitalisation, representing 1,044 hospitalisations per 100,000 people of all ages. Both investigations are indicated in only a limited number of conditions, so the high rates reported suggest inappropriate use. This should be reviewed so that gastroscopies that are of little benefit are minimised, and theatre time can be allocated to people with greater need for a timely colonoscopy.

Proton pump inhibitor medicines in adults

PPI medicines are among the most commonly used medicines in Australia. Most use is for gastro-oesophageal reflux disease. There is good evidence that PPI medicines are overused and that many people are inappropriately using them for long periods.[28-30] Lifestyle changes can reduce symptoms of reflux in many patients, without the risk of long-term complications that may be caused by PPI medicines.[31-34]

The Atlas found that the rate of dispensing of PPI medicines in adults varies five-fold between local areas in Australia.

Key findings and recommendations

2. Gastrointestinal investigations and treatments

Data item	Range across local areas* per 100,000	Times difference	Times difference excluding top and bottom 10%	Number during 2016–17
2.1 Colonoscopy hospitalisations, all ages	622–4,607	7.4	2.2	765,411
2.2 Gastroscopy hospitalisations, all ages	444–3,297	7.4	2.1	505,544
2.3 Proton pump inhibitor medicines dispensing†, 18 years and over	34,489–172,780	5.0	1.6	21,768,718

* Statistical Area Level 3
† Based on number of PBS prescriptions

Recommendations

Colonoscopy

2a. State and territory health departments to adopt triaging systems to prioritise colonoscopy for individuals who are most at risk of bowel cancer. Colonoscopy should not be used routinely for primary screening, and timing of repeat surveillance colonoscopies should follow National Health and Medical Research Council guidelines.

2b. Health service organisations to ensure that, in settings where colonoscopy and gastroscopy are provided in the same clinic, patient need and likelihood of benefit of each procedure determine the overall clinical priority.

2c. The National Bowel Cancer Screening Program to develop and test methods to improve uptake by Aboriginal and Torres Strait Islander Australians.

2d. Relevant colleges and clinical societies to review their training programs to incorporate the Colonoscopy Clinical Care Standard and meet the needs of at-risk groups, including Aboriginal and Torres Strait Islander Australians, people at socioeconomic disadvantage and people living outside major cities.

2e. Health service organisations and facilities providing colonoscopies to monitor adherence to the Colonoscopy Clinical Care Standard to ensure that patients with the greatest need for colonoscopy are prioritised.

Gastroscopy

2f. The Medicare Benefits Schedule (MBS) Review Taskforce to review descriptors for gastroscopy with evidence-based criteria using a consensus process. The taskforce to consider reserving subsidies for a set of specific indications for gastroscopy, including:

i. Upper abdominal symptoms that persist despite an appropriate trial of therapy

ii. Upper abdominal symptoms associated with other symptoms or signs suggesting structural change (for example, difficulty swallowing), or new-onset symptoms in patients over 50 years of age.

2g. State and territory health departments to prioritise gastroscopy for individuals, consistent with the epidemiology of upper gastrointestinal cancer.

Proton pump inhibitor medicines for adults

2h. Relevant colleges and clinical societies to:

i. Develop educational programs targeting both general practitioners and specialists to improve the appropriateness of use of PPI medicines

ii. Review their training programs to ensure that guidance on the use of PPI medicines is consistent with the current evidence base.

2i. Relevant colleges and clinical societies to develop educational programs for consumers to educate them about the importance and benefits of lifestyle changes to reduce their risk of chronic diseases, particularly gastro-oesophageal reflux disease and bowel cancer.

2j. The Commission to develop a clinical care standard on investigation and management of dyspepsia and gastro-oesophageal reflux disease.

2k. NPS MedicineWise to ensure that information for consumers about appropriate use of PPI medicines and about modifiable lifestyle factors that increase the risk of gastro-oesophageal reflux disease is highlighted, where appropriate, in its public education campaigns.

Key findings and recommendations

3. Thyroid investigations and treatments

Thyroid function testing

Measuring thyroid stimulating hormone (TSH) is recommended as the single first-line test for possible thyroid dysfunction. More comprehensive tests of thyroid function – TSH plus free tri-iodothyronine (T3) and/or free thyroxine (T4) – are recommended only if TSH is abnormal or for investigation of certain conditions. The rate of thyroid function testing has increased in Australia, faster than the rate of population growth.[35] The fast growth of thyroid testing in Australia suggest that there is over-testing.

The Atlas found that, in 2016–17, 5.5 million TSH tests and 2.3 million thyroid function tests (TSH plus T3 and/or T4) were ordered in Australia. This is likely to be an underestimate of testing rates, as a result of characteristics of the way data are captured.

Neck ultrasound and thyroidectomy

Neck ultrasound can be used to investigate thyroid nodules and goitre. One of the reasons for thyroidectomy (removal of the thyroid) is to treat malignant thyroid nodules.

The Atlas found that the rate of neck ultrasound varies up to six-fold, and the rate of thyroidectomy varies up to five-fold, between local areas in Australia. Underlying patterns of disease are unlikely to fully explain the variations seen.

Data item	Range across local areas* per 100,000	Times difference	Times difference excluding top and bottom 10%	Number during 2016–17
3.1a Thyroid stimulating hormone tests†, 18 years and over	15,735–40,814	2.6	1.6	5,539,805
3.1b Thyroid function tests†, 18 years and over	6,425–16,077	2.5	1.6	2,344,089
3.2a Neck ultrasound tests†, 18 years and over	513–2,893	5.6	2.1	308,247

* Statistical Area Level 3
† Based on number of MBS-subsidised services

Data item	Range across local areas* per 100,000	Times difference	Times difference excluding top and bottom 10%	Number during 2014–17
3.2b Thyroidectomy hospitalisations, 18 years and over	28–130	4.6	2.0	35,166

* Statistical Area Level 3

Investigations for possible thyroid disease are very common and overall represent a significant cost for the healthcare budget in Australia. There are concerns about the appropriateness of some testing. The inability to capture accurate information about the extent of investigations for thyroid disease makes it difficult to identify targeted interventions that could improve appropriateness of care and ensure wise use of resources. The recommendations in the general section about improving collection and public reporting of MBS data, and ensuring that the information is collected in a way that allows meaningful audit and feedback about their practice to clinicians, are particularly applicable to the items in this chapter.

Recommendations

Thyroid function tests

3a. The MBS Review Taskforce to advise on how the data collected by the MBS could provide clinically meaningful information to allow regular audit and feedback to clinicians on the appropriateness of use of tests, as well as accurate public reporting on use of healthcare resources. In relation to thyroid function tests, the taskforce could advise on:

   i. Changes to rules related to data suppression due to provider confidentiality and changes to reporting of episode coning*

   ii. Creating an MBS item specific for ultrasound investigation of the thyroid.

Neck ultrasound

3b. Relevant colleges and clinical societies to agree on a nationally consistent approach to providing standardised, high-quality thyroid ultrasound reports, such as using the ATA (American Thyroid Association) guidelines or the TI-RADS (Thyroid Imaging Reporting and Data System) score to support general practitioner decision-making and help reduce unnecessary repeat ultrasounds.

* Episode coning in the MBS means that, when more than three tests are requested by a general practitioner (GP) per patient attendance, benefits are paid only for the three tests with the highest fees. If a GP requests a test with three other more expensive tests, it is 'coned out' and may not be included in the MBS dataset.

Key findings and recommendations

4. Cardiac tests

Cardiac stress tests and imaging are used in people with symptoms suggestive of coronary heart disease for accurate diagnosis, risk assessment and treatment planning. The Atlas examined use of exercise electrocardiograms, stress echocardiography, myocardial perfusion scans and computed tomography of the coronary arteries as one item. It also examined use of stress echocardiography and myocardial perfusion scans as separate items.

Equitable access to cardiac imaging is important for improving cardiac care and outcomes in people at high risk of coronary artery disease in Australia. Appropriate use of these tests is also important for the sustainability of the health system, because they account for a substantial portion of the health budget. Use of cardiac imaging has grown at about twice the rate of treatment with revascularisation, suggesting that some testing is unnecessary and that healthcare resources could be better used.

The Atlas found that the rate of cardiac stress testing and imaging varies up to 10-fold between local areas in Australia. The largest variation is seen in the rates of stress echocardiography (varies 47-fold) and myocardial perfusion scanning (varies 57-fold).

The Atlas also mapped use of standard (or transthoracic) echocardiography, which is used in people with symptoms suggestive of heart failure, structural heart diseases and other heart conditions for accurate diagnosis and treatment planning.

The Atlas found that the rate of standard echocardiography varies up to four-fold between local areas.

A lack of access to some cardiac tests for people in regional and remote areas is a key concern. The Atlas found that rates of cardiac stress tests and imaging, and standard echocardiography are higher in major cities than in regional and remote areas. This finding does not follow the pattern of need, as the burden of cardiovascular disease is higher in regional and remote areas.[36] Barriers to access outside major cities include higher out-of-pocket costs for patients.

The Atlas also found that use of myocardial perfusion scans is more common in socioeconomically disadvantaged areas in major cities and inner regional areas. This may be because myocardial perfusion scans are less likely to have an out-of-pocket cost than stress echocardiography. Stress echocardiography is preferred to a myocardial perfusion scan when it will give similar clinical information, because it does not expose the patient to radiation.

Data item	Range across local areas* per 100,000	Times difference	Times difference excluding top and bottom 10%	Number during 2016–17
4.1 Cardiac stress tests and imaging†§, 18 years and over	1,184–11,568	9.8	3.8	933,727
4.2 Stress echocardiography§, 18 years and over	104–4,894	47.1	5.8	303,525
4.3 Myocardial perfusion scans§, 18 years and over	29–1,652	57.0	4.9	79,905
4.4 Standard echocardiography§, 18 years and over	2,279–7,957	3.5	2.1	945,056

* Statistical Area Level 3
† Exercise electrocardiograms, stress echocardiography, myocardial perfusion scans and computed tomography of coronary arteries
§ Based on number of MBS-subsidised services

Recommendations

4a. The Commission to develop a clinical care standard on diagnosis, investigation and management of ischaemic heart disease.

Further recommendations for improving use of these tests are included under ‘General recommendations’ (page 25).

Key findings and recommendations

5. Repeat analyses

Antimicrobial medicines

The Atlas found that, between 2013–14 and 2016–17, the rate of antimicrobial prescriptions dispensed per 100,000 people nationally decreased by 9%. The magnitude of variation in dispensing rates increased from 4.6-fold to 4.8-fold. The reduction in dispensing rates has had little effect on the overall volume of antimicrobials supplied on any given day in the Australian community during the four-year period.[†]

The Atlas found that, between 2013–14 and 2016–17, dispensing rates for amoxicillin fell. However, rates of amoxicillin–clavulanate dispensing did not fall in line with this. There has also been little change in the volume of either of these antimicrobials supplied on any given day in the Australian community, suggesting that there has been little change in the overall amount of use during the four years. Further efforts to improve use of these antibiotics and antimicrobial use more generally are needed.

Inappropriate use of antipsychotic medicines

Concerns have been raised about prescribing of antipsychotic medicines outside guideline recommendations – such as for behavioural disturbances related to dementia or delirium – before secondary causes have been excluded and non-pharmacological measures have been tried.

The Atlas found that, between 2013–14 and 2016–17, there was no decline in the use of antipsychotic medicines in people aged 17 years and under or in people aged 18–64 years, nationally. The rate of antipsychotic medicines dispensed per 100,000 people in both these age groups increased by 8–9% during the four-year period. The magnitude of variation in dispensing has decreased, but is still considerable. For people aged 65 years and over, prescription rates of antipsychotic medicines decreased during the four years; however, the volume of antipsychotic medicines supplied on any given day in the Australian community remained stable, indicating that there has been little change in the overall amount of use during the four years.

The current use of antipsychotic medicines outside current guideline recommendations as a form of restrictive practice to manage behavioural and psychological symptoms of dementia (BPSD) in aged care homes is a matter of grave concern. Efforts to reduce inappropriate use of antipsychotic medicines in Australia have included guidelines, safety warnings, education and policy. The Commission proposes a series of regulatory responses.

† Volume as measured by defined daily doses per 1,000 people per day.

Attention deficit hyperactivity disorder medicines, 17 years and under

The Atlas found that, between 2013–14 and 2016–17, the rate of ADHD medicines dispensed per 100,000 people aged 17 years and under increased by 30%, nationally. Further investigation is required to determine whether this is due to increased incidence and diagnosis of ADHD, or increased prescribing outside guideline recommendations. Prescription rates based on practitioner type will be helpful to identify whether targeted strategies are needed. Ongoing vigilance is required to promote appropriate prescribing of these medicines.

Opioid medicines

Opioid medicines are indicated for acute pain and cancer pain, and are highly addictive. The Atlas found that, between 2013–14 and 2016–17, the rate of opioid medicines dispensing per 100,000 people increased by 5% nationally. The magnitude of variation in dispensing rates also increased, from 4.8-fold to 5.1-fold. It is unclear whether these changes are due to more people requiring opioids for appropriate uses or an increase in inappropriate prescribing. Despite the number of regulatory efforts already in place to minimise harm from these medicines, continued focus on improving medicine use in this area is needed.

Recommendations

A detailed publication showing variation at a local level will be available in 2019 for the repeat analyses, with recommendations to improve appropriateness of care. However, because of the work that has already been undertaken about use of antipsychotic medicines in people aged 65 years and over, and ongoing concerns that these medicines are being prescribed inappropriately, recommendations on this topic are included here.

5a. Prescribers to use antipsychotic medicines for people 65 years and over as a form of restrictive practice only as a last resort, and not until alternative strategies have been considered. The following conditions must be met:

   i. Informed consent (or from the patient or a properly authorised substitute decision maker)

   ii. A structured consent form to be mandated for use in aged care homes to help ensure that prescribers comply with clinical and legal requirements

   iii. A pharmacist to conduct a medicines review after six months, with the outcomes of the review provided to the treating general practitioner and placed in the medication record

   iv. Approval of pro re nata (PRN) orders to be no more than three times a month, and repeat PRN prescription to be limited so that renewal is only permitted after a further evaluation of the resident by the prescribing practitioner.

5b. Aged care providers to record the use of antipsychotic medicines as a form of restrictive practice on all applicable patients in their aged care home and report on this to the Aged Care Quality and Safety Commission.

Key findings and recommendations

5. Repeat analyses

5c. The Aged Care Quality and Safety Commission accreditation assessments to review the use of psychotropic agents in aged care homes.

5d. The Aged Care Quality and Safety Commission to commence public reporting from July 2020 on rate of use of antipsychotic medicines, in line with recommendation 13 of the 2014 Senate Community Affairs References Committee on care and management of younger and older Australians living with dementia and BPSD.

5e. The Aged Care Quality and Safety Commission to consider approaches to educating consumers about the risks of prescribing antipsychotic medicines outside guideline recommendations – such as for BPSD – before secondary causes have been excluded and non-pharmacological measures have been tried.

5f. The Therapeutic Goods Administration (TGA) to review product information for all the antipsychotic medicines most commonly prescribed inappropriately for BPSD in older people, to ensure that the lack of evidence of efficacy and the harms associated with use for BPSD are expressed as clearly as possible, and the product information is optimally framed to discourage prescribing for unapproved use for BPSD.

5g. The TGA to establish and/or review risk management plans for atypical antipsychotic medicines commonly prescribed for BPSD outside therapeutic guidelines. This will include requiring sponsors to more proactively provide or support education in appropriate treatment options for BPSD, emphasising the significant clinical risks and lack of efficacy in using antipsychotic medicines for this purpose.

5h. The Pharmaceutical Benefits Advisory Committee to review the relevant PBS streamlined authority as it applies to the prescribing of atypical antipsychotic medicines to ensure sufficient information about the clinical justification for prescribing of these medicines. This should include the condition for which the medicine is being prescribed, and a record that consent or substitute consent has been provided. This information should be specified on the form which is provided to the dispensing pharmacist.

General recommendations

Several overarching themes have emerged from the Atlas series: the need for regular public reporting, access to more complete and informative data, quality improvement strategies for the use of tests, and better information for consumers to allow informed decision-making. In particular, the Atlas series highlights the importance of making best possible use of current data systems to explore and understand patterns of care. This will enable us to assess whether spending on care best matches need, and whether we are making the best use of our investment in health care. The recommendations below outline how these improvements could be achieved.

Public reporting, audit and feedback to clinicians, and improving data and accountability

6a. The Australian Government Department of Health to consider ways in which regular public reports can be produced on appropriateness of, and variation in, healthcare use across Australia using MBS and PBS data. This work would complement current work on clinical quality registries and the Australian Health Performance Framework, but would specifically focus on ensuring that the MBS and PBS data:

i. Are collected and presented in a way that is clinically meaningful, to ensure that appropriate care is being provided and to prompt action if required

ii. Can be used to provide assurance that Australians are obtaining the expected value from investment in these programs.

6b. The MBS Review Taskforce to advise on how the data collected by the MBS in key clinical priority areas could enable production of clinically meaningful public reports on appropriateness of, and variation in, healthcare use. Among the issues the MBS Review Taskforce should consider are:

i. Where possible, alignment of descriptors with evidence-based criteria

ii. Instances in which descriptors should specify reasons for provision of service

iii. Approaches to ensuring that coning[§] and data suppression because of provider confidentiality do not prevent appropriate assessment of use of services at a local level.

6c. The MBS to regularly review claims for reimbursement of MBS services to ensure that they meet the identified evidence-based criteria. Information on use and ordering of tests across Australia, including on intervals for repeat testing, should be documented, and fed back to referrers and providers.

6d. The Australian Government Department of Health and the Australian Institute of Health and Welfare to ensure that reports on variation in care can include a better picture of patterns of care received by Aboriginal and Torres Strait Islander Australians.

6e. State and territory health departments to agree on, and implement, consistent policies on coding of admissions so that reliable information is available nationally on procedures that can be undertaken as either a day patient or an outpatient. This would enable a more complete picture of care provided in Australia

§ Episode coning in the MBS means that, when more than three tests are requested by a GP per patient attendance, benefits are paid only for the three tests with the highest fees. If a GP requests a test with three other more expensive tests, it is 'coned out' and may not be included in the MBS dataset.

Key findings and recommendations

General recommendations

6f. The Commission to examine the potential to include indicators about the appropriateness of care, and equity of access and outcomes for people from rural and remote regions and for Aboriginal and Torres Strait Islander people in the indicators it recommends for the Australian Health Performance Framework

6g. The Commission to use linked data in future work to investigate appropriateness and effectiveness of care – for example, to examine:

i. The relationship between investigations and clinically relevant outcomes (for example, colonoscopy use and the incidence of bowel cancer)

ii. The extent to which appropriate preventive care is being used (for example, for people with cardiac disease)

iii. Whether care aligns with guidelines and clinical care standards.

Improving use of testing for diagnosis and management

6h. State and territory health departments, relevant colleges, specialist societies and Primary Health Networks to collaborate to develop evidence-based structured referral pathways for consultation and patient review that may lead to further investigations such as colonoscopy, cardiac testing and thyroid ultrasound. Such referral pathways could provide referrers with guidance on inclusion and exclusion criteria, services provided and their location, and any specific service requirements to support referral management. Standardising the format of referrals by providing templates or forms (where available) can be included in the referral pathway and may serve multiple purposes:

i. Educating referrers

ii. Providing a basis for suggesting more appropriate care or management

iii. Rejecting inappropriate referrals

iv. Populating care pathways within Primary Health Networks

v. Ensuring that reimbursement met MBS requirements.

6i. The Australian Government Department of Health to work with state and territory health departments, clinical colleges, software providers and researchers to investigate ways in which decision support software used in health care can facilitate appropriate testing and testing intervals for commonly requested tests – for example, thyroid function testing in primary care.

6j. The Australian Government Department of Health to investigate methods to improve access for clinicians and consumers to previous test results, to prevent any adverse effects on patients and waste associated with unnecessary repeat tests. In addition to My Health Record, other methods to ensure access to previous test results funded by Medicare should be investigated.

Providing information to enable patients to make more informed decisions

6k. Clinicians to ensure that all patients are offered copies of their test results, and that discussions with patients about the diagnostic significance of these results and how they affect management are documented in clinical notes.

6l. Clinical colleges to actively promote the practice of shared decision making and to prioritise training and continuing development programs in this area. This should include use of the Commission's risk communication online module, with feedback to the Commission on ways in which the module could be improved in future revisions.

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About the Atlas

Who has developed the Atlas?

The Australian Commission on Safety and Quality in Health Care (the Commission), in collaboration with the Australian Institute of Health and Welfare (AIHW), has led the development of the Atlas. Development has involved broad consultation with:

- The Australian Government Department of Health
- State and territory health departments and agencies
- Professional colleges and specialist societies
- Clinicians
- Healthcare organisations.

An oversight and advisory structure, including a Primary Care Expert Advisory Group and a state and territory advisory group (Jurisdictional Advisory Group), has ensured wide-ranging input into the development of the Atlas. For each chapter, a Topic Expert Group of lead clinicians and academic experts from across Australia was established. The Topic Expert Groups provided advice at each stage of development, from selection of the clinical items to interpretation of the Atlas findings. Members of the advisory groups are required to sign a confidentiality agreement and declare conflicts of interest before release of the preliminary data. The AIHW conducted the data extraction and analysis, produced the maps and graphs, and provided expertise in interpreting the data.

How was it developed?

The Atlas examines a selection of clinical items for featured procedures, tests, investigations, treatments or hospitalisations in a range of clinical areas. A large number of clinical items were nominated and considered for inclusion, but many were not suitable because of poor data quality or small numbers, which limited the capacity to analyse and present the data. The final selection of clinical items reflects the following criteria:

- High levels of current or projected use
- Significant current or projected disease burden
- Significant potential for harm
- High use of health system resources
- Interest in the topic and clinical engagement to support review and action
- Availability of suitable data.

The clinical items that met these criteria were reviewed by the Primary Care Expert Advisory Group, the Jurisdictional Advisory Group and the Commission's executive. Following confirmation of clinical items for analysis, Topic Expert Groups were established around clinical themes. The Topic Expert Groups were consulted on prioritisation of the clinical items for analysis and on development of the data specifications, where possible. Following analysis of the data for each clinical item, the Primary Care Expert Advisory Group, the Jurisdictional Advisory Group, the Topic Expert Groups and an epidemiologist reviewed the results.

The expert groups also provided content for, and reviewed, the clinical commentaries. Their suggestions and the Commission's reviews of the literature were used as the basis for commentary on the possible reasons for healthcare variation and strategies for addressing variation. The clinical commentaries were also reviewed by:

- The AIHW
- Epidemiology and medicines use experts
- The National Aboriginal and Torres Strait Islander Health Standing Committee
- Relevant clinical colleges.

More than 150 clinicians, researchers, policy experts and consumer representatives have examined and commented on the data.

What does the Atlas measure?

The data in the Atlas show the rates for featured procedures, tests, investigations, treatments or hospitalisations in each geographic area. To calculate rates, the number of interventions that occurred in an area is divided by the population of that area. Rates are age and sex standardised. All rates are based on the patient's place of residence, not the location of the health service.

Why are the data age standardised and sex standardised?

The data in the Atlas have been age standardised (that is, controlled for age) so that fair comparisons can be made between areas that have different age structures. Without age standardisation, it would be difficult to know whether higher rates of an intervention in an area with a large number of retirees, for example, were due only to the older age of the local population. The data are also sex standardised, so that having a larger proportion of males or females in an area does not influence the findings. The early planned caesarean section indicator is not age standardised because of insufficient data quality.

Age standardisation involves calculating the rate in each area as if the area had a standard proportion of older and younger people. Sex standardisation involves calculating the rate in each area as if the area had a standard proportion of males and females. The resulting age- and sex-standardised rates can then be compared for all areas, knowing that differences in age and/or sex structure of the population have been accounted for.

About the Atlas

Magnitude of variation

The magnitude of variation (‘fold variation’ or ‘times difference’) shows how large the difference is between the lowest and highest rates of each intervention, and is expressed as a ratio of the highest to the lowest rates. For example, if the lowest rate was 10 per 100,000 people and the highest rate was 20 per 100,000 people, the magnitude of variation is two-fold.

Australian rate

Rates for an intervention may appear higher or lower than the Australian rate; in most cases, the most appropriate rate is difficult to define and not necessarily the Australian rate. Depending on the intervention, a higher or lower rate may be clinically appropriate. It is difficult to conclude what proportion of the variation is unwarranted or to comment on the relative performance of health services and clinicians in one area compared with another. An Australian rate is provided to encourage investigation into the reasons for any variation seen at local, regional, and state and territory levels.

About the data

The Atlas provides information on clinical items grouped into four clinical themes, covering procedures, tests, investigations, treatments or hospitalisations.

The introduction to each chapter provides an overview of the clinical items; international comparisons, where possible; national and state or territory initiatives to improve care; and key findings and recommendations. Specific data limitations are also outlined. Clinical commentary is presented alongside each clinical item, outlining the context, magnitude of variation, and possible reasons for the variation.

The Atlas uses data sourced from four national health datasets:

- Medicare Benefits Schedule (MBS) data
- National Hospital Morbidity Database (NHMD)
- National Perinatal Data Collection (NPDC)
- Pharmaceutical Benefits Scheme (PBS) data.

The years of data shown for each clinical item depend on the source and the most recently available data:

- MBS items are analysed for services provided in 2016–17
- NHMD items are analysed for hospitalisations in 2016–17, except the thyroidectomy item, which is analysed for three combined years (2014–15 to 2016–17) because of small numbers
- The NPDC item is analysed for early planned caesarean sections in 2015
- PBS items are analysed for prescriptions dispensed in 2016–17.

Seven repeat PBS items from the first Atlas are analysed for changes over four years and are presented in a series of ‘turnip’ graphs. These include prescriptions of antimicrobial, psychotropic and opioid medicines dispensed from 2013–14 to 2016–17.

For MBS and PBS items, the rates are based on where the patient lives as determined by the person’s Medicare enrolment postcode. For NHMD items, the rates are determined by the person’s place of residence as recorded at the time of hospital admission. For the NPDC item, the rates are based on the mother’s place of residence.

The Atlas presents age- and sex-standardised rates per 100,000 people for all items. The exception is the NPDC item, which is presented as a percentage. Rates are age and sex standardised to the Australian population using the Australian Bureau of Statistics (ABS) Estimated Resident Population as at 30 June 2001 (based on the 2001 Census of Population and Housing).

The geographic local areas used are ABS standard geographical regions known as the Statistical Area Level 3 (SA3). SA3s provide a standardised regional breakdown to assist in analysing data at the regional level. SA3s generally have populations between 30,000 and 130,000 people. To enable comparisons, local areas are also grouped by state and territory, and by remoteness and socioeconomic status. The remote and very remote categories were combined into one, giving a total of four remoteness categories.

Remoteness is calculated according to the ABS Australian Statistical Geography Standard (ASGS) 2016 using Statistical Area Level 1 (SA1) to remoteness concordance. SA1 population was concorded to SA3, and the remoteness category with the highest percentage of population was allocated to the SA3.

The socioeconomic quintiles are based on the ABS 2016 Index of Relative Socio-Economic Disadvantage at the SA1 level. The quintile with the highest number of SA1s was allocated to the SA3. Some quintiles were combined within a remoteness category to ensure sufficient numbers of SA3s for comparison purposes.

Defined daily dose (DDD) is a measurement unit of assumed average maintenance dose per day for a medicine used for its main indication in adults, created by the World Health Organization. The DDD does not necessarily correspond to the recommended or average prescribed daily dose.

Use of DDDs allows comparisons of medicines dispensing independent of differences in price, preparation and quality per prescription. Expressing medicines dispensing in DDDs per thousand people per day (DDDs/1,000/day) allows the aggregation of data for medicines that have different daily doses.

The data specifications for each item can be accessed on the AIHW Metadata Online Registry (METeOR) at www.meteor.aihw.gov.au.

Data limitations

The clinical items describe variation in health service provision. It is not currently possible to conclude what proportion of the variation is unwarranted, or to comment on the relative performance of health services and clinicians in one area compared with another. The data are provided to encourage further analysis and discussion about the reasons for any variation at local, regional, and state and territory levels.

The hospital data from the NHMD excludes non-admitted care provided in outpatient clinics or emergency departments. Because there is no standardised admission policy across states and territories, analysis of variation for some procedures should take into account possible differences in admission practices and policies among providers, and states and territories. For example, some same-day procedures such as gastroscopy and colonoscopy can be performed in either non-admitted or admitted care settings.

Some data have been suppressed for the following reasons:

- To protect confidentiality of a patient – for example, when the number of prescriptions and the population are very small; this could potentially lead to identifying a patient
- To protect confidentiality of a service provider or a business entity in the MBS data – for example, when the services are predominantly provided by one or two providers
- To account for low numbers of events or very small populations – these rates are more susceptible to random fluctuations
- To preserve confidentiality – numbers of events are suppressed, where applicable.

Suppressed SA3 data are included for larger area analysis.

About the Atlas

The MBS rules for protecting provider and entity identity have had a marked effect on reporting of three items in this Atlas: myocardial perfusion scans, thyroid function tests and thyroid stimulating hormone tests. The implications of these suppression rules are outlined in the chapters on these items. For further information on the data limitations, refer to the individual clinical items. Detailed information on the methods used is provided in the Technical Supplement.

Data for Aboriginal and Torres Strait Islander Australians

Data according to Aboriginal and Torres Strait Islander status have been provided for NHMD and NPDC items only. However, analysis was not undertaken by Aboriginal and Torres Strait Islander status for the MBS and PBS data because this information was not available at the time of publication.

Analyses in this report have not been adjusted to account for the under-identification of Aboriginal and Torres Strait Islander Australians in NHMD and NPDC datasets. Data by Aboriginal and Torres Strait Islander status should be interpreted with caution because hospitalisations for Aboriginal and Torres Strait Islander patients are under-enumerated, and there is variation in the under-enumeration among states and territories.

Maps and graphs

Data for each of the items in the Atlas are displayed as graphs and maps to show variation in rates by geographic location of patient residence.

On the map, age- and sex-standardised rates in each of the geographic areas are ranked from lowest to highest and then split into 10 categories (deciles). These are displayed with colour gradients, where darker colours represent higher rates and lighter colours represent lower rates. Separate maps show the greater capital city areas in more detail.

Standard figures are provided for new items (non-repeat items). Each figure presents a different analysis:

- Numbers and rates by local area, listing the areas with the lowest and highest rates
- Numbers and rates by state and territory
- Numbers and rates by remoteness and socioeconomic status.

Standard figures for repeat PBS items are:

- Rates at a national level, and year
- DDDs/1,000/day, and year.

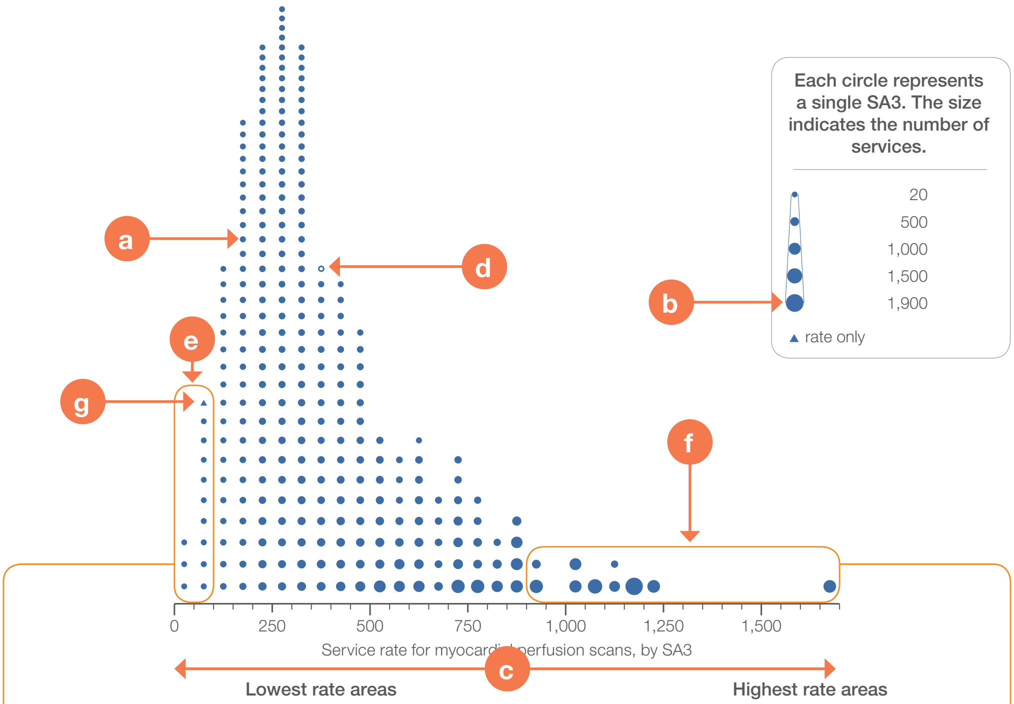
Some items include additional figures, for example, thyroidectomy item:

- Rates by state and territory, and Aboriginal and Torres Strait Islander status
- Rates by state and territory, and patient funding status.

Further information on interpreting the figures is provided on pages 33–37.

How to interpret our data visualisations

Histogram



Lowest rate areas				Highest rate areas			
SA3	State	Rate	Services	SA3	State	Rate	Services
~~Example 1~~	~~State~~	29*	45	Example 1	State	1,652	1,102
Example 2	State	43	27	Example 2	State	1,246	1,119
Example 3	State	44	30	Example 3	State	1,190	1,859

a

What does the circle represent?

Each circle represents an SA3. SA3s are geographical areas defined by the ABS that provide a standardised regional breakdown of Australia. SA3s generally have populations between 30,000 and 130,000 people.

b

Circle size

The size of a circle indicates the number of events in that SA3. A large circle represents an SA3 with a greater number of events than SA3s with a smaller circle. Each histogram is accompanied by a legend to indicate scale.

c

Horizontal axis

The horizontal axis shows the age- and sex-standardised rate. Rates are age and sex standardised to allow comparisons between populations with different age and sex structures.

d

Hollow circles and asterisks

A hollow circle or an SA3 rate that has an asterisk indicates a rate that is considered more volatile and should be interpreted with caution.

e

Lowest rates

Circles and triangles in the box are SA3s with the lowest age- and sex-standardised rates in Australia. The names, rates and numbers of events for these SA3s are listed in the table below the histogram.

f

Highest rates

Circles and triangles in the box are SA3s with the highest age- and sex-standardised rates in Australia. The names, rates and numbers of events for these SA3s are listed in the table below the histogram.

g

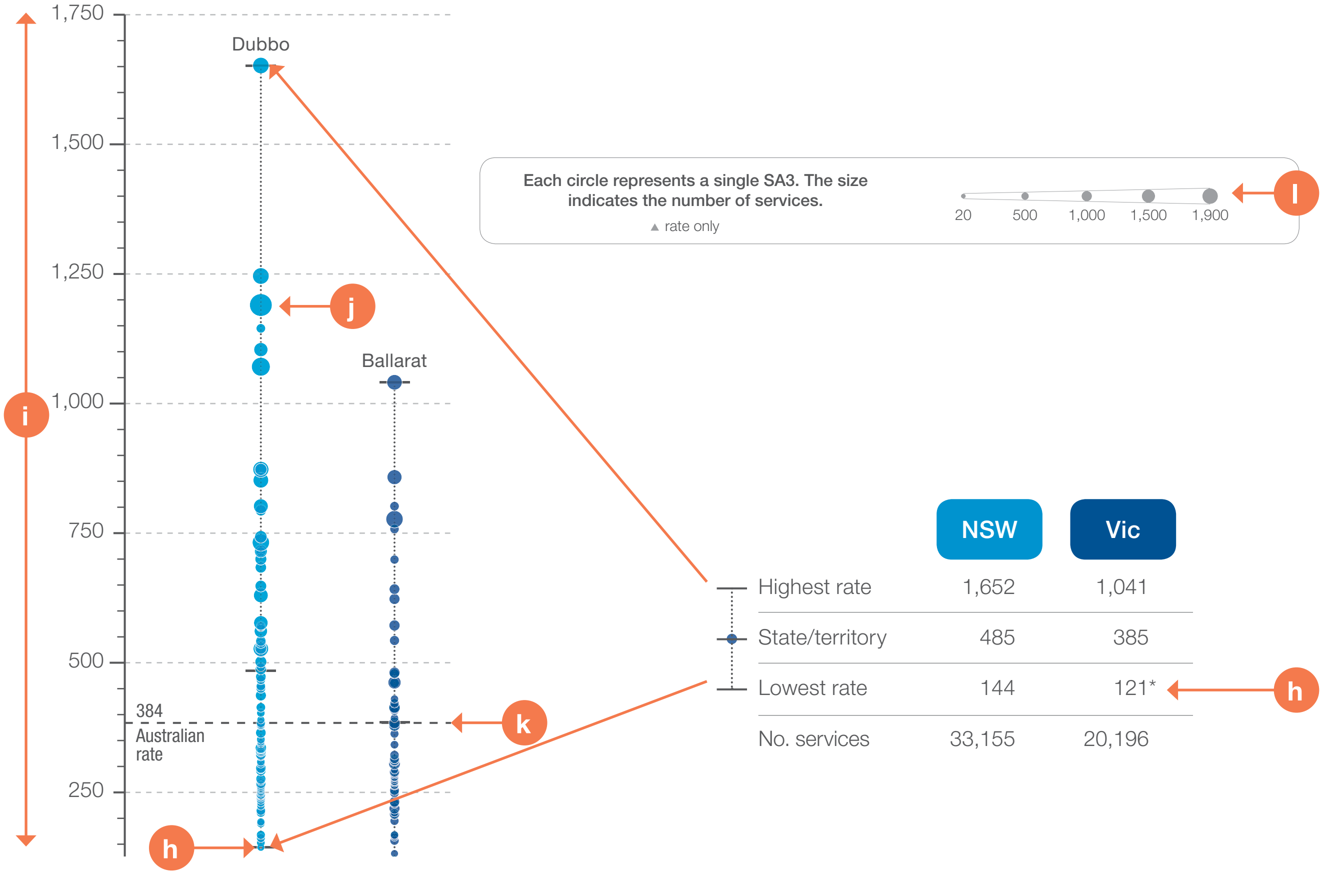
What does the triangle represent?

Each triangle represents an SA3 where only the rate is published. The number of events is not published for confidentiality reasons.

About the Atlas

How to interpret our data visualisations

State and territory graphic



h **Hollow circles and asterisks**
A hollow circle or an SA3 rate that has an asterisk indicates a rate that is considered more volatile and should be interpreted with caution.

i **Vertical axis**
The vertical axis shows the age- and sex-standardised rate. Rates are age and sex standardised to allow comparisons between populations with different age and sex structures.

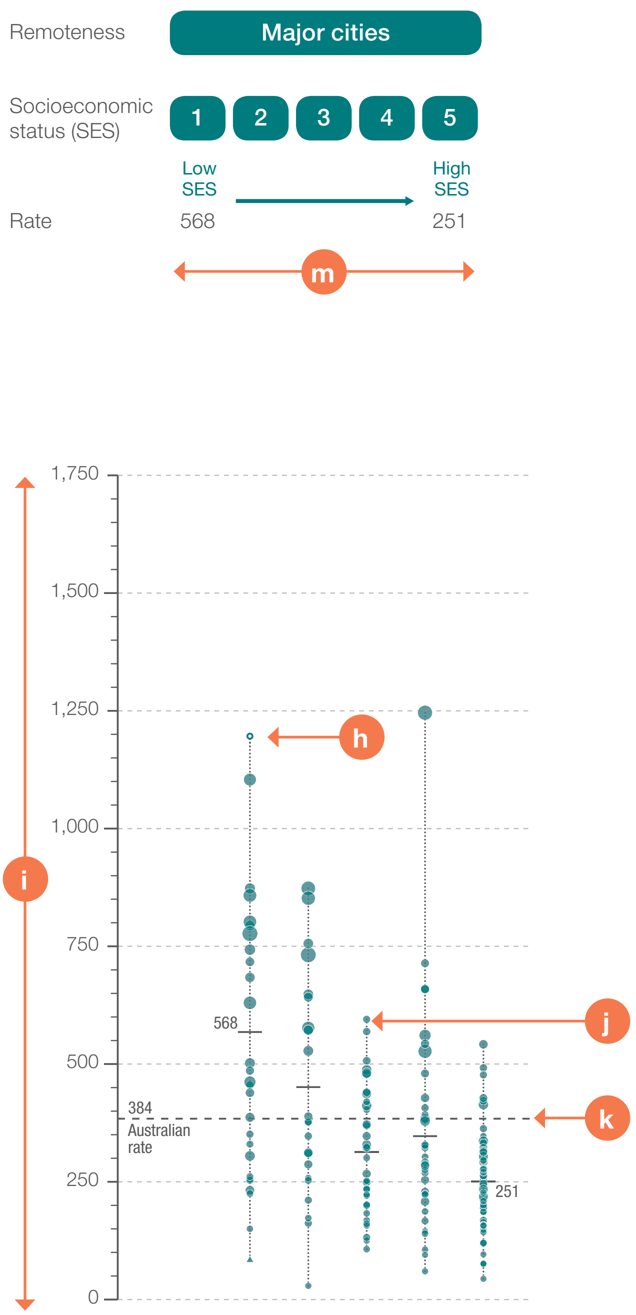
j **What does the circle represent?**
Each circle represents an SA3. SA3s are geographical areas defined by the ABS that provide a standardised regional breakdown of Australia. SA3s generally have populations between 30,000 and 130,000 people.

k **Australian rate line**
This line indicates the Australian age- and sex-standardised rate.

l **Circle size**
The size of a circle indicates the number of events in that SA3. A large circle represents an SA3 with a greater number of events than SA3s with a smaller circle. Each graphic is accompanied by a legend to indicate scale.

How to interpret our data visualisations

Remoteness and socioeconomic status graphic



m **Remoteness and socioeconomic status**

Each SA3 is assigned a remoteness category and a socioeconomic status (SES) category, using remoteness and SES defined by the ABS. The lowest SES category has the most overall disadvantage, and the highest SES category has the least overall disadvantage. Some SES categories are combined in remoteness categories, except in major cities, to ensure sufficient numbers of SA3s for comparison. In this example, the remoteness and SES rate is higher with greater socioeconomic disadvantage.

About the Atlas

How to interpret our data visualisations

Repeat analyses graphic

a **What does the rectangle represent?**
Each rectangle represents an SA3. SA3s are geographical areas defined by the ABS that provide a standardised regional breakdown of Australia. SA3s generally have populations between 30,000 and 130,000 people.

b **Hollow rectangles and asterisks**
A hollow rectangle or an SA3 rate that has an asterisk indicates a rate that is considered more volatile and should be interpreted with caution.

c **Vertical axis**
The vertical axis shows the age- and sex-standardised rate. Rates are age and sex standardised to allow comparisons between populations with different age and sex structures.

d **Highest rate without top 10%**
This line indicates the highest age- and sex-standardised rate after excluding the highest 10% of SA3 rates.

e **Australian rate**
This line indicates the Australian age- and sex-standardised rate.

f **Lowest rate without bottom 10%**
This line indicates the lowest age- and sex-standardised rate after excluding the lowest 10% of SA3 rates.

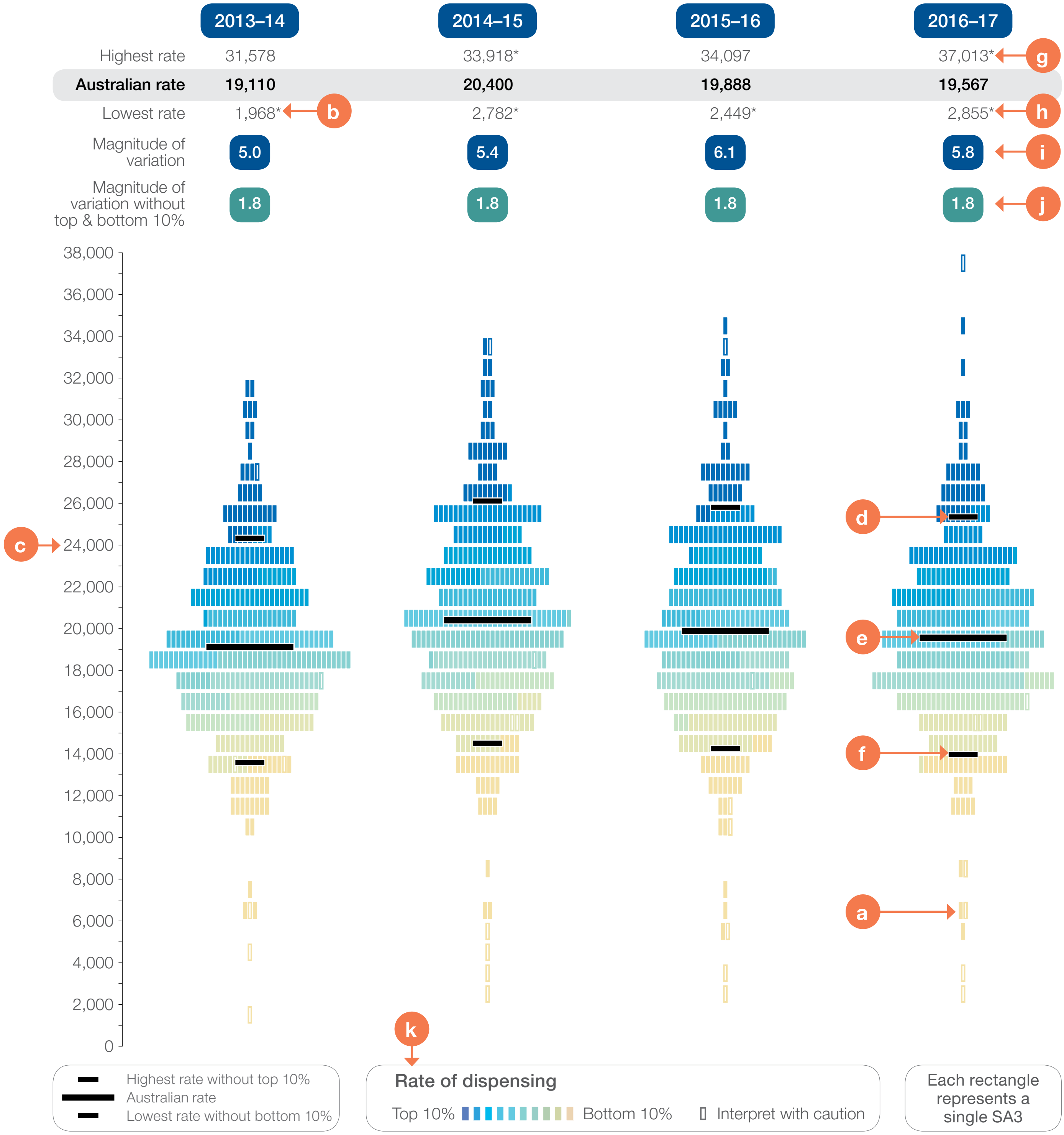
g **Highest rate**
The highest rate is the highest age- and sex-standardised rate of all SA3 rates.

h **Lowest rate**
The lowest rate is the lowest age- and sex-standardised rate of all SA3 rates.

i **Magnitude of variation**
The magnitude of variation is the times difference between the highest and lowest SA3 rates in Australia. Rates published with caution are excluded from the calculation.

j **Magnitude of variation without top and bottom 10%**
The magnitude of variation is the times difference between the highest and lowest SA3 rates after excluding the highest and lowest 10% of SA3 rates.

k **Rate of dispensing**
Darker colours represent SA3s with a higher age- and sex-standardised rate, and lighter colours represent SA3s with a lower rate.



2013–14
2014–15
2015–16
2016–17
Highest rate
31,578
33,918*
34,097
37,013*
Australian rate
19,110
20,400
19,888
19,567
Lowest rate
1,968*
2,782*
2,449*
2,855*
Magnitude of variation
5.0
5.4
6.1
5.8
Magnitude of variation without top & bottom 10%
1.8
1.8
1.8
1.8
38,000
36,000
34,000
32,000
30,000
28,000
26,000
24,000
22,000
20,000
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
a
b
c
d
e
f
g
h
i
j
k
Highest rate without top 10%
Australian rate
Lowest rate without bottom 10%
Rate of dispensing
Top 10%
Bottom 10%
Interpret with caution
Each rectangle represents a single SA3

Chapter 1
Neonatal and paediatric health

At a glance

Early planned caesarean section without medical or obstetric indication

Planned early birth is an important intervention in maternity care, but the timing of birth should be carefully considered to optimise the outcome. There is growing evidence that planned caesarean section before 39 weeks' gestation increases short-term risks, including neonatal respiratory problems and infections in the first five years of life. It may also increase the risk of long-term developmental problems, poorer school performance and attention deficit hyperactivity disorder.

The Atlas found that, in 2015, between 42% and 60% of planned caesarean sections performed before 39 weeks' gestation did not have a medical or obstetric indication, and between 10% and 22% performed before 37 weeks did not have a medical or obstetric indication. These data have recently begun to be collected routinely in Australia; four states or territories with reliable data have been reported on. Rates were generally higher for privately funded patients than for publicly funded patients.

Antibiotics in children

The rate of antibiotic use in children in Australia is high compared with similar countries. For example, Australia's use in children aged 0–9 years is three times higher than in Norway and the Netherlands. In many cases, antibiotics are not needed – for example, for viral illnesses. Overuse of antibiotics contributes to bacterial resistance. Emerging research also suggests that changes to the normal gut bacteria caused by antibiotics may increase the risk of chronic autoimmune diseases in children, such as asthma. The Atlas found high rates of antibiotic use in children, with more than 3 million antibiotic prescriptions dispensed for children aged 0–9 years in 2016–17.

Proton pump inhibitor medicines in infants

Proton pump inhibitor medicines are often used to treat infants with simple reflux or colicky symptoms, such as irritability or crying, even though they are not effective for these symptoms. These medicines reduce the level of stomach acid, and increase the risk of infections such as pneumonia. They can also change the gut microbiome, which may increase the risk of allergies. The Atlas found about a four-fold difference between the lowest and highest state and territory rates in dispensing of proton pump inhibitor medicines under the Pharmaceutical Benefits Scheme for infants aged 1 year and under in Australia.

Recommendations

Early planned caesarean section without medical or obstetric indication

1a. Local Hospital Networks, health service organisations and clinicians to have systems in place to obtain fully informed patient consent for planned caesarean section by providing prospective parents with comparative information on the short- and long-term risks of planned early-term caesarean section without a medical or obstetric indication.

1b. The Medicare Benefits Schedule (MBS) Review Taskforce to review item 16519 (Management of labour and birth by any means including caesarean section), and ensure that item descriptors align with current clinical evidence and support a gestation period of at least 39 weeks unless there are medical or obstetric indications.

1c. Relevant colleges to initiate a joint project to develop evidence-based guidance, education and consumer information on early planned caesarean section without a medical or obstetric indication. This guidance should emphasise the need to ensure that potential risks for both mother and baby are discussed with the prospective parents.

1d. Local Hospital Networks and health service organisations to have systems in place, as part of their clinical governance processes, for regular review and reporting of rates of early planned caesarean section without a medical or obstetric indication, and for addressing unwarranted variation.

1e. All states and territories to ensure consistent, routine collection and reporting of data on gestational age for planned caesarean section without a medical or obstetric indication to improve the quality of data collections. This should include reporting of gestational age in days to allow more in-depth understanding of the distribution of births occurring before 39 weeks.

1f. The National Health and Medical Research Council to consider funding research to identify the effects of gestational age and delivery method on childhood development.

1g. The Commission to investigate the potential to include early planned caesarean section without a medical or obstetric indication in the national list of hospital-acquired complications, given the evidence about potential short- and long-term risks.

Inappropriate use of proton pump inhibitor medicines and antibiotics in children

1h. The Pharmaceutical Benefit Advisory Committee to recommend Pharmaceutical Benefits Scheme streamlined authority required listings for proton pump inhibitor medicines that have Therapeutic Goods Administration-approved indications in infants and children, such as gastro-oesophageal reflux disease.

1i. NPS MedicineWise to ensure that its public education campaigns highlight the potential harms of inappropriate antibiotic use in children, and provide advice for parents on managing coughs, colds, earaches and sore throats without the use of antibiotics.

1j. The Commission, as part of the Antimicrobial Use and Resistance in Australia Surveillance System, to monitor antibiotic use in children in hospitals and the community.

1k. The National Health and Medical Research Council to consider funding research into approaches to reduce antibiotic overuse in children, particularly in acute respiratory infections when antibiotics are most commonly prescribed.

1.1 Early planned caesarean section without medical or obstetric indication – special report

Why is this important?

Planned early birth is an important intervention in maternity care, but the timing of birth should be carefully considered to optimise the outcome for mother and child. Birth before 39 weeks' gestation is associated with higher risks of short-term adverse effects on the baby, such as respiratory distress, hypoglycaemia and jaundice, and an increased likelihood of admission to a neonatal intensive care unit. There is also emerging evidence of potential long-term adverse developmental effects, such as poorer educational outcomes in childhood.[1-6] Until recently, neonatal outcomes were generally thought to be the same whether planned birth occurred at 37, 38 or 39 weeks' gestation – but this is not the case. Pregnant women may not be aware that waiting until 39 weeks is best for their baby if there are no medical reasons for earlier birth.[7]

What did we find?

In 2015, the percentage of planned caesarean sections performed at less than 39 weeks' gestation without an obstetric or medical indication ranged from 42% to 60% in the four states/territories with presented data. The percentage of planned caesarean sections performed at less than 37 weeks' gestation without an obstetric or medical indication ranged from 10% to 22% in the four states/territories with presented data. Rates were generally higher for privately funded patients than for publicly funded patients for planned caesareans done before both gestational ages.

These findings should be seen in the context that Australian states and territories began routinely collecting standardised data on the main reason for caesarean section relatively recently, and the quality of data was sufficient for publication for four states/territories only. Of the reporting states/territories, data collection processes may be at different stages of maturity, so rates are not comparable across states/territories.

Early planned caesarean section without medical or obstetric indication

What can be done?

The emerging data on long-term adverse effects show that practices need to be reconsidered. Outcomes for babies could be improved by reducing rates of planned caesarean section without obstetric or medical indication at less than 39 weeks' gestation. Strategies to reduce rates should include:

- Providing parents with information about short and long-term adverse effects of early-term births
- Clinician education
- Improving data collection and monitoring
- Hospital-level public reporting.

Why a special report?

This report presents data on rates of planned caesarean section at less than 39 weeks', and at less than 37 weeks', gestation, without an obstetric or medical indication – that is, caesarean section when there was no established labour or other obstetric or medical reason for not waiting until 39 weeks.

Collection of data for this indicator is relatively new in Australia, and many states and territories do not yet collect the data required to calculate this national indicator. Therefore, the mapping and data analyses presented for other items in the Atlas are not possible for this item. Among the reporting states/territories, data collection processes may be at different stages of maturity, so rates are not comparable across states/territories. In addition, the difference between the gestational age recommended in the Royal Australian and New Zealand College of Obstetricians and Gynaecologists (RANZCOG) position statement and the indicator for this data item ('approximately 39 weeks' versus '39 weeks', respectively) may increase the rates reported for this item.[8] For example, deliveries at 38 weeks and 6 days' gestation are appropriate according to the RANZCOG position statement, but are included in the data for this indicator.[8] The additional analysis with 37 weeks as the cut-off gestation period was included to clarify the proportion of planned caesarean sections that occurred well before the RANZCOG recommended minimum gestational age.

Given the emerging evidence of what appears to be high rates of early planned caesarean section without a medical indication, a discussion of the issue and the available data are presented despite these limitations.

The timing of planned caesarean section, in light of the potential effects on the child's subsequent health, is the focus of this report. A broader discussion about rates of caesarean section was presented in the *Second Australian Atlas of Healthcare Variation*.[9]

Risks of early-term birth

Until recently, birth at any time between 37 and 41 weeks' gestation was considered full term, and neonatal outcomes were generally thought to be uniform during this period.[10,11] Evidence of poorer outcomes for babies born before 39 weeks prompted a re-evaluation of this definition, and, from 2010, the descriptor 'early term' began to be used for 37 and 38 weeks' gestation, and 'full term' for 39–41 weeks' gestation.[10,11]

Where there are certain obstetric or medical complications, such as pre-eclampsia or foetal growth restriction, earlier planned caesarean section may be necessary because the risks of waiting until 39 weeks' gestation outweigh the benefits.[8] If serious complications develop in the mother or baby, caesarean section may be performed regardless of gestation (that is, an emergency caesarean section).

Waiting until 39 weeks' gestation for a planned caesarean section, if there are no medical reasons for earlier birth, is now recommended by several international organisations and some Australian states.[12-16] A position statement from RANZCOG states: 'On balance, weighing up the risk of respiratory morbidity following elective caesarean section and the risk of labouring prior to caesarean section, it is recommended that elective caesarean section in women without additional risks should be carried out at approximately 39 weeks gestation'.[8]

Short-term risks

The increased risk of respiratory problems and of admission to neonatal intensive care for babies born by planned caesarean section at early term rather than full term is well established.[17-19] The risk of serious neonatal respiratory morbidity is significantly higher in babies delivered by elective caesarean section at 37–38 weeks than in those delivered at 39–41 weeks (1.2% compared with 0.5%).[20] The risks of hypoglycaemia, jaundice and admission to a neonatal intensive care unit are also increased in babies delivered by elective caesarean section at 37 or 38 weeks' gestation rather than at 39 to 41 weeks' gestation.[18,20]

The risk of hospitalisation for infections in the first five years of life is also higher among children delivered by planned caesarean section performed at 37–38 weeks' gestation rather than at 39 weeks' gestation.

Long-term risks

Evidence of longer-term effects of early-term birth has also grown recently. Children born at early term are at increased risk of poorer school performance and attention deficit hyperactivity disorder compared with those born at full term.[1-4]

In some cases, poorer developmental outcomes may be explained by the maternal or foetal factors that prompted the earlier birth. Studies that accounted for these factors still found poorer outcomes with birth at early term rather than full term. This suggests that harm is associated with the earlier timing, regardless of the effect of the factors that prompted it.[5]

For example, a United States study of 128,050 children in third grade found that those born at early term had significantly worse performance in maths than those born at full term.[5] This effect remained even after accounting for the effect of obstetric factors such as caesarean birth, birth weight and maternal age, as well as socioeconomic disadvantage.[5]

Although developmental risks are greater for babies born before 37 weeks' gestation, the greater frequency of births at 37 or 38 weeks' gestation means that these births have larger implications at a population level.[2,6] In a Scottish study, early-term births were estimated to account for a higher proportion of special educational needs in school-aged children than were preterm (less than 37 weeks' gestation) births (5.5% and 3.6%, respectively).[6]

Risks of waiting until 39 weeks

A United States study of the effect of policies to reduce planned births before 39 weeks' gestation did not find an increase in adverse outcomes. The prospective study of outcomes in 27 hospitals reported no significant increase in stillbirths when the rate of planned births at less than 39 weeks' gestation without an obstetric or medical indication was reduced from 9.6% to 4.3% of all births.[21] (Note that these rates are not directly comparable with the data presented in this report.)

A common concern about waiting until 39 weeks' gestation for a planned caesarean section is the risk of the mother going into spontaneous labour beforehand, and possibly requiring an emergency caesarean section.[22] Emergency caesarean section is associated with higher risks of complications and higher costs.[23,24] If caesarean section is planned for 39 weeks' gestation, an estimated 13–25% of women will end up having a caesarean section after labour has started, compared with 8–11% if it is planned for 38 weeks' gestation.[22]

Early planned caesarean section without medical or obstetric indication

Trends in Australia

Caesarean section rates

Rates of caesarean section overall have risen steadily in Australia since the early 1990s. In 2016, 34% of births in Australia were by caesarean section, compared with 31% in 2006 and 18% in 1990.[25,26]

Planned caesarean section and early-term planned birth

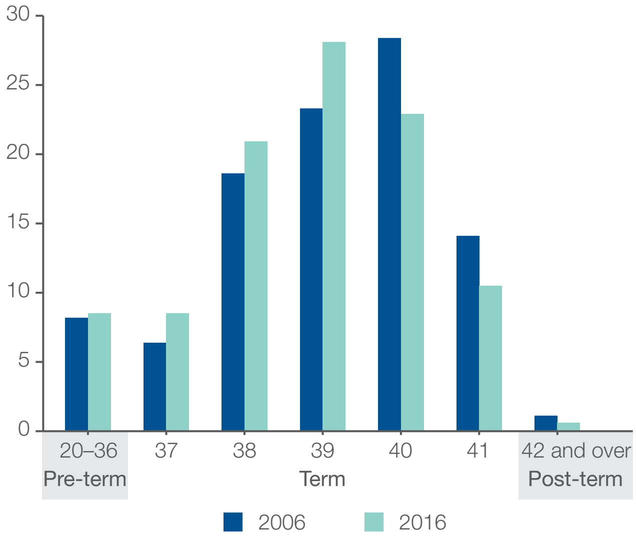
Few Australian data are available on trends in the proportion of caesarean sections that are planned and occur at early term. In New South Wales, between 1994 and 2009, the contribution of all (pre-labour) planned caesarean sections to all singleton births almost doubled, increasing from 9.1% to 17.1% over this period.[27]

Another study of New South Wales data showed that, between 2001 and 2009, the rate of planned caesarean section at 38 weeks' gestation increased by 25%, and at 39 weeks' gestation by 68%.[28] The proportion of all caesarean sections or inductions reported with established medical indications, such as maternal hypertension or foetal distress, decreased between 2001 and 2009, while the proportion increased for conditions in which evidence is equivocal (for example, diabetes mellitus).[28]

Gestational age at birth

The proportion of babies born at early term has increased in the past decade in Australia. Between 2006 and 2016, the proportion of babies born between 37 and 39 weeks' gestation increased, while the proportion born from 40 weeks onwards decreased (Figure 1.1).[25] Between 2006 and 2016, the average gestational age for all babies born in Australia fell from 38.9 weeks to 38.6 weeks.[25,29] A number of factors may have contributed to this shift.

Figure 1.1: Percentage of babies, by gestational age in weeks, 2006 and 2016



Note:
Pre-term births include a small number of births of less than 20 weeks' gestation.
Source: *Australia's Mothers and Babies 2016.*[25]

Important notes on the data used in this report

The draft National Core Maternity Indicator 18 – 'Caesarean sections <39 completed weeks (273 days) without obstetric or medical indication' – was created to benchmark practice and to reduce neonatal respiratory morbidity by minimising early birth. However, this indicator has not yet been submitted for endorsement by the National Health Data and Information Standards Committee. While the indicator was developed by the Expert Commentary Group responsible for the National Core Maternity Indicators, it was not further tested for reporting because the data were not available, and it is not currently reported by the Australian Institute of Health and Welfare (AIHW).

There are a number of limitations with the data quality for one of the data elements: 'main reason for caesarean section'. This data element is new to the National Perinatal Data Collection, and data that meet its specification are only available for some states and territories. Of the reporting states, data collection processes may be at different stages of maturity, so rates are not comparable across states/territories. For this reason, the reporting states/territories have not been identified.

In addition, state health departments that reviewed their data found that recording of the main reason for caesarean section was not always updated as the clinical situation evolved. For example, medical indications for early birth, such as foetal compromise, were not always recorded as the main indication for early caesarean section if a caesarean section had already been planned for other reasons. Similarly, clinical events such as pre-labour rupture of membranes may lead to an unplanned early caesarean section, but these were not always recorded if the caesarean section had already been planned for other reasons. Data on the original planned date are not available in these cases, and a proportion are likely to have been planned for 39 weeks. This means that the count of planned caesarean sections performed before 39 weeks without medical or obstetric indication is an overestimate for some states. For example, data from one state/territory are overestimated by approximately 3%; another state/territory was unable to distinguish between the main and additional reasons for caesarean section. In this instance, the reason reported as the main reason is the first-listed reason. Another state/territory was unable to collect data for this item (main reason for caesarean section) according to revised specifications introduced from 1 July 2015. Data were mapped by the AIHW to the revised specifications, where possible, and remaining data have been included in the 'Other, not further defined' category.

Data on the main indication for caesarean section are published at the state and territory level in the supplementary tables for the AIHW report *Australia's Mothers and Babies*.[25] It is anticipated that, as clinicians start to use the data for quality improvement purposes, more states and territories will be able to report according to the specifications.

The numerator of the indicator contains caesarean sections 'without obstetric/medical indication' where the caesarean section occurred in the absence of labour and at less than 39 completed weeks for the following reasons:

- Maternal choice in the absence of any obstetric, medical, surgical or psychological indication
- Previous caesarean section
- Previous severe perineal trauma
- Previous shoulder dystocia.

While these may be indications for planned caesarean section, they were not considered reasons for early planned caesarean section – that is, before 39 weeks.

The denominator is the total number of women who gave birth by caesarean section at less than 39 completed weeks' gestation and where there was no established labour.

Early planned caesarean section without medical or obstetric indication

Data source and subanalyses

Data are sourced from the National Perinatal Data Collection, which includes births that occur in hospitals, birth centres and the community (such as home births), for public and private patients. Because of small numbers, data are reported only at state/territory level. Reporting by smaller geographical area, remoteness and socioeconomic disadvantage is not possible.

Data availability

Data of sufficient quality for publication were available from four states/territories. Data on 'main reason for caesarean section' did not meet the specification for the remaining four states and territories. The states/territories with publishable data are leaders in data usage for exploring this issue; the other states and territories are developing their capabilities in this area.

Nationally, there were 36,757 caesarean sections before 39 weeks' gestation without established labour (denominator of the indicator) in 2015. Of these, 15,236 caesarean sections (41%) were from the four reporting states/territories; 21,521 (59%) were from other states and territories, and are not included in the data for this item.

What do the data show?

In 2015 in the four states/territories for which data were published, there were 8,547 caesarean sections without obstetric or medical indication at less than 39 weeks' gestation, out of a total of 15,236 caesarean sections at less than 39 weeks' gestation. There were 510 caesarean sections without obstetric or medical indication at less than 37 weeks, out of a total of 3,045 caesarean sections at less than 37 weeks' gestation in the four states/territories with published data.

In 2015 in the four states/territories for which data were published, the percentage of planned caesarean sections performed at less than 39 weeks' gestation without an obstetric or medical indication ranged between 42% and 60%. The percentage of planned caesarean sections performed at less than 37 weeks' gestation without an obstetric or medical indication ranged between 10% and 22%.

Analysis by patient funding status

In 2015 in the four states/territories with published data, the percentage of caesarean sections at less than 39 weeks' gestation without an obstetric or medical indication was 51.6% for publicly funded patients, compared with 60.1% for privately funded patients,. The percentage of caesarean sections performed at 39 weeks' gestation without an obstetric or medical indication was higher for privately funded patients in three of the four states/territories for which data are published.

At 37 weeks' gestation, the percentage of caesarean sections without an obstetric or medical indication for publicly funded patients was 14.3%, compared with 20.3% for privately funded patients. The percentage was higher for privately funded patients in the three states/territories for which both public and private data could be presented.

Analysis by Aboriginal and Torres Strait Islander status

Data analysed by Aboriginal and Torres Strait Islander status were available from two states/territories for caesarean section without obstetric or medical indication at less than 39 weeks' gestation, and from one state/territory at less than 37 weeks' gestation. The denominators are low for this category (for example, for one state/territory, the denominator is 163 for less than 39 weeks' gestation), so caution should be exercised in judging whether differences are significant.

The percentage of caesarean sections performed at less than 39 weeks' gestation without an obstetric or medical indication in one state/territory was lower among Aboriginal and Torres Strait Islander women (53.4%) than among other Australian women (56.1%). Percentages were similar for both groups in the other state/territory with publishable data (61.3% for Aboriginal and Torres Strait Islander women and 59.6% for other Australian women). The rate of caesarean section at less than 37 weeks' gestation without an obstetric or medical indication in the state/territory with published data in this category was higher among Aboriginal and Torres Strait Islander women (19.8%) than among other Australian women (15.2%).

Interpretation

Data from the four published states/territories showed that between 42.2% and 59.6% of planned caesarean sections performed before 39 weeks' gestation did not have an obstetric or medical indication, and between 9.6% and 22.2% performed before 37 weeks' gestation did not have an obstetric or medical indication. The variation between states was relatively small, but the reported rates suggest that the opportunity to improve outcomes in Australia is substantial.

Reported rates could be influenced by a number of factors, such as adherence to guidelines, differences in guidelines (for example, whether clinicians follow recommendations for planned caesarean no earlier than 39 weeks or at approximately 39 weeks)[8,15,16,31-33], and rates of private health insurance.

The need to avoid an emergency caesarean section is greater in settings without rapid access to 24-hour obstetric care. Rates of caesarean section before 39 weeks' gestation may be higher in some non-metropolitan areas for this reason.

Public–private partnership models may increase the rate of caesarean sections in some areas; for example, a public–private partnership in Western Australia was associated with a 4% increase in the rate of caesarean section in the catchment area in 2016–17. Social factors may influence rates in some areas – for example, timing to ensure that spouses are present for the birth in areas with military bases or fly-in-fly-out workers. Operating theatre capacity may also influence rates.

Differences in the quality of data collection may also influence rates. See 'Important notes on the data used in this report', page 45.

Policy and guideline differences

Differences in the gestational age used as the cut-off for this indicator ('39 completed weeks and over') versus that recommended in the RANZCOG position statement ('approximately 39 weeks') may have inflated rates reported for this item.[8] For example, births at 38 weeks and 6 days' gestation are appropriate according to the RANZCOG position statement, but are included in the data for this indicator.[8]

Data were available only in completed weeks of gestation. Data reported by days of gestation would provide more information about the proportion of planned caesarean sections without medical or obstetric indication that occurred at 38 weeks and 6 days compared with earlier gestation. However, even if the actual rates of planned caesarean sections without an obstetric or medical indication before 39 weeks' gestation were much lower than the rates reported, the scope to reduce preventable harm by reducing early-term births is still considerable. In addition, the percentage of planned caesarean sections without obstetric or medical indication occurring before 37 weeks' gestation (9.6–22.2%) shows that a substantial number are occurring well before the RANZCOG recommendation of approximately 39 weeks' gestation.[8]

Early planned caesarean section without medical or obstetric indication

Reducing early planned caesarean section

The high rates reported for planned caesarean sections without an obstetric or medical indication occurring before 39 weeks' gestation, and before 37 weeks' gestation, highlight the need for a concerted effort to address this issue.

Many organisations in the United States have worked to reduce rates of preterm and early-term birth without a medical indication, and large improvements have been seen in recent years.[34] Strategies have included publishing data, public awareness campaigns, clinician education and prohibiting bookings for births before full term. At least one state Medicaid agency in the United States has also stopped providing reimbursement for non-indicated births before 39 weeks' gestation.[13]

A multifaceted approach is also needed in Australia. This could include:

- Providing parents with information about short- and long-term adverse effects of early-term births
- Clinician education
- Improving data collection and monitoring
- Hospital-level public reporting.

Informed consent

More than half of pregnant women believe 37–38 weeks' gestation is the earliest time for safe birth, according to a recent Australian survey.[7] Education about the difference in outcomes, and particularly the effects on long-term child development, between early-term and full-term births could be a powerful strategy to reduce early caesarean section where there are no medical or obstetric indications. Prospective mothers who have opted for a planned caesarean section and who have no obstetric or medical indications for an early-term birth should be given information about the optimal time for the caesarean section, and the short- and long-term effects of early-term caesarean section. Prospective mothers should be given this information as far in advance as possible.

Informing mothers about the role of vaginal birth after caesarean section could also reduce the overall planned caesarean section rate, as approximately 58% of caesarean sections are repeat procedures.[28]

Clinician education and hospital policies

Educating clinicians about the most recent evidence for optimal timing of planned caesarean section may be useful for reducing planned caesarean section without medical or obstetric indication, but combining education with changes to hospital policies is more effective.[21] Three different approaches to reducing elective early-term births (inductions and caesarean sections) were compared in a United States study of births in 27 hospitals:[21]

- Education only – physicians were given literature and recommendations against performing purely elective births at less than 39 weeks' gestation
- Education plus a 'soft stop' approach – compliance with a policy of not scheduling purely elective births at less than 39 weeks' gestation was left up to individual physicians, but all exceptions to the policy were referred to a local peer review committee
- Education plus a 'hard stop' approach – purely elective planned births at less than 39 weeks' gestation were prohibited, and the policy was enforced by hospital staff who were empowered to refuse to schedule such births.

During the two-year study period, the hard stop policy was associated with the largest drop in elective births before 39 weeks (from 8.2% to 1.7%).[21] The soft stop approach was associated with a smaller, but still significant, drop (from 8.4% to 3.3%). Clinician education alone was less effective in changing practice, with a non-significant drop in rates (from 10.9% to 6.0%). For all groups combined, the rate of neonatal intensive care unit admission fell significantly during the study (from 8.9% to 7.5%). The study authors suggested that a rate of elective birth at less than 39 weeks' gestation, without medical indication, of less than 5% was a realistic national quality benchmark.[21] (Note that the data used in this study are not directly comparable with those in this report.)

An education campaign specifically focused for Australian general practitioners (GPs) on optimal timing for planned caesarean section could be worthwhile, as GPs undertake shared care with obstetricians in some cases.

Hospital monitoring and public reporting of local rates

Quality improvement activities by hospitals, obstetricians and neonatologists could provide insights into local rates of planned caesarean section without an obstetric or medical indication before 39 weeks' gestation. For example, local monitoring of clinical variation, as required by Action 1.28 of the Clinical Governance for Health Service Organisations Standard in the National Safety and Quality Health Service Standards (second edition)[35], could include monitoring of variation between the local rate and the state rate, variation between practitioners, and deviation from evidence-based guidelines.

Improving data collection and monitoring

The lack of publishable data for this indicator from many states and territories in Australia underscores the urgency of improving the completeness and consistency of national data collection on early planned caesarean section. Complete data would clarify the scale of the problem in Australia, allow efforts to be targeted where they are most needed, and show whether interventions are having an effect.

Data improvements could include:

- Complete collection from all states and territories to allow regular reporting as part of the National Core Maternity Indicators
- Reporting of gestational age in days to allow more in-depth understanding of the distribution of births occurring before 39 weeks
- Hospital monitoring and public reporting of local rates
- Inclusion of early planned caesarean section as a hospital-acquired complication.

In the United States, planned early-term birth without a medical indication is a national perinatal quality benchmark monitored by the National Quality Forum and the Joint Commission.[14] Consumers in the United States also have access to published rates of early elective births for many hospitals.[14,34]

United States data from the Leapfrog Hospital Survey (a voluntary safety and quality survey) showed that the proportion of planned births by caesarean section or induction performed without medical necessity before 39 weeks' gestation was 4.6% in 2013.[34] This rate fell to 1.6% in 2017, following increased interventions to reduce the rate.[34] (These rates are not directly comparable with the state rates reported in this chapter because the denominators are different, the participating United States hospitals may not be a representative sample and the measure includes inductions.[14]) The percentage of planned births before 39 weeks without an obstetric or medical indication, along with other indicator results, is publicly reported in a consumer-friendly format for each hospital assessing this indicator for the Leapfrog survey.[36]

Early planned caesarean section without medical or obstetric indication

Resources

- United States National Quality Forum Maternity Action Team, *Playbook for the Successful Elimination of Early Elective Deliveries*[37]
- California Maternal Quality Care Collaborative Toolkit to Transform Maternity Care, *Elimination of Non-medically Indicated (Elective) Deliveries Before 39 Weeks Gestational Age*[38]
- March of Dimes Foundation, Healthy Babies are Worth the Wait® community education toolkit[39]
- World Health Organization, statement on caesarean section rates[40]
- 'Antenatal care for Aboriginal and Torres Strait Islander women'.[41]

Australian initiatives

The information in this chapter will complement work already under way to improve outcomes from planned caesarean section in Australia. At a national level, this work includes:

- RANZCOG statement on timing of elective caesarean section at term[8]
- RANZCOG statement on caesarean delivery on maternal request.[42]

Many state and territory initiatives are also in place, including:

- Australian Capital Territory, policy of booking all elective caesarean sections for 39 weeks unless there is an obstetric or medical indication for earlier delivery
- South Australia Maternal and Neonatal Clinical Network, perinatal practice guidelines for caesarean section[31]
- New South Wales Health, guideline on timing of elective or pre-labour caesarean section[16]
- New South Wales Health translational research project grant for 'Are we there yet? Optimising timing of planned birth to improve newborn outcomes and reduce health service costs'
- Safer Care Victoria, *Planning for Birth After Caesarean*[15]
- Queensland Clinical Guidelines, *Vaginal Birth After Caesarean Section (VBAC)*[32]
- Western Australian Preterm Birth Prevention Initiative.[33]

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1.2 Antibiotics dispensing in children, 9 years and under

Why is this important?

Much of current antibiotic use is inappropriate, with antibiotics being prescribed for viral illnesses when their use is not indicated.[1] More than 30 million prescriptions for antimicrobials were dispensed to people of all ages in the Australian community in 2015, with no change in this number since 2008.[2] There are harms associated with high use of antibiotics. For example, development of bacterial resistance that means some antibiotics are no longer effective in combating infections. Antimicrobial resistance is known to be increasing in Australia.[2] Other potential harms of high use of antibiotics are now being investigated. Antibiotic use in children is associated with a higher risk of asthma, Crohn's disease and weight gain, although researchers are still exploring these links.[3-6]

What did we find?

The rate of dispensing of antibiotics to children aged 9 years and under is almost equivalent to one antibiotic prescription annually per child in this age group in Australia.

What can be done?

Improving antibiotic prescribing has been a focus of attention for many years, but there has been limited success in reducing rates.[7-10] Sustained and concerted efforts to ensure patient and community awareness of the potential harms associated with antibiotic use in children are essential.[2,11] Improving patient knowledge of the trade-offs between likely benefits and harms has been shown to reduce the use of antibiotics.[12,13] Tools to assist with shared decision making should be promoted to ensure that parents are properly informed about appropriate use of antibiotics in their children. More attention needs to be given to strategies that would encourage clinician adherence to guidelines on appropriate prescribing.[11]

Antibiotics dispensing in children, 9 years and under

Context

This item focuses on rates of antibiotic dispensing for children aged 9 years and under. Antibiotics are used to treat infections, and to prevent infections in some susceptible patients (for example, during some types of surgery).[14] Antibiotic use in Australia is highest in children aged 0–9 years and in older people (aged 65 years and over).[2]

Upper respiratory tract infections are a common reason for seeking medical care, accounting for 26% of paediatric general practitioner (GP) consultations in Australia.[15] As most respiratory tract infections are caused by viruses, antibiotics have a limited role in treatment and should be reserved for cases in which a bacterial cause is suspected.[7] Inappropriate use of antibiotics was highlighted by a 2017 Australian study showing that GPs prescribed antibiotics for acute respiratory infections in children and adults at 4–9 times the rate expected if guidelines were followed.[1] Australia's rate of antibiotic use for children aged 9 years and under is about three times higher than that of similar countries such as Norway and the Netherlands.[8]

Antibiotic use promotes bacterial resistance, both in the individual and the community.[9,16] For example, an individual prescribed an antibiotic for a respiratory tract infection is more likely to carry bacteria resistant to that antibiotic within 12 months of use.[17] Longer duration of antibiotic use and multiple courses are associated with higher rates of bacterial resistance in an individual.[17] Children appear to be important transmitters and recipients of resistant bacteria[18], so inappropriate antibiotic use in children affects rates of resistance in the whole community.

Evidence of a link between childhood antibiotic use and an increased risk of chronic diseases is growing, but is based on observational data. Antibiotic use causes changes in the gut microbiome, and this may cause immune system changes that subsequently increase the risk of some conditions.[3-5,19] Antibiotic use in young children and babies is associated with an increased risk of asthma.[3,20,21] Childhood use of certain antibiotics is associated with an increased risk of weight gain, and the risk is higher with more courses of antibiotics.[6,22] Childhood antibiotic use is also associated with an increased risk of developing Crohn's disease.[4,23] The incidence of inflammatory bowel disease in children has increased markedly in Australia and worldwide, and antibiotic use has been suggested as a contributor to this trend.[24-27]

About the data

Data are sourced from the Pharmaceutical Benefits Scheme (PBS) dataset. This dataset includes all prescriptions dispensed under the PBS or the Repatriation Pharmaceutical Benefits Scheme, including prescriptions that do not receive an Australian Government subsidy. Note that some dispensed medicines may not be used.

The dataset does not include prescriptions dispensed for patients during their admission to public hospitals, discharge prescriptions dispensed from public hospitals in New South Wales and the Australian Capital Territory, direct supply of medicines to remote Aboriginal health services, over-the-counter purchase of medicines, doctor's bag medicines or private prescriptions.

Rates are based on the number of prescriptions dispensed for systemic antibiotics per 100,000 children aged 0–9 years in 2016–17. Antibiotics used orally, intravenously and intramuscularly are included; topical antibiotics are not included.

The term 'antibiotics' is used rather than 'antimicrobials' in this data item because other antimicrobials (antifungals, antivirals and antiparasitics) are not included. Note that the repeat analysis of antimicrobial medicines (in Chapter 5, page 239) includes a wider range of antimicrobials, not only antibiotics.

The analysis and maps are based on the residential address of the patient recorded in the PBS prescription claim and not the location of the prescriber or the dispensing pharmacy.

Rates are age and sex standardised to allow comparisons between populations with different age and sex structures.

This analysis was not undertaken by Aboriginal and Torres Strait Islander status because this information was not available for the PBS data at the time of publication.

What do the data show?

Magnitude of variation

In 2016–17, there were 3,053,315 PBS prescriptions dispensed for antibiotics in children, representing 96,721 prescriptions per 100,000 children aged 9 years and under (the Australian rate).

The number of PBS prescriptions dispensed for antibiotics across 328* local areas (Statistical Area Level 3 – SA3), ranged from 9,707 to 159,688 per 100,000 children aged 9 years and under. The rate was **16.5 times as high** in the area with the highest rate compared to the area with the lowest rate. The number of prescriptions dispensed varied across states and territories, from 69,015 per 100,000 children aged 9 years and under in the Northern Territory to 102,339 in Queensland (Figures 1.4–1.7).

After the highest and lowest 10% of results were excluded and 264 SA3s remained, the number of prescriptions dispensed per 100,000 children aged 9 years and under was 1.7 times as high in the area with the highest rate compared to the area with the lowest rate.

Analysis by remoteness and socioeconomic status

Rates of antibiotic dispensing in children aged 9 years and under were higher in major cities than in other areas. Rates were higher in areas with lower socioeconomic status in major cities and inner regional areas. However, there was no clear pattern according to socioeconomic status in other remoteness categories. Low rates of antibiotic dispensing in some remote, low-socioeconomic-status areas may be underestimates because dispensing through Aboriginal health services is not captured in the data (Figure 1.8).

* There are 340 SA3s. For this item, data were suppressed for 12 SA3s due to a small number of prescriptions dispensed and/or population in an area.

Antibiotics dispensing in children, 9 years and under

Analysis by age group

The rate of antibiotic dispensing was higher for children aged 4 years and under (113,906 prescriptions per 100,000 children) than for children aged 5–9 years (80,417 prescriptions per 100,000 children). This pattern was consistent across all states and territories (Figure 1.2).

Figure 1.2: Number of PBS prescriptions dispensed for antibiotics per 100,000 children in specific age group, sex standardised, by state and territory of patient residence, 2016–17

The data for Figure 1.2 are available at www.safetyandquality.gov.au/atlas

Children dispensed at least one prescription

The number of children aged 9 years and under who had at least one prescription for an antibiotic dispensed in 2016–17 was 45,085 per 100,000 – that is, 45% of the child population aged 9 years and under. The rate varied from 32,108 per 100,000 children aged 9 years and under in the Northern Territory to 46,824 per 100,000 in New South Wales (Figure 1.3).

Figure 1.3: Number of children dispensed at least one antibiotic per 100,000 children aged 9 years and under, age and sex standardised, by state and territory of patient residence, 2016–17

The data for Figure 1.3 are available at www.safetyandquality.gov.au/atlas

Notes:
For further detail about the methods used, please refer to the Technical Supplement.
Source: AIHW analysis of Pharmaceutical Benefits Scheme data and ABS Estimated Resident Population 30 June 2016.

Interpretation

The overall rates of antibiotic dispensing in children aged 9 years and under are high. Variation in rates of antibiotic dispensing is likely to be due to geographical differences in the factors discussed below.

Clinical decision-making

Differences in clinicians' perceptions, attitudes towards managing patient illness and patient expectations, and prescribing behaviour will affect patterns of antibiotic prescribing.[28] Clinician adherence to guidelines about antibiotic use (for example, prescribing antibiotics for upper respiratory tract infections only when a bacterial infection is identified) is likely to affect rates of dispensing. Clinician non-adherence to guidelines, such as prescribing antibiotics for viral infections, will contribute to higher rates of inappropriate antibiotic use.

Socioeconomic status and health literacy

Parents with lower levels of education may have a poorer understanding of viral versus bacterial causes of childhood illnesses, and may have a greater expectation of antibiotic prescription for viral illnesses.[29,30] Other groups with low health literacy may also have higher expectations of antibiotic prescription, which in turn influences GP prescribing behaviour.[29-31] In some cases, prescribers may incorrectly assume that patients expect a prescription for an antibiotic.[31]

Rates of underlying illnesses

The local rate of bacterial infections that require antibiotic treatment is likely to affect rates of dispensing. Rates in some areas may be increased by small numbers of patients who require frequent antibiotics – for example, children with chronic diseases such as cystic fibrosis. Variation could also be influenced by local rates of influenza (flu) vaccination, as this could affect the number of patients seeking antibiotics during the flu season.

The burden of infectious disease tends to be higher in low-income communities.[32,33] The rate of infections may be influenced by social and housing conditions, including smoking in the household and overcrowding, and other factors such as climate.[34,35] Low rates of antibiotic dispensing in some remote, socioeconomically disadvantaged areas may be underestimates because dispensing through Aboriginal medical services is not captured in the data.

Access to medical care

Geographic access to medical care and the ability to pay out of pocket costs, are likely to affect the rates of people seeking care from clinicians for conditions that may require antibiotic treatment, or that are believed to require treatment, and subsequent rates of antibiotic dispensing. Clinicians treating patients who face financial or geographical barriers to accessing care may be more likely to prescribe opportunistically because of uncertain follow-up of the patient. Additionally, clinicians in regional and remote Australia may have less access to pathology services to support their decision-making.

Data limitations

Rates in remote geographic areas with high proportions of Aboriginal and Torres Strait Islander children are likely to be artificially low because the PBS dataset does not include data from Aboriginal health services, which supply medicines under the S100 scheme (an alternative arrangement for supplying PBS medicines).

Rates of prescriptions dispensed could be different from rates of medicines consumed.

Antibiotics dispensing in children, 9 years and under

Promoting appropriate care

Increasing antibiotic resistance highlights the urgency of reducing Australia's rate of inappropriate antibiotic use in children[1], especially in the areas shown to have the highest rates. Although the link between childhood antibiotic use and diseases in later life is not firmly established, this possibility adds to the case for restricting antibiotic use to situations where the need for antibiotics is clear.

Many groups have been working to reduce inappropriate antibiotic use in Australia; some success has been seen, but major challenges remain.[7-10] Antimicrobial use in Australian hospitals has been declining since the peak usage rate in 2010.[2] However, most antibiotic use occurs in the community.[2] The rate of antimicrobial prescribing in the community in Australia peaked in 2008, and the rate in 2015 was very similar, with more than 30 million prescriptions for antimicrobials in Australia in 2015.[2,11] Sustained efforts, combining different approaches, will be needed to make a difference to community prescribing.

A lack of access to data on dispensing from Aboriginal health services limited the current analysis, and initiatives to include these data are vital to providing a more complete picture of antibiotic use across Australia. Differences in the burden of disease need to be taken into account when interpreting antibiotic use in different settings. Interventions to address antibiotic resistance need to take into account differences in the type of infections in Aboriginal and Torres Strait Islander children in some areas compared with other children, as well as cultural differences.[36,37]

In an Australian survey of GPs, patient expectations were the main reason given for prescribing antibiotics for an upper respiratory tract infection.[31] This overarching reason may include other factors such as limited time, poor doctor–patient communication and diagnostic uncertainty.[31]

Communication skills training for prescribers and shared decision making have been successful in reducing antibiotic use for respiratory tract infections in the community.[38,39] Communication skills training evaluated in trials involved learning to deal with perceived pressure to prescribe, and to communicate with patients about their expectations on antibiotic prescribing.[38] This training reduced the rate of antibiotic prescribing for lower respiratory tract infections from 54% to 27% among patients in a Dutch trial.[40] A multi-centre European trial reported a reduction in primary care antibiotic prescribing for upper respiratory tract infections from 45% to 36% with internet-based communication skills training.[41]

Shared decision making has been shown to reduce the rate of antibiotic prescribing for acute respiratory infections in general practice from 47% to 29%.[12] In shared decision making interventions, the patient and clinician discuss the benefits and harms of antibiotic treatment, and the evidence of antibiotic effectiveness.[13] Patient decision aids on antimicrobial use, including for sore throat, acute bronchitis and middle ear infection in children, have been developed for use in the Australian primary care setting.[42-44] Interventions that promote shared decision making could also provide clinicians with skills that can be used in the management of other conditions, which may add to the cost-effectiveness of this approach.[39]

Counselling about appropriate use of antibiotics can be more time-consuming than writing a prescription, and time pressures on doctors are a contributor to inappropriate antibiotic prescribing.[31] Using resources to aid explanations of why an antibiotic prescription is not appropriate for some conditions, and support from nurse practitioners in counselling patients about antibiotic use, could help reduce inappropriate prescribing.

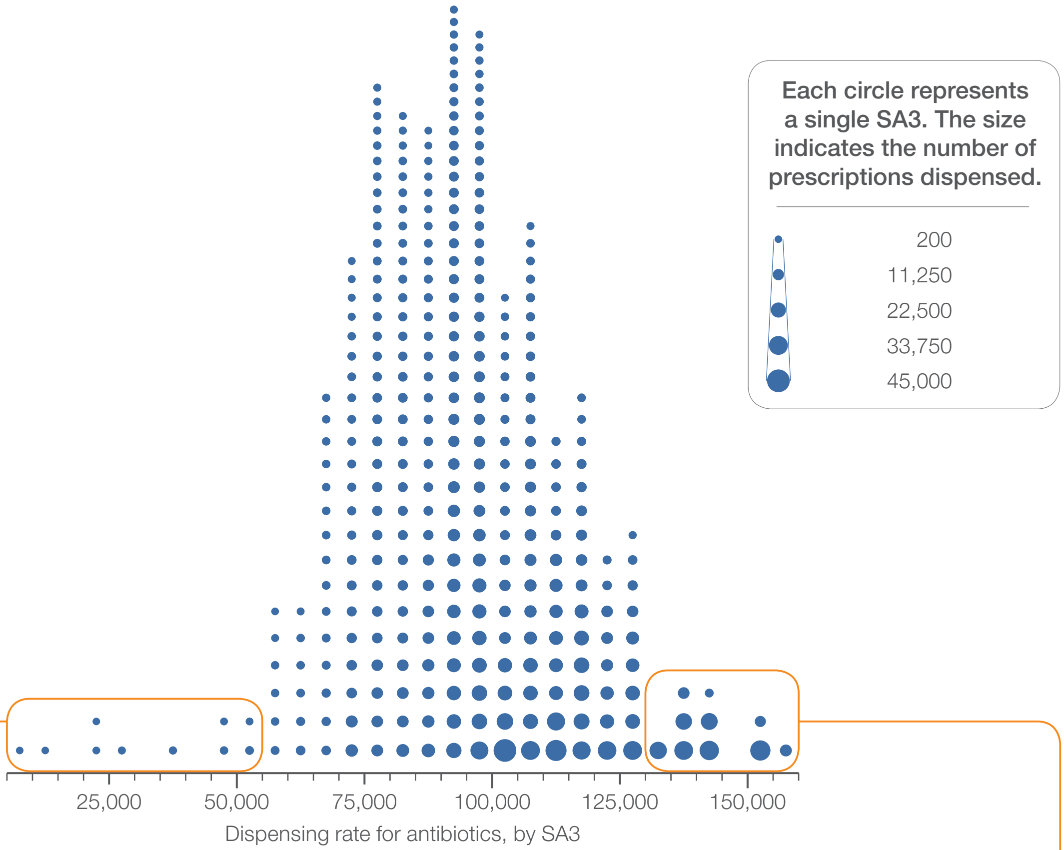
Public education is essential for supporting any interventions targeting prescribers, and ongoing, repeated efforts are required to make a substantial change in public awareness of the issues concerning antibiotic prescribing.[11,45] NPS MedicineWise has led programs to reduce the inappropriate use of antibiotics in Australia, including academic detailing and prescribing feedback for GPs, as well as public awareness campaigns.[11] Some success has been seen; for example, NPS MedicineWise campaigns between 2009 and 2015 were estimated to have resulted in a reduction of 14% in antibiotic dispensing volumes over this period.[46] However, data showing that GPs prescribe antibiotics at 4–9 times the rate expected if guidelines were followed highlight the size of the challenge that remains.[1]

A variety of other interventions could help reduce overuse of antibiotics in Australia – for example, changes to prescribing software so the default option for antibiotic prescriptions is ‘no repeats’, and aligning the dispensed amount of antibiotic with the recommended duration of therapy to avoid leftover doses.[11] Providing antibiotic prescriptions to patients with respiratory tract infections for use if symptoms do not resolve (delayed prescriptions) is another strategy that reduces unnecessary use of antibiotics.[47]

Antibiotics dispensing in children, 9 years and under

Rates by local area

Figure 1.4: Number of PBS prescriptions dispensed for antibiotics per 100,000 children aged 9 years and under, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2016–17



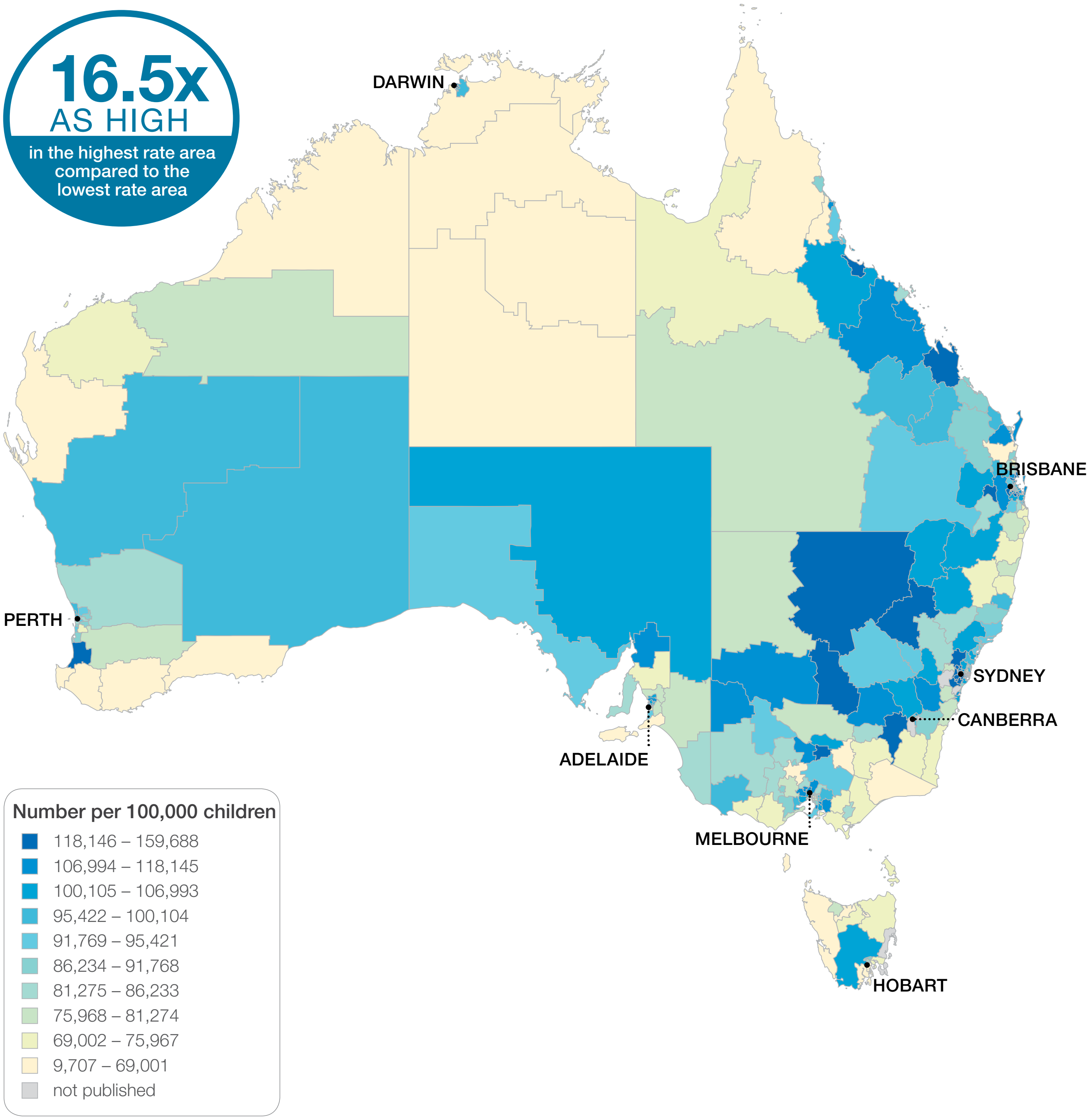
Lowest rate areas				Highest rate areas			
SA3	**State**	**Rate**	**Prescriptions**	**SA3**	**State**	**Rate**	**Prescriptions**
Daly - Tiwi - West Arnhem	NT	**9,707**	316	St Marys	NSW	**159,688**	13,152
East Arnhem	NT	**13,446**	375	Fairfield	NSW	**154,713**	37,602
Barkly	NT	**23,535**	271	Griffith - Murrumbidgee (West)	NSW	**152,566**	10,681
Katherine	NT	**24,302**	915	Campbelltown (NSW)	NSW	**142,501**	35,189
Alice Springs	NT	**29,028**	1,741	Bribie - Beachmere	Qld	**142,207**	4,113
Kimberley	WA	**35,930**	2,319	Mount Druitt	NSW	**141,411**	27,748
Far North	Qld	**48,065**	2,957	Liverpool	NSW	**137,887**	26,855
Huon - Bruny Island	Tas	**48,730**	1,103	Shepparton	Vic	**136,694**	12,329
Esperance	WA	**50,215**	1,125	Merrylands - Guildford	NSW	**136,160**	33,383
Augusta - Margaret River - Busselton	WA	**54,387**	4,029	Penrith	NSW	**132,552**	29,335

Notes:
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of Pharmaceutical Benefits Scheme data and ABS Estimated Resident Population 30 June 2016.

Antibiotics dispensing in children, 9 years and under

Rates across Australia

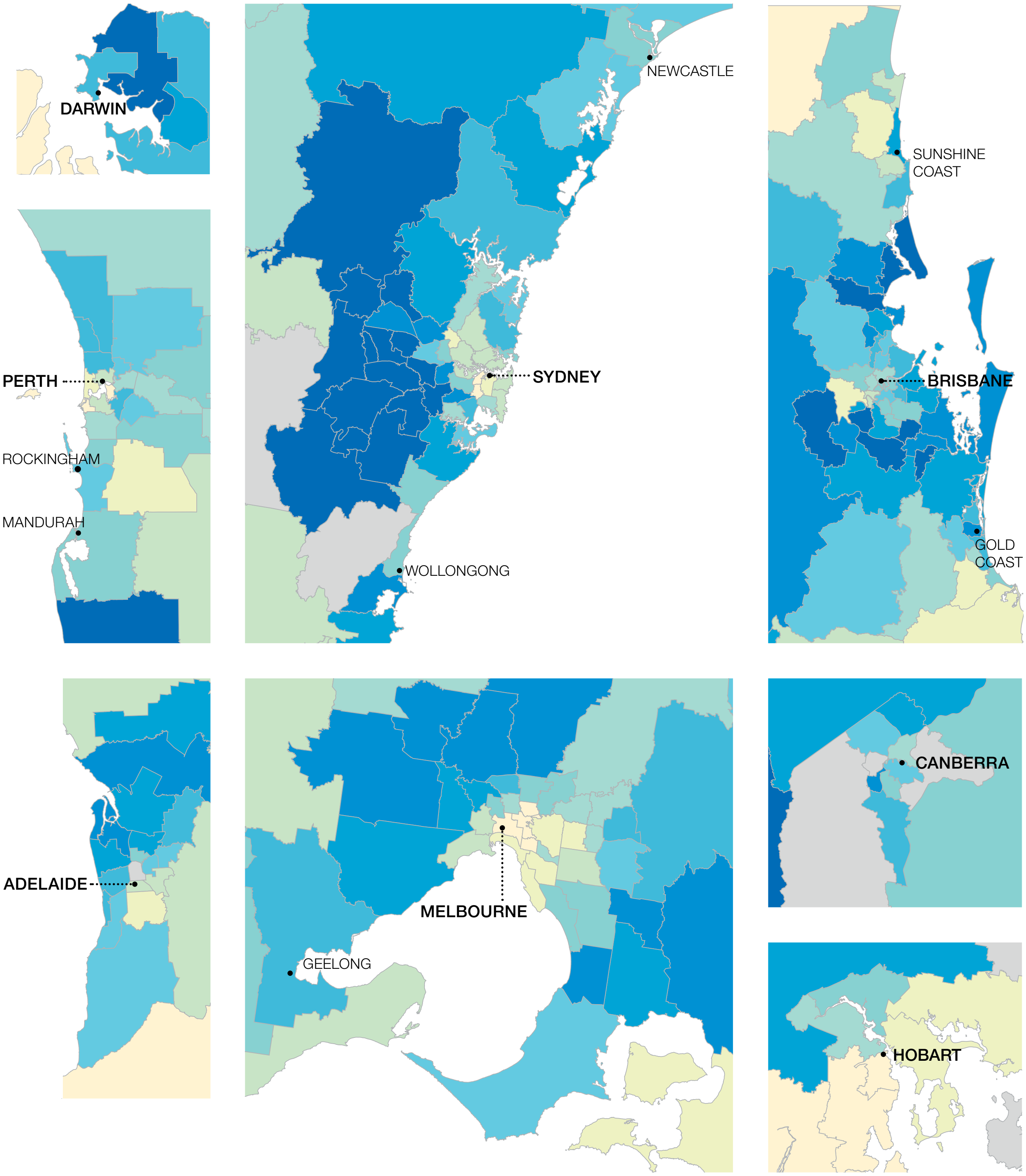
Figure 1.5: Number of PBS prescriptions dispensed for antibiotics per 100,000 children aged 9 years and under, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2016–17



Notes:
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of Pharmaceutical Benefits Scheme data and ABS Estimated Resident Population 30 June 2016.

Rates across capital city areas

Figure 1.6: Number of PBS prescriptions dispensed for antibiotics per 100,000 children aged 9 years and under, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2016–17



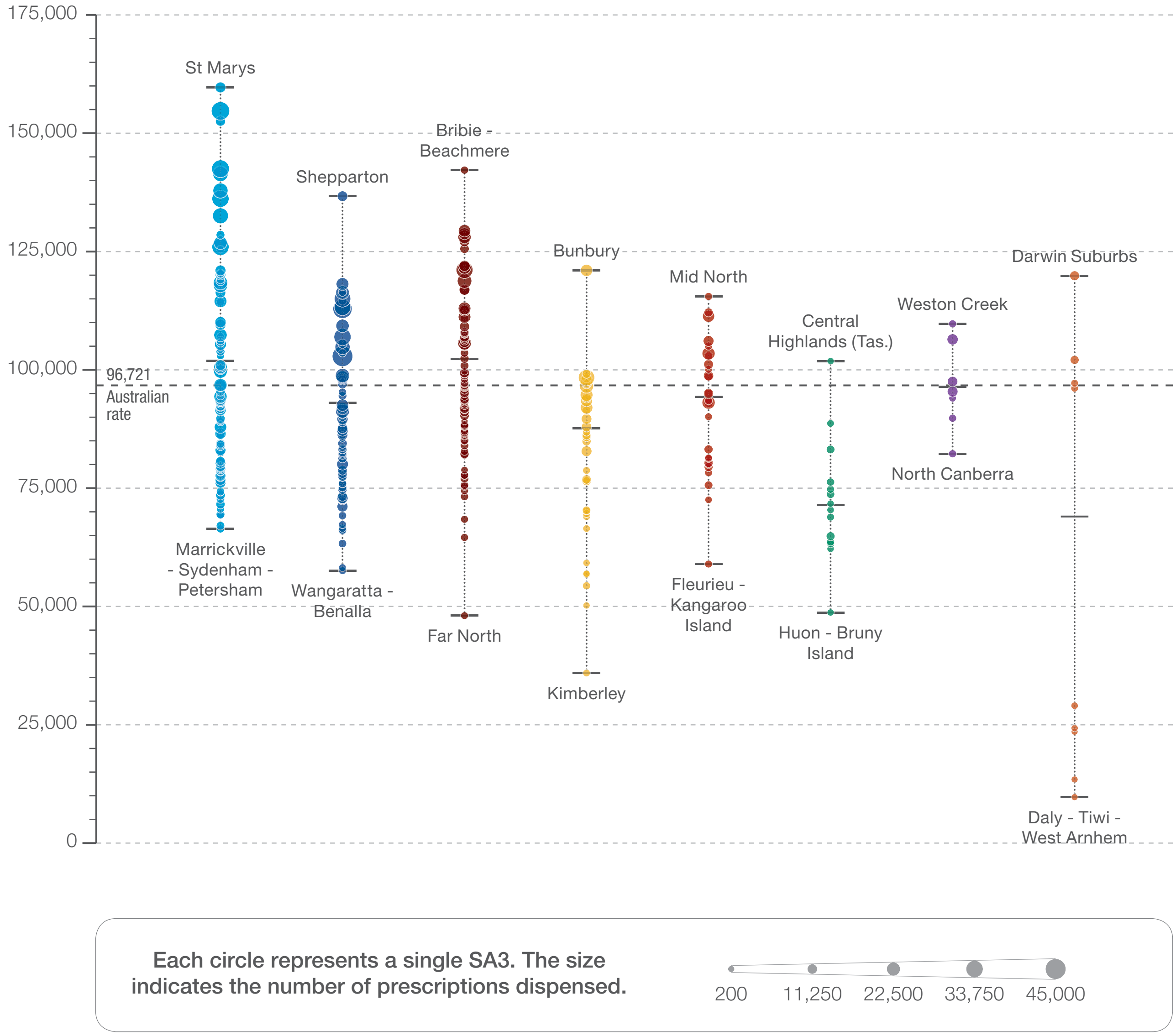
Notes:
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of Pharmaceutical Benefits Scheme data and ABS Estimated Resident Population 30 June 2016.

Antibiotics dispensing in children, 9 years and under

Rates by state and territory

Figure 1.7: Number of PBS prescriptions dispensed for antibiotics per 100,000 children aged 9 years and under, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2016–17

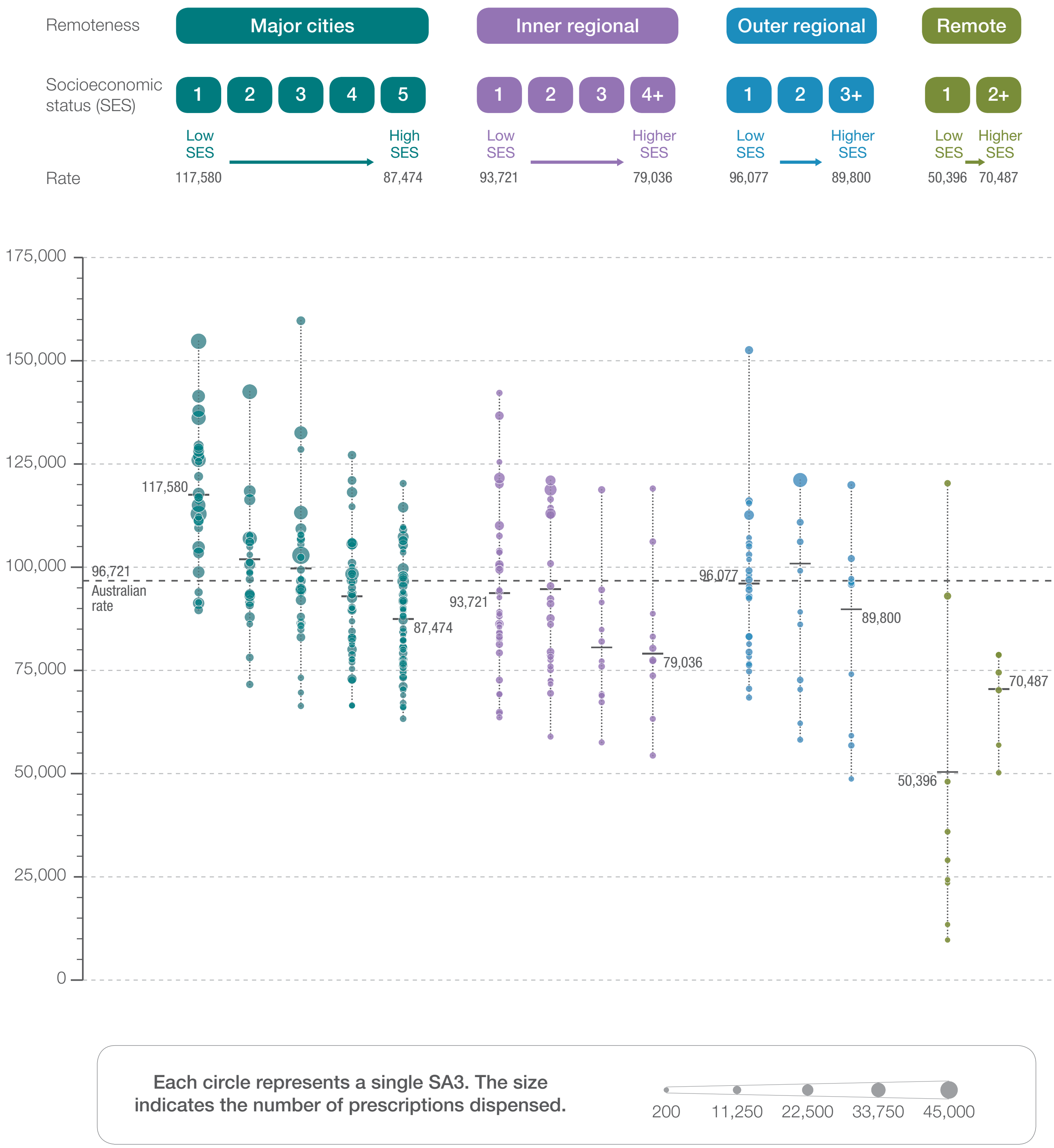
	NSW	Vic	Qld	WA	SA	Tas	ACT	NT
Highest rate	159,688	136,694	142,207	121,012	115,504	101,857	109,733	119,885
State/territory	101,950	93,018	102,339	87,662	94,312	71,472	96,447	69,015
Lowest rate	66,391	57,562	48,065	35,930	58,958	48,730	82,273	9,707
No. prescriptions	1,023,567	738,699	664,062	302,588	196,083	44,699	52,890	26,240



Notes:
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of Pharmaceutical Benefits Scheme data and ABS Estimated Resident Population 30 June 2016.

Rates by remoteness and socioeconomic status

Figure 1.8: Number of PBS prescriptions dispensed for antibiotics per 100,000 children aged 9 years and under, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2016–17



Notes:
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of Pharmaceutical Benefits Scheme data and ABS Estimated Resident Population 30 June 2016.

Antibiotics dispensing in children, 9 years and under

Resources

- *Therapeutic Guidelines: Antibiotic*[48], including mobile app
- Australian Commission on Safety and Quality in Health Care, Antimicrobial Stewardship Clinical Care Standard[49]
- Australian Commission on Safety and Quality in Health Care, patient decision aids on antibiotic use for sore throat, acute bronchitis and middle ear infection[42-44]
- Australian Commission on Safety and Quality in Health Care, *Helping Patients Make Informed Decisions: Communicating risks and benefits* (eLearning module)[50]
- NPS MedicineWise, *What Every Parent Should Know About Colds, Coughs, Earaches and Sore Throats*
- NPS MedicineWise, antimicrobial learning modules
- Australian Government, Nurses and antimicrobial resistance fact sheet
- Australian Government, What health professionals can do; What you can do (infographics)
- National Centre for Antimicrobial Stewardship, 'Antimicrobial prescribing in children' (infographic).[51]

Australian initiatives

The information in this chapter will complement work already under way to improve the appropriateness of antibiotic use in children in Australia. At a national level, this work includes:

- Antimicrobial Stewardship Clinical Care Standard and accompanying indicators[49]
- Antibiotic Awareness Week
- Antimicrobial Use and Resistance in Australia (AURA) Surveillance System[2]
- *Australia's First National Antimicrobial Resistance Strategy 2015–2019*[10]
- National Antimicrobial Prescribing Survey, education and training[10]
- National Antimicrobial Utilisation Surveillance Program[52]
- NPS MedicineWise consumer and clinician interventions
- Royal Australian College of Physicians Paediatrics Child Health Division, Choosing Wisely recommendation 1: Do not routinely prescribe oral antibiotics to children with fever without an identified bacterial infection[53]
- Royal Australian College of General Practitioners, Choosing Wisely recommendation 9: Don't treat otitis media (middle ear infection) with antibiotics, in non-Indigenous children aged 2–12 years, where reassessment is a reasonable option[9]
- Australian Society of Infectious Diseases, Choosing Wisely recommendations 1–4:
  - Do not use antibiotics for asymptomatic bacteriuria
  - Do not take a swab or use antibiotics for the management of a leg ulcer without clinical infection
  - Avoid prescribing antibiotics for upper respiratory tract infection
  - Do not investigate or treat for faecal pathogens in the absence of diarrhoea or other gastrointestinal symptoms.[54]

Many state and territory initiatives are also in place to improve the appropriateness of antibiotic use in children, including antimicrobial stewardship programs and guidelines for managing childhood infections. For example:

- The Tasmanian Infection Prevention and Control Unit provides feedback to rural inpatient facilities and GP prescribers on their antimicrobial prescribing, and Primary Health Tasmania provides education on antimicrobial prescribing
- Safer Care Victoria, New South Wales Health and Queensland Health have recently developed the Paediatric Improvement Collaborative; this involves a tri-state memorandum of understanding and funding agreement to enable New South Wales Health and Queensland Health to formally use the Victorian clinical practice guidelines.

Antibiotics dispensing in children, 9 years and under

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1.3 Proton pump inhibitor medicines dispensing, 1 year and under

Why is this important?

Proton pump inhibitor (PPI) medicines have become increasingly prescribed for managing gastro-oesophageal reflux in infants. They are also prescribed for general symptoms such as irritability and crying (or colic) on the basis that reflux might be causing these symptoms. This is despite a lack of evidence of effectiveness, as well as uncertainty about the long-term effects of these medicines in the very young. In particular, there is concern about the potential for increased susceptibility to infections and food allergies that may result from the alteration of normal gut bacteria.[1-3]

What did we find?

There was about a four-fold difference between the lowest and highest state and territory rates in Pharmaceutical Benefits Scheme (PBS) dispensing of PPI medicines for infants aged 1 year and under in Australia.

What can be done?

Greater clarity and consistency of guidelines on gastro-oesophageal reflux and colic in infants, with a focus on alternative approaches to managing symptoms that lead to PPI medicine prescribing by general practitioners (GPs) and specialists, could help to reduce the rate of inappropriate use of PPI medicines in infants in Australia. Ensuring that support is available for new parents, and that information about the potential risks and likelihood of benefits of PPI medicines use in infants is more readily available, may also reduce inappropriate use. Introducing an authority requirement for prescribing PPI medicines for infants could also reduce inappropriate use.

Proton pump inhibitor medicines dispensing, 1 year and under

Context

PPIs are a group of medicines that reduce acid production in the stomach.[4] Medicines in the PPI group include omeprazole, pantoprazole, lansoprazole, rabeprazole and esomeprazole.[5] This data item analyses PPI medicines use in infants (aged 1 year and under). See Chapter 2, page 117, for analysis of PPI medicine use in adults (aged 18 years and over).

Use of PPI medicines for gastro-oesophageal reflux and gastro-oesophageal reflux disease (GORD) in infants is common and increasing in Australia[6,7], despite concerns about side effects and evidence that PPI medicines are not effective in this age group for these conditions or for colic.[8-10] Most guidelines recommend non-medical therapy for simple reflux in infants aged 1 year and under (0–12 months)[11-13], but guidelines for the management of infant GORD (which involves complications, such as oesophagitis) are unclear in some cases and inconsistent.[6] Australian advice includes:

- Do not routinely treat GORD in infants with acid suppression therapy[11]
- Consider PPI therapy if there are concerns that excessive GORD of long duration is the cause of irritability in infants.[13]

Although a trial of PPI therapy has become a common recommendation for infants for problematic reflux symptoms, or for those with complications, trials have shown it is no better than placebo for symptoms of infant reflux.[14]

An Australian study of children treated in 2012–2013 either by a GP, by a paediatrician in an emergency department or as an inpatient reported that 41% of healthy, thriving infants presenting with irritability or unexplained crying were prescribed an acid suppression medicine at first presentation.[15] A study of Australian GPs found that the proportion of infants with gastro-oesophageal reflux that they managed by prescribing a PPI medicine increased from 12% in 2006–2008 to 28% in 2014–2016.[6] The proportion of infants with GORD managed by prescribing a PPI medicine increased from 33% to 50% over the same period.[6]

Gastric acid is an important factor in infection resistance and the composition of gastrointestinal flora.[1] A prospective study of 91 otherwise healthy young children (average age 10 months) taking either omeprazole or ranitidine (another type of acid suppression medicine) for GORD found that they were significantly more likely to develop acute gastroenteritis or pneumonia than the control group.[1] Retrospective studies have also found an association between PPI medicine use in infants and children and an increased risk of developing allergies.[2,3]

About the data

Data are sourced from the PBS dataset which includes all prescriptions dispensed under the PBS or the Repatriation Pharmaceutical Benefits Scheme. This includes prescriptions that do not receive an Australian Government subsidy and prescriptions dispensed under the Closing the Gap scheme.

The dataset does not include prescriptions dispensed for patients during their admission to public hospitals, discharge prescriptions dispensed from public hospitals in New South Wales and the Australian Capital Territory, direct supply of medicines to remote Aboriginal health services, over-the-counter purchase of medicines, doctor's bag medicines or private prescriptions.

Rates are based on the number of prescriptions dispensed for PPI medicines per 100,000 infants aged 1 year and under in 2016–17.

The analysis and maps are based on the residential address of the patient recorded in the PBS prescription claim and not the location of the prescriber or the dispensing pharmacy.

Rates are sex standardised to allow comparisons between populations with different sex structures.

Because of small numbers, data are reported only at state level. Reporting by smaller geographical area, remoteness and socioeconomic disadvantage is not possible.

This analysis was not undertaken by Aboriginal and Torres Strait Islander status because this information was not available for the PBS data at the time of publication.

What do the data show?

Magnitude of variation

In 2016–17, there were 22,810 PBS prescriptions dispensed for PPI medicines to infants aged 1 year and under, representing 3,628 prescriptions per 100,000 infants aged 1 year and under (the Australian rate).

The number of PBS prescriptions dispensed for PPI medicines varied across states and territories, from 2,195 per 100,000 infants in the Northern Territory to 8,066 per 100,000 in South Australia (Figure 1.9).

Analysis by prescriber type

GPs prescribed 66% of the PBS prescriptions dispensed for PPI medicines in infants, paediatricians prescribed 27%, and other health professionals prescribed 7%. The proportion prescribed by GPs varied across states and territories from 30% in the Northern Territory to 80% in Western Australia (Figure 1.9).

Interpretation

Variation in rates of PPI medicines dispensing is likely to be due to geographical differences in the factors discussed below.

Clinical decision-making

Variation in awareness of, and adherence to, guidelines for management of simple reflux symptoms in infants is likely to influence the pattern of use, as could over-diagnosis of reflux in infants presenting with irritability and unexplained crying (colic).

Use of other medicines

Use of other types of acid suppression medicines, such as H2 blockers, for reflux symptoms in infants is likely to influence the patterns of PPI medicines use.[6]

Access to medical care

Access to GPs, paediatricians and gastroenterologists may influence the likelihood of consumers seeking care for gastro-oesophageal reflux and GORD for their children, and therefore affect rates of PPI medicines use. Access to programs that provide education and support for parents may also affect rates of consultation for unexplained crying in infants, and affect rates of PPI medicines use.

As well, variations between states/territories may not directly reflect the practices of the clinicians who are based in these areas. The analysis is based on where people live rather than where they obtain their health care. Patients may travel outside their local area to receive care.

Proton pump inhibitor medicines dispensing, 1 year and under

Promoting appropriate care

The quality of evidence on long-term risks of PPI medicines is generally low[16], but these possible risks are important when seen in the context of large-scale inappropriate use and the potential for effects on health over an infant's life course. Limiting use to appropriate indications would also reduce patient costs and waste of health resources.[16,17]

The Pharmaceutical Benefits Advisory Committee recently proposed reconsidering the PBS restriction levels for PPI medicines.[18] Introducing an authority requirement for prescribing PPI medicines for infants could reduce inappropriate use in Australia.

Educational campaigns for family and child health nurses, GPs and parents, as well as greater clarity and consistency of guidelines for managing gastro-oesophageal reflux and colic in infants, could also help to reduce the rate of inappropriate use of PPI medicines in infants in Australia.[6,19] Further research to give a better understanding of the influences on PPI medicines prescribing would also be helpful for informing strategies.[6]

Misinformation about the appropriate use of PPI medicines in infants – in both medical and consumer publications – poses a risk to children.[20] Providing evidence-based information is vital, especially in widely read publications that family and child health nurses and GPs may rely on for continuing education.

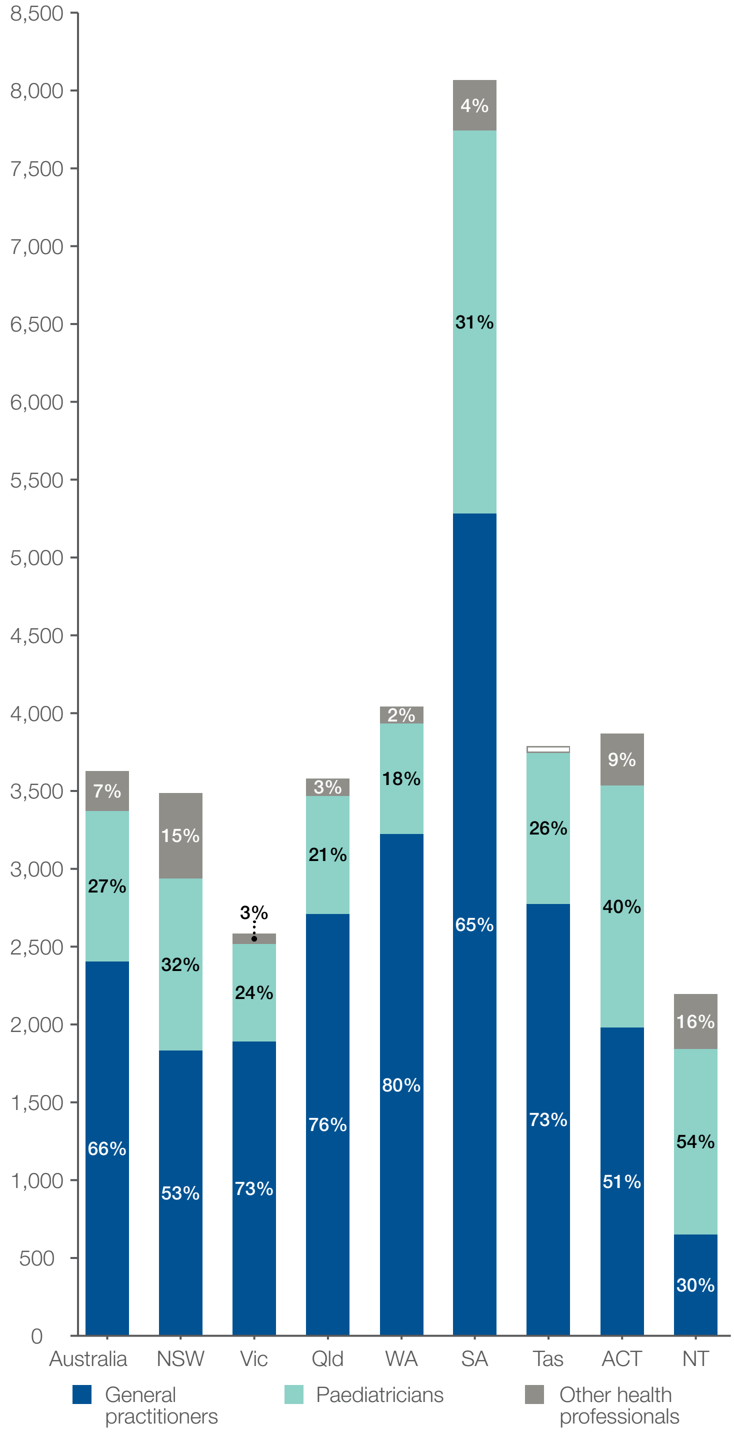
Infants may be over-diagnosed with GORD, which could lead to other causes of symptoms not being addressed, as well as overuse of PPI medicines.[21,22] The great majority of infants will respond to non-pharmacological measures, or get better with time, and a stepwise approach to investigation and management will reduce the number of infants exposed to PPI medicines.[20] Irritable infants with uncomplicated GORD are recommended to continue lifestyle modifications and to avoid acid suppression therapy.[23] Further research is needed to determine how best to support parents to manage gastro-oesophageal reflux in infants, and to get to the root cause of their reasons for seeking medical help.[21]

United States research shows that adherence to guidelines recommending against empirical acid suppression for gastro-oesophageal reflux in infants is low in children's hospitals.[22,24] Quality improvement interventions in hospitals could improve appropriateness of care in this setting, and could have a flow-on effect to prescribing in the community, as hospital recommendations for PPI medicines use may influence PPI medicines use after discharge.[25]

Creating hospital-specific policies could improve adherence to the recommendations of national guidelines.[24] Implementing an evidence-based guideline in a United States neonatal intensive care unit correlated with a substantial decrease in non-indicated prescriptions of PPI medicines (from 7.5 per month to zero).[26] The intervention followed plan–do–study–act cycles of quality improvement, and included staff education and guideline revision based on staff feedback. Keys to the program's success were thought to include leadership involvement, staff incentives and real-time data tracking.[26] The intervention could be implemented in similar inpatient settings for newborns.[26]

Rates by state and territory and prescriber type

Figure 1.9: Number of PBS prescriptions dispensed for proton pump inhibitor medicines per 100,000 infants aged 1 year and under, sex standardised, by state and territory of patient residence, by prescriber type, 2016–17



The data for Figure 1.9 are available at www.safetyandquality.gov.au/atlas

Notes:
Unshaded data (Tasmanian other health professionals) are based on a small number of prescriptions dispensed.
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of Pharmaceutical Benefits Scheme data and ABS Estimated Resident Population 30 June 2016.

Proton pump inhibitor medicines dispensing, 1 year and under

Resources

- National Institute for Health and Care Excellence, *Gastro-oesophageal Reflux Disease in Children and Young People: Diagnosis and management* (clinical guideline)[12]
- Royal Children's Hospital Melbourne, 'Gastro-oesophageal reflux in infants'[13]
- Royal Children's Hospital Melbourne, *Reflux (GOR) and GORD*, fact sheet for parents[27]
- New South Wales Health, *Infants and Children: Acute management of the unsettled and crying infant*.[28]

Australian initiatives

The information in this chapter will complement work already under way to improve the appropriateness of PPI medicines use in Australia. At a national level, this work includes:

- Royal Australian College of Physicians, Paediatrics and Child Health Division top 5 low-value practices and interventions – EVOLVE recommendation 4: Do not routinely treat gastroesophageal reflux disease (GORD) in infants with acid suppression therapy.[11]
- Pharmaceutical Benefits Advisory Committee, recommendations in 2018 to change PBS restriction levels for some PPI medicines.[18]

Many state and territory initiatives are also in place to improve the appropriateness of PPI medicines use, including:

- Tasmanian HealthPathways web-based information portal, 'Gastro-oesophageal reflux in children'.[29]

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Chapter 2
Gastrointestinal investigations and treatments

At a glance

Colonoscopy

Most colonoscopies are done to detect bowel cancer. The Atlas found low rates of hospitalisation for colonoscopy in the following groups, raising concerns about their access to colonoscopy: Aboriginal and Torres Strait Islander Australians, people in outer regional and remote areas and people living in areas of low socioeconomic status. Strategies to increase participation in the National Bowel Cancer Screening Program in these groups and colonoscopy for those with a positive screening test will drive more appropriate care. Addressing preventable risk factors, such as obesity, smoking and poor diet, would reduce the rate of bowel cancer and lead to better use of healthcare services.

Gastroscopy

Gastroscopy is used mainly to investigate upper gastrointestinal symptoms such as heartburn. It is also used to exclude a diagnosis of cancer. Rates of gastroscopy in Australia continue to rise, despite low and stable rates of oesophageal and stomach cancers. The Atlas found that the rate of hospitalisation for gastroscopy varies up to seven-fold between local areas in Australia.

This pattern suggests underuse in some parts of the population and overuse in others. Lower rates of gastroscopy in outer regional and remote areas raise concerns about a lack of access in these areas. The low rates for Aboriginal and Torres Strait Islander Australians raise similar concerns.

The Atlas also found that, in 2016–17, there were 274,559 hospitalisations for gastroscopy and colonoscopy on the same day, representing 1,044 hospitalisations per 100,000 people of all ages. Investigation with both endoscopes is indicated in only a limited number of conditions, so the high rates reported suggest some inappropriate use.

Proton pump inhibitor medicines in adults

Proton pump inhibitor medicines are mainly used for gastro-oesophageal reflux disease. There is good evidence that proton pump inhibitor medicines are overused and that many people are inappropriately using them for long periods. Lifestyle changes can reduce symptoms of reflux in many patients. The Atlas found that the rate of dispensing of proton pump inhibitor medicines in adults varies up to five-fold between local areas in Australia.

Recommendations

Colonoscopy

2a State and territory health departments to adopt triaging systems to prioritise colonoscopy for individuals who are most at risk of bowel cancer. Colonoscopy should not be used routinely for primary screening, and timing of repeat surveillance colonoscopies should follow National Health and Medical Research Council guidelines.

2b. Health service organisations to ensure that, in settings where colonoscopy and gastroscopy are provided in the same clinic, patient need and likelihood of benefit of each procedure determine the overall clinical priority.

2c. The National Bowel Cancer Screening Program to develop and test methods to improve uptake by Aboriginal and Torres Strait Islander Australians.

2d. Relevant colleges and clinical societies to review their training programs to incorporate the Colonoscopy Clinical Care Standard and meet the needs of at-risk groups, including Aboriginal and Torres Strait Islander Australians, people at socioeconomic disadvantage and people living outside major cities.

2e. Health service organisations and facilities providing colonoscopies to monitor adherence to the Colonoscopy Clinical Care Standard to ensure that patients with the greatest need for colonoscopy are prioritised.

Gastroscopy

2f. The Medicare Benefits Schedule Review Taskforce to review descriptors for gastroscopy with evidence-based criteria using a consensus process. The taskforce to consider reserving subsidies for a set of specific indications for gastroscopy, including:

i. Upper abdominal symptoms that persist despite an appropriate trial of therapy

ii. Upper abdominal symptoms associated with other symptoms or signs suggesting structural change (for example, difficulty swallowing), or new-onset symptoms in patients over 50 years of age.

2g. State and territory health departments to prioritise gastroscopy for individuals, consistent with the epidemiology of upper gastrointestinal cancer.

Proton pump inhibitor medicines for adults

2h. Relevant colleges and clinical societies to:

i. Develop educational programs targeting both general practitioners and specialists to improve the appropriateness of use of proton pump inhibitor medicines

ii. Review their training programs to ensure that guidance on the use of PPI medicines is consistent with the current evidence base.

2i. Relevant colleges and clinical societies to develop educational programs for consumers to educate them about the importance and benefits of lifestyle changes to reduce their risk of chronic diseases, particularly gastro-oesophageal reflux disease and bowel cancer.

2j. The Commission to develop a clinical care standard on investigation and management of dyspepsia and gastro-oesophageal reflux disease.

2k. NPS MedicineWise to ensure that information for consumers about appropriate use of PPI medicines and about modifiable lifestyle factors that increase the risk of gastro-oesophageal reflux disease is highlighted, where appropriate, in its public education campaigns.

2.1 Colonoscopy hospitalisations, all ages

Why is this important?

Most colonoscopies are performed to detect bowel cancer. Australia's National Bowel Cancer Screening Program recommends colonoscopy for those people who have a positive faecal occult blood test. Guidelines for bowel cancer screening and surveillance provide evidence-based recommendations on the timing of colonoscopy for people who are at higher risk of bowel cancer. Other indications for colonoscopy include detection and assessment of inflammatory bowel disease. Australian data show that there is substantial overuse of colonoscopy in some parts of the population and underuse in others. This exposes some people to unnecessary risk from the procedure and others to potential harm because a needed procedure was not performed. It is a poor use of resources.

What did we find?

The Atlas found the rate of hospitalisation for inpatient colonoscopy varies up to about seven-fold between local areas across Australia. The rate of hospitalisations for colonoscopy for Aboriginal and Torres Strait Islander Australians was 47% lower than the rate for other Australians.

What can be done?

Triaging systems, already in place in some states, could be more widely used in Australia to prioritise colonoscopy for patients who are most at risk of bowel cancer, and to reduce inappropriate use for primary screening and unnecessary repeat colonoscopies. Lower participation in the National Bowel Cancer Screening Program, as well as poorer access to colonoscopy, needs to be addressed for Aboriginal and Torres Strait Islander Australians, people at socioeconomic disadvantage and those living outside major cities.

Colonoscopy hospitalisations, all ages

Context

Most colonoscopies are performed to detect bowel cancer. Australia is estimated to have the 11th highest incidence of colorectal cancer in the world, and bowel cancer is the second most commonly diagnosed cancer in men and in women in Australia.[1,2] Although the estimated age-standardised incidence of bowel cancer in Australia will have fallen between 1997 and 2018, the number of cases will increase from 11,184 to an estimated 17,004 per year due to the ageing population.[3]

About 51% of Australia's bowel cancer burden can be attributed to preventable risk factors such as physical inactivity, obesity, a diet low in fibre and high in red and processed meat, alcohol use, and smoking.[3] Although smoking rates have declined in the population as a whole, the percentage of Australian adults who are overweight or obese increased from 56% to 63% between 1995 and 2011–12.[4]

Screening reduces morbidity and mortality from bowel cancer, and Australia's National Bowel Cancer Screening Program offers biennial faecal occult blood testing (FOBT) for people aged 50–74 years. Guidelines recommend colonoscopy for people who have a positive FOBT, and for follow-up at particular time points for people who have had previous polyps or bowel cancer.

Recommendations to limit colonoscopy to higher-risk groups have been made, taking into account the risks of the procedure (for example, perforation of the bowel or bleeding) as well as the costs to society and the individual.[5] However, these recommendations do not appear to be followed well currently, resulting in overuse of colonoscopy in people at lower risk and underuse in those at higher risk. For every 1 million Australians aged 50 years and over, an estimated 80,000 people at average risk of bowel cancer are being over-screened with colonoscopy and 29,000 people at increased risk are not having the colonoscopy they need.[5-7]

The National Bowel Cancer Screening Program commenced in 2006, and the rate of Medicare Benefits Schedule (MBS)-subsidised colonoscopy increased by 46% between 2006 and 2017.[8] In Australia, the rate of MBS-subsidised colonoscopy was 2,355 per 100,000 people in 2013–14.[9] In England, the rate of colonoscopy and flexible sigmoidoscopy combined was lower, at 1,527 per 100,000 people in 2014–15.[10]

Why revisit variation in colonoscopy?

The first *Australian Atlas of Healthcare Variation* found that, in 2013–14, the highest rate of MBS-subsidised colonoscopy was 30 times as high as the lowest rate.[9] While people living in outer regional areas have the highest rate of bowel cancer in Australia[1], the first Atlas found that they had some of the lowest rates of colonoscopy. In major cities, colonoscopy rates were lowest in areas of low socioeconomic status, despite such areas having the highest bowel cancer incidence and mortality rates. This socioeconomic patterning was not observed in regional or remote areas. Analysis in the first Atlas was based on MBS data, which did not include data on colonoscopies provided to publicly funded patients admitted to hospital, and did not allow analysis by Indigenous status.

This edition of the Atlas uses admitted patient data from the National Hospital Morbidity Database (NHMD), which captures information on people admitted as day patients or overnight in both public and private hospitals throughout Australia. The NHMD does not capture colonoscopies for non-admitted patients. While the MBS database includes data on people who receive an MBS-subsidised service whether or not they are admitted, no national data are available on the number of non-admitted (that is, outpatient) colonoscopies funded publicly under a hospital budget. Therefore, it is not possible to get a complete picture of all colonoscopy activity across Australia.

The reason for exploring colonoscopy using NHMD data in this edition of the Atlas is to produce a more complete picture of the use of this investigation in Australia, to see whether the patterns for admitted patients are similar to those found in the MBS data. The analysis will also shine a light on access for vulnerable populations who may be missing out on appropriate colonoscopy care, particularly:

- Aboriginal and Torres Strait Islander Australians
- Publicly funded patients (patients without private health insurance or without the ability to pay for the service themselves).

About the data

Data are sourced from the NHMD, and include admitted patients in both public and private hospitals. Rates are based on the number of hospitalisations for colonoscopy per 100,000 people of all ages in 2016–17.

Because a record is included for each hospitalisation for the procedure rather than for each patient, patients hospitalised for the procedure more than once in the financial year will be counted more than once.

The analysis and maps are based on the residential address of the patient and not the location of the hospital.

Rates are age and sex standardised to allow comparisons between populations with different age and sex structures.

Same-day procedure admission policies

States and territories differ in their admission policies for same-day procedures. As colonoscopies for non-admitted publicly funded patients are not included in the data shown, variation in admission policies is expected to contribute to variation in colonoscopy rates between states and territories. For example, in 2013–14 in Western Australia and Victoria, almost all endoscopy procedures occurred as admitted patient care, so the data shown should be a near complete count of colonoscopies in these states.[11] In contrast, many colonoscopies in South Australia occurred as non-admitted care, and so the data shown are likely to be an under-count.

In Tasmania, procedures that are bulk-billed are coded as non-admitted episodes. This will lead to an underestimate of colonoscopy rates. A substantial proportion of public patients accessing Tasmanian public hospitals may be bulk-billed and therefore not represented in the data.

Aboriginal and Torres Strait Islander identification

The identification of Aboriginal and Torres Strait Islander patients may not be accurate for all admissions, and processes for seeking and recording identification may vary among states and territories. Therefore, the data shown may under-count the number of Aboriginal and Torres Strait Islander Australians hospitalised for colonoscopy.

What do the data show?

Magnitude of variation

In 2016–17, there were 765,411 hospitalisations for colonoscopy, representing 2,881 hospitalisations per 100,000 people of all ages (the Australian rate).

The number of hospitalisations for colonoscopy across 330* local areas (Statistical Area Level 3 – SA3) ranged from 622 to 4,607 per 100,000 people of all ages. The rate was **7.4 times as high** in the area with the highest rate compared to the area with the lowest rate. The number of hospitalisations varied across states and territories, from 1,144 per 100,000 people of all ages in the Australian Capital Territory to 3,371 in Victoria (Figures 2.3-2.6).

* There are 340 SA3s. For this item, data were suppressed for 10 SA3s due to a small number of hospitalisations and/or population in an area.

Notes:

Data from a number of ACT private hospitals, which undertake some colonoscopies, were not provided to the National Hospital Morbidity Database. For this reason, data for the ACT should be interpreted with caution.

Some of the published SA3 rates were considered more volatile than others. These rates are excluded from the calculation of the difference between the highest and lowest SA3 rates in Australia.

For further detail about the methods used, please refer to the Technical Supplement.

Colonoscopy hospitalisations, all ages

After the highest and lowest 10% of results were excluded and 264 SA3s remained, the number of hospitalisations per 100,000 people of all ages was 2.2 times as high in the area with the highest rate compared to the area with the lowest rate.

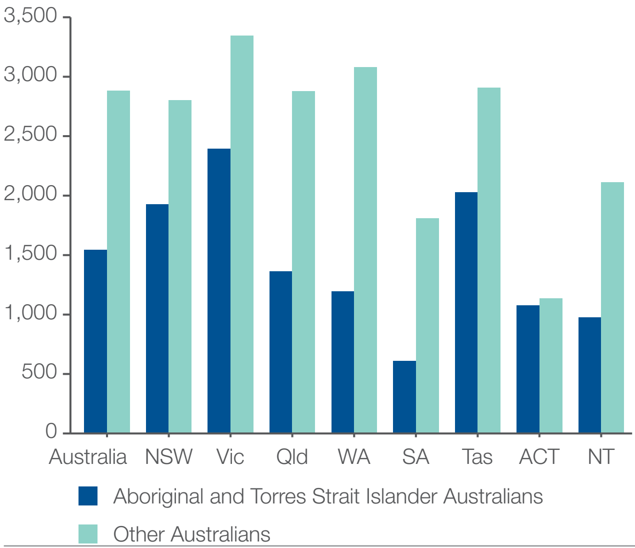
Analysis by remoteness and socioeconomic status

Rates for hospitalisation for colonoscopy were higher in major cities and inner regional areas than in outer regional and remote areas. Rates were lower in areas with lower socioeconomic status in major cities and remote areas. However, there was no clear pattern according to socioeconomic status in other remoteness categories (Figure 2.7).

Analysis by Aboriginal and Torres Strait Islander status

The rate for Aboriginal and Torres Strait Islander Australians (1,542 per 100,000 people) was 47% lower than the rate for other Australians (2,884 per 100,000 people) (Figure 2.1).

Figure 2.1: Number of hospitalisations for colonoscopy per 100,000 people of all ages, age and sex standardised, by state and territory of patient residence, by Aboriginal and Torres Strait Islander status, 2016–17



Analysis by sex for people aged 49 years and under

The age-standardised rate of hospitalisations for colonoscopy among people aged 49 years and under was 1,022 per 100,000 for males and 1,291 per 100,000 for females (Figure 2.2).

Figure 2.2: Number of hospitalisations for colonoscopy per 100,000 people aged 49 years and under, age standardised, by state and territory of patient residence, by sex, 2016–17

The data for Figures 2.1 and 2.2 are available at www.safetyandquality.gov.au/atlas.

Notes:
Data by Indigenous status should be interpreted with caution as hospitalisations for Aboriginal and Torres Strait Islander patients are under-enumerated and there is variation in the under-enumeration among states and territories.
Data from a number of ACT private hospitals, which undertake some colonoscopies, were not provided to the National Hospital Morbidity Database. For this reason, data for the ACT should be interpreted with caution.
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of National Hospital Morbidity Database and ABS Estimated Resident Population 30 June 2016.

Interpretation

Variation is warranted and desirable when it reflects variation in the underlying need for care. However, use of colonoscopy does not appear to match patterns of patient need. The pattern in major cities, where there is greater use of colonoscopy in higher socioeconomic areas, does not reflect disease patterns for bowel cancer, as bowel cancer incidence and mortality rates are highest in areas of socioeconomic disadvantage.[1,3] The higher rate of colonoscopy in females across all states is the reverse of what would be expected, given the known higher rates of bowel cancer in men.[1]

These data are consistent with the patterns found in the first Atlas using MBS colonoscopy data.[9] The degree of overall variation observed in these hospitalisation data is less than previously observed when using MBS data. Differences in the scope of each dataset are likely to contribute to this.

Variations between areas may not directly reflect the practices of the clinicians who are based in these areas. The analysis is based on where people live rather than where they obtain their health care. Patients may travel outside their local area to receive care.

Variation in rates of colonoscopy is likely to be due to geographical differences in the factors discussed below and the data issues discussed above.

Clinical decision-making

High rates of colonoscopy in some areas may be related to clinical practice that is not supported by guidelines. A recent Australian study found that, among people who underwent colonoscopy in the previous five years, in 21% of cases it had been performed as a screening test or for another reason not supported by guidelines.[12] Previous Australian studies have also found that repeat and surveillance colonoscopies were often requested sooner than recommended by guidelines.[13,14]

Inappropriate use of colonoscopy to investigate non-specific irritable bowel syndrome symptoms, particularly in younger patients without red flags such as rectal bleeding or weight loss, may also contribute to variation in rates and the high rates in people under 50 years of age, particularly women. Conversely, not performing colonoscopy when it is warranted – for example, in older patients with unexplained iron deficiency anaemia or rectal bleeding – will also contribute to variation.

Access to colonoscopy services

Ability to pay out-of-pocket costs for colonoscopy is likely to be lower in areas of socioeconomic disadvantage, and geographic access is likely to be more difficult in areas with fewer gastroenterology services. Open access endoscopy services are likely to increase the rates of colonoscopy in areas where these services are available, because general practitioners are effectively able to request a colonoscopy without further review from a specialist.

Rates of colonoscopy are lower in outer regional and remote areas, raising concerns about adequate access to colonoscopy in these areas. The lower rates in Aboriginal and Torres Strait Islander Australians suggest that this population group is also missing out on appropriate care and need improved access to colonoscopy.

Rates of private health insurance

Having private health insurance significantly reduces waiting time between presenting to a doctor and having a diagnosis of bowel cancer (with colonoscopy in most cases).[15] Higher rates of private health insurance in areas of greater socioeconomic advantage may explain the higher rates of colonoscopy in these areas.

Notes:
Data from a number of ACT private hospitals, which undertake some colonoscopies, were not provided to the National Hospital Morbidity Database. For this reason, data for the ACT should be interpreted with caution.
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of National Hospital Morbidity Database and ABS Estimated Resident Population 30 June 2016.

Colonoscopy hospitalisations, all ages

Uptake of bowel cancer screening

The percentage of invited people who participate in the National Bowel Cancer Screening Program varies by:

- State and territory – between 28% (Northern Territory) and 47% (South Australia)
- Remoteness – 28% and 44% in very remote and inner regional areas, respectively
- Socioeconomic status – 30% and 43% in areas of highest and lowest socioeconomic status, respectively.[3]

Participation by Aboriginal and Torres Strait Islander Australians was estimated at 20% in 2015–16, compared to 42% of other Australians.[3]

Other factors

Higher rates of colonoscopy in women under 50 years of age may also reflect investigation of anaemia in women who have not been properly investigated for heavy menstrual bleeding. Management of heavy menstrual bleeding according to the Australian Clinical Care Standard[16] may reduce rates of unnecessary colonoscopy in premenopausal women.

Variation in rates of colonoscopy between areas may also be influenced by the number of clinicians providing services to people living in the area. The practices of specific clinicians are likely to have a greater impact on rates in smaller local areas with fewer clinicians, such as rural and regional locations. Specific clinicians may influence rates across several local areas, especially those with small populations. The effects of practice styles of individual clinicians will be diluted in areas with larger numbers of practising clinicians.

Addressing variation

The National Bowel Cancer Screening Program has been implemented in stages, and by 2020 all eligible Australians between 50 and 74 years of age will be invited for screening every two years.[3] This will further increase the demand for colonoscopies, and adds to the urgency to better target colonoscopy resources so that those with a clear need are prioritised. Strategies could include prioritising patients who are most at risk of bowel cancer, and reducing the number of colonoscopies inappropriately used for primary screening or repeated more frequently than recommended. Despite national guidelines, confusion persists about appropriate use of colonoscopy in people with a family history of bowel cancer.

Lower participation in the National Bowel Cancer Screening Program, as well as poorer access to colonoscopy, needs to be addressed for Aboriginal and Torres Strait Islander Australians, people at socioeconomic disadvantage and those living outside major cities. Improving management of irritable bowel syndrome could reduce inappropriate use of colonoscopy.

Colonoscopy Clinical Care Standard

The Australian Commission on Safety and Quality in Health Care (the Commission) released a national Colonoscopy Clinical Care Standard in 2018, which includes a requirement for timely and appropriate use of colonoscopy, as per Australian guidelines.[17] As the number of colonoscopies continues to increase in Australia, ensuring quality and safety is essential to maximise the benefits that are delivered to individual patients and the population as a whole. The Colonoscopy Clinical Care Standard highlights the key components of a high-quality colonoscopy. These include appropriate referral and timely assessment, maximising adenoma detection rates through certification of proceduralists and adequate bowel preparation before colonoscopy, safe use of sedation, and surveillance intervals based on best evidence. The clinical care standard also requires that patients are properly informed about each aspect of their care.

Facilities providing colonoscopies should be monitoring adherence to the clinical care standard to ensure that patients with the greatest need are prioritised for colonoscopy. Aligning surveillance intervals with guidelines is one of the aims of the proposed changes to MBS items for colonoscopy, and this may reduce the use of colonoscopies more frequently than recommended.[18]

Triage systems

Some states in Australia (Queensland, Victoria and Western Australia) have introduced models of care or triage guidelines to support appropriate referral for colonoscopy.[19-21] These programs include guidance for prioritisation of patients for colonoscopy, and prompts for key information required from referring clinicians. Implementing such triaging programs more widely across Australia, through online systems or with standardised referral templates, could result in better use of current colonoscopy capacity.

Appropriate prioritisation of colonoscopy and gastroscopy

Gastroscopies and colonoscopies are often performed by the same specialists and on the same procedural list. Bowel cancer is much more common than cancer of the upper gastrointestinal tract, but gastroscopies currently may be inappropriately prioritised over more clinically important colonoscopies, thus contributing to access problems. One way to examine whether this is happening at a local level would be to explore the volume of each procedure being undertaken and the pathology yield rates for both colonoscopy and gastroscopy.

The national rate of hospitalisations for colonoscopy is 2,881 per 100,000, and for gastroscopy it is 1,931 per 100,000. However, these figures do not reflect the relevant relative burden of disease. For example, the estimated age-standardised incidence rate per 100,000 in 2017 for oesophageal cancer was 8.4 for men and 3.0 for women; for stomach cancer, the estimated age-standardised incidence rate per 100,000 in 2017 was 10.9 for men and 5.2 for women.[22] In comparison, for bowel cancer in 2017, the estimated age-standardised incidence rate per 100,000 was 67.3 for men and 49.4 for women.[22]

A reduction in gastroscopy services could free up resources for colonoscopy. The MBS Review Taskforce recommended that the Gastroenterological Society of Australia consider the need for guidelines on the appropriate concurrent use of upper and lower gastrointestinal endoscopy services.[23] See page 97 for analysis of gastroscopy services in Australia.

Prevention of bowel cancer

Preventing bowel cancer by promoting lifestyle changes, particularly in populations with the highest rates of risk factors, would reduce the overall need for colonoscopy. Risk factors for bowel cancer include smoking, alcohol intake, dietary factors, obesity and family history.[1] Physical inactivity and high body mass index (BMI) are the greatest contributors to bowel cancer burden in Australia (16% and 13%, respectively).[3]

Aboriginal and Torres Strait Islander Australians and bowel cancer

Although the reported incidence of bowel cancer is equal among Aboriginal and Torres Strait Islander Australians and other Australians, survival rates are not.[24] (Additionally, the reported incidence of bowel cancer for Aboriginal and Torres Strait Islander Australians may be an underestimate.) Aboriginal and Torres Strait Islander Australians have a 58% chance, on average, of surviving for five years after being diagnosed with bowel cancer, compared with other Australians, who have a 67% chance, on average, of surviving for five years.[24]

Trends in detected bowel cancers and mortality do not show improvements for Aboriginal and Torres Strait Islander Australians. The incidence of bowel cancer increased significantly among Aboriginal and Torres Strait Islander Australians between 1998 and 2013, but remained steady among other Australians.[24] The mortality rate from bowel cancer remained steady among Aboriginal and Torres Strait Islander Australians between 1998 and 2015, but fell among other Australians.[24]

Colonoscopy hospitalisations, all ages

Participation by Aboriginal and Torres Strait Islander Australians in the National Bowel Cancer Screening Program (20% in 2014–15) was lower than for other Australians (42%).[3] Lower participation in the screening program is likely to contribute to poorer outcomes among Aboriginal and Torres Strait Islander Australians.[24] Many factors may contribute to lower participation, including:

- Lack of knowledge and awareness about bowel cancer (poor health literacy)
- Bowel cancer being a taboo topic or not a health priority
- An out-of-date address in Medicare registration details preventing Aboriginal and Torres Strait Islander Australians receiving an FOBT kit.

Lower rates of private health insurance may also contribute to the lower rate of colonoscopy among Aboriginal and Torres Strait Islander Australians[25], as well as poorer access to effective and culturally safe primary health care and specialist care.

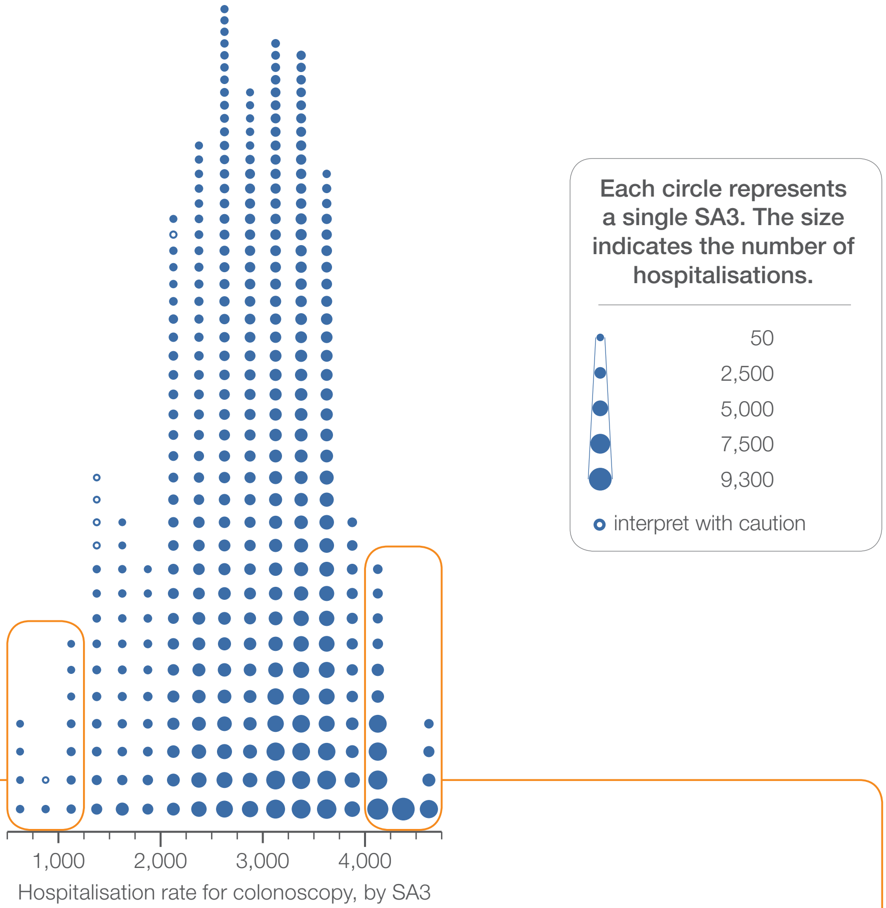
Increasing participation by Aboriginal and Torres Strait Islander Australians in the National Bowel Cancer Screening Program could improve survival rates, if matched by better access to treatment.

A New South Wales study of bowel cancer among Aboriginal and Torres Strait Islander Australians reported poorer survival than for other Australians, despite no obvious differences in the treatment or follow-up.[26] It is possible that small delays and differences in treatment, which could be due to cultural barriers, also contribute to poorer survival, in addition to other factors.[26]

More work is needed to identify and understand the reasons for the disparities between Aboriginal and Torres Strait Islander Australians and other Australians in bowel cancer screening and survival.

Rates by local area

Figure 2.3: Number of hospitalisations for colonoscopy per 100,000 people of all ages, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2016–17



Lowest rate areas

SA3	State	Rate	Hospitalisations
Woden Valley	ACT	**622**	244
Tuggeranong	ACT	**656**	586
Weston Creek	ACT	**673**	187
South Canberra	ACT	**724**	227
Baw Baw	Vic	**878**	543
Barkly	NT	**952***	48
Eyre Peninsula and South West	SA	**1,117**	782
Far North	Qld	**1,172**	342
Murray and Mallee	SA	**1,179**	1,149
Port Douglas - Daintree	Qld	**1,184**	175
Playford	SA	**1,186**	1,039
Outback - North and East	SA	**1,193**	350
Limestone Coast	SA	**1,194**	1,017

Highest rate areas

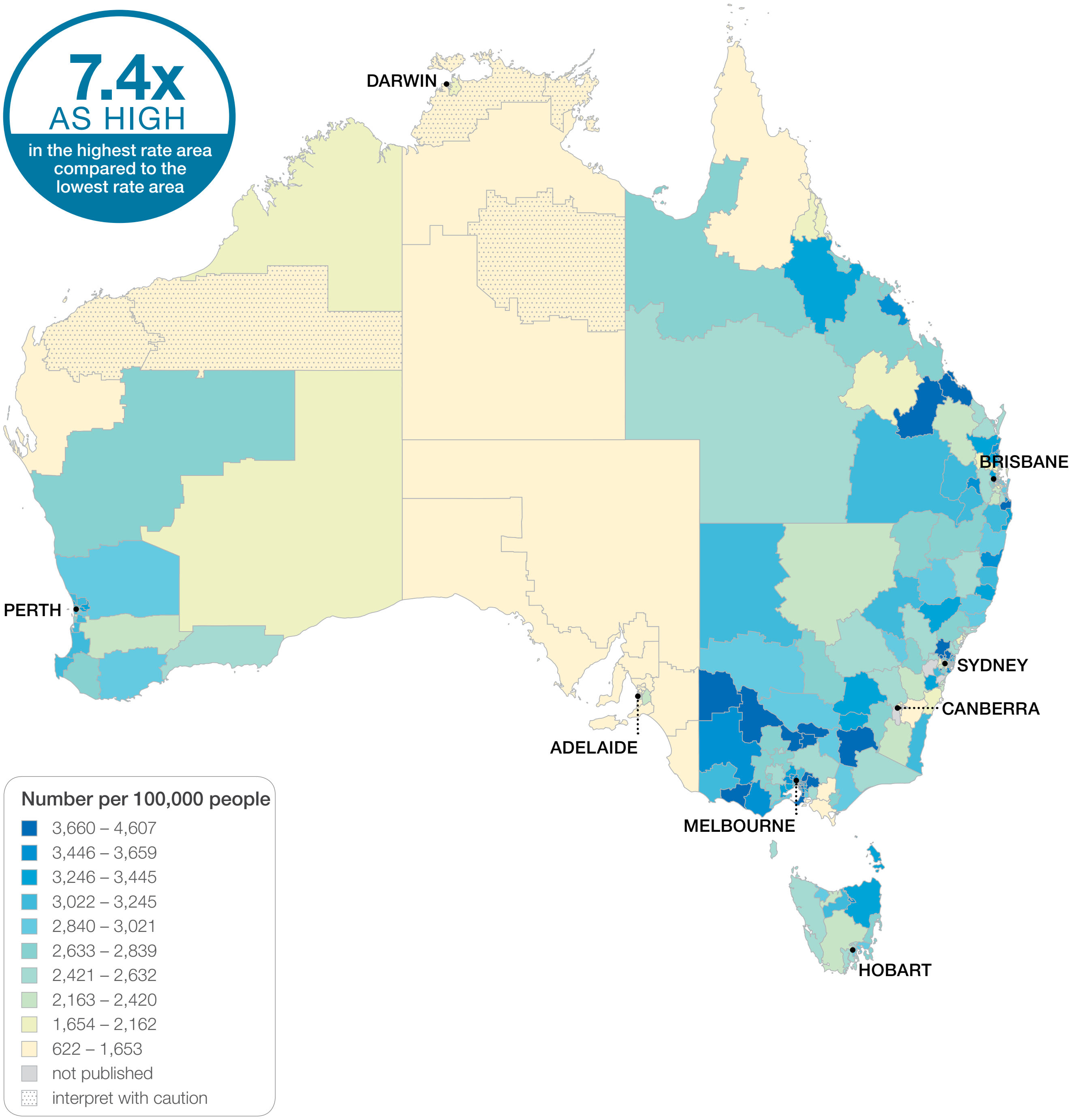
SA3	State	Rate	Hospitalisations
Hawkesbury	NSW	**4,607**	1,227
Shepparton	Vic	**4,579**	3,332
Eastern Suburbs - North	NSW	**4,547**	6,530
Campaspe	Vic	**4,534**	2,193
Mornington Peninsula	Vic	**4,357**	9,265
Richmond - Windsor	NSW	**4,241**	1,638
Rouse Hill - McGraths Hill	NSW	**4,195**	1,281
Moira	Vic	**4,142**	1,572
Monash	Vic	**4,139**	8,316
Frankston	Vic	**4,112**	6,312
Yarra Ranges	Vic	**4,036**	7,019
Stonnington - East	Vic	**4,035**	1,876
Whitehorse - East	Vic	**4,021**	2,949
Nillumbik - Kinglake	Vic	**4,001**	3,040
Glen Eira	Vic	**4,000**	6,558

Notes:
Hollow circles (○) and asterisks (*) indicate rates that are considered more volatile than other published rates and should be interpreted with caution.
Data from a number of ACT private hospitals, which undertake some colonoscopies, were not provided to the National Hospital Morbidity Database. For this reason, data for the ACT should be interpreted with caution.
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of National Hospital Morbidity Database and ABS Estimated Resident Population 30 June 2016.

Colonoscopy hospitalisations, all ages

Rates across Australia

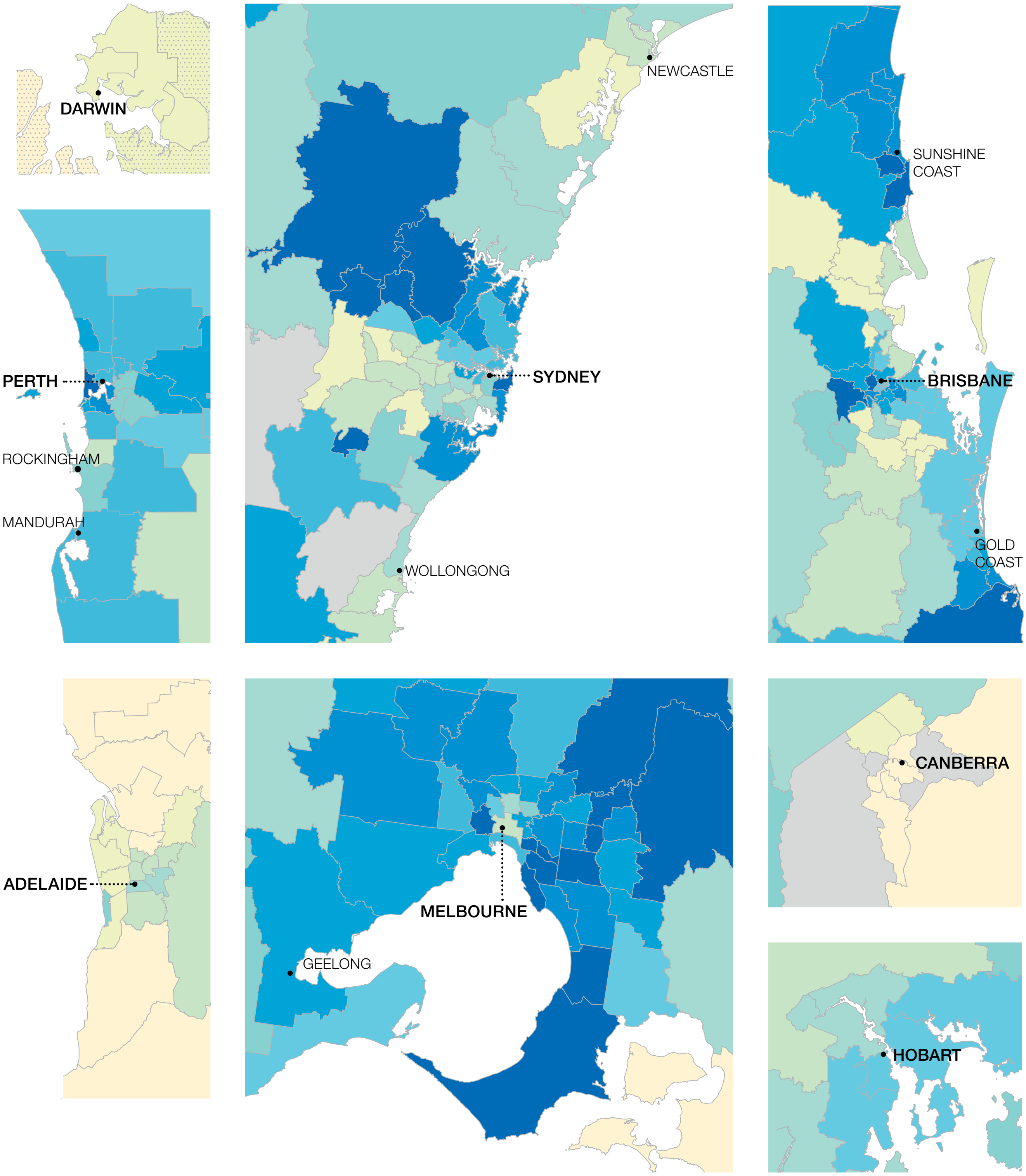
Figure 2.4: Number of hospitalisations for colonoscopy per 100,000 people of all ages, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2016–17



Notes:
Dotted areas indicate rates that are considered more volatile than other published rates and should be interpreted with caution. These rates are excluded from the calculation of the difference between the highest and lowest SA3 rates in Australia.
Data from a number of ACT private hospitals, which undertake some colonoscopies, were not provided to the National Hospital Morbidity Database. For this reason, data for the ACT should be interpreted with caution.
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of National Hospital Morbidity Database and ABS Estimated Resident Population 30 June 2016.

Rates across capital city areas

Figure 2.5: Number of hospitalisations for colonoscopy per 100,000 people of all ages, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2016–17



Notes:

Dotted areas indicate rates that are considered more volatile than other published rates and should be interpreted with caution.

Data from a number of ACT private hospitals, which undertake some colonoscopies, were not provided to the National Hospital Morbidity Database. For this reason, data for the ACT should be interpreted with caution.

For further detail about the methods used, please refer to the Technical Supplement.

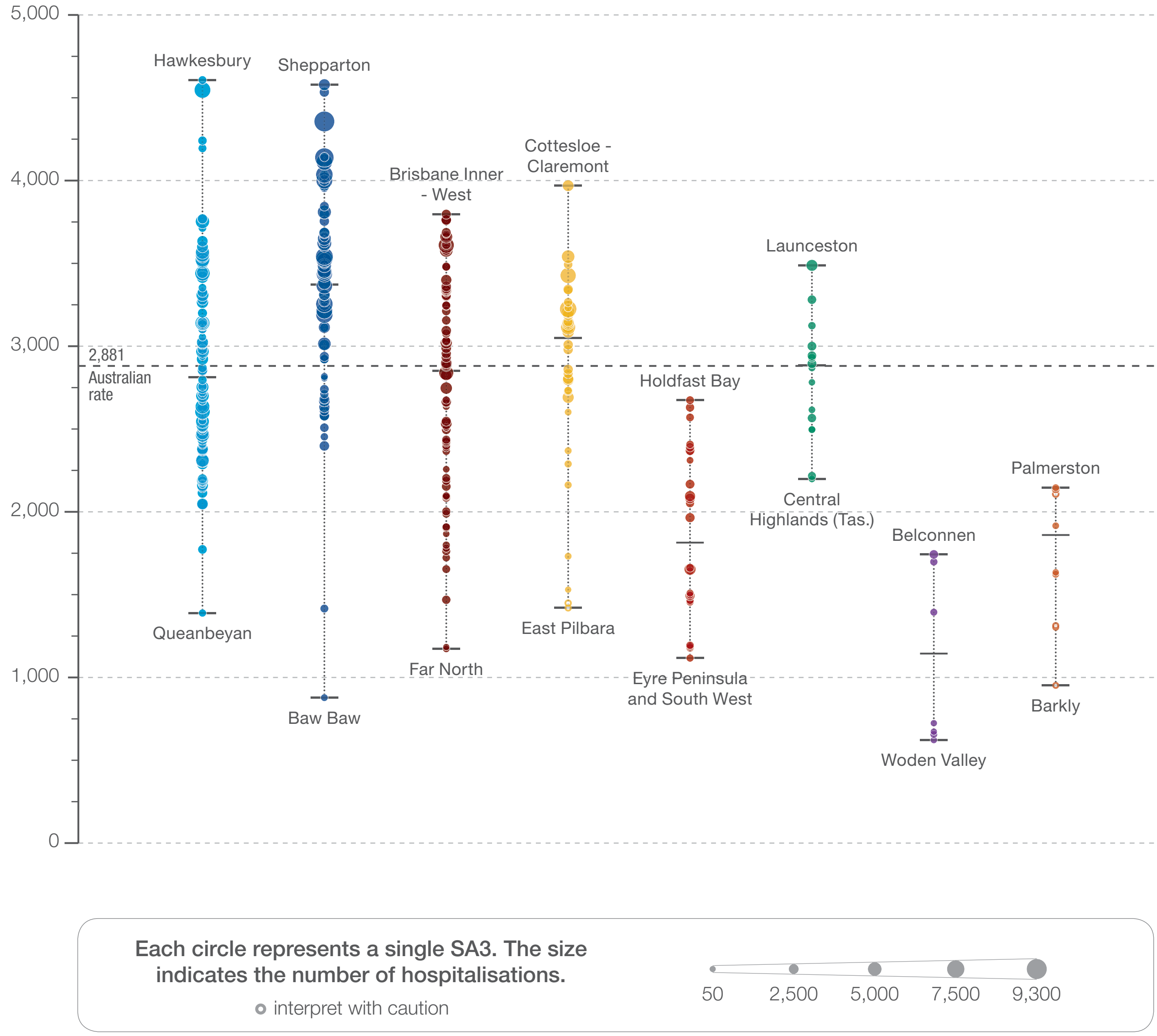
Sources: AIHW analysis of National Hospital Morbidity Database and ABS Estimated Resident Population 30 June 2016.

Colonoscopy hospitalisations, all ages

Rates by state and territory

Figure 2.6: Number of hospitalisations for colonoscopy per 100,000 people of all ages, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2016–17

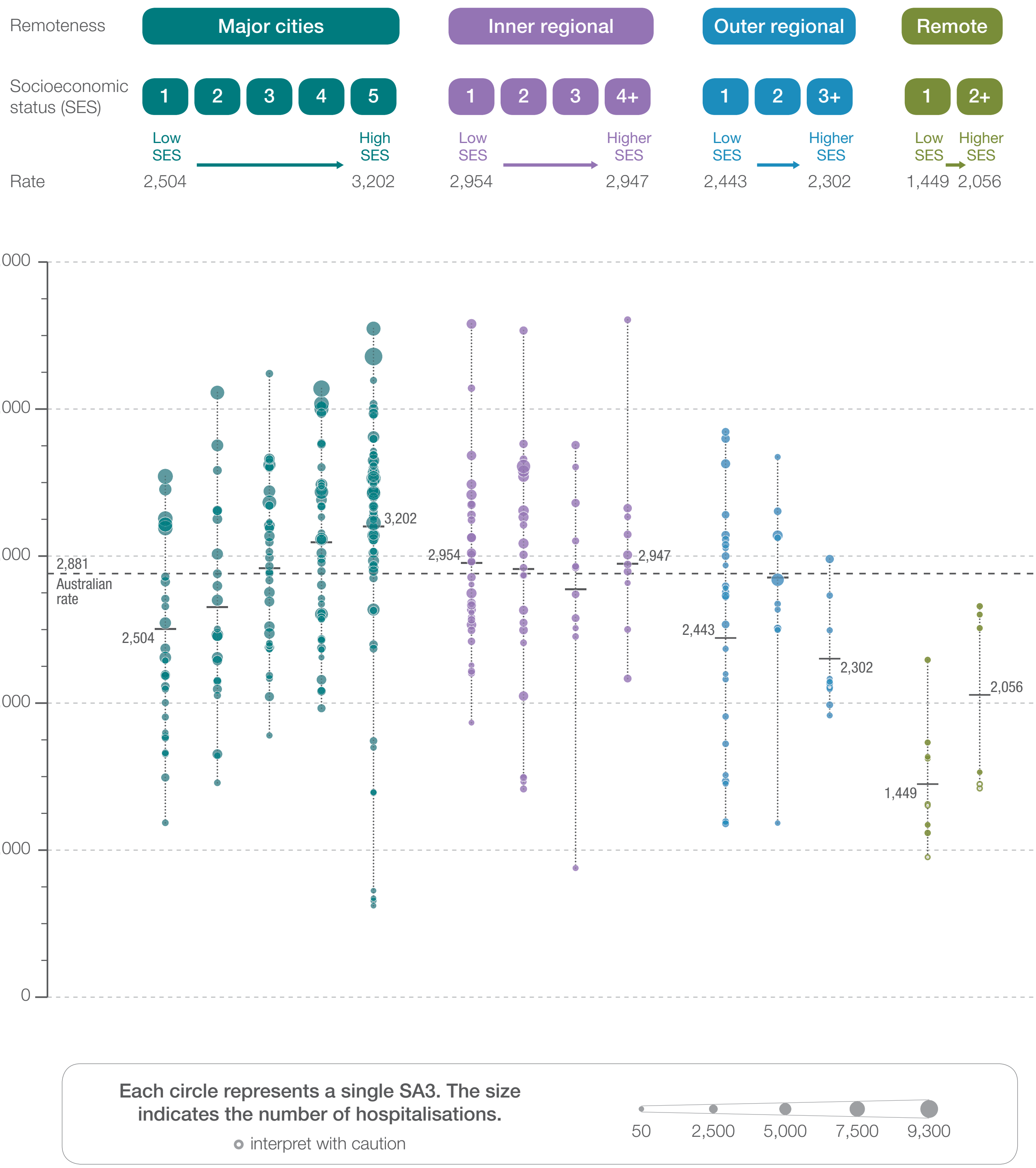
	NSW	Vic	Qld	WA	SA	Tas	ACT	NT
Highest rate	4,607	4,579	3,797	3,969	2,674	3,488	1,743	2,146
State/territory	2,814	3,371	2,851	3,051	1,814	2,885	1,144	1,860
Lowest rate	1,389	878	1,172	1,420*	1,117	2,198	622	952*
No. hospitalisations	242,070	225,764	150,784	82,217	37,203	18,529	4,557	3,833



Notes:
Hollow circles (○) and asterisks (*) indicate rates that are considered more volatile than other published rates and should be interpreted with caution.
Data from a number of ACT private hospitals, which undertake some colonoscopies, were not provided to the National Hospital Morbidity Database. For this reason, data for the ACT should be interpreted with caution.
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of National Hospital Morbidity Database and ABS Estimated Resident Population 30 June 2016.

Rates by remoteness and socioeconomic status

Figure 2.7: Number of hospitalisations for colonoscopy per 100,000 people of all ages, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2016–17



Notes:

Hollow circles (○) indicate rates that are considered more volatile than other published rates and should be interpreted with caution.

For further detail about the methods used, please refer to the Technical Supplement.

Sources: AIHW analysis of National Hospital Morbidity Database and ABS Estimated Resident Population 30 June 2016.

Colonoscopy hospitalisations, all ages

Resources

- Australian Commission on Safety and Quality in Health Care, Colonoscopy Clinical Care Standard[17]
- Australian Commission on Safety and Quality in Health Care, Colonoscopy Clinical Care Standard clinician and consumer fact sheets[27]
- Cancer Council Australia, *Clinical Practice Guidelines for the Prevention, Early Detection and Management of Colorectal Cancer*[28]
- Gastroenterological Society of Australia, IBS4GPs, an online IBS management tool for general practitioners[29]
- Cancer Council Australia, *Clinical Practice Guidelines for Surveillance Colonoscopy*[30]
- Royal Australian College of General Practitioners, *Guidelines for Preventive Activities in General Practice* (9th edition). Section 9.2: Colorectal cancer.[31]

Australian initiatives

The information in this chapter will complement work already under way to improve the use of colonoscopy in Australia. At a national level, this work includes:

- MBS Review Taskforce, review of MBS colonoscopy items[23]
- Australian Commission on Safety and Quality in Health Care, Colonoscopy Clinical Care Standard[17]
- Gastroenterological Society of Australia, Choosing Wisely recommendation 1: Do not repeat colonoscopies more often than recommended by the National Health and Medical Research Council (NHMRC) endorsed guidelines[32]
- Gastroenterological Society of Australia, online management tool for irritable bowel syndrome[29]
- Colorectal Surgical Society of Australia and New Zealand, Bi-National Colorectal Cancer Audit.

Many states and territory initiatives are also in place to improve the use of colonoscopy, including:

- Queensland Health, clinical prioritisation criteria for gastroenterology[33]
- Agency for Clinical Innovation, New South Wales, clinical priority categories for colonoscopy[34]
- NSW Cancer Institute, grants for research projects on access to bowel cancer screening services
- Department of Health, Tasmania, Patients First Colonoscopy Access Strategy
- Department of Health and Human Services, Victoria, *Colonoscopy Categorisation Guidelines*[20]
- Department of Health, Western Australia, *Colonoscopy Services Model of Care*.[19]

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2.2 Gastroscopy hospitalisations, all ages

Why is this important?

Gastroscopy is mainly used to investigate upper gastrointestinal symptoms such as heartburn. It is also used to exclude a diagnosis of cancer.[1-3] Rates of gastroscopy in Australia continue to rise despite the limited role of gastroscopy in reflux and dyspepsia; and low rates of oesophageal and stomach cancers.[4-8] Guidelines recommend acid suppression therapy or a ‘test and treat’ regimen for *Helicobacter pylori*, as first-line treatment for the management of upper gastrointestinal symptoms.[6-8] Guidelines recommend against use of gastroscopy to investigate uncomplicated reflux or dyspepsia in people at low risk of oesophageal or stomach cancer.[8] Australian data show a reduction in gastroscopy when guidelines are followed.[9] Improving adherence to guidelines and reducing the number of inappropriate referrals for gastroscopy could free up services for higher-yield procedures, such as colonoscopy for people with positive faecal occult blood tests.

What did we find?

The Atlas found the rate of hospitalisation for inpatient gastroscopy varies up to about seven-fold between local areas across Australia. The pattern of use suggests overuse of gastroscopy in some areas. Lower rates of gastroscopy in outer regional and remote areas raise concerns about a lack of access to gastroscopy in these areas. The low rates for Aboriginal and Torres Strait Islander Australians raise similar concerns.

What can be done?

Aligning Medicare Benefits Schedule (MBS) items for gastroscopy with evidence-based criteria, together with auditing against the revised items, are important strategies that could be used to reduce inappropriate use of gastroscopy. Prioritising patients waiting for either colonoscopy or gastroscopy as a single group, rather than having separate lists, could improve the diagnostic yield from these investigations and improve patient outcomes. Education and audit for referrers could be a useful tool for improving appropriate use of gastroscopy, as could structured referral forms. Consumer education for women about the importance of excluding heavy menstrual bleeding in the management of anaemia may reduce unnecessary gastroscopy in this group.

Gastroscopy hospitalisations, all ages

Context

Gastroscopy (or upper gastrointestinal endoscopy) involves inserting a flexible tube with a camera (an endoscope) through the mouth into the oesophagus, stomach or duodenum.[1,2] The procedure is used to investigate signs and symptoms of upper gastrointestinal disease, including iron deficiency, difficulty swallowing and possible cancer.[1,3] Gastroscopy is also used to treat upper gastrointestinal conditions, monitor chronic conditions and perform biopsies (for example, for suspected coeliac disease).[1,3] Therapeutic gastroscopies are not included in this data item.

Guidelines recommend against using gastroscopy to investigate uncomplicated reflux or dyspepsia in people at low risk of oesophageal or stomach cancer, such as people under 55 years of age.[8,10] This is because most people with upper gastrointestinal symptoms can be effectively treated without investigation and do not have any abnormalities visible on gastroscopy.[6,8] Also, upper gastrointestinal cancers are rare, particularly before 55 years of age (Figure 2.8).[6,8]

Gastroscopy is recommended for excluding a diagnosis of cancer in people at risk, such as those aged over 55 years with signs and symptoms suggestive of cancer.[8,10] Risk factors for stomach and oesophageal cancer include smoking, alcohol and dietary factors.[5] Stomach cancer is also associated with *Helicobacter pylori* infection.[11]

Rates of upper gastrointestinal cancer are relatively low in Australia. For example, in 2017, the estimated age-standardised incidence per 100,000 people for oesophageal cancer was 8.4 for men and 3.0 for women; the estimated age-standardised incidence for stomach cancer was 10.9 for men and 5.2 for women.[12] In comparison, the estimated age-standardised incidence for bowel cancer in 2017 was 67.3 for men and 49.4 for women.[12] Aboriginal and Torres Strait Islander Australians have a higher age-standardised incidence of oesophageal cancer per 100,000 people than other Australians (11.5 compared with 5.2 in 2009–2013) and a higher incidence of stomach cancer (12.2 compared with 7.8 in 2009–2013).[13]

Although the age-standardised incidence of stomach cancer per 100,000 people has fallen in Australia (from 9.4 to 8.0 between 2004 and 2014) and that of oesophageal cancer is relatively stable (5.9 in 2004 and 5.4 in 2014)[14], the rate of gastroscopy is continuing to rise.[4] The crude rate of MBS-subsidised gastroscopy per 100,000 people grew by 3% per year in Australia between 2008 and 2017.[15] In 2016–17, gastroscopy was the sixth most common same-day procedure in Australian hospitals.[16]

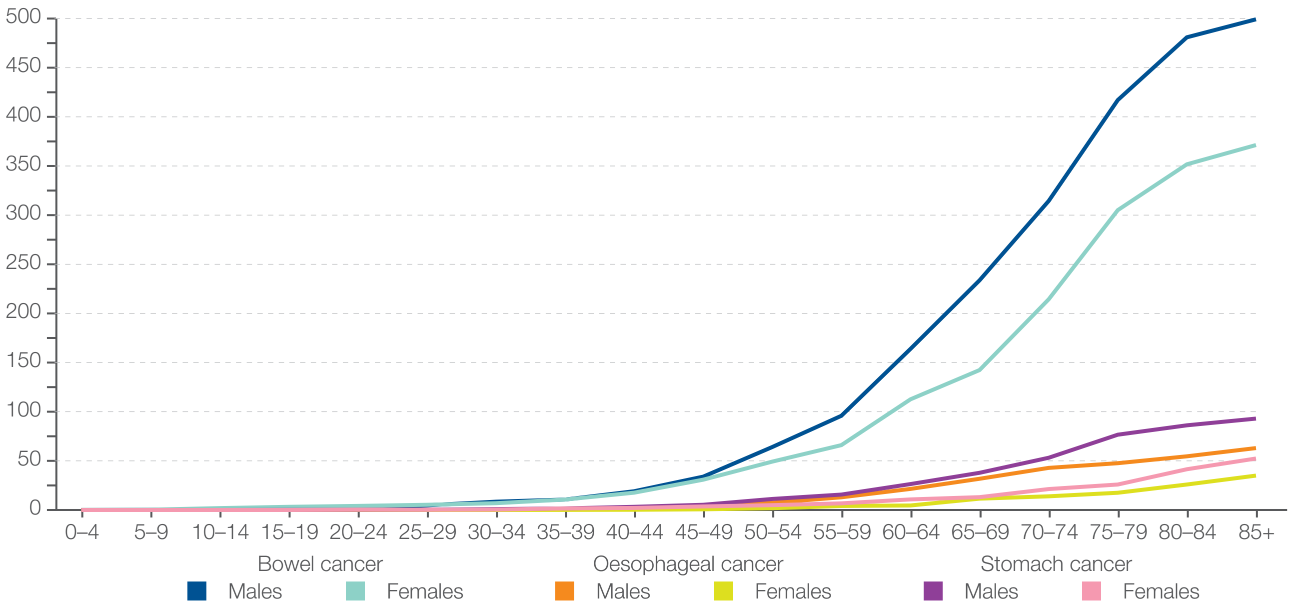
There are few international comparisons of gastroscopy rates. In 2014–15, the crude rate of gastroscopy in Australia was 1,629 MBS-subsidised services per 100,000 people[15], while the age-, sex- and deprivation-standardised rate in England for the same year was 1,331 per 100,000 people.[17]

Use of gastroscopy was included in a recent New South Wales analysis of low-value care in public hospitals – that is, care that is unlikely to provide benefit to patients, or care for which risks exceed benefit or added costs do not provide proportional added benefit.[18,19] The authors found that, in 2016–17, approximately 14% of gastroscopies in adults under 55 years of age in New South Wales public hospitals fitted the criteria for low-value care and cost approximately $11 million.[18] In addition, the rate of low-value gastroscopy was reported to be increasing: the proportion of gastroscopies in New South Wales public hospitals that were assessed as low value rose by approximately 8% annually between 2010–11 and 2016–17.[18]

Overuse of gastroscopy has also been studied internationally, with estimated rates of inappropriate requesting ranging from 7.5% to 54%.[20,21] According to a 2018 study in the United Kingdom, gastroscopy for inappropriate indications is one of the top five most costly and commonly performed interventions that offer little benefit.[22]

The five-year survival rate for stomach and oesophageal cancer is substantially lower than for bowel cancer[12], and concerns about late diagnosis and medico-legal issues may contribute to over-testing. Although diagnostic gastroscopy has a relatively low rate of adverse events (between 1 in 200 and 1 in 10,000)[23], the risks still need to be considered, particularly when the diagnostic yield in patients without alarm symptoms is also very low. Even in the presence of Barrett's oesophagus, which can progress to oesophageal cancer, guidelines note that the harms of surveillance with gastroscopy may outweigh the benefits for some patients who do not have additional risk factors.[7]

Figure 2.8: Incidence of bowel cancer, oesophageal cancer and stomach cancer per 100,000 people, by age group and sex, in Australia, 2014



Sources: Australian Institute of Health and Welfare. Australian Cancer Incidence and Mortality (ACIM) books: colorectal cancer, stomach cancer, oesophageal cancer. Canberra: AIHW; 2017.

Gastroscopy hospitalisations, all ages

About the data

Data were sourced from the National Hospital Morbidity Database (NHMD), and include admitted patients in both public and private hospitals throughout Australia. Rates are based on the number of hospitalisations for gastroscopy per 100,000 people of all ages in 2016–17.

Because a record is included for each hospitalisation for the procedure rather than for each patient, patients hospitalised for the procedure more than once in the financial year will be counted more than once.

The analysis and maps are based on the residential address of the patient and not the location of the hospital.

Rates are age and sex standardised to allow comparisons between populations with different age and sex structures.

The NHMD includes data on people admitted to hospital as day patients or overnight, but does not include data on people who are not admitted to hospital. While the MBS database includes data on people who receive an MBS-subsidised service whether or not they are admitted, no national data are available on the number of non-admitted (that is, outpatient) gastroscopies funded publicly under a hospital budget. Therefore, it is not possible to get a complete picture of all gastroscopy activity across Australia.

Limitations of the data source may account for some variations seen.

Same-day procedure admission policies

States and territories differ in their admission policies for same-day procedures. As gastroscopies for non-admitted publicly funded patients are not included in the data shown, variation in admission policies is expected to contribute to variation in gastroscopy rates between states and territories. For example, in 2013–14 in Western Australia and Victoria, almost all endoscopy procedures occurred as admitted patient care, so the data shown should be a near complete count of gastroscopies in these states.[24] In contrast, many gastroscopies in South Australia occurred as non-admitted care, and so the data shown are likely to be an under-count.

In Tasmania, procedures that are bulk-billed are coded as non-admitted episodes. This will lead to an underestimate of gastroscopy rates. A substantial proportion of public patients accessing Tasmanian public hospitals may be bulk-billed and therefore not represented in the data.

Aboriginal and Torres Strait Islander identification

The identification of Aboriginal and Torres Strait Islander patients may not be accurate for all admissions, and processes for seeking and recording identification may vary among states and territories. Therefore, the data shown may under-count the number of Aboriginal and Torres Strait Islander Australians hospitalised for gastroscopy.

What do the data show?

Magnitude of variation

In 2016–17, there were 505,544 hospitalisations for gastroscopy, representing 1,931 hospitalisations per 100,000 people of all ages (the Australian rate).

The number of hospitalisations for gastroscopy across 328* local areas (Statistical Area Level 3 – SA3) ranged from 444 to 3,297 per 100,000 people of all ages. The rate was **7.4 times as high** in the area with the highest rate compared to the area with the lowest rate. The number of hospitalisations varied across states and territories, from 701 per 100,000 people of all ages in the Australian Capital Territory to 2,259 in Victoria (Figures 2.12–2.15).

After the highest and lowest 10% of results were excluded and 264 SA3s remained, the number of hospitalisations per 100,000 people of all ages was 2.1 times as high in the area with the highest rate compared to the area with the lowest rate.

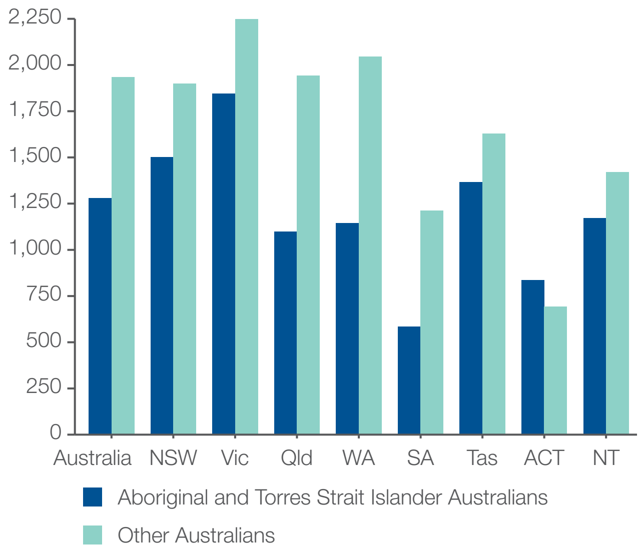
Analysis by remoteness and socioeconomic status

Rates of hospitalisation for gastroscopy were higher in major cities and inner regional areas than in outer regional and remote areas. Rates were lower in areas with lower socioeconomic status in major cities and remote areas. However, there was no clear pattern according to socioeconomic status in other remoteness categories (Figure 2.16).

Analysis by Aboriginal and Torres Strait Islander status

The rate for Aboriginal and Torres Strait Islander Australians (1,279 per 100,000 people) was 34% lower than the rate for other Australians (1,934 per 100,000 people) (Figure 2.9).

Figure 2.9: Number of hospitalisations for gastroscopy per 100,000 people of all ages, age and sex standardised, by state and territory of patient residence, by Aboriginal and Torres Strait Islander status, 2016–17



The data for Figure 2.9 are available at www.safetyandquality.gov.au/atlas.

* There are 340 SA3s. For this item, data were suppressed for 12 SA3s due to a small number of hospitalisations and/or population in an area.

Notes:

Data by Indigenous status should be interpreted with caution as hospitalisations for Aboriginal and Torres Strait Islander patients are under-enumerated and there is variation in the under-enumeration among states and territories.

Data from a number of ACT private hospitals, which undertake some gastroscopies, were not provided to the National Hospital Morbidity Database. For this reason, data for ACT should be interpreted with caution.

For further detail about the methods used, please refer to the Technical Supplement.

Sources: AIHW analysis of National Hospital Morbidity Database and ABS Estimated Resident Population 30 June 2016.

Gastroscopy hospitalisations, all ages

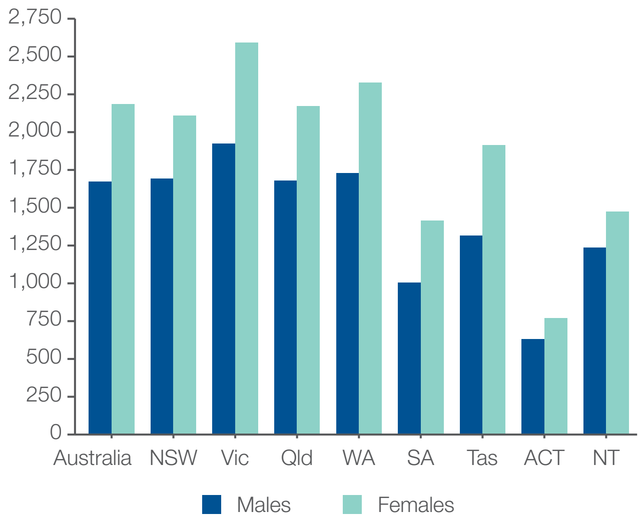
Analysis by sex

The rate of hospitalisations for gastroscopy was 1.3 times as high in females as in males.

In 2016–17, there were 220,687 hospitalisations for gastroscopy for males of all ages, representing 1,673 hospitalisations per 100,000 males (the Australian rate). The number of hospitalisations varied across states and territories, from 632 per 100,000 males in the Australian Capital Territory to 1,923 per 100,000 in Victoria.

In 2016–17, there were 284,857 hospitalisations for gastroscopy in females of all ages, representing 2,185 hospitalisations per 100,000 females (the Australian rate). The number of hospitalisations varied across states and territories, from 769 per 100,000 females in the Australian Capital Territory to 2,590 per 100,000 in Victoria (Figure 2.10).

Figure 2.10: Number of hospitalisations for gastroscopy per 100,000 people of all ages, age standardised, by state and territory of patient residence, by sex, 2016–17

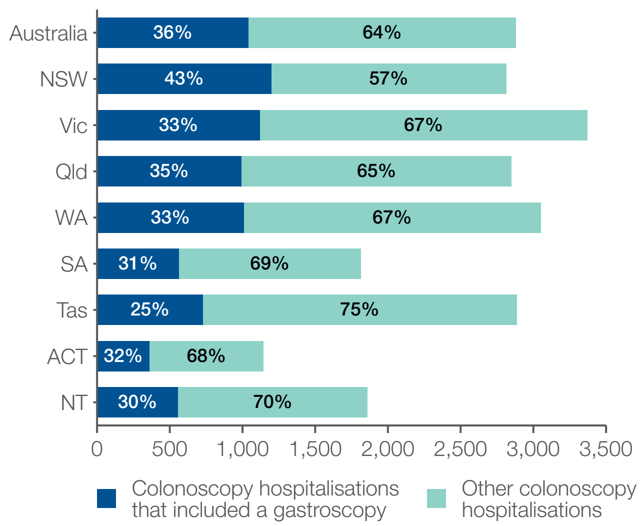


The data for Figure 2.10 are available at www.safetyandquality.gov.au/atlas.

Gastroscopy and colonoscopy during the same hospitalisation

In 2016–17, 36% of hospitalisations for colonoscopy included a gastroscopy. There were 274,559 hospitalisations for colonoscopy that also included gastroscopy, representing 1,044 hospitalisations per 100,000 people of all ages (the Australian rate). The number of hospitalisations varied across states and territories, from 362 per 100,000 people in the Australian Capital Territory to 1,200 per 100,000 people in New South Wales (Figure 2.11).

Figure 2.11: Number of hospitalisations for colonoscopy per 100,000 people of all ages, age and sex standardised, by state and territory of patient residence and same hospitalisation included a gastroscopy, 2016–17



The data for Figure 2.11 are available at www.safetyandquality.gov.au/atlas.

Notes:
Data from a number of ACT private hospitals, which undertake some colonoscopies and gastroscopies, were not provided to the National Hospital Morbidity Database. For this reason, data for the ACT should be interpreted with caution.
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of National Hospital Morbidity Database and ABS Estimated Resident Population 30 June 2016.

Interpretation

The patterns of gastroscopy use suggest possible underuse in some parts of the population and overuse in others. Lower rates of gastroscopy in outer regional and remote areas raise concerns about a possible lack of appropriate access to gastroscopy in these areas. The low rates for Aboriginal and Torres Strait Islander Australians raise similar concerns.

Variation is warranted and desirable when it reflects variation in the underlying need for care. The use of gastroscopy should reflect the distribution of symptoms of upper gastrointestinal cancer and other conditions for which gastroscopy is appropriate. The pattern in major cities, where there is greater use of gastroscopy in areas of higher socioeconomic status, does not reflect need. Upper gastrointestinal symptoms and gastro-oesophageal reflux disease (GORD) are more common in low socioeconomic groups.[25-28] Smoking and obesity, which are risk factors for upper gastrointestinal symptoms and cancers, are also more common in lower socioeconomic groups.[7,29] Overall, the pattern of use does not reflect the burden of disease, suggesting a component of unwarranted variation.

Data artefacts may account for some of the disparity, as people from areas of lower socioeconomic status may be higher users of non-admitted public hospital services and therefore may be under-counted. However, this is unlikely to explain all of the association. Public–private partnership models may also influence patterns of gastroscopy use.

The Atlas has also found a clear anomaly between cancer burden and use of investigations for gastrointestinal diseases in Australia. The national rate for colonoscopy hospitalisations is about 1.5 times that for gastroscopy hospitalisations (2,881 per 100,000 compared with 1,931 per 100,000), yet the incidence of colorectal cancer is about 7 times that of stomach cancer and about 11 times that of oesophageal cancer.[15] This anomaly and other patterns observed in the data raise concern about the appropriateness of this use.

The higher rate of gastroscopy in females than in males (2,185 per 100,000 versus 1,673 per 100,000) may reflect higher rates of iron deficiency in females (due to heavy menstrual bleeding), as gastroscopy is recommended to investigate some cases of iron deficiency.[30] Management of heavy menstrual bleeding according to the Australian Heavy Menstrual Bleeding Clinical Care Standard may reduce rates of unnecessary gastroscopy in premenopausal women.[31] Functional dyspepsia is also more common in women, and gastroscopy may be used to rule out organic causes.[32,33]

Clinical decision-making

Variation in adherence to guidelines may influence use of gastroscopy. According to a meta-analysis, an estimated 22% of referrals for gastroscopy are inappropriate (as defined by United States and European guidelines).[22] It is likely that inappropriate gastroscopy for people aged 55 years and under contributes to variation in rates seen in Australia. Australian and United States guidelines recommend that young patients with longstanding mild reflux symptoms and no alarm symptoms be trialled with acid suppression therapy without having gastroscopy.[11,34]

Access to endoscopy services

Availability and affordability of endoscopy services are likely to influence the pattern of gastroscopy use. Open access endoscopy services are likely to increase the rates of gastroscopy in areas where these services are available, because general practitioners (GPs) are effectively able to request a gastroscopy without further review from a specialist. Statewide triage systems for endoscopy, such as those in Western Australia and Victoria, may increase access to gastroscopy for urgent indications, but also reduce access for use that is not supported by evidence.

Gastroscopy hospitalisations, all ages

Rates of private health insurance

Access to gastroscopy is likely to be greater for people with private health insurance. This may explain the lower rate of use in areas of socioeconomic disadvantage in major cities.

Other factors

Differences in clinical opinion on management where evidence is unclear may also contribute to variation. Many clinicians are uncertain about the value of gastroscopy in screening and surveillance for Barrett's oesophagus, and this may be contributing to the variation seen. Although the risk of someone with Barrett's oesophagus developing oesophageal cancer is at least 30 times as high as that for the general population, the absolute risk of developing cancer for a patient with non-dysplastic Barrett's oesophagus is low; recent studies suggest rates close to 0.22% per year.[35]

In suspected coeliac disease, gastroscopy is necessary to obtain a biopsy for confirmation of the diagnosis.[36] Coeliac disease affects approximately 1 in 100 Australians, and is often unrecognised.[37,38] It is not clear what proportion of gastroscopies in Australia are requested for investigating suspected coeliac disease.

Variation in rates of gastroscopy between areas may also be influenced by the number of clinicians providing services to people living in the area. The practices of specific clinicians are likely to have a greater impact on rates in smaller local areas with fewer clinicians, such as rural and regional locations. Specific clinicians may influence rates across several local areas, especially those with small populations. The effects of practice styles of individual clinicians will be diluted in areas with larger numbers of practising clinicians.

Variations between areas may not directly reflect the practices of the clinicians who are based in these areas. The analysis is based on where people live rather than where they obtain their health care. Patients may travel outside their local area to receive care.

Addressing variation

Unwarranted variation in use of gastroscopy would be addressed by reducing the rate of inappropriate gastroscopies and increasing access in areas that are currently under-served. Australia's finite health resources should be directed to high-value care, and away from low-value care such as gastroscopy in situations where it will not change management. Reducing the number of inappropriate referrals for gastroscopy could free up resources to help reduce waiting times for public colonoscopy services in Australia.

Improving preventive care could also reduce unwarranted variation. For example, risk factors for gastro-oesophageal reflux include obesity, dietary factors and smoking. Addressing these risk factors as the first step could reduce the incidence of reflux, reduce the incidence of symptoms that do not respond to treatment and the risk of developing Barrett's oesophagus, and reduce the need for gastroscopy.

Review of MBS item descriptions

Aligning MBS item descriptions for gastroscopy with evidence- and consensus-based criteria, and likely yield, and auditing against the revised items, are important strategies that could be used to reduce inappropriate use of gastroscopy. Most patients with upper gastrointestinal symptoms can be effectively managed without gastroscopy, and long-term follow-up shows that most patients with these symptoms have a benign course.[34,39] United States guidelines recommend reserving gastroscopy for specific indications, including:

- Upper abdominal symptoms that persist despite an appropriate trial of therapy
- Upper abdominal symptoms associated with other symptoms or signs suggesting structural disease (for example, weight loss) or new-onset symptoms in patients over 50 years of age
- Difficulty swallowing
- Persistent vomiting of unknown cause.[40]

Education and clinical audit

An Australian study of GPs found that participation in clinical self-audit against Gastroenterological Society of Australia recommendations improved management of GORD.[9] Referral for gastroscopy fell from 48% to 45% of patients during the audit program, and other aspects of management improved – for example, identification of risk factors for exacerbations (including medications), and recommendations for lifestyle modifications such as weight loss and dietary changes.[9] Clinical audit is a valuable tool, which could be used more widely to increase appropriate use of gastroscopy in Australia.

Using guidelines to assess the appropriateness of referrals for gastroscopy could increase the diagnostic yield, according to a New Zealand study of an open access gastroscopy service.[41] The study was prompted by concerns about an increase in inappropriate referrals with a low positive yield, and a consequent increase in waiting times for patients with potentially serious disease.[41] The analysis found that 42% of referrals were inappropriate, according to American Society of Gastroenterology criteria.[41] For hospital-based consultants, surveillance of healed benign lesions was the most common inappropriate reason to request gastroscopy (31% of consultant requests); for GPs, symptoms considered functional were the most common inappropriate reason (25% of GP requests).[41]

Targeting both gastroenterologists and GPs for educational programs could improve the appropriateness of requests for gastroscopy. Education could include information about the low yield of gastroscopy for simple upper gastrointestinal symptoms, and when surveillance is appropriate. Structured referral forms listing the appropriate indications for gastroscopy could serve two purposes: educating referrers and providing a basis for rejecting inappropriate referrals. Education for consumers and GPs about the limited role for gastroscopy in reflux and functional dyspepsia could also improve appropriateness of use. Similarly, consumer education about lifestyle changes to reduce the risk of gastro-oesophageal reflux would be valuable.

Concurrent gastroscopy and colonoscopy

The high rate of patients undergoing gastroscopy and colonoscopy during the same hospitalisation warrants closer scrutiny. Both investigations are indicated in only a limited number of conditions, so the high rates reported suggest some inappropriate use. The MBS Review Taskforce recommended that the Gastroenterological Society of Australia consider the need for guidelines on the appropriate concurrent use of upper and lower gastrointestinal endoscopy.[42] See page 81 for analysis of colonoscopy services in Australia.

Concurrent gastroscopy and colonoscopy is used to investigate the cause of iron deficiency in patients, including premenopausal women.[43] Improving management of heavy menstrual bleeding, and adherence to the Heavy Menstrual Bleeding Clinical Care Standard[31], may reduce the number of women presenting with iron deficiency, and reduce the number unnecessarily investigated with gastroscopy and colonoscopy. Similarly, better management of functional gastrointestinal conditions could reduce unnecessary gastroscopy and colonoscopy.

Barrett's oesophagus surveillance

There is a low level of evidence to support surveillance gastroscopy for patients with Barrett's oesophagus to prevent oesophageal cancer.[44,45] The cost-effectiveness of this strategy has been questioned, given the very low risk of progression to cancer in some patients.[46,47] Stopping surveillance in subgroups of patients with a very low risk of progression to cancer could result in more effective use of healthcare resources.[46] This should be complemented by addressing risk factors such as smoking, obesity and uncontrolled gastro-oesophageal reflux symptoms. A variety of biomarkers for identifying patients with Barrett's oesophagus who are most at risk of developing oesophageal cancer are currently under investigation.[47]

Gastroscopy hospitalisations, all ages

Appropriate prioritisation of colonoscopy and gastroscopy

Gastroscopies and colonoscopies are often performed by the same specialists and on the same procedural list. Resources for endoscopy may be better used by prioritising patients for gastroscopy or colonoscopy according to urgency within the combined patient group, rather than within the two separate groups. Colonoscopy for patients with a positive faecal occult blood test (and therefore a relatively high risk of cancer) could then be prioritised over gastroscopy for patients with a low likelihood of findings that would change management. Bowel cancer is much more common than cancer of the upper gastrointestinal tract, but gastroscopies currently may be inappropriately prioritised over more clinically important colonoscopies, thus contributing to access problems. One way to examine whether this is happening at a local level would be to explore the volume of each procedure being undertaken and the pathology yield rates for both colonoscopy and gastroscopy.

Western Australia and Victoria have introduced triage systems to improve use of endoscopy services.[48-50] Queensland has also introduced clinical prioritisation criteria for many clinical areas, including gastroenterology, to triage patients referred to public specialist outpatient services.[51] Wider use of such systems could result in more appropriate prioritisation of gastroscopy and colonoscopy.

Consumer education

Informing younger patients of their very low risk of stomach and oesophageal cancer may reduce the demand for inappropriate gastroscopy. In men under 50 years of age, the incidence of stomach cancer is less than 7 per 100,000, and the incidence of oesophageal cancer is less than 4 per 100,000.[12] In women under 50 years of age, the incidence of stomach cancer is less than 4 per 100,000, and the incidence of oesophageal cancer is less than 1 per 100,000.[12]

Consumer education for women about the importance of excluding heavy menstrual bleeding in the management of anaemia may reduce unnecessary gastroscopy in this group.

Reducing risk factors

Reducing risk factors for upper gastrointestinal cancer would reduce the burden of disease, and reduce the overall need for gastroscopy. Intensifying public health initiatives to reduce smoking, obesity and excessive alcohol consumption in high-risk groups should be a priority.

Aboriginal and Torres Strait Islander Australians and gastroscopy

Aboriginal and Torres Strait Islander Australians[13]:

- Are 1.5 times as likely as other Australians to be diagnosed with stomach cancer and 1.8 times as likely to die from it
- Are 2.2 times as likely as other Australians to be diagnosed with oesophageal cancer and 1.8 times as likely to die from it
- Have, on average, a 20% chance of surviving for five years after being diagnosed with stomach cancer, compared with an average 28% chance for other Australians.

Improving access to gastroscopy for Aboriginal and Torres Strait Islander Australians with symptoms suggesting stomach or oesophageal cancer could potentially improve survival after diagnosis. Aboriginal and Torres Strait Islander Australians have a lower rate of procedures when hospitalised, than other Australians (62% versus 81%).[52] This disparity is likely to reflect a range of factors, such as[52]:

- Lack of private health insurance
- Comorbidities
- Clinical judgements about post-procedural compliance
- Communication and cultural issues.

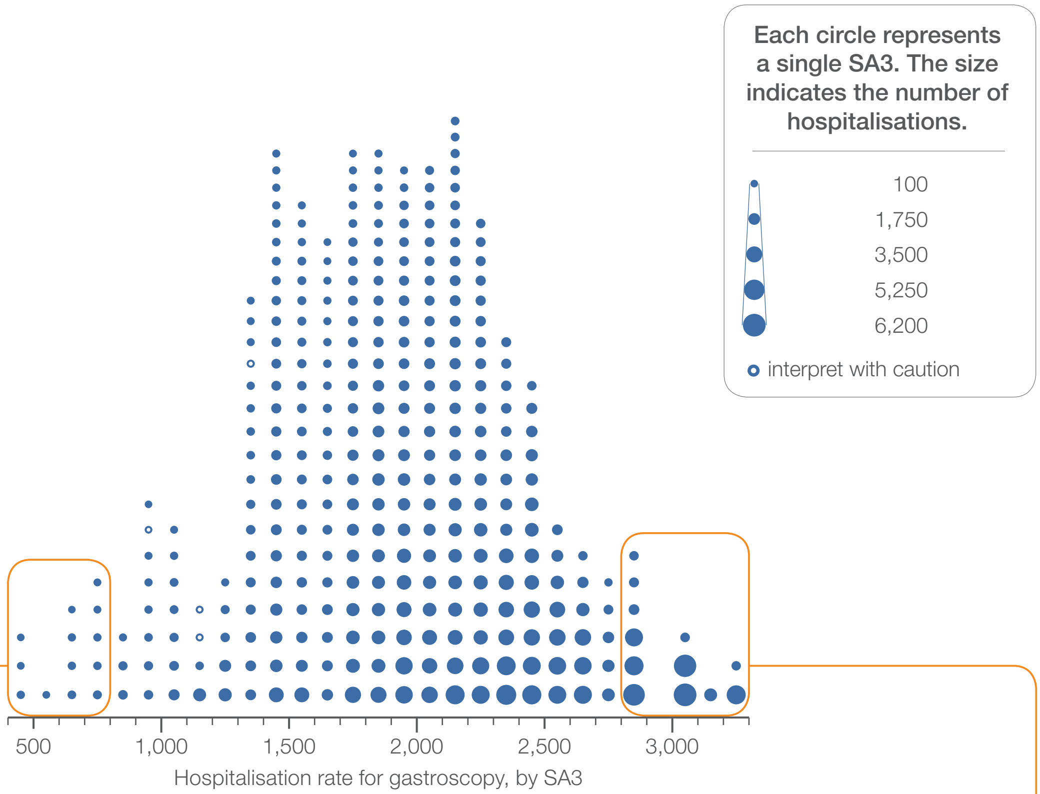
To better understand the reasons for lower rates of procedures such as gastroscopy for Aboriginal and Torres Strait Islander Australians, detailed analysis is needed to understand the population's needs and potential solutions in specific settings.[53] This could be done, for example, through hospital-level research that fulfils the criteria for Action 1[28] in the Governance standard of the National Safety and Quality Health Service Standards (second edition).[54]

Increasing appropriate publicly funded access to gastroscopy, as well as culturally safe care, should be prioritised to improve care for Aboriginal and Torres Strait Islander Australians with symptoms requiring gastroscopy. Improving prevention through reducing risk factors is also fundamental to reducing rates of stomach and oesophageal cancer in Aboriginal and Torres Strait Islander Australians.

Gastroscopy hospitalisations, all ages

Rates by local area

Figure 2.12: Number of hospitalisations for gastroscopy per 100,000 people of all ages, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2016–17



Lowest rate areas

SA3	State	Rate	Hospitalisations
Weston Creek	ACT	**444**	118
Woden Valley	ACT	**450**	172
Tuggeranong	ACT	**471**	406
South Canberra	ACT	**533**	158
Eyre Peninsula and South West	SA	**602**	417
Baw Baw	Vic	**625**	381
Port Douglas - Daintree	Qld	**632**	89
Limestone Coast	SA	**682**	551
Murray and Mallee	SA	**722**	668
Queanbeyan	NSW	**737**	446
North Canberra	ACT	**774**	377
Far North	Qld	**797**	230
Outback - North and East	SA	**799**	232

Highest rate areas

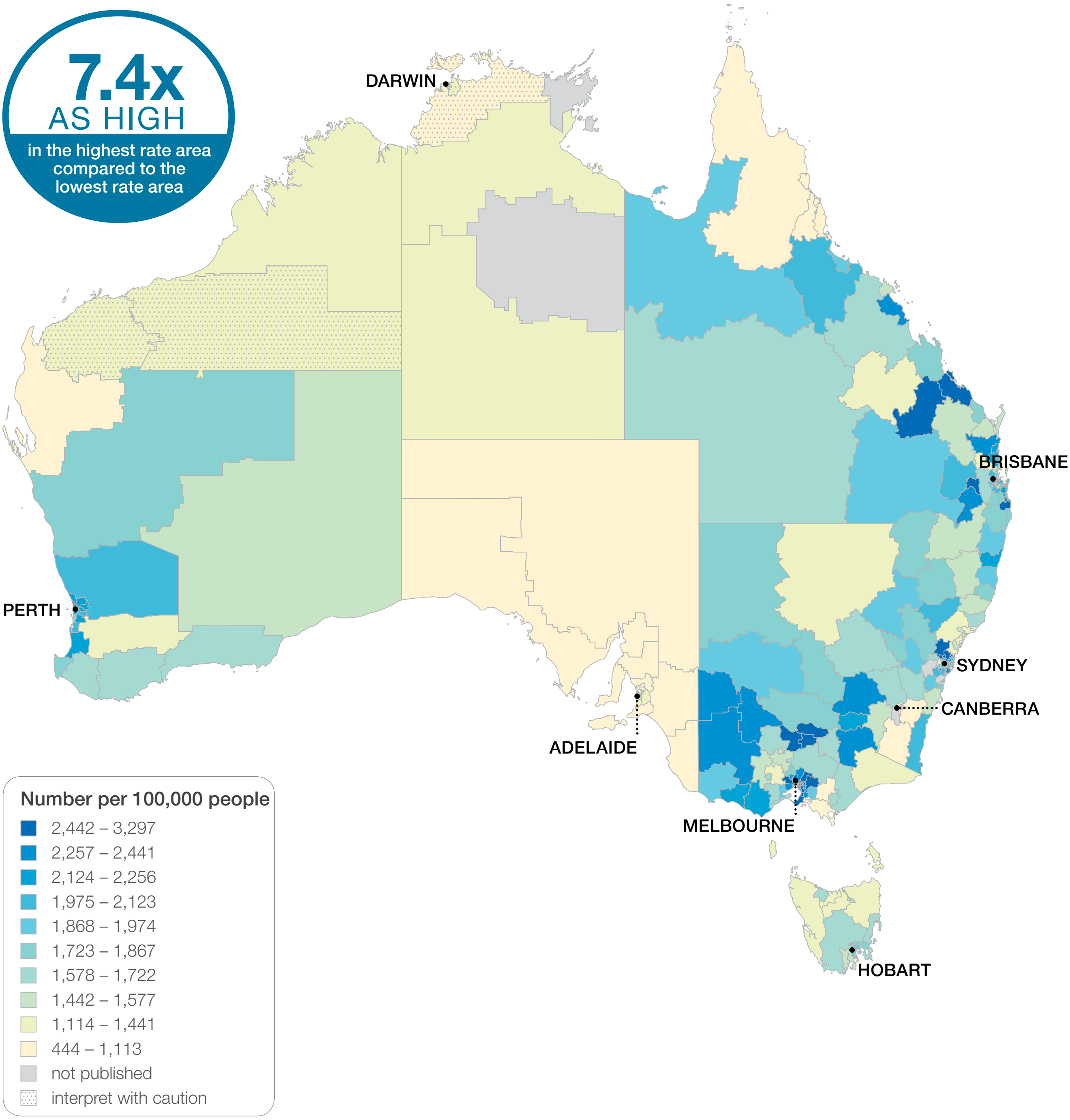
SA3	State	Rate	Hospitalisations
Eastern Suburbs - North	NSW	**3,297**	4,705
Hawkesbury	NSW	**3,208**	832
Shepparton	Vic	**3,142**	2,232
Dandenong	Vic	**3,039**	6,195
Monash	Vic	**3,036**	6,061
Rouse Hill - McGraths Hill	NSW	**3,021**	924
Campaspe	Vic	**2,892**	1,358
Frankston	Vic	**2,853**	4,304
Mornington Peninsula	Vic	**2,823**	5,764
Yarra Ranges	Vic	**2,822**	4,731
Richmond - Windsor	NSW	**2,808**	1,076
Dural - Wisemans Ferry	NSW	**2,800**	869

Notes:
Hollow circles (○) indicate rates that are considered more volatile than other published rates and should be interpreted with caution.
Data from a number of ACT private hospitals, which undertake some gastroscopies, were not provided to the National Hospital Morbidity Database. For this reason, data for the ACT should be interpreted with caution.
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of National Hospital Morbidity Database and ABS Estimated Resident Population 30 June 2016.

Gastroscopy hospitalisations, all ages

Rates across Australia

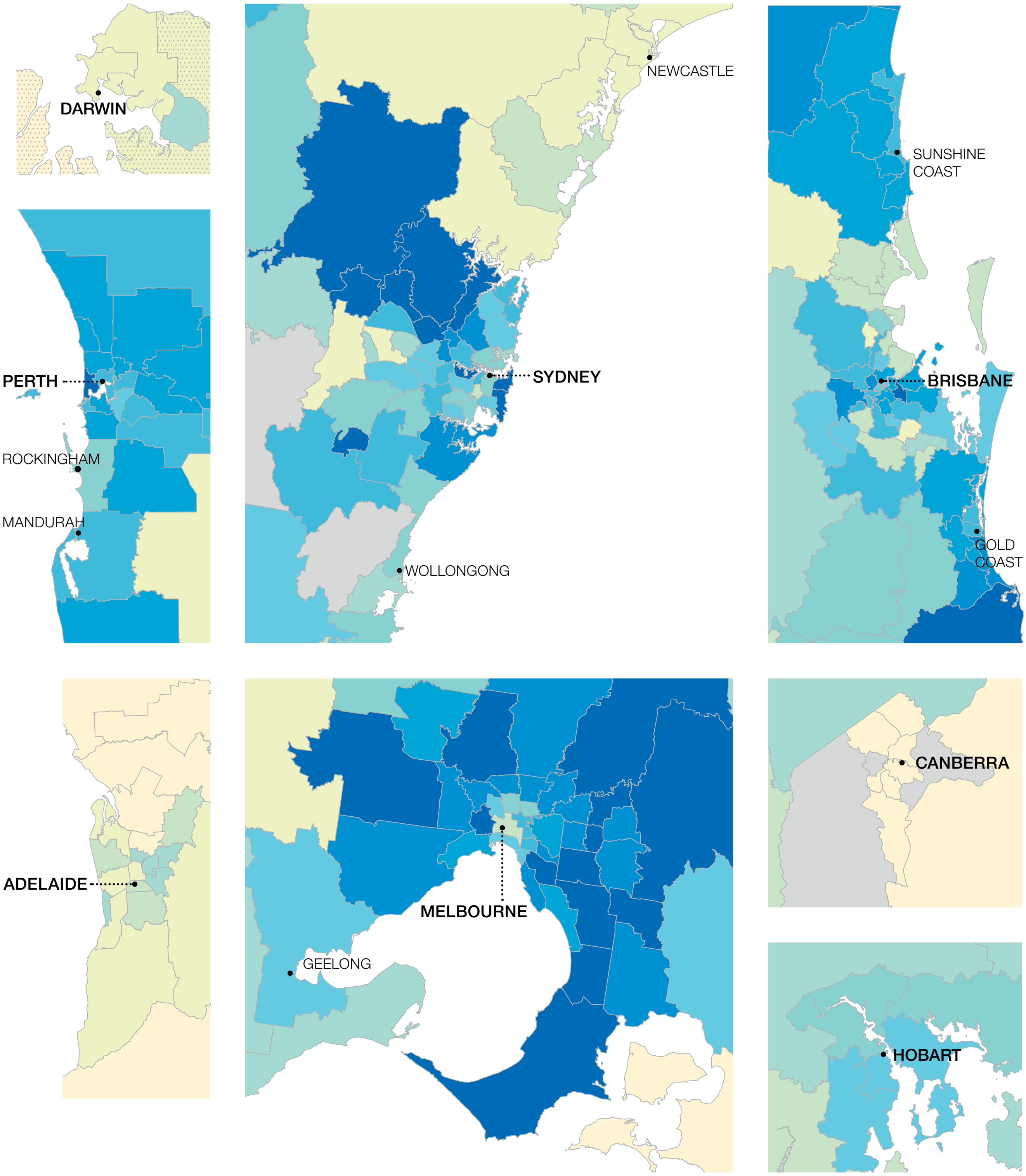
Figure 2.13: Number of hospitalisations for gastroscopy per 100,000 people of all ages, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2016–17



Notes:
Dotted areas indicate rates that are considered more volatile than other published rates and should be interpreted with caution. These rates are excluded from the calculation of the difference between the highest and lowest SA3 rates in Australia.
Data from a number of ACT private hospitals, which undertake some gastroscopies, were not provided to the National Hospital Morbidity Database. For this reason, data for the ACT should be interpreted with caution.
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of National Hospital Morbidity Database and ABS Estimated Resident Population 30 June 2016.

Rates across capital city areas

Figure 2.14: Number of hospitalisations for gastroscopy per 100,000 people of all ages, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2016–17



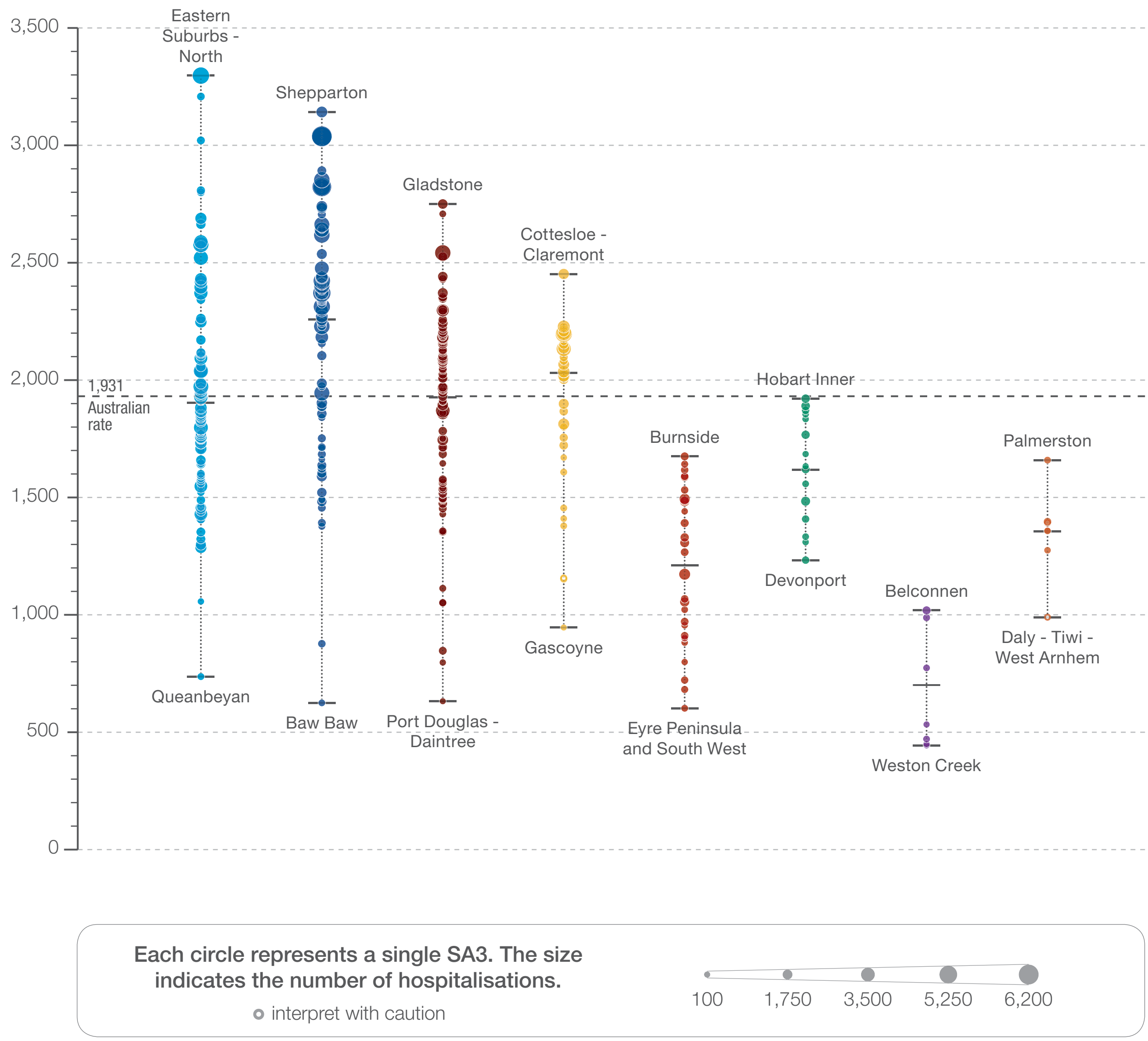
Notes:
Dotted areas indicate rates that are considered more volatile than other published rates and should be interpreted with caution.
Data from a number of ACT private hospitals, which undertake some gastroscopies, were not provided to the National Hospital Morbidity Database. For this reason, data for the ACT should be interpreted with caution.
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of National Hospital Morbidity Database and ABS Estimated Resident Population 30 June 2016.

Gastroscopy hospitalisations, all ages

Rates by state and territory

Figure 2.15: Number of hospitalisations for gastroscopy per 100,000 people of all ages, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2016–17

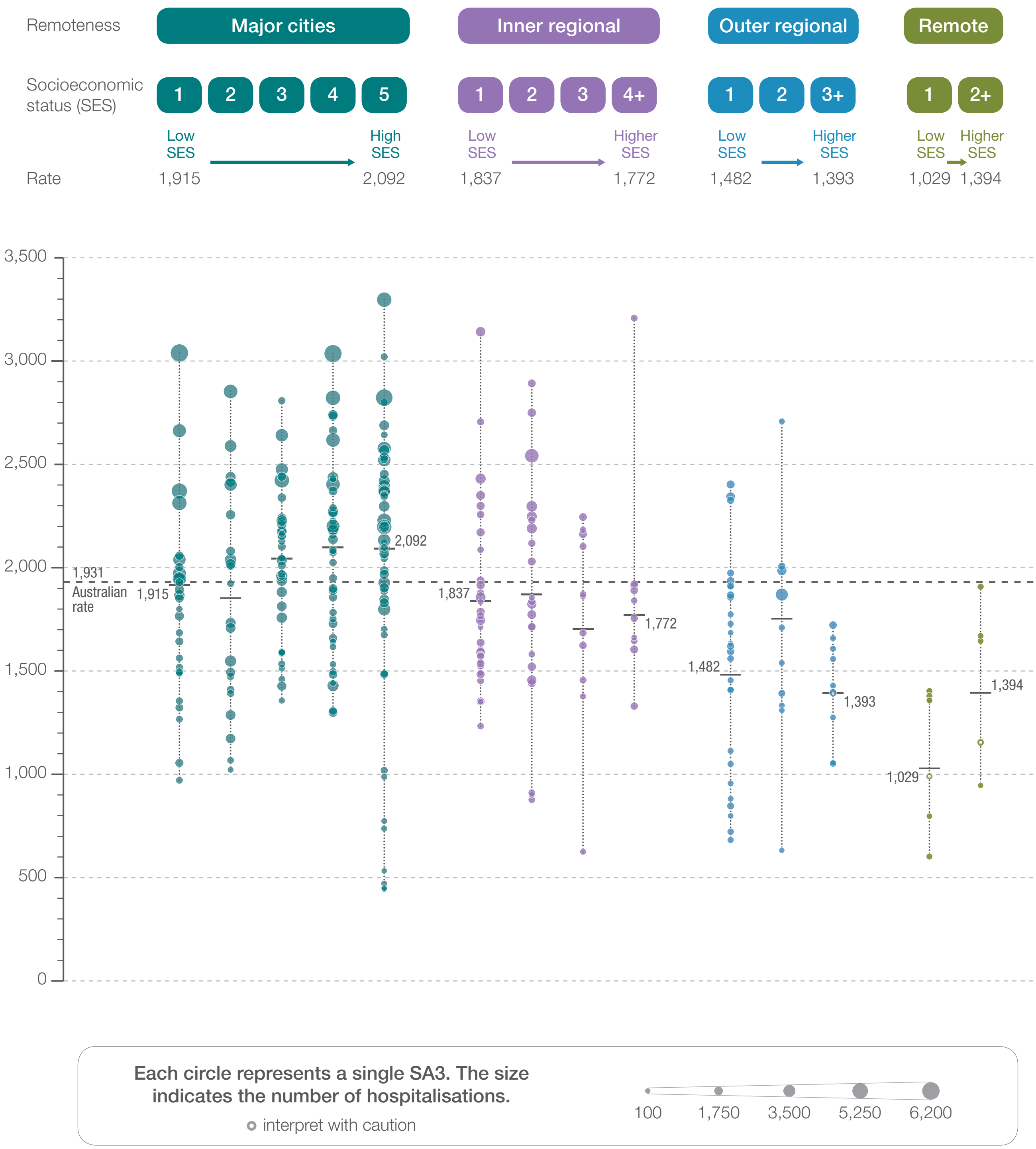
	NSW	Vic	Qld	WA	SA	Tas	ACT	NT
Highest rate	3,297	3,142	2,750	2,452	1,675	1,921	1,019	1,659
State/territory	1,903	2,259	1,927	2,031	1,211	1,618	701	1,355
Lowest rate	737	625	632	946	602	1,233	444	990*
No. hospitalisations	161,454	149,455	100,437	54,039	24,009	10,077	2,784	2,822



Notes:
Hollow circles (◦) and asterisks (*) indicate rates that are considered more volatile than other published rates and should be interpreted with caution.
Data from a number of ACT private hospitals, which undertake some gastroscopies, were not provided to the National Hospital Morbidity Database. For this reason, data for the ACT should be interpreted with caution.
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of National Hospital Morbidity Database and ABS Estimated Resident Population 30 June 2016.

Rates by remoteness and socioeconomic status

Figure 2.16: Number of hospitalisations for gastroscopy per 100,000 people of all ages, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2016–17



Notes:
Hollow circles (○) indicate rates that are considered more volatile than other published rates and should be interpreted with caution.
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of National Hospital Morbidity Database and ABS Estimated Resident Population 30 June 2016.

Gastroscopy hospitalisations, all ages

Resources

- Gastroenterological Society of Australia, *Gastro-oesophageal Reflux in Adults: Clinical update*[6]
- Cancer Council Australia, Australian clinical practice guideline for diagnosis and management of Barrett's oesophagus[44]
- National Institute for Health and Care Excellence (NICE), *Gastro-oesophageal Reflux Disease and Dyspepsia in Adults: Investigation and management* (clinical guideline)[7]
- NICE, Section 1.2: Upper gastrointestinal tract cancers, in *Suspected Cancer: Recognition and referral* (NICE guideline)[10]
- Australian Health Ministers' Advisory Council, *Aboriginal and Torres Strait Islander Health Performance Framework 2017 Report*, performance measure 3.06: access to hospital procedures.[52]

Australian initiatives

The information in this chapter will complement work already under way to improve the use of gastroscopy in Australia. At a national level, this work includes:

- Gastroenterological Society of Australia, Choosing Wisely recommendation 5: Do not perform a follow-up endoscopy less than three years after two consecutive findings of no dysplasia from endoscopies with appropriate four quadrant biopsies for patients diagnosed with Barrett's oesophagus[55]
- Royal Australasian College of Surgeons, Choosing Wisely recommendation 4: Do not use endoscopy for investigation in gastric band patients with symptoms of reflux[56]
- Australian Health Ministers' Advisory Council, monitoring of access to hospital procedures within the Aboriginal and Torres Strait Islander Health Performance Framework.[52]

Many states and territory initiatives are also in place to address access to gastroscopy, including:

- Queensland Health, Endoscopy Action Plan[57]
- Queensland Health, referral criteria and guidelines for gastroenterology[48]
- Queensland Health, clinical prioritisation criteria for gastroenterology[51]
- Department of Health, Western Australia, referral guidelines for direct access gastrointestinal endoscopic procedures[49]
- Department of Health, Western Australia, urgency categorisation and access policy for public direct access adult gastrointestinal endoscopy services.[50]

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2.3 Proton pump inhibitor medicines dispensing, 18 years and over

Why is this important?

Proton pump inhibitor (PPI) medicines are among the most commonly used medicines in Australia, and most use is for gastro-oesophageal reflux disease (GORD). Although PPI medicines are highly effective at controlling symptoms of gastro-oesophageal reflux in adults, there is good evidence that they are overused, that opportunities for lifestyle interventions are not maximised and that many people are inappropriately using PPI medicines for long periods of time. There are some concerns about side effects with long-term use.

What did we find?

The Atlas found that the rate of PPI medicines dispensing varies up to five-fold between local areas in Australia. Fifteen per cent of the adult population had at least one prescription for a PPI medicine dispensed in the year.

What can be done?

Interventions should focus on consumer education about modifiable lifestyle factors that increase the risk of GORD, on appropriate prescribing when adults are first placed on a PPI medicine, and on deprescribing. Multifaceted approaches directed at both clinicians and consumers have been found to be effective. These could include information for consumers, information for general practitioners encouraging ‘stepping-down’ PPI therapy for GORD and a list of their patients taking ongoing PPI therapy, and information for pharmacists. Quality improvement interventions in hospitals could improve appropriateness of care in this setting. This could then have a flow-on effect to prescribing in the community, as hospital recommendations for PPI medicines use may influence PPI medicines use after discharge.[1]

Proton pump inhibitor medicines dispensing, 18 years and over

Context

PPIs are a group of medicines that reduce acid production in the stomach.[2] Medicines in the PPI group include omeprazole, pantoprazole, lansoprazole, rabeprazole and esomeprazole.[3] This data item analyses PPI medicines use in adults (aged 18 years and over). See page 71 for analysis of PPI medicines use in infants (aged 1 year and under).

The most common reasons for PPI therapy for adults in Australia are gastro-oesophageal reflux (68%) and, less frequently, oesophagitis (15%).[4] Both conditions are associated with exposure of the gullet (oesophagus) to stomach acid. PPI medicines are also often prescribed for prophylaxis in people taking non-steroidal anti-inflammatory drugs. A trial of PPI therapy may be worthwhile in people with functional dyspepsia if the main symptom is epigastric burning.[5]

PPI medicines are the most potent acid suppression therapy available. They are therefore attractive as first-line therapy because they give fast symptom relief.[6,7] Many patients are not appropriately 'stepped down' to less potent therapy such as a low-dose PPI medicine, histamine 2 antagonist or, least potent of all, antacids. Many people have mild or intermittent symptoms and do not require PPI medicines or regular treatment. Long-term treatment with PPI medicines is appropriate for people with complicated GORD or a small number of other conditions, and for prophylaxis in people treated with medicines that can cause upper gastrointestinal problems such as gastric bleeding.[7]

Pharmaceutical treatment does not address the underlying promoters of reflux and oesophageal cancer (an uncommon long-term complication of poorly controlled GORD). Lifestyle measures such as dietary changes, smoking cessation and weight loss can reduce reflux and reduce oesophageal cancer risk.[6-8] There is good evidence that these factors are given insufficient attention in the Australian population. While smoking rates have declined overall in Australia, other risk factors for GORD have increased. In 2014–15, the national rate of overweight and obesity in Australia was 63.4% (equivalent to 11.2 million Australian adults), up from 56.3% in 1995.[6-8]

PPI medicines are among the most commonly used medicines in the world. The issue of their widespread and possibly inappropriate long-term use has been raised as a problem in several countries.[9,10] International studies suggest that approximately half of prescriptions for PPI medicines are inappropriate according to guidelines; recent estimates of the proportion of inappropriate prescribing of PPI medicines in Australia range from 22% to 63%.[11-13]

PPI medicines became available in Australia in the early 1990s, and their use increased by 1,300% from 1995 to 2006.[9] The rate of increase then slowed, rising by 5% between 2007 and 2017, but PPI medicines have remained among the top 10 prescribed drugs in Australia since the 2000s.[14] In 2015–16, an estimated 12% of the Australian population were taking a PPI medicine or had in the past year.[4] Similar patterns have been seen in other countries. For example, in the United Kingdom, PPI medicine prescriptions increased from 26 million in 2006 to 58 million in 2016, and 15% of the population were estimated to be taking a PPI medicine in 2014.[15-17] PPI medicines are also available over the counter in Australia and are advertised to consumers; however, figures for this supply are not readily available.

Although PPI medicines are generally well tolerated, concerns have been raised about rare, but serious, risks associated with long-term PPI medicines use. For example, PPI medicines alter the gut microbiome and there is some evidence that this may increase the risk of enteric infections with *Clostridium difficile* and other pathogens, as well as bone fractures, chronic kidney disease and interstitial nephritis.[7,10,13,18,19] Most of this evidence is from observational studies, and strong evidence of a causal link is lacking.[10,20]

About the data

Data are sourced from the Pharmaceutical Benefits Scheme (PBS) dataset, which includes all prescriptions dispensed under the PBS or the Repatriation Pharmaceutical Benefits Scheme. This includes prescriptions with co-payment that do not receive an Australian Government subsidy and prescriptions dispensed under the Closing the Gap scheme.

The dataset does not include prescriptions dispensed for patients during their admission to public hospitals, discharge prescriptions dispensed from public hospitals in New South Wales and the Australian Capital Territory, direct supply of medicines to remote Aboriginal health services, over-the-counter purchase of medicines, doctor's bag medicines or private prescriptions.

Rates are based on the number of prescriptions dispensed for PPI medicines per 100,000 people aged 18 years and over in 2016–17.

The analysis and maps are based on the residential address of the patient recorded in the PBS prescription claim and not the location of the prescriber or the dispensing pharmacy.

Rates are age and sex standardised to allow comparisons between populations with different age and sex structures.

This analysis was not undertaken by Aboriginal and Torres Strait Islander status because this information was not available for the PBS data at the time of publication.

What do the data show?

Magnitude of variation

In 2016–17, there were 21,768,718 PBS prescriptions dispensed for PPI medicines, representing 105,294 prescriptions per 100,000 people aged 18 years and over (the Australian rate).

The number of PBS prescriptions dispensed for PPI medicines across 333* local areas (Statistical Area Level 3 – SA3) ranged from 34,489 to 172,780 per 100,000 people aged 18 years and over. The rate was **5.0 times as high** in the area with the highest rate compared to the area with the lowest rate. The number of prescriptions dispensed varied across states and territories, from 63,230 per 100,000 people aged 18 years and over in the Northern Territory to 127,993 in Tasmania.

After the highest and lowest 10% of results were excluded and 267 SA3s remained, the number of prescriptions dispensed per 100,000 people aged 18 years and over was 1.6 times as high in the area with the highest rate compared to the area with the lowest rate.

* There are 340 SA3s. For this item, data were suppressed for 7 SA3s due to a small number of prescriptions dispensed and/or population in an area.

Notes:

Some of the published SA3 rates were considered more volatile than others. These rates are excluded from the calculation of the difference between the highest and lowest SA3 rates in Australia.

For further detail about the methods used, please refer to the Technical Supplement.

Proton pump inhibitor medicines dispensing, 18 years and over

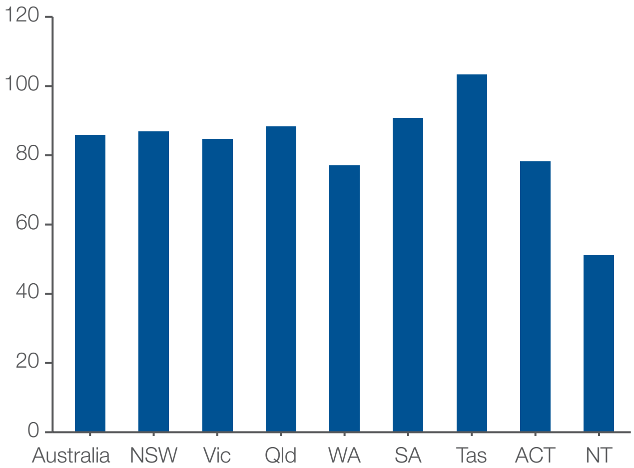
Analysis by remoteness and socioeconomic status

Rates of PPI medicines dispensing were higher in inner regional and outer regional areas than in other areas. There was a pattern of an increasing rate of PPI medicines dispensing with socioeconomic disadvantage in major cities, and inner regional and outer regional areas (Figure 2.23).

Rate of defined daily doses

The number of defined daily doses (DDD)† of PPI medicines per 1,000 people aged 18 years and over dispensed on any given day was 85.95 – this is equivalent to 8.6% of the adult population receiving a PPI medicine on any given day of 2016–17. The DDD rate varied across states and territories from 51.15 per 1,000 people per day in the Northern Territory to 103.32 in Tasmania (Figure 2.17).

Figure 2.17: Number of defined daily doses of proton pump inhibitor medicines per 1,000 people aged 18 years and over per day, age and sex standardised, by state and territory of patient residence, 2016–17



The data for Figure 2.17 are available at www.safetyandquality.gov/atlas

People dispensed at least one prescription

The number of people aged 18 years and over who had at least one prescription for a PPI medicine dispensed in 2016–17 was 15,135 per 100,000 people – that is 15% of the adult population (Figure 2.18).

Figure 2.18: Number of patients dispensed at least one proton pump inhibitor medicine per 100,000 people aged 18 years and over, age and sex standardised, by state and territory of patient residence, 2016–17

The data for Figure 2.18 are available at www.safetyandquality.gov/atlas

Interpretation

Variation in rates of PPI medicines dispensing is likely to be due to geographical differences in the factors discussed below. In addition, variation in use of over-the-counter PPI medicines may influence rates of prescription PPI medicines dispensing. Affordability of over-the-counter PPI medicines may contribute to some of the variation seen in PBS-subsidised dispensing, including the lower rates of dispensing seen in less disadvantaged areas.

† A defined daily dose (DDD) is a measure of medicines use that allows comparison between different therapeutic groups, and between countries. The DDD is based on the average dose per day of the medicine when used for its main indication by adults.

Notes:
For further detail about the methods used, please refer to the Technical Supplement.

Sources: AIHW analysis of Pharmaceutical Benefits Scheme data and ABS Estimated Resident Population 30 June 2016.

Variations between areas may not directly reflect the practices of the clinicians who are based in these areas. The analysis is based on where people live rather than where they obtain their health care. Patients may travel outside their local area to receive care.

Rates of underlying disease

Variation is warranted and desirable when it reflects variation in the underlying need for care. Rates of PPI medicines use may vary according to rates of GORD risk factors in adults (such as obesity, smoking and alcohol intake) and other indications for PPI medicines use, such as *Helicobacter pylori* infection (when PPI medicines are used as an adjunct to antibiotic therapy) and use of medicines that increase the risk of gastrointestinal bleeding.[6] GORD is more common among people with lower levels of education and other elements of socioeconomic disadvantage, and the higher rates of PPI medicines use in areas of socioeconomic disadvantage are consistent with this pattern.[21,22] Higher rates of obesity and smoking may contribute to the higher rates of GORD in socioeconomically disadvantaged areas.[23]

Clinical decision-making

Clinician and consumer willingness to discuss lifestyle risk factors and to act to reduce their impact may affect PPI prescribing rates. Variation in adherence to guidelines for prescribing PPIs in adults and infants is also likely to influence the pattern of use – for example, rates of prescribing PPIs for simple gastro-oesophageal reflux, which is not recommended.[6] Differences in participation in national interventions to increase appropriateness of PPI prescribing for adults, such as academic detailing for general practitioners (GPs), audit and feedback, and a multifaceted program for veterans, may also influence rates of use.[24]

Access to medical care

Access to GPs and gastroenterologists may influence the likelihood of consumers seeking care for gastro-oesophageal reflux and GORD for themselves or their children, and therefore affect rates of PPI use.[25]

Variation in rates of PPI medicines dispensing between areas may also be influenced by the number of clinicians providing services to people living in the area. The practices of specific clinicians are likely to have a greater impact on rates in smaller local areas with fewer clinicians, such as rural and regional locations. Specific clinicians may influence rates across several local areas, especially those with small populations. The effects of practice styles of individual clinicians will be diluted in areas with large numbers of practising clinicians.

Addressing variation

The number of prescriptions for PPI medicines dispensed in 2016–17 equates to every person in Australia aged 18 years and over receiving at least one prescription for a PPI medicine annually.

The quality of evidence on long-term risks of PPI medicines is generally low, but these possible risks are important when seen in the context of large-scale inappropriate use.[10] Limiting use to appropriate indications would also reduce waste of health resources and patient costs.[10,20]

Despite recommendations to reserve long-term use for select situations, the average duration of PPI therapy is 3.8 years in Australia.[4] Almost all of the serious side effects associated with PPI medicines occur in people on long-term therapy, so periodic review of the need for ongoing PPI therapy and minimising the duration of therapy could greatly reduce the risk of harm.[13] Australian Choosing Wisely recommendations advise not using PPI medicines long term in patients with uncomplicated disease without regular attempts at reducing the dose or ceasing therapy.[26,27] PPI therapy should also be discontinued in patients with functional dyspepsia if it does not improve symptoms.[5]

Proton pump inhibitor medicines dispensing, 18 years and over

Interventions that simply identify patients as having potentially inappropriate PPI therapy and highlight them as possible candidates for deprescribing (for example, by a discharge letter) have been unsuccessful.[28] Interventions that not only identified inappropriate PPI medicines prescription but also focused on knowledge translation and close stakeholder engagement have had greater success.[28] Any deprescribing also needs to be carefully targeted, to avoid adverse effects from inappropriate discontinuation of PPI therapy.

A multifaceted series of initiatives conducted in the Australian veterans population exemplified this approach. The initiatives ran between 2004 and 2012, and resulted in a 21% relative decrease in use of PPI medicines.[24] The program included repeating the following interventions, several years apart:

- Information to consumers
- Information encouraging 'stepping-down' PPI therapy for GORD to all GPs caring for veterans taking a PPI medicine, and a list of their patients taking ongoing PPI therapy
- Information to community pharmacies and pharmacists accredited to perform home medicines reviews.

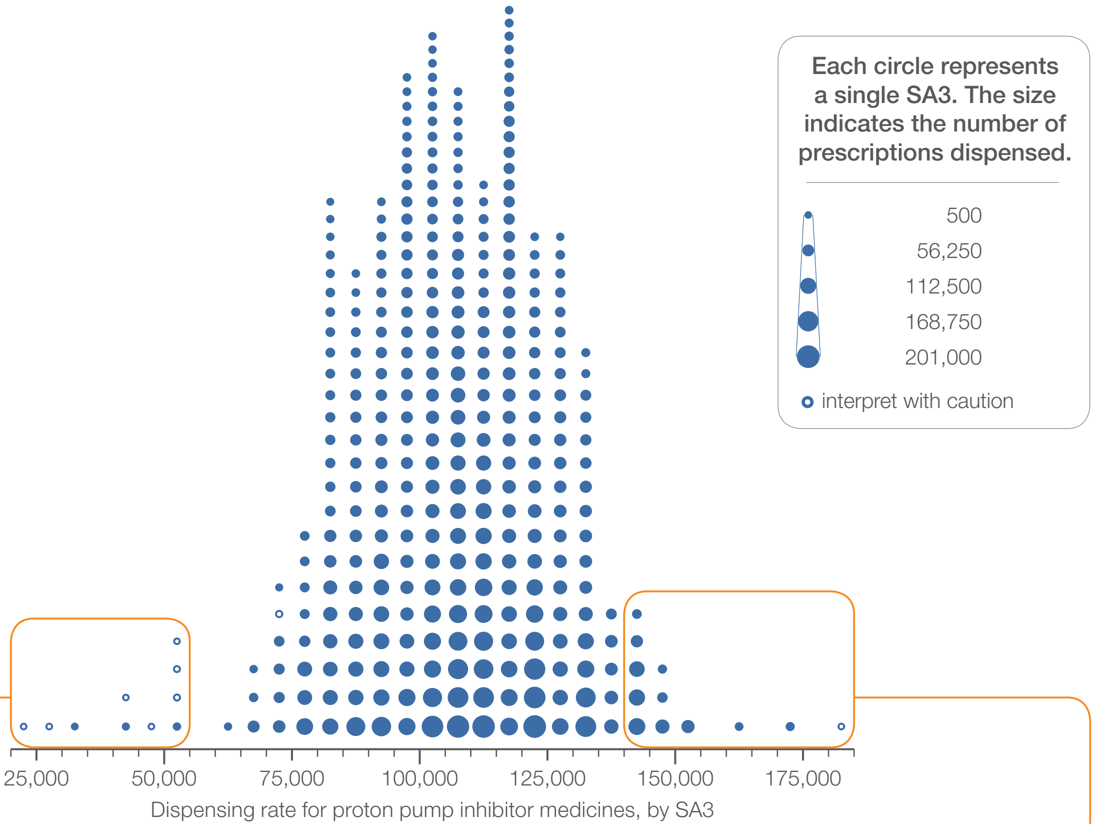
Over the same period, a national program to improve the quality of PPI medicines use was conducted with all GPs at three points. Elements of the program included academic detailing, prescribing recommendations, audit and feedback, and peer meetings including presentations.[24]

The combination and repetition of these strategies were thought to be key to the success in the veterans population.[24] Using a similar multifaceted approach, with repetition, in a wider population of adult PPI medicine users and their health professionals could be effective in improving appropriate use of PPI medicines in Australia.

Quality improvement interventions in hospitals could improve appropriateness of care in this setting, and could have a flow-on effect to prescribing in the community, as hospital recommendations for PPI medicines use may influence PPI medicines use after discharge.[1]

Rates by local area

Figure 2.19: Number of PBS prescriptions dispensed for proton pump inhibitor medicines per 100,000 people aged 18 years and over, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2016–17



Lowest rate areas

SA3	State	Rate	Prescriptions
East Arnhem	NT	**21,765***	1,389
Daly - Tiwi - West Arnhem	NT	**28,709***	2,540
Katherine	NT	**34,489**	3,833
Christmas Island	OT	**40,006***	458
Kimberley	WA	**43,023**	8,465
Barkly	NT	**48,081***	1,357
East Pilbara	WA	**52,214***	5,883
Alice Springs	NT	**52,876**	11,836
Norfolk Island	OT	**52,947***	1,160
West Pilbara	WA	**54,586***	7,170

Highest rate areas

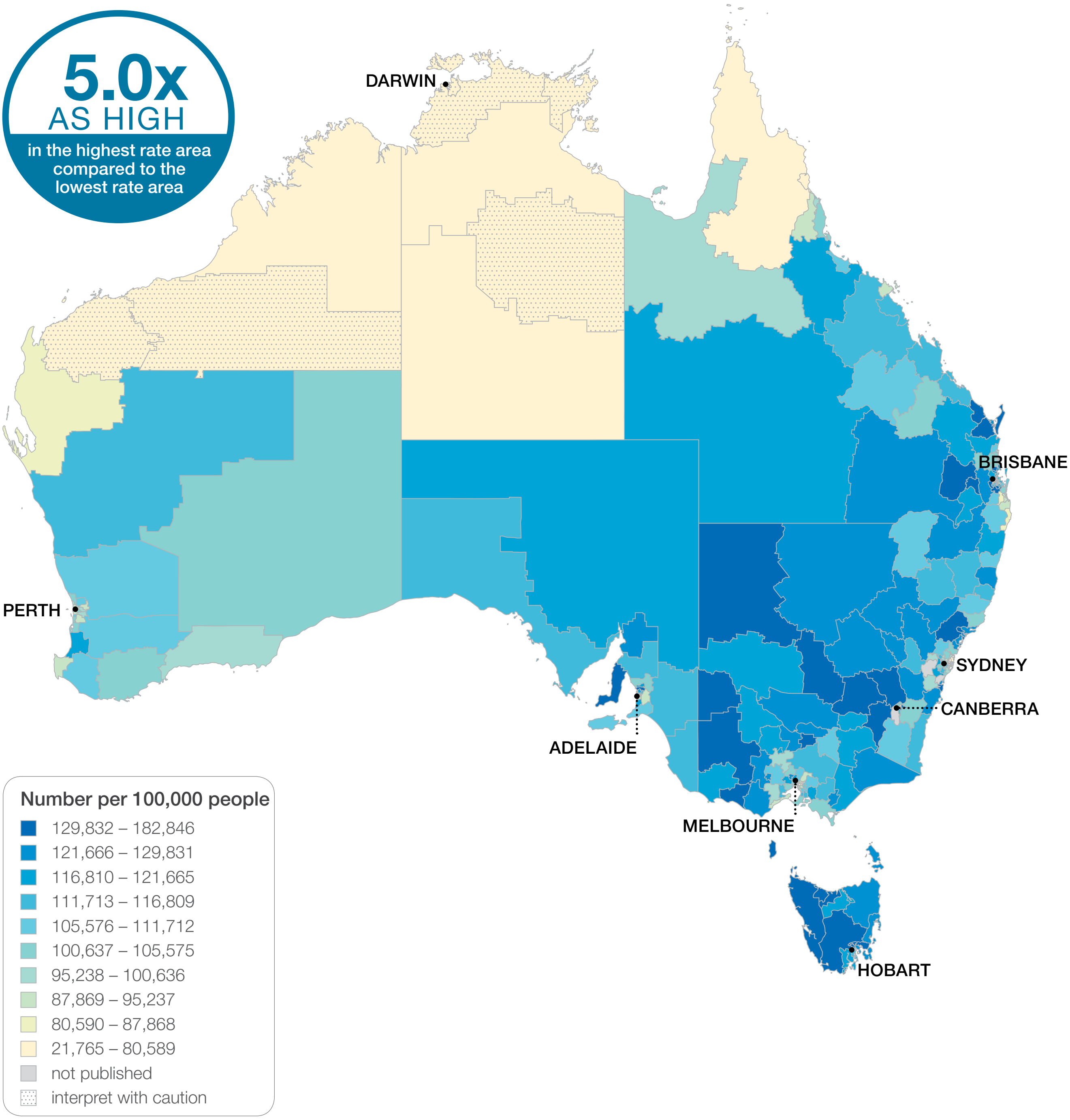
SA3	State	Rate	Prescriptions
Canberra East	ACT	**182,846***	1,923
Brighton	Tas	**172,780**	21,338
Central Highlands (Tas.)	Tas	**163,948**	16,813
Hobart - North West	Tas	**154,053**	75,396
Jimboomba	Qld	**147,767**	39,397
Sorell - Dodges Ferry	Tas	**147,423**	22,622
Maitland	NSW	**145,767**	87,845
Wagga Wagga	NSW	**143,082**	124,185
Ipswich Inner	Qld	**141,639**	116,319
Griffith - Murrumbidgee (West)	NSW	**141,624**	62,654
Broken Hill and Far West	NSW	**141,460**	29,573
Lower Hunter	NSW	**140,953**	107,185

Notes:
Hollow circles (○) and asterisks (*) indicate rates that are considered more volatile than other published rates and should be interpreted with caution.
OT represents other territories.
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of Pharmaceutical Benefits Scheme data and ABS Estimated Resident Population 30 June 2016.

Proton pump inhibitor medicines dispensing, 18 years and over

Rates across Australia

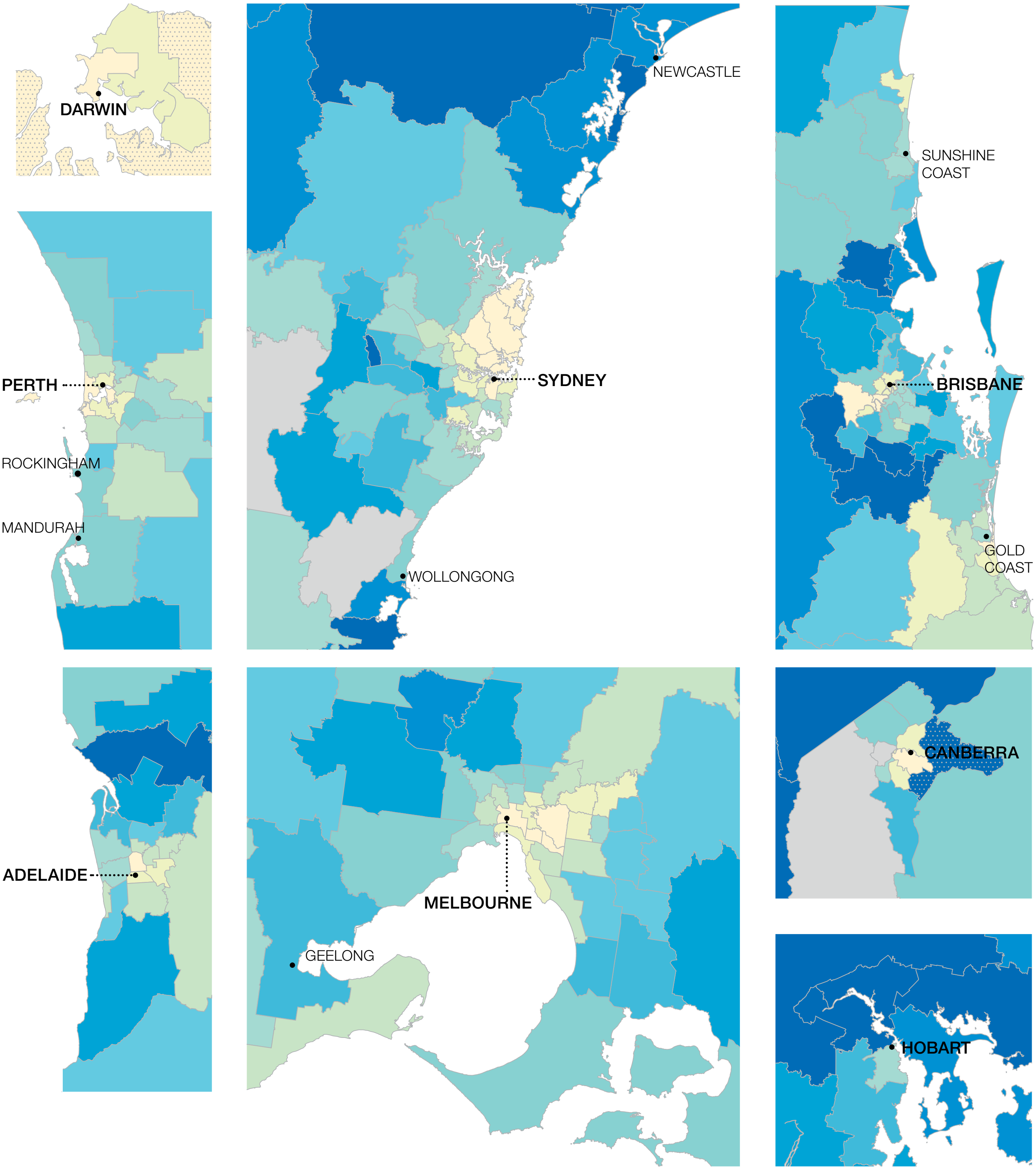
Figure 2.20: Number of PBS prescriptions dispensed for proton pump inhibitor medicines per 100,000 people aged 18 years and over, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2016–17



Notes:
Dotted areas indicate rates that are considered more volatile than other published rates and should be interpreted with caution. These rates are excluded from the calculation of the difference between the highest and lowest SA3 rates in Australia.
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of Pharmaceutical Benefits Scheme data and ABS Estimated Resident Population 30 June 2016.

Rates across capital city areas

Figure 2.21: Number of PBS prescriptions dispensed for proton pump inhibitor medicines per 100,000 people aged 18 years and over, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2016–17



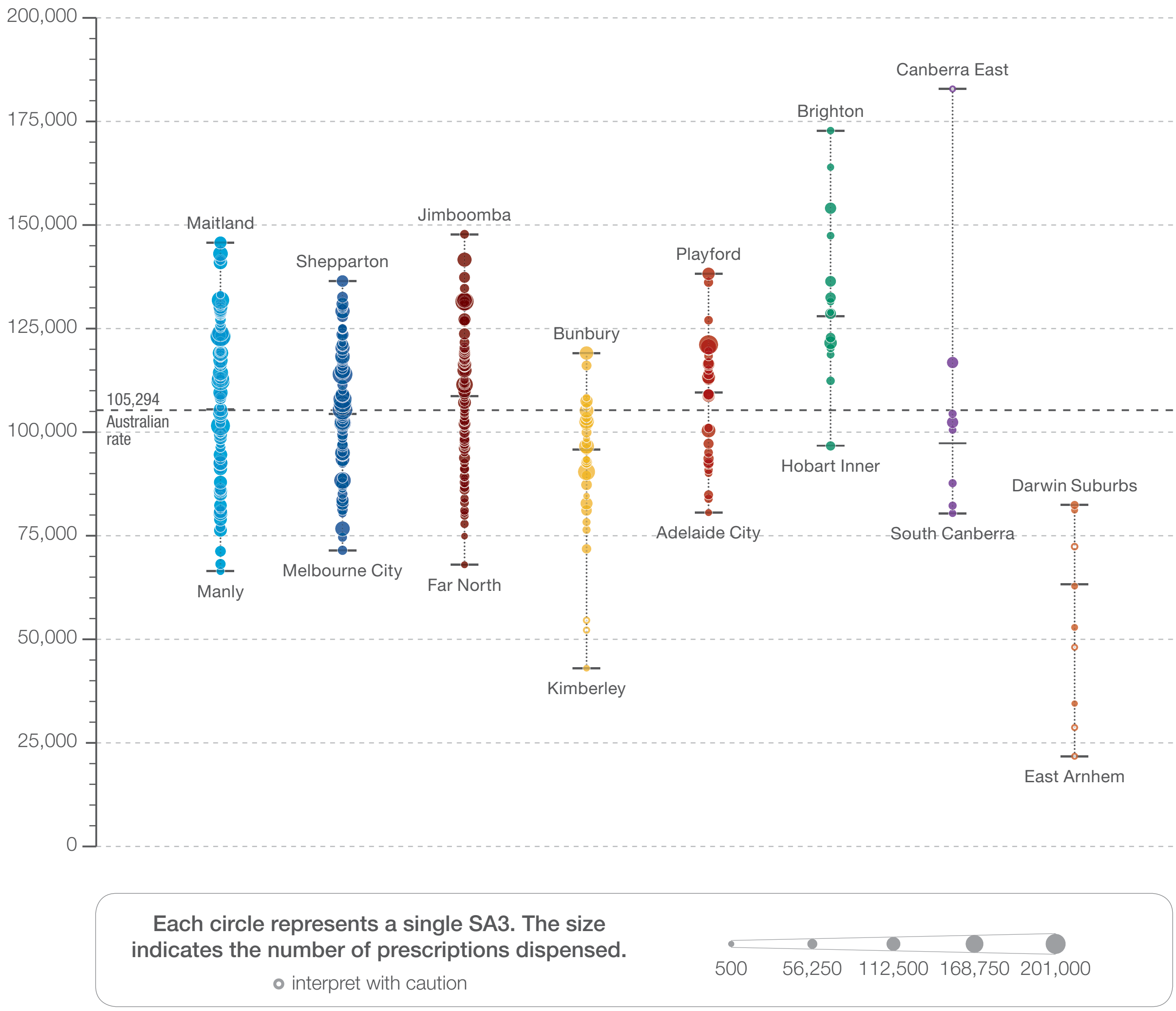
Notes:
Dotted areas indicate rates that are considered more volatile than other published rates and should be interpreted with caution.
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of Pharmaceutical Benefits Scheme data and ABS Estimated Resident Population 30 June 2016.

Proton pump inhibitor medicines dispensing, 18 years and over

Rates by state and territory

Figure 2.22: Number of PBS prescriptions dispensed for proton pump inhibitor medicines per 100,000 people aged 18 years and over, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2016–17

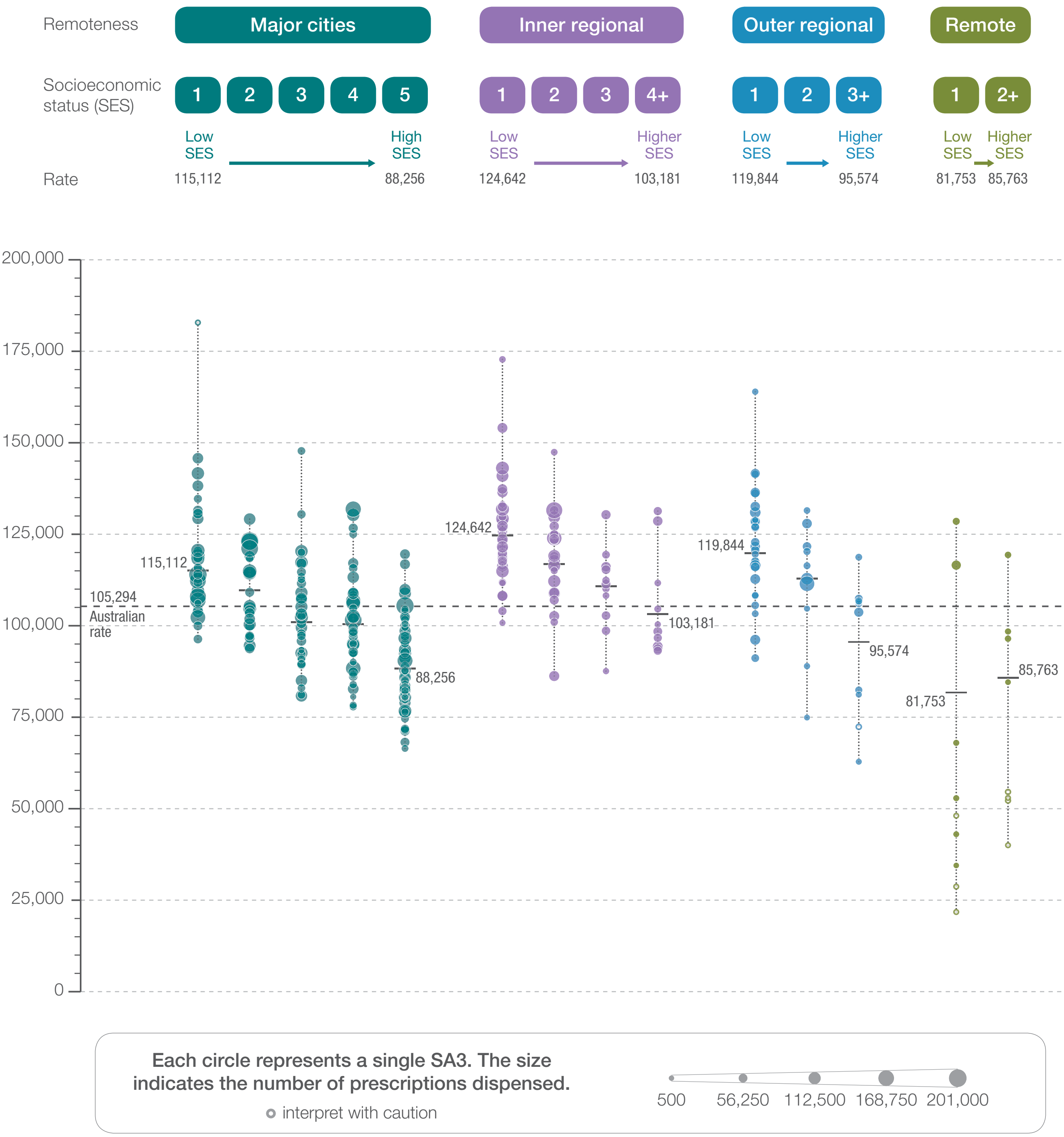
	NSW	Vic	Qld	WA	SA	Tas	ACT	NT
Highest rate	145,767	136,475	147,767	119,093	138,226	172,780	182,846*	82,423
State/territory	105,543	104,408	108,660	95,806	109,527	127,993	97,312	63,230
Lowest rate	66,462	71,488	67,992	43,023	80,589	96,691	80,420	21,765*
No. prescriptions	7,159,289	5,482,136	4,384,675	1,948,629	1,770,298	646,894	288,088	83,684



Notes:
Hollow circles (○) and asterisks (*) indicate rates that are considered more volatile than other published rates and should be interpreted with caution.
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of Pharmaceutical Benefits Scheme data and ABS Estimated Resident Population 30 June 2016.

Rates by remoteness and socioeconomic status

Figure 2.23: Number of PBS prescriptions dispensed for proton pump inhibitor medicines per 100,000 people aged 18 years and over, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2016–17



Notes:
Hollow circles (○) indicate rates that are considered more volatile than other published rates and should be interpreted with caution.
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of Pharmaceutical Benefits Scheme data and ABS Estimated Resident Population 30 June 2016.

Proton pump inhibitor medicines dispensing, 18 years and over

Resources

- NPS MedicineWise, 'Starting, stepping down and stopping medicines – PPIs' program, includes educational visiting program for GPs, online clinical audit[29], information for prescribers[30] and a consumer resource *Managing Your Medicine for Reflux and Heartburn*[31]
- Primary Health Tasmania, *A Guide to Deprescribing Proton Pump Inhibitors*[3]
- Veterans' MATES (Medicines Advice and Therapeutics Education Services), information for consumers and health professionals[32]
- *Therapeutic Guidelines: Gastointestinal*[6]
- Gastroenterological Society of Australia, *Gastro-oesophageal Reflux in Adults: Clinical update*[8]
- National Institute for Health and Care Excellence, Gastro-oesophageal Reflux Disease and Dyspepsia in Adults: Investigation and management (clinical guideline).[33]

Australian initiatives

The information in this chapter will complement work already under way to improve the appropriateness of PPI medicine use in Australia. At a national level, this work includes:

- NPS MedicineWise, 'Starting, stepping down and stopping medicines – PPIs' program (includes educational visiting program for GPs, online clinical audit[29], information for prescribers[30] and a consumer resource *Managing Your Medicine for Reflux and Heartburn*[31])
- Veterans' MATES, Department of Veterans' Affairs, series of initiatives to improve PPI use[24]
- Royal Australian College of General Practitioners, Choosing Wisely recommendation 1: Don't use PPIs long term in patients with uncomplicated disease without regular attempts at reducing dose or ceasing[27]
- Gastroenterological Society of Australia, and Choosing Wisely recommendation 3: Do not continue prescribing long term PPI medication to patients without attempting to reduce the medication down to the lowest effective dose or cease the therapy altogether[26]
- Pharmaceutical Benefits Advisory Committee, recommendations in 2018 to change PBS restriction levels for some PPIs, including authority requirement for higher-dose esomeprazole and streamlined authority requirement for standard-dose PPIs, and reduction of the number of repeats for some PPIs to align with recommended duration of treatment.[34]

Many state and territory initiatives are also in place to improve the appropriateness of PPI medicines use, including:

- Primary Health Tasmania, *A Guide to Deprescribing Proton Pump Inhibitors*[3], deprescribing workshops for a number of medicines including PPIs, and Health Pathways for dyspepsia and heartburn/GORD
- Western Australia, Choosing Wisely initiative conducted in five hospitals.

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Chapter 3
Thyroid investigations and treatments

At a glance

Thyroid function testing

Measuring thyroid stimulating hormone (TSH) is recommended as the single first-line test for possible thyroid dysfunction. More comprehensive tests of thyroid function – TSH plus free tri-iodothyronine (T3) and/or free thyroxine (T4) – are recommended only if TSH is abnormal or for investigation of certain conditions. The rate of thyroid function testing has increased in Australia, faster than the rate of population growth. The fast growth and high rate of thyroid testing in Australia suggest that there is over-testing.

The Atlas found that, in 2016–17, 5.5 million TSH tests and 2.3 million thyroid function tests (TSH plus T3 and/or T4) were ordered in Australia. This is likely to be an underestimate of testing rates, because of the way data are captured.

Improved policies for collecting Medicare Benefits Schedule data would allow a better understanding of publicly funded thyroid function testing across Australia.

Neck ultrasound and thyroidectomy

Neck ultrasound can be used to investigate suspected disease of the thyroid gland, including the examination of thyroid nodules (or lumps) for possible cancer. One of the reasons for thyroidectomy (removal of the thyroid) is to treat malignant thyroid nodules. Some small thyroid cancers (thyroid papillary microcarcinomas) have a very low risk of harm if left untreated. The benefit to patients of detecting and managing these is unclear.

The Atlas found that the rate of neck ultrasound varies up to six-fold, and the rate of thyroidectomy varies up to five-fold, between local areas in Australia. Underlying patterns of disease are unlikely to fully explain the variations seen.

Australia and other developed countries have seen a substantial rise in thyroid cancer incidence in the past three decades. In some developed countries, this rise has been clearly driven by increased detection and investigation of small, low-risk thyroid cancers, which has led to a rise in thyroidectomy. Although detection of more small, low-risk thyroid cancers does not fully explain the rising incidence of thyroid cancer in Australia, experiences from other countries highlight the importance of ensuring appropriate use of ultrasound for investigating the thyroid, and thyroidectomy.

Recommendations

Thyroid function tests

3a. The Medicare Benefits Schedule (MBS) Review Taskforce to advise on how the data collected by the MBS could provide clinically meaningful information to allow regular audit and feedback to clinicians on the appropriateness of use of tests, as well as accurate public reporting on use of healthcare resources. In relation to thyroid function tests, the taskforce could advise on:

- i Changes to rules related to data suppression due to provider confidentiality and changes to reporting of episode coning*
- ii Creating an MBS item specific for ultrasound investigation of the thyroid.

Neck ultrasound

3b. Relevant colleges and clinical societies to agree on a nationally consistent approach to providing standardised, high-quality thyroid ultrasound reports, such as using the ATA (American Thyroid Association) guidelines or the TI-RADS (Thyroid Imaging Reporting and Data System) score to support general practitioner decision-making and help reduce unnecessary repeat ultrasounds.

* Episode coning in the MBS means that when more than three tests are requested by a general practitioner (GP) per patient attendance, benefits are paid only for the three tests with the highest fees. If a GP requests a test with three other more expensive tests, it is 'coned out' and may not be included in the MBS dataset.

3.1 Thyroid function testing

Thyroid stimulating hormone tests

Thyroid function tests

Why is this important?

The number of people having thyroid function testing in Australia has increased faster than the rate of population growth. Between 2012 and 2017, the number of people with Medicare Benefits Scheduled (MBS) claims for thyroid function testing increased by 5.7% per year, compared with 1.6% per year growth in the population.[1,2] The fast growth of thyroid function testing in Australia suggests that there is over-testing.

Measuring thyroid stimulating hormone (TSH) is recommended as the single first-line test for possible thyroid dysfunction.[3] Thyroid function tests (TFTs) – measuring TSH plus free tri-iodothyronine (T3) and/or free thyroxine (T4) – are recommended only if TSH is abnormal or for investigation of certain conditions.[3]

What did we find?

The ability to examine variation in thyroid function testing is restricted by episode coning* (a funding arrangement that applies to MBS data), and MBS data confidentiality requirements.

In 2016–17, 5.5 million TSH tests and 2.3 million TFTs (TSH plus T3 and/or T4) were recorded in the MBS dataset in Australia. The data do not capture the full extent of testing in the community because of episode coning. The Atlas found the rates of both TSH tests and TFTs vary up to about three-fold between local areas in Australia. This is likely to be an underestimate of the true variation across Australia, due to the impact of confidentiality rules on reporting.

What can be done?

Improved policies and arrangements for collection and reporting of MBS data would allow a better understanding of thyroid function testing across Australia. The appropriateness of testing and the benefits gained from these tests could be increased by audit and feedback to clinicians on requesting of tests; increasing access to previous test results with a central repository; changing protocols for further laboratory testing after an initial TSH measurement; and educating general practitioners and consumers.

* Episode coning is a funding arrangement that applies to some MBS pathology items; data confidentiality requirements are rules for protecting the confidentiality of patients and providers. See 'About the data' for more information.

Thyroid function testing

Context

This section includes data on the use of thyroid function testing in adults. It examines two items:

- Thyroid stimulating hormone (TSH) tests: TSH alone[†]
- Thyroid function tests (TFTs): TSH in combination with free tri-iodothyronine (T3) and/or free thyroxine (T4).

These tests are used to diagnose thyroid dysfunction, such as hypothyroidism (underactive thyroid) and hyperthyroidism (overactive thyroid), and to monitor the response to treatment. They are also used to monitor patients taking other medicines that affect thyroid function.[3]

Thyroid dysfunction is common; the prevalence of hypothyroidism is 3.1% to 5.6%, and the prevalence of hyperthyroidism is 0.4% to 1.3%, in the adult population.[4-6] Thyroid function testing can be used to investigate common problems that may indicate underlying thyroid disease, such as unexplained weight change, fertility problems, menstrual changes, goitre, depression and anxiety, as well as non-specific symptoms such as tiredness.[3] Thyroid function testing may also be performed as part of investigations for older patients with symptoms of dementia or other behavioural changes. The most common reasons for Australian general practitioners (GPs) to request thyroid function testing are hypothyroidism (13.4%) and hyperthyroidism (4.3%), weakness or tiredness (9.4%), and general check-ups (4.9%).[7]

Some variation in the rate of thyroid function testing due to differences in clinical judgement is expected.[8] Symptoms prompting investigation of thyroid disease can be non-specific and subtle.[3,9] However, population screening of asymptomatic patients for thyroid dysfunction is not recommended.[10]

Measuring TSH alone is recommended as the first-line test in most situations to investigate possible thyroid dysfunction.[3] If the TSH level is abnormal, measurement of T4 and possibly T3 may be appropriate to provide further information.[3] In some situations (for example, known or suspected pituitary disease), initial measurement of TSH plus either T3 or T4 is appropriate.[3]

The number of people having thyroid function testing in Australia has increased faster than the rate of population growth. The number of people with MBS claims for thyroid function testing grew by 5.7% per year, compared with approximately 1.6% per year growth in population, between 2012 and 2017.[1,2] GPs request the majority of TSH tests and TFTs in Australia. In 2014–15, they requested approximately 90% of TSH tests and 75% of TFTs.[1] Variation in GPs' requesting rates for thyroid tests has been noted previously, as a small number of GPs have a substantially higher rate of requesting than the average. In 2014–15, the average rate of TSH testing by GPs in Australia was 7 per 100 patients; however, a group of 310 GPs had a rate of between 40 and 173 TSH tests per 100 patients.[1]

Few directly comparable rates of TSH testing are available from other countries, but a study in the United Kingdom found that 12% of patients in a general practice had TSH testing in 2012.[8] Only 2% of the patients had an abnormal result, suggesting that testing could be better targeted without missing diagnoses.[8] Rising rates of thyroid function testing, and large variation in use, have been noted in several countries, and inappropriate requests for tests have been suggested as an important cause.[8,11] Interventions to improve the quality of requesting for thyroid function testing have also been implemented around the world.[12]

† Includes MBS item numbers for TSH tests that do not include testing for T3 or T4.

The MBS Review Taskforce recently recommended a number of changes to MBS items to support appropriate thyroid function testing, as well as education programs for GPs and consumers on appropriate use of TSH tests.[1] The Choosing Wisely initiative includes a Royal Australian College of General Practitioners 'Do not do' recommendation for GPs: 'Don't test thyroid function as population screening for asymptomatic patients'.[10]

About the data

Data are sourced from the MBS dataset. This dataset includes information on MBS claims processed by the Australian Government Department of Human Services. It covers a wide range of services (attendances, procedures, tests) provided across primary care and hospital settings.

The dataset does not include:

- Services for publicly funded patients in hospitals
- Services for patients in hospital outpatient clinics where claims are not made to the MBS
- Services covered under Department of Veterans' Affairs arrangements.

Rates are based on the number of MBS-subsidised services for TSH tests or TFTs per 100,000 people aged 18 years and over in 2016–17.

Because an MBS claim is included for each service rather than for each patient, patients who receive any of the services listed in this data item more than once in the financial year will have more than one MBS claim counted.

The analysis and maps are based on the residential address of the patient recorded in the MBS claim and not the location of the service.

Rates are age and sex standardised to allow comparisons between populations with different age and sex structures.

This analysis was not undertaken by Aboriginal and Torres Strait Islander status because this information was not available for MBS data at the time of publication.

Episode coning

MBS items for TSH tests and TFTs are subject to episode coning. Episode coning is an MBS funding arrangement that applies to GPs outside hospitals requesting multiple tests for the same patient on the same day. If more than three items are requested by a GP per patient attendance, benefits are paid only for the three items with the highest fees. The arrangement means that, if a test is requested with three other more expensive tests, it is 'coned out' and may not be included in the MBS dataset. As the MBS fee for TFTs is higher than for TSH tests, TFT data are less affected by this arrangement.

Data suppression

For all MBS items in the Atlas, some data have been suppressed to manage volatility and confidentiality. This process takes into account the Australian Government Department of Health's requirements for reporting MBS data (see the Technical Supplement).

The process has resulted in particularly marked data suppression for MBS items for thyroid function testing. This is indicated on the maps in grey. Most local areas (Statistical Area Level 3 – SA3) were suppressed to prevent identification of the provider (practitioner or business entity). The effect of data suppression was greatest in outer regional and remote areas.

Thyroid function testing

For TSH tests:

- Overall, 53 SA3s were suppressed, which represents 16% of all SA3s and 10% of all services
- 43 SA3s were suppressed to prevent identification of the provider
- The proportion of SA3s suppressed in each remoteness category was 7% in major cities, 24% in inner regional areas, 26% in outer regional areas and 37% in remote areas.

For TFTs:

- Overall, 79 SA3s were suppressed, which represents 23% of all SA3s and 18% of all services
- 67 SA3s were suppressed to prevent identification of the provider
- The proportion of SA3s suppressed in each remoteness category was 16% in major cities, 26% in inner regional areas, 36% in outer regional areas and 47% in remote areas.

What do the data show?

Thyroid stimulating hormone tests

Magnitude of variation

In 2016–17, there were 5,539,805 MBS-subsidised services for TSH tests, representing 28,742 services per 100,000 people aged 18 years and over (the Australian rate).

The number of MBS-subsidised services for TSH tests across 287[§] local areas (Statistical Area Level 3 – SA3) ranged from 15,735 to 40,814 per 100,000 people aged 18 years and over. The rate was **2.6 times as high** in the area with the highest rate compared to the area with the lowest rate. The number of services varied across states and territories, from 20,106 per 100,000 people aged 18 years and over in Tasmania to 30,640 in New South Wales (Figures 3.4–3.7).

After the highest and lowest 10% of results were excluded and 231 SA3s remained, the number of services per 100,000 people aged 18 years and over was 1.6 times as high in the area with the highest rate compared to the area with the lowest rate.

Analysis by remoteness and socioeconomic status

Rates of TSH tests were higher in major cities and in inner regional areas than in outer regional and remote areas. Rates were higher in areas with lower socioeconomic status in major cities, inner regional areas and outer regional areas. The pattern was less clear in remote areas (Figure 3.8).

[§] There are 340 SA3s. For this item, data were suppressed for 53 SA3s due to one or more of a small number of services or population in an area, or potential identification of individual patients, practitioners or business entities.

Notes:

Some of the published SA3 rates were considered more volatile than others. These rates are excluded from the calculation of the difference between the highest and lowest SA3 rates in Australia.

For further detail about the methods used, please refer to the Technical Supplement.

Thyroid function tests

Magnitude of variation

In 2016–17, there were 2,344,089 MBS-subsidised services for TFTs, representing 12,116 services per 100,000 people aged 18 years and over (the Australian rate).

The number of MBS-subsidised services for TFTs across 261[#] local areas (Statistical Area Level 3 – SA3) ranged from 6,425 to 16,077 per 100,000 people aged 18 years and over. The rate was **2.5 times as high** in the area with the highest rate compared to the area with the lowest rate. The number of services varied across states and territories, from 8,868 per 100,000 people aged 18 years and over in the Northern Territory to 13,866 in the Australian Capital Territory (Figures 3.9–3.12).

After the highest and lowest 10% of results were excluded and 209 SA3s remained, the number of services per 100,000 people aged 18 years and over was 1.6 times as high in the area with the highest rate compared to the area with the lowest rate.

Analysis by remoteness and socioeconomic status

Rates of TFTs were markedly lower in remote areas than in other areas. There was no clear pattern according to socioeconomic status. Suppressed data are included in the calculation of overall rates by remoteness and socioeconomic status (Figure 3.13).

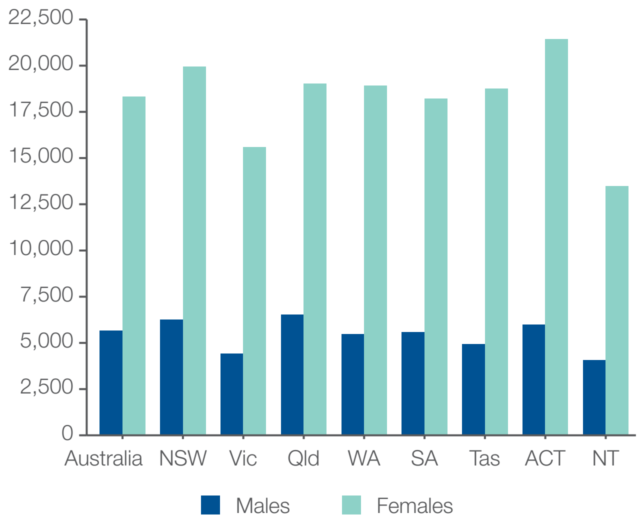
Analysis by sex

Rates of TFTs were 3.2 times as high in females as in males.

In 2016–17, there were 558,142 MBS-subsidised services for TFTs for males aged 18 years and over, representing 5,656 services per 100,000 males (the Australian rate). The number of services varied across states and territories, from 4,072 per 100,000 males in the Northern Territory to 6,527 per 100,000 males in Queensland (Figure 3.1).

In 2016–17, there were 1,785,947 MBS-subsidised TFTs for females aged 18 years and over, representing 18,341 services per 100,000 females (the Australian rate). The number of services varied across states and territories, from 13,490 services per 100,000 females in the Northern Territory to 21,449 per 100,000 females in the Australian Capital Territory (Figure 3.1).

Figure 3.1: Number of MBS-subsidised services for thyroid function tests per 100,000 people aged 18 years and over, age standardised, by state and territory of patient residence, by sex, 2016–17



The data for Figure 3.1 are available at www.safetyandquality.gov.au/atlas

There are 340 SA3s. For this item, data were suppressed for 79 SA3s due to one or more of a small number of services or population in an area, or potential identification of individual patients, practitioners or business entities.

Notes:

Some of the published SA3 rates were considered more volatile than others. These rates are excluded from the calculation of the difference between the highest and lowest SA3 rates in Australia.

For further detail about the methods used, please refer to the Technical Supplement.

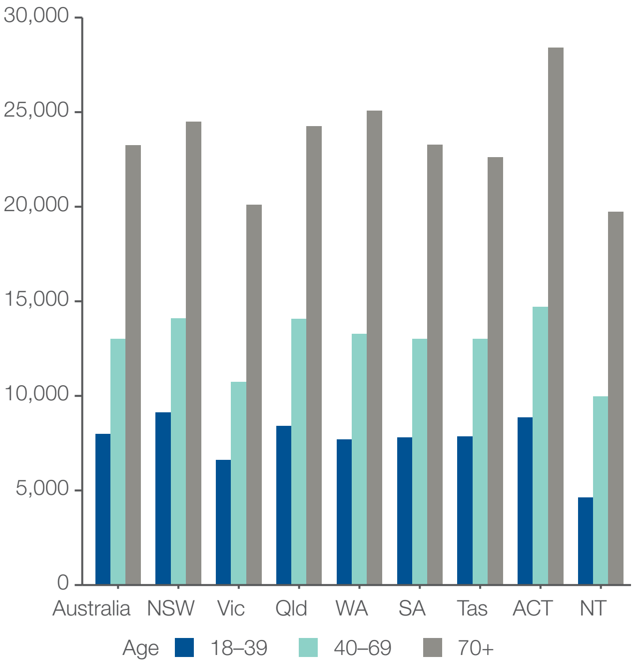
Sources: AIHW analysis of Medicare Benefits Schedule data and ABS Estimated Resident Population 30 June 2016.

Thyroid function testing

Analysis by age group

Rates of TFTs were highest for the 70 years and over age group (23,258 services per 100,000 people). The number of services for this age group varied across states and territories, from 19,735 per 100,000 people in the Northern Territory to 28,407 per 100,000 people in the Australian Capital Territory. The rate for the 70 years and over age group was 1.8 times as high as the rate for the 40–69 years age group and 2.9 times as high as the rate for the 18–39 years age group (Figure 3.2).

Figure 3.2: Number of MBS-subsidised services for thyroid function tests per 100,000 people in specific age group, age and sex standardised, by state and territory of patient residence, 2016–17

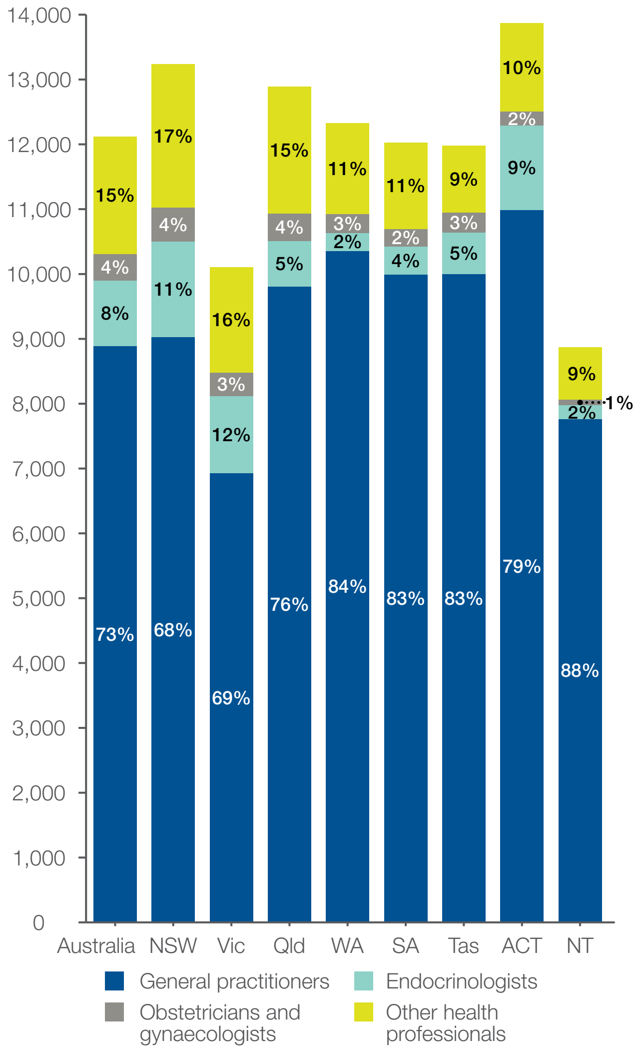


The data for Figure 3.2 and 3.3 are available at www.safetyandquality.gov.au/atlas

Analysis by referrer type

GPs ordered 73% of TFTs in Australia, endocrinologists ordered 8%, obstetricians and gynaecologists ordered 4%, and other health professionals ordered 15%. The proportion ordered by GPs varied from 68% in New South Wales to 88% in the Northern Territory (Figure 3.3).

Figure 3.3: Number of MBS-subsidised services for thyroid function tests per 100,000 people aged 18 years and over, age and sex standardised, by state and territory of patient residence, by referrer type, 2016–17



Notes:
Specialty of referrer was derived for some records for which this information was unknown.
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of Medicare Benefits Schedule data and ABS Estimated Resident Population 30 June 2016.

Interpretation

Variation in rates of thyroid function testing is likely to be due to geographical differences in the factors discussed below.

Clinical decision-making

Rates of thyroid function testing will be influenced by clinicians' adherence to guidelines – for example, different approaches to screening patients with TFTs, or the frequency and appropriateness of repeat testing for certain conditions. Clinicians' decision-making, and how clinicians respond to patient requests for testing, also influence requesting of tests.[13]

Clinical information systems may affect the choice of tests. For example, if a short-cut menu in GP software lists TSH tests in combination with TFTs, then it is likely that fewer standalone TSH tests will be ordered.

Rates of underlying disease

Variation is warranted and desirable when it reflects variation in the underlying need for care. Areas with higher rates of thyroid disease, conditions that affect the thyroid such as diabetes, and other symptoms for which TFTs are indicated, are expected to have higher rates of thyroid function testing. Rates of thyroid dysfunction are affected by the local prevalence of iodine deficiency, as iodine is essential for production of thyroid hormones.[14] Tasmania had the highest rate of iodine deficiency in Australia in 2011–12, and Western Australia had the lowest.[14] Iodine deficiency was also more common in inner regional areas of Australia than in major cities (15.4% compared with 11.9%).[14]

Health conditions that are more common in areas of socioeconomic disadvantage, such as obesity, depression and anxiety, may have contributed to the higher rates of TSH testing seen in these areas. TSH testing is recommended for patients with unexplained weight change and tiredness.[3,15]

Access to services

Population groups with more frequent GP visits, and those with greater geographic access to a GP and the ability to pay out-of-pocket costs may be more likely to have thyroid function testing.

Availability of previous test results

Difficulty in accessing previous results of thyroid function testing may contribute to requests for repeat tests.[13] MBS data from 2014 showed that 38% of patients had a repeat TSH test within 12 months of their first test.[1] Ease of access to previous results in computerised record systems may vary and influence local rates of testing.

Episode coning

There are no published data on the extent of episode coning for TSH tests and TFTs. It is also unclear if the proportion of tests 'coned out' varies across the country. Refer to 'About the data' for more information on episode coning.

Pathology provider practices

Differences in pathology provider practices may be a source of variation. For example, recommendations about repeat testing may vary between pathology providers.

Thyroid function testing

Promoting appropriate care

High rates of thyroid function testing in Australia, and the variation between practitioners noted by the MBS Review Taskforce, suggest that standardising practice could have benefits for sustainability of the health system. Successful interventions to improve the quality of requesting for thyroid function testing have included audit and feedback, guidelines, changes to funding policy and educational programs.[12]

The MBS Review Taskforce recently recommended that several of these interventions be put in place to improve the quality of thyroid function testing in general practice: education programs for GPs and consumers, and an audit and feedback program for GPs.[1] The MBS Review Taskforce also recommended changing MBS item descriptors to align with guidelines.[1]

Other strategies that have been suggested for improving the quality of TFT use include a role for laboratories in managing the timing of follow-up TSH testing, improving access to previous test results and narrowing the range of TSH levels that would trigger testing of T4.[13,16,17]

Timing of repeat testing

The appropriateness of repeat TSH testing may deserve particular focus in education. Analysis of TSH testing in Tasmania between 1995 and 2013 showed that the rate of initial testing remained stable, but the rate of follow-up TSH tests increased four-fold.[18] The timing of repeat testing requested by GPs may not align well with guidelines.[17] In a study of people taking levothyroxine therapy in the United Kingdom, the frequency of repeat TSH testing was too short, on average, for patients with normal initial TFT results, and too long for patients with abnormal test results.[17] Direct requesting of follow-up thyroid tests by laboratories (with the facility for override by clinicians) has been suggested as a way to bring patients more quickly to target TSH levels and reduce unnecessary testing.[17]

Access to previous results

Results of previous thyroid function testing requested within a practice, and by clinicians in other practices or in hospital, can be difficult to access.[13] Use of a central repository for test results, such as My Health Record, could reduce unnecessary repeat testing and duplicate requesting of pathology tests.

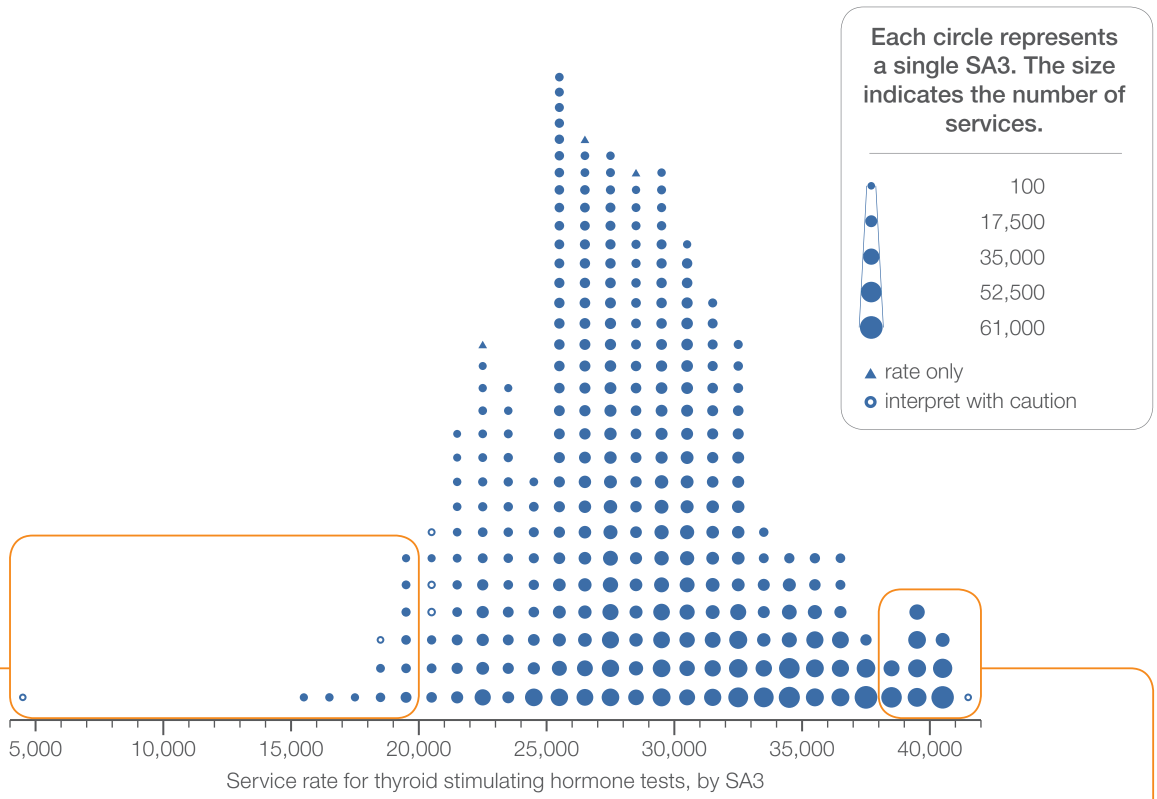
Cut-off levels for reflex testing

Laboratories often measure TSH alone in initial assessment of thyroid function, and measure T4 only if the TSH level is outside the reference range (reflex testing).[16] This means that T4 is measured only when an abnormal result is reasonably likely.[16] There is some evidence that changing the cut-off level of TSH that would trigger reflex testing could reduce the number of T4 tests without adversely affecting patient care.[16]

Thyroid stimulating hormone tests

Rates by local area

Figure 3.4: Number of MBS-subsidised services for thyroid stimulating hormone tests per 100,000 people aged 18 years and over, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2016–17



Lowest rate areas

SA3	State	Rate	Services
Norfolk Island	OT	**4,438***	76
Whitsunday	Qld	**15,735**	2,676
Far North	Qld	**16,950**	3,568
Snowy Mountains	NSW	**17,456**	2,906
Hobart Inner	Tas	**18,037**	7,802
Barkly	NT	**18,119***	666
Alice Springs	NT	**18,685**	5,264
Hobart - South and West	Tas	**19,048**	5,039
Hobart - North East	Tas	**19,053**	8,400
Tablelands (East) - Kuranda	Qld	**19,071**	6,690
Hobart - North West	Tas	**19,669**	8,472
Sorell - Dodges Ferry	Tas	**19,822**	2,623
Launceston	Tas	**19,995**	13,569

Highest rate areas

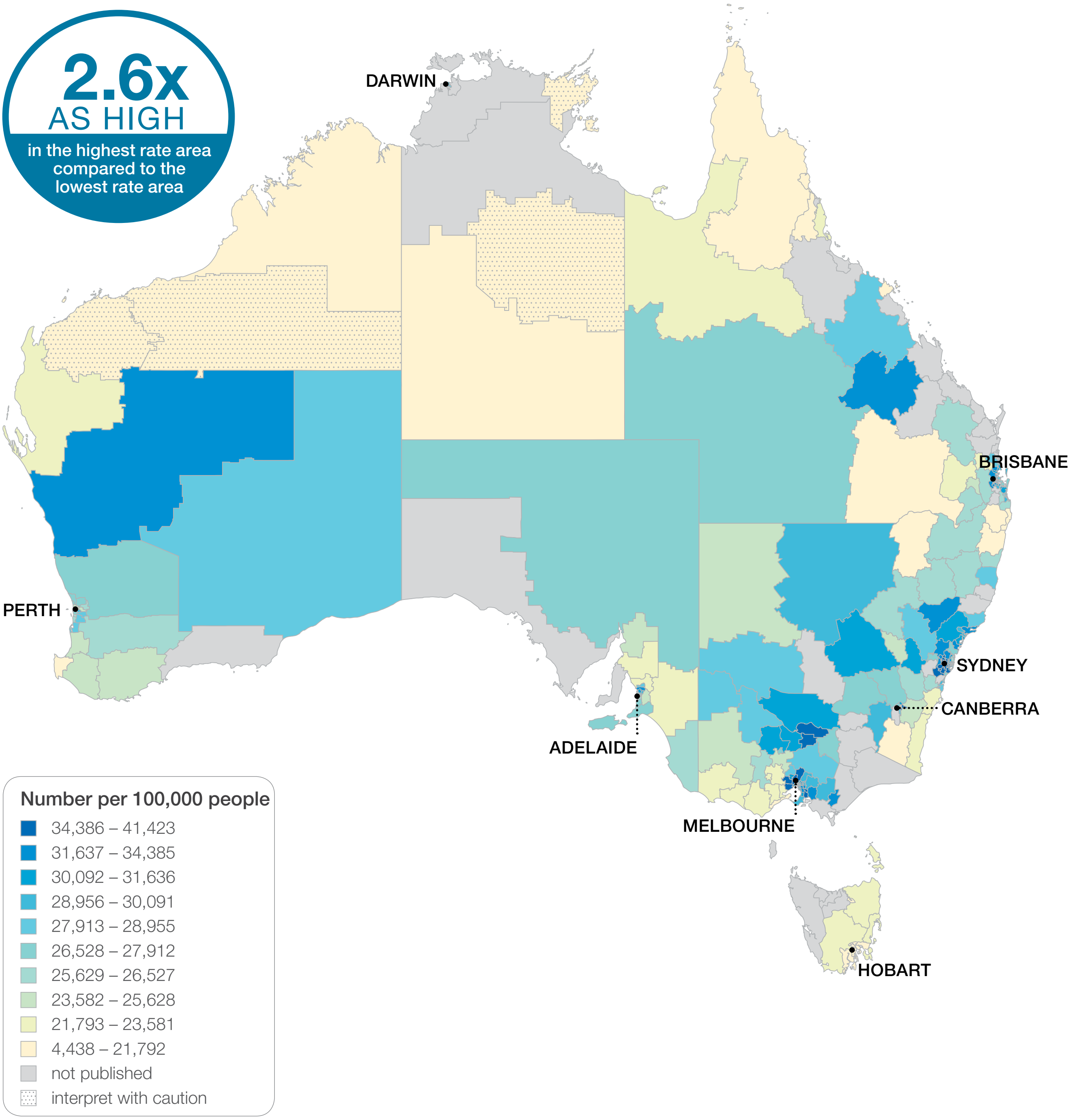
SA3	State	Rate	Services
Canberra East	ACT	**41,423***	421
Blacktown - North	NSW	**40,814**	25,640
Fairfield	NSW	**40,033**	60,113
Tullamarine - Broadmeadows	Vic	**40,033**	47,297
Mount Druitt	NSW	**39,753**	31,600
Merrylands - Guildford	NSW	**39,646**	45,486
Blacktown	NSW	**39,481**	41,021
Canterbury	NSW	**39,290**	42,061
Bankstown	NSW	**38,944**	52,385
Liverpool	NSW	**38,631**	33,999

Notes:
Hollow circles (○) and asterisks (*) indicate rates that are considered more volatile than other published rates and should be interpreted with caution.
Triangles (▲) indicate SA3s where only rates are published. The numbers of services are not published for confidentiality reasons.
OT represents other territories.
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of Medicare Benefits Schedule data and ABS Estimated Resident Population 30 June 2016.

Thyroid stimulating hormone tests

Rates across Australia

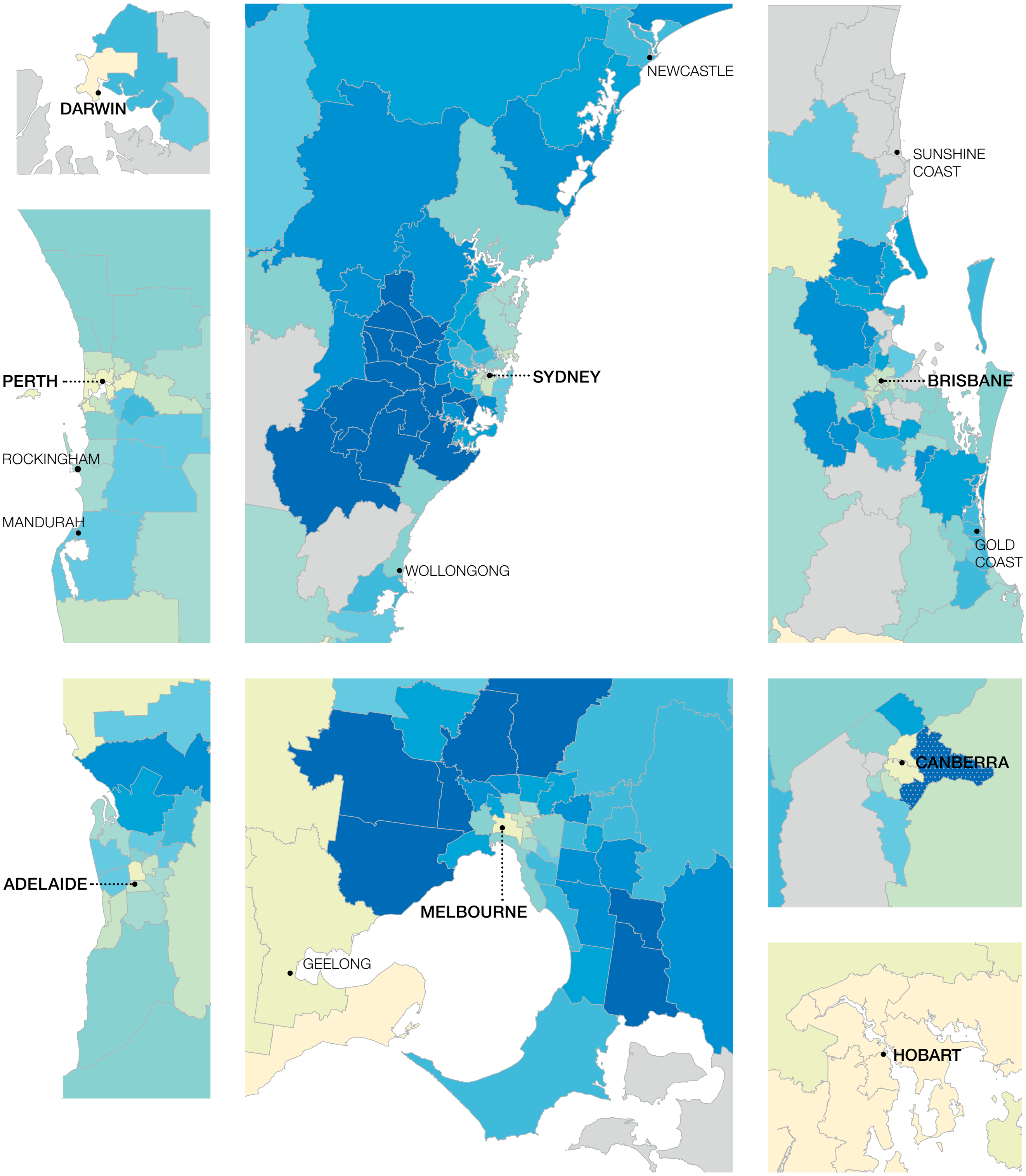
Figure 3.5: Number of MBS-subsidised services for thyroid stimulating hormone tests per 100,000 people aged 18 years and over, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2016–17



Notes:
Dotted areas indicate rates that are considered more volatile than other published rates and should be interpreted with caution. These rates are excluded from the calculation of the difference between the highest and lowest SA3 rates in Australia.
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of Medicare Benefits Schedule data and ABS Estimated Resident Population 30 June 2016.

Rates across capital city areas

Figure 3.6: Number of MBS-subsidised services for thyroid stimulating hormone tests per 100,000 people aged 18 years and over, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2016–17



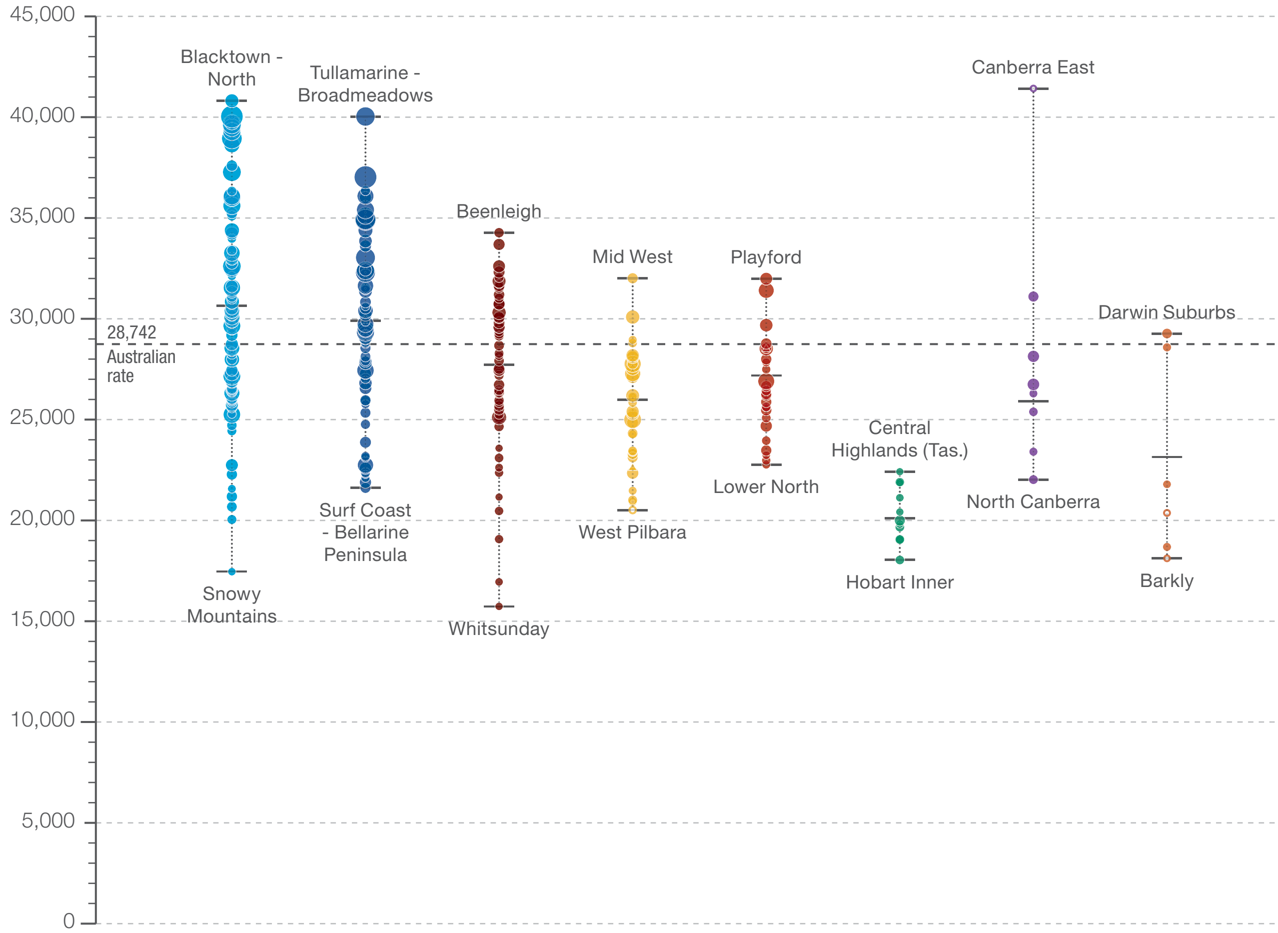
Notes:
Dotted areas indicate rates that are considered more volatile than other published rates and should be interpreted with caution.
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of Medicare Benefits Schedule data and ABS Estimated Resident Population 30 June 2016.

Thyroid stimulating hormone tests

Rates by state and territory

Figure 3.7: Number of MBS-subsidised services for thyroid stimulating hormone tests per 100,000 people aged 18 years and over, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2016–17

	NSW	Vic	Qld	WA	SA	Tas	ACT	NT
Highest rate	40,814	40,033	34,270	32,010	31,987	22,417	41,423*	29,270
State/territory	30,640	29,899	27,712	25,988	27,176	20,106	25,920	23,145
Lowest rate	17,456	21,613	15,735	20,515*	22,765	18,037	22,024	18,119*
No. services	1,906,486	1,471,039	1,055,392	514,853	386,639	87,638	79,354	37,837



Each circle represents a single SA3. The size indicates the number of services.

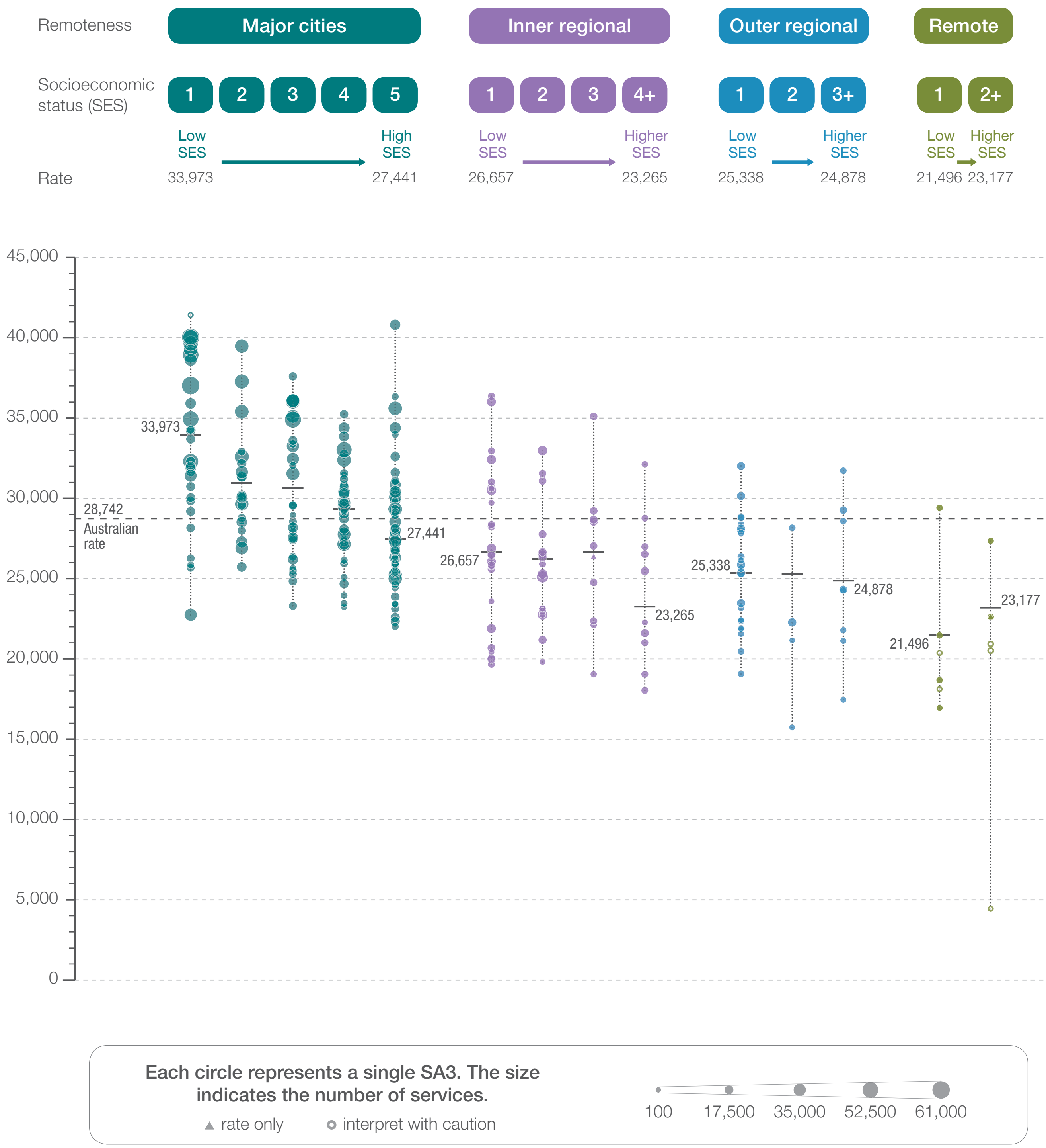
▲ rate only   ○ interpret with caution

100   17,500   35,000   52,500   61,000

Notes:
Hollow circles (○) and asterisks (*) indicate rates that are considered more volatile than other published rates and should be interpreted with caution.
Triangles (▲) indicate SA3s where only rates are published. The numbers of services are not published for confidentiality reasons.
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of Medicare Benefits Schedule data and ABS Estimated Resident Population 30 June 2016.

Rates by remoteness and socioeconomic status

Figure 3.8: Number of MBS-subsidised services for thyroid stimulating hormone tests per 100,000 people aged 18 years and over, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2016–17



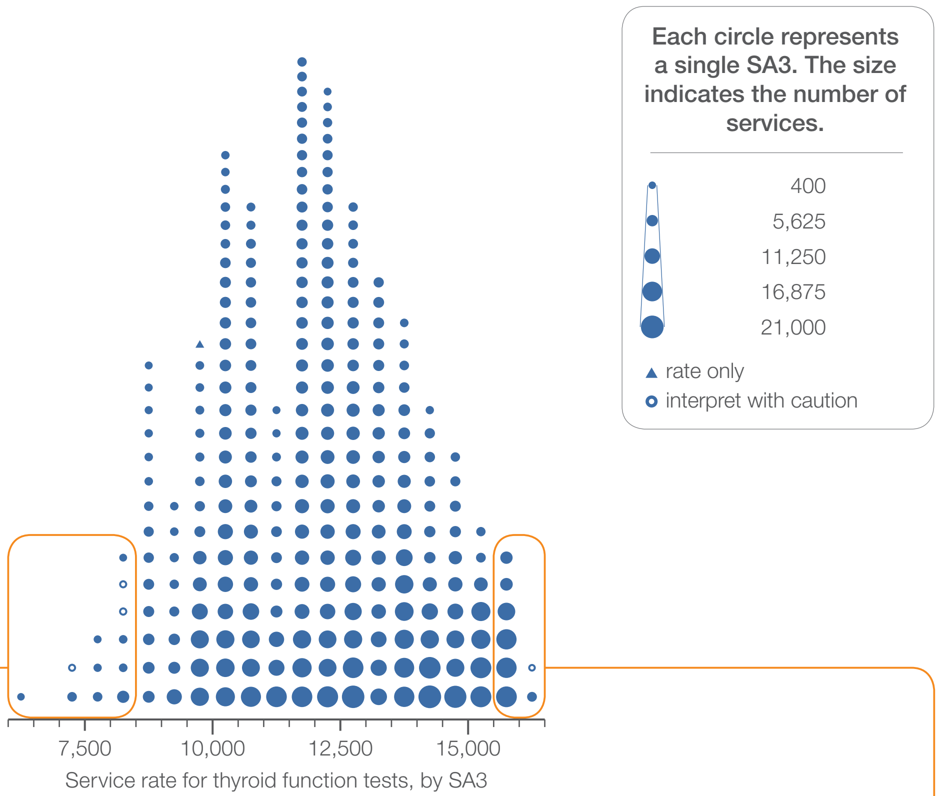
Notes:
Hollow circles (○) indicate rates that are considered more volatile than other published rates and should be interpreted with caution.
Triangles (▲) indicate SA3s where only rates are published. The numbers of services are not published for confidentiality reasons.
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of Medicare Benefits Schedule data and ABS Estimated Resident Population 30 June 2016.

Thyroid function testing

Thyroid function tests

Rates by local area

Figure 3.9: Number of MBS-subsidised services for thyroid function tests per 100,000 people aged 18 years and over, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2016–17



Lowest rate areas

SA3	State	Rate	Services
Gascoyne	WA	6,425	459
Litchfield	NT	7,470*	1,097
Gippsland - East	Vic	7,487	3,229
Upper Murray exc. Albury	NSW	7,531	3,143
Esperance	WA	7,634	1,005
Darwin City	NT	7,664	1,473
East Pilbara	WA	8,051*	1,166
Maryborough - Pyrenees	Vic	8,092	1,930
Melbourne City	Vic	8,107	6,733
Kimberley	WA	8,230	1,861
West Pilbara	WA	8,243*	1,421
Loddon - Elmore	Vic	8,428	853

Highest rate areas

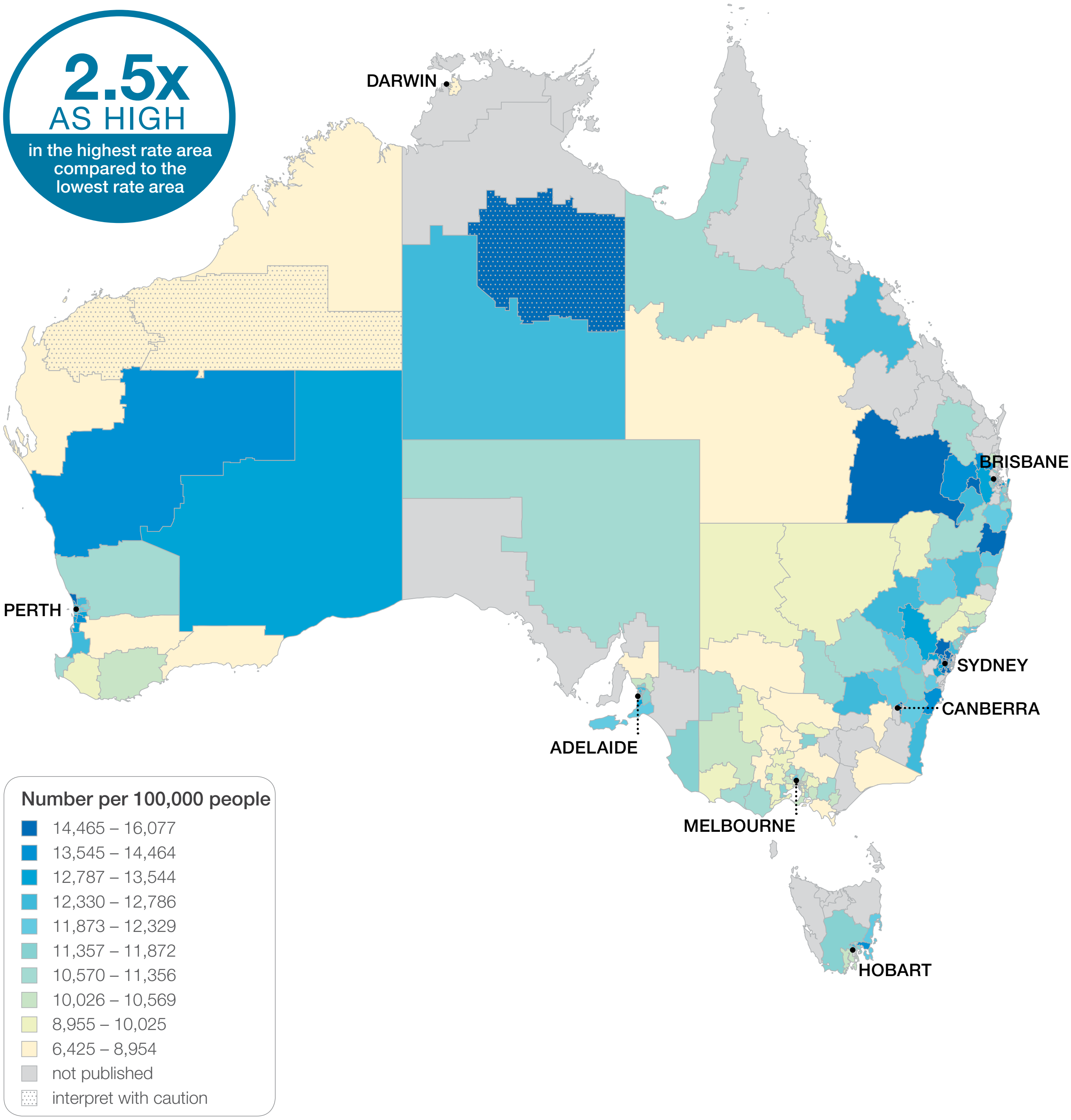
SA3	State	Rate	Services
Dural - Wisemans Ferry	NSW	16,077	3,504
Barkly	NT	16,038*	509
Gungahlin	ACT	15,983	6,935
Sutherland - Menai - Heathcote	NSW	15,927	14,081
Baulkham Hills	NSW	15,897	18,342
Parramatta	NSW	15,778	17,670
Clarence Valley	NSW	15,598	7,337
Merrylands - Guildford	NSW	15,587	17,807

Notes:
Hollow circles (○) and asterisks (*) indicate rates that are considered more volatile than other published rates and should be interpreted with caution.
Triangles (▲) indicate SA3s where only rates are published. The numbers of services are not published for confidentiality reasons.
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of Medicare Benefits Schedule data and ABS Estimated Resident Population 30 June 2016.

Thyroid function tests

Rates across Australia

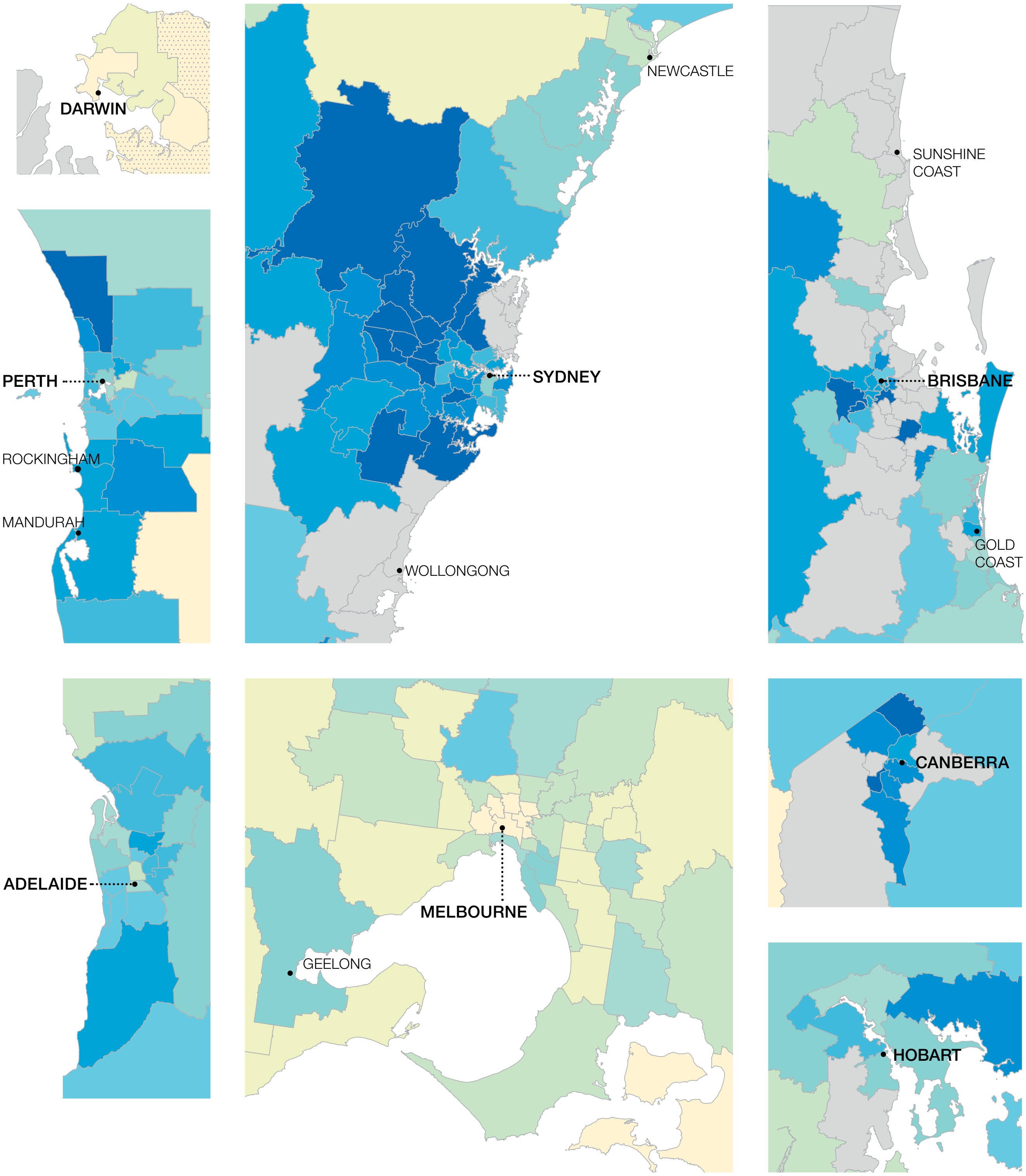
Figure 3.10: Number of MBS-subsidised services for thyroid function tests per 100,000 people aged 18 years and over, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2016–17



Notes:
Dotted areas indicate rates that are considered more volatile than other published rates and should be interpreted with caution. These rates are excluded from the calculation of the difference between the highest and lowest SA3 rates in Australia.
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of Medicare Benefits Schedule data and ABS Estimated Resident Population 30 June 2016.

Rates across capital city areas

Figure 3.11: Number of MBS-subsidised services for thyroid function tests per 100,000 people aged 18 years and over, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2016–17



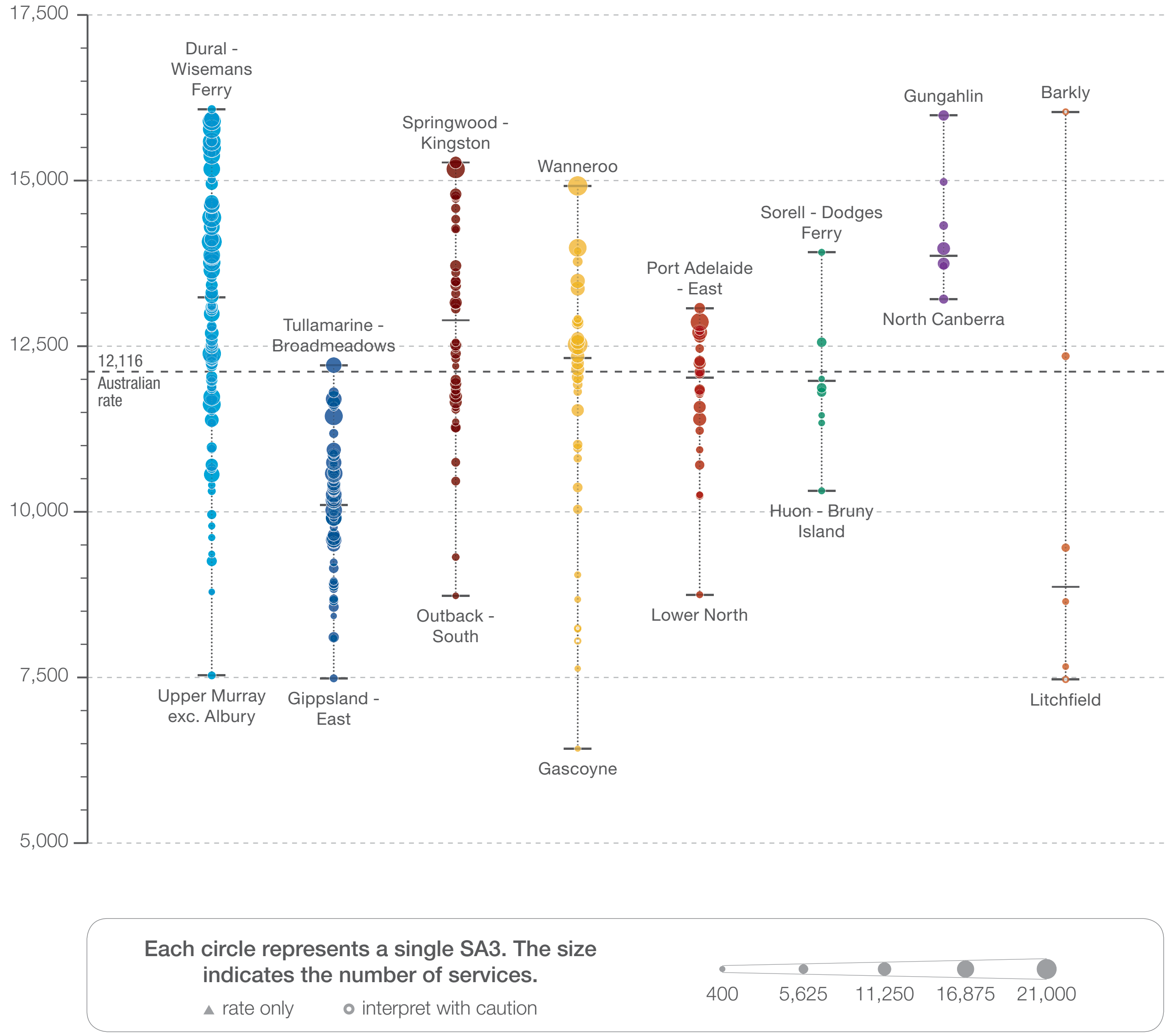
Notes:
Dotted areas indicate rates that are considered more volatile than other published rates and should be interpreted with caution.
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of Medicare Benefits Schedule data and ABS Estimated Resident Population 30 June 2016.

Thyroid function tests

Rates by state and territory

Figure 3.12: Number of MBS-subsidised services for thyroid function tests per 100,000 people aged 18 years and over, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2016–17

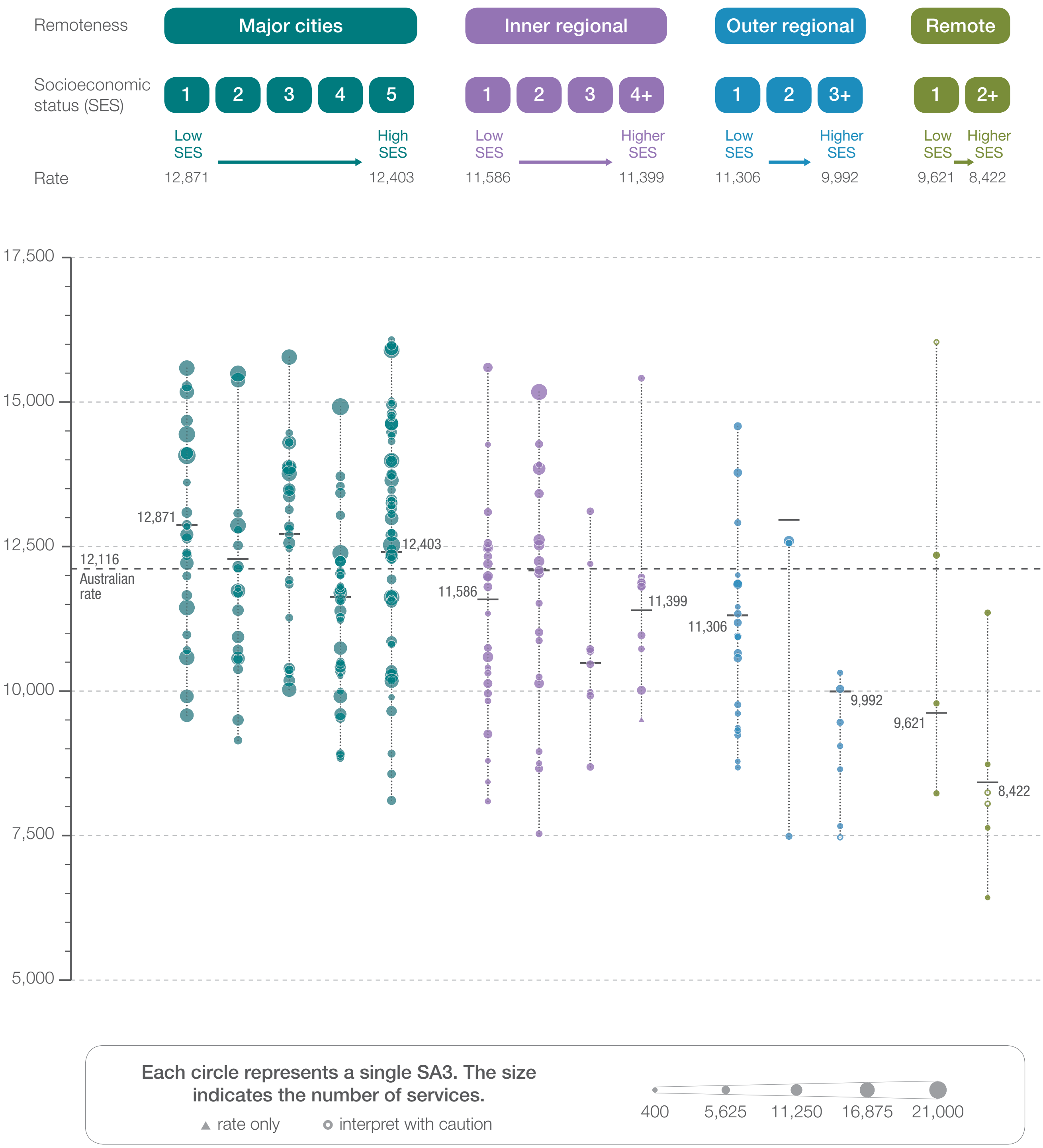
	NSW	Vic	Qld	WA	SA	Tas	ACT	NT
Highest rate	16,077	12,214	15,273	14,919	13,074	13,917	15,983	16,038*
State/territory	13,234	10,105	12,892	12,324	12,027	11,978	13,866	8,868
Lowest rate	7,531	7,487	8,732	6,425	8,749	10,317	13,211	7,470*
No. services	824,854	500,080	492,076	243,925	173,540	53,280	42,246	13,879



Notes:
Hollow circles (○) and asterisks (*) indicate rates that are considered more volatile than other published rates and should be interpreted with caution.
Triangles (▲) indicate SA3s where only rates are published. The numbers of services are not published for confidentiality reasons.
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of Medicare Benefits Schedule data and ABS Estimated Resident Population 30 June 2016.

Rates by remoteness and socioeconomic status

Figure 3.13: Number of MBS-subsidised services for thyroid function tests per 100,000 people aged 18 years and over, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2016–17



Notes:
Hollow circles (○) indicate rates that are considered more volatile than other published rates and should be interpreted with caution.
Triangles (▲) indicate SA3s where only rates are published. The numbers of services are not published for confidentiality reasons.
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of Medicare Benefits Schedule data and ABS Estimated Resident Population 30 June 2016.

Thyroid function testing

Resources

- Royal Australian College of General Practitioners, *Guidelines for Preventive Activities in General Practice* (9th edition), Section 15: Screening tests of unproven benefit[19]
- Royal College of Pathologists of Australasia, position statement: Thyroid function testing for adult diagnosis and monitoring, July 2017[3]
- *Therapeutic Guidelines: Endocrinology* (for electronic version, visit http://tgldcdp.tg.org.au/etgcomplete).[20]

Australian initiatives

The information in this chapter will complement work already under way to improve the appropriateness of thyroid function testing in Australia. At a national level, this work includes:

- Royal Australian College of General Practitioners. Choosing Wisely recommendation 10: Don't test thyroid function as population screening for asymptomatic patients[10]
- Endocrine Society of Australia, Choosing Wisely recommendation 5: Don't order a total or free T3 level when assessing thyroxine dose in hypothyroid patients[21]
- Royal Australian and New Zealand College of Obstetricians and Gynaecologists, testing of serum TSH levels in pregnant women.[22]

State and territory initiatives are also in place to improve the appropriateness of thyroid function testing, including:

- Tasmanian Health Pathways, thyroid investigations.

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3.2 Neck ultrasound and thyroidectomy

Why is this important?

Neck ultrasound can be used to investigate suspected disease of the thyroid gland, including the examination of thyroid nodules (or lumps) for possible cancer. Nodules found to be malignant are usually treated with thyroidectomy (removal of the thyroid) with a combination of other treatments, depending on the characteristics of the cancer.[1] Some small thyroid cancers (thyroid papillary microcarcinomas) have a very low risk of harm if left untreated.[1] The benefit to patients of detecting and managing these is unclear.[2]

Australia and other developed countries have seen a substantial rise in thyroid cancer incidence in the past three decades.[3-5] In some developed countries, the incidence rise has been clearly driven by increased use of ultrasound and investigation of small low-risk thyroid cancers, which has led to a rise in thyroidectomy.[4] While detection of more small, low-risk thyroid cancers does not fully explain the rising incidence of thyroid cancer in Australia[6], experiences from other countries highlight the importance of ensuring appropriate use of ultrasound for investigating the thyroid, and thyroidectomy.[4,5]

Mapping use of ultrasound for thyroid cancer is not currently possible in Australia because of limitations with the national data sources. For example, the Medicare Benefits Schedule (MBS) dataset does not have a specific item for ultrasound for thyroid investigation. As a first step, the Atlas maps rates of neck ultrasound and thyroidectomy to identify potential unwarranted variation and to highlight opportunities for improving data collection on thyroid cancer investigations and treatments.

What did we find?

The Atlas found the rate of neck ultrasound varies up to six-fold and the rate of thyroidectomy varies up to five-fold between local areas across Australia. Underlying patterns of disease are unlikely to fully explain the size of the variations seen.

Neck ultrasound and thyroidectomy

What can be done?

Strategies to improve the use of thyroid investigations include:

- Ensuring that ultrasounds for investigation of the thyroid are requested only when a patient has clinically detected, visible or palpable thyroid nodules or goitre (enlarged thyroid gland), is otherwise known to be at risk of thyroid cancer (such as a strong family history or radiation exposure), or requires active surveillance of a known thyroid cancer, could reduce unnecessary imaging[1,7]
- Having MBS items that require the reason for neck ultrasound to be specified, including differentiation between initial investigation of thyroid abnormalities and follow-up for active surveillance would provide better information on the appropriateness of ultrasound use
- Improving information on general practitioner (GP) referrals for thyroid ultrasound, such as specifying the reason for the imaging, could help improve the benefit gained from the ultrasound
- Implementing an agreed nationally consistent approach to providing high-quality thyroid ultrasound reports, such as using the ATA (American Thyroid Association) guidelines or the TI-RADS (Thyroid Imaging Reporting and Data System) score, could help reduce unnecessary repeat ultrasounds[1]
- Giving patients clear information that allows them to make informed choices about their management options, including active surveillance by specialists as an option for some low-risk thyroid cancers[8,9]
- Ensuring that thyroid cancer is included in datasets such as the New South Wales Cancer Institute Reporting for Better Cancer Outcomes Program[10], could help reduce unwarranted variation and improve quality of care; establishment of the Australian and New Zealand Thyroid Cancer Registry also aims to help surgeons follow best practice for patients having thyroid surgery.[11]

Context

This section includes data on neck ultrasound and thyroidectomy. These procedures are both central to the diagnosis and treatment of thyroid cancer, but are also used to investigate and treat other conditions.

Australia and other developed countries have seen a substantial rise in thyroid cancer incidence in the past three decades, but with little change in mortality.[3-5] In 2018, an estimated 3,300 people will be diagnosed with thyroid cancer in Australia. Thyroid cancer occurs three times more often in women than in men and is the seventh most common cancer affecting Australian women.[3] Aboriginal and Torres Strait Islander Australians have a similar incidence of diagnosis of thyroid cancer as other Australians but are 3.1 times as likely to die from it.[12]

There are different types of thyroid cancer: papillary, follicular, medullary and anaplastic. The papillary subtype is the most commonly diagnosed, accounting for 75% of thyroid cancers in women and 65% of thyroid cancers in men.[6] The increase in thyroid cancer diagnoses in other countries has been mainly attributed to increased detection of small papillary thyroid cancers.[4,5]

Neck ultrasound

Neck ultrasound includes ultrasound of the thyroid gland, which is indicated for assessment of palpable goitre and thyroid nodules. Results of thyroid ultrasound are used by clinicians to determine the need for fine needle aspiration biopsy of nodules (FNAB). FNAB involves collecting a small sample of tissue for cytology (cell) testing, guided by a further thyroid ultrasound. FNAB is used for diagnostic assessment and to exclude malignancy for nodules ≥1 cm in size.[1,7]

MBS data do not differentiate between neck ultrasound for thyroid examination and neck ultrasound for other investigations. The proportion of neck ultrasound performed for thyroid examinations compared with that for other indications is not clear, but thyroid examination appears to account for the majority.[13] Neck ultrasound is also used to investigate cervical lymphadenopathy (enlargement of cervical lymph nodes) and to assess other structures in the neck, such as the salivary glands and carotid arteries. Carotid duplex imaging has separate MBS item numbers and is not included in this data item.

Guidelines recommend that everyone being investigated for possible thyroid cancer, such as people with throat symptoms, lumps or swelling in the neck, has a neck ultrasound.[1] Neck ultrasound is also recommended for active surveillance of small, low-risk thyroid cancers and to monitor disease status after thyroidectomy.[1] Neck ultrasound is not recommended for screening asymptomatic people for thyroid cancer unless the person is otherwise known to be at risk of thyroid cancer (such as having a strong family history or radiation exposure). Neck ultrasound is also not recommended for routine investigation of people with abnormal thyroid function tests if there is no palpable abnormality of the thyroid gland, or for routine follow-up of nodules that are benign.[14-16]

The crude rate of neck ultrasound in Australia quadrupled between 1997 and 2017.[17] International comparisons of neck ultrasound rates are not available.

Thyroidectomy

Thyroidectomy involves full or partial removal of the thyroid gland. It is used to treat thyroid cancer, suspicious nodules and uncontrollable overactive thyroid gland such as in Graves' disease.[18]

Thyroidectomy carries a 2–6% risk of permanent hypoparathyroidism (dysfunction of the parathyroid glands, resulting in low blood calcium levels) and a 1–2% risk of laryngeal nerve injury (resulting in a hoarse or weak voice).[19] Most patients require lifelong thyroid hormone replacement therapy after thyroidectomy.[4]

Guidelines recommend total thyroidectomy for patients with large thyroid cancer tumours, or tumours of any size with additional risk factors.[14] Surgery for thyroid papillary microcarcinomas (cancers 10 millimetres or less in size) is a controversial issue because the risks for some individuals may outweigh the benefits.[14]

A study of New South Wales data showed that both thyroidectomy rates and thyroid cancer incidence doubled between 2003 and 2012, with no change in mortality.[20] The estimated thyroidectomy rate for 2012 in this study was 18.8 per 100,000 women and 6.0 per 100,000 men. Few international comparisons of thyroidectomy rates are available. In 2012, the age-standardised rate of thyroidectomy in Switzerland was 11.6 per 100,000 women and 4.0 per 100,000 men.[21]

Radioiodine (I-131) therapy (nuclear medicine) is also used in the postoperative treatment of thyroid cancer.[14] Ultrasound and nuclear medicine can be used to assess post-surgery thyroid cancer patients. Radioiodine has a whole-body surveillance role in patients after their initial therapy.[14]

Thyroid cancer management in Australia

Most patients diagnosed with thyroid cancer have a very good prognosis. The five-year survival rate for thyroid cancer in Australia is 97%[3] and 92% for Aboriginal and Torres Strait Islander Australians.[12] While neck ultrasound is an important investigation for detecting thyroid cancer, there is increased awareness that the harm associated with detection of small, low-risk cancers, such as the psychological burden of a cancer diagnosis and the side effects of some treatments, may outweigh the risk these cancers pose.[7]

Neck ultrasound and thyroidectomy

The introduction of neck ultrasonography in the late 1980s allowed the detection of thyroid nodules only a few millimetres in size, and large increases in diagnoses of thyroid cancer were subsequently seen in many high-income countries.[2,22] For example, a study in the United States reported a two-fold increase between 2000 and 2012, and the most extreme example was a 15-fold increase in South Korea between 1993 and 2011.[4,23] Despite these increases in diagnoses, mortality rates did not change substantially in either country.[4,5]

Similarly, the rate of thyroid cancer diagnoses in Australia increased between 1997 and 2017: 2.6-fold in women (from 7.0 to 18.0 per 100,000) and 2.5-fold in men (from 2.6 to 6.6 per 100,000).[24] The mortality rate over this period stayed at 0.4 per 100,000 in men, and rose from 0.4 to 0.5 per 100,000 in women.[24]

One reason for an increased incidence of cancer without an accompanying increase in mortality may be the greater detection of thyroid papillary microcarcinomas – cancers not likely to cause symptoms or death in a patient's lifetime.[4,19,25] Epidemiological modelling estimated that detection of these cancers was responsible for an estimated 10,301 extra cases of thyroid cancer in women, and 2,148 in men, between 1988 and 2007 in Australia.[22]

Greater detection of low-risk papillary cancers appears to explain most of the rise in thyroid cancer in Australia, but there is evidence that a true increase in disease has also contributed. Analysis of Queensland thyroid cancer data from 1982 to 2008 showed that the greatest increase occurred in diagnosis of early-stage cancers, but a significant increase in the incidence of advanced cancers was also found.[6] In a similar study of Tasmanian data from 1988 to 1998, thyroid papillary microcarcinoma accounted for most of the rising thyroid cancer incidence, but the rate of larger papillary thyroid cancers also increased.[26] The fact that the incidence of high-grade thyroid disease has increased without an increase in mortality suggests that advanced thyroid cancer is being appropriately identified and successfully treated.

Suggested causes for the increase in thyroid cancer incidence beyond increased testing include radiation exposure in children due to medical imaging, rising rates of diabetes and obesity, and iodine deficiency and excess.[5] Radiation exposure due to computed tomography (CT) scans in children is likely to account for less than 1% of the increased incidence of thyroid cancer, according to an analysis from the United States.[5] The evidence is conflicting or weak at this stage for an association between thyroid cancer and diabetes or iodine intake.[5] Whether there is a causal relationship between increased prevalence of obesity and increasing thyroid cancer rates is also unclear.[27,28]

Neck ultrasound

About the data

Data are sourced from the MBS dataset.

This dataset includes information on MBS claims processed by the Australian Government Department of Human Services. It covers a wide range of services (attendances, procedures, tests) provided across primary care and hospital settings.

The dataset does not include:

- Services for publicly funded patients in hospitals
- Services for patients in hospital outpatient clinics where claims are not made to the MBS
- Services covered under Department of Veterans' Affairs arrangements.

Rates are based on the number of MBS-subsidised services for neck ultrasound per 100,000 people aged 18 years and over in 2016–17.

Because an MBS claim is included for each service rather than for each patient, patients who receive a service more than once in the financial year will have more than one MBS claim counted.

The analysis and maps are based on the residential address of the patient recorded in the MBS claim and not the location of the service.

Rates are age and sex standardised to allow comparisons between populations with different age and sex structures.

Data were not analysed by Aboriginal and Torres Strait Islander status as this information was not available for the MBS data at the time of publication.

What do the data show?

Magnitude of variation

In 2016–17, there were 308,247 MBS-subsidised services for neck ultrasound, representing 1,606 services per 100,000 people aged 18 years and over (the Australian rate).

The number of MBS-subsidised services for neck ultrasound across 329* local areas (Statistical Area Level 3 – SA3), ranged from 513 to 2,893 per 100,000 people aged 18 years and over. The rate was **5.6 times as high** in the area with the highest rate compared to the area with the lowest rate. The number of services varied across states and territories, from 983 per 100,000 people aged 18 years and over in the Northern Territory to 1,946 in New South Wales (Figures 3.17–3.20).

After the highest and lowest 10% of results were excluded and 265 SA3s remained, the number of services per 100,000 people aged 18 years and over was 2.1 times as high in the area with the highest rate compared to the area with the lowest rate.

Analysis by remoteness and socioeconomic status

Rates of neck ultrasound were higher in major cities than in other areas. Rates were higher in areas with lower socioeconomic status in major cities and remote areas. However, there was no clear pattern according to socioeconomic status in other remoteness categories (Figure 3.21).

* There are 340 SA3s. For this item, data were suppressed for 11 SA3s due to one or more of a small number of services or population in an area, or potential identification of individual patients, practitioners or business entities.

Notes:

Some of the published SA3 rates were considered more volatile than others. These rates are excluded from the calculation of the difference between the highest and lowest SA3 rates in Australia.

For further detail about the methods used, please refer to the Technical Supplement.

Neck ultrasound

Interpretation

Variation in rates of neck ultrasound is likely to be due to geographical differences in the factors discussed below.

Access to services

Access to ultrasound services, and medical and surgical specialists (for example, specialist endocrine surgeons, and head and neck surgeons) could explain higher rates in major cities. Rates of neck ultrasound were also markedly higher in the most populous states (New South Wales, Victoria and Queensland) than elsewhere, which may also reflect differences in access to ultrasound and specialist services.

It is likely that having greater access to medical care increases investigations for thyroid abnormalities. About 60% of patients in a New South Wales study were diagnosed with thyroid cancer in the absence of symptoms.[29] Compared with people living in rural areas, people living in metropolitan areas were more likely to be diagnosed as a result of surgery for benign thyroid disease or diagnostic imaging for another health problem, or after a thyroid lump was first noticed by a doctor.[29]

Higher rates of neck ultrasound in major cities could also reflect more intensive monitoring following thyroidectomy because it is easier for patients to access ultrasound services.[1] As well, more patients in major cities may opt for active surveillance of low-risk papillary cancers compared to patients elsewhere because of better access with specialist services. However, rates of thyroidectomy were also found to be higher in major cities and inner regional areas (see 'Thyroidectomy'), suggesting that access to health services generally may contribute more to variation than having treatment choices.

Use of other imaging tests

Referrals arising from incidental findings of thyroid nodules following diagnostic imaging for other health problems may be a source of variation. This may include referrals from Doppler carotid artery assessment, CT scans, magnetic resonance imaging (MRI) and positron emission tomography (PET) scans.[2,29]

Clinical decision-making

Clinical decision-making about whether to actively search for thyroid nodules during physical examination may influence the rate of neck ultrasound.[28] Differences in adherence to guidelines on use of ultrasound for suspected thyroid disease are likely to account for some variation. For example, higher rates could be associated with either inappropriate use of neck ultrasound for screening or appropriate use for active surveillance of small, low-risk cancers.

Numbers of repeat ultrasounds

Differences in the quality of ultrasound reports and cytology reports are likely to affect numbers of repeat ultrasounds. Higher rates of indeterminate findings following an FNAB may also lead to higher rates of repeat ultrasound.[1]

Rates of underlying disease

Prevalence of underlying diseases, and of symptoms or history that would prompt testing for thyroid disease, could also affect rates.

Rates of neck ultrasound were higher in areas with low socioeconomic status in major cities and remote areas. This finding contrasts with research from the United States that showed a higher incidence of thyroid cancer in areas with high socioeconomic status[25], which was considered to reflect greater access to diagnostic services.[30] Reasons for the pattern in Australia are unclear.

Thyroidectomy

Funding models

The data for this item exclude services that are free of charge to public patients in hospitals, such as neck ultrasound done for public patients in public hospital outpatient clinics or emergency departments. This means that the funding models for neck ultrasound services available in an area, and the relative accessibility of services to patients, may influence the variation seen. For example, the rates of neck ultrasound seen in remote Western Australia, South Australia and the Northern Territory may be low because a higher proportion of ultrasounds in these areas is done for public patients in hospital outpatient clinics (which are not counted in this data item). In contrast, the rates in New South Wales may be high because there are many locations in New South Wales where services and investigations undertaken in public hospital outpatient clinics are claimed through the MBS under specialist medical practitioner rights of private practice.

Because MBS data do not differentiate between neck ultrasound and thyroid ultrasound, variations in rates of neck ultrasound performed for reasons other than thyroid investigation will also affect the rates reported here.

About the data

Data are sourced from the National Hospital Morbidity Database, and include admitted patients in both public and private hospitals.

Rates are based on the number of hospitalisations for thyroidectomy per 100,000 people aged 18 years and over, over the three-year period 2014–15 to 2016–17. Data are aggregated over three years to provide sufficient numbers to support reporting at the local level. The number of hospitalisations and the summed population over three years are used to provide an average rate. This is comparable to a rate based on data collected over one year.

Because a record is included for each hospitalisation for the procedure, rather than for each patient, patients hospitalised for the procedure more than once in the three financial years will be counted more than once.

The analysis and maps are based on the residential address of the patient and not the location of the hospital.

Rates are age and sex standardised to allow comparisons between populations with different age and sex structures.

Aboriginal and Torres Strait Islander identification

The identification of Aboriginal and Torres Strait Islander patients may not be accurate for all admissions, and processes for seeking and recording identification may vary among states and territories. The data shown may under-count the number of Aboriginal and Torres Strait Islander Australians hospitalised for thyroidectomy.

Thyroidectomy

What do the data show?

Magnitude of variation

Over the three-year period 2014–15 to 2016–17, there were 35,166 hospitalisations for thyroidectomy, representing an average rate of 62 hospitalisations per 100,000 people aged 18 years and over (the Australian rate).

The number of hospitalisations for thyroidectomy across 327† local areas (Statistical Area Level 3 – SA3), ranged from 28 to 130 per 100,000 people aged 18 years and over. The rate was **4.6 times as high** in the area with the highest rate compared to the area with the lowest rate. The number of hospitalisations varied across states and territories, from 42 per 100,000 people aged 18 years and over in the Australian Capital Territory to 68 in New South Wales (Figures 3.22–3.25).

After the highest and lowest 10% of results were excluded and 266 SA3s remained, the number of hospitalisations per 100,000 people aged 18 years and over was 2.0 times as high in the area with the highest rate compared to the area with the lowest rate.

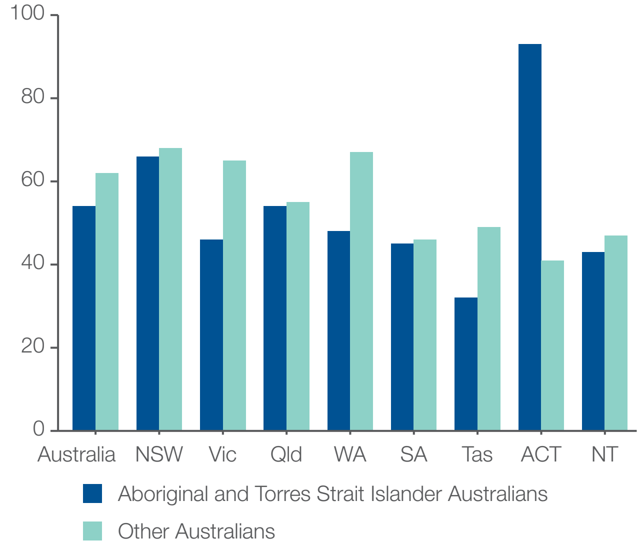
Analysis by remoteness and socioeconomic status

Rates of hospitalisations for thyroidectomy were higher in major cities and inner regional areas than in outer regional and remote areas. Rates were higher in areas with lower socioeconomic status in major cities and in inner regional areas. However, there was no clear pattern according to socioeconomic status in other remoteness categories (Figure 3.26).

Analysis by Aboriginal and Torres Strait Islander status

The rate of hospitalisations for Aboriginal and Torres Strait Islander Australians (54 per 100,000 people) was 13% lower than the rate for other Australians (62 per 100,000 people) (Figure 3.14).

Figure 3.14: Number of hospitalisations for thyroidectomy per 100,000 people aged 18 years and over, age and sex standardised, by Aboriginal and Torres Strait Islander status, 2014–15 to 2016–17



The data for Figure 3.14 are available at www.safetyandquality.gov.au/atlas

† There are 340 SA3s. For this item, data were suppressed for 13 SA3s due to a small number of hospitalisations and/or population in an area.

Notes:

Data by Indigenous status should be interpreted with caution as hospitalisations for Aboriginal and Torres Strait Islander patients are under-enumerated and there is variation in the under-enumeration among states and territories.

For further detail about the methods used, please refer to the Technical Supplement.

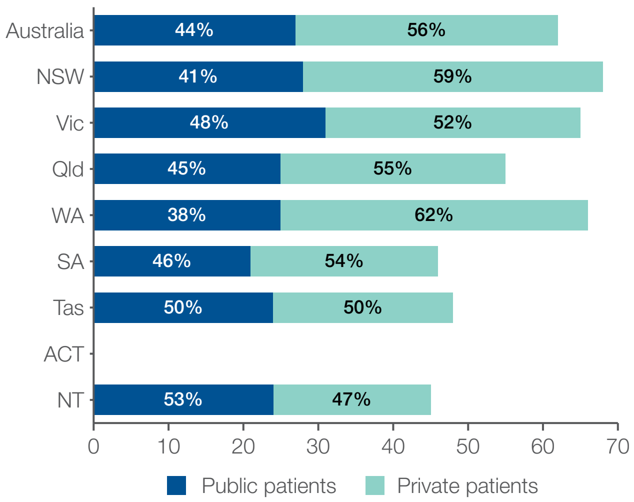
Sources: AIHW analysis of National Hospital Morbidity Database and ABS Estimated Resident Population 30 June 2014 to 2016.

Analysis by patient funding status

Overall, 56% of hospitalisations for thyroidectomy were for privately funded patients. This proportion varied from 47% in the Northern Territory to 62% in Western Australia (Figure 3.15).

The median age at operation was 53 years for publicly funded patients and 56 years for privately funded patients.

Figure 3.15: Number of hospitalisations for thyroidectomy per 100,000 people aged 18 years and over, age and sex standardised, by state and territory of patient residence, by patient funding status, 2014–15 to 2016–17

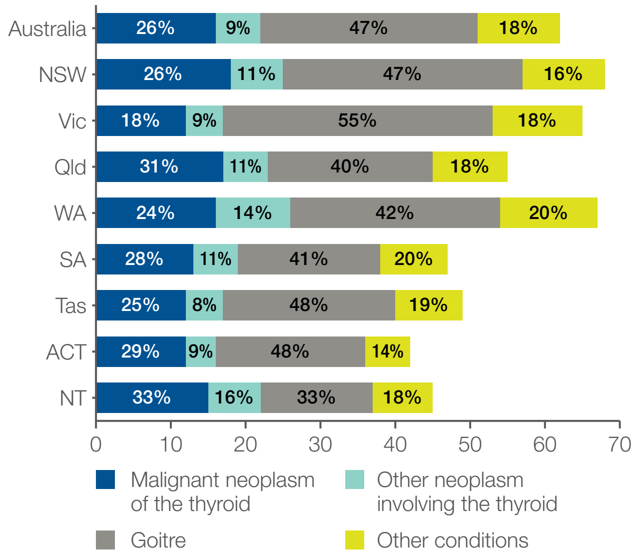


The data for Figures 3.15 and 3.16 are available at www.safetyandquality.gov.au/atlas

Analysis by principal diagnosis

The number of hospitalisations for thyroidectomy for patients with malignant neoplasms varied across states and territories, from 12 per 100,000 people in the Australian Capital Territory, Victoria and Tasmania to 18 in New South Wales. The number of hospitalisations for thyroidectomy for patients with goitre varied from 15 per 100,000 people in the Northern Territory to 36 in Victoria (Figure 3.16).

Figure 3.16: Number of hospitalisations for thyroidectomy per 100,000 people aged 18 years and over, age and sex standardised, by state and territory of patient residence, by principal diagnosis, 2014–15 to 2016–17



Notes:
Hospitalisations for public patients do not incur a charge to the patient or a third-party payer (for example, a private health insurance fund), unlike hospitalisations for private patients.
For 2016–17, there were data quality issues related to the recording of patient funding source for patients admitted to ACT private hospitals. For this reason, 2016–17 data for ACT private hospitals are excluded from the analysis and data for the ACT are not published.
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of National Hospital Morbidity Database and ABS Estimated Resident Population 30 June 2014 to 2016.

Thyroidectomy

Interpretation

Variation in rates of thyroidectomy between areas may be influenced by the number of clinicians providing services to people living in the area. The practices of specific clinicians are likely to have a greater impact on rates in smaller local areas with fewer clinicians, such as rural and regional locations. Specific clinicians may influence rates across several local areas, especially those with small populations. The effects of practice styles of individual clinicians will be diluted in areas with large numbers of practising clinicians.

Variations between areas may not directly reflect the practices of the clinicians who are based in these areas. The analysis is based on where people live rather than where they obtain their health care. Patients may travel outside their local area to receive care.

Variation in rates of thyroidectomy is likely to follow on from the pattern of variation in neck ultrasound, as well as geographical differences in the factors discussed below.

Underlying disease

Goitre was the most common reason for thyroidectomy hospitalisation in Australia. The rate of thyroidectomy for goitre was higher in Victoria than elsewhere. People in Victoria's Latrobe Valley, an area of low socioeconomic status, had a markedly higher rate of thyroidectomy hospitalisations than people living in other areas of Australia. Iodine deficiency has been a problem in some areas of Victoria in the past, but this does not appear to explain the current thyroidectomy rates seen in this area. It is possible that the history of goitre from earlier generations has sensitised clinicians to look for thyroid problems in people from this area and to refer them more readily for investigations if nodules are detected. However, such a legacy effect was not seen in Tasmania. Despite a high degree of community awareness of thyroid disease and the history of goitre in Tasmania, ultrasound and thyroidectomy rates were lower in this state than Australian averages.

Clinical decision-making

Clinical decision-making on whether to perform thyroidectomy for low-risk thyroid papillary microcarcinomas may influence local rates. There are differences of opinion about progression to surgery for these cancers. Some guidelines recommend that active surveillance be considered rather than immediate surgery for these low-risk cancers.[1] Decisions to stage total thyroidectomy may also affect rates. Two-stage operations for the one individual would result in two hospitalisations for thyroidectomy.

Access to services

Under-diagnosis of thyroid disease could be a contributor to the lower rates seen for Aboriginal and Torres Strait Islander Australians compared to other Australians. Poor access to services in remote areas may also disproportionately affect thyroidectomy rates for Aboriginal and Torres Strait Islander Australians because they make up proportionally more of the population in remote areas.

Patient preference

Patient preferences about options for managing low-risk thyroid papillary microcarcinomas may differ.[31] People with better access to health care will have greater ability to opt for active surveillance, which requires regular physical examinations and ultrasounds. However, greater ability to choose treatments does not appear to explain the variation in rates seen between remoteness areas because rates of thyroidectomy were higher in major cities and inner regional areas than elsewhere.

Neck ultrasound and thyroidectomy

Promoting appropriate care

Understanding how much of the variation in rates of neck ultrasound represents unwarranted variation is difficult given current data capture of the MBS dataset. Strategies to ensure appropriate use of neck ultrasound and thyroidectomy in the management of thyroid cancer include:

- Improving adherence to guidelines for requesting thyroid ultrasounds
- Better capture of information on reasons for requesting neck ultrasound
- Standardised reporting of thyroid abnormalities observed at ultrasound
- Improved information for both clinicians and consumers on the relative benefits and harms of active surveillance versus immediate surgery for low-risk papillary cancers
- Improved monitoring and feedback to clinicians of information on investigation, management and outcomes of thyroid cancer.

Improved adherence to guidelines for ultrasound requests

Optimising GP adherence to guidelines on the assessment of thyroid disease will improve the appropriateness of referrals for neck ultrasound.[7] One such initiative is the Endocrine Society of Australia's 'Do not do' recommendation for clinicians: 'Don't routinely order a thyroid ultrasound in patients with abnormal thyroid function tests if there is no palpable abnormality of the thyroid gland'.[16] As well, better GP referrals for neck ultrasound that include the reason for the imaging will aid the quality of ultrasound reporting and, in turn, guide clinical decision-making.

Better capture of information on ultrasound requests

This Atlas has highlighted a number of limitations of current data collections for ensuring the appropriateness of thyroid investigations and management across Australia. The data showed lower rates of neck ultrasound and thyroidectomy in rural areas than in urban areas, but the significance of this on patient outcomes is unclear. Linking thyroid ultrasound use with thyroid cancer incidence and mortality data reported at a local area level would help ensure the appropriate use of thyroid ultrasound. However, this analysis is not possible currently without improvements to data capture for thyroid ultrasound.

Improving information on GP referrals for thyroid ultrasound, such as specifying the reason for the imaging, would help improve reporting and, in turn, better guide management. As well, revising MBS items to require the reason for neck ultrasound to be specified, including differentiation between initial investigation of thyroid abnormalities and follow-up for active surveillance, would vastly improve reporting and help ensure appropriate use of neck ultrasound.

Standardised reporting of thyroid abnormalities on ultrasound

Over the past decade, a number of standardised criteria for thyroid ultrasound reporting have been developed to support clinical decision-making and help determine the need for FNAB.[1] Examples include the American College of Radiology's Thyroid Imaging, Reporting and Data System (TI-RADS) and the European system, EU-TIRADs.[32] It is not yet known if use of these criteria reduces over-diagnosis and over-treatment of thyroid cancer.

Neck ultrasound and thyroidectomy

Improved information for clinicians and consumers on treatment options for low-risk papillary cancers

There is evidence that adverse effects are lower among patients who choose active surveillance over immediate surgery for low-risk thyroid papillary microcarcinomas.[33] However, Australian qualitative research found that a sample of clinicians were generally not comfortable offering active surveillance, as they did not feel that the evidence was strong enough to support this approach.[34] A sample of Australian patients diagnosed with thyroid papillary microcarcinomas were also not comfortable with the idea of active surveillance, preferring surgery in order to remove their anxiety about the cancer diagnosis.[31] Further research to identify which thyroid cancers are not likely to cause harm may increase the acceptability of active surveillance.

Patients with low-risk thyroid papillary microcarcinomas should be given clear information about all their options for management, including the option of active surveillance by a specialist (for example, having regular ultrasounds and physical examinations), so that they can choose the management approach best for them.[8,9]

Improved data for clinicians on their management and outcomes of thyroid cancer

Initiatives to provide clinicians and health services with regular data and feedback on their practice and on outcomes of investigation and management of thyroid disease would enable undesirable variations in care to be monitored. Further investigation is needed to examine the appropriateness of neck ultrasound use across Australia for thyroid cancer management. Investigating the correlation between rates of neck ultrasound and the incidence of thyroid cancer and goitre may shed light on whether rates reflect patient need.

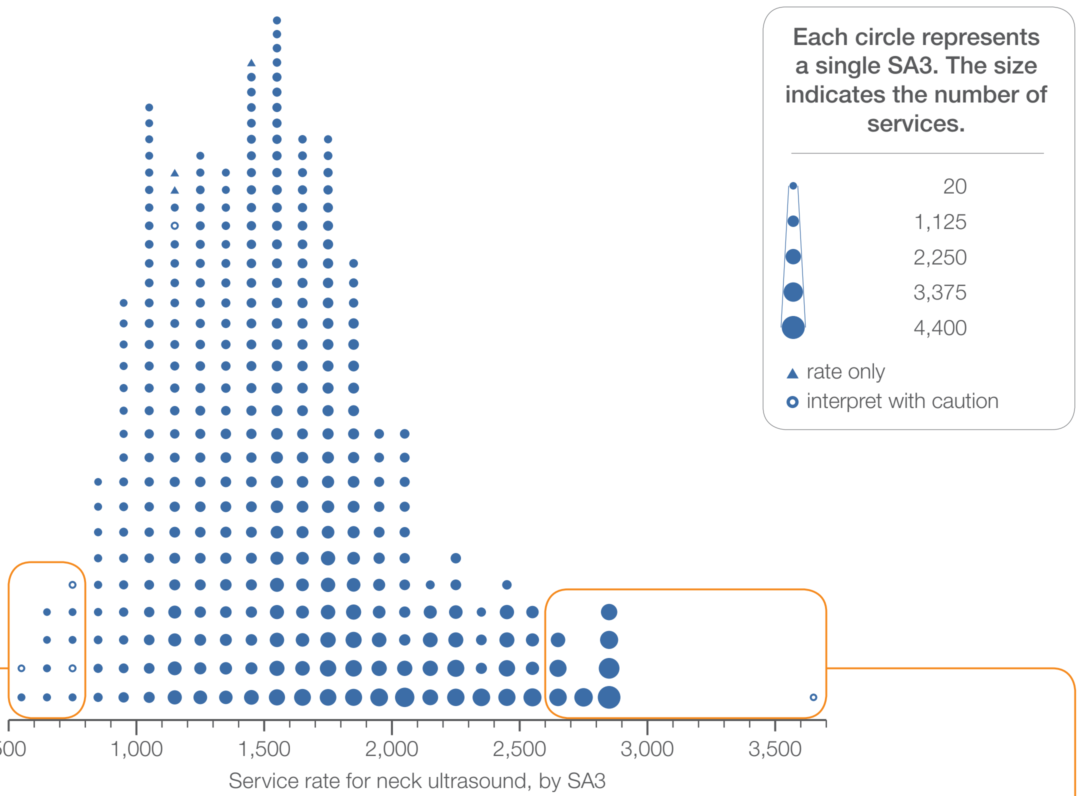
Other strategies

A change in nomenclature to better reflect the natural history and risks of these abnormalities may also be helpful. This strategy has been used overseas in an effort to reduce the impact of diagnosis of low-risk thyroid cancers. The United States Endocrine Pathology Society changed the name of a subtype of papillary thyroid cancer in 2015, to reduce its over-treatment and psychological impact.[35] The non-invasive encapsulated follicular variant of papillary thyroid cancer was renamed 'non-invasive follicular thyroid neoplasm with papillary-like nuclear features' (NIFTP).[35] Patients with NIFTP are unlikely to benefit from total thyroidectomy and radioactive iodine therapy, and can be treated less aggressively.[35] This type of thyroid tumour has increased two- to three-fold in the past 20–30 years, and accounts for 10–20% of all thyroid cancers diagnosed in North America and Europe.[35]

Neck ultrasound

Rates by local area

Figure 3.17: Number of MBS-subsidised services for neck ultrasound per 100,000 people aged 18 years and over, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2016–17



Lowest rate areas

SA3	State	Rate	Services
Alice Springs	NT	513	143
Daly - Tiwi - West Arnhem	NT	543*	61
Esperance	WA	618	78
Outback - North and East	SA	682	139
Mid North	SA	684	166
Gascoyne	WA	687	52
Wheat Belt - South	WA	708	128
West Pilbara	WA	738*	143
Lower North	SA	740	153
East Pilbara	WA	751*	117
West Coast	Tas	798	118

Highest rate areas

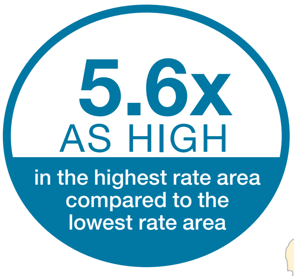
SA3	State	Rate	Services
Canberra East	ACT	3,631*	27
Fairfield	NSW	2,893	4,315
Canterbury	NSW	2,861	3,020
Liverpool	NSW	2,858	2,525
Bankstown	NSW	2,835	3,753
Merrylands - Guildford	NSW	2,765	3,127
Bringelly - Green Valley	NSW	2,685	2,001
Hurstville	NSW	2,662	2,851
Blacktown	NSW	2,637	2,745

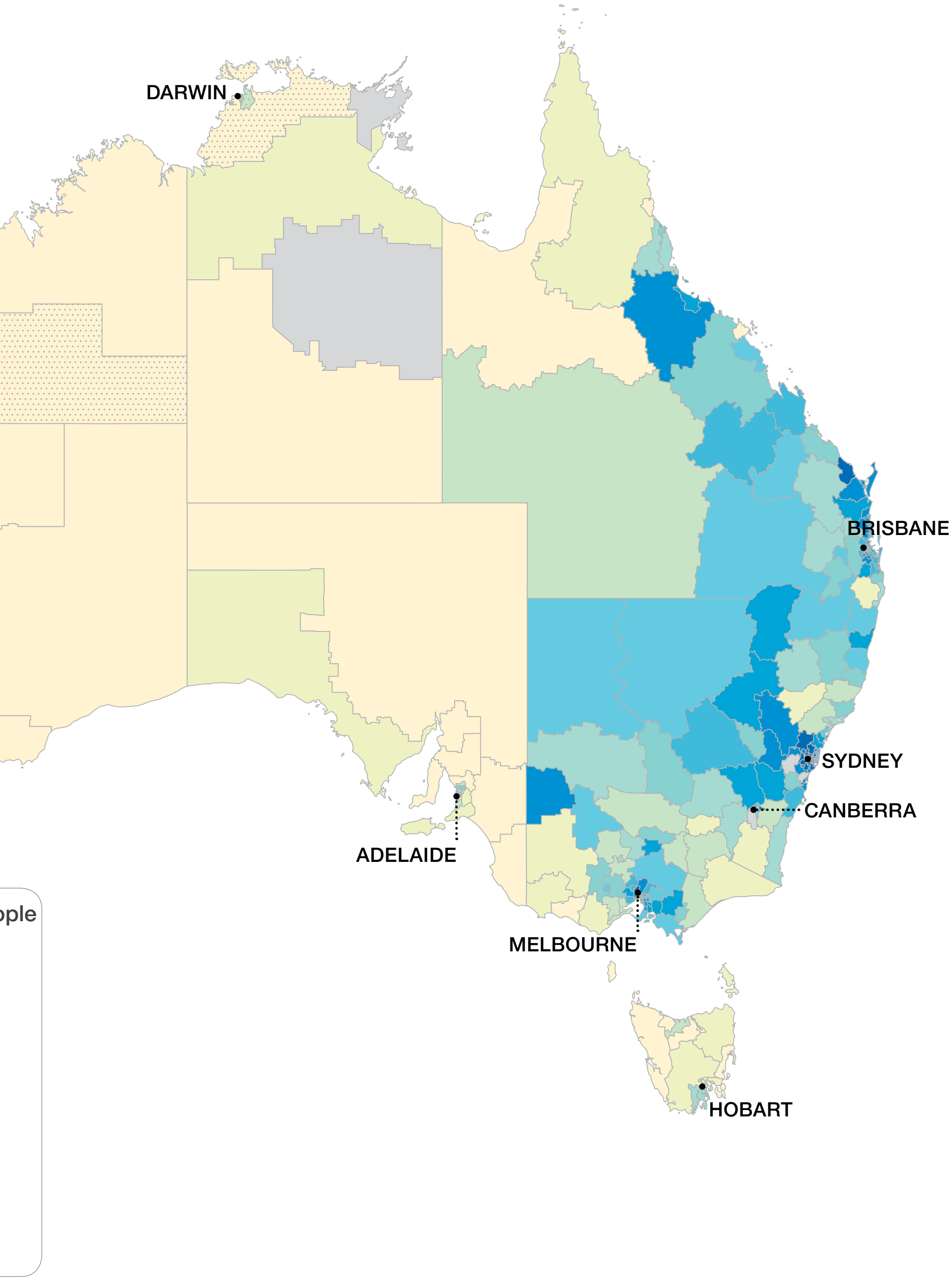
Notes:
Hollow circles (○) and asterisks (*) indicate rates that are considered more volatile than other published rates and should be interpreted with caution.
Triangles (▲) indicate SA3s where only rates are published. The numbers of services are not published for confidentiality reasons.
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of Medicare Benefits Schedule data and ABS Estimated Resident Population 30 June 2016.

Neck ultrasound

Rates across Australia

Figure 3.18: Number of MBS-subsidised services for neck ultrasound per 100,000 people aged 18 years and over, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2016–17

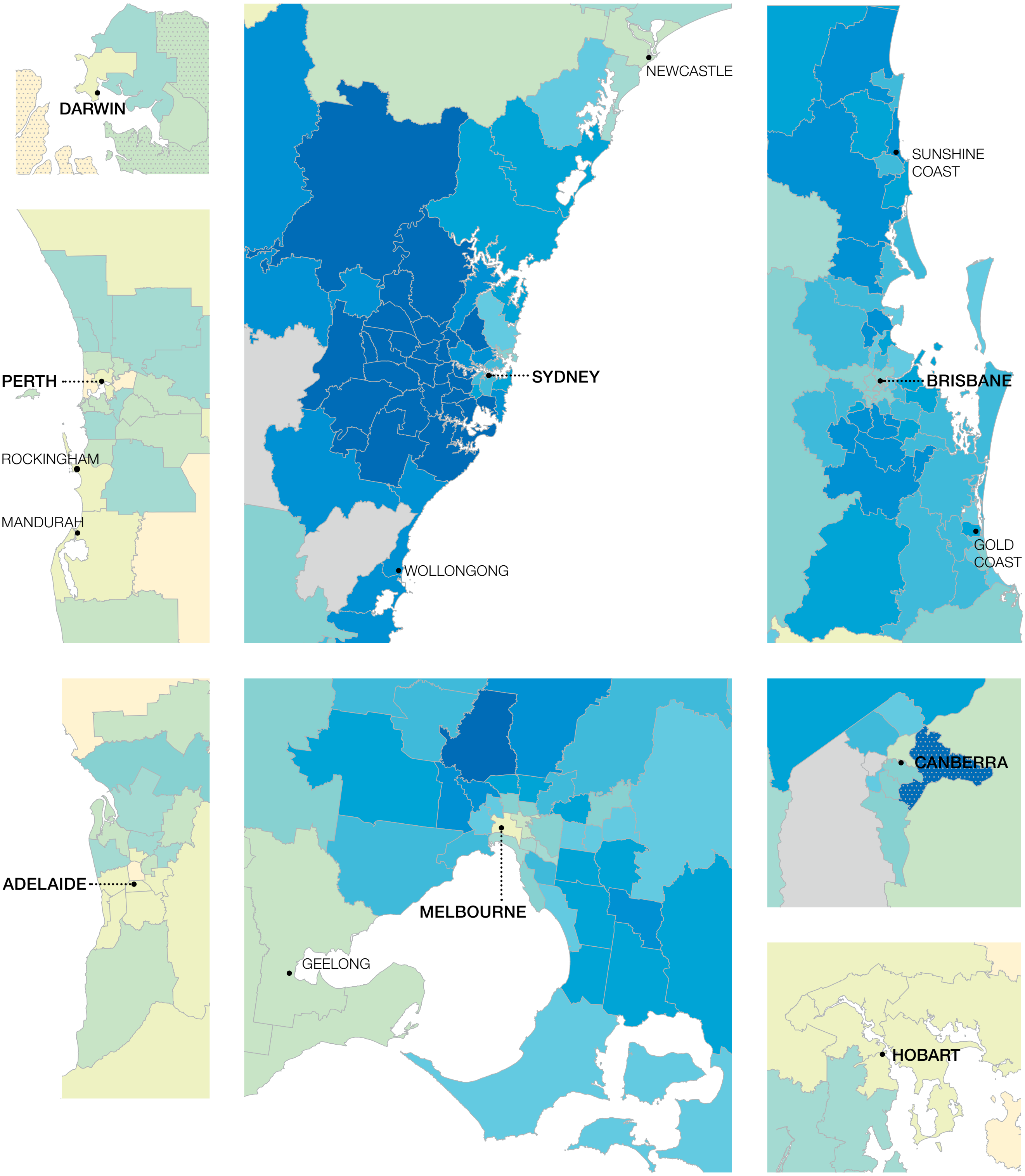




Notes:
Dotted areas indicate rates that are considered more volatile than other published rates and should be interpreted with caution. These rates are excluded from the calculation of the difference between the highest and lowest SA3 rates in Australia.
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of Medicare Benefits Schedule data and ABS Estimated Resident Population 30 June 2016.

Rates across capital city areas

Figure 3.19: Number of MBS-subsidised services for neck ultrasound per 100,000 people aged 18 years and over, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2016–17



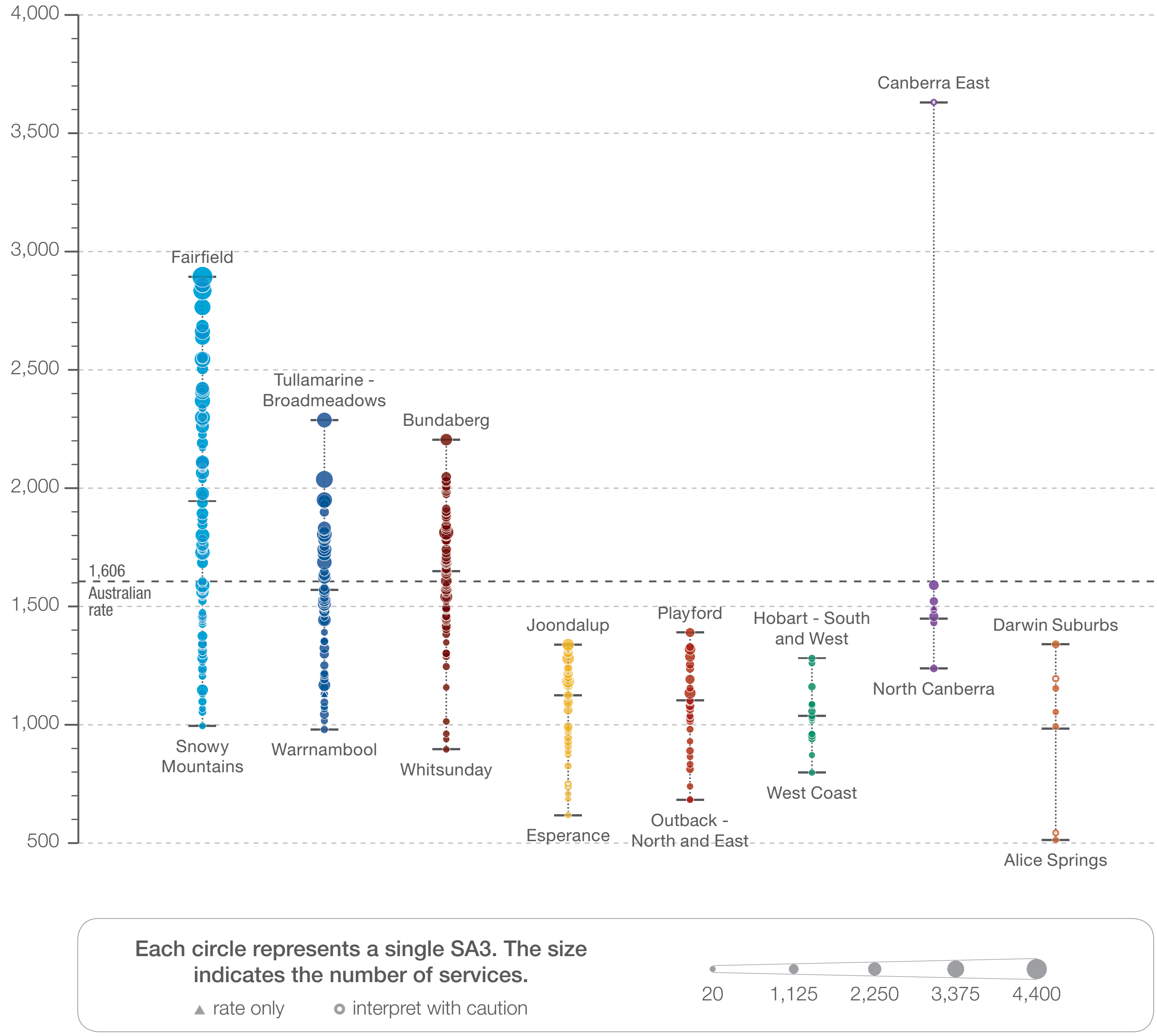
Notes:
Dotted areas indicate rates that are considered more volatile than other published rates and should be interpreted with caution.
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of Medicare Benefits Schedule data and ABS Estimated Resident Population 30 June 2016.

Neck ultrasound

Rates by state and territory

Figure 3.20: Number of MBS-subsidised services for neck ultrasound per 100,000 people aged 18 years and over, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2016–17

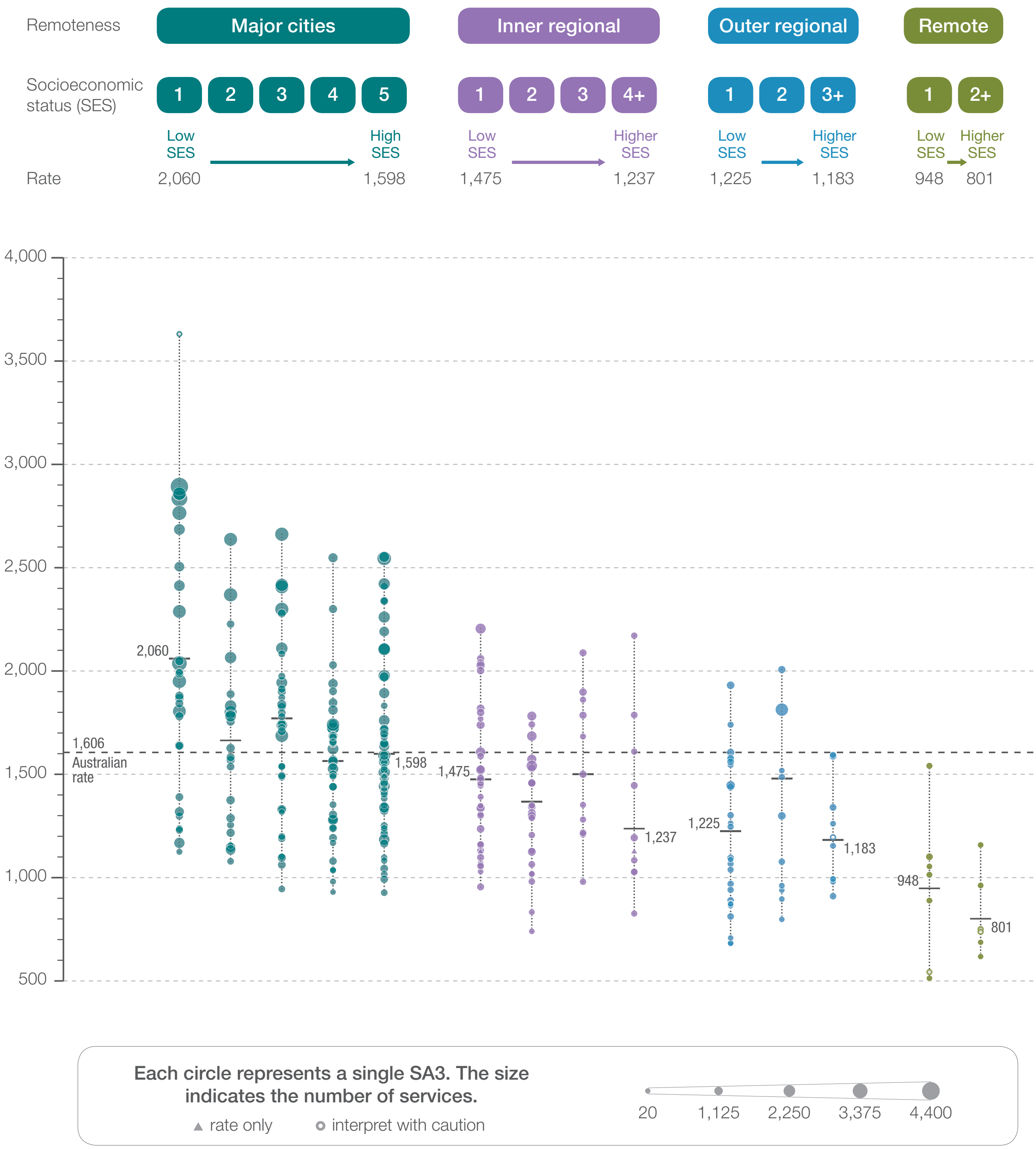
	NSW	Vic	Qld	WA	SA	Tas	ACT	NT
Highest rate	2,893	2,288	2,205	1,339	1,390	1,281	3,631*	1,340
State/territory	1,946	1,570	1,650	1,125	1,103	1,037	1,449	983
Lowest rate	995	980	896	618	682	798	1,238	513
No. services	120,072	76,831	63,006	22,211	15,501	4,547	4,444	1,615



Notes:
Hollow circles (○) and asterisks (*) indicate rates that are considered more volatile than other published rates and should be interpreted with caution.
Triangles (▲) indicate SA3s where only rates are published. The numbers of services are not published for confidentiality reasons.
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of Medicare Benefits Schedule data and ABS Estimated Resident Population 30 June 2016.

Rates by remoteness and socioeconomic status

Figure 3.21: Number of MBS-subsidised services for neck ultrasound per 100,000 people aged 18 years and over, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2016–17



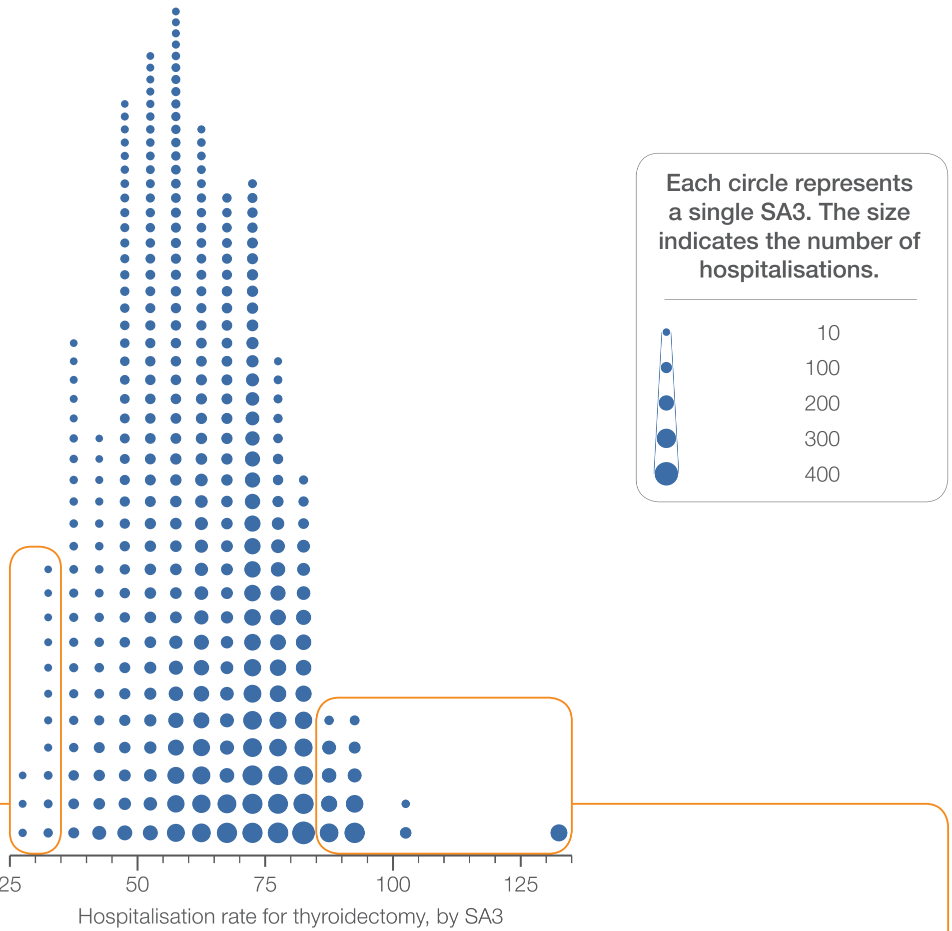
Notes:
Hollow circles (○) indicate rates that are considered more volatile than other published rates and should be interpreted with caution.
Triangles (▲) indicate SA3s where only rates are published. The numbers of services are not published for confidentiality reasons.
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of Medicare Benefits Schedule data and ABS Estimated Resident Population 30 June 2016.

Neck ultrasound and thyroidectomy

Thyroidectomy

Rates by local area

Figure 3.22: Number of hospitalisations for thyroidectomy per 100,000 people aged 18 years and over, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2014–15 to 2016–17



Lowest rate areas

SA3	State	Rate	Hospitalisations
Outback - South	Qld	**28**	14
Great Lakes	NSW	**29**	30
Yorke Peninsula	SA	**29**	20
Mid North	SA	**30**	24
Darwin City	NT	**31**	19
Whitsunday	Qld	**32**	17
West Coast	Tas	**32**	14
Robina	Qld	**33**	41
South Canberra	ACT	**33**	22
Weston Creek	ACT	**33**	19
Katherine	NT	**33**	12
Broadbeach - Burleigh	Qld	**34**	55
Hobart Inner	Tas	**34**	43
Upper Hunter	NSW	**34**	24

Highest rate areas

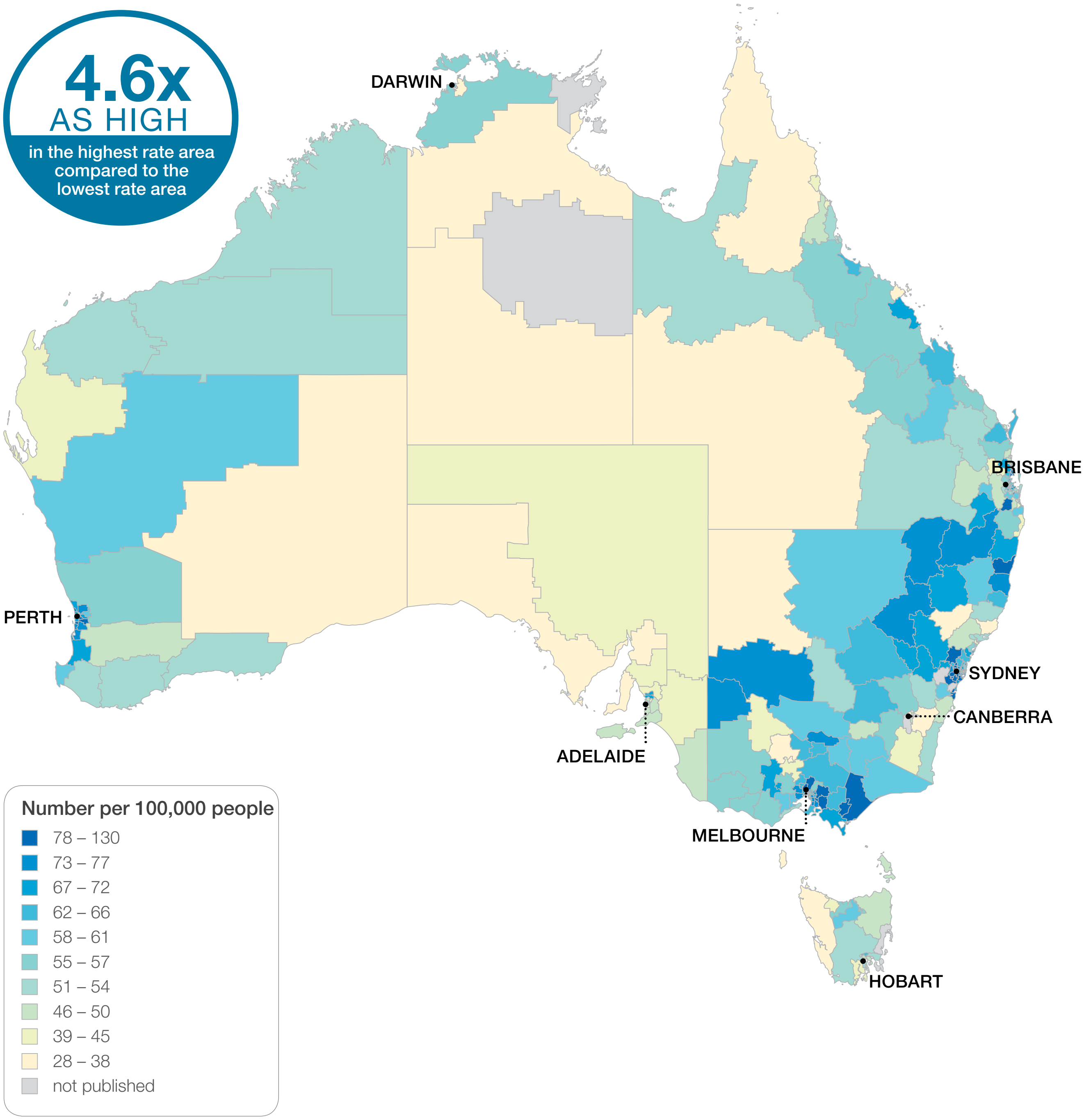
SA3	State	Rate	Hospitalisations
Latrobe Valley	Vic	**130**	242
Botany	NSW	**104**	109
Beaudesert	Qld	**101**	33
Campbelltown (NSW)	NSW	**92**	325
Cronulla - Miranda - Caringbah	NSW	**92**	258
Blacktown - North	NSW	**91**	169
Kwinana	WA	**91**	69
Camden	NSW	**90**	119
Rouse Hill - McGraths Hill	NSW	**89**	57
Dapto - Port Kembla	NSW	**88**	166
Liverpool	NSW	**87**	224
Kogarah - Rockdale	NSW	**86**	286
Bringelly - Green Valley	NSW	**86**	184

Notes:
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of National Hospital Morbidity Database and ABS Estimated Resident Population 30 June 2014 to 2016.

Thyroidectomy

Rates across Australia

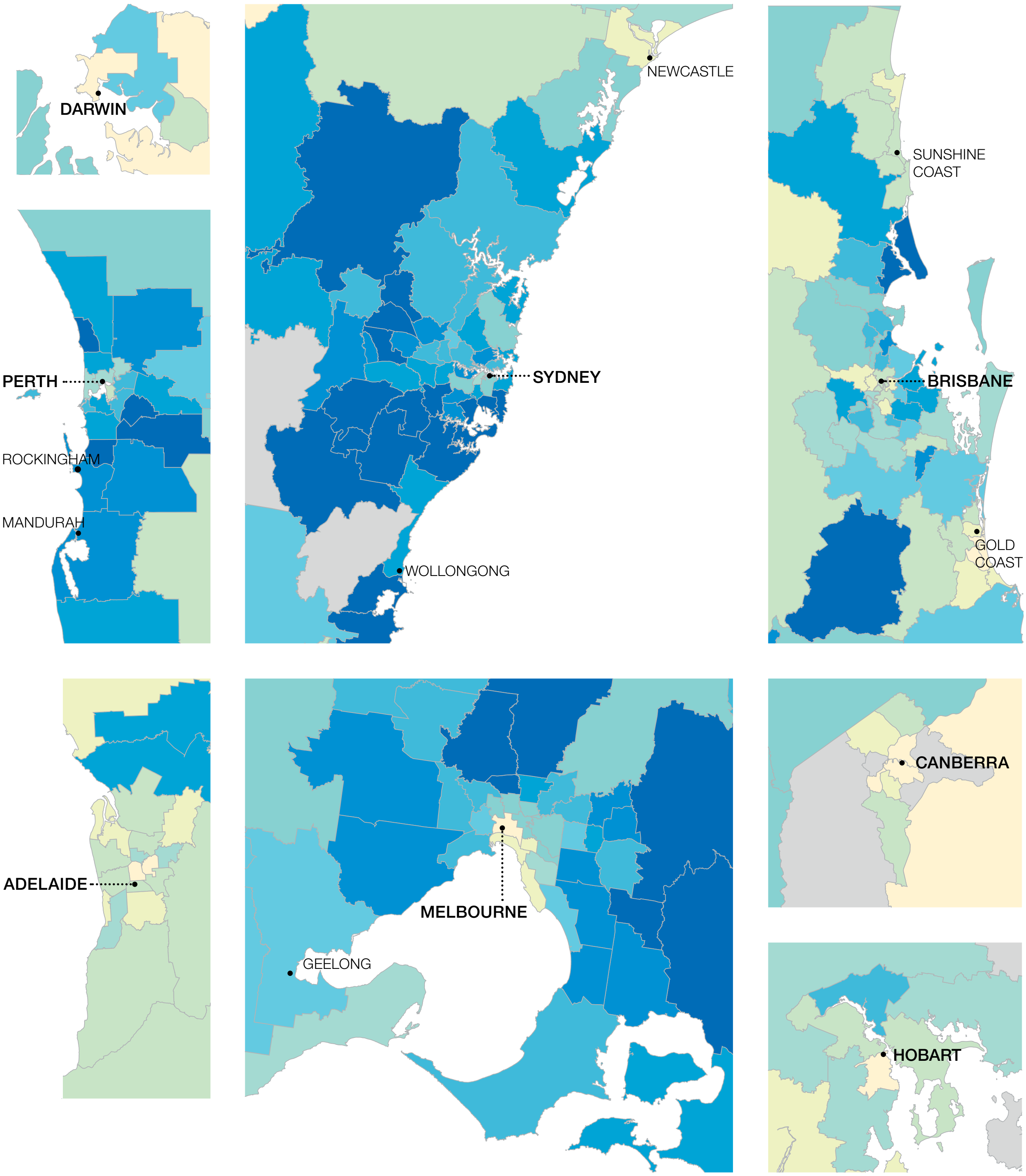
Figure 3.23: Number of hospitalisations for thyroidectomy per 100,000 people aged 18 years and over, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2014–15 to 2016–17



Notes:
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of National Hospital Morbidity Database and ABS Estimated Resident Population 30 June 2014 to 2016.

Rates across capital city areas

Figure 3.24: Number of hospitalisations for thyroidectomy per 100,000 people aged 18 years and over, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2014–15 to 2016–17



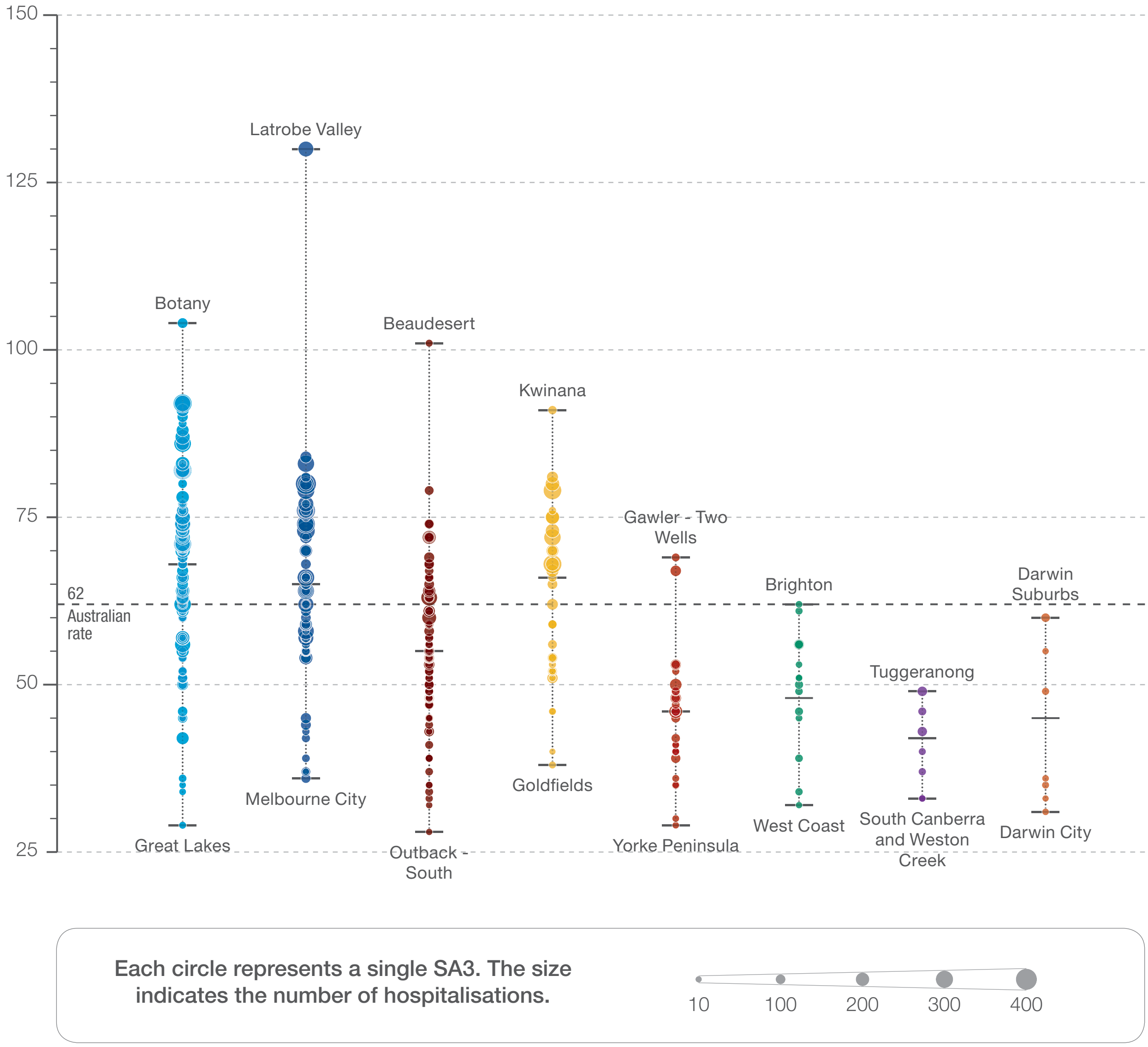
Notes:
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of National Hospital Morbidity Database and ABS Estimated Resident Population 30 June 2014 to 2016.

Thyroidectomy

Rates by state and territory

Figure 3.25: Number of hospitalisations for thyroidectomy per 100,000 people aged 18 years and over, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2014–15 to 2016–17

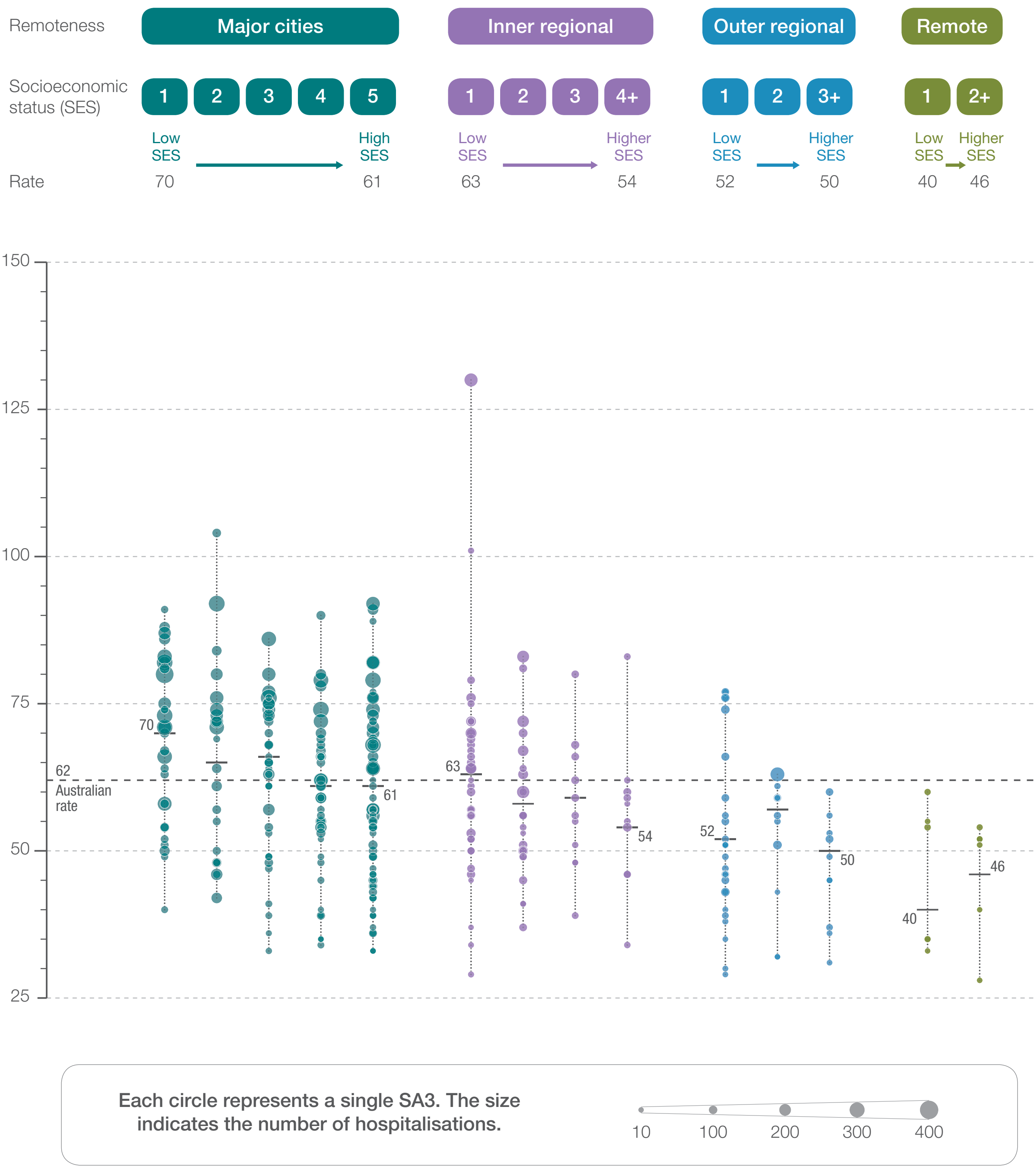
	NSW	Vic	Qld	WA	SA	Tas	ACT	NT
Highest rate	104	130	101	91	69	62	49	60
State/territory	68	65	55	66	46	48	42	45
Lowest rate	29	36	28	38	29	32	33	31
No. hospitalisations	12,485	9,388	6,217	3,879	1,926	621	380	222



Notes:
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of National Hospital Morbidity Database and ABS Estimated Resident Population 30 June 2014 to 2016.

Rates by remoteness and socioeconomic status

Figure 3.26: Number of hospitalisations for thyroidectomy per 100,000 people aged 18 years and over, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2014–15 to 2016–17



Notes:
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of National Hospital Morbidity Database and ABS Estimated Resident Population 30 June 2014 to 2016.

Neck ultrasound and thyroidectomy

Resources

- British Thyroid Association guidelines for the management of thyroid cancer, 3rd edition[14]
- American Thyroid Association management guidelines for adult patients with thyroid nodules and differentiated thyroid cancer[1]
- *Therapeutic Guidelines: Endocrinology*[36] (for electronic version, visit http://tgldcdp.tg.org.au/etgcomplete)
- Cancer Council of Australia, *Understanding Thyroid Cancer: A guide for people with cancer, their families and friends*.[37]

Australian initiatives

The information in this chapter will complement work already under way to improve the management of thyroid cancer in Australia. At a national level, this work includes:

- Australia and New Zealand Thyroid Cancer Registry, Monash University, established 2017[11]
- Endocrine Society of Australia, Choosing Wisely recommendation 1: Don't routinely order a thyroid ultrasound in patients with abnormal thyroid function tests if there is no palpable abnormality of the thyroid gland.[16]

Many state and territory initiatives are also in place to improve management of thyroid cancer, including:

- WA Cancer and Palliative Care Network, *Thyroid Cancer Model of Care*[38]
- Tasmanian Ministerial Thyroid Advisory Committee (established in the 1970s) – leads advocacy for thyroid research informing public health policy
- Tasmanian Health Pathways – provides advice in line with the Endocrine Society of Australia's Choosing Wisely recommendations
- Queensland Health Clinical Prioritisation Criteria – provide guidance to GPs on referral requirements for specialist hospital care for thyroid enlargement or nodules (https://cpc.health.qld.gov.au/Condition/222/thyroid-enlargement-thyroid-nodules and https://cpc.health.qld.gov.au/Condition/69/thyroid-mass).

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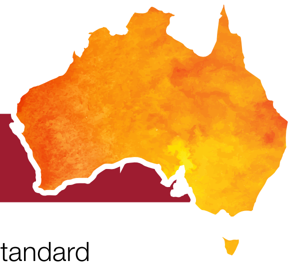
Chapter 4
Cardiac tests



At a glance

Cardiac stress tests and imaging are used in people with symptoms suggestive of coronary heart disease for accurate diagnosis, risk assessment and treatment planning. The Atlas examined use of exercise electrocardiogram (ECG), stress echocardiography, myocardial perfusion scans (MPS) and computed tomography of the coronary arteries, as one item. It also examined use of stress echocardiography and MPS as separate items.

Equitable access to cardiac imaging is important for improving cardiac care and outcomes in people at high risk of coronary artery disease in Australia. Appropriate use of these tests is also important for the sustainability of the health system, as they account for a substantial portion of the health budget. Use of cardiac imaging has grown at about twice the rate of treatment with revascularisation, suggesting that some testing is unnecessary and that healthcare resources could be better used.

The Atlas found that the rate of cardiac stress testing and imaging varies up to 10-fold between local areas in Australia. The largest variation is seen in the rates of stress echocardiography (varies up to 47-fold) and MPS (varies up to 57-fold).

The Atlas also mapped use of standard (or transthoracic) echocardiography, which is used to investigate symptoms suggestive of heart failure, structural heart diseases and other heart conditions. The Atlas found that the rate of standard echocardiography varies up to four-fold between local areas.

A lack of access to some cardiac tests for people in regional and remote areas is a key concern. The Atlas found that rates of cardiac stress tests and imaging, and standard echocardiography are higher in major cities than in regional and remote areas. This finding does not follow the pattern of need, as the burden of cardiovascular disease is higher in regional and remote areas. Barriers to access outside major cities include higher out-of-pocket costs for patients.

The Atlas also found that use of MPS is more common in socioeconomically disadvantaged areas in major cities and inner regional areas. This may be because MPS is less likely to have an out-of-pocket cost than stress echocardiography. Stress echocardiography is preferable to MPS in cases where it will give similar clinical information, because it does not expose the patient to radiation.

Regular review of MBS claims for reimbursement against identified criteria could improve the value gained from cardiac tests.

Recommendation

Cardiac stress tests and imaging

4a. The Commission to develop a clinical care standard on diagnosis, investigation and management of ischaemic heart disease.

Further recommendations for improving use of these tests are included under ‘General recommendations’. See ‘Key findings and recommendations’, page 25.

4.1 Cardiac stress tests and imaging, 18 years and over

Why is this important?

Cardiac stress tests and imaging are used in people with symptoms suggestive of coronary heart disease for accurate diagnosis, risk assessment and treatment planning (for example, treatment with revascularisation by stenting or bypass surgery). Equitable access to cardiac imaging is important for improving cardiac care and outcomes in people at high risk of coronary artery disease in Australia.

Appropriate use of these tests is also important for the sustainability of the health system, as they account for a substantial portion of the health budget. Use of cardiac imaging has grown at about twice the rate of treatment with revascularisation – suggesting that some testing is unnecessary and that healthcare resources could be better used.

Rates of use of stress echocardiography have risen rapidly in recent years, with variation in use across Australia. There are concerns about both overservicing in some areas and underservicing in others.

What did we find?

Rates of cardiac stress tests and imaging vary up to about 10-fold across local areas, and are higher in major cities than in other areas.

What can be done?

Clinical decision support systems could guide the appropriate choice and frequency of cardiac stress tests and imaging, especially if they were incorporated into primary health practice software to ensure that the most appropriate tests are ordered. Medicare Benefits Schedule (MBS) financial reimbursement should reflect evidence-based best practice. Regular review of MBS claims for reimbursement could ensure that they meet the identified criteria.

Given the burden of disease in Aboriginal and Torres Strait Islander Australians, collecting accurate MBS data on services to these groups would be valuable for gaining further understanding of where improvements are most needed.

Cardiac stress tests and imaging, 18 years and over

Context

This item examines use of the following cardiac tests:

- Stress electrocardiogram (ECG), also known as an exercise ECG – an ECG performed while the patient exercises, usually on a treadmill
- Stress echocardiogram – an ultrasound of the heart, before and after exercise
- Myocardial perfusion scan (MPS) – radionuclide imaging of cardiac perfusion and function, with and without exercise
- Computed tomography of coronary arteries (CTCA) – a CT scan showing cardiac blood vessels.

An exercise ECG is not an imaging test; the other three tests listed above are imaging tests. The first three tests listed above are stress tests, while CTCA is an alternative to a stress test. Diagnostic imaging tests need to be provided in accordance with the item descriptors in the Health Insurance (Diagnostic Imaging Services Table) Regulations 2018.[1]

Stress echocardiogram use and MPS use are also examined in this Atlas as separate items. See Section 4.2 'Stress echocardiogram, 18 years and over' (page 201) and Section 4.3 'Myocardial perfusion scans, 18 years and over' (page 211). Stress ECG use and CTCA use are examined in this combined item only.

Stress tests show how well the heart can respond to an external stress such as exercise or specific medicines. These tests are used to investigate new or worsening symptoms in patients with known or suspected coronary heart disease.[2] Other indications for these tests include heart failure, cardiomyopathy, valvular heart disease and assessment several years after revascularisation (for example, by stenting or bypass surgery).[2] The choice of test is determined by the symptoms and clinical condition of the patient, although other factors such as local availability and cost to the patient will also influence test choice.[2]

Coronary heart disease is very common, and affects 5% of Australian men and 2% of Australian women.[3-4] Although both the fatal and non-fatal burden due to coronary heart disease have fallen substantially in Australia in recent times (by 35% and 21%, respectively, from 2003 to 2011), it remains the leading cause of burden of disease in this country.[4] Disease burden from coronary heart disease increases with socioeconomic disadvantage, and is higher in regional and remote areas of Australia than in major cities.[4]

Cardiovascular disease deaths are the greatest contributor to the mortality gap between Aboriginal and Torres Strait Islander Australians and other Australians.[5] In 2011–2015, Aboriginal and Torres Strait Islander Australians died from preventable and avoidable cardiovascular disease at 4.2 times the rate of other Australians (83.1 and 19.9 per 100,000, respectively).[6] In 2015–16, Aboriginal and Torres Strait Islander Australians were hospitalised for cardiovascular disease at a rate 1.7 times as high as the rate for other Australians, and would be expected to have a greater need for cardiac tests.[3,5,6]

Trends in use

As in many other countries, the use of cardiac imaging has grown rapidly in Australia since the early 2000s.[7-9] It is difficult to measure how much this greater use of cardiac imaging has improved cardiac outcomes, but the rate of cardiac imaging in Australia grew at about twice the rate of treatment with revascularisation between 2005–06 and 2014–15.[8,10] Between 2005–06 and 2014–15, the average growth per year for cardiac stress tests and imaging was[10]:

- Exercise ECG – 4%
- Stress echocardiogram – 14%
- MPS – 1%.

CTCA was introduced in Australia more recently than the other tests; the number of these tests grew by an average of 22% per year between 2011–12 and 2014–15.[10]

Overall, use of coronary artery disease diagnostics in Australia grew by an average of 6% per year from 2005–06 to 2014–15. Population ageing and growth each account for a 1–2% increase during this period.[10] Other potential contributors to the rise in cardiac testing include increased numbers of cardiologists, an increase in patient demand due to information on the internet, inappropriate use of testing, and more inexperienced operators performing tests (which may lead to increased repetition of tests because a previous test was of low quality).[9,11] National figures showing the change in the number of cardiologists between 2005 and 2015 are not available, but the number of cardiologists registered in Australia increased by 273 (from 1,152 to 1,425) between October 2013 and June 2018.[12]

International comparisons of cardiac imaging rates are limited by differences in data collection methods.

Appropriate use of cardiac tests

Cardiac stress tests are used to investigate symptoms of coronary heart disease; the results are used to determine the patient's diagnosis, risk level and appropriate interventions.[2] Cardiac stress tests are generally performed by cardiologists; however, they may also be performed by general physicians.

Cardiac stress tests are rarely appropriate for screening for coronary heart disease in patients without symptoms.[2] In some cases, cardiac stress tests are used to plan management in people without symptoms if they have high absolute cardiovascular risk based on multiple risk factors such as age, blood pressure and cholesterol level.[2] Absolute cardiovascular risk is the risk of having a cardiovascular event, such as myocardial infarction (heart attack), in the next five years.[13]

For many low-risk patients with symptoms of coronary heart disease, an exercise ECG gives enough clinical information to plan management and is less costly than stress echocardiography, MPS and CTCA.[2,10,14] Stress echocardiography or MPS is recommended for low- and high-risk patients who have symptoms but are not suitable candidates for an exercise ECG – for example, if they cannot exercise or have an uninterpretable ECG.[2,10] Interpreting results of stress echocardiography can be difficult in morbidly obese patients, and other tests (for example, MPS with positron emission scanning) may be better alternatives.[2] Stress imaging is also recommended for higher-risk patients with symptoms.[10]

For most patients with suspected coronary artery disease, stress echocardiography and MPS give equivalent information. If locally available, stress echocardiography should generally be preferred as it does not involve radiation exposure and is less costly for the health system.[2,10] While an MPS is generally considered safe, the associated dose of radiation is approximately that of 150 chest X-rays.[10]

CTCA is a relatively new test. Currently in Australia, to qualify for an MBS rebate, CTCA can only be requested by a specialist or consultant physician.[1,10] CTCA may be appropriate for higher-risk patients with symptoms, and is valuable for ruling out disease with a high degree of confidence. However, because of its high cost, it should not be used in low-risk patients.[10,15,16]

Access to cardiac tests

Despite the universal healthcare system in Australia, there are geographic and financial barriers to accessing cardiac tests for some population groups. Availability of some of these cardiac tests is limited outside metropolitan areas and larger regional centres.[17] It may not be financially viable for private radiology practices to provide services to areas with small populations, and a public hospital may become the default provider of radiology services.[18] If a public diagnostic imaging service is not available locally, patients may need to travel further to access a public service or pay an out-of-pocket expense for a private service.[18] The average out-of-pocket cost for diagnostic imaging was $94 per service in 2009–10, but costs increased as remoteness increased.[19]

About the data

Data are sourced from the MBS dataset. This dataset includes information on MBS claims processed by the Australian Government Department of Human Services. It covers a wide range of services (attendances, procedures, tests) provided across primary care and hospital settings.

Cardiac stress tests and imaging, 18 years and over

The dataset does not include:

- Services for publicly funded patients in hospitals
- Services for patients in hospital outpatient clinics where claims are not made to the MBS
- Services covered under Department of Veterans' Affairs arrangements.

Rates are based on the number of MBS-subsidised services for cardiac stress tests and imaging per 100,000 people aged 18 years and over in 2016–17.

Because an MBS claim is included for each service rather than for each patient, patients who receive any of the services listed in this data item more than once in the financial year will have more than one MBS claim counted.

The analysis and maps are based on the residential address of the patient recorded in the MBS claim and not the location of the service.

Rates are age and sex standardised to allow comparisons between populations with different age and sex structures.

This analysis was not undertaken by Aboriginal and Torres Strait Islander status because this information was not available for the MBS data at the time of publication.

What do the data show?

Magnitude of variation

In 2016–17, there were 933,727 MBS-subsidised services for cardiac stress tests and imaging, representing 4,575 services per 100,000 people aged 18 years and over (the Australian rate).

The number of MBS-subsidised services for cardiac stress tests and imaging across 329* local areas (Statistical Area Level 3 – SA3) ranged from 1,184 to 11,568 per 100,000 people aged 18 years and over. The rate was **9.8 times as high** in the area with the highest rate compared to the area with the lowest rate. The number of services varied across states and territories, from 2,289 per 100,000 people aged 18 years and over in Tasmania to 6,673 in New South Wales (Figures 4.4–4.7).

After the highest and lowest 10% of results were excluded and 264 SA3s remained, the number of services per 100,000 people aged 18 years and over was 3.8 times as high in the area with the highest rate compared to the area with the lowest rate.

Analysis by remoteness and socioeconomic status

Rates of cardiac stress tests and imaging were higher in major cities than in other areas. There was no clear pattern according to socioeconomic status (Figure 4.8).

Analysis by cardiac test type

Nationally, 53% of cardiac stress tests and imaging were exercise ECGs, 33% were stress echocardiograms, 8% were MPS and 6% were CTCA. The proportions for each test were similar across all states and territories (Figure 4.1).

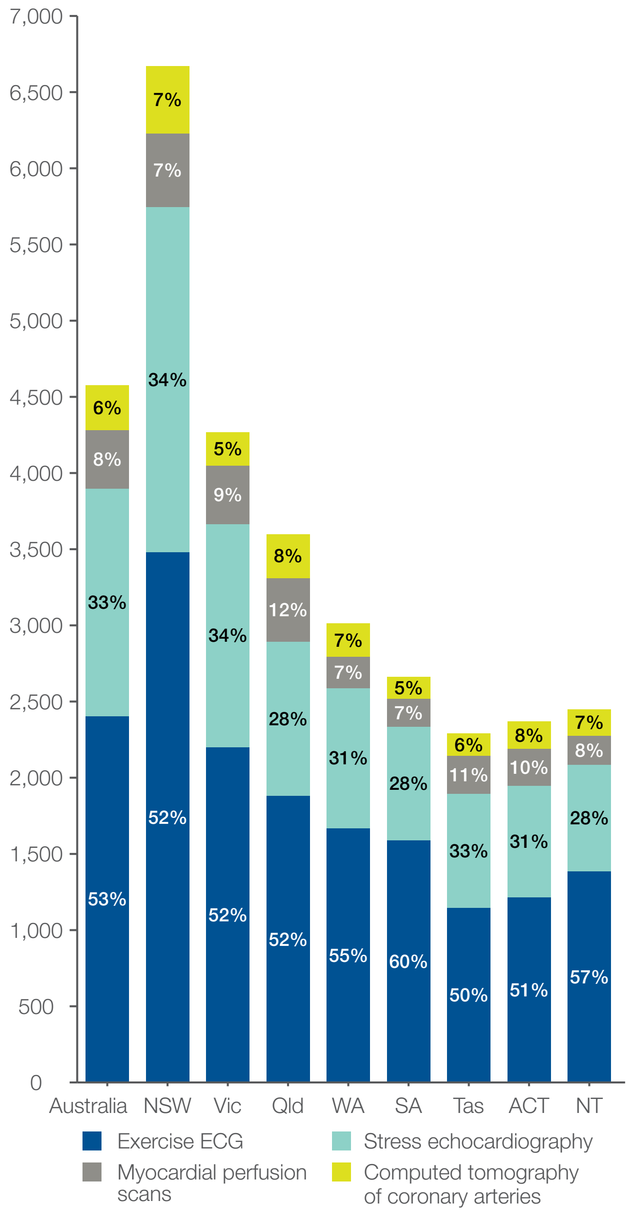
Analysis by referrer type

Nationally, 64% of cardiac stress tests and imaging were requested by general practitioners (GPs), 26% of tests were requested by cardiologists and 10% were requested by other health professionals. The proportion of tests requested by GPs varied from 42% in South Australia to 72% in New South Wales and the Australian Capital Territory. The proportion of tests requested by cardiologists varied from 19% in New South Wales to 47% in South Australia (Figure 4.2).

* There are 340 SA3s. For this item, data were suppressed for 11 SA3s due to one or more of a small number of services or population in an area, or potential identification of individual patients, practitioners or business entities.

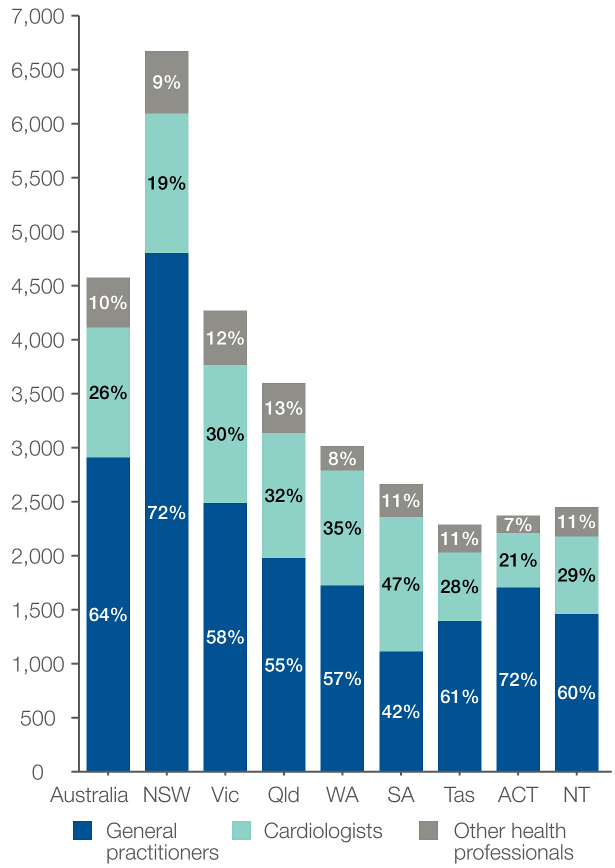
Notes:
Some of the published SA3 rates were considered more volatile than others. These rates are excluded from the calculation of the difference between the highest and lowest SA3 rates in Australia.
For further detail about the methods used, please refer to the Technical Supplement.

Figure 4.1: Number of MBS-subsidised services for cardiac stress tests and imaging per 100,000 people aged 18 years and over, age and sex standardised, by state and territory of patient residence, by cardiac test type, 2016–17



The data for Figure 4.1 are available at www.safetyandquality.gov.au/atlas

Figure 4.2: Number of MBS-subsidised services for cardiac stress tests and imaging per 100,000 people aged 18 years and over, age and sex standardised, by state and territory of patient residence, by referrer type, 2016–17



The data for Figure 4.2 are available at www.safetyandquality.gov.au/atlas

Notes:
Speciality of referrer was derived for some records for which this information was unknown.
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of Medicare Benefits Schedule data and ABS Estimated Resident Population 30 June 2016.

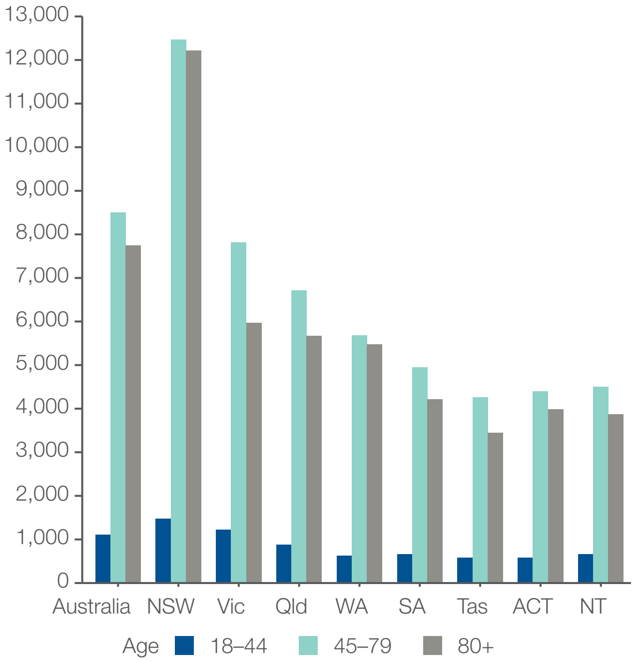
Cardiac stress tests and imaging, 18 years and over

Analysis by age group

Rates of cardiac stress tests and imaging were highest in the 45–79 years age group. The national rate in this age group was 8,497 per 100,000 people and varied from 4,255 per 100,000 people in Tasmania to 12,466 per 100,000 people in New South Wales.

The national rate for tests performed on the 80 years and over age group was slightly lower at 7,744 per 100,000 people. The rate varied from 3,447 per 100,000 people in Tasmania to 12,211 per 100,000 people in New South Wales (Figure 4.3).

Figure 4.3: Number of MBS-subsidised services for cardiac stress tests and imaging per 100,000 people by age group, age and sex standardised, by state and territory of patient residence, 2016–17



The data for Figure 4.3 are available at www.safetyandquality.gov.au/atlas

Interpretation

Rates of MBS-subsidised cardiac stress tests and imaging, and echocardiography varied markedly between states and territories. Variation in combined rates of use of these cardiac tests is likely to be due to geographical differences in the factors discussed below.

Rates of underlying disease

Variation is warranted and desirable when it reflects variation in the underlying need for care. Groups with higher rates of cardiovascular disease have greater need for cardiac tests, which should influence the variation in rates of use of these tests. Hospitalisations associated with cardiovascular disease increase with remoteness and with socioeconomic disadvantage, and are higher among Aboriginal and Torres Strait Islander Australians than among other Australians.[3]

Data analysis for this data item indicates that rates of MBS-subsidised cardiac stress tests and imaging were higher in major cities than in other remoteness categories. This suggests that people in inner and outer regional, and remote areas may be missing out on appropriate cardiac stress tests and imaging.

Access to services

Variation in cardiac testing rates is likely to reflect differences in geographical and financial access to services, both for referral and for performance of the tests.[8] Differences in the relative availability of private and public cardiology services in an area will influence the rates of MBS-subsidised cardiac stress tests and imaging requested. Diagnostic imaging services are concentrated in major cities, and out-of-pocket costs increase as remoteness increases.[19] Bulk-billing is common in some socioeconomically disadvantaged areas of major cities, so out-of-pocket costs will not be a barrier where this is the case.

Notes:
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of Medicare Benefits Schedule data and ABS Estimated Resident Population 30 June 2016.

Clinical decision-making

Clinicians' differing thresholds for referral for cardiac testing are likely to affect patterns of variation in the use of cardiac tests – for example, in rates of testing asymptomatic patients.[10] Differences in practice regarding regularity of reviews and intervals for repeat testing are also likely to influence variation, both within and between states and territories. Patient demand may also influence clinical decision-making.[10]

Availability of previous test results

The extent of repeat testing on patients will also be related to the ease with which clinicians can access previous test findings or their perceptions about the quality of previously performed tests. Geographic differences in either of these factors will contribute to the variation observed in patterns of cardiac testing.

Cultural factors and access to culturally appropriate healthcare services are also likely to influence access to cardiac testing for Aboriginal and Torres Strait Islander Australians. Examples include conflicting cultural priorities and gender role responsibilities (such as enculturation of males to be 'strong' and to not express pain, and the female's prioritisation of family needs over self), and perceived discrimination within the health system.[20]

Funding models

The data for this item exclude services that are free of charge to public patients in hospitals, such as cardiac tests done for public patients in public hospital outpatient clinics or emergency departments. This means that the funding models of cardiac test services available in an area, and the relative accessibility of services to patients, may influence the variation seen. For example, the rates of cardiac testing seen in the Northern Territory and remote Western Australia may be low because a higher proportion of tests in these areas is done for public patients in hospital outpatient clinics (which are not counted in this data item). In contrast, the rates in New South Wales may be high because there are many locations in New South Wales where services and investigations undertaken in public hospital outpatient clinics are claimed through the MBS under specialist medical practitioner rights of private practice arrangements.

Proportions of individual tests

Variation in the proportions of individual cardiac tests used is likely to be due to geographical differences in the availability of the expertise required for different tests. For example, exercise ECG and stress echocardiography require different specialist expertise from MPS. Different patterns of availability of radiology and cardiology services will affect the proportions of individual tests undertaken in different areas. The local availability of sonographers will also influence the rate of stress echocardiography.

An MPS has a lower out-of-pocket cost for the patient than a stress echocardiogram. This may encourage referrers to request an MPS, even if a stress echocardiogram is appropriate, and this may be more common in socioeconomically disadvantaged areas. More than 95% of MPS studies are bulk-billed, compared with 70% of stress echocardiograms.[10]

Some patient characteristics and comorbidities, such as obesity, make exercise ECG unsuitable, and other cardiac tests need to be substituted.[21] Lower rates of exercise ECG and higher rates of the other cardiac tests in some areas could be partly due to variation in the proportion of patients who are not suitable candidates for exercise ECG.

Addressing variation

Variation that is unrelated to patient need or preference is referred to as unwarranted variation. Addressing variation in underlying disease burden and reducing the burden of disease overall would require strategies to address modifiable risk factors for cardiovascular conditions. These risk factors include smoking, obesity, alcohol use, physical inactivity, high blood pressure and poor diet.[4] A substantial proportion of cardiovascular events and burden of disease could be prevented by addressing modifiable risk factors from an early age through to adulthood, at both an individual and a population level.[22-24]

Cardiac stress tests and imaging, 18 years and over

Approaches to reducing unwarranted variation and improving appropriateness of care for cardiac testing are discussed below.

Improving equity of access

Equity issues related to out-of-pocket costs for diagnostic imaging and geographic distribution of imaging services were examined in a recent Senate inquiry into availability and accessibility of diagnostic imaging equipment around Australia.[25] Several strategies to increase access have been proposed, including increasing remuneration and providing equipment subsidies for providers of imaging in regional and remote areas to compensate for the extra costs of delivering services in these settings.[17,18]

Diagnostic imaging equipment and workforce are concentrated in larger cities in Australia.[25,26] There is a national shortage of sonographers, who carry out ultrasound examinations including stress and standard echocardiography.[27] While this problem affects all parts of Australia, it is more pronounced in rural and remote areas.[28] The scarcity of clinical training places for sonography graduates contributes to this shortage.[25] One of the barriers for private and public radiology services providing clinical placement training for sonography graduates is the cost involved. A subsidy to encourage services to take on trainees has been suggested.[29]

Training nurses and nurse practitioners to perform sonography in metropolitan and rural areas has also been recommended as a way to improve access to ultrasound.[25] Cardiac technologists could also be trained to perform sonography. Increasing support for tele-radiology services[25] and innovative service delivery models such as mobile cardiac investigation services could also improve access to diagnostic imaging in rural and remote areas.[25]

Overcoming cultural barriers that prevent Aboriginal and Torres Strait Islander Australians accessing health services will require a culturally respectful and non-discriminatory health system.[30]

Improving appropriate use of tests

A rapid increase in the use of cardiac imaging in recent times has prompted debate about appropriate and sustainable use in many countries.[7,8] Appropriate use of tests in patients with symptoms or diagnosed disease has also been a topic of international concern. The American College of Cardiology and others have published appropriate use criteria for cardiac imaging, including MPS (2005), CTCA (2006), stress echocardiography (2008) and multi-modality imaging (2014).[14,31-33] The European Society of Cardiology and the European Association of Cardiovascular Imaging have also recognised a need for appropriateness criteria for use of cardiac imaging, and have published criteria for use of imaging in heart failure.[7,34]

The United States Preventive Services Task Force released a recommendation statement in 2018 recommending against using resting or exercise electrocardiogram for screening in asymptomatic adults at low risk of cardiovascular events.[35]

A lack of alignment between United States appropriate use criteria and guidelines for standard echocardiography used by Australian clinicians has been noted.[36] Greater consistency between guidelines and appropriate use criteria would increase their usefulness if they were to be introduced in Australia.[36]

Use of cardiac stress tests and imaging to screen asymptomatic patients is not recommended in Australia. The Heart Foundation and the Royal Australian College of General Practitioners recommend conducting an absolute cardiovascular disease risk assessment every two years on adults aged 45 years and over who are not known to have cardiovascular disease or who are not clinically determined to be at high risk. The absolute cardiovascular disease risk assessment combines several risk factors to calculate the probability of a person having a cardiovascular event such as a heart attack or a stroke in the next five years. People deemed to have a low absolute cardiovascular risk (<10% absolute five-year cardiovascular risk) do not require a cardiac test.[37,38]

The Australian Choosing Wisely program reinforces this message. Choosing Wisely recommendations from the Royal Australian College of General Practitioners include 'Don't screen asymptomatic, low-risk patients (<10% absolute five-year cardiovascular risk) using ECG, stress test, coronary artery calcium score or carotid artery ultrasound'.[13,39] Choosing Wisely recommendations from the Australian and New Zealand College of Anaesthetists recommend against routinely requesting cardiac stress testing for asymptomatic patients before low- to intermediate-risk non-cardiac surgery.[40]

Clinical decision support material

Developing clinical decision support material to guide the choice and frequency of cardiac stress tests and imaging, and incorporating these decision aids into primary care practice software, would assist clinicians to choose the most appropriate cardiac stress test and improve appropriateness of care. Cardiovascular clinical decision support materials could be developed and made available alongside other decision support resources for primary healthcare practitioners.

As noted, this MBS item reports cardiac stress tests and imaging services but does not report on patients who receive a service more than once in the financial year – either the same type of cardiac test or any of the other tests listed in the data item. Reducing clinically unnecessary repeat testing is one way to reduce over-testing. Wider use of the My Health Record system should help reduce duplicate testing by ensuring that results of previous tests are available at the point of care.[41]

MBS item descriptions

Rebates are provided to patients for private cardiac stress tests and imaging through the MBS. The Cardiac Services Clinical Committee, under the auspices of the MBS Review Taskforce, has undertaken an extensive review of current MBS items in cardiology. The committee has made a number of recommendations to the Australian Government with the overarching themes of:

- Aligning MBS services with elements of evidence-based practice guidelines, where possible
- Ongoing review of items to ensure currency
- Ensuring that appropriate indications for use of services are clearly identified
- Developing systems for regular review and audit to ensure that claims for reimbursement meet the identified criteria.

This approach – ensuring that financial reimbursement of services is structured in a way that encourages appropriate care that is in line with the best available evidence – would benefit patients by improving the care they receive, and would benefit the community by allocating resources to services that are of high value.

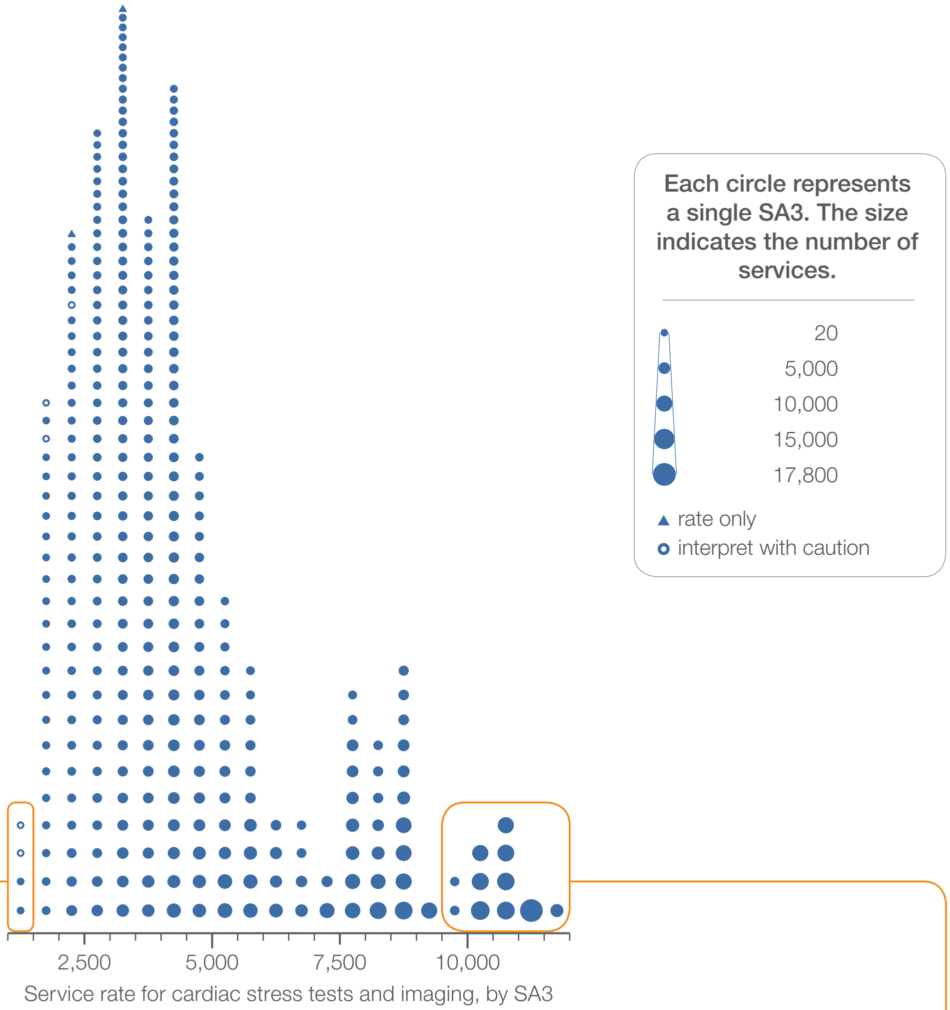
Other approaches

Other approaches to improving appropriateness of cardiac testing include structured request forms to prompt the most appropriate test to be selected, teaching medical students about the implications of overuse, and using decision support tools with patients during a discussion with their clinician about their symptoms and risk factors and their level of risk of having a cardiac event within five years.[10,42,43] In the emergency department setting, a decision aid for use with low-risk patients with chest pain resulted in a 19% lower rate of admission for cardiac stress testing compared with usual care, with no increase in adverse events.[42] The support of senior staff and clinicians is likely to be an important factor in promoting evidence-based best practice.

Cardiac stress tests and imaging, 18 years and over

Rates by local area

Figure 4.4: Number of MBS-subsidised services for cardiac stress tests and imaging per 100,000 people aged 18 years and over, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2016–17



Lowest rate areas

SA3	State	Rate	Services
Outback - North and East	SA	1,184	271
Alice Springs	NT	1,269	334
East Pilbara	WA	1,318*	189
West Pilbara	WA	1,351*	231

Highest rate areas

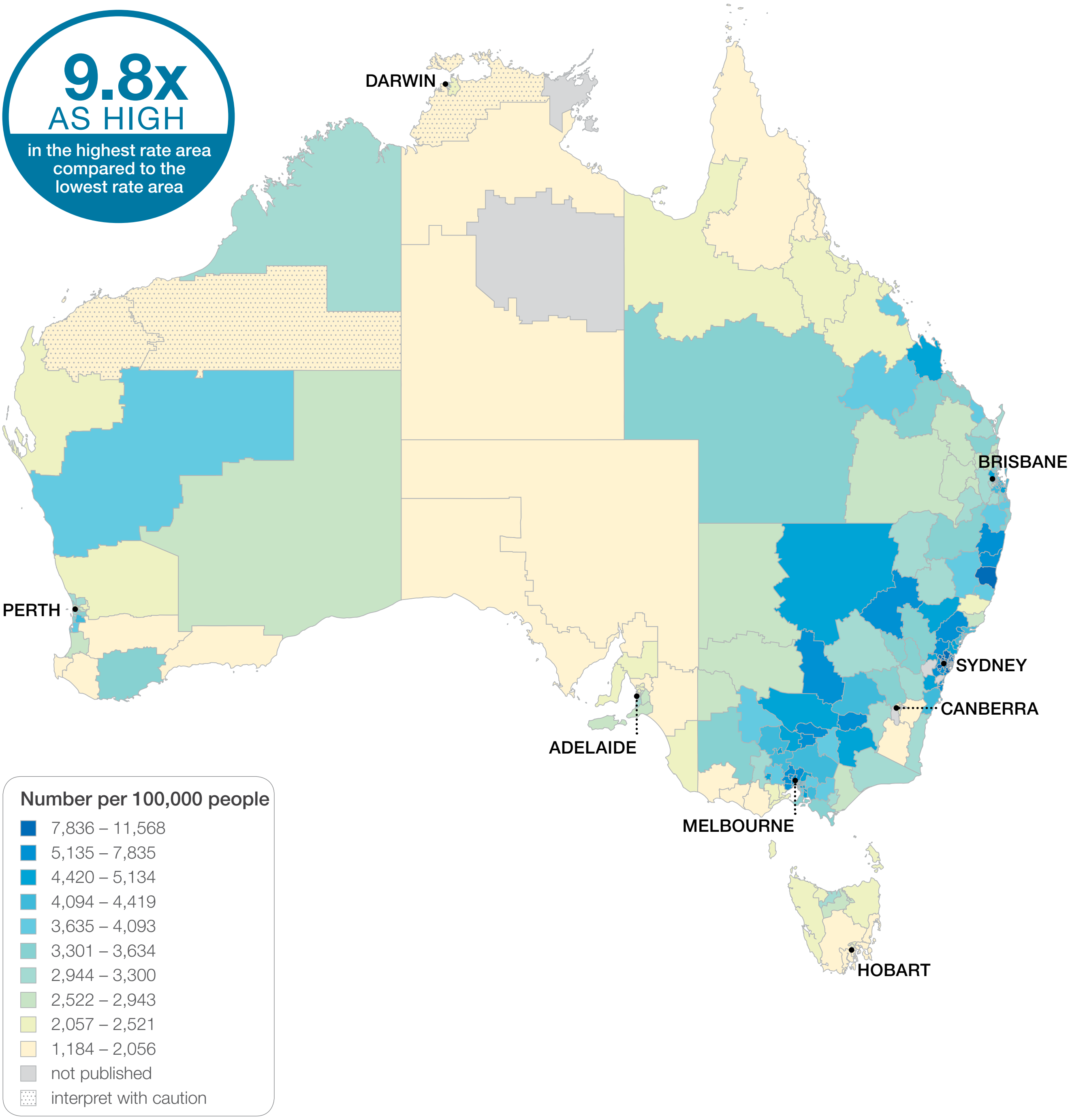
SA3	State	Rate	Services
Blacktown - North	NSW	11,568	6,487
Fairfield	NSW	11,267	17,772
Cronulla - Miranda - Caringbah	NSW	10,917	11,694
Merrylands - Guildford	NSW	10,722	12,094
Sutherland - Menai - Heathcote	NSW	10,638	10,155
Blacktown	NSW	10,518	10,912
Canterbury	NSW	10,499	11,237
Baulkham Hills	NSW	10,350	13,101
Parramatta	NSW	10,293	10,195
Rouse Hill - McGraths Hill	NSW	9,890	2,250
Dural - Wisemans Ferry	NSW	9,681	2,555

Notes:
Hollow circles (○) and asterisks (*) indicate rates that are considered more volatile than other published rates and should be interpreted with caution.
Triangles (▲) indicate SA3s where only rates are published. The numbers of services are not published for confidentiality reasons.
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of Medicare Benefits Schedule data and ABS Estimated Resident Population 30 June 2016.

Cardiac stress tests and imaging, 18 years and over

Rates across Australia

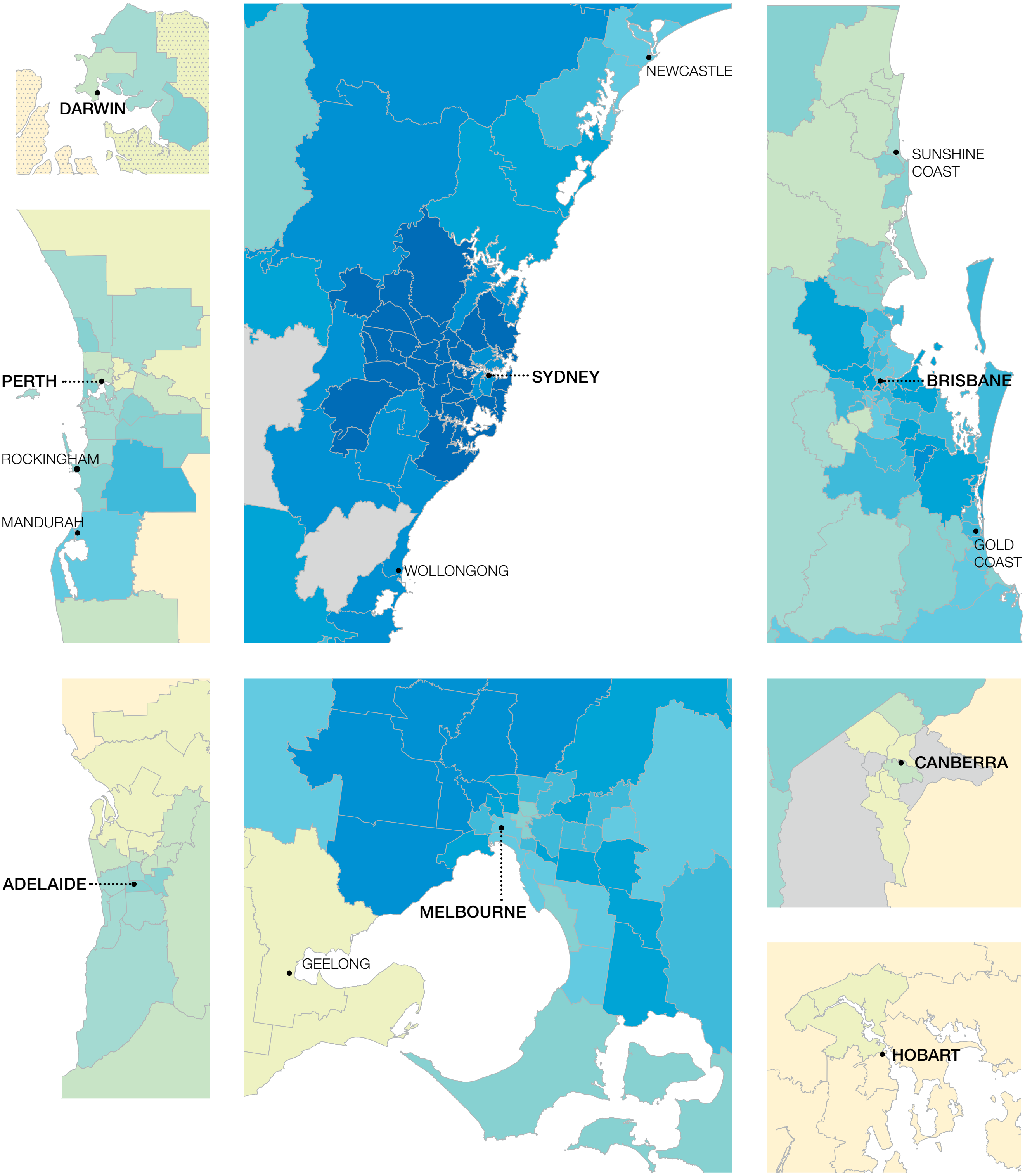
Figure 4.5: Number of MBS-subsidised services for cardiac stress tests and imaging per 100,000 people aged 18 years and over, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2016–17



Notes:
Dotted areas indicate rates that are considered more volatile than other published rates and should be interpreted with caution. These rates are excluded from the calculation of the difference between the highest and lowest SA3 rates in Australia.
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of Medicare Benefits Schedule data and ABS Estimated Resident Population 30 June 2016.

Rates across capital city areas

Figure 4.6: Number of MBS-subsidised services for cardiac stress tests and imaging per 100,000 people aged 18 years and over, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2016–17



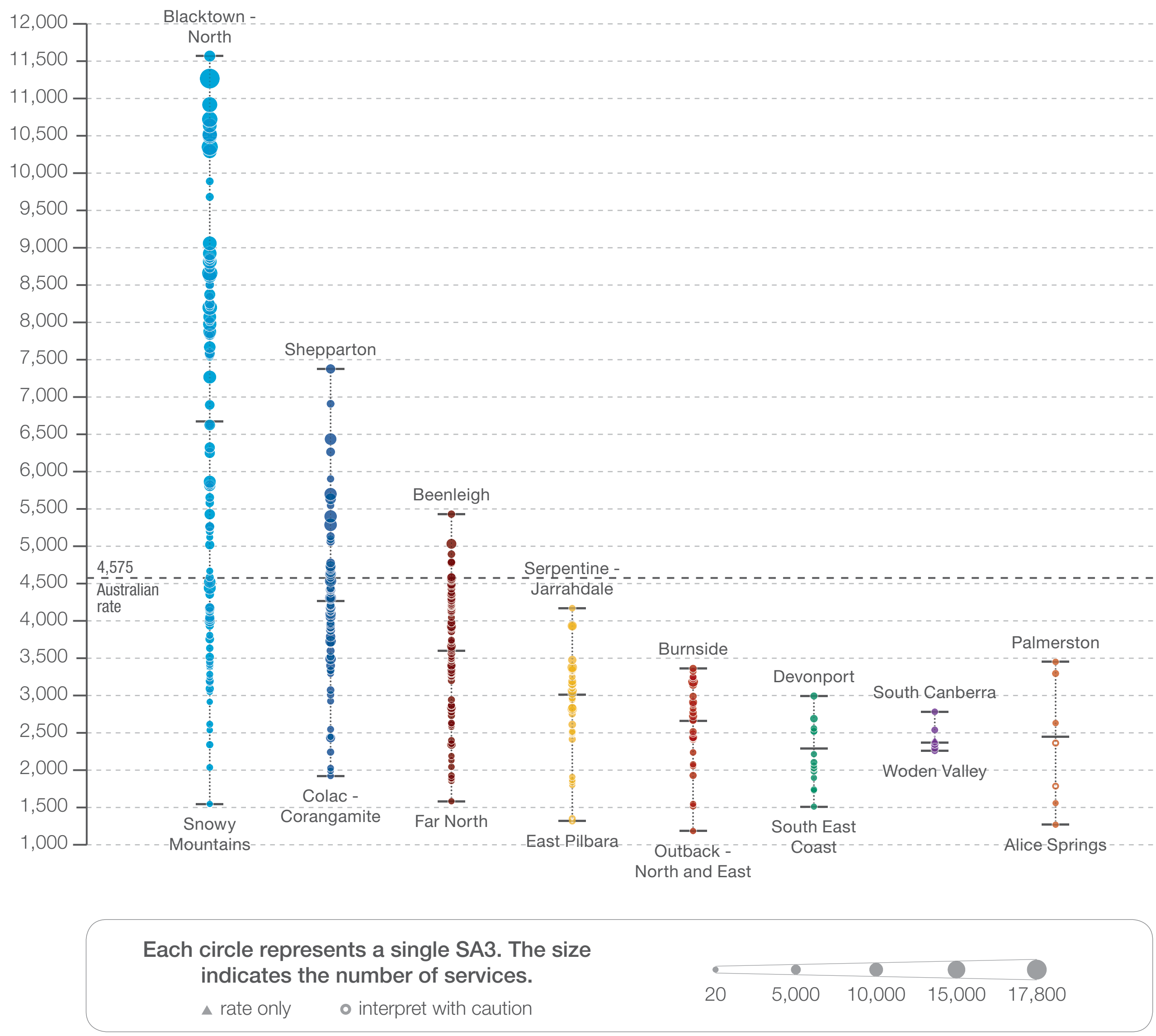
Notes:
Dotted areas indicate rates that are considered more volatile than other published rates and should be interpreted with caution.
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of Medicare Benefits Schedule data and ABS Estimated Resident Population 30 June 2016.

Cardiac stress tests and imaging, 18 years and over

Rates by state and territory

Figure 4.7: Number of MBS-subsidised services for cardiac stress tests and imaging per 100,000 people aged 18 years and over, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2016–17

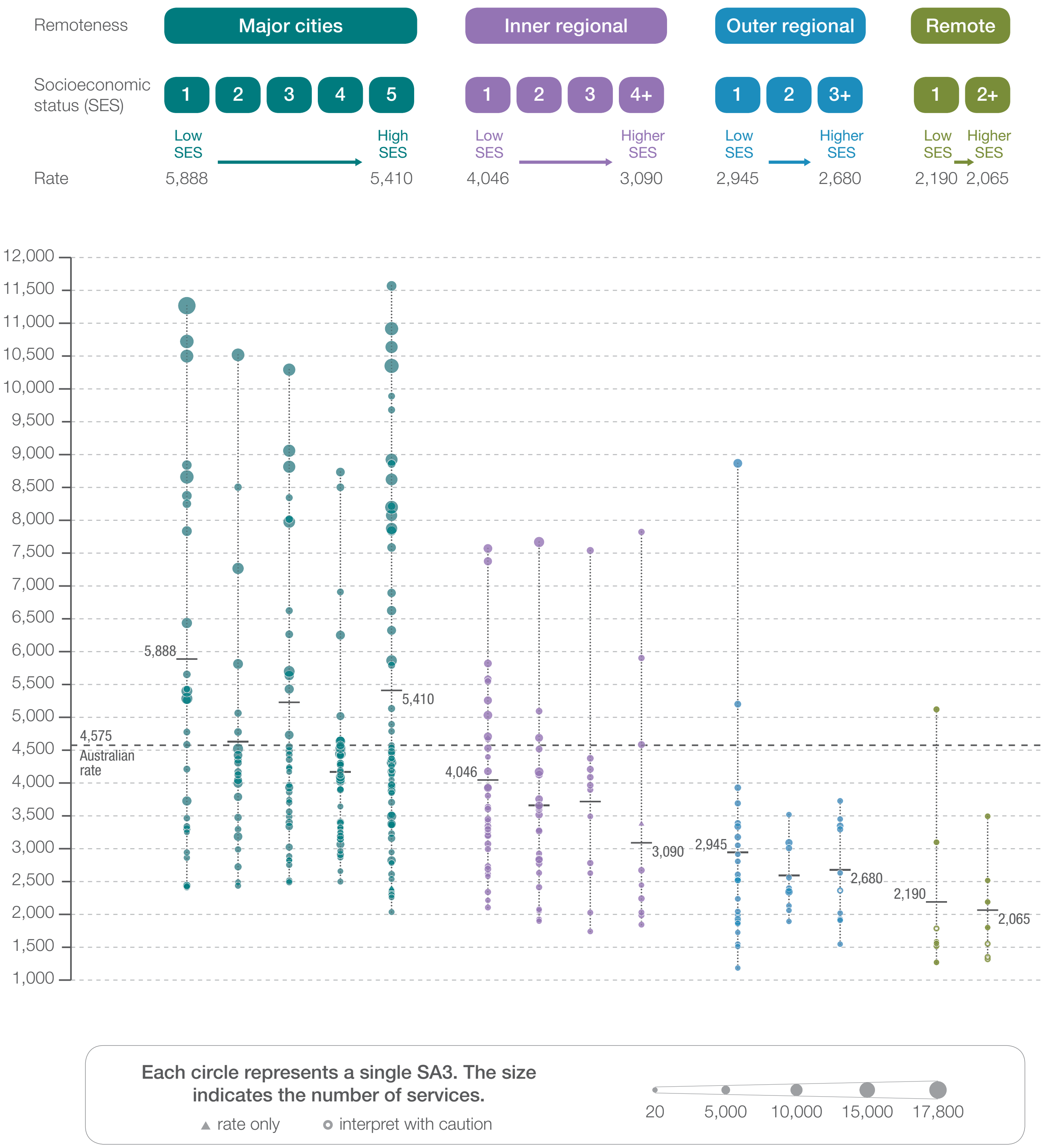
	NSW	Vic	Qld	WA	SA	Tas	ACT	NT
Highest rate	11,568	7,376	5,430	4,170	3,363	2,994	2,782	3,451
State/territory	6,673	4,268	3,597	3,012	2,661	2,289	2,370	2,450
Lowest rate	1,547	1,923	1,583	1,318*	1,184	1,511	2,259	1,269
No. services	444,753	216,856	145,791	62,080	41,745	11,552	7,125	3,739



Notes:
Hollow circles (○) and asterisks (*) indicate rates that are considered more volatile than other published rates and should be interpreted with caution.
Triangles (▲) indicate SA3s where only rates are published. The numbers of services are not published for confidentiality reasons.
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of Medicare Benefits Schedule data and ABS Estimated Resident Population 30 June 2016.

Rates by remoteness and socioeconomic status

Figure 4.8: Number of MBS-subsidised services for cardiac stress tests and imaging per 100,000 people aged 18 years and over, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2016–17



Notes:
Hollow circles (○) indicate rates that are considered more volatile than other published rates and should be interpreted with caution.
Triangles (▲) indicate SA3s where only rates are published. The numbers of services are not published for confidentiality reasons.
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of Medicare Benefits Schedule data and ABS Estimated Resident Population 30 June 2016.

Cardiac stress tests and imaging, 18 years and over

Resources

- Cardiac Society of Australia and New Zealand, *Noninvasive Coronary Artery Imaging: Current clinical applications*[16]
- *Therapeutic Guidelines: Cardiovascular*[44] (for electronic version, visit https://tgldcdp.tg.org.au/etgcomplete)
- Australian and New Zealand College of Anaesthetists, Choosing Wisely recommendation 2: Avoid ordering cardiac stress testing for asymptomatic patients prior to undergoing low to intermediate risk non-cardiac surgery[40]
- Royal Australian College of General Practitioners, Choosing Wisely recommendation 4: Don't screen asymptomatic, low-risk patients (<10% absolute 5-year CV risk) using ECG, stress test, coronary artery calcium score, or carotid artery ultrasound[39]
- Australian Commission on Safety and Quality in Health Care, *National Safety and Quality Health Service Standards* (2nd edition)[45]
- Wardliparingga Aboriginal Research Unit of the South Australian Health and Medical Research Institute, *National Safety and Quality Health Service Standards User Guide for Aboriginal and Torres Strait Islander Health*[46]

Australian initiatives

The information in this chapter will complement work already under way to improve the appropriate use of cardiac investigations in Australia. At a national level, this work includes:

- Australian and New Zealand College of Anaesthetists and Royal Australian College of General Practitioners, Choosing Wisely recommendations[39,40]
- MBS Review Taskforce Cardiac Services Clinical Committee, review including recommendations about cardiac tests[10]
- Australian Health Ministers' Advisory Council, *Aboriginal and Torres Strait Islander Health Performance Framework 2017 Report*.[6]

Many state and territory initiatives are also in place, including:

- Implementation of the Victorian cardiac services plan – *Design, Service and Infrastructure Plan for Victoria's Cardiac System*[47]
- The New South Wales Leading Better Value Care Program, which focuses on delivering better care for patients using a patient experience and health outcomes approach.[48]

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4.2 Stress echocardiography, 18 years and over

What did we find?

Rates of stress echocardiography vary up to about 50-fold across local areas, and are higher in major cities and inner regional areas than in outer regional and remote areas.

Context

A stress echocardiogram is an ultrasound of the heart that shows how it responds to stress with either exercise (treadmill or bicycle) or specific medicines.[1] This test is used to investigate new or worsening symptoms in patients with known or suspected coronary heart disease.[1,2] Other indications include pulmonary hypertension and heart valve disease.[1] It is rarely appropriate for investigating asymptomatic patients. See Section 4.1 'Cardiac stress tests and imaging, 18 years and over (page 183) for a discussion of the role of stress echocardiography compared with other cardiac tests.

In Australia, growth in the use of stress echocardiograms averaged 14% per year between 2005–06 and 2014–15.[3] Increases have also been seen in other countries.[4] Differences in data collection methods make international comparisons of rates of use difficult, but, in 2014, the rate of stress echocardiography in Ontario, Canada, was 730 per 100,000 people, compared with 1,049 per 100,000 people in Australia in 2014–15.[5,6]

Stress echocardiography, 18 years and over

About the data

Data are sourced from the Medicare Benefits Schedule (MBS) dataset. This dataset includes information on MBS claims processed by the Australian Government Department of Human Services. It covers a wide range of services (attendances, procedures, tests) provided across primary care and hospital settings.

The dataset does not include:

- Services for publicly funded patients in hospitals
- Services for patients in hospital outpatient clinics where claims are not made to the MBS
- Services covered under Department of Veterans' Affairs arrangements.

Rates are based on the number of MBS-subsidised services for stress echocardiograms per 100,000 people aged 18 years and over in 2016–17.

Because an MBS claim is included for each service rather than for each patient, patients who receive any of the services listed in this data item more than once in the financial year will have more than one MBS claim counted.

The analysis and maps are based on the residential address of the patient recorded in the MBS claim and not the location of the service.

Rates are age and sex standardised to allow comparisons between populations with different age and sex structures.

This analysis was not undertaken by Aboriginal and Torres Strait Islander status because this information was not available for the MBS data at the time of publication.

What do the data show?

Magnitude of variation

In 2016–17, there were 303,525 MBS-subsidised services for stress echocardiography, representing 1,491 services per 100,000 people aged 18 years and over (the Australian rate).

The number of MBS-subsidised services for stress echocardiography across 325* local areas (Statistical Area Level 3 – SA3) ranged from 104 to 4,894 per 100,000 people aged 18 years and over. The rate was **47.1 times as high** in the area with the highest rate compared to the area with the lowest rate. The number of services varied across states and territories, from 698 per 100,000 people aged 18 years and over in the Northern Territory to 2,265 in New South Wales (Figures 4.9–4.12).

After the highest and lowest 10% of results were excluded and 260 SA3s remained, the number of services per 100,000 people aged 18 years and over was 5.8 times as high in the area with the highest rate compared to the area with the lowest rate.

Analysis by remoteness and socioeconomic status

Rates of stress echocardiography were higher in major cities and inner regional areas than in outer regional and remote areas. There was no clear pattern according to socioeconomic status (Figure 4.13).

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* There are 340 SA3s. For this item, data were suppressed for 15 SA3s due to one or more of a small number of services or population in an area, or potential identification of individual patients, practitioners or business entities.

Notes:

Some of the published SA3 rates were considered more volatile than others. These rates are excluded from the calculation of the difference between the highest and lowest SA3 rates in Australia.

For further detail about the methods used, please refer to the Technical Supplement.

Interpretation

Variation in rates of MBS-subsidised stress echocardiography is likely to be due to geographical differences in the factors discussed under 'Cardiac stress tests and imaging, 18 years and over' on page 188.

Addressing variation

Strategies for addressing variation in the use of stress echocardiography are discussed under 'Cardiac stress tests and imaging, 18 years and over' on page 189.

Resources

See 'Cardiac stress tests and imaging, 18 years and over' on page 198.

Australian initiatives

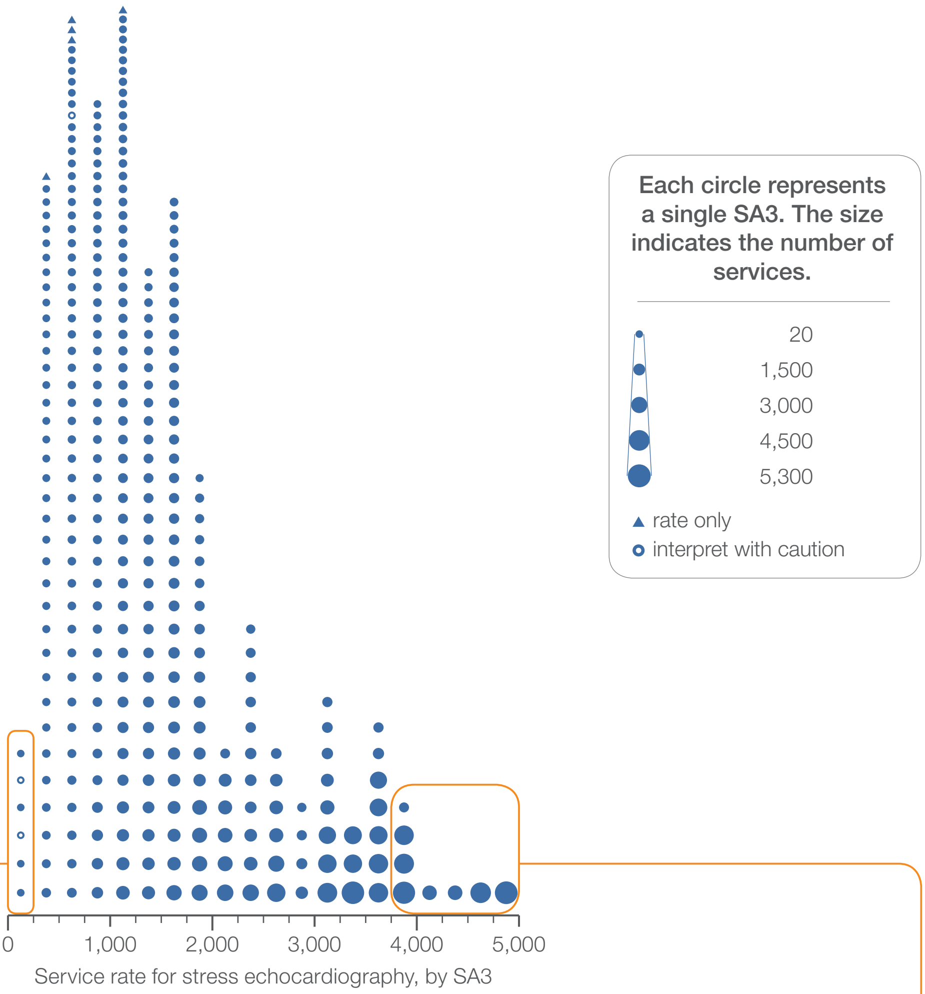
See 'Cardiac stress tests and imaging, 18 years and over' on page 198.

Notes:
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of Medicare Benefits Schedule data and ABS Estimated Resident Population 30 June 2016.

Stress echocardiography, 18 years and over

Rates by local area

Figure 4.9: Number of MBS-subsidised services for stress echocardiography per 100,000 people aged 18 years and over, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2016–17



Lowest rate areas

SA3	State	Rate	Services
Eyre Peninsula and South West	SA	**104**	60
Goldfields	WA	**129**	32
Mid North	SA	**171**	50
East Pilbara	WA	**227***	34
West Pilbara	WA	**235***	42
Esperance	WA	**248**	40

Highest rate areas

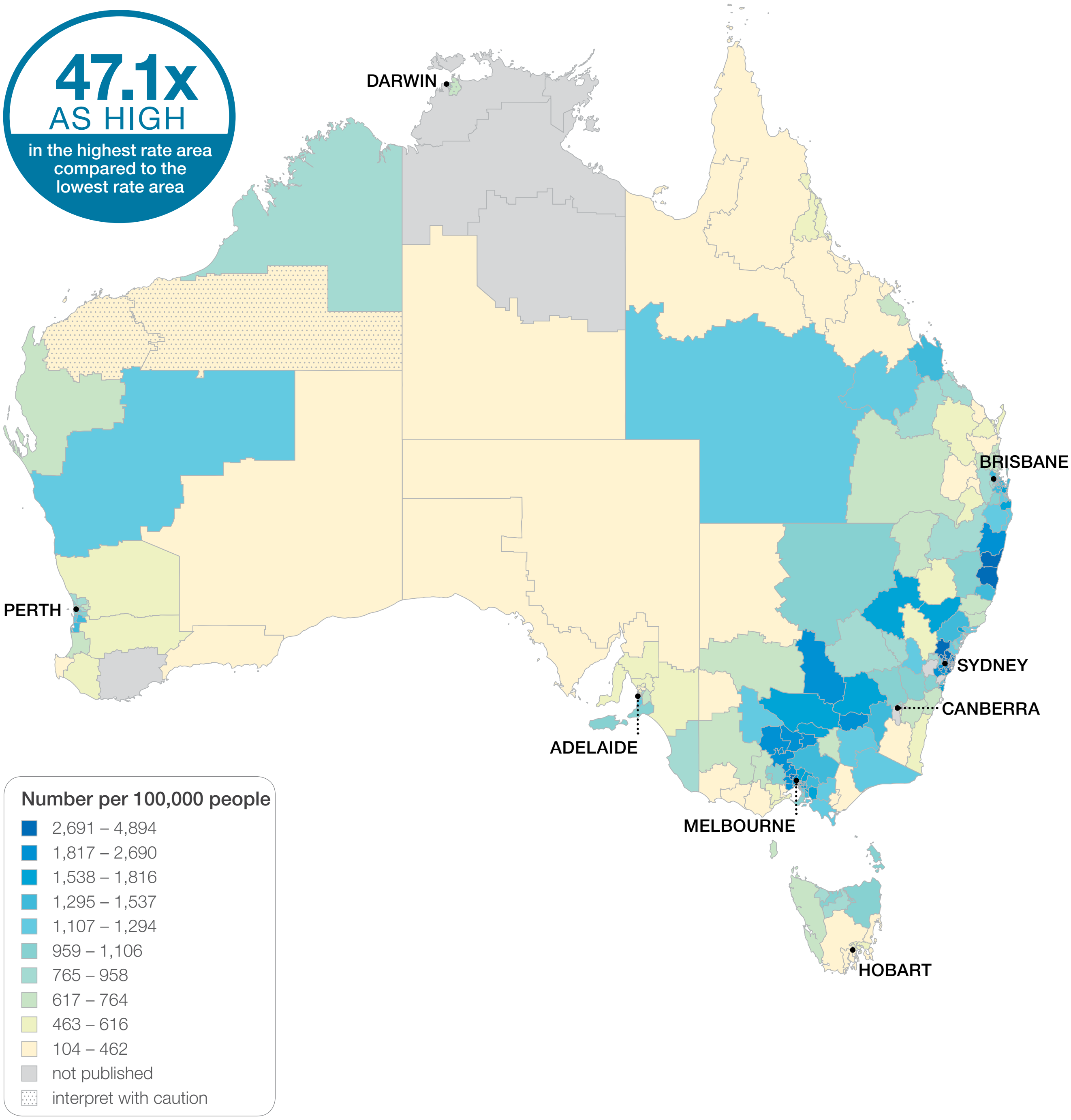
SA3	State	Rate	Services
Cronulla - Miranda - Caringbah	NSW	**4,894**	5,234
Sutherland - Menai - Heathcote	NSW	**4,713**	4,508
Blacktown - North	NSW	**4,261**	2,438
Kempsey - Nambucca	NSW	**4,123**	2,414
Baulkham Hills	NSW	**3,999**	5,057
Canterbury	NSW	**3,998**	4,276
Rouse Hill - McGraths Hill	NSW	**3,781**	864
Eastern Suburbs - South	NSW	**3,768**	4,147

Notes:
Hollow circles (○) and asterisks (*) indicate rates that are considered more volatile than other published rates and should be interpreted with caution.
Triangles (▲) indicate SA3s where only rates are published. The numbers of services are not published for confidentiality reasons.
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of Medicare Benefits Schedule data and ABS Estimated Resident Population 30 June 2016.

Stress echocardiography, 18 years and over

Rates across Australia

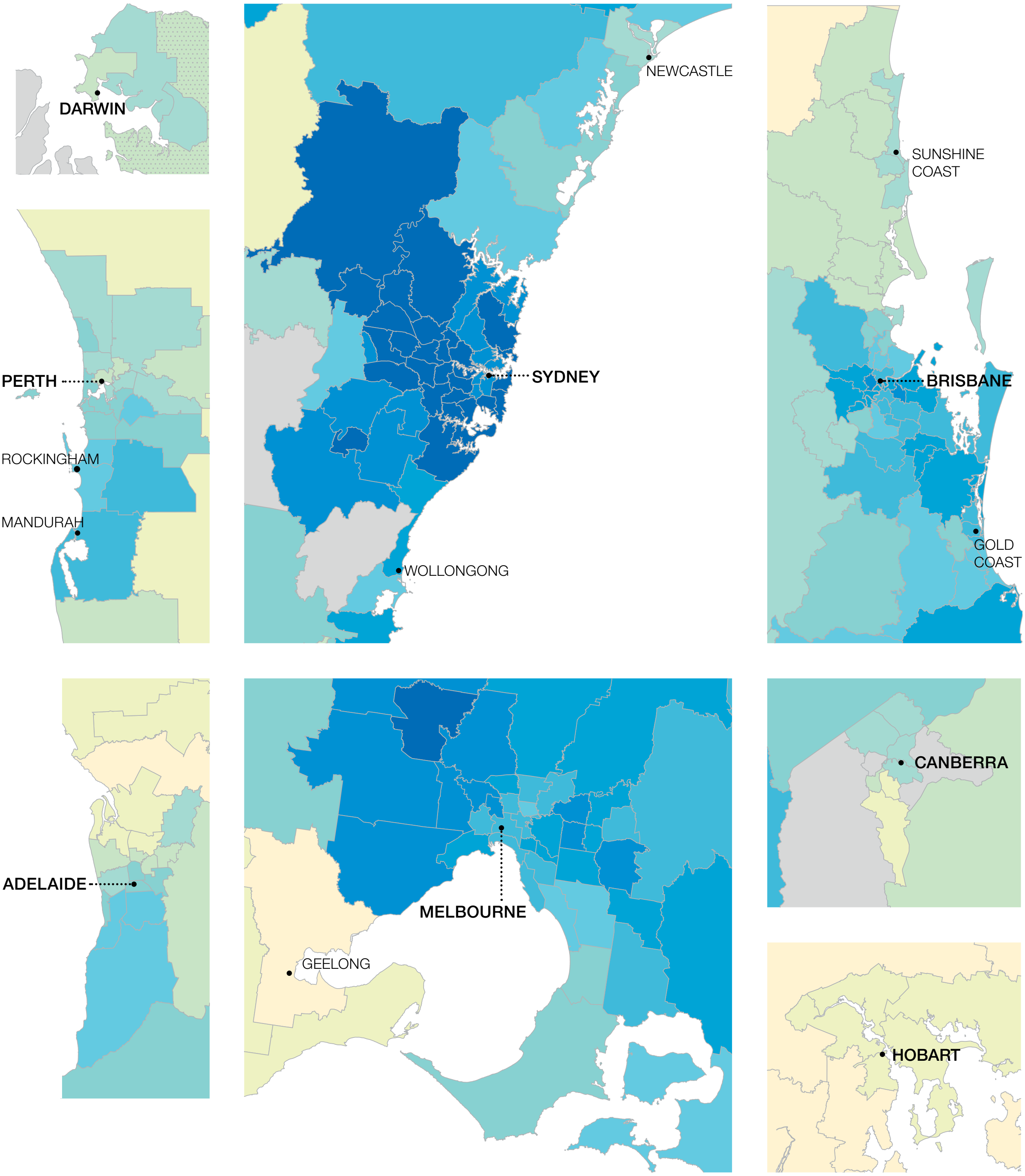
Figure 4.10: Number of MBS-subsidised services for stress echocardiography per 100,000 people aged 18 years and over, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2016–17



Notes:
Dotted areas indicate rates that are considered more volatile than other published rates and should be interpreted with caution. These rates are excluded from the calculation of the difference between the highest and lowest SA3 rates in Australia.
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of Medicare Benefits Schedule data and ABS Estimated Resident Population 30 June 2016.

Rates across capital city areas

Figure 4.11: Number of MBS-subsidised services for stress echocardiography per 100,000 people aged 18 years and over, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2016–17



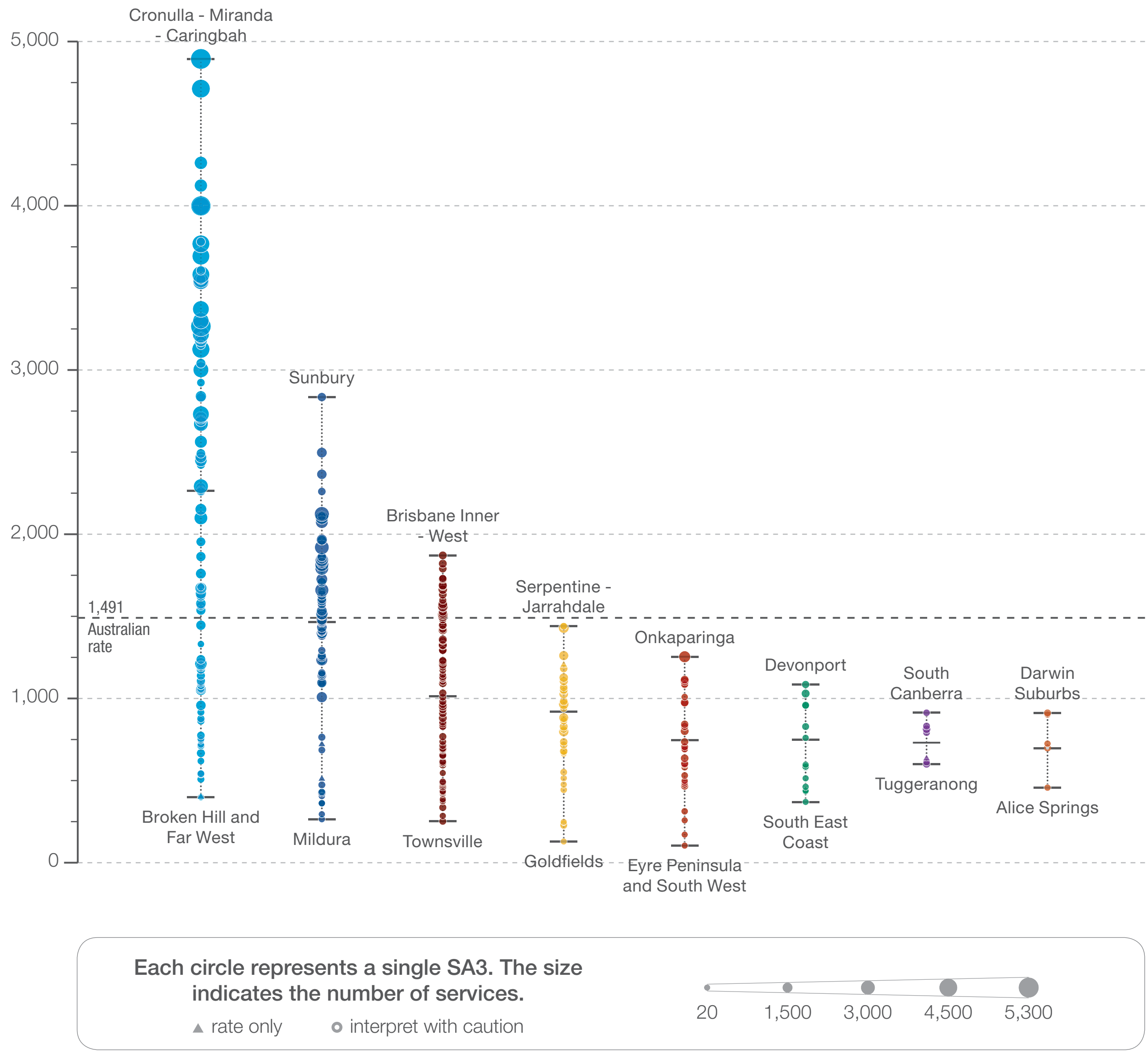
Notes:
Dotted areas indicate rates that are considered more volatile than other published rates and should be interpreted with caution.
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of Medicare Benefits Schedule data and ABS Estimated Resident Population 30 June 2016.

Stress echocardiography, 18 years and over

Rates by state and territory

Figure 4.12: Number of MBS-subsidised services for stress echocardiography per 100,000 people aged 18 years and over, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2016–17

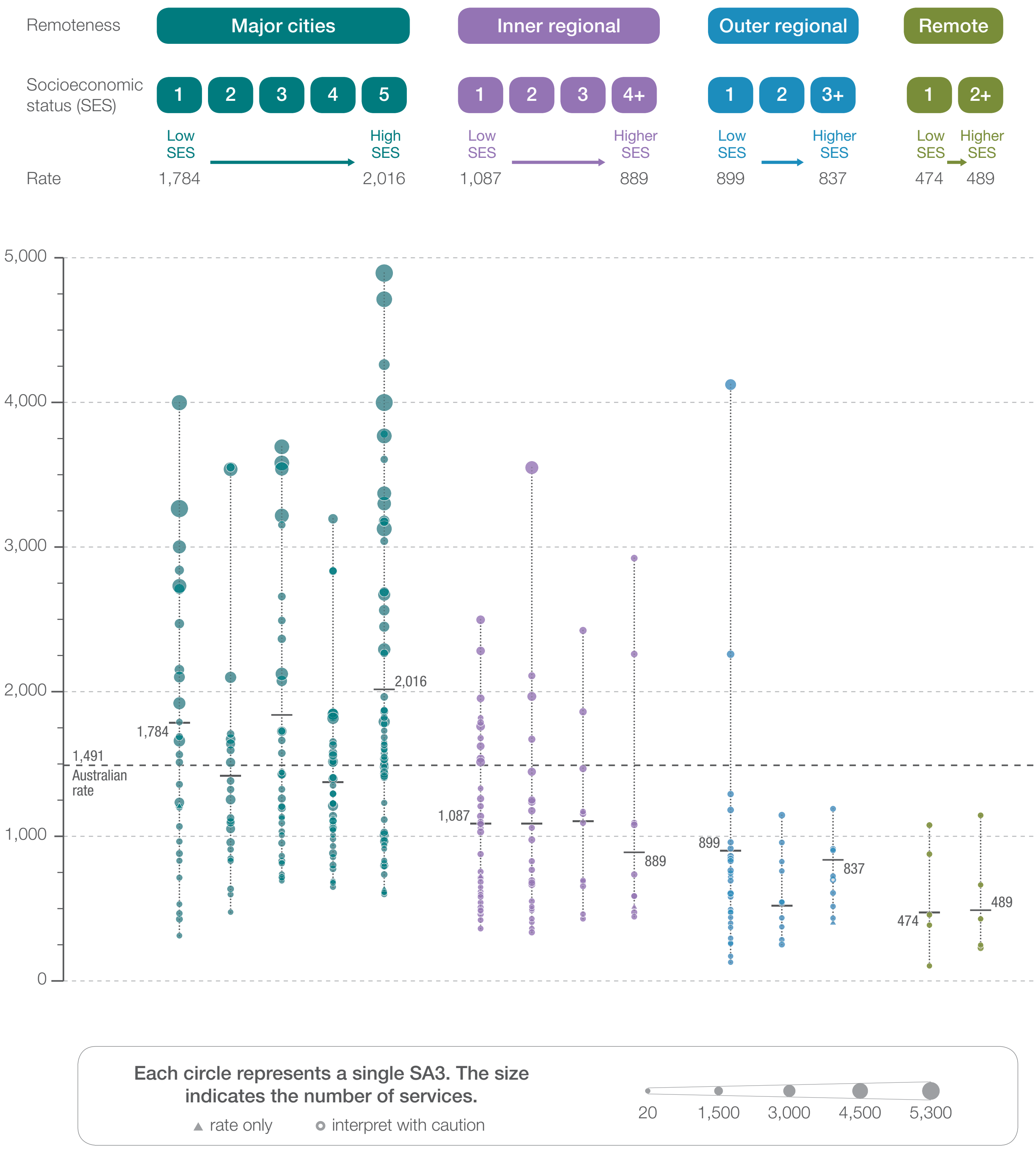
	NSW	Vic	Qld	WA	SA	Tas	ACT	NT
Highest rate	4,894	2,835	1,871	1,440	1,254	1,085	913	912
State/territory	2,265	1,465	1,014	920	747	749	731	698
Lowest rate	399	265	252	129	104	370	600	457
No. services	150,723	73,863	41,160	18,942	11,782	3,774	2,214	1,042



Notes:
Hollow circles (○) indicate rates that are considered more volatile than other published rates and should be interpreted with caution.
Triangles (▲) indicate SA3s where only rates are published. The numbers of services are not published for confidentiality reasons.
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of Medicare Benefits Schedule data and ABS Estimated Resident Population 30 June 2016.

Rates by remoteness and socioeconomic status

Figure 4.13: Number of MBS-subsidised services for stress echocardiography per 100,000 people aged 18 years and over, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2016–17



Notes:
Hollow circles (○) indicate rates that are considered more volatile than other published rates and should be interpreted with caution.
Triangles (▲) indicate SA3s where only rates are published. The numbers of services are not published for confidentiality reasons.
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of Medicare Benefits Schedule data and ABS Estimated Resident Population 30 June 2016.

Stress echocardiography, 18 years and over

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2. Wolk MJ, Bailey SR, Doherty JU, Douglas PS, Hendel RC, Kramer CM, et al. ACCF/AHA/ASE/ASNC/HFSA/HRS/SCAI/SCCT/SCMR/STS 2013 multimodality appropriate use criteria for the detection and risk assessment of stable ischemic heart disease: a report of the American College of Cardiology Foundation Appropriate Use Criteria Task Force, American Heart Association, American Society of Echocardiography, American Society of Nuclear Cardiology, Heart Failure Society of America, Heart Rhythm Society, Society for Cardiovascular Angiography and Interventions, Society of Cardiovascular Computed Tomography, Society for Cardiovascular Magnetic Resonance, and Society of Thoracic Surgeons. J Am Coll Cardiol 2014;63(4):380–406.
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4.3 Myocardial perfusion scans, 18 years and over

What did we find?

Rates for myocardial perfusion scans (MPS) vary up to about 60-fold across local areas, and are higher in major cities and inner regional areas than in outer regional and remote areas.

Context

MPS is a radionuclide imaging test of cardiac perfusion and function, with and without exercise. It is used to investigate symptoms of coronary artery disease, and allows evaluation of cardiac perfusion and function at rest and during stress.[1] MPS is also known as myocardial perfusion imaging.

Indications for MPS include:

- Symptoms suggesting angina
- Acute chest pain
- Recent acute coronary syndrome
- Known coronary artery disease and new or worsening symptoms
- Previous coronary revascularisation
- Valvular heart disease.[1,2]

MPS is not appropriate for screening of asymptomatic low-risk patients.[2]

The rate of MPS use in Australia rose by 51% between 1999 and 2007 and then fell by 16% between 2007 and 2017.[3] Canada has shown a smaller but similar pattern of rise and fall: MPS use rose by 7% from 1992 to 2001, and fell by 8.2% from 2008 to 2014.[4]

Appropriate use of MPS

A stress electrocardiogram (ECG) may be the appropriate first step for many low-risk patients with symptoms of coronary heart disease, as it can provide the required information without exposing the patient to radiation and at less cost to the health system than other cardiac tests.[2,5,6] If a stress ECG is not available, or would not give the required clinical information, stress echocardiography is generally preferred over MPS, again because it does not involve radiation exposure and is less costly to the health system.[2]

Myocardial perfusion scans, 18 years and over

MPS provides better clinical information than stress echocardiography for some patients.[2] MPS may also be appropriate for patients who are not good candidates for stress echocardiography (for example, patients who are unable to exercise).[2] See Section 4.1 'Cardiac tests and imaging, 18 years and over' (page 183) for a discussion of the role of MPS compared with other cardiac tests.

Access to MPS

Availability of MPS and other cardiac tests varies according to location in Australia.[7] Availability of tests will reflect geographic availability of the required expertise. A previous study of variation in cardiac testing in Australia found that rates of echocardiography and stress echocardiography were strongly correlated with the local availability of doctors, whereas rates of MPS were not.[8]

An MPS has a lower out-of-pocket cost for the patient than a stress echocardiogram. This may encourage referrers to request an MPS, even if a stress echocardiogram is appropriate, and this may be more common in socioeconomically disadvantaged areas. More than 95% of MPS studies are bulk-billed, compared with 70% of stress echocardiograms.[5]

The Cardiac Services Clinical Committee of the Medicare Benefits Schedule (MBS) Review Taskforce reviewed cardiac imaging tests and commented that, although it would be preferable for all patients to have easy access to stress echocardiography, this is unlikely to be achieved in the short term.[5] The committee recommended retaining MBS reimbursement for MPS as a first-line investigation for patients who cannot access stress echocardiography because of distance, waiting time or out-of-pocket costs for stress echocardiography in their area.[5] The committee noted that, given the differing cost and radiation exposure of these cardiac tests, the patient should be fully informed and involved in the decision about which test should be requested.

About the data

Data are sourced from the MBS dataset. This dataset includes information on MBS claims processed by the Australian Government Department of Human Services. It covers a wide range of services (attendances, procedures, tests) provided across primary care and hospital settings.

The dataset does not include:

- Services for publicly funded patients in hospitals
- Services for patients in hospital outpatient clinics where claims are not made to the MBS
- Services covered under Department of Veterans' Affairs arrangements.

Rates are based on the number of MBS-subsidised services for MPS per 100,000 people aged 18 years and over in 2016–17.

Because an MBS claim is included for each service rather than for each patient, patients who receive any of the services listed in this data item more than once in the financial year will have more than one MBS claim counted.

The analysis and maps are based on the residential address of the patient recorded in the MBS claim and not the location of the service.

Rates are age and sex standardised to allow comparisons between populations with different age and sex structures.

This analysis was not undertaken by Aboriginal and Torres Strait Islander status because this information was not available for the MBS data at the time of publication.

Data suppression

For all items in the Atlas, some data have been suppressed to manage the low number of events and/or very small populations in some areas, to protect the identity of patients and providers. This process takes into account the Australian Government Department of Health's requirements for reporting MBS data (see Technical Supplement).

The process has resulted in particularly marked data suppression for MPS MBS items. This is indicated on the maps in grey. Most local areas (Statistical Area Level 3 – SA3) were suppressed to prevent identification of the provider (practitioner or business entity). The effect of data suppression was greatest in inner and outer regional and remote areas:

- Overall, 62 SA3s were suppressed, which represents 18% of all SA3s and 8% of all services
- 37 SA3s were suppressed to prevent identification of the provider
- The proportion of SA3s suppressed in each remoteness category was 3% in major cities, 26% in inner regional areas, 43% in outer regional areas and 74% in remote areas.

What do the data show?

Magnitude of variation

In 2016–17, there were 79,905 MBS-subsidised services for MPS, representing 384 services per 100,000 people aged 18 years and over (the Australian rate).

The number of MBS-subsidised services for MPS across 278* local areas (Statistical Area Level 3 – SA3) ranged from 29 to 1,652 per 100,000 people aged 18 years and over. The rate was **57.0 times as high** in the area with the highest rate compared to the area with the lowest rate. The number of services varied across states and territories, from 182 per 100,000 people aged 18 years and over in South Australia to 485 in New South Wales (Figures 4.14–4.17).

After the highest and lowest 10% of results were excluded and 224 SA3s remained, the number of services per 100,000 people aged 18 years and over was 4.9 times as high in the area with the highest rate compared to the area with the lowest rate.

Analysis by remoteness and socioeconomic status

Rates of MPS were higher in major cities and inner regional areas than in other remote areas. Rates were higher in areas with lower socioeconomic status in major cities, and inner regional and remote areas. There was no clear pattern according to socioeconomic status in outer regional areas (Figure 4.18).

Interpretation

Variation in rates of MBS-subsidised MPS is likely to be due to geographical differences in the factors discussed under 'Cardiac stress tests and imaging, 18 years and over' on page 188.

Addressing variation

Strategies for addressing variation in the use of MPS are discussed under 'Cardiac stress tests and imaging, 18 years and over' on page 189.

Resources

See 'Cardiac stress tests and imaging, 18 years and over' on page 198.

Australian initiatives

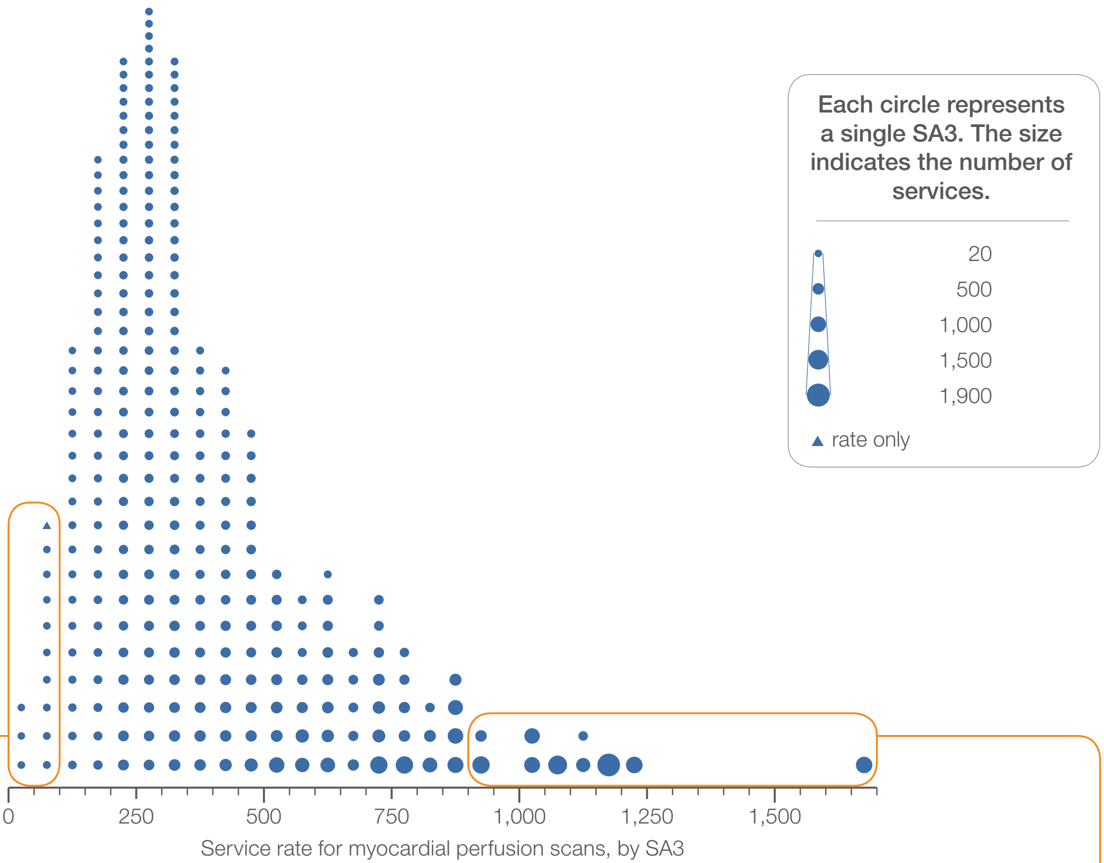
See 'Cardiac stress tests and imaging, 18 years and over' on page 198.

* There are 340 SA3s. For this item, data were suppressed for 62 SA3s due to one or more of a small number of services or population in an area, or potential identification of individual patients, practitioners or business entities.

Myocardial perfusion scans, 18 years and over

Rates by local area

Figure 4.14: **Number of MBS-subsidised services for myocardial perfusion scans per 100,000 people aged 18 years and over, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2016–17**



Lowest rate areas

SA3	State	Rate	Services
Onkaparinga	SA	**29**	45
Fleurieu - Kangaroo Island	SA	**43**	27
Mitcham	SA	**44**	30
Marion	SA	**60**	47
Cairns - South	Qld	**71**	59
Kenmore - Brookfield - Moggill	Qld	**76**	32
Sherwood - Indooroopilly	Qld	**76**	26
Murray and Mallee	SA	**78**	61
Kwinana	WA	**86**	
Fremantle	WA	**95**	34
Manjimup	WA	**96**	26
Brisbane Inner - East	Qld	**96**	25
Adelaide Hills	SA	**98**	66

Highest rate areas

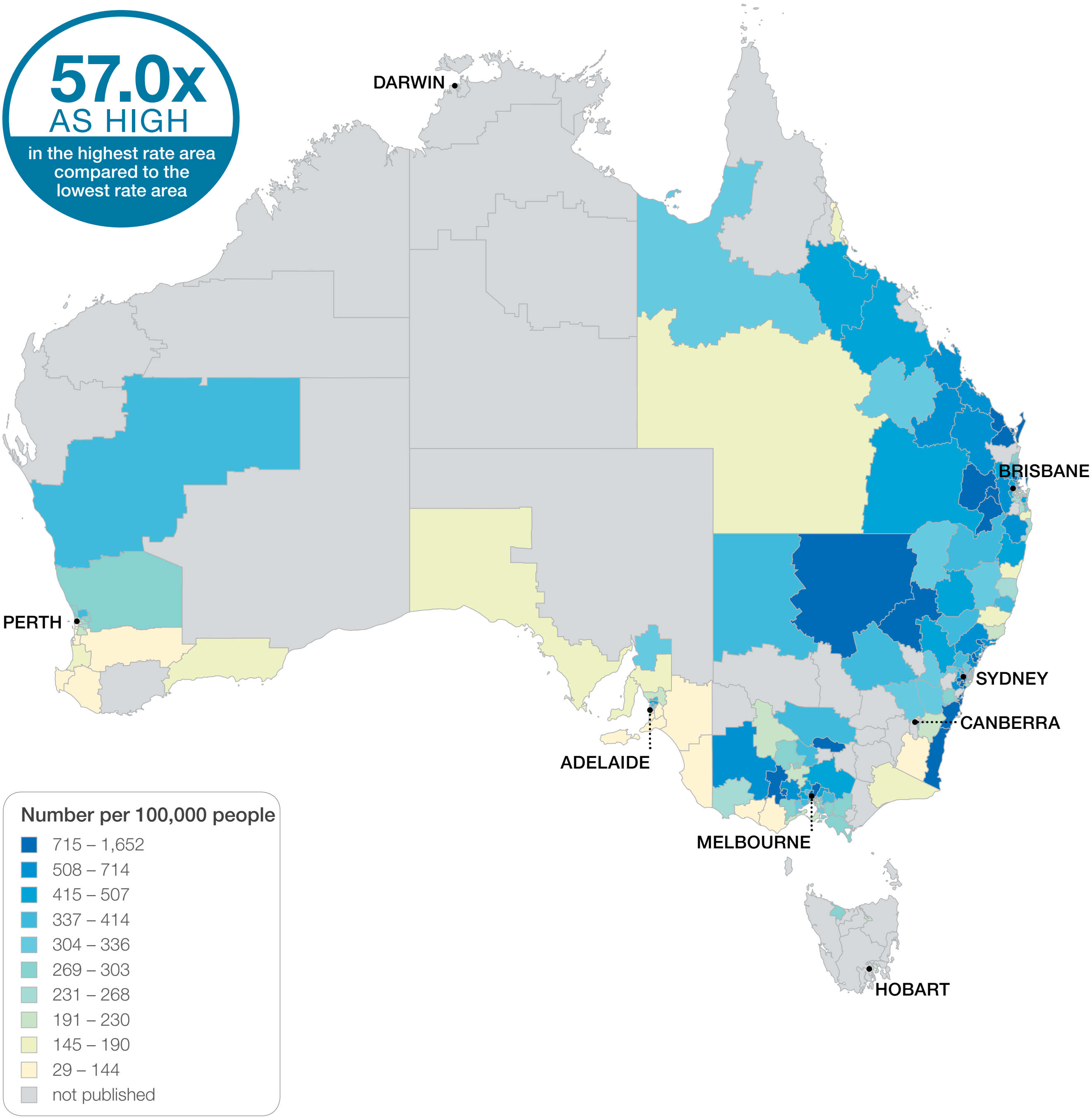
SA3	State	Rate	Services
Dubbo	NSW	**1,652**	1,102
Kiama - Shellharbour	NSW	**1,246**	1,119
Fairfield	NSW	**1,190**	1,859
Bourke - Cobar - Coonamble	NSW	**1,145**	265
Dapto - Port Kembla	NSW	**1,104**	822
Shoalhaven	NSW	**1,071**	1,392
Ballarat	Vic	**1,041**	984
Bundaberg	Qld	**1,033**	1,037
Maryborough	Qld	**940**	506
Toowoomba	Qld	**912**	1,209

Notes:
Triangles (▲) indicate SA3s where only rates are published. The numbers of services are not published for confidentiality reasons.
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of Medicare Benefits Schedule data and ABS Estimated Resident Population 30 June 2016.

Myocardial perfusion scans, 18 years and over

Rates across Australia

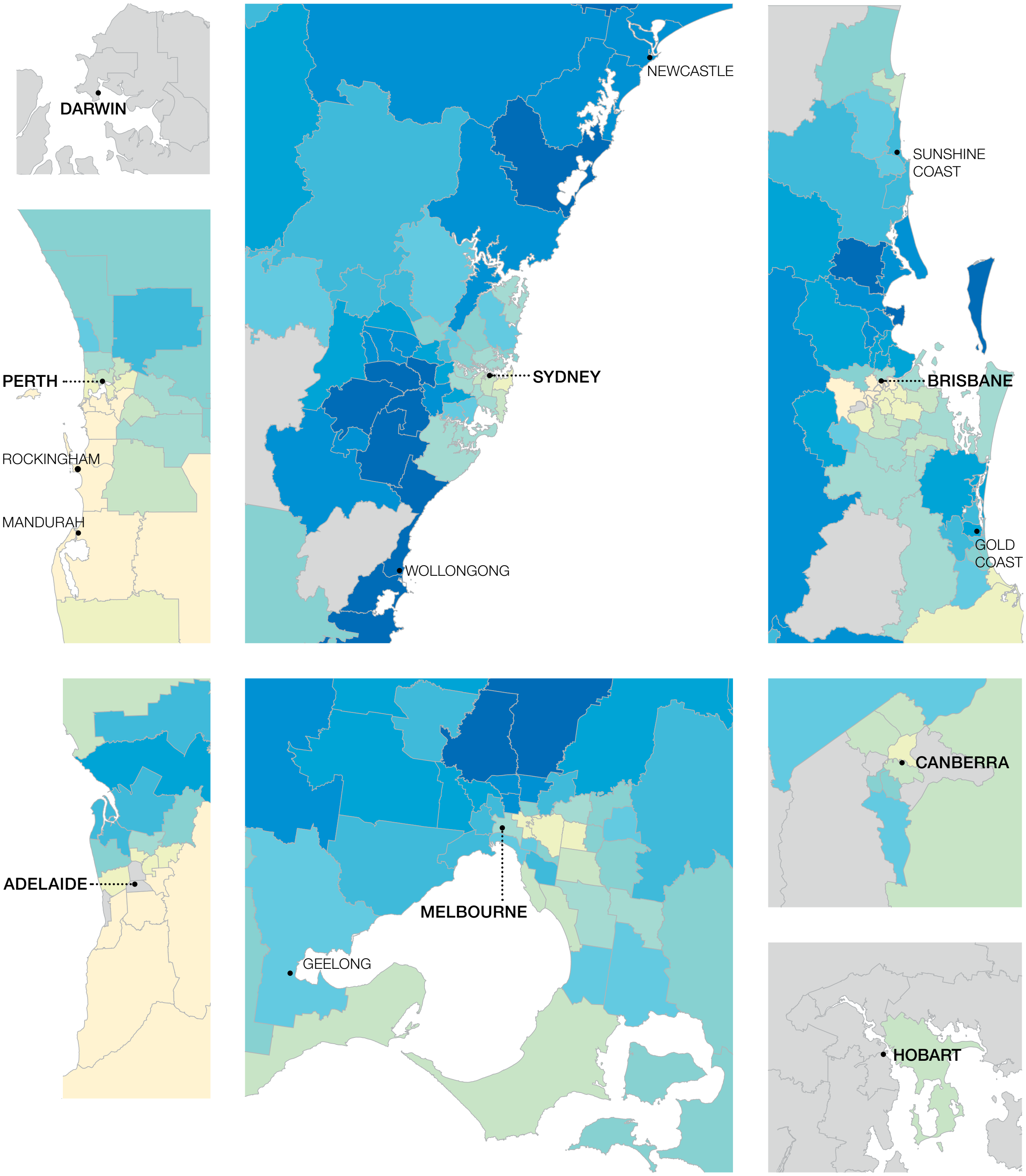
Figure 4.15: Number of MBS-subsidised services for myocardial perfusion scans per 100,000 people aged 18 years and over, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2016–17



Note:
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of Medicare Benefits Schedule data and ABS Estimated Resident Population 30 June 2016.

Rates across capital city areas

Figure 4.16: Number of MBS-subsidised services for myocardial perfusion scans per 100,000 people aged 18 years and over, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2016–17



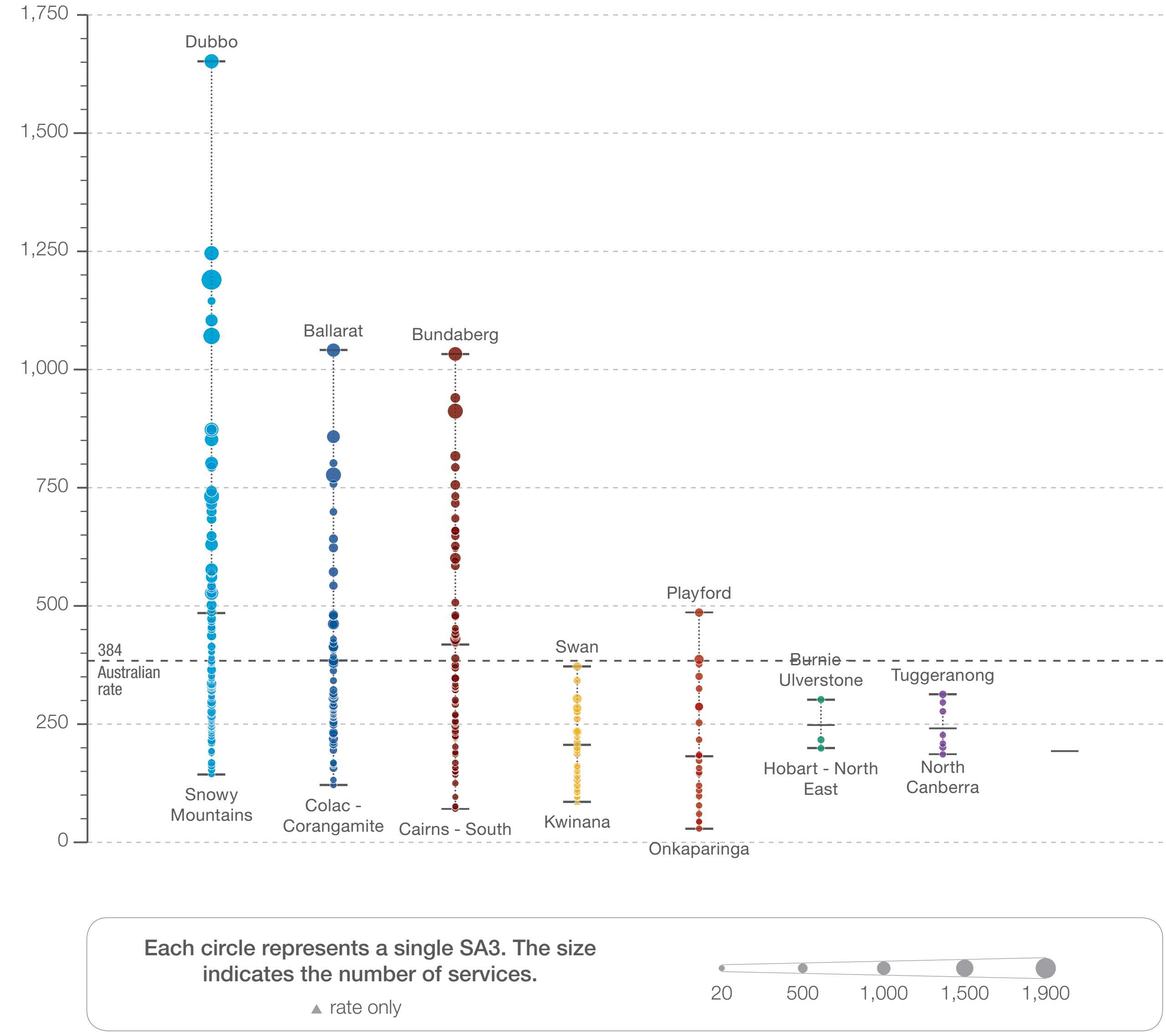
Note:
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of Medicare Benefits Schedule data and ABS Estimated Resident Population 30 June 2016.

Myocardial perfusion scans, 18 years and over

Rates by state and territory

Figure 4.17: Number of MBS-subsidised services for myocardial perfusion scans per 100,000 people aged 18 years and over, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2016–17

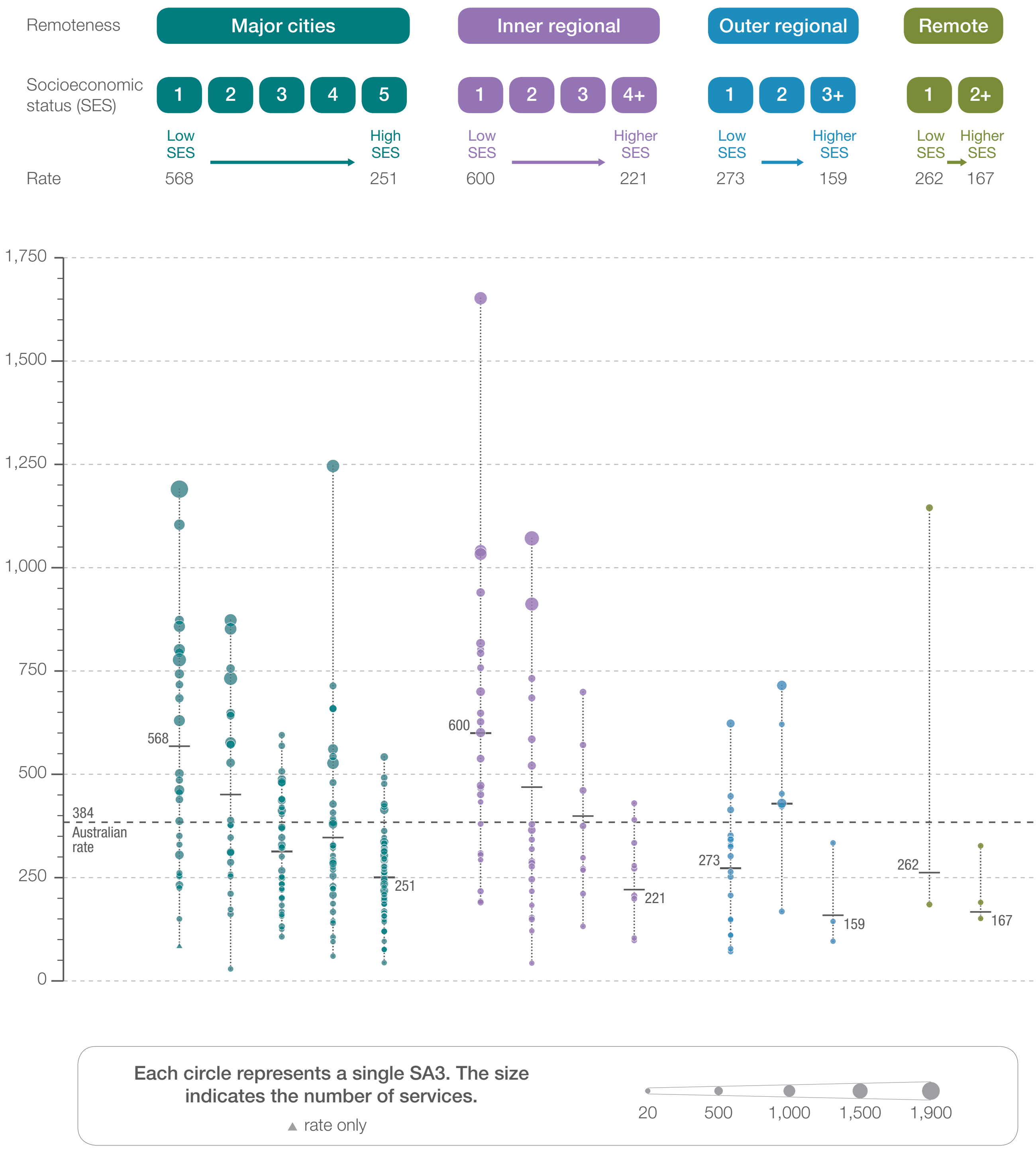
	NSW	Vic	Qld	WA	SA	Tas	ACT	NT
Highest rate	1,652	1,041	1,033	372	486	302	313	
State/territory	485	385	418	206	182	248	241	193
Lowest rate	144	121	71	86	29	199	186	
No. services	33,155	20,196	17,112	4,227	2,953	1,292	700	262



Notes:
Triangles (▲) indicate SA3s where only rates are published. The numbers of services are not published for confidentiality reasons.
Rates for NT SA3s are not published for reliability and/or confidentiality reasons.
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of Medicare Benefits Schedule data and ABS Estimated Resident Population 30 June 2016.

Rates by remoteness and socioeconomic status

Figure 4.18: Number of MBS-subsidised services for myocardial perfusion scans per 100,000 people aged 18 years and over, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2016–17



Notes:
Triangles (▲) indicate SA3s where only rates are published. The numbers of services are not published for confidentiality reasons.
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of Medicare Benefits Schedule data and ABS Estimated Resident Population 30 June 2016.

Myocardial perfusion scans, 18 years and over

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4.4 Standard echocardiography, 18 years and over

Why is this important?

Standard (or transthoracic) echocardiography is used for accurate diagnosis and treatment planning in people with symptoms suggestive of heart failure, structural heart diseases and other heart conditions. It is an important clinical tool, but a rapid increase in use of standard echocardiography has raised concerns that some use is not appropriate.

There are also concerns that standard echocardiography is not always available where it is needed most. The burden of cardiovascular disease is higher in regional and remote areas of Australia, and equitable access to standard echocardiography is important for improving cardiac care and outcomes for people living in these areas.

What did we find?

Rates of standard echocardiography vary up to about four-fold across local areas, and are higher in major cities and inner regional areas than in outer regional and remote areas.

What can be done?

Aligning the Medicare Benefits Schedule (MBS) item descriptors for standard echocardiography items with best-practice guidelines, as recommended by the MBS Review Taskforce, could improve the appropriateness of use.

A centralised system for storing images and reports in Australia could reduce unnecessary repeat requests because of difficulties accessing previous results. A combination of education, audit and feedback may be another viable strategy to reduce potential low-value echocardiography use and increase adherence to best-practice guidelines.

Reducing financial and geographic barriers to access is important for increasing equity of use of standard echocardiography. Barriers to access outside major cities include higher out-of-pocket costs for patients living in these areas.

Standard echocardiography, 18 years and over

Context

This data item examines the use of standard (or transthoracic) echocardiography, an ultrasound examination of the heart. The data presented for this item include echocardiography provided in the primary care and hospital settings. Use of stress echocardiography is discussed separately (see Section 4.2 'Stress echocardiography, 18 years and over', page 201).

Guidelines recommend echocardiography to investigate:

- Suspected heart failure or structural heart disease[1,2]
- Suspected or known ventricular hypertrophy or dysfunction[2]
- Valvular disease[3]
- Pulmonary hypertension[4]
- Congenital heart disease[5]
- Suspected or confirmed acute rheumatic fever.[6]

The most common of these is investigation of suspected heart failure or structural heart disease.[7] The clinical indications for the use of MBS-subsidised cardiac ultrasound services are specified in the item descriptors in the Health Insurance (Diagnostics Imaging Services Table) Regulations 2018.[8]

Echocardiography is an important clinical tool, but a rapid increase in use has led to concerns about inappropriate use in several countries.[9] Between 2012 and 2017, the number of echocardiography services grew by an average of 7% each year in Australia.[9] In the United Kingdom (UK), the rate increased by 7% each year between 2007 and 2013.[10] In the United States (US), the rate of echocardiography among Medicare beneficiaries increased by 8% per year in the early 2000s, prompting a number of measures to improve appropriateness of requests, including appropriate use criteria.[11-13]

Two Australian hospital-based studies have assessed reasons for echocardiography referrals against the US appropriate use criteria. The proportion of 'inappropriate' echocardiography referrals was 20% at a regional hospital, and 10% at a large tertiary hospital.[7,14] In the regional hospital, inappropriate echocardiography referrals were more common for outpatients than for inpatients (24.4% versus 9.6%). The most common inappropriate indication at both hospitals was for routine surveillance as part of regular follow-up in patients with stable chronic cardiac conditions, such as heart failure and coronary artery disease, with no change in clinical status.[7,14]

There have not been any similar analyses of Australian echocardiography referrals in community settings.

Comparison of international rates of echocardiography is limited by differences in data collection methods. Considerable variation in the use of echocardiography has been noted between different areas within Australia[15] previously, and within the US[12] and the UK.[10]

Cardiovascular disease deaths are the greatest contributor to the mortality gap between Aboriginal and Torres Strait Islander Australians and other Australians.[16] Aboriginal and Torres Strait Islander Australians have higher rates of heart failure and rheumatic heart disease (which damages heart valves) than other Australians[17-19] and would be expected to have greater need for echocardiography.

Cardiovascular disease is a greater contributor to fatal disease burden among Aboriginal and Torres Strait Islander adults living in remote areas compared with those living in non-remote areas.[19] Poor access to echocardiography in regional and remote areas is likely to disproportionately affect Aboriginal and Torres Strait Islander Australians living in these areas.

About the data

Data are sourced from the MBS dataset. This dataset includes information on MBS claims processed by the Australian Government Department of Human Services. It covers a wide range of services (attendances, procedures, tests) provided across primary care and hospital settings.

The dataset does not include:

- Services for publicly funded patients in hospitals
- Services for patients in hospital outpatient clinics where claims are not made to the MBS
- Services covered under Department of Veterans' Affairs arrangements.

Rates are based on the number of MBS-subsidised services for standard echocardiograms per 100,000 people aged 18 years and over in 2016–17.

Because an MBS claim is included for each service rather than for each patient, patients who receive any of the services listed in this data item more than once in the financial year will have more than one MBS claim counted.

The analysis and maps are based on the residential address of the patient recorded in the MBS claim and not the location of the service.

Rates are age and sex standardised to allow comparisons between populations with different age and sex structures.

This analysis was not undertaken by Aboriginal and Torres Strait Islander status because this information was not available for the MBS data at the time of publication.

What do the data show?

Magnitude of variation

In 2016–17, there were 945,056 MBS-subsidised services for standard echocardiography, representing 4,599 services per 100,000 people aged 18 years and over (the Australian rate).

The number of MBS-subsidised services for standard echocardiography across 328* local areas (Statistical Area Level 3 – SA3) ranged from 2,279 to 7,957 per 100,000 people aged 18 years and over. The rate was **3.5 times as high** in the area with the highest rate compared to the area with the lowest rate. The number of services varied across states and territories, from 2,624 per 100,000 people aged 18 years and over in Tasmania to 5,309 in New South Wales (Figures 4.20–4.23).

After the highest and lowest 10% of results were excluded and 264 SA3s remained, the number of services per 100,000 people aged 18 years and over was 2.1 times as high in the area with the highest rate compared to the area with the lowest rate.

Analysis by remoteness and socioeconomic status

Rates of standard echocardiography were higher in major cities and inner regional areas than in outer regional and remote areas. There was no clear pattern according to socioeconomic status (Figure 4.24).

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* There are 340 SA3s. For this item, data were suppressed for 12 SA3s due to one or more of a small number of services or population in an area, or potential identification of individual patients, practitioners or business entities.

Notes:

Some of the published SA3 rates were considered more volatile than others. These rates are excluded from the calculation of the difference between the highest and lowest SA3 rates in Australia.

For further detail about the methods used, please refer to the Technical Supplement.

Sources: AIHW analysis of Medicare Benefits Schedule data and ABS Estimated Resident Population 30 June 2016.

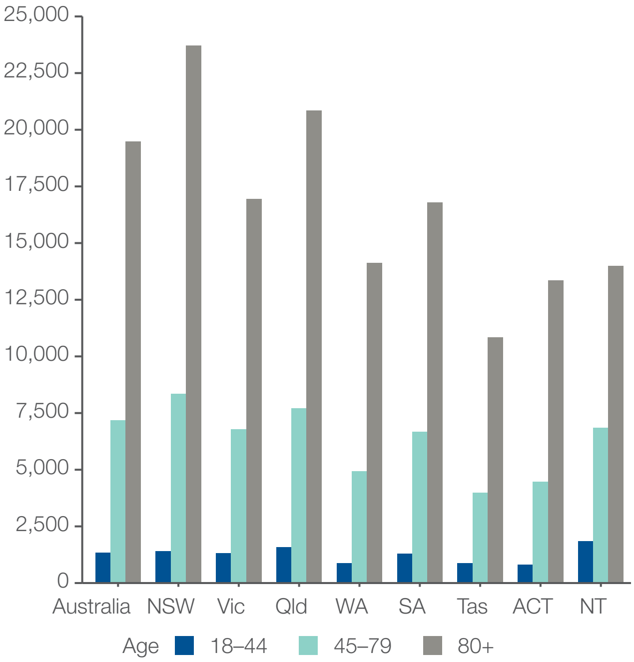
Standard echocardiography, 18 years and over

Analysis by age group

Rates of standard echocardiography were highest for the 80 years and over age group. The national rate for this age group was 19,469 services per 100,000 people and varied from 10,829 services per 100,000 people in Tasmania to 23,703 services per 100,000 people in New South Wales.

The national rate for tests performed on the 80 years and over age group was 2.7 times as high as the rate for the 45–79 years age group (which had the next highest rate). This pattern was consistent across all states and territories (Figure 4.19).

Figure 4.19: **Number of MBS-subsidised services for standard echocardiography per 100,000 people by age group, age and sex standardised, by state and territory of patient residence, by age group, 2016–17**



The data for Figure 4.19 are available at www.safetyandquality.gov.au/atlas

Interpretation

In addition to overarching reasons for variation discussed under 'Cardiac stress tests and imaging, 18 years and over' on page 188, variation in rates of use of MBS-subsidised standard echocardiography is likely to be due to geographical differences in the factors discussed below.

Rates of underlying disease

Variation is warranted and desirable when it reflects variation in the underlying need for care. Groups with higher rates of cardiovascular disease have greater need for cardiac tests, which should influence the variation in rates of use of these tests. The need for echocardiography is likely to be higher in areas with higher rates of heart failure and other relevant conditions, such as rheumatic heart disease. Rates of cardiovascular disease increase with age and socioeconomic disadvantage.[17]

Rates of heart failure and rheumatic heart disease are also higher among Aboriginal and Torres Strait Islander Australians than among other Australians.[18,19] Areas with larger proportions of Aboriginal and Torres Strait Islander people would be expected to show higher rates of echocardiography. The Northern Territory Rheumatic Heart Disease Control Program may account for higher rates of echocardiography in some areas of the Northern Territory.[20]

Access to services

Variation in echocardiography rates is likely to reflect differences in geographical and financial access to services, both for referral and for performance of echocardiography.[15] A previous analysis of outpatient cardiac imaging in Australia found that the local availability of doctors was the strongest correlate of echocardiography rates.[15]

Notes:
For further information about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of Medicare Benefits Schedule and ABS Estimated Resident Population 30 June 2016.

In the same study, greater socioeconomic advantage was also correlated with higher use of echocardiography.[15] Out-of-pocket costs for imaging are likely to be a barrier for socioeconomically disadvantaged populations. The average out-of-pocket cost for standard echocardiography in Australia was $102 in 2014.[21]

Clinical decision-making

Clinicians' differing thresholds for echocardiography referral may contribute to variation. For example, greater use of repeat testing by clinicians for individual patients may influence the patterns seen. In a recent study of Australian doctors' decision-making about cardiac imaging, greater experience and training were flagged as an important factor in selecting appropriate patients for echocardiography.[22]

Availability of previous echocardiography results

In a qualitative study of Australian hospital doctors, lack of availability of previous test results, even if recent, was cited as a common reason for requesting an echocardiogram.[22] It has been suggested that requesting of repeat tests contributes to the higher echocardiography rates in large Australian cities, where there are several referral centres.[15]

Funding models

As is the case for cardiac stress tests and imaging, the funding models of echocardiography services available in an area, and the relative accessibility of these services to patients, may influence the variation seen. For example, the rates of cardiac testing seen in the Northern Territory and remote Western Australia may be low because a higher proportion of tests in these areas is done for public patients in hospital outpatient clinics (which are not counted in this data item). In contrast, the rates in New South Wales may be high because there are many locations in New South Wales where services and investigations undertaken in public hospital outpatient clinics are claimed through the MBS under specialist medical practitioner rights of private practice arrangements.

Patient and referrer expectations

According to a sample of Australian doctors who request echocardiograms, patients often expect a test to be done.[22] Doctors interviewed for the study thought that patient expectations were influenced by information found on the internet, the level of patients' private insurance cover and referral to a cardiologist.[22]

Addressing variation

Strategies for addressing variation in the use of echocardiography are discussed below.

The Cardiac Services Clinical Committee of the MBS Review Taskforce recently recommended to the Australian Government that MBS items for echocardiography be restructured into six new items that align with best-practice guidelines.[8] The committee also recommended including these items in an online checker tool to determine eligibility of requests for echocardiography.[8] A previous poor-quality echocardiogram is a common indication for a repeat echocardiogram. The Cardiac Services Clinical Committee recommended that the MBS item descriptors be revised to reflect the Cardiac Society of Australia and New Zealand's position statement for training and performance in adult echocardiography.[9,23]

Other strategies that have been proposed to better target use of echocardiography to patient need in Australia include US-style appropriateness criteria; a combination of education, audit and feedback; a centralised system for storage of imaging reports; and reducing financial and geographic barriers to access. These strategies are discussed below.

In response to a rapid increase in use of echocardiography in the early 2000s, the American College of Cardiology and others published appropriate use criteria for echocardiography in 2007, followed by an update in 2011.[24-27] US Medicare reimbursement cuts for echocardiography were also made in the US in 2005 and 2007.[28] Rates of echocardiography among Medicare beneficiaries plateaued from 2007.[12]

Standard echocardiography, 18 years and over

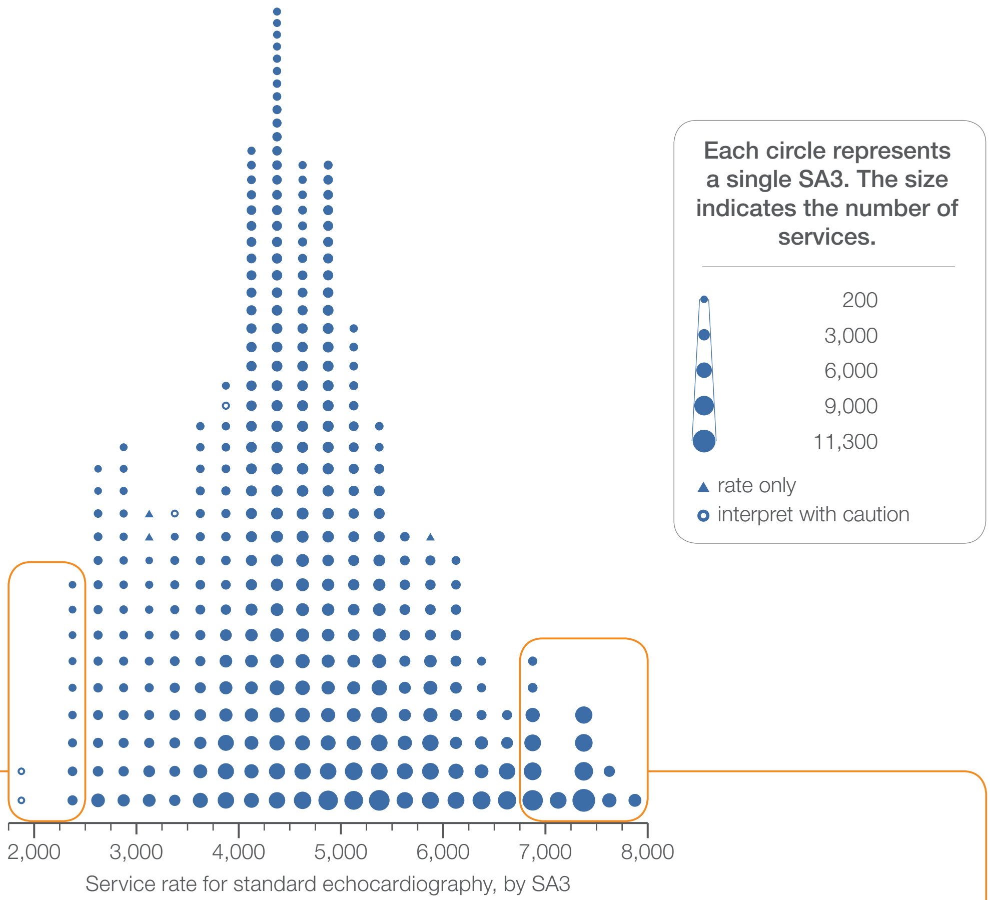
Some have suggested that incorporating the US appropriate use criteria for echocardiography into Australian practice has the potential to improve patient outcomes, contain costs and reduce variation.[29] However, Australian practice relies heavily on US and European guidelines, and inconsistencies between these guidelines and the US appropriate use criteria should be addressed before considering their application in Australia.[29] In addition, Australian research into the decision-making process of doctors requesting cardiac imaging argues against using appropriateness criteria, as other factors are stronger influences.[22] These factors include training, experience, management of patient expectations, and accessibility of services.[22] Investigating aspects of bulk-billing practices and cardiology practice models that influence rates of cardiac testing, and the choice of tests, could point to other system-level changes to improve appropriate use.

A centralised system for storing images and reports in Australia could reduce unnecessary repeat requests because of difficulties accessing previous results.[8] Repeat echocardiograms within the same year account for 11% of MBS echocardiography services, and repeats within a five-year window account for 40% of services.[8] An Australian qualitative study has reported that requesting of repeat echocardiograms occurs because a patient's recent echocardiogram results could not be obtained.[22]

A combination of education, audit and feedback may be another viable strategy to reduce potential low-value echocardiography use and increase adherence to best-practice guidelines.[30,31] Also, given the burden of disease in Aboriginal and Torres Strait Islander Australians, collecting accurate MBS data on services to these groups would be valuable for gaining further understanding of where improvements are most needed.

Rates by local area

Figure 4.20: Number of MBS-subsidised services for standard echocardiography per 100,000 people aged 18 years and over, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2016–17



Lowest rate areas

SA3	State	Rate	Services
East Pilbara	WA	**1,785***	203
West Pilbara	WA	**1,906***	248
Mundaring	WA	**2,279**	865
West Coast	Tas	**2,329**	378
Bayswater - Bassendean	WA	**2,335**	1,670
Belmont - Victoria Park	WA	**2,375**	1,293
Meander Valley - West Tamar	Tas	**2,388**	567
Swan	WA	**2,390**	2,054
Esperance	WA	**2,396**	352
Huon - Bruny Island	Tas	**2,446**	497
Central Highlands (Tas)	Tas	**2,469**	256

Highest rate areas

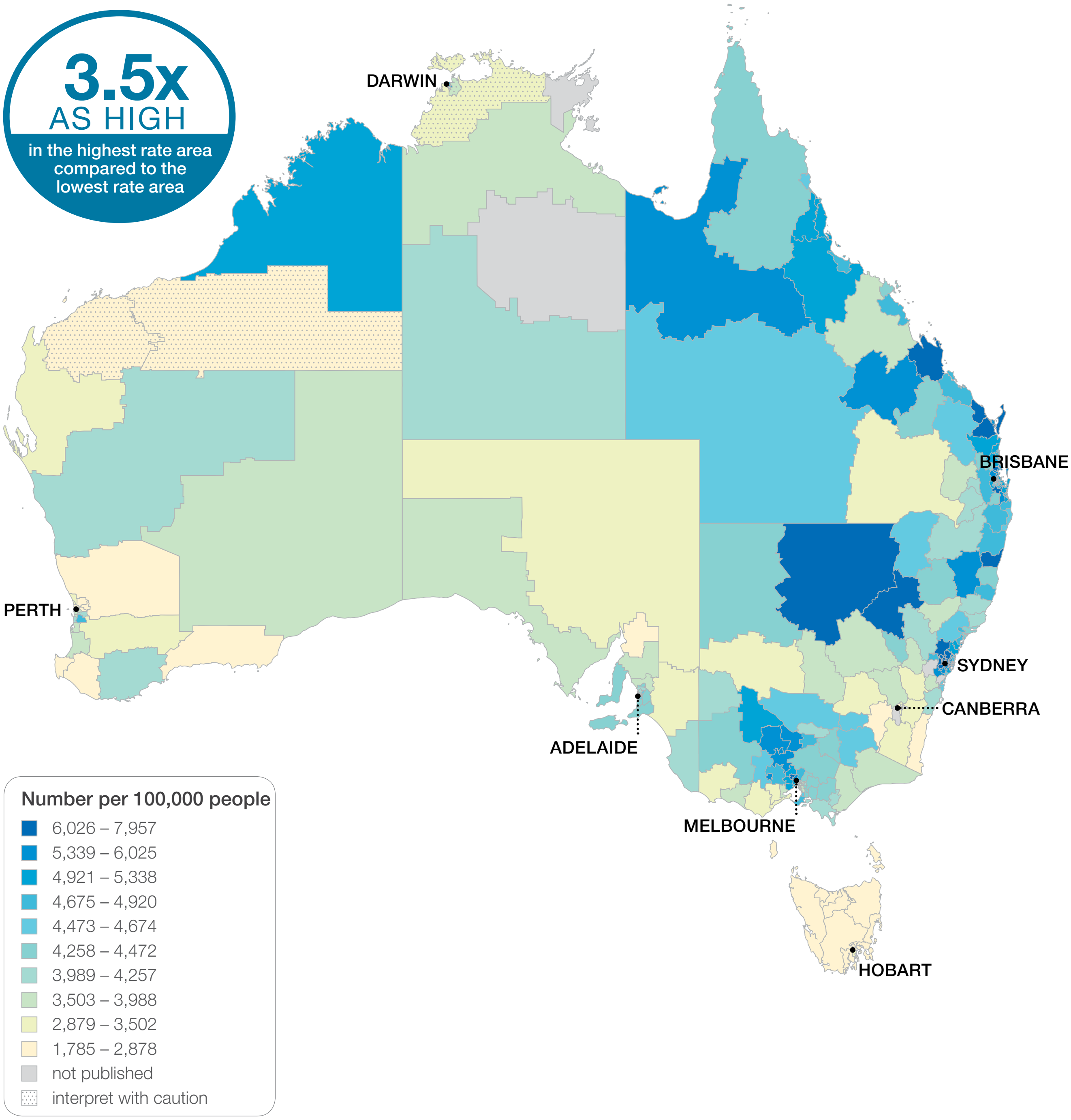
SA3	State	Rate	Services
Blacktown - North	NSW	**7,957**	4,079
Dubbo	NSW	**7,626**	5,083
St Marys	NSW	**7,625**	2,855
Blacktown	NSW	**7,426**	7,566
Fairfield	NSW	**7,277**	11,282
Penrith	NSW	**7,269**	7,265
Merrylands - Guildford	NSW	**7,268**	8,241
Bundaberg	Qld	**7,051**	6,842
Mount Druitt	NSW	**6,999**	5,136
Rouse Hill - McGraths Hill	NSW	**6,976**	1,450
Canterbury	NSW	**6,966**	7,660
Rockhampton	Qld	**6,898**	6,902
Dural - Wisemans Ferry	NSW	**6,839**	1,776
Bankstown	NSW	**6,792**	9,606

Notes:
Hollow circles (○) and asterisks (*) indicate rates that are considered more volatile than other published rates and should be interpreted with caution.
Triangles (▲) indicate SA3s where only rates are published. The numbers of services are not published for confidentiality reasons.
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of Medicare Benefits Schedule data and ABS Estimated Resident Population 30 June 2016.

Standard echocardiography, 18 years and over

Rates across Australia

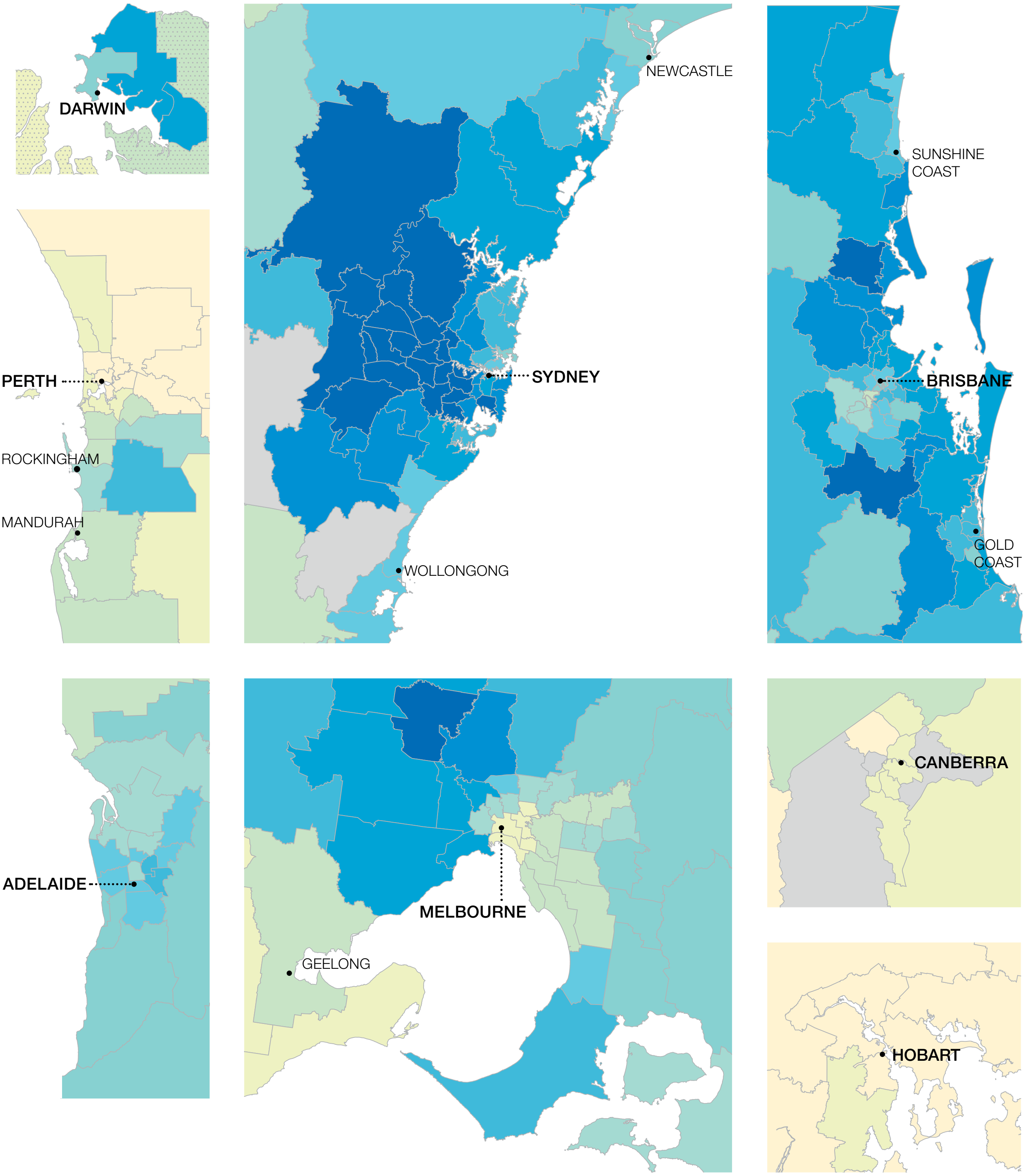
Figure 4.21: Number of MBS-subsidised services for standard echocardiography per 100,000 people aged 18 years and over, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2016–17



Notes:
Dotted areas indicate rates that are considered more volatile than other published rates and should be interpreted with caution. These rates are excluded from the calculation of the difference between the highest and lowest SA3 rates in Australia.
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of Medicare Benefits Schedule data and ABS Estimated Resident Population 30 June 2016.

Rates across capital city areas

Figure 4.22: Number of MBS-subsidised services for standard echocardiography per 100,000 people aged 18 years and over, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2016–17



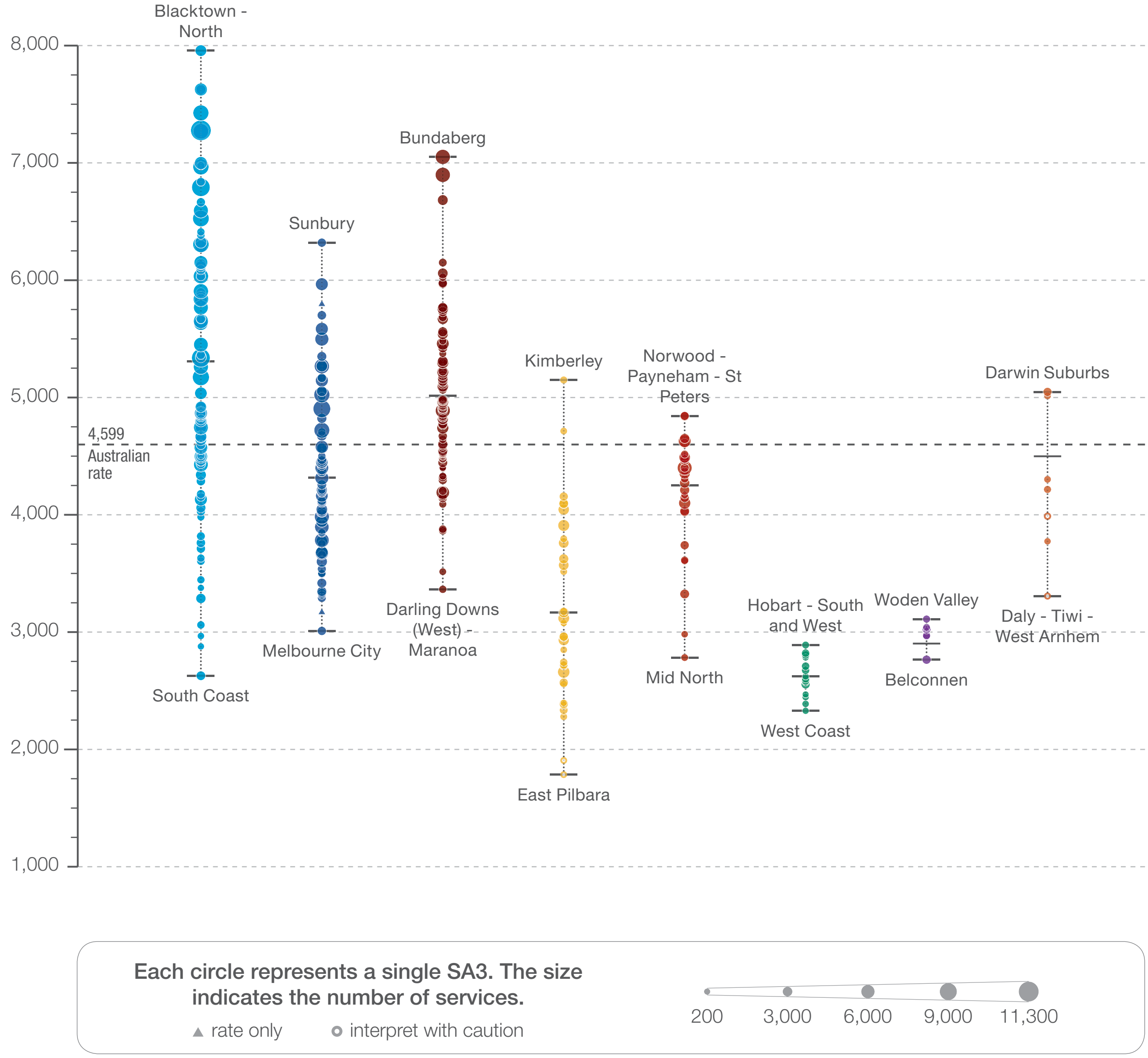
Notes:
Dotted areas indicate rates that are considered more volatile than other published rates and should be interpreted with caution.
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of Medicare Benefits Schedule data and ABS Estimated Resident Population 30 June 2016.

Standard echocardiography, 18 years and over

Rates by state and territory

Figure 4.23: Number of MBS-subsidised services for standard echocardiography per 100,000 people aged 18 years and over, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2016–17

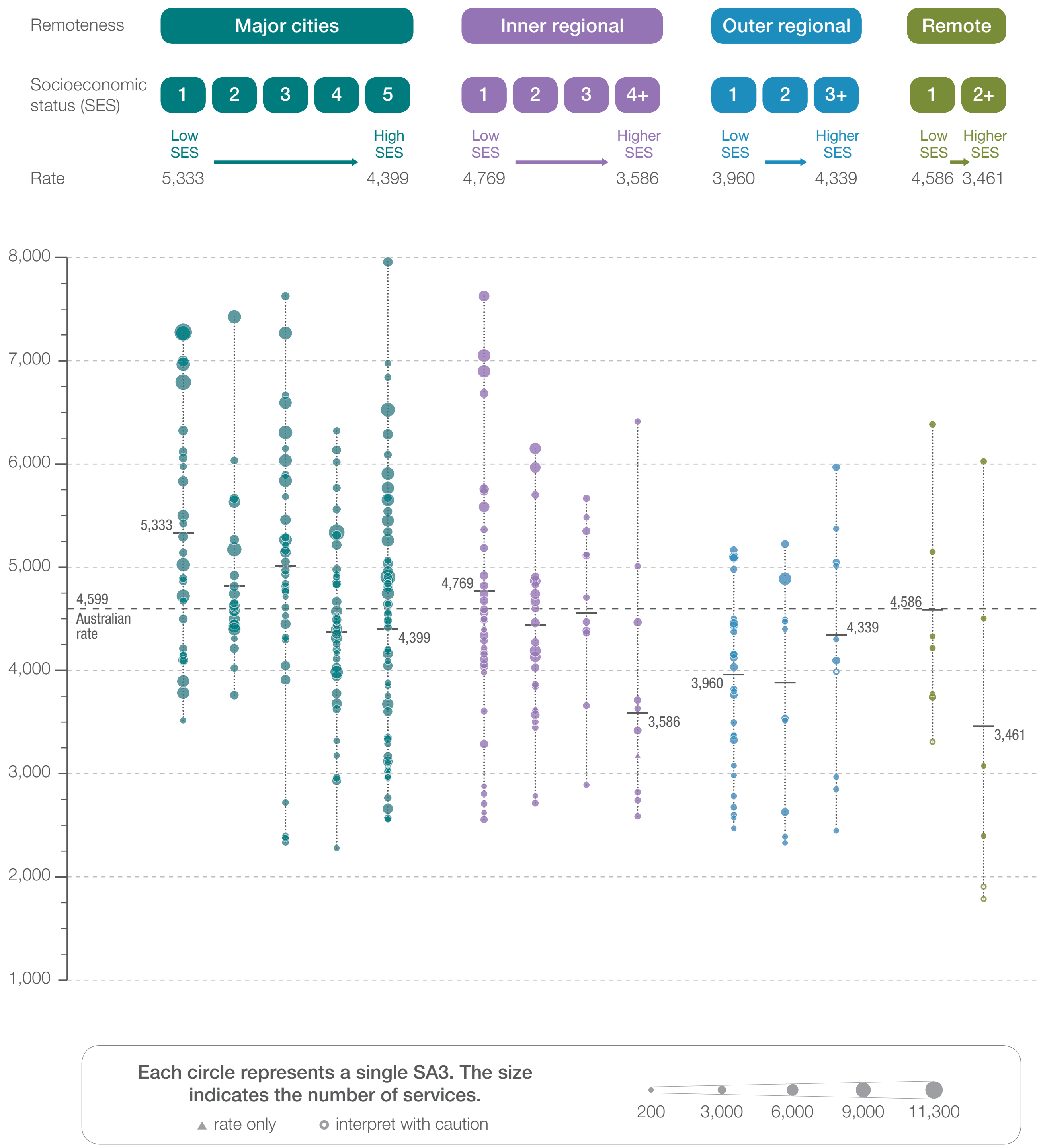
	NSW	Vic	Qld	WA	SA	Tas	ACT	NT
Highest rate	7,957	6,320	7,051	5,149	4,843	2,890	3,111	5,048
State/territory	5,309	4,316	5,016	3,167	4,250	2,624	2,902	4,499
Lowest rate	2,628	3,010	3,365	1,785*	2,783	2,329	2,765	3,307*
No. services	359,202	224,211	200,703	64,222	68,247	13,211	8,590	6,582



Notes:
Hollow circles (○) and asterisks (*) indicate rates that are considered more volatile than other published rates and should be interpreted with caution.
Triangles (▲) indicate SA3s where only rates are published. The numbers of services are not published for confidentiality reasons.
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of Medicare Benefits Schedule data and ABS Estimated Resident Population 30 June 2016.

Rates by remoteness and socioeconomic status

Figure 4.24: Number of MBS-subsidised services for standard echocardiography per 100,000 people aged 18 years and over, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2016–17



Notes:
Hollow circles (○) indicate rates that are considered more volatile than other published rates and should be interpreted with caution.
Triangles (▲) indicate SA3s where only rates are published. The numbers of services are not published for confidentiality reasons.
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of Medicare Benefits Schedule data and ABS Estimated Resident Population 30 June 2016.

Standard echocardiography, 18 years and over

Resources

- *Therapeutic Guidelines: Cardiovascular*[32] (for electronic version, visit https://tgldcdp.tg.org.au/etgcomplete)
- US appropriate use criteria for echocardiography[27]
- British Society of Echocardiography, clinical indications for echocardiography[33]
- American Society of Echocardiography, clinical guidelines on use of echocardiography in various conditions.[34]

Australian initiatives

The information in this chapter will complement work already under way to improve the appropriate use of echocardiography in Australia. At a national level, this work includes:

- MBS Review Taskforce Cardiac Services Clinical Committee, review including recommendations about cardiac tests[9]
- The Better Cardiac Care for Aboriginal and Torres Strait Islander People project.

Many state and territory initiatives are also in place, including:

- Implementation of initiatives in New South Wales to improve cardiovascular care for Aboriginal and Torres Strait Islander people
  - NSW Ministry of Health provides echocardiography machines for loan through the Poche Centre for Indigenous Health at the University of Sydney, for clinicians visiting Aboriginal health services
  - NSW Ministry of Health is part of the national Better Cardiac Care for Aboriginal and Torres Strait Islander People (Better Cardiac Care) initiative
- Implementation of the Victorian cardiac services plan – *Design, Service and Infrastructure Plan for Victoria's Cardiac System*.[35]

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Chapter 5
Repeat analyses

Introduction

This chapter examines changes over time in numbers of Pharmaceutical Benefits Scheme (PBS) prescriptions dispensed for the following items mapped in the first *Australian Atlas of Healthcare Variation*:

- Antimicrobial medicines dispensing, all ages
- Amoxicillin and amoxicillin–clavulanate dispensing, all ages
- Antipsychotic medicines dispensing, 17 years and under
- Antipsychotic medicines dispensing, 18–64 years
- Antipsychotic medicines dispensing, 65 years and over
- Attention deficit hyperactivity disorder (ADHD) medicines dispensing, 17 years and under
- Opioid medicines dispensing, all ages.

These are among the most commonly prescribed medicines in Australia, and are effective treatments when used for the right patient at the right dose and duration, for the right condition. When used outside these indications, these medicines can potentially expose individuals and the community to avoidable harms and unnecessary costs.

The first Atlas showed large variations in dispensing rates of PBS prescriptions for these medicines according to where people live in 2013–14. The findings suggested that some people may be missing out on effective treatment while others may be taking these medicines for little or no benefit.[1]

Introduction

Why explore use of these medicines over time?

Growing concerns about the potential harms to individuals and the community from high and rising use of these medicines demonstrates a clear need to monitor variations in their use across Australia.

Antimicrobials

Monitoring use is a national priority for antimicrobials. Antimicrobial resistance is a global threat to human health.[2,3] Findings from the third Atlas will complement data collected by the Antimicrobial Use and Resistance in Australia (AURA) Surveillance System, and support national, state and local initiatives to improve prescribing of antimicrobial medicines.[2,3]

Antipsychotic and ADHD medicines

The third Atlas findings on antipsychotic medicines and ADHD medicines are of particular importance for better understanding use among key prescribers.

The third Atlas revisits these medicine items and examines use over time (from 2013–14 to 2016–17) with the aims of:

- Monitoring rises and falls in rates nationally
- Monitoring changes in the magnitude of variation across Australia
- Understanding whether more effort is needed to promote safe and appropriate use of these medicines.

Opioids

Improving opioid medicines use is a national priority as a result of recent increases in misuse, overdose and opioid dependence.[4,5] Between 2011 and 2015, twice as many people died from overdose due to an opioid medicine than due to heroin (2,145 compared with 985).[6] Opioids are one of the priority substances identified in the National Drug Strategy 2017–2026.[7] Increased opioid misuse has also prompted a number of national regulatory and policy responses in Australia over the past three years to support harm minimisation.[5,8]

The Australian Commission on Safety and Quality in Health Care (the Commission) will publish a detailed analysis of the data in this chapter in 2019, including recommendations for improving the appropriate use of these medicines. However, because of the work that has already been undertaken on use of antipsychotic medicines in people aged 65 years and over, and ongoing concerns that these medicines are being prescribed inappropriately, recommendations on this topic are included in this Atlas on page 237.

The 2019 report will also include analyses by state and territory, and local area, which will help to inform interventions by health departments and health service organisations for improving the safe and appropriate use of these medicines.

Recommendations

Recommendations for improving the safe and appropriate use of antipsychotic medicines in people aged 65 years and over are included below. Recommendations for the other topics in this chapter will be published in 2019.

5a. Prescribers to use antipsychotic medicines for people 65 years and over as a form of restrictive practice only as a last resort, and not until alternative strategies have been considered. The following conditions must be met:

  i. Informed consent (from the patient or a properly authorised substitute decision maker) to be given in writing

  ii. A structured consent form to be mandated for use in aged care homes to help ensure that prescribers comply with clinical and legal requirements

  iii. A pharmacist to conduct a medicines review after six months, with the outcomes of the review provided to the treating general practitioner and placed in the medication record

  iv. Approval of pro re nata (PRN) orders to be no more than three times a month, and repeat PRN prescription to be limited so that renewal is only permitted after a further evaluation of the resident by the prescribing practitioner.

5b. Aged care providers to record the use of antipsychotic medicines as a form of restrictive practice on all applicable patients in their aged care home and report on this to the Aged Care Quality and Safety Commission.

5c. The Aged Care Quality and Safety Commission accreditation assessments to review the use of psychotropic agents in aged care homes.

5d. The Aged Care Quality and Safety Commission to commence public reporting from July 2020 on rate of use of antipsychotic medicines, in line with recommendation 13 of the 2014 Senate Community Affairs References Committee on care and management of younger and older Australians living with dementia and behavioural and psychological symptoms of dementia (BPSD).

5e. The Aged Care Quality and Safety Commission to consider approaches to educating consumers about the risks of prescribing antipsychotic medicines outside guideline recommendations – such as for BPSD – before secondary causes have been excluded and non-pharmacological measures have been tried.

5f. The Therapeutic Goods Administration (TGA) to review product information for all the antipsychotics most commonly prescribed inappropriately for BPSD in older people, to ensure that the lack of evidence of efficacy and the harms associated with use for BPSD are expressed as clearly as possible, and the product information is optimally framed to discourage prescribing for unapproved use for BPSD.

5g. The TGA to establish and/or review risk management plans for atypical antipsychotic medicines commonly prescribed for BPSD outside therapeutic guidelines. This will include requiring sponsors to more proactively provide or support education in appropriate treatment options for BPSD, emphasising the significant clinical risks and lack of efficacy in using antipsychotic medicines for this purpose.

5h. The Pharmaceutical Benefits Advisory Committee to review the relevant PBS streamlined authority as it applies to the prescribing of atypical antipsychotic medicines to ensure sufficient information about the clinical justification for prescribing of these medicines. This should include the condition for which the medicine is being prescribed, and a record that consent or substitute consent has been provided. This information should be specified on the form which is provided to the dispensing pharmacist.

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5.1 Antimicrobial medicines dispensing, all ages

Context

This section examines antimicrobial medicines dispensing in Australia from 2013–14 to 2016–17 for people of all ages.

Antimicrobial medicines are used to treat microbial infections. They include antibiotics (or antibacterials), antivirals and antifungals. Use is often driven by factors such as physician experience, patient factors, the incidence of infection, and the prevalence of antimicrobial resistance.[1]

The rate of antimicrobial dispensing per 100,000 people in all age groups was mapped in the first *Australian Atlas of Healthcare Variation*, published in November 2015. The first Atlas reported that, in 2013–14, more than 30 million Pharmaceutical Benefits Scheme (PBS) prescriptions for antimicrobial medicines were dispensed in Australia. Dispensing rates tended to be higher in areas with socioeconomic disadvantage. This is consistent with poorer health outcomes and higher infection rates observed in areas with socioeconomic disadvantage. Dispensing rates were lower in areas with socioeconomic advantage, as well as in remote communities. Low dispensing rates in remote communities were partly attributed to medicines dispensed by remote-area Aboriginal health services not being captured in the PBS database.[1]

The data item on antimicrobial dispensing included systemic and topical antibacterials and antifungals, because the resistance issues for antifungals are similar to those for antibacterials. It did not include antivirals.

Antimicrobial medicines dispensing, all ages

Why is it important to monitor antimicrobial use nationally?

Improving the use of antimicrobials is a national priority because of the ongoing concern about antimicrobial resistance (AMR) and because inappropriate use is exposing patients unnecessarily to the adverse effects of these medicines.

Antimicrobial-resistant microorganisms can stop an antimicrobial from working effectively. AMR is a concern because, as antimicrobials become ineffective, the ability to treat infections becomes more limited. With few new antimicrobials under development, especially for infections that occur in the community, AMR has been declared by the World Health Organization as one of the greatest threats to human and animal health, as well as to food and agriculture.[2] Without effective antimicrobials, there is the possibility of a post-antibiotic era when minor infections can no longer be treated. Use of antimicrobials is one of the biggest drivers of resistance in the individual and wider community – the more they are used, the more likely it is that resistance will develop. For example, an individual prescribed an antibiotic for respiratory tract infection is 2.4 times more likely to acquire bacteria resistant to that antimicrobial and carry it for up to 12 months.[3]

Prescribing antimicrobials inappropriately – for example, for longer than necessary – contributes to resistance and exposes patients unnecessarily to the adverse effects of these medicines. Examining how antimicrobials are being used will help inform strategies to minimise resistance and adverse effects in patients.

Australia continues to have very high overall rates of community antimicrobial use compared with other countries. In 2015, almost half the Australian population in the community setting had at least one antimicrobial dispensed under the PBS or Repatriation Pharmaceutical Benefits Scheme (RPBS). The 11 most commonly dispensed antimicrobials made up 84% of all use, and were most often dispensed to young children, or those aged over 65 years. Use in all age groups was also higher in winter months, suggesting that they are potentially being used for respiratory tract infections. Most antimicrobial use in the Australian community is unnecessary, because they are frequently used to treat infections for which they provide little or no benefit.[4,5]

What initiatives have taken place since 2015?

Increased antimicrobial use has prompted a number of policy and regulatory responses in Australia since publication of the first Atlas in 2015. Australia has taken a One Health approach, coordinating responses from all sectors that use antimicrobials. Responses have included:

- Development of Australia's First National Antimicrobial Resistance Strategy, as part of a global response to combat AMR[2]
- Development of the Antimicrobial Use and Resistance in Australia (AURA) Surveillance System by the Australian Commission on Safety and Quality in Health Care (the Commission) to inform strategies to prevent and contain AMR[6]
- Establishment of the National Alert System for Critical Antimicrobial Resistance (CARAlert) by the Commission, as part of AURA, to collect close to real-time data on critical resistances to the last-line antimicrobials[6]
- Establishment of the National Centre for Antimicrobial Stewardship, to promote the rational use of antimicrobials across Australia[7]
- Implementation of antimicrobial stewardship programs in all health service organisations across Australia, under the requirements of the National Safety and Quality Health Service Standards[8]
- Continued delivery of the NPS MedicineWise Resistance Fighter campaign (2012–2017) – a national initiative to help raise awareness of AMR and encourage reduction in antibiotic use where appropriate and safe to do so[9]
- Letters from Australia's Chief Medical Officer to general practitioners prescribing high amounts of antimicrobials, prompting audit of their antimicrobial prescribing practice to identify areas for quality improvement.[10]

About the data

Data are sourced from the PBS dataset. This dataset includes all prescriptions dispensed under the PBS or the RPBS, including prescriptions that do not receive an Australian Government subsidy. Note that some dispensed medicines may not be consumed by the patient.

The dataset does not include prescriptions dispensed for patients during their hospitalisation in public hospitals, discharge prescriptions dispensed from public hospitals in New South Wales and the Australian Capital Territory, direct supply of medicines to remote Aboriginal health services, over-the-counter purchase of medicines, doctor's bag medicines and private prescriptions.

This analysis was not undertaken by Aboriginal and Torres Strait Islander status because this information was not available for PBS data at the time of publication.

Changes have been made to the data specification used in the first Atlas to improve the robustness of comparing rates over time. The main change is the addition of sex standardisation, as the data specification for the first Atlas standardised for age only. These changes have resulted in small differences in the rates reported for 2013–14 in the first Atlas and this Atlas. The rates reported in this Atlas should be used to monitor changes over time.

Antimicrobial medicines dispensing, all ages

What do the data show?

Magnitude of variation*

In 2016–17, the rate of dispensing of antimicrobial medicine prescriptions was **4.8 times as high** in the area (Statistical Area Level 3 – SA3) with the highest rate as in the SA3 with the lowest rate. The magnitude of variation **increased** from 2013–14, when there was a 4.6-fold difference between the highest and lowest rates (Figure 5.3).

Rate of prescriptions dispensed

In 2016–17, there were 29,147,238 PBS prescriptions dispensed for antimicrobial medicines, representing an Australian rate of **115,894** prescriptions dispensed per 100,000 people of all ages. The Australian rate **decreased** from 2013–14, when 126,864 prescriptions per 100,000 people were dispensed (Figure 5.3).

People dispensed at least one prescription

In 2016–17, there were **43,215** people per 100,000 people nationally who had at least one prescription dispensed for an antimicrobial medicine. The number of people nationally who had at least one prescription dispensed in a year **decreased** from 2013–14, when 45,411 people per 100,000 people nationally had at least one antimicrobial medicine prescription dispensed (Table 5.1).

Table 5.1: Number of people dispensed at least one PBS prescription for an antimicrobial medicine per 100,000 people of all ages, age and sex standardised, 2013–14 to 2016–17

	2013–14	2014–15	2015–16	2016–17
Australian rate	45,411	46,032	44,866	43,215

Volume of antimicrobial medicine use

In 2016–17, there were 23.21 defined daily doses† (DDDs)† of antimicrobial medicines per 1,000 people dispensed on any given day. The national DDD rate per 1,000 people per day was relatively **stable** between 2013–14 and 2016–17 (Table 5.2).

Table 5.2: Number of defined daily doses of antimicrobial medicines dispensed per 1,000 people of all ages per day, age and sex standardised, 2013–14 to 2016–17

	2013–14	2014–15	2015–16	2016–17
Australian rate	23.55	24.16	23.64	23.21

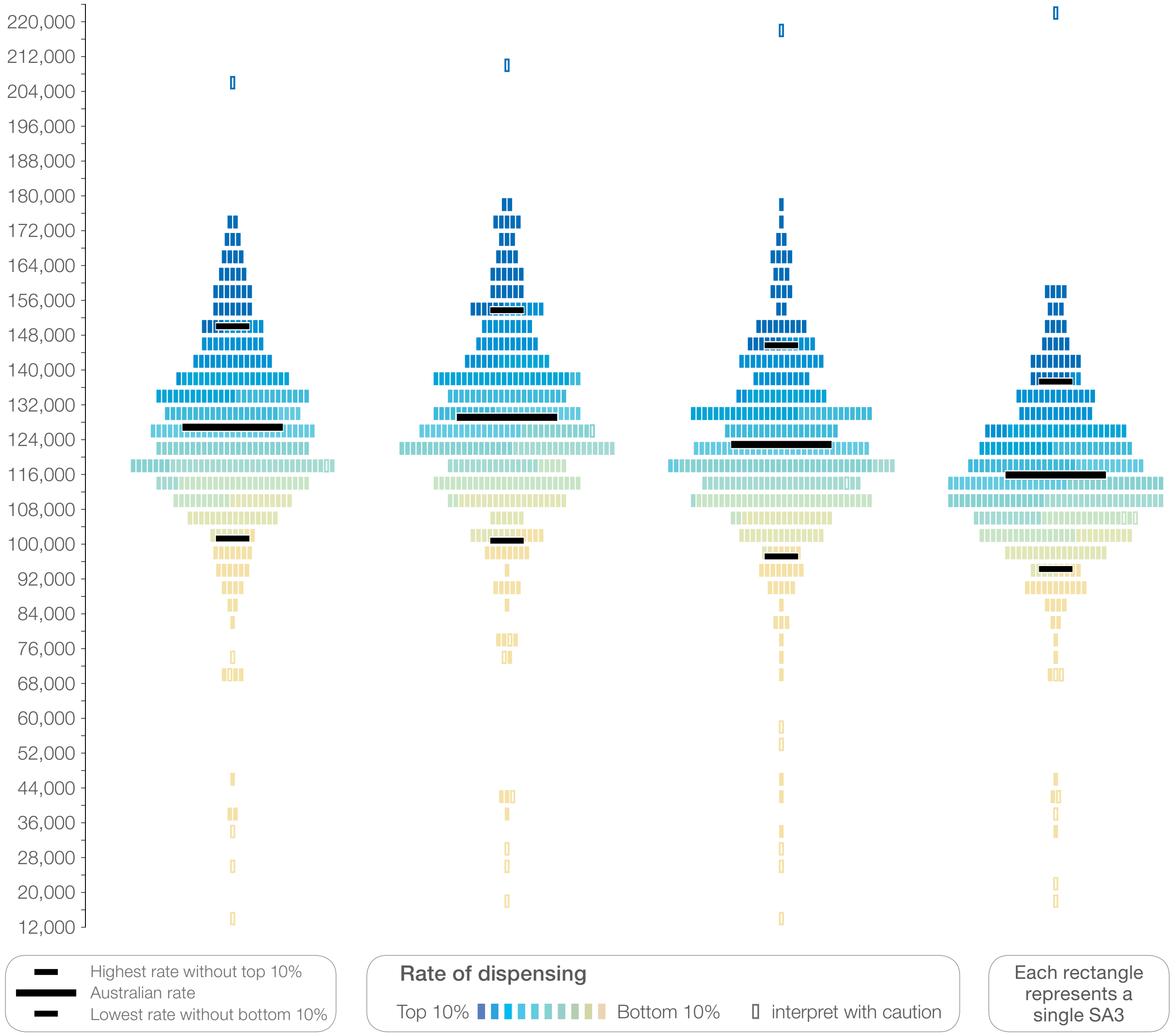
* Some of the published SA3 rates were considered more volatile than others. These rates are excluded from the calculation of the difference between the highest and lowest SA3 rates in Australia.

† A defined daily dose (DDD) is a measure of medicines use that allows comparison between different therapeutic groups, and between countries. The DDD is based on the average dose per day of the medicine when used for its main indication by adults. Refer to the Technical Supplement for more information.

Rates across years

Figure 5.3: Number of PBS prescriptions dispensed for antimicrobial medicines per 100,000 people of all ages, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2013–14 to 2016–17

	2013–14	2014–15	2015–16	2016–17
Highest rate	205,050*	209,452*	219,707*	222,863*
Australian rate	**126,864**	**129,137**	**122,892**	**115,894**
Lowest rate	15,163*	17,585*	15,812*	17,861*
Magnitude of variation	4.6	4.5	5.0	4.8
Magnitude of variation without top & bottom 10%	1.5	1.5	1.5	1.5



Notes:
Hollow rectangles (▯) and asterisks (*) indicate rates that are considered more volatile than other published rates and should be interpreted with caution. These rates are excluded from the calculation of the difference between the highest and lowest SA3 rates in Australia.
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of Pharmaceutical Benefits Scheme data and ABS Estimated Resident Population 30 June 2013 to 2016.

Antimicrobial medicines dispensing, all ages

Interpretation

Between 2013–14 and 2016–17, the rate of antimicrobial prescriptions dispensed per 100,000 people nationally decreased by 9%, and the rate of people dispensed at least one prescription for an antimicrobial also decreased. While this is encouraging, the volume of antimicrobials used in the Australian community, as indicated by the DDD per 1,000 people per day, remained relatively stable, indicating that there was little change in the amount of antimicrobial medicines supplied during the four-year period. Further, the magnitude of variation in dispensing rates also increased, which might indicate changes in antimicrobial medicine use in some areas but not others.

Potential reasons for this pattern include:

- The number of authority prescriptions dispensed – for example, a rise in these types of prescriptions for an increased quantity supplied could lower rates of prescriptions dispensed
- Changes in guidelines and prescribing behaviours, affecting the type of antimicrobial chosen and dose dispensed (as different conditions might require courses with a different dose or the same condition may be treated with a higher dose, which will not affect the rate of prescriptions dispensed, but will affect the DDD).

To explore this, further analysis could potentially focus on:

- Types of antimicrobials, reasons for prescribing and doses being dispensed
- Quantities of antimicrobials being dispensed on authority prescriptions
- The context in which antimicrobials are dispensed – for example, in patients with chronic disease.

Is there more to be done?

Although antimicrobial dispensing rates fell in Australia between 2013–14 and 2016–17, the findings suggest that further efforts to improve antimicrobial use are needed. The magnitude of variation in dispensing rates increased, which is unlikely to be explained by infection rates. Despite reduced dispensing rates, this has had little effect on the overall volume of antimicrobial medicines supplied on any given day in the Australian community during the four-year period. Improving antimicrobial prescribing requires a sustained, multi-pronged approach. Australia's first National Antimicrobial Resistance Strategy describes the collaborative efforts required to bring about practice change where appropriate, and to implement initiatives that support improvement in antimicrobial use in all settings of health care.[2]

The Commission will publish a further report of these data in 2019, including analyses by state and territory, and local area. This information will help to identify whether changes in antimicrobial use are occurring in some areas and not others, and what further targeted strategies are needed to promote safe and appropriate use of antimicrobials in Australia.

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5.2 Amoxicillin and amoxicillin–clavulanate dispensing, all ages

Context

This section examines amoxicillin and amoxicillin–clavulanate dispensing in Australia between 2013–14 and 2016–17 for people of all ages.

Antimicrobial medicines are used to treat microbial infections. They include antibiotics (or antibacterials), antivirals and antifungals. Use is often driven by factors such as physician experience, patient factors, the incidence of infection, and the prevalence of antimicrobial resistance.[1]

Amoxicillin is an antibiotic, and is the most frequently prescribed antimicrobial in the community. In 2013, amoxicillin accounted for 21% of systemic antimicrobial dispensing, with repeat dispensing ordered on 40% of prescriptions.[2] Amoxicillin is preferred for treating infections that are less likely to be cause by β-lactamase-producing bacteria, such as most upper and lower bacterial respiratory tract infections.[3]

The addition of clavulanic acid, a β-lactamase inhibitor, to amoxicillin broadens its spectrum of activity to include bacteria that commonly harbour acquired β-lactamases, such as *Escherichia coli*, *Klebsiella* species and *Staphylococcus aureus*.[3] The combination of amoxicillin–clavulanate is the third most commonly prescribed antimicrobial in the community.[2] Because antimicrobial resistance is known to be increasing in Australia, amoxicillin–clavulanate is preferred over amoxicillin for treating urinary tract infections.[1,3]

The rate of amoxicillin and amoxicillin–clavulanate dispensing per 100,000 people in all age groups was mapped in the first *Australian Atlas of Healthcare Variation*, published in November 2015.[1] The first Atlas reported that, combined, these two antimicrobials accounted for more than 10 million Pharmaceutical Benefits Scheme (PBS) prescriptions dispensed in 2013–14; nearly 5.7 million were for amoxicillin and nearly 4.7 million were for amoxicillin–clavulanate.[1]

Amoxicillin and amoxicillin–clavulanate dispensing, all ages

As with dispensing for all antimicrobials, rates of amoxicillin and amoxicillin–clavulanate dispensing tended to be higher in areas with socioeconomic disadvantage. This is consistent with poorer health outcomes and higher infection rates observed in areas with socioeconomic disadvantage. Dispensing rates were lower in areas with socioeconomic advantage, as well as in remote communities. Low dispensing rates in remote communities were partly attributed to medicines dispensed by remote-area Aboriginal health services not being captured in the PBS database.[1]

Why is it important to monitor antimicrobial use nationally?

Improving the use of antimicrobials is a national priority because of the ongoing concern about antimicrobial resistance (AMR) and because inappropriate use is exposing patients unnecessarily to the adverse effects of these medicines.

Antimicrobial-resistant microorganisms can stop an antimicrobial from working effectively. AMR is a concern because, as antimicrobials become ineffective, the ability to treat infections becomes more limited. With few new antimicrobials under development, especially for infections that occur in the community, AMR has been declared by the World Health Organization as one of the greatest threats to human and animal health, as well as food and agriculture.[4] Without effective antimicrobials, there is the possibility of a post-antibiotic era when minor infections can no longer be treated. Use of antimicrobials is one of the biggest drivers of resistance in the individual and wider community – the more they are used, the more likely it is that resistance will develop. For example, an individual prescribed an antibiotic for respiratory tract infection is 2.4 times more likely to acquire a bacterium resistant to that antimicrobial and carry it for up to 12 months.[5]

Prescribing antimicrobials inappropriately – for example, for longer than necessary – contributes to resistance and exposes patients unnecessarily to the adverse effects of these medicines. Examining how antimicrobials are being used will help inform strategies to minimise resistance and adverse effects in patients.

Australia continues to have very high overall rates of amoxicillin and amoxicillin–clavulanate use in the community compared with other countries, and misuse is common. For example, amoxicillin–clavulanate, which is the third most commonly dispensed antimicrobial in the community, should only be prescribed for infections where resistance to amoxicillin is suspected or proven. In 2017, the second Australian report on antimicrobial use and resistance in human health reported data obtained from the NPS MedicineWise MedicineInsight program. It showed that 14% of amoxicillin–clavulanate prescriptions were for upper respiratory tract infections, where antimicrobials are not needed, and 15% of prescriptions were for sinusitis, where antimicrobials are only needed in certain circumstances (with amoxicillin being the recommended medicine).[3,6]

What initiatives have taken place since 2015?

Increased antimicrobial use and misuse has prompted a number of policy and regulatory responses in Australia since publication of the first Atlas in 2015. Australia has taken a One Health approach, coordinating responses from all sectors that use antimicrobials. Responses have included:

- Development of Australia's First National Antimicrobial Resistance Strategy, as part of a global response to combat AMR[4]
- Development of the Antimicrobial Use and Resistance in Australia (AURA) Surveillance System by the Australian Commission on Safety and Quality in Health Care (the Commission) to inform strategies to prevent and contain AMR[7]
- Establishment of the National Alert System for Critical Antimicrobial Resistance (CARAlert) by the Commission, as part of AURA, to collect close to real-time data on critical resistances to the last-line antimicrobials[7]
- Establishment of the National Centre for Antimicrobial Stewardship, to promote the rational use of antimicrobials across Australia[8]
- Implementation of antimicrobial stewardship programs in all health service organisations across Australia, under the requirements of the National Safety and Quality Health Service Standards[9]
- Continued delivery of the NPS MedicineWise Resistance Fighter campaign (2012–2017) – a national initiative to help raise awareness of antibiotic resistance and encourage reduction in antibiotic use where appropriate and safe to do so[10]
- Letters from Australia's Chief Medical Officer to general practitioners prescribing high amounts of antimicrobials, prompting audit of their antimicrobial prescribing practice to identify areas for quality improvement.[11]

About the data

Data are sourced from the PBS dataset. This dataset includes all prescriptions dispensed under the PBS or the Repatriation Pharmaceutical Benefits Scheme, including prescriptions that do not receive an Australian Government subsidy. Note that some dispensed medicines may not be consumed by the patient.

The dataset does not include prescriptions dispensed for patients during their admission to public hospitals, discharge prescriptions dispensed from public hospitals in New South Wales and the Australian Capital Territory, direct supply of medicines to remote Aboriginal health services, over-the-counter purchase of medicines, doctor's bag medicines and private prescriptions.

This analysis was not undertaken by Aboriginal and Torres Strait Islander status because this information was not available for PBS data at the time of publication.

Changes have been made to the data specification used in the first Atlas to improve the robustness of comparing rates over time. The main change is the addition of sex standardisation, as the data specification for the first Atlas standardised for age only. These changes have resulted in small differences in the rates reported for 2013–14 in the first Atlas and this Atlas. The rates reported in this Atlas should be used to monitor changes over time.

Amoxicillin and amoxicillin–clavulanate dispensing, all ages

What do the data show?

Magnitude of variation*

In 2016–17, the rate of dispensing of amoxicillin prescriptions was **7.6 times as high** in the area (Statistical Area Level 3 – SA3) with the highest rate as in the SA3 with the lowest rate. The magnitude of variation was stable from 2013–14, then **decreased** from 2015–16 when there was a 7.9-fold difference between the highest and lowest rates (Figure 5.4).

The rate of dispensing of amoxicillin–clavulanate prescriptions was **5.8 times as high** in the SA3 with the highest rate as in the SA3 with the lowest rate 2016–17. The magnitude of variation **increased** from 2013–14, when there was a 5.0-fold difference between the highest and lowest rates (Figure 5.9).

Rate of prescriptions dispensed

In 2016–17, there were 5,443,251 PBS prescriptions dispensed for amoxicillin, representing an Australian rate of **22,286** prescriptions dispensed per 100,000 people of all ages. The Australian rate **decreased** from 2013–14, when 24,112 prescriptions per 100,000 people were dispensed. (Figure 5.4)

In 2016–17, there were 4,936,412 PBS prescriptions dispensed for amoxicillin–clavulanate, representing an Australian rate of **19,567** prescriptions dispensed per 100,000 people of all ages. The Australian rate **increased** from 2013–14, when 19,110 prescriptions per 100,000 people were dispensed (Figure 5.9).

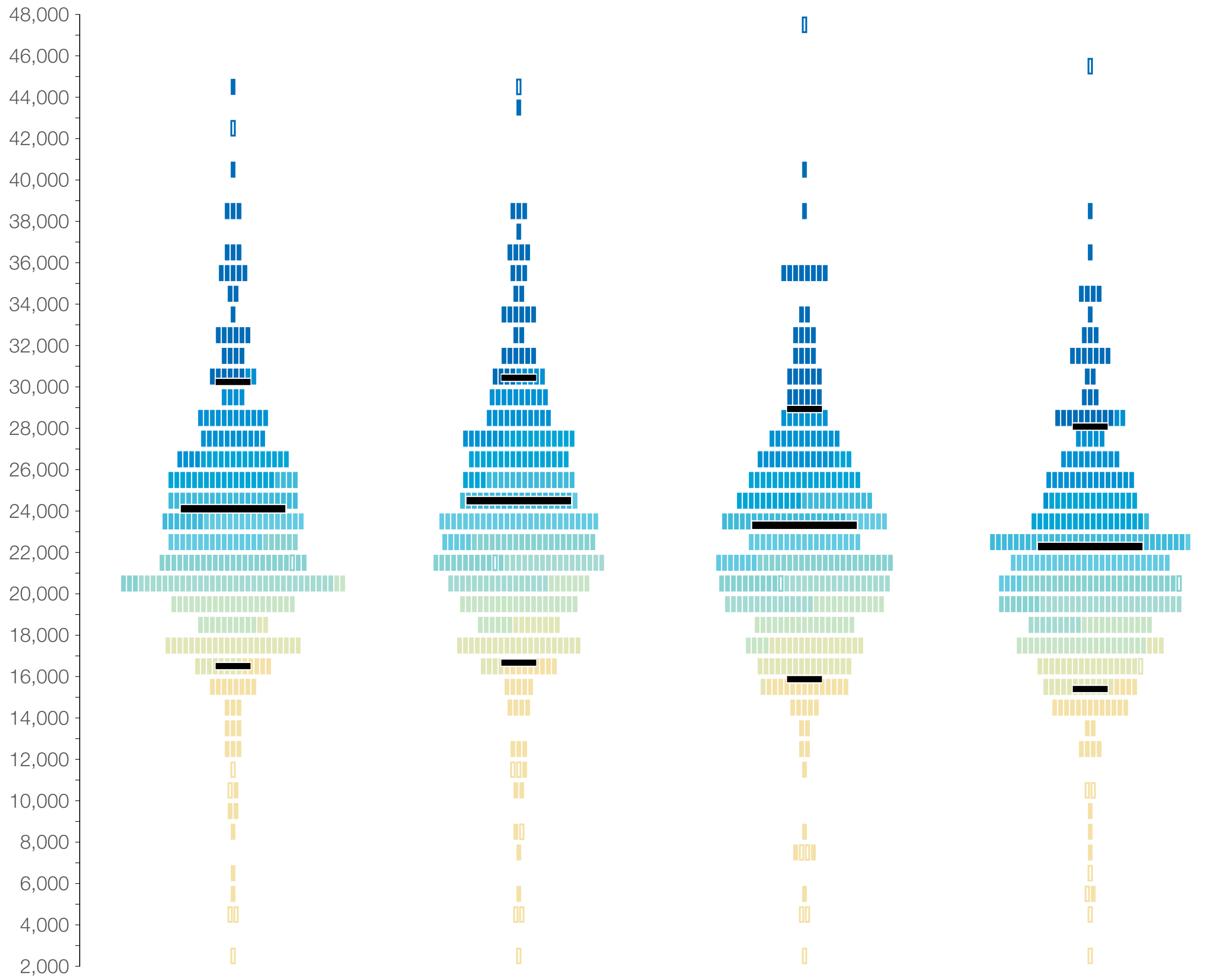
* Some of the published SA3 rates were considered more volatile than others. These rates are excluded from the calculation of the difference between the highest and lowest SA3 rates in Australia.

Amoxicillin dispensing, all ages

Rates across years

Figure 5.4: Number of PBS prescriptions dispensed for amoxicillin per 100,000 people of all ages, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2013–14 to 2016–17

	2013–14	2014–15	2015–16	2016–17
Highest rate	44,644	44,262*	47,380*	45,555*
Australian rate	**24,112**	**24,503**	**23,312**	**22,286**
Lowest rate	2,198*	2,195*	2,296*	2,744*
Magnitude of variation	7.9	7.9	7.9	7.6
Magnitude of variation without top & bottom 10%	1.8	1.8	1.8	1.8



Highest rate without top 10%
Australian rate
Lowest rate without bottom 10%

Rate of dispensing

Top 10% Bottom 10% ▯ Interpret with caution

Each rectangle represents a single SA3

Notes:
Hollow rectangles (▯) and asterisks (*) indicate rates that are considered more volatile than other published rates and should be interpreted with caution. These rates are excluded from the calculation of the difference between the highest and lowest SA3 rates in Australia.
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of Pharmaceutical Benefits Scheme data and ABS Estimated Resident Population 30 June 2013 to 2016.

Amoxicillin and amoxicillin–clavulanate dispensing, all ages

People dispensed at least one prescription

In 2016–17, there were **15,143** people per 100,000 people nationally who had at least one prescription dispensed for amoxicillin. The number of people nationally who had at least one prescription dispensed in a year **decreased** from 2013–14, when 15,890 people per 100,000 people nationally had at least one amoxicillin prescription dispensed (Table 5.5).

Table 5.5: Number of people dispensed at least one PBS prescription for amoxicillin per 100,000 people of all ages, age and sex standardised, 2013–14 to 2016–17

	2013–14	2014–15	2015–16	2016–17
Australian rate	15,890	16,205	15,733	15,143

In 2016–17, there were **10,683** people per 100,000 people nationally who had at least one prescription dispensed for amoxicillin–clavulanate. The number of people nationally who had at least one prescription dispensed in a year **increased** from 2013–14, when 10,338 people per 100,000 people nationally had at least one amoxicillin–clavulanate prescription dispensed (Table 5.6).

Table 5.6: Number of people dispensed at least one PBS prescription for amoxicillin–clavulanate per 100,000 people of all ages, age and sex standardised, 2013–14 to 2016–17

	2013–14	2014–15	2015–16	2016–17
Australian rate	10,338	10,996	10,849	10,683

Volume of amoxicillin and amoxicillin–clavulanate use

In 2016–17, there were 5.12 defined daily doses† (DDDs) of amoxicillin per 1,000 people dispensed on any given day. The national DDD rate per 1,000 people per day **fell** from 2013–14, when it was 5.33 (Table 5.7).

Table 5.7: Number of defined daily doses of amoxicillin dispensed per 1,000 people of all ages per day, age and sex standardised, 2013–14 to 2016–17

	2013–14	2014–15	2015–16	2016–17
Australian rate	5.33	5.47	5.27	5.12

In 2016–17, there were 4.31 DDDs of amoxicillin–clavulanate per 1,000 people dispensed on any given day. The national DDD per 1,000 people per day **increased** from 2013–14, when it was 4.17 (Table 5.8).

Table 5.8: Number of defined daily doses of amoxicillin–clavulanate dispensed per 1,000 people of all ages per day, age and sex standardised, 2013–14 to 2016–17

	2013–14	2014–15	2015–16	2016–17
Australian rate	4.17	4.46	4.36	4.31

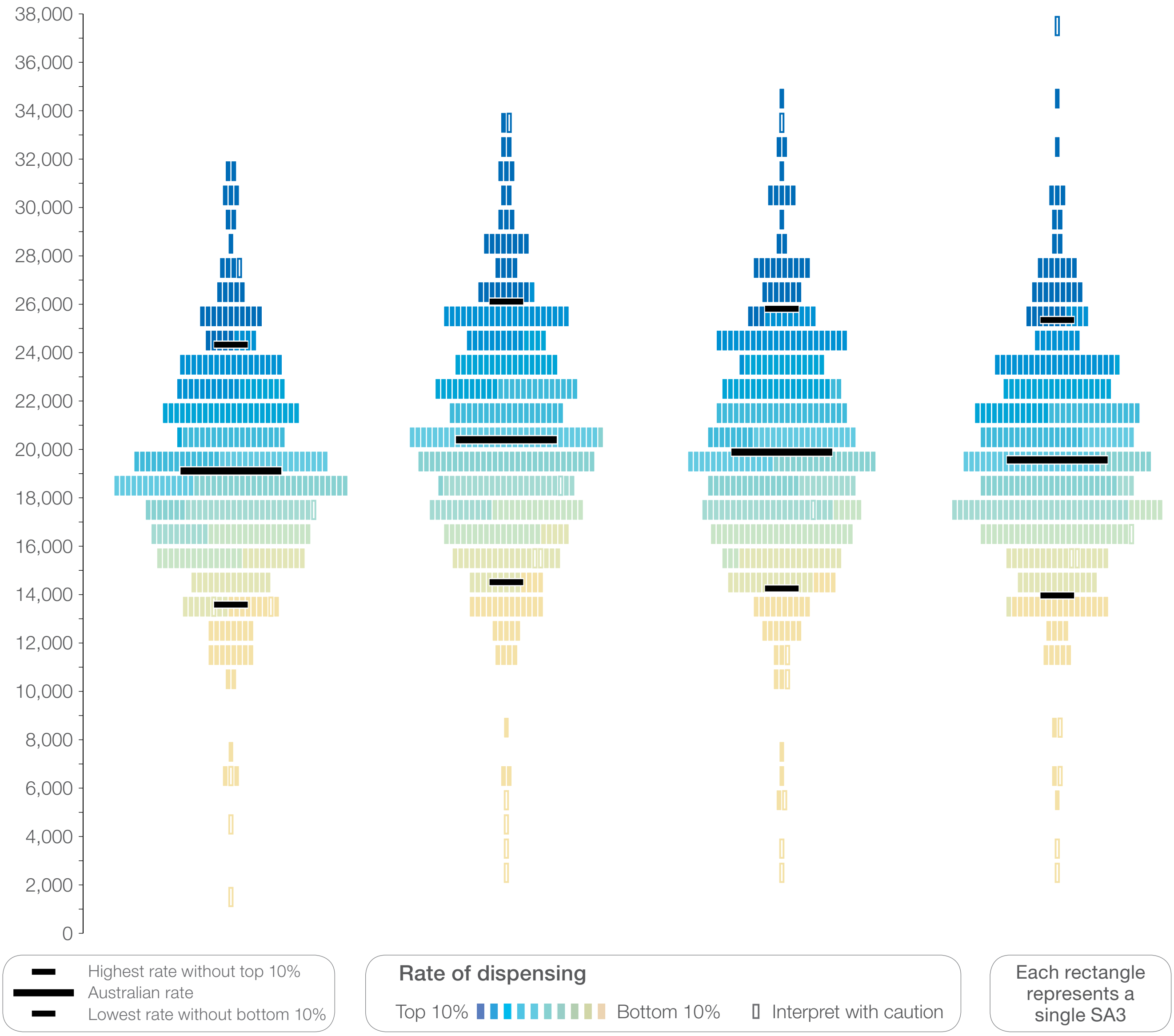
† A defined daily dose (DDD) is a measure of medicines use that allows comparison between different therapeutic groups, and between countries. The DDD is based on the average dose per day of the medicine when used for its main indication by adults. Refer to the Technical Supplement for more information.

Amoxicillin–clavulanate dispensing, all ages

Rates across years

Figure 5.9: Number of PBS prescriptions dispensed for amoxicillin–clavulanate per 100,000 people of all ages, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2013–14 to 2016–17

	2013–14	2014–15	2015–16	2016–17
Highest rate	31,578	33,918*	34,097	37,013*
Australian rate	**19,110**	**20,400**	**19,888**	**19,567**
Lowest rate	1,968*	2,782*	2,449*	2,855*
Magnitude of variation	5.0	5.4	6.1	5.8
Magnitude of variation without top & bottom 10%	1.8	1.8	1.8	1.8



Notes:
Hollow rectangles (▯) and asterisks (*) indicate rates that are considered more volatile than other published rates and should be interpreted with caution. These rates are excluded from the calculation of the difference between the highest and lowest SA3 rates in Australia.
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of Pharmaceutical Benefits Scheme data and ABS Estimated Resident Population 30 June 2013 to 2016.

Amoxicillin and amoxicillin–clavulanate dispensing, all ages

Interpretation

Between 2013–14 and 2016–17, the rate of amoxicillin prescriptions dispensed per 100,000 people nationally decreased by 7.6%, and the rate of people dispensed at least one prescription for amoxicillin also decreased. In contrast, the rate of amoxicillin–clavulanate prescriptions dispensed per 100,000 people nationally increased by 2.4%. Collectively, the volume of both medicines used in the Australian community, as indicated by the DDDs per 1,000 people per day, has remained relatively stable, indicating that there has been little change in the amount of either of these antimicrobials supplied during the four-year period. The magnitude of variation in dispensing decreased for amoxicillin, but increased for amoxicillin–clavulanate. It is unclear whether these patterns indicate changes in some areas and not others.

Potential reasons for these patterns include:

- The number of authority prescriptions dispensed – for example, a rise in these types of prescriptions for an increased quantity supplied could lower rates of prescriptions dispensed
- Changes in guidelines and prescribing behaviours, affecting the choice of amoxicillin or amoxicillin–clavulanate and dose dispensed (as different conditions might require courses with a different dose or the same condition may be treated with a higher dose, which will not affect the rate of prescriptions dispensed, but will affect the DDD).

To explore this, further analysis could potentially focus on:

- Reasons for prescribing and doses being dispensed
- Quantities being dispensed on authority prescriptions
- The context in which these antibiotics are being prescribed and whether it is in accordance with guidelines.

Is there more to be done?

Although amoxicillin dispensing rates fell in Australia between 2013–14 and 2016–17, rates for amoxicillin–clavulanate dispensing did not. The magnitude of variation in dispensing rates decreased for amoxicillin and increased for amoxicillin–clavulanate, which is unlikely to be explained by infection rates. Australia still has high volumes of use of both amoxicillin and amoxicillin–clavulanate. Further investigation is required to identify whether these patterns are warranted. Improving prescribing of these antimicrobials requires a sustained, multi-pronged approach. Australia's first National Antimicrobial Resistance Strategy describes the collaborative efforts required to bring about practice change where appropriate, and to implement initiatives that support improvement in use in all settings of health care.[4]

The Commission will publish a further analysis of these data in 2019, including analyses by state and territory, and local area. This information will help to identify whether changes in the use of these antimicrobials are occurring in some areas and not others, and what further targeted strategies are needed to promote safe and appropriate use of these medicines in Australia.

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5.3 Antipsychotic medicines dispensing, 17 years and under

Context

This section examines antipsychotic medicines dispensing for children and adolescents aged 17 years and under between 2013–14 and 2016–17.

Antipsychotic medicines are primarily used to manage psychotic disorders such as schizophrenia, and the psychotic symptoms of mood disorders. They are used to reduce or sometimes eliminate the distressing and disabling symptoms of psychosis, such as paranoia, confused thinking, delusions and hallucinations. In adolescents, this is the most common use of these medicines.

In children and some adolescents, antipsychotic medicines are also used to treat a range of behavioural disturbances related to developmental and behavioural conditions, including autism spectrum disorder, attention deficit hyperactivity disorder and conduct disorder.

Effective management of psychosis and behavioural disorders usually includes ongoing clinical support in the community and psychological therapy, including family therapy, education about symptoms and how to manage them, assistance with accommodation and employment, and educational support. Antipsychotic medicines are considered to be just one component of treating mental health conditions and rarely considered sufficient when used on their own.[1]

The rate of antipsychotic medicines dispensing per 100,000 people aged 17 years and under was mapped in the first *Australian Atlas of Healthcare Variation*, published in November 2015.[1] The first Atlas reported that, in 2013–14, nearly 105,000 Pharmaceutical Benefits Scheme (PBS) prescriptions for antipsychotic medicines were dispensed in Australia to people aged 17 years and under. Variation was marked, with a 22.5-fold difference in rates of dispensing between local areas. Dispensing rates were similar in major cities and regional areas, and lowest in remote communities. Socioeconomic groupings had a small association with dispensing rates. Lower rates of dispensing of antipsychotic medicines in remote communities were partly attributed to medicines dispensed by remote-area Aboriginal health services not being captured in the PBS database.[1]

Antipsychotic medicines dispensing, 17 years and under

Why is it important to monitor antipsychotic medicines use nationally?

Antipsychotic medicines can cause long-term harm, even at low doses. It is therefore essential that these medicines are prescribed appropriately in young people to ensure that their benefits outweigh the risks. Use of antipsychotic medicines for non-approved indications, such as acute sedation in the absence of psychotic symptoms, is a particular concern.[2,3]

What initiatives have taken place since 2015?

Since 2015, initiatives to improve use of antipsychotic medicines in people aged 17 years and under have been undertaken as part of a wider strategy to improve the management of mental health conditions in Australia. The National Mental Health Commission, which was established in 2012, continues to provide advice on ways to improve Australia's mental health and acts as a catalyst for change.[4] In 2016, the Australian Bureau of Statistics published *Patterns of Use of Mental Health Services and Prescription Medications, 2011*.[5]

Updated guidelines from the Royal Australian and New Zealand College of Psychiatrists – *Professional Practice Guideline 7: Guidance for psychotropic medication use in children and adolescents* (2015) – were also published.[6] Mental health organisations such as Beyond Blue and the Black Dog Institute provide support to all people across Australia, including children and adolescents, who are living with a mental health condition. Other programs such as Headspace have been developed to specifically focus on supporting youth mental health.

About the data

Data are sourced from the PBS dataset. This dataset includes all prescriptions dispensed under the PBS or the Repatriation Pharmaceutical Benefits Scheme, including prescriptions that do not receive an Australian Government subsidy. Note that some dispensed medicines may not be consumed by the patient.

The dataset does not include prescriptions dispensed for patients during their hospitalisation in public hospitals, discharge prescriptions dispensed from public hospitals in New South Wales and the Australian Capital Territory, direct supply of medicines to remote Aboriginal health services, over-the-counter purchase of medicines, doctor's bag medicines and private prescriptions.

The PBS data do not include prescriptions for clozapine dispensed by public hospitals and claimed through offline arrangements up to 2014–15. The Technical Supplement has further details about clozapine prescriptions.

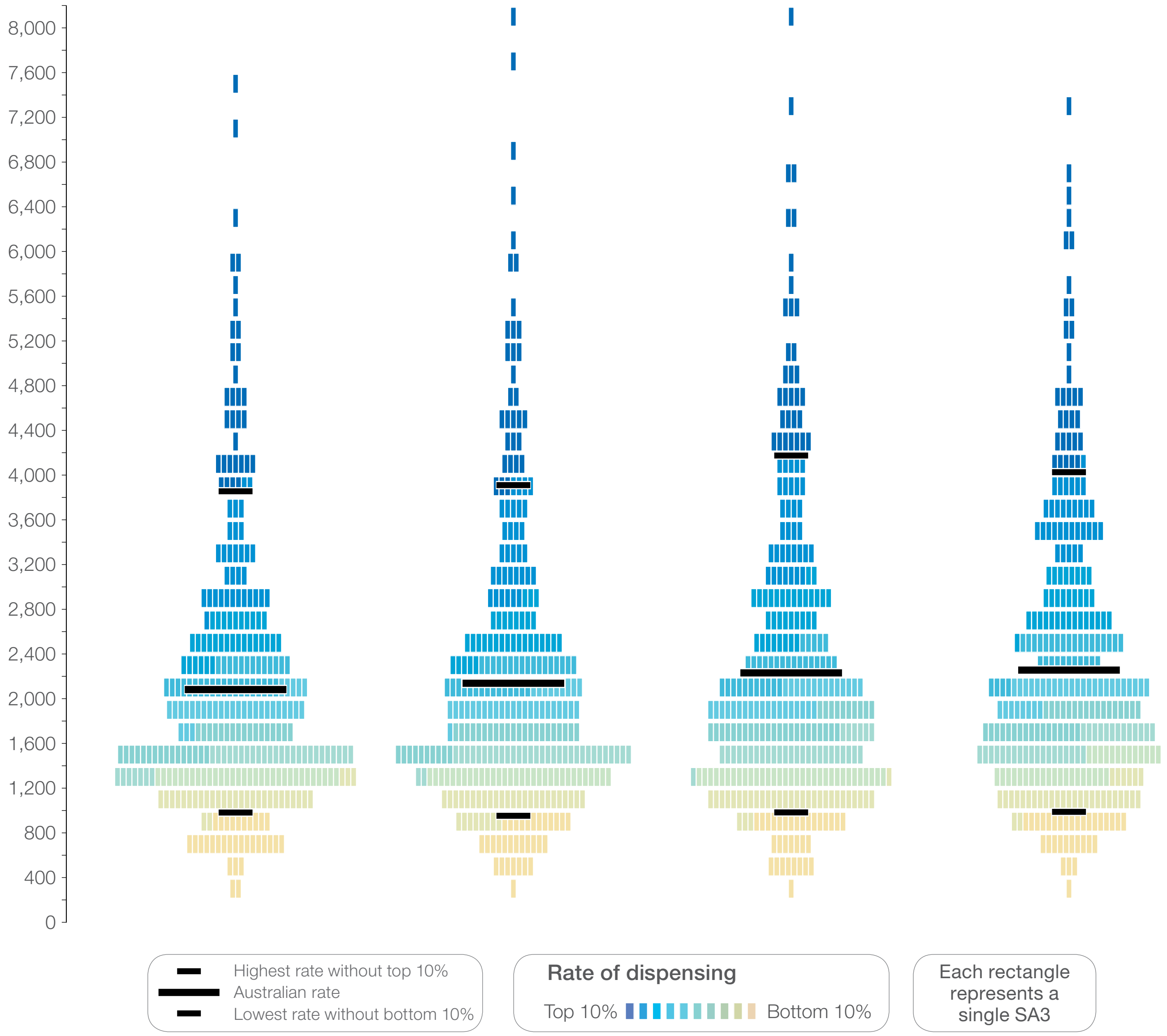
This analysis was not undertaken by Aboriginal and Torres Strait Islander status because this information was not available for PBS data at the time of publication.

Changes have been made to the data specification used in the first Atlas to improve the robustness of comparing rates over time. The main change is the addition of sex standardisation, as the data specification for the first Atlas standardised for age only. These changes have resulted in small differences in the rates reported for 2013–14 in the first Atlas and this Atlas. The rates reported in this Atlas should be used to monitor changes over time.

Rates across years

Figure 5.10: Number of PBS prescriptions dispensed for antipsychotic medicines per 100,000 people aged 17 years and under, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2013–14 to 2016–17

	2013–14	2014–15	2015–16	2016–17
Highest rate	7,410	8,020	8,130	7,201
Australian rate	**2,082**	**2,138**	**2,231**	**2,256**
Lowest rate	315	333	343	364
Magnitude of variation	23.5	24.1	23.7	19.8
Magnitude of variation without top & bottom 10%	3.9	4.1	4.2	4.1



Notes:
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of Pharmaceutical Benefits Scheme data and ABS Estimated Resident Population 30 June 2013 to 2016.

Antipsychotic medicines dispensing, 17 years and under

What do the data show?

Magnitude of variation

In 2016–17, the rate of dispensing of antipsychotic medicine prescriptions in people aged 17 years and under was **19.8 times as high** in the area (Statistical Area Level 3 – SA3) with the highest rate as in the SA3 with the lowest rate. The magnitude of variation **decreased** from 2013–14, when there was a 23.5-fold difference between the highest and lowest rates (Figure 5.10).

Rate of prescriptions dispensed

In 2016–17, there were 117,511 PBS prescriptions dispensed for antipsychotic medicines to people aged 17 years and under, representing an Australian rate of **2,256** prescriptions per 100,000 people aged 17 years and under. The Australian rate **increased** during the four years from 2013–14, when 2,082 prescriptions per 100,000 people aged 17 years and under were dispensed (Figure 5.10).

People dispensed at least one prescription

In 2016–17, there were **438** people per 100,000 people aged 17 years and under nationally who had at least one prescription dispensed for an antipsychotic medicine. The number of people nationally who had at least one prescription dispensed in a year **increased** during the four years from 2013–14, when 393 people per 100,000 people aged 17 years and under nationally had at least one antipsychotic medicine prescription dispensed (Table 5.11).

Table 5.11: Number of people dispensed at least one prescription for an antipsychotic medicine per 100,000 people aged 17 years and under, age and sex standardised, 2013–14 to 2016–17

	2013–14	2014–15	2015–16	2016–17
Australian rate	393	407	423	438

Volume of antipsychotic medicines use in people aged 17 years and under

In 2016–17, there were 0.92 defined daily doses* (DDDs) of antipsychotic medicines per 1,000 people aged 17 years and under dispensed on any given day. The national DDD rate per 1,000 people aged 17 years and under per day **increased** during the four years from 2013–14, when it was 0.83 (Table 5.12).

Table 5.12: Number of defined daily doses of antipsychotic medicines dispensed per 1,000 people aged 17 years and under per day, age and sex standardised, 2013–14 to 2016–17

	2013–14	2014–15	2015–16	2016–17
Australian rate	0.83	0.86	0.90	0.92

* A defined daily dose (DDD) is a measure of medicines use that allows comparison between different therapeutic groups, and between countries. The DDD is based on the average dose per day of the medicine when used for its main indication by adults. Refer to the Technical Supplement for more information.

Interpretation

Between 2013–14 and 2016–17, the rate of antipsychotic medicines dispensed per 100,000 people aged 17 years and under increased by 8% in Australia during the four-year period. The magnitude of variation in dispensing rates decreased, but was still high in 2016–17. The rate of people dispensed at least one prescription increased during the four years from 2013–14. The volume of antipsychotic medicines used in the Australian community in this age group, as indicated by the DDD per 1,000 people per day, also increased, indicating that the overall amount of antipsychotic medicines supplied to people in this age group increased during the four-year period.

Potential reasons for this pattern include:

- An increase in the prevalence of mental health conditions in this age group
- An increase in the number of people in this age group seeking care
- Changes to guidelines and prescribing behaviours, affecting the type of antipsychotic medicine chosen and the dose dispensed (as doses for different indications will affect the DDD)
- Changes in access to psychosocial interventions, mental health services, or psychiatric and psychological services.

To explore this, further analysis could potentially focus on:

- Types of antipsychotics, reasons for prescribing and doses being prescribed
- Dispensing rates based on practitioner type, to determine whether there is variation in prescribing between primary care and specialist care providers (currently under analysis by the Australian Commission on Safety and Quality in Health Care – the Commission).

Is there more to be done?

Dispensing rates and the volume of antipsychotic medicines in the community on any given day in people aged 17 years and under continued to increase during the four years from 2013–14. It is unclear whether this reflects increased incidence of mental health conditions and diagnosis, improved access to medicines, or increased inappropriate use. Although the magnitude of variation in dispensing rates fell from 2013–14, it was still high in 2016–17. Further investigation is required to identify whether these patterns are unwarranted, and what ongoing vigilance is needed to promote safe and appropriate use of these medicines.

The Commission will publish a further analysis of these data in 2019, including analyses by state and territory, and local area; and an analysis by practitioner type. This information will help to identify what further targeted interventions are needed to improve the management of mental illness, and that of behavioural disturbances in autism spectrum disorder.

Antipsychotic medicines dispensing, 17 years and under

References

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5.4 Antipsychotic medicines dispensing, 18–64 years

Context

This section examines antipsychotic medicines dispensing for people aged 18–64 years between 2013–14 and 2016–17.

Antipsychotic medicines are used to manage psychotic disorders such as schizophrenia, and the psychotic symptoms of mood disorders. In adults, antipsychotic medicines are commonly used to reduce or sometimes eliminate the distressing and disabling symptoms of psychosis, such as paranoia, confused thinking, delusions and hallucinations.

Effective treatment of schizophrenia and related disorders usually includes ongoing clinical support in the community and psychological therapy, including education about symptoms and how to manage them, psychosocial rehabilitation, assistance with accommodation and employment, and educational support. Antipsychotic medicines are considered to be just one component of treating mental health conditions and rarely considered sufficient when used on their own.[1]

The rate of antipsychotic medicines dispensing per 100,000 people aged 18–64 years was mapped in the first *Australian Atlas of Healthcare Variation*, published in November 2015. The first Atlas reported that, in 2013–14, just over 2.5 million Pharmaceutical Benefits Scheme (PBS) prescriptions for antipsychotic medicines were dispensed in Australia to people aged 18–64 years. Dispensing rates were lower than for people aged 65 years and over. Rates were similar in major cities and regional areas, but higher rates were observed in areas with socioeconomic disadvantage. Dispensing rates were lower in remote communities, which was partly attributed to medicines dispensed by remote-area Aboriginal health services not being captured in the PBS database.[1]

Antipsychotic medicines dispensing, 18–64 years

Why is it important to monitor antipsychotic medicines use nationally?

Improving use of antipsychotic medicines in this age group is of national importance because of the wide variation in use across Australia. Of particular concern is that these medicines are being inappropriately prescribed to manage sleep disorders, which is outside their approved indication for use.[1-3]

What initiatives have taken place since 2015?

Since 2015, initiatives to improve use of antipsychotic medicines in people aged 18–64 years have been undertaken as part of a wider strategy to improve the management of mental health conditions in Australia. The National Mental Health Commission, which was established in 2012, continues to provide advice on ways to improve Australia's mental health and acts as a catalyst for change.[4] In 2016, the Australian Bureau of Statistics published *Patterns of Use of Mental Health Services and Prescription Medications, 2011*.[5] Regulatory changes have also been made to the number of repeat supplies that can be ordered on prescriptions for low-dose quetiapine.

About the data

Data are sourced from the PBS dataset. This dataset includes all prescriptions dispensed under the PBS or the Repatriation Pharmaceutical Benefits Scheme, including prescriptions that do not receive an Australian Government subsidy. Note that some dispensed medicines may not be consumed by the patient.

The dataset does not include prescriptions dispensed for patients during their hospitalisation in public hospitals, discharge prescriptions dispensed from public hospitals in New South Wales and the Australian Capital Territory, direct supply of medicines to remote Aboriginal health services, over-the-counter purchase of medicines, doctor's bag medicines and private prescriptions.

The PBS data do not include prescriptions for clozapine dispensed by public hospitals and claimed through offline arrangements up to 2014–15. The Technical Supplement has further details about clozapine prescriptions.

This analysis was not undertaken by Aboriginal and Torres Strait Islander status because this information was not available for PBS data at the time of publication.

Changes have been made to the data specification used in the first Atlas to improve the robustness of comparing rates over time. The main change is the addition of sex standardisation, as the data specification for the first Atlas standardised for age only. These changes have resulted in small differences in the rates reported for 2013–14 in the first Atlas and this Atlas. The rates reported in this Atlas should be used to monitor changes over time.

What do the data show?

Magnitude of variation*

In 2016–17, the rate of dispensing of antipsychotic medicine prescriptions in people aged 18–64 years was **14.1 times as high** in the area (Statistical Area Level 3 – SA3) with the highest rate as in the SA3 with the lowest rate. The magnitude of variation **decreased** from 2013–14, when there was an 18.5-fold difference between the highest and lowest rates (Figure 5.13).

Rate of prescriptions dispensed

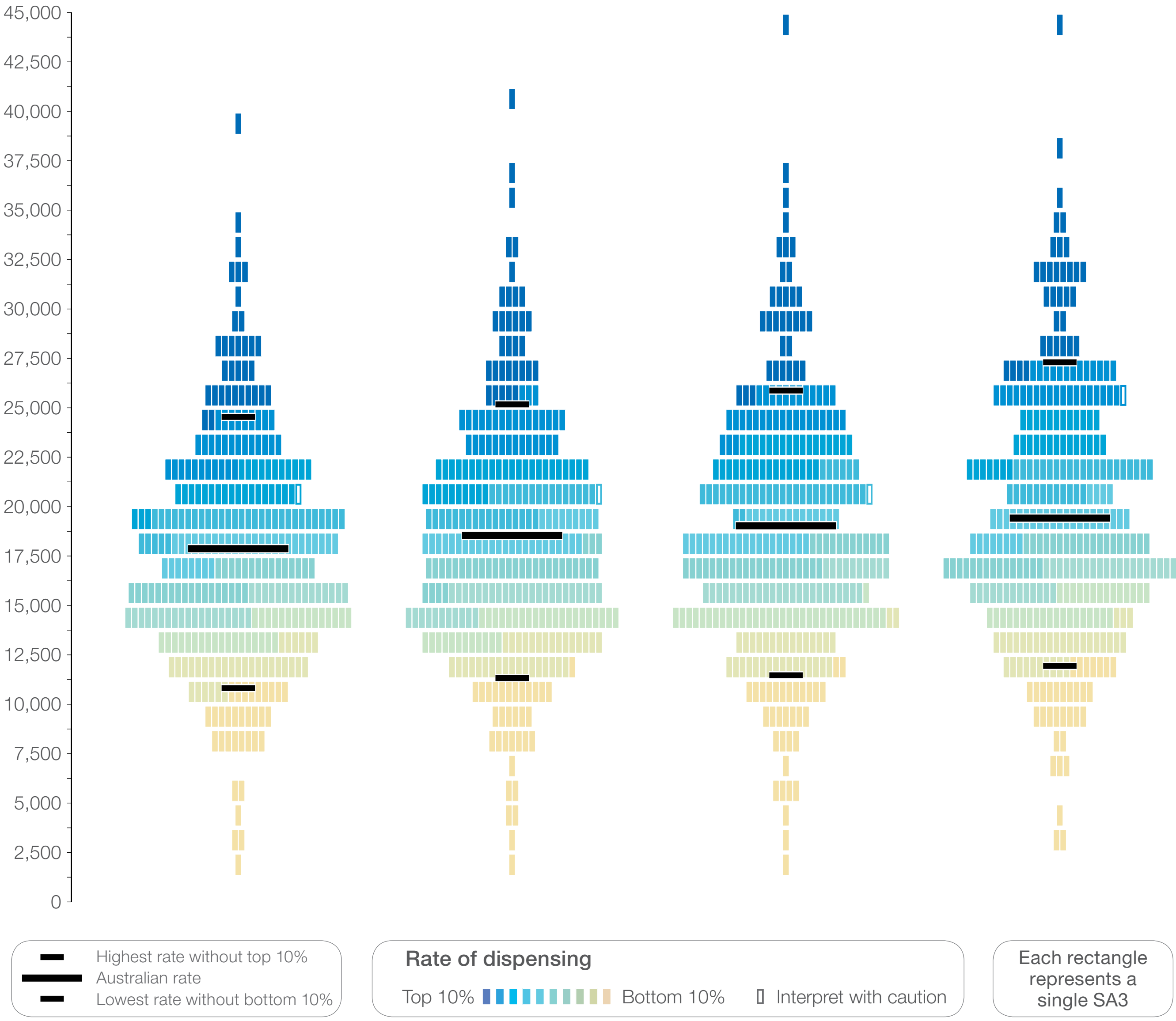
In 2016–17, there were 2,908,555 PBS prescriptions dispensed for antipsychotic medicines to people aged 18–64 years, representing an Australian rate of **19,420** prescriptions dispensed per 100,000 people aged 18–64 years. The Australian rate **increased** during the four years from 2013–14, when 17,873 prescriptions per 100,000 people were dispensed (Figure 5.13).

* Some of the published SA3 rates were considered more volatile than others. These rates are excluded from the calculation of the difference between the highest and lowest SA3 rates in Australia.

Rates across years

Figure 5.13: Number of PBS prescriptions dispensed for antipsychotic medicines per 100,000 people aged 18–64 years, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2013–14 to 2016–17

	2013–14	2014–15	2015–16	2016–17
Highest rate	39,283	41,104	43,795	44,085
Australian rate	**17,873**	**18,544**	**19,032**	**19,420**
Lowest rate	2,126	2,006	2,297	3,124
Magnitude of variation	18.5	20.5	19.1	14.1
Magnitude of variation without top & bottom 10%	2.3	2.2	2.3	2.3



Notes:
Hollow rectangles (▯) indicate rates that are considered more volatile than other published rates and should be interpreted with caution. These rates are excluded from the calculation of the difference between the highest and lowest SA3 rates in Australia.
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of Pharmaceutical Benefits Scheme data and ABS Estimated Resident Population 30 June 2013 to 2016.

Antipsychotic medicines dispensing, 18–64 years

People dispensed at least one prescription

In 2016–17, there were **2,074** people per 100,000 people aged 18–64 years nationally who had at least one prescription dispensed for an antipsychotic medicine. The number of people who had at least one prescription dispensed in a year **increased** during the four years from 2013–14, when 1,975 people per 100,000 people nationally had at least one antipsychotic medicine prescription dispensed (Table 5.14).

Table 5.14: Number of people dispensed at least one PBS prescription for an antipsychotic medicine per 100,000 people aged 18–64 years, age and sex standardised, 2013–14 to 2016–17

	2013–14	2014–15	2015–16	2016–17
Australian rate	1,975	2,006	2,046	2,074

Estimated proportion of population treated daily with antipsychotic medicines

In 2016–17, there were 15.23 defined daily doses† (DDDs) of antipsychotic medicines per 1,000 people aged 18–64 years dispensed on any given day – this is equivalent to 1.5% of the population receiving an antipsychotic medicine each day in that year. The national DDD rate per 1,000 people per day **increased** during the four years from 2013–14, when it was 14.06 (Table 5.15).

Table 5.15: Number of defined daily doses of antipsychotic medicines dispensed per 1,000 people aged 18–64 years per day, age and sex standardised, 2013–14 to 2016–17

	2013–14	2014–15	2015–16	2016–17
Australian rate	14.06	14.71	15.02	15.23

† A defined daily dose (DDD) is a measure of medicines use that allows comparison between different therapeutic groups, and between countries. The DDD is based on the average dose per day of the medicine when used for its main indication by adults. Refer to the Technical Supplement for more information.

Interpretation

Between 2013–14 and 2016–17, the rate of antipsychotic medicines dispensed per 100,000 people aged 18–64 years increased by 9% in Australia during the four-year period. The magnitude of variation in dispensing rates decreased from 2013–14, but was still high in 2016–17. The rate of people dispensed at least one prescription increased. The volume of antipsychotic medicines used in the Australian community in this age group, as indicated by the DDD per 1,000 people per day, increased, indicating that the overall amount of antipsychotic medicines supplied to people in this age group increased during the four-year period.

Potential reasons for this pattern include:

- The prevalence of mental health conditions in this age group
- The number of people in this age group seeking care
- Use in conditions other than psychosis
- Prescribing indications and behaviours, affecting the type of antipsychotic medicine chosen and dose dispensed (as doses for different indications will affect the DDD)
- Access to psychosocial interventions, mental health services, or psychiatric and psychological services.

To explore this, further analysis could potentially focus on:

- Types of antipsychotic medicines, reasons for prescribing and doses being prescribed
- Dispensing rates based on practitioner type to determine whether there is variation in prescribing between primary care and specialist care providers (currently under analysis by the Australian Commission on Safety and Quality in Health Care – the Commission)
- Dispensing rates excluding low-dose quetiapine, given concerns about its non-approved use as a sedative.

Is there more to be done?

Dispensing rates and the volume of antipsychotic medicines in the community on any given day in people aged 18–64 years continued to increase during the four years from 2013–14. It is unclear whether this reflects increased incidence of mental health conditions and diagnosis, improved access to medicines, or increased inappropriate use. Although variation in the magnitude of dispensing of antipsychotic medicines has fallen since 2013–14, it is still high. Further investigation is required to identify whether these patterns are unwarranted, and what ongoing vigilance is needed to promote safe and appropriate use of these medicines.

The Commission will publish a further analysis of these data in 2019, including analyses by state and territory, and local area; and an analysis by practitioner type. This information will help to identify what further targeted interventions are needed to improve the use of antipsychotic medicines.

Antipsychotic medicines dispensing, 18–64 years

References

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5.5 Antipsychotic medicines dispensing, 65 years and over

Context

This section examines antipsychotic medicines dispensing for people aged 65 years and over between 2013–14 and 2016–17.

Antipsychotic medicines are used to manage psychotic disorders such as schizophrenia, and the psychotic symptoms of mood disorders. Antipsychotic medicines are commonly used to reduce or sometimes eliminate the distressing and disabling symptoms of psychosis, such as paranoia, confused thinking, delusions and hallucinations. In older adults, antipsychotic medicines are also used where non-pharmacological approaches have failed to manage behavioural and psychological symptoms of dementia (BPSD).

Effective treatment of psychosis and related disorders includes ongoing clinical support in the community and psychological therapy, including education about symptoms and how to manage them, psychosocial rehabilitation, assistance with accommodation and employment, and educational support. Antipsychotic medicines are considered to be just one component of treating mental health conditions and rarely considered sufficient when used on their own.[1]

Although antipsychotic medicines may be appropriate for adults with severe mental health issues or long-term mental illness, there is concern that these medicines are being prescribed inappropriately in people aged 65 years and over for their sedative effects – that is, as a form of chemical restraint for people with psychological and behavioural symptoms of dementia or delirium.[1,2]

The rate of antipsychotic medicines dispensing per 100,000 people aged 65 years and over was mapped in the first *Australian Atlas of Healthcare Variation*, published in November 2015.[1] The first Atlas reported that, in 2013–14, nearly 1 million Pharmaceutical Benefits Scheme (PBS) prescriptions for antipsychotic medicines were dispensed in Australia to people aged 65 years and over. Dispensing rates were higher than for people aged 18–64 years. Rates were higher in major cities than in regional and remote areas, and there was a weak pattern of higher rates in areas with socioeconomic disadvantage. Lower rates of dispensing of antipsychotic medicines in remote communities were partly attributed to medicines dispensed by remote-area Aboriginal health services not being captured in the PBS database.[1]

Antipsychotic medicines dispensing, 65 years and over

Why is it important to monitor antipsychotic medicines use nationally?

Improving use of antipsychotic medicines in this age group is of national importance because of concerns about overuse to manage BPSD, and variation in use of these medicines across Australia. Of particular concern is that these medicines are being prescribed to manage behavioural disturbances related to dementia or delirium before secondary causes have been excluded or non-pharmacological treatment has been tried, which is outside current guideline recommendations.[1-5] People with behavioural disturbances related to dementia or delirium should be treated in the first instance with approaches that do not include antipsychotic medicines. Antipsychotic medicines offer only a modest benefit and are associated with harms such as confusion, falls, pneumonia, hip fracture and stroke.[6-8] For people with severe symptoms – for example, if a person is severely distressed or is a significant risk of harm to themselves or others – antipsychotic medicines may be indicated alongside ongoing non-pharmacological management.[2,5]

What initiatives have taken place since 2015?

Concerns about the misuse of antipsychotic medicines in people aged 65 years and over have prompted a number of national responses during the past three years. These have included:

- The Caring for Cognitive Impairment campaign by the Australian Commission on Safety and Quality in Health Care (the Commission) – see the infographic at Figure 5.19, page 275. The campaign builds on initiatives to increase awareness of cognitive impairment as a safety and quality issue, including the use of antipsychotic medicines.[9] Actions have included
  - release of the Delirium Clinical Care Standard, which emphasises the importance of minimising use of antipsychotic medicines for behavioural disturbances related to delirium[10]
  - incorporation of actions relating to managing cognitive impairment and minimising use of antipsychotic medicines into the National Safety and Quality Health Service Standards (second edition)[11]
- Two roundtable meetings with key experts convened by the Commission, to specifically discuss ways to reduce inappropriate use of antipsychotic medicines in this age group; the meetings identified the need for a range of multi-component strategies, and system and regulatory levers to address the issue[2]
- Regulatory changes by the Therapeutic Goods Administration, limiting the indication for risperidone use to BPSD of the Alzheimer's type only, and limiting the duration of therapy to a maximum of 12 weeks[2]
- The Veterans' MATES program, funded by the Australian Government Department of Veterans' Affairs, to reduce the use of antipsychotic medicines for treating BPSD[2,12]

- Updated guidelines from the Royal Australian and New Zealand College of Psychiatrists on use of antipsychotic medicines for treatment of BPSD[5,13]
- NPS MedicineWise and Alzheimer's Australia consumer awareness campaign about medicines and dementia[14]
- Training programs from Dementia Training Australia for staff working in aged care homes about optimising use of antipsychotic medicines in people with dementia[15]
- The Empowered Project, funded by the Australian Government Dementia and Aged Care Services Fund, to empower people living with dementia and their carers to be informed decision-makers about the care and treatment (including any medicines) they receive for their condition[16]
- The RedUSe project (Reducing Use of Sedatives in residential aged care facilities), a prospective, longitudinal program across 150 Australian aged care homes to improve prescribing and use of antipsychotic medicines and benzodiazepines in residents of aged care homes[17,18]
- Inclusion of advice about appropriate use of antipsychotic medicines in Evolve[19] and Choosing Wisely Australia campaigns[20]
- Development of the new Aged Care Quality Standards; assessment and monitoring against these standards will commence from 1 July 2019[21]
- Review of National Aged Care Quality Regulatory Processes and the proposal to establish an Aged Care Quality and Safety Commission.[22]

About the data

Data are sourced from the PBS dataset. This dataset includes all prescriptions dispensed under the PBS or the Repatriation Pharmaceutical Benefits Scheme, including prescriptions that do not receive an Australian Government subsidy. Note that some dispensed medicines may not be consumed by the patient.

The dataset do not include prescriptions dispensed for patients during their hospitalisation in public hospitals, discharge prescriptions dispensed from public hospitals in New South Wales and the Australian Capital Territory, direct supply of medicines to remote Aboriginal health services, over-the-counter purchase of medicines, doctor's bag medicines and private prescriptions.

The PBS data do not include prescriptions for clozapine dispensed by public hospitals and claimed through offline arrangements up to 2014–15. The Technical Supplement has further details about clozapine prescriptions.

This analysis was not undertaken by Aboriginal and Torres Strait Islander status because this information was not available for PBS data at the time of publication.

Changes have been made to the data specification used in the first Atlas to improve the robustness of comparing rates over time. The main change is the addition of sex standardisation, as the data specification for the first Atlas standardised for age only. These changes have resulted in small differences in the rates reported for 2013–14 in the first Atlas and this Atlas. The rates reported in this Atlas should be used to monitor changes over time.

Antipsychotic medicines dispensing, 65 years and over

What do the data show?

Magnitude of variation*

In 2016–17, the rate of dispensing of antipsychotic medicine prescriptions in people aged 65 years and over was **13.2 times as high** in the area (Statistical Area Level 3 – SA3) with the highest rate as in the SA3 with the lowest rate. The magnitude of variation **increased** from 2013–14, when there was a 7.9-fold difference between the highest and lowest rates (Figure 5.18).

Rate of prescriptions dispensed

In 2016–17, there were 947,941 PBS prescriptions dispensed for antipsychotic medicines to people aged 65 years and over, representing an Australian rate of **25,788** prescriptions dispensed per 100,000 people aged 65 years and over. The Australian rate **decreased** during the four years from 2013–14, when 27,396 prescriptions per 100,000 people were dispensed (Figure 5.18).

People dispensed at least one prescription

In 2016–17, there were **3,594** people per 100,000 people aged 65 years and over nationally who had at least one prescription dispensed for an antipsychotic medicine. The number of people who had at least one prescription dispensed in a year **decreased** during the four years from 2013–14, when 3,738 people per 100,000 nationally had at least one antipsychotic medicine prescription dispensed (Table 5.16).

Table 5.16: Number of people dispensed at least one PBS prescription for an antipsychotic medicine per 100,000 people aged 65 years and over, age and sex standardised, 2013–14 to 2016–17

	2013–14	2014–15	2015–16	2016–17
Australian rate	3,738	3,713	3,652	3,594

Volume of antipsychotic medicines use in people aged 65 years and over

In 2016–17, there were 11.54 defined daily doses† (DDDs) of antipsychotic medicines per 1,000 people aged 65 years and over dispensed on any given day. The national DDD rate per 1,000 people per day was **stable** from 2013–14 to 2016–17 (Table 5.17).

Table 5.17: Number of defined daily doses of antipsychotic medicines dispensed per 1,000 people aged 65 years and over per day, age and sex standardised, 2013–14 to 2016–17

	2013–14	2014–15	2015–16	2016–17
Australian rate	11.48	11.55	11.56	11.54

Interpretation

Between 2013–14 and 2016–17, the rate of antipsychotic medicine prescriptions dispensed per 100,000 people aged 65 years and over decreased by 6% in Australia during the four year period, and the rate of people dispensed at least one prescription also decreased. The volume of antipsychotic medicines used in the community in this age group, as indicated by the DDD per 1,000 people per day, remained relatively stable, indicating that there was little change in the overall amount of antipsychotic medicines supplied to people in this age group during the four-year period. The magnitude of variation in dispensing rates also increased from 2013–14, which might indicate changes in medicine use in some areas but not in others.

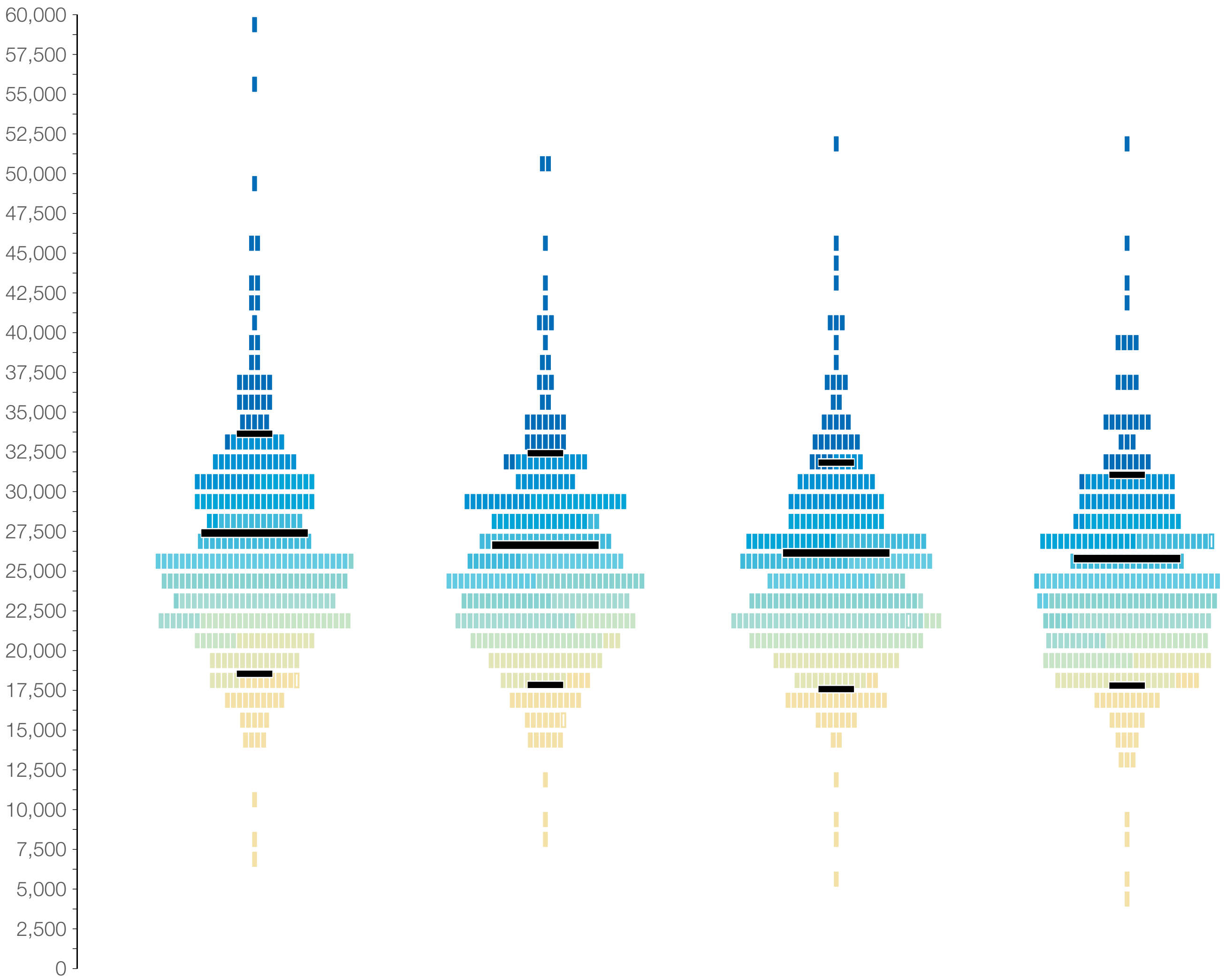
* Some of the published SA3 rates were considered more volatile than others. These rates are excluded from the calculation of the difference between the highest and lowest SA3 rates in Australia.

† A defined daily dose (DDD) is a measure of medicines use that allows comparison between different therapeutic groups, and between countries. The DDD is based on the average dose per day of the medicine when used for its main indication by adults. Refer to the Technical Supplement for more information.

Rates across years

Figure 5.18: Number of PBS prescriptions dispensed for antipsychotic medicines per 100,000 people aged 65 years and over, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2013–14 to 2016–17

	2013–14	2014–15	2015–16	2016–17
Highest rate	59,076	50,350	51,608	52,257
Australian rate	**27,396**	**26,636**	**26,145**	**25,788**
Lowest rate	7,446	8,654	5,635	3,969
Magnitude of variation	7.9	5.8	9.2	13.2
Magnitude of variation without top & bottom 10%	1.8	1.8	1.8	1.7



Highest rate without top 10%
Australian rate
Lowest rate without bottom 10%

Rate of dispensing
Top 10% Bottom 10% Interpret with caution

Each rectangle represents a single SA3

Notes:
Hollow rectangles (▯) indicate rates that are considered more volatile than other published rates and should be interpreted with caution. These rates are excluded from the calculation of the difference between the highest and lowest SA3 rates in Australia.
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of Pharmaceutical Benefits Scheme data and ABS Estimated Resident Population 30 June 2013 to 2016.

Antipsychotic medicines dispensing, 65 years and over

Potential reasons for this pattern include:

- Changes in guidelines and prescribing behaviours, affecting the type of antipsychotic medicine chosen and the dose dispensed (as different doses for different indications will affect the DDD)
- People in this age group using these treatments for longer durations.

To explore this, further analysis could potentially focus on:

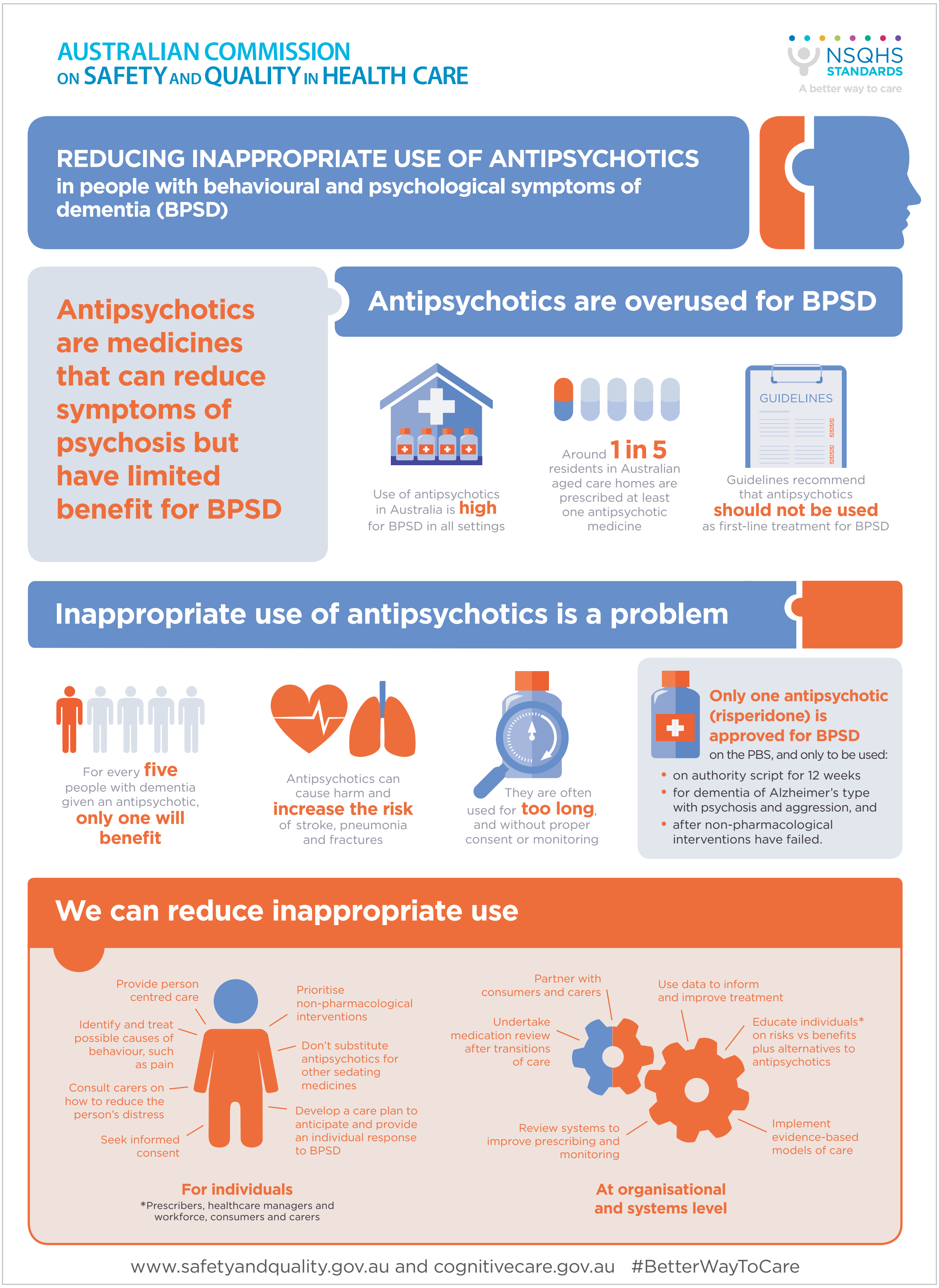
- Types of antipsychotic medicines, reasons for prescribing (for example, behavioural disturbances in older people) and doses being prescribed
- Possible substitution with other sedating medicines
- Quantities of antipsychotic medicines being dispensed on authority prescriptions
- The relationship between dispensing rates and location of aged care facilities.

Is there more to be done?

Although the rate of prescriptions dispensed for antipsychotic medicines for people aged 65 years and over fell in Australia during the four years from 2013–14, the findings suggest that a continued focus on improving use in older people is warranted. The magnitude of variation in dispensing rates of antipsychotic medicines between areas increased from 2013–14, and there was no major change in the overall volume of antipsychotic medicines supplied on any given day in the Australian community to people in this age group. Improved data on the reasons antipsychotic medicines are prescribed are essential for identifying whether prescribing is appropriate. This will help to identify whether further targeted strategies and regulatory changes are needed to discourage the use of antipsychotic medicines as a restrictive practice, and encourage non-pharmacological management of behavioural and psychological symptoms of dementia and delirium.

The Commission will publish a further analysis of these data in 2019, including analyses by state and territory, and local area; and an analysis by practitioner type. This information will help to identify what further targeted interventions are needed to promote the safe and appropriate use of these medicines.

Figure 5.19: Infographic from the Caring for Cognitive Impairment Campaign



Antipsychotic medicines dispensing, 65 years and over

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5.6 ADHD medicines dispensing, 17 years and under

Context

This section examines dispensing rates of medicines for attention deficit hyperactivity disorder (ADHD) for children and adolescents aged 17 years and under between 2013–14 and 2016–17.

It is estimated that ADHD affects about 7% of Australian children.[1] Children with ADHD often experience changes in behaviour, concentration and attention, and have problems with inattention, impulsivity or overactivity. The condition is also associated with higher rates of accidents and injuries, learning difficulties, drug and alcohol abuse, and family conflict.[2,3]

A comprehensive assessment involving the child or adolescent and their family and teachers is important in developing an individualised management plan that addresses the specific needs of the child or adolescent in managing ADHD.[2,4]

Management of ADHD can include a range of interventions, either alone or in combination. Interventions are commonly psychological, pharmacological or educational in nature. Milder forms of ADHD can be treated with non-pharmacological interventions, and medicines should not be used as first-line treatment in children of preschool age. Medicines should only be used when symptoms significantly impair academic, social or behavioural functions.[2,5]

The rate of ADHD medicines dispensing per 100,000 people aged 17 years and under was mapped in the first *Australian Atlas of Healthcare Variation*, published in November 2015.[2] The first Atlas reported that, in 2013–14, just over 500,000 Pharmaceutical Benefits Scheme (PBS) prescriptions for ADHD medicines were dispensed in Australia to people aged 17 years and under. Variation in use was marked, with a 75-fold difference in rates of dispensing between local areas. Rates were higher in inner and outer regional areas than in major cities, and lower again in remote communities. Dispensing rates were also higher in areas with socioeconomic disadvantage. Lower dispensing rates of ADHD medicines in remote communities were attributed to medicines dispensed by remote-area Aboriginal health services not being captured in the PBS database.[2]

ADHD medicines dispensing, 17 years and under

Why is it important to monitor ADHD medicines use nationally?

Improving the use of ADHD medicines is of national importance because of the wide variation in use, and uncertainties about appropriate use.[2] Although ADHD medicines can be very effective in reducing symptoms of ADHD, not all children experience benefit. Some children may experience uncomfortable or harmful side effects. It is therefore essential that these medicines are prescribed appropriately to ensure that the benefits outweigh the risks.

What initiatives have taken place since 2015?

Since 2015, initiatives to improve use of ADHD medicines in this age group have been undertaken as part of a wider strategy to improve the management of mental health conditions in Australia. The National Mental Health Commission, which was established in 2012, continues to provide advice on ways to improve Australia's mental health and acts as a catalyst for change.[6] In 2016, the Australian Bureau of Statistics published *Patterns of Use of Mental Health Services and Prescription Medications, 2011*.[7] In 2016, the Australian ADHD Professionals Association was formed to specifically promote evidence-based research, diagnosis and management of ADHD across Australia.[8]

About the data

Data are sourced from the PBS dataset. This dataset includes all prescriptions dispensed under the PBS or Repatriation Pharmaceutical Benefits Scheme, including prescriptions that do not receive an Australian Government subsidy. Note that some dispensed medicines may not be consumed by the patient.

The dataset does not include prescriptions dispensed for patients during their hospitalisation in public hospitals, discharge prescriptions dispensed from public hospitals in New South Wales and the Australian Capital Territory, direct supply of medicines to remote Aboriginal health services, over-the-counter purchase of medicines, doctor's bag medicines and private prescriptions.

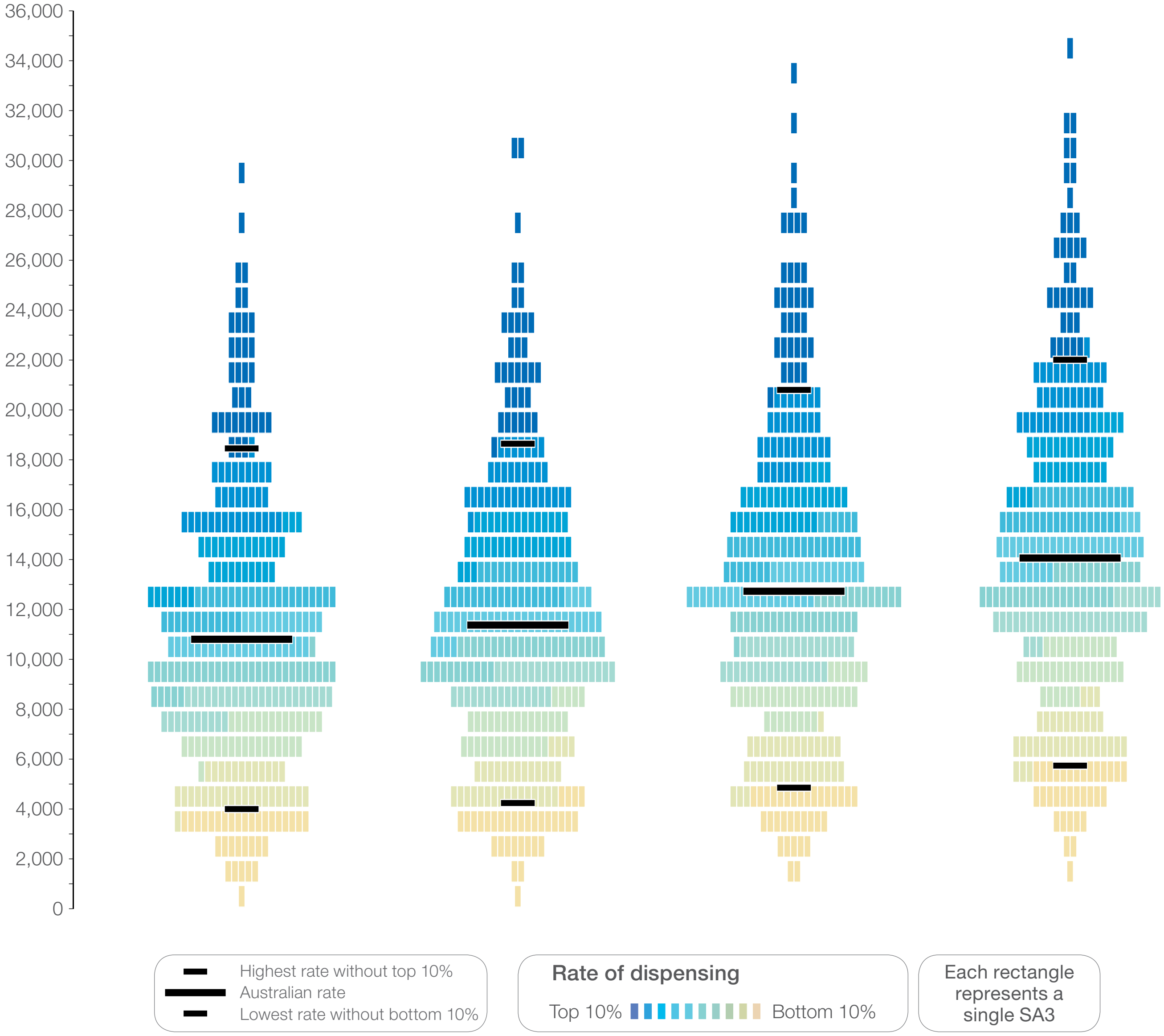
This analysis was not undertaken by Aboriginal and Torres Strait Islander status because this information was not available for PBS data at the time of publication.

Changes have been made to the data specification used in the first Atlas to improve the robustness of comparing rates over time. The main change is the addition of sex standardisation, as the data specification for the first Atlas standardised for age only. These changes have resulted in small differences in the rates reported for 2013–14 in the first Atlas and this Atlas. The rates reported in this Atlas should be used to monitor changes over time.

Rates across years

Figure 5.20: Number of PBS prescriptions dispensed for ADHD medicines per 100,000 people aged 17 years and under, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2013–14 to 2016–17

	2013–14	2014–15	2015–16	2016–17
Highest rate	29,817	30,839	33,712	34,465
Australian rate	**10,805**	**11,373**	**12,730**	**14,061**
Lowest rate	401	768	1,226	1,981
Magnitude of variation	74.4	40.2	27.5	17.4
Magnitude of variation without top & bottom 10%	4.6	4.4	4.3	3.8



Notes:
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of Pharmaceutical Benefits Scheme data and ABS Estimated Resident Population 30 June 2013 to 2016.

ADHD medicines dispensing, 17 years and under

What do the data show?

Magnitude of variation

In 2016–17, the rate of dispensing of ADHD medicine prescriptions in people aged 17 years and under was **17.4 times as high** in the area (Statistical Area Level 3 – SA3) with the highest rate as in the SA3 with the lowest rate. The magnitude of variation **decreased** from 2013–14, when there was a 74.4-fold difference between the highest and lowest rates (Figure 5.20).

Rate of prescriptions dispensed

In 2016–17, there were 737,037 PBS prescriptions dispensed for ADHD medicines to people aged 17 years and under, representing an Australian rate of **14,061** prescriptions dispensed per 100,000 people aged 17 years and under. The Australian rate **increased** during the four years from 2013–14, when 10,805 prescriptions per 100,000 people aged 17 years and under were dispensed (Figure 5.20).

People dispensed at least one prescription

In 2016–17, there were **1,940** people per 100,000 people aged 17 years and under nationally who had at least one ADHD medicine prescription dispensed. The number of people who had at least one prescription dispensed in a year **increased** during the four years from 2013–14, when 1,540 people aged 17 years and under nationally had at least one ADHD medicine prescription dispensed (Table 5.21).

Table 5.21: Number of people dispensed at least one prescription for an ADHD medicine per 100,000 people aged 17 years and under, age and sex standardised, 2013–14 to 2016–17

	2013–14	2014–15	2015–16	2016–17
Australian rate	1,540	1,620	1,784	1,940

Volume of ADHD medicines used in people aged 17 years and under

In 2016–17, there were 13.75 defined daily doses* (DDDs) of ADHD medicines per 1,000 people aged 17 years and under dispensed on any given day. The national DDD rate per 1,000 people per day **increased** during the four years from 2013–14, when it was 10.52 (Table 5.22).

Table 5.22: Number of defined daily doses of ADHD medicines dispensed per 1,000 people aged 17 years and under per day, age and sex standardised, 2013–14 to 2016–17

	2013–14	2014–15	2015–16	2016–17
Australian rate	10.52	11.03	12.35	13.75

Interpretation

Between 2013–14 and 2016–17, the rate of ADHD medicines dispensed per 100,000 people aged 17 years and under increased by 30% in Australia during the four-year period. The rate of people dispensed at least one prescription also increased during the four years from 2013–14. The volume of ADHD medicines used in the Australian community in this age group, as indicated by the rate of DDD per 1,000 people per day, increased, indicating that the overall amount of ADHD medicines supplied increased during the four-year period. Although the magnitude of variation in dispensing rates fell substantially, this might indicate changes in medicine use in some areas but not others.

* A defined daily dose (DDD) is a measure of medicines use that allows comparison between different therapeutic groups, and between countries. The DDD is based on the average dose per day of the medicine when used for its main indication by adults. Refer to the Technical Supplement for more information.

Potential reasons for this pattern include:

- Changes in prevalence of mental health conditions in this age group
- Changes in the number of people seeking care in this age group
- Changes in access to psychosocial services, mental health services, or psychiatric and psychological services
- People in this age group using these treatments for longer durations.

To explore this, further analysis could potentially focus on:

- Dispensing rates based on practitioner type, to determine whether there is variation in prescribing between primary care and specialist care providers (currently under analysis by the Australian Commission on Safety and Quality in Health Care – the Commission)
- Dispensing rates by state and territory, and local area, to determine whether there has been a change in prescribing in some areas and not others
- Whether dispensing rates differ between age groups – for example, pre- and post-puberty
- The relationship between dispensing rates and the location of youth correction centres.

Is there more to be done?

Dispensing rates and the volume of ADHD medicines in the community continued to increase during the four years from 2013–14. It is unclear whether this reflects increased incidence of ADHD and diagnosis, improved access to medicines and specialised services, differences in models of care, or increased inappropriate use. Although the magnitude of variation in dispensing rates fell substantially over the four-year period, it is still high. Further investigation is required to identify whether these patterns are unwarranted, and what ongoing vigilance is needed to promote safe and appropriate use of these medicines.

The Commission will publish a further analysis of these data in 2019, including analyses by state and territory, and local area; and an analysis by practitioner type. This information will help better understand whether targeted interventions are needed to promote the safe and appropriate use of these medicines.

ADHD medicines dispensing, 17 years and under

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5.7 Opioid medicines dispensing, all ages

Context

This section examines opioid medicines dispensing in Australia between 2013–14 and 2016–17.

Opioid medicines are effective for managing acute pain, cancer pain, pain in a palliative care setting and opioid dependency. Growing evidence indicates that opioids are being used outside these indications, leading to potentially avoidable adverse events and harm. Of concern, opioids are being used beyond the acute pain period for chronic non-cancer pain, despite a lack of evidence of benefits, with increased risk of harm.[1]

The transition from acute pain to chronic non-cancer pain includes a change in management strategies away from opioids and towards a multimodal approach of non-pharmacological and pharmacological therapy, supported by a general practitioner (GP) and multidisciplinary allied health teams. In most cases, discontinuing opioids beyond the acute pain period is not associated with an increase in pain intensity and therefore should not be viewed as withholding effective treatment.[2]

Assessment and management of chronic non-cancer pain require a cautious and comprehensive multidimensional approach, combining strategies to reduce pain and its impact, specifically addressing psychosocial factors that often contribute to the patient's pain.[3,4] Currently, opioids have a limited role in the evidence-based management of chronic non-cancer pain other than as part of a multimodal approach. Evidence suggests that modest clinical benefit from opioid use declines over time and can be outweighed by harms. Pharmacological therapy should be considered for patients not responding to non-pharmacological therapy. If opioid therapy is to be considered despite a lack of evidence in a chronic non-cancer pain setting, a trial-based approach of short duration is recommended, with clearly defined management goals and frequent monitoring of patients to determine benefit.[3,4]

Opioid medicines dispensing, all ages

The rate of opioid medicines dispensing per 100,000 people in all age groups was mapped in the first *Australian Atlas of Healthcare Variation*, published in November 2015.[4] The first Atlas reported that, in 2013–14, almost 14 million Pharmaceutical Benefits Scheme (PBS) prescriptions for opioid medicines were dispensed in Australia. Dispensing rates tended to be higher in inner and outer regional areas than in major cities, and tended to be higher in areas with socioeconomic disadvantage.[4]

It is important to note that data captured in the PBS and reported in the first *Australian Atlas of Healthcare Variation* underestimate total opioid dispensing. This is because the data do not capture sales of over-the-counter medicines (from pharmacies) containing low-dose codeine in combination with simple analgesics, nor opioids dispensed on private prescriptions. Since 1 February 2018, medicines in Australia that contain low-dose codeine can only be obtained on a prescription, but are not captured in PBS data because they are private prescriptions (not included on the PBS).

Why is it important to monitor opioid use nationally?

Improving opioid medicines use is of national importance because of concerns about increases in inappropriate prescribing and misuse, overdose and opioid dependence.[5,6] High doses of opioids (more than 100 mg of oral morphine or equivalent per day) are associated with an increased risk of harm.[1,4] Between 2001 and 2014, opioids were the second most common medicine contributing to all adverse drug reaction–related hospital admissions in New South Wales.[7] In addition, there is a lack of quality evidence for the effectiveness of chronic dosing of opioid medicines to improve chronic non-cancer pain.[3,8] Guidelines used in primary care settings recommend variable daily dose limits in oral morphine milligram equivalents.[9]

Opioid medicine deaths in Australia exceed heroin deaths by a significant margin. Between 2011 and 2015, twice as many people died from overdose associated with an opioid medicine as from an overdose of heroin (2,145 compared with 985).[6,10] Over the same period, deaths due to opioid overdose (including pharmaceutical opioids and heroin) increased by 1.6-fold compared with 2001–2005.[10]

What initiatives have taken place since 2015?

Concerns about inappropriate prescribing and misuse of opioids have prompted a number of national responses in Australia during the past three years to support harm minimisation. The first *Australian Atlas of Healthcare Variation*, published in November 2015, made five recommendations to support improved prescribing and use of opioid medicines. In response, state and territory departments of health and Primary Health Networks have collaborated to provide access to pain and addiction medicine referral pathways for GPs managing patients with chronic non-cancer pain and/or substance abuse disorder. Implementation of real-time prescription monitoring is also under way in various states and territories. Other national responses that have been implemented or proposed include:

- Updated recommendations from the Faculty of Pain Medicine, Australian and New Zealand College of Anaesthetists, on the use of opioid medicines in chronic non-cancer pain[11]
- Guidelines published by the Royal Australian College of General Practitioners to improve the prescribing of opioid medicines for acute and chronic non-cancer pain[9]
- The Faculty of Pain Medicine position statement on the use of slow-release opioids[12]
- The NPS MedicineWise Chronic Pain educational visiting program[13], and the Faculty of Pain Medicine Better Pain Management program[14]
- The Therapeutic Goods Administration public consultation on a regulatory response to the use of strong opioids[6]

- Restrictions to the availability of low-dose codeine products in combination with simple analgesics, so that these products are no longer available to patients over the counter at pharmacies[15]
- The Chronic Pain MedsCheck Trial, as part of the 6th Community Pharmacy Agreement[16]
- Letters from the Australian Government Department of Health to selected GPs prompting audit of their opioid prescribing practice to identify areas for quality improvement[17]
- Updated guidance from the Australian Pain Society regarding the management of pain in aged care homes.[18]

About the data

Data are sourced from the PBS dataset. This dataset includes all prescriptions dispensed under the PBS or the Repatriation Pharmaceutical Benefits Scheme, including prescriptions that do not receive an Australian Government subsidy. Note that some dispensed medicines may not be consumed by the patient.

The dataset does not include prescriptions dispensed for patients during their hospitalisation in public hospitals, discharge prescriptions dispensed from public hospitals in New South Wales and the Australian Capital Territory, direct supply of medicines to remote Aboriginal health services, over-the-counter purchase of medicines, doctor's bag medicines and private prescriptions.

The data do not include codeine-based pain medicines that were available over the counter and became Schedule 4 prescription medicines in February 2018.

This analysis was not undertaken by Aboriginal and Torres Strait Islander status because this information was not available for PBS data at the time of publication.

Changes have been made to the data specification used in the first Atlas to improve the robustness of comparing rates over time. The main change is the addition of sex standardisation, as the data specification for the first Atlas standardised for age only. These changes have resulted in small differences in the rates reported for 2013-14 in the first Atlas and in this Atlas. The rates reported in this Atlas should be used to monitor changes over time.

What do the data show?

Magnitude of variation*

In 2016–17, the rate of dispensing of opioid medicine prescriptions in people of all ages was **5.1 times as high** in the area (Statistical Area Level 3 – SA3) with the highest rate as in the SA3 with the lowest rate. The magnitude of variation **increased** from 2013–14, when there was a 4.8-fold difference between the highest and lowest rates (Figure 5.25).

Rate of prescriptions dispensed

In 2016–17, there were 15,419,793 PBS prescriptions dispensed for opioid medicines, representing an Australian rate of **58,595** prescriptions dispensed per 100,000 people of all ages. The Australian rate **increased** from 2013–14, when 55,900 prescriptions per 100,000 people were dispensed (Figure 5.25).

* Some of the published SA3 rates were considered more volatile than others. These rates are excluded from the calculation of the difference between the highest and lowest SA3 rates in Australia.

Opioid medicines dispensing, all ages

People dispensed at least one prescription

In 2016–17, there were 12,345 people per 100,000 people nationally who had at least one prescription dispensed for an opioid medicine. The number of people nationally who had at least one prescription dispensed in a year **increased** from 2013–14, when 12,102 people per 100,000 people nationally had at least one opioid medicine prescription dispensed (Table 5.23).

Table 5.23: Number of people dispensed at least one PBS prescription for an opioid medicine per 100,000 people of all ages, age and sex standardised, 2013–14 to 2016–17

	2013–14	2014–15	2015–16	2016–17
Australian rate	12,102	12,406	12,418	12,345

Estimated proportion of population treated daily with opioid medicines

In 2016–17, there were 15.39 defined daily doses† (DDDs) of opioid medicines per 1,000 people dispensed on any given day – this is equivalent to 1.5% of the population receiving an opioid medicine each day in that year. The national DDD rate per 1,000 people per day **fell** during the four years from 2013–14, when it was 16.39 (Table 5.24).

Table 5.24: Number of defined daily doses of opioid medicines dispensed per 1,000 people of all ages per day, age and sex standardised, 2013–14 to 2016–17

	2013–14	2014–15	2015–16	2016–17
Australian rate	16.39	16.32	15.81	15.39

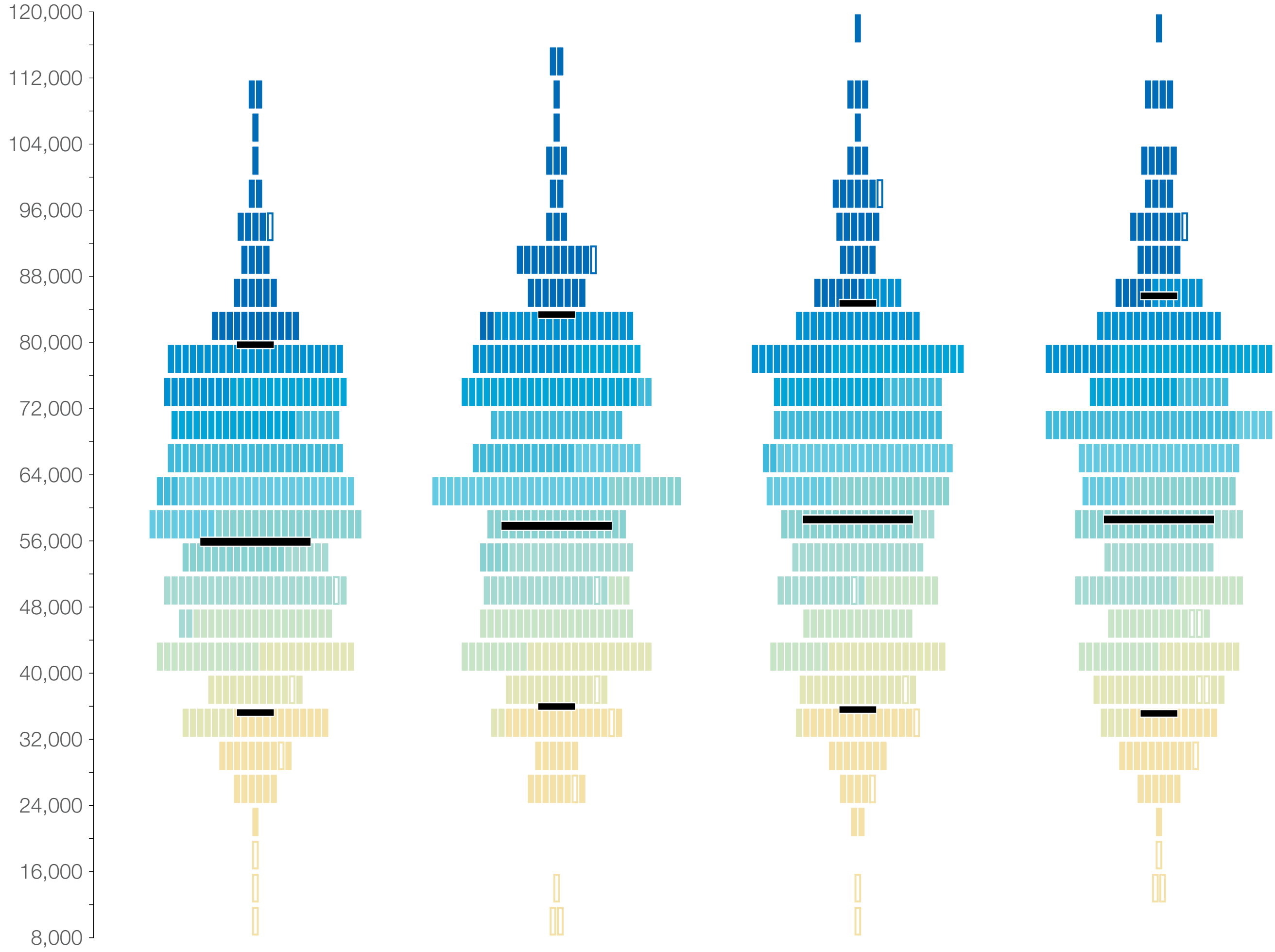
* Some of the published SA3 rates were considered more volatile than others. These rates are excluded from the calculation of the difference between the highest and lowest SA3 rates in Australia.

† A defined daily dose (DDD) is a measure of medicines use that allows comparison between different therapeutic groups, and between countries. The DDD is based on the average dose per day of the medicine when used for its main indication by adults. Refer to the Technical Supplement for more information.

Rates across years

Figure 5.25: Number of PBS prescriptions dispensed for opioid medicines per 100,000 people of all ages, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2013–14 to 2016–17

	2013–14	2014–15	2015–16	2016–17
Highest rate	110,415	113,682	117,780	116,303
Australian rate	**55,900**	**57,833**	**58,600**	**58,595**
Lowest rate	11,002*	11,296*	10,644*	13,172*
Magnitude of variation	4.8	4.7	5.0	5.1
Magnitude of variation without top & bottom 10%	2.3	2.3	2.4	2.4



Highest rate without top 10%
Australian rate
Lowest rate without bottom 10%

Rate of dispensing
Top 10% Bottom 10% Interpret with caution

Each rectangle represents a single SA3

Notes:
Hollow rectangles (▯) and asterisks (*) indicate rates that are considered more volatile than other published rates and should be interpreted with caution. These rates are excluded from the calculation of the difference between the highest and lowest SA3 rates in Australia.
For further detail about the methods used, please refer to the Technical Supplement.
Sources: AIHW analysis of Pharmaceutical Benefits Scheme data and ABS Estimated Resident Population 30 June 2013 to 2016.

Opioid medicines dispensing, all ages

Interpretation

Between 2013–14 and 2016–17, the rate of opioid medicines dispensed per 100,000 people nationally increased by 5%, during the four-year period, and the rate of people dispensed at least one prescription also increased. An increase in the magnitude of variation in dispensing rates also occurred. It is unclear whether this pattern indicates changes in medicines use in some states and territories or local areas and not others. However, the volume of opioids used in the Australian community, as indicated by the DDD per 1,000 people per day, declined slightly, indicating that the overall amount of opioid medicines supplied decreased slightly during the four-year period.

Potential reasons for this pattern include, but are not limited to changes in:

- The amount or type of surgery being performed, with associated opioid dispensing in a greater number of patients postoperatively
- The availability and accessibility of non-pharmacological treatment options
- Prescribing indications and behaviours affecting the reason for choosing an opioid, the type of opioid chosen and the dose dispensed.

To explore this, further analysis could potentially focus on:

- The amount or types of surgery being performed, and whether any increase coincides with the number of patients prescribed opioids postoperatively to manage their pain
- The use of multidisciplinary pain referral pathways or addiction medicine pathways for GPs managing patients with chronic non-cancer pain and/or substance abuse disorder
- Types of opioids, reasons for prescribing and doses being dispensed
- Quantities of opioid medicines being dispensed on authority prescriptions
- Dispensing rates based on practitioner type, to determine whether there is variation in prescribing between primary care and specialist care providers
- Weak and strong opioid use
- Use of services and other strategies to help patients self-manage their pain
- Use of other agents for chronic non-cancer pain, such as non-steroidal anti-inflammatory drugs (NSAIDs), gabapentinoids, clonidine and possibly medicinal cannabis.

Is there more to be done?

Although it is encouraging to see that the overall amount of opioid medicines supplied decreased slightly during the four years from 2013–14, dispensing rates continued to increase. It is unclear if these changes are due to changes in the number of people requiring opioids for appropriate uses, changes in doses used, or an increase in inappropriate prescribing. The magnitude of variation in dispensing rates between local areas has also increased. This is despite the number of regulatory efforts already in place to minimise harm from opioid medicines, and strategies to optimise the management of chronic non-cancer pain. It suggests that a continued focus on improving medicine use in this area is needed. Improved understanding of reasons for prescribing opioid medicines will help to identify whether these patterns are unwarranted and whether further targeted strategies are needed.

The Commission will publish a further analysis of these data in 2019, including analyses by state and territory, and local areas. This information will help identify the regional areas where dispensing of opioid medicines continues to rise.

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Chapter 6
Response to the Atlas series

The aim of the *Australian Atlas of Healthcare Variation* series (the Atlas series) is to provide clinically meaningful information that can be used to investigate and improve the appropriateness, effectiveness and efficiency of health care in Australia. The first and second Atlases were published relatively recently (2015 and 2017, respectively), and implementing changes in complex systems takes time. The Commission will provide future updates to evaluate progress in the clinical areas examined in the Atlas series.

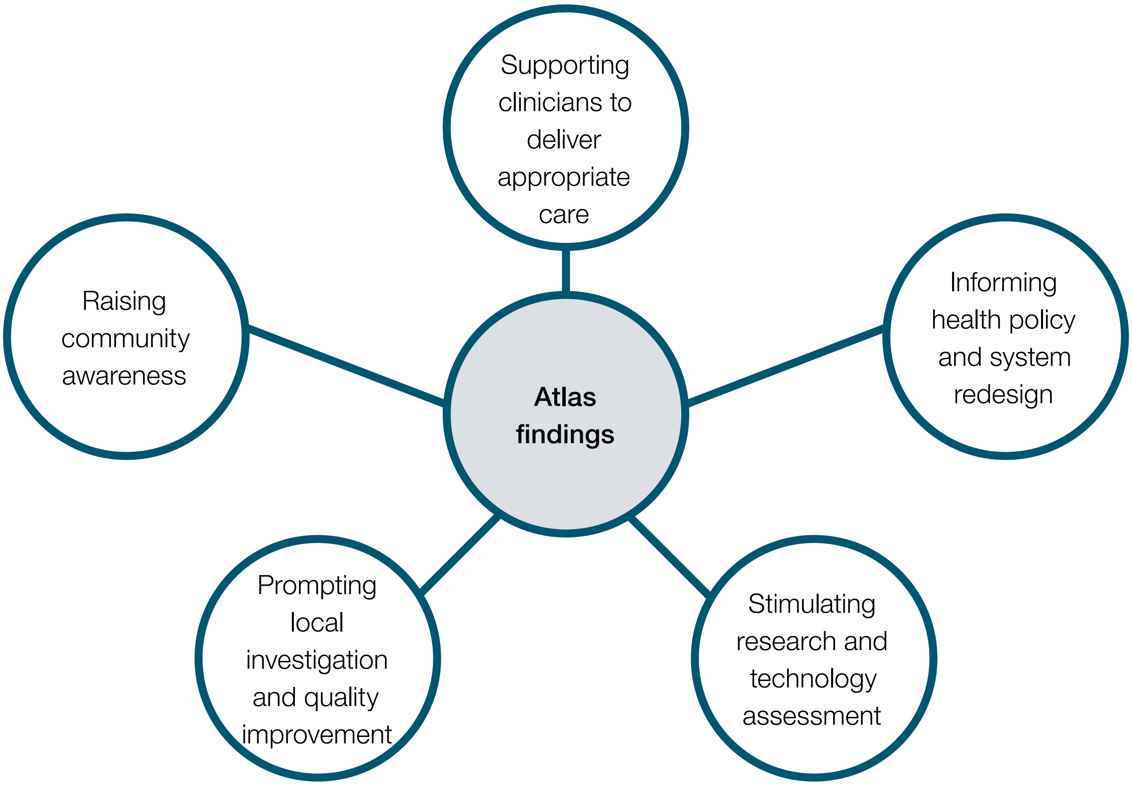
Mapping data is only the first step in using data on clinical variation for quality improvement. Translating the information in the Atlas series into better patient care and outcomes also depends on:

- Raising awareness of how to use data on variation to improve health care
- Building capacity for data collection and audit into clinical practice
- Engaging clinicians, policymakers and system managers to investigate reasons for variation and to address unwarranted variation
- Raising awareness among consumers of risks and benefits of healthcare interventions
- Implementing appropriate change at all relevant levels of the health system.

Figure 6.1 illustrates how the Atlas series can improve the value of healthcare delivery.

Response to the Atlas series

Figure 6.1: Channels of influence for the *Australian Atlas of Healthcare Variation* series



Raising awareness

Media reporting of the Atlas findings played an important role in communicating the findings. It also brought discussions about variation and improving appropriateness of care into the mainstream. Atlas findings were featured in more than 70 print media stories, with a total audience of more than 4 million, and more than 15 articles in medical journals. The Atlas also generated more than 15,000 website hits and 120,000 Twitter impressions.

Clinician engagement

Clinicians have been central to the development of the Atlas series, leading the analysis of Atlas findings and development of recommendations to improve appropriateness of care. This strong engagement with clinicians is reflected in the many statements of support for the Atlases from clinical colleges and societies. Atlas data have also been presented at national educational meetings of clinician groups.

Health services to monitor clinical variation at a local level

The value of monitoring clinical variation is now reflected in the National Safety and Quality Health Service Standards (second edition), effective in 2019.[1] The Clinical Governance Standard ensures that patients and consumers receive safe and high-quality health care. Action 1.28 of this standard requires health services to have systems in place to monitor and respond to variation in clinical care.

Health sector responses

State and territory health departments have been important partners in both developing and responding to the Atlas series. Some states of Australia have been investigating and addressing clinical variation for many years, whereas others have started using this approach in quality improvement more recently. However, the Atlas is the first national-level report series of its kind, and provides states and territories with a unique perspective for assessing variation.

Changes in the health system are usually the result of the accumulated efforts of many players over many years, rather than a single intervention such as the Atlas series. Table 6.2 gives examples of how different groups within the health sector have addressed issues highlighted in the first and second Atlases, in the context of the many other organisations working to improve health care in Australia.

Table 6.2: Example initiatives to address unwarranted variation in Atlas topics

Medicines for psychiatric conditions
• Clinicians and consumers developed strategies to reduce use of antipsychotic medicines in older people at a Commission-led meeting
• Tasmanian health services led improvements in prescribing through new mental health pathways, as well as education and audits (see 'Case study: State response to high rates of psychotropic medicines use', page 294)
• ACT Health implemented mental health pathways with general practitioners to reduce unnecessary prescribing of antidepressants
• The Royal Australian and New Zealand College of Psychiatrists has produced updated clinical practice guidelines on the management of mood disorders (depressive and bipolar disorders), schizophrenia and anxiety disorders, to provide greater clarity about treatment options and when medication is appropriate
• Paediatricians are researching reasons for variation in prescribing medicines for attention deficit hyperactivity disorder, and antidepressants and antipsychotic medicines for children (see 'Case study: Studying reasons for variation in use of attention deficit hyperactivity disorder medicines, page 295)
• The National Safety and Quality Health Service Standards (second edition) requires the use of antipsychotics and other psychoactive medicines to be in accordance with best practice and legislation[1]

Knee arthroscopy
• The Medicare Benefits Schedule (MBS) Review Taskforce used Atlas data on knee arthroscopy to guide its review
• The Commission released the Osteoarthritis of the Knee Clinical Care Standard[2] (see 'Case study: Falling rates of knee arthroscopy in people aged 55 years and over', page 296)

Potentially preventable hospitalisations
• The Queensland Clinical Senate held a meeting to discuss the Atlas findings and strategies to reduce potentially preventable hospitalisations[3]
• The Northern Territory Clinical Senate discussed Atlas findings at its inaugural meeting

Colonoscopy
• The MBS Review Taskforce used Atlas data on colonoscopy to guide its review

Hysterectomy
• The Commission released the Heavy Menstrual Bleeding Clinical Care Standard[4]

Caesarean section
• The Australian Institute of Health and Welfare adopted the Robson classification for reporting data on caesarean sections, as recommended in the first Atlas. Data reported using this system allow comparison of rates of caesarean section between groups with the same obstetric and neonatal risk factors. This makes it easier to see where variation in rates is likely to be due to differences in clinical practice rather than patient characteristics.

Response to the Atlas series

Case study: State response to high rates of psychotropic medicines use

Several areas of Tasmania were among the highest users in Australia of anxiety and depression medicines in the first Atlas, and Hobart–North West had more than double the national average rate of use of anxiety medicines.[5] Differences in rates of anxiety and depression in the population did not account for these high rates. A lack of awareness of, and access to, non-medicine treatment for mental illnesses was thought to be a potential problem.

Primary Health Tasmania undertook a comprehensive needs assessment to gain a deeper understanding of the Atlas findings, and to see how resources to support optimal treatment of anxiety and depression could best be used. Staff from Primary Health Tasmania collaborated with other clinicians, including the Chief Psychiatrist, and consulted with the Chief Pharmacist, to look more closely at treatment of mental illnesses in different parts of Tasmania.

Primary Health Tasmania, together with the Tasmanian Health Service and the Department of Health and Human Services, took a multi-pronged approach to improving the quality of clinical care.

Quality improvement initiatives included:

- Auditing practice data
- Having conversations with clinicians in target areas and providing peer support to improve practice
- Developing deprescribing resources and training clinicians in their use
- Developing and promoting Tasmanian Health Pathways for mental health.

The team assessed the availability of mental health services in different areas of Tasmania, and increased access where gaps were found. The team increased access to face-to-face social work and psychology supports, promoted consumer self-management tools for depression and anxiety, and increased the use of GP Mental Health Treatment Plans.

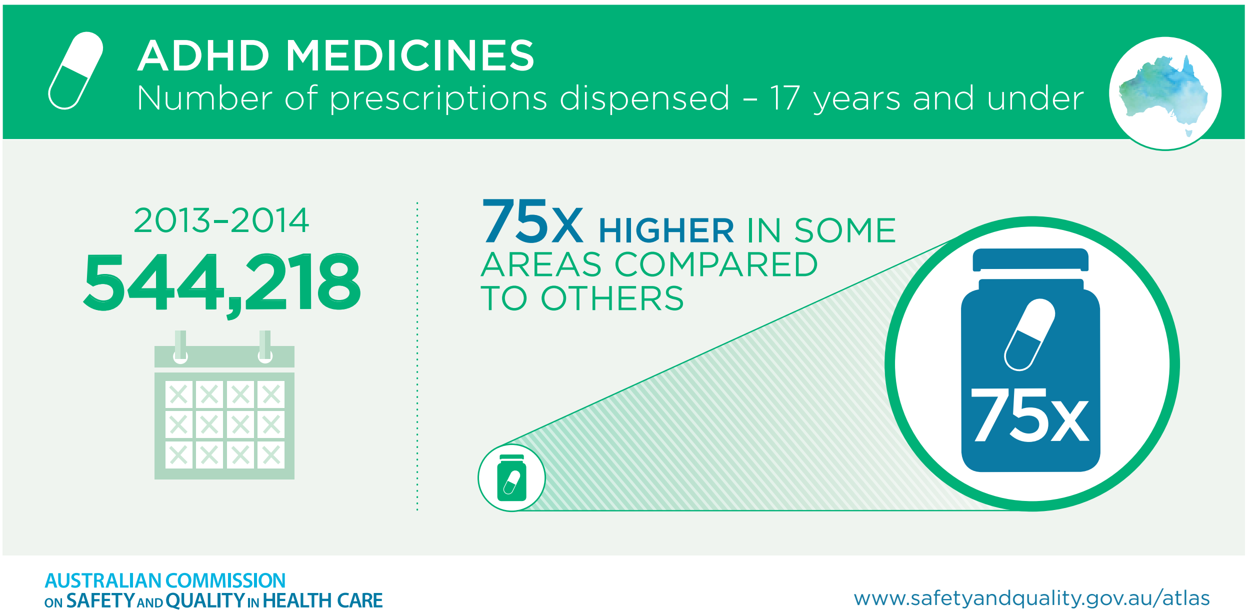
Primary Health Tasmania is continuing to explore local management of other illnesses examined in the Atlas, such as diabetes.

Case study: Studying reasons for variation in use of attention deficit hyperactivity disorder medicines

In the first Atlas, the rate of prescriptions for attention deficit hyperactivity disorder (ADHD) medicines varied more than any other item examined in the Atlas series, with 75-fold variation between the lowest and highest rates in Australia.[5] (Figure 6.3). These data prompted research into the underlying reasons for variation, led by Professor Harriet Hiscock, Director, Health Services Research Unit, Royal Children's Hospital, Melbourne, and researcher at the Centre for Community Child Health, Murdoch Children's Research Institute.

Professor Hiscock studied the mismatch between estimated rates of ADHD and prescriptions for ADHD medicines. She concluded that some children were missing out and some may have been over-treated. In 2018 and 2019, Professor Hiscock and her team are analysing variation in the number of ADHD medicines prescriptions, dosages and costs across states. Through a grant from the National Health and Medical Research Council, the team is looking at factors associated with a lack of Medicare Benefits Schedule (MBS)-related care for children with high levels of behavioural and emotional problems – that is, identifying which groups of children are missing out on general practitioner, allied health, psychology, paediatrician or psychiatry care. The project is also investigating whether variation in care is associated with poorer quality of life for children, and what can be done from a clinician and patient perspective to improve access to care. According to Professor Hiscock, the Atlas contributed to securing funding in this area and encouraged a multidisciplinary research approach, bringing together paediatricians, psychiatrists, psychologists, health economists and qualitative researchers.

Figure 6.3: PBS dispensing of medicines for attention deficit hyperactivity disorder in Australia, people aged 17 years and under, 2013–14



Source: First *Australian Atlas of Healthcare Variation*[5]

Response to the Atlas series

Case study: Falling rates of knee arthroscopy in people aged 55 years and over

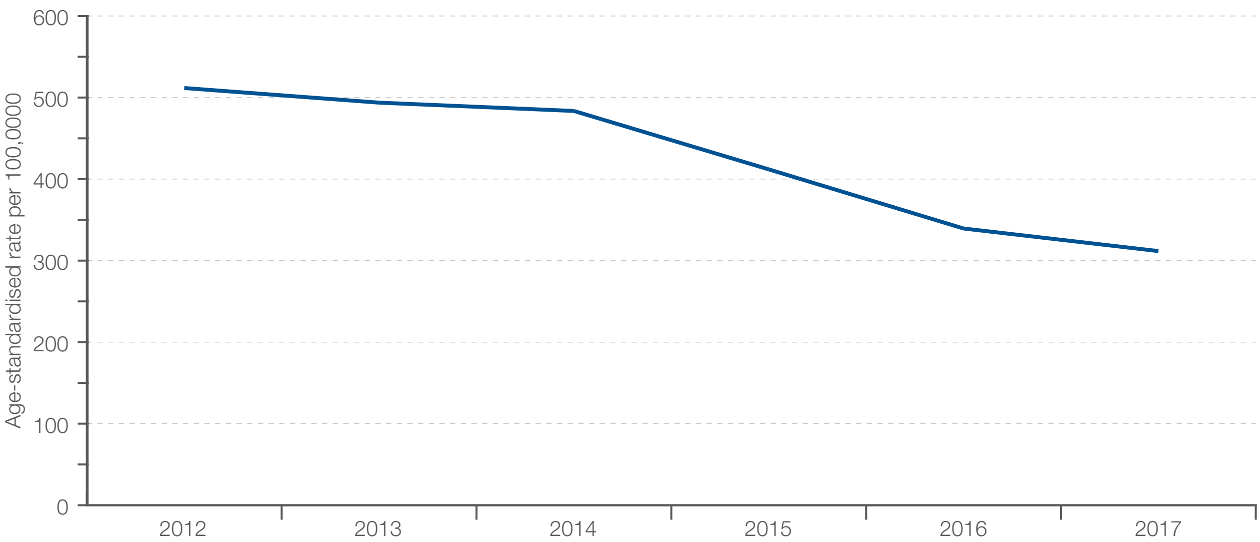
Knee arthroscopy is a surgical procedure for examining the inside of the knee joint and, if necessary, repairing it. Arthroscopic procedures are not effective for treating knee osteoarthritis.[6,7] In older patients with knee pain caused by osteoarthritis or degenerative meniscal changes, arthroscopic procedures provide only minor pain relief, which is offset by an increased risk of harm, when compared with conservative management.[8] Exercise therapy is more effective than knee arthroscopy for reducing osteoarthritic knee pain.[9]

In 2015, the first Atlas reported that there were more than 33,000 admissions for knee arthroscopy in people aged 55 years and over in Australia in 2012–13.[5] The rate of admissions was seven times higher in the area with the highest rate compared with the area with the lowest rate.[5]

In light of the Atlas findings, the Commission released a clinical care standard for osteoarthritis of the knee[2] and commissioned a documentary about appropriate care for knee pain. The Commission also referred the findings to the MBS Review Taskforce, which subsequently recommended removal of funding for knee arthroscopy for degenerative changes.

The rate of knee arthroscopy in people aged 55 years and over in Australia fell from 412 per 100,000 in 2015 to 312 per 100,000 in 2017 – a 24% drop (Figure 6.4).[10] Many drivers are likely to have contributed to this reduction, in addition to the Atlas – for example, research and guidelines highlighting the lack of benefit of knee arthroscopy for osteoarthritis, and the MBS Review Taskforce review.[8,11]

Figure 6.4: Rate of knee arthroscopy in people aged 55 years and over, Australia, 2012–2017



Source: Australian Commission on Safety and Quality in Health Care analysis of MBS data, 2018, item codes 49566, 49563, 49561, 49560, 49559, 49558, 49557[10]

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Technical supplement

Introduction

This is the *Third Australian Atlas of Healthcare Variation* in a series providing statistics at a local level identifying variation across Australia for a number of health indicators. Statistics in the Atlas are presented in the form of maps, graphs and tables. This technical supplement provides information on the methods used for data extraction, and analysis for presentation in the maps and graphs. Activity rates are presented by local areas using the Australian Bureau of Statistics (ABS) Statistical Area Level 3 (SA3) geography, as well as 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 www.meteor.aihw.gov.au/content/index.phtml/itemId/708955.

The specifications include details such as:

- The data source
- The relevant population
- 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 because of confidentiality and/or volatility reasons).

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Unless otherwise stated, indicators relate to all ages.

Analyses are based on the place of usual residence of the patient and not the location of the health service. If the place of usual residence of the patient was unknown or invalid, or could not be allocated to an SA3, or state or territory, the record was included for the total for Australia only. Records with unknown or invalid age or sex were also excluded from the analyses as they could not be age and sex standardised.

Four data sources were used in the Atlas:

1. Medicare Benefits Schedule (MBS) data
2. National Hospital Morbidity Database (NHMD)
3. National Perinatal Data Collection (NPDC)
4. Pharmaceutical Benefits Scheme (PBS) data.

The AIHW conducted the data extraction and analysis, and presentation of the data in maps and graphs. Analyses in this report have not been adjusted to account for the under-identification of Aboriginal and Torres Strait Islander Australians in the data sources used. Data by Aboriginal and Torres Strait Islander status should be interpreted with caution because Aboriginal and Torres Strait Islander patients are under-enumerated in health data, and there is variation in the under-enumeration among states and territories.

Medicare Benefits Schedule data

MBS data are a by-product of the assessment of claims for Medicare benefits by the Australian Government Department of Human Services, and are provided to the Australian Government Department of Health. The MBS data in this report comprise services provided in financial year 2016–17 for claims processed up to and including 28 February 2018. A service includes any claims resulting in the payment of a Medicare benefit. Bulk-billing incentives and 'top-up' services are excluded from service counts as they are not attendances or procedures in their own right.

MBS data do not include:

- Services provided free of charge to public patients in hospitals
- Services that qualify for a benefit under the Department of Veterans' Affairs National Treatment Account
- Services provided under an entitlement such as services covered by third-party or workers compensation, where an interim benefit has not been paid, or services provided to repatriation beneficiaries or defence personnel
- Services provided for insurance or employment purposes
- Health screening services.

Some Australian residents may access medical services through other arrangements, such as salaried doctor arrangements. As a result, MBS data may underestimate the use of services by some members of the community.

Under Medicare, 'eligible persons' are persons who reside permanently in Australia. This includes New Zealand citizens and holders of permanent residence visas. Applicants for permanent residency may also be eligible, depending on their circumstances. In addition, overseas visitors from countries with which Australia has a Reciprocal Health Care Agreement might also be entitled to benefits under MBS arrangements.

For some patients, the total service count for the services in question may be zero or negative (for example, due to cheque cancellations; see http://meteor.aihw.gov.au/content/index.phtml/itemId/601800). In these cases, all records of the patient are excluded from the analyses.

A patient's age in MBS data is their age in years on the date the service was provided to them.

Components of MBS analysis

Referral provider specialty

Referral provider specialty is the field of specialty of the authorised health practitioner who requested the service. A provider's specialty is determined by taking into account both the health practitioner's registered medical specialties and their service pattern.

For the thyroid function test indicator, some records did not have a referral provider specialty. In these cases, the missing specialty was replaced with the service provider specialty. This was possible because a high percentage of the services were self-determined by the service provider (data provided by the Australian Government Department of Health). Services are classified as self-determined when they are in addition to those specified in the original request from the referral provider and are of the type that would have otherwise required a referral.

For the cardiac stress tests and imaging indicator, some records of stress echocardiography, myocardial perfusion scans and computed tomography of the coronary arteries did not have a referral provider specialty. This missing specialty was replaced with the service provider specialty because a high percentage of the services from each test type were self-determined by the service provider (data provided by the Department of Health).

For exercise stress tests (also known as stress or exercise electrocardiography [ECG]), no records had a referral provider specialty. Clinical advice indicated that stress echocardiography is usually performed in conjunction with an ECG. Therefore, the referral provider specialty of stress echocardiography records was used as a proxy for ECG records for patients who received stress echocardiography and ECG by the same provider on the same date. For these records, the referral provider specialty was replaced with the referral provider specialty of the stress echocardiography record or with the service provider specialty if the referral provider specialty was missing.

The remaining ECG records were apportioned according to the proportions of general practitioners, cardiologists and other health professionals who requested stress echocardiography in the above scenario (stress echocardiography and ECG performed by the same provider to the same patient on the same date).

National Hospital Morbidity Database

NHMD data used in this report are for 2016–17, except for the thyroidectomy indicator. For each reference year, the NHMD includes episodes for admitted patients discharged (separated) between 1 July and 30 June.

For the thyroidectomy indicator, the annual number of hospitalisations is too low or unreliable to report at a local level, so three financial years of data (2014–15, 2015–16 and 2016–17) are combined. 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 results from both methods will generally be the same, or very similar, especially for areas with low proportional population change between years.

For the gastroscopy and colonoscopy indicators, admission practices across states and territories vary. Gastroscopies and colonoscopies can be performed in non-admitted care settings. This should be taken into account when comparing rates across states and territories, and local areas. For 2016–17, the NHMD received no data from the private freestanding day hospital facilities and one overnight private hospital in the Australian Capital Territory. For this reason, data for the Australian Capital Territory should be interpreted with caution for these two indicators.

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The 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 may be included. The data elements (variables) included in the NHMD are based on the Admitted Patient Care National Minimum Data Set (APC NMDS). More information on the APC NMDS for 2014–15, 2015–16 and 2016–17 can be found at http://meteor.aihw.gov.au/content/index.phtml/itemId/535047, http://meteor.aihw.gov.au/content/index.phtml/itemId/588909 and http://meteor.aihw.gov.au/content/index.phtml/itemId/612171.

For a summary of key data quality issues related to the NHMD for 2014–15, 2015–16 and 2016–17, see *Admitted Patient Care* reports of Australian hospital statistics for the specified years, available at www.aihw.gov.au/reports/hospitals/ahs-2014-15-admitted-patient-care, www.aihw.gov.au/reports/hospitals/ahs-2015-16-admitted-patient-care and www.aihw.gov.au/reports/hospitals/ahs-2016-17-admitted-patient-care.

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 counting unit for the NHMD is a 'separation'. Separation refers to an 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'.

Because a record is included for each hospitalisation, rather than for each patient, patients hospitalised more than once in the financial year have more than one record in the NHMD.

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.

Hospitalisation 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.

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

In 2011–12, it was estimated that 88% of Aboriginal and Torres Strait Islander patients were correctly identified as such in public hospital admission records. The estimated (weighted) levels of Aboriginal and Torres Strait Islander identification (and 95% confidence intervals) for public hospitals in 2011–12 were 80% (76–83%) in New South Wales, 78% (71–84%) in Victoria, 87% (84–91%) in Queensland, 91% (85–95%) in South Australia, 96% (92–98%) in Western Australia, 64% (53–74%) in Tasmania, 98% (96–99%) in the Northern Territory and 58% (46–69%) in the Australian Capital Territory. It is not known to what extent Aboriginal and Torres Strait Islander patients might be under-identified in private hospital admission records.

There were wide variations in Aboriginal and Torres Strait Islander identification by remoteness, ranging from 77% (72–81%) in major cities to 99% (96–100%) in very remote areas. For more information, see *Indigenous Identification in Hospital Separations Data: Quality report* at www.aihw.gov.au/publication-detail/?id=60129543215.

Components of NHMD analysis

Diagnoses and procedures

Hospital diagnosis and procedure data used in this report were reported to the NHMD by states and territories using the ninth edition 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, for 2015–16 and 2016–17. For 2014–15, the eighth edition was used.

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. Further information on the quality and comparability of the coded data at a state and territory level can be found in *Admitted Patient Care* reports of Australian hospital statistics for the specified years, available at www.aihw.gov.au/reports/hospitals/ahs-2014-15-admitted-patient-care, www.aihw.gov.au/reports/hospitals/ahs-2015-16-admitted-patient-care and www.aihw.gov.au/reports/hospitals/ahs-2016-17-admitted-patient-care.

Aboriginal and Torres Strait Islander status

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

Patient funding status

NHMD data in this report are presented separately for hospitalisations according to the funding status of the patient. This reflects the funding arrangements for the patient's hospitalisation, rather than the sector of the hospital to which they were admitted. Hospitalisations were categorised by funding status of patients – public or private – using the APC NMDS variable 'source of funding'. For further details, see http://meteor.aihw.gov.au/content/index.phtml/itemId/553314.

In some cases, the 'patient election status' (http://meteor.aihw.gov.au/content/index.phtml/itemId/326619) or 'hospital sector' (http://meteor.aihw.gov.au/content/index.phtml/itemId/269977) variables were also used. This is the approach used for reporting national hospital data by patient funding status.

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 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 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-funding
- Other funding source
- Not known.

For 2016–17, there were data quality issues related to the recording of patient funding source for patients admitted to private hospitals in the Australian Capital Territory. For this reason, 2016–17 data for these private hospitals were excluded from analysis by patient funding status.

Technical supplement

National Perinatal Data Collection

The NPDC collects data about births in Australia, including births in hospitals, birth centres and the community (such as home births). All live births and stillbirths of at least 20 weeks gestation or at least 400 grams birth weight are included, except in Victoria and Western Australia, where births are included if gestational age is at least 20 weeks or, if gestation is unknown, birth weight is at least 400 grams. NPDC data in this report relate to births that occurred in the calendar year 2015.

NPDC data are based on births reported to the perinatal data collection in each state and territory in Australia. Midwives and other birth attendants, using information obtained from mothers and from hospital or other records, complete notification forms for each birth. Each state or territory perinatal data collection provides a standard de-identified extract to the AIHW annually to form the NPDC. The data elements in the NPDC include the Perinatal National Minimum Data Set (Perinatal NMDS) and additional data elements. More information on the Perinatal NMDS for 2015 can be found at http://meteor.aihw.gov.au/content/index.phtml/itemId/517456.

Additional data elements are at different stages of standardisation. Some have national data standards but have not been implemented in the Perinatal NMDS, while others do not have common definitions for collecting the data.

The data quality statement for the 2015 NPDC is available at http://meteor.aihw.gov.au/content/index.phtml/itemId/681798.

The key data element for the early planned caesarean section indicator is 'main indication for caesarean section'. This data element was added to the Perinatal Data Set Specification (http://meteor.aihw.gov.au/content/index.phtml/itemId/510127) from 1 July 2014 and was revised from 1 July 2015. Before July 2014, the data element was provided to the NPDC without a national data standard on a voluntary basis.

Across Australia:

- Data of sufficient quality for publication were available from four states/territories. Data on 'main reason for caesarean section' did not meet the specification for the remaining four states and territories
- Clinical indications for early planned birth, such as foetal compromise, were not always recorded as the main indication for caesarean section when the decision to perform a caesarean section was pre-planned in the antenatal period
- Clinical events such as pre-labour rupture of membranes, which may lead to an unplanned early caesarean section, were not always recorded when the decision to perform a caesarean section was pre-planned in the antenatal period.

Analysis was by place of usual residence of the mother and excluded Australian non-residents, residents of external territories, and records in which place of usual residence was not stated.

All states and territories have a data item on their perinatal notification form to record Aboriginal and Torres Strait Islander status of the mother, although there are some differences among the states and territories. In 2015, information on Aboriginal and Torres Strait Islander status was provided for nearly all mothers (99.9%) who gave birth; however, no formal assessment of the quality of Aboriginal and Torres Strait Islander identification in NPDC data has been undertaken. For more information, see *Australia's Mothers and Babies 2015: in brief*, available at www.aihw.gov.au/reports/mothers-babies/australias-mothers-babies-2015-in-brief.

Components of NPDC analysis

Aboriginal and Torres Strait Islander status

For NPDC data, data for Aboriginal and Torres Strait Islander women are compared with data for other Australian women. Other Australian women comprise women who were reported as not of Aboriginal and/or Torres Strait Islander origin. Women for whom information on Aboriginal and Torres Strait Islander status was not reported were excluded from the analysis.

Patient funding status

For NPDC data, patient funding status was determined using the additional data element ‘admitted patient elected accommodation status’. Public patients are those for whom the admitted patient’s (mother’s) elected accommodation status was ‘public’. Private patients are those for whom the admitted patient’s elected accommodation status was ‘private’. Women who gave birth at home or in birth centres attached to hospitals were not included in the analysis of patient funding status. The specification for this data element is only for births in hospitals. The exception to this was Northern Territory home birth services that were provided by the hospital with the mother as an admitted patient. The number of these records was small, and they were included in the analysis by the admitted patient elected accommodation status.

Pharmaceutical Benefits Scheme data

The PBS and Repatriation Pharmaceutical Benefits Scheme (RPBS) are the two main Australian Government subsidy schemes for medicines managed by the Department of Health and the Department of Veterans’ Affairs, respectively. Claims for reimbursement for the supply of PBS- or RPBS-subsidised medicines are submitted by pharmacies through the Department of Human Services for processing. Subsidies for listed prescription medicines are available to all Australian residents who hold a current Medicare card and overseas visitors from countries with which Australia has a Reciprocal Health Care Agreement. Patients pay a contribution to the cost of the medicine (co-payment), and the Australian Government covers the remaining cost.

The PBS data in this report are sourced from claim records of prescriptions dispensed under the PBS or RPBS, where either:

- The Australian Government paid the subsidy
- The prescription was dispensed at a price less than the relevant patient co-payment (under co-payment prescriptions) and did not attract a subsidy.

The PBS data cover all prescriptions dispensed by approved suppliers, including community pharmacies, public and private hospital pharmacies, and dispensing doctors.

The PBS data do not cover:

- Over-the-counter purchases (non-prescription)
- Private prescriptions (non-listed or prescriptions off-indication prescription medicines, or for overseas visitors who were not eligible for the PBS or RPBS)
- Medicines supplied to admitted patients in public hospitals (although discharge prescriptions dispensed in all states and territories except New South Wales and the Australian Capital Territory are included).

Technical supplement

Patient categories of 'general', 'concessional', 'repatriation' and 'unknown' are included (http://meteor.aihw.gov.au/content/index.phtml/itemId/604103). Closing the Gap prescriptions are also included (www.humanservices.gov.au/organisations/health-professionals/services/medicare/closing-gap-pbs-co-payment-measure). Doctor's bag medicines (supply of medicines free to patients for emergency use) and medicines dispensed through alternative arrangements where the patient cannot be identified, such as direct supply to Aboriginal health services, are excluded.

The number of prescriptions represents the total number of times that a prescribed medicine is supplied to a patient. Prescriptions can be written either as one-off (original with no repeats) or original with repeats. When an original prescription and all of the repeats were supplied at the one time, the total number of prescriptions (original and repeats) was counted.

For individual prescriptions where the quantity dispensed varied from the listed maximum quantity, no adjustment was made for increased or reduced quantity supplied. The supply was counted as one prescription.

A patient's age in PBS data is their age in years on the date the medicine was supplied to them.

The PBS data in this report were extracted in April 2018 and comprise prescriptions dispensed in:

- 2016–17 for three PBS indicators
- 2013–14 to 2016–17 for seven PBS indicators for time series analysis.

PBS and RPBS data maintained by the Department of Health are sourced from prescription information collected by the Department of Human Services as a by-product of the payment system. In 2015, the Department of Human Services implemented changes to the PBS and RPBS claiming arrangements with pharmacies. As a result, from 1 July 2016, new arrangements were put in place to transfer the daily data feed of prescription records from the Department of Human Services to the Department of Health. The Department of Health has advised that these new arrangements may have had a slight impact on 2016–17 prescription volumes that are presented in this report, and this should be taken into account when viewing time series.

For the antipsychotic medicines indicators, the PBS data do not include public hospital prescriptions dispensed through alternative arrangements that were claimed by public hospitals 'offline' for the data up to 2014–15. Clozapine was the only mental health–related medicine in this category. From 2010–11, clozapine claims transitioned to the 'standard' PBS or RPBS payment system. Clozapine offline claiming arrangements ceased completely as of 1 January 2015; all data are included in the standard payment system from 2015–16 onwards.

In addition to prescription counts, patient counts (patients dispensed at least one prescription) and defined daily doses per thousand people per day (DDDs/1,000/day) are also presented in this report.

Defined daily dose

DDD is defined by the World Health Organization (WHO) as the assumed average maintenance dose per day for a medicine used for its main indication in adults. DDDs are assigned to medicines by the WHO Collaborating Centre for Drug Statistics Methodology. Using DDDs allows comparisons of medicine dispensing independent of differences in the price, preparation and quantity per prescription. Expressing medicine dispensing in DDDs/1,000/day allows data for medicines with differing daily doses to be aggregated. However, the DDD is only a unit of measurement and does not necessarily reflect the recommended or average prescribed dose. DDDs are not established for all medicines. For the antimicrobial medicines indicator, some antimicrobials do not have a DDD. Further information on DDD is available at www.who.int/medicines/regulation/medicines-safety/toolkit_ddd/en.

As DDD is an adult dose, caution should be exercised when interpreting DDDs/1,000/day for indicators in this report that relate to all ages, or age 17 years and under. For this reason, DDDs/1,000/day are not calculated for the antibiotics in children indicator.

Combination medicines

For combination medicines (with multiple active ingredients), there is a difference in DDD assignment by the WHO and by the Australian Government Department of Health. The WHO method takes account of the main ingredient of the combination medicine (www.whocc.no/ddd/definition_and_general_considera/#DDDs), whereas the Department of Health method takes account of each ingredient. The WHO method is used in this report to allow international comparisons. Because of this, DDDs/1,000/day in this report may not always align with those published in the *Australian Statistics on Medicines* annual report.

DDDs used in this report are the WHO-assigned DDDs at January 2018. Information on DDD assignment to medicines is available at www.whocc.no/atc_ddd_index.

Components of PBS analysis

Prescriber specialty

Prescriber specialty is the field of specialty of the authorised health practitioner responsible for writing a prescription. A prescriber's specialty is determined by taking into account both the health practitioner's registered medical specialties and their service pattern.

Analysis methods

Populations

All indicators use an estimated resident population in the denominator, except the early planned caesarean section indicator, for which the denominator is women who gave birth by caesarean section from the NPDC.

Where available, populations were based on the estimated resident population from the ABS at the start of the reporting period, based on data from the 2011 and 2016 Census of Population and Housing. For example, for the reporting period 2016–17, the estimated resident population at 30 June 2016 was used. For the thyroidectomy indicator, where three financial years of data (2014–15, 2015–16 and 2016–17) were used, the population was the sum of the estimated resident population at 30 June 2014, 30 June 2015 and 30 June 2016.

The population of Aboriginal and Torres Strait Islander Australians was based on the projected Aboriginal and Torres Strait Islander population (Series B projection using the Aboriginal and Torres Strait Islander population from the 2011 Census: www.ausstats.abs.gov.au/Ausstats/subscriber.nsf/0/AEE5C09DB715A1BBCA257CC900143F80/$File/aboriginal%20and%20torres%20strait%20islander%20population%20projections%20fact%20sheet.pdf). The population of other Australians was based on the estimated resident population.

Derived populations

For the thyroidectomy indicator with an age range of 18 years and over, separate male and female estimates for Aboriginal and Torres Strait Islander Australians aged 18 and 19 years were not published by the ABS. They were derived as follows:

- Sex ratios for Aboriginal and Torres Strait Islander Australians were calculated for people aged 18 and 19 years separately, and for each state and territory, based on the 2011 Census counts of Aboriginal and Torres Strait Islander males and females aged 18 and 19 years, in each state and territory
- The sex ratios were applied to the total of Aboriginal and Torres Strait Islander Australians aged 18 and 19 years in each state and territory, to calculate Aboriginal and Torres Strait Islander males and females by single year of age in each state and territory
- The corresponding population of other Australians was calculated by deducting the estimate of Aboriginal and Torres Strait Islander Australians from the estimated resident population.

Technical supplement

Age and sex standardisation

This report presents age- and sex-standardised rates, except for the early planned caesarean section and proton pump inhibitor medicines dispensing for 1 year and under indicators. Age and sex standardisation is a method used to remove the influence of age and sex when comparing populations with different age and sex structures. For this report, the Australian estimated resident population at 30 June 2001 was used as the standard population. Some indicators used specific age ranges. In these cases, only the relevant age groups were included in age- and sex-standardisation calculations. Standardised rates based on different age groups and/or standard populations are not directly comparable.

The age group of 65 years and over was the highest used in standardisation for Aboriginal and Torres Strait Islander status analysis, and 85 years and over was the highest age group used for all other analyses, except those that used specific age ranges under 85 years.

The general age standardisation formula for populations is available at http://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 (http://meteor.aihw.gov.au/content/index.phtml/itemId/659727). These areas were grouped by state or territory, remoteness and socioeconomic status to assist comparisons. For further information, see www.abs.gov.au/geography.

Allocation to an SA3 was based on the patient's place of usual residence, rather than the place where they received the service. The geographical data that were used to allocate the number of events (hospitalisations, services, prescriptions, DDDs and patients) to an SA3 level varied depending on the data source (Table 1).

For 2014–15 to 2016–17, SA2s collected in the NHMD were based on the ASGS 2011. 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.

Table 1: Geographical data used to allocate an SA3, 2016

Data source	Data on geographic location
MBS data	Postcode
NHMD	SA2 2011, except New South Wales For New South Wales, SA2 2011 was derived. For 2014–15, SA2 was mapped from Statistical Local Area* (SLA). For 2015–16 and 2016–17, SA2 was mapped from SLA; where mapping could not be undertaken on SLA, postcode was used.
NPDC	Not applicable; data are presented by state or territory of mother's residence
PBS data	Postcode

* This is the geographic area defined in the ABS Australian Standard Geographical Classification (the classification used before the ASGS).

For the MBS and PBS data, an ABS correspondence file was used to correspond postcode to SA3 2011. In some cases, a postcode overlapped SA3 boundaries. Where this occurred, the number of events that overlapped boundaries was apportioned across the SA3s, according to the proportion of the postcode population in the SA3s. The number of events at SA3 2011 was then mapped to SA3 2016 using an ABS correspondence file. Consistent with the above, where an SA3 2011 overlapped SA3 2016 boundaries, the number of events that overlapped boundaries was apportioned across the SA3s 2016, according to the proportion of the population of SA3 2011 in the SA3s 2016. Because of this apportionment, events by SA3 2016 for individual records might not be precise; however, the overall distribution of records by SA3 2016 is considered to be statistically representative of the split population.

For the PBS data, the number of patients was determined at the Australian level. In some cases, patients can have multiple records, with different postcodes recorded in those records. Where this occurred, the patient count was apportioned across the postcodes, according to the proportion of the patient's prescriptions in that postcode. The number of patients at postcode level was mapped to SA3 2011 and then mapped to SA3 2016 using the same process as above.

For the NHMD, when Statistical Local Area (SLA) or postcode was used, appropriate ABS correspondence files were used to identify the corresponding SA2 2011. In some cases, a geographic unit overlapped SA2 boundaries. Where this occurred, records for that geographic unit 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 nature of the allocation, the SA2 data for individual records might not be accurate or reliable; however, the overall distribution of records by SA2 is considered useful. The SA2 2011 was then aggregated to SA3 2011. The number of hospitalisations at SA3 2011 was mapped to SA3 2016 using the same process as for MBS and PBS data.

As a result of boundary misalignment between postcode and SA3 2011, the proportions of the population in an SA3 2011 for a number of postcodes either did not equal or did not sum to one in the ABS correspondence file. The same applied to the SA3 2011 to SA3 2016 correspondence file. These proportions were rescaled to make the sum equal to one.

Post office boxes

For indicators based on MBS and PBS data, six post office box postcodes in major cities were excluded from analyses by SA3 level, remoteness and socioeconomic status. This is because it is difficult to estimate the place of patient residence in these cases. However, these post office box postcodes were included in analyses by state and territory, and at national level.

The following post office box postcodes were excluded:

- 2001 Sydney
- 2124 Parramatta
- 3001 Melbourne
- 4001 Brisbane
- 5001 Adelaide
- 6843 Perth.

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. For more information on SEIFA, see http://meteor.aihw.gov.au/content/index.phtml/itemId/695778. This method of grouping was applied to the data used in this report to assign the derived SA3s to remoteness and socioeconomic groups. Owing to the method used, national data by remoteness and socioeconomic status presented here 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.

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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 publishes a remoteness category for each SA1 (available at www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/1270.0.55.005July%202016?OpenDocument). The proportion of the population in each remoteness category was calculated for each SA3 using the ABS correspondence file SA1 to remoteness area, and the hierarchical code structure of SA1 to SA3 (see http://meteor.aihw.gov.au/content/index.phtml/itemId/659750). The remoteness category with the highest proportion of population was allocated to the SA3.

The SEIFA Index of Relative Socio-Economic Disadvantage (IRSD) was used for socioeconomic analysis. The SEIFA IRSD is a product developed by the ABS (see *Census of Population and Housing: Socio-Economic Indexes for Areas (SEIFA), Australia, 2016*, www.abs.gov.au/AUSSTATS/abs@.nsf/allprimarymainfeatures/6CD4E5CE952FEDBFCA257B3B001AC3E5?opendocument) that 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 publishes an index value for each SA1 (available at www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/2033.0.55.0012016?OpenDocument). The SA1s are then 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 that SA3.

Combining remoteness and SEIFA

When remoteness categories and socioeconomic quintiles are combined, there are 25 possible 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).

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+).

Table 2: Number* of SA3s by combined ASGS remoteness categories and SEIFA IRSD quintiles

ASGS remoteness	Quintiles of SEIFA IRSD				
	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.

Suppression protocol

Rates based on low numbers of events and/or very small populations are more susceptible to random fluctuations and therefore may not provide a reliable representation of activity in that area. For this reason, results for some areas were suppressed (Table 3). Results that could lead to the identification of individual patients, providers or business entities were also suppressed. Suppression of areas to protect business entity confidentiality was advised by the Australian Government Department of Health. If applicable, consequential suppression was applied to manage confidentiality. Geographic areas with suppressed results were marked as not published and coloured grey in maps.

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

Data source	Numerator	Denominator	Denominator for age- and sex-specific groups
MBS data	• Fewer than 20 • Fewer than 6 services* • Fewer than 6 patients* • Fewer than 6 providers* • One provider provided more than 85% of services* • Two providers provided more than 90% of services*	Fewer than 1,000	Fewer than 30
NHMD	• Fewer than 20 (single year of data) • Fewer than 10 (three years of data)	Fewer than 1,000	Fewer than 30
NPDC	Fewer than 5	Fewer than 100	Not applicable; data are not standardised
PBS data	Fewer than 20	Fewer than 1,000	Fewer than 30

* Suppression rules relating to protecting confidentiality set by the Department of Health. Suppression rules not marked with an asterisk relate to volatility.

Data from suppressed SA3s were included in analyses for larger geographic areas – for example, analysis by state and territory, remoteness and socioeconomic status.

Technical supplement

As most of the data were age- and sex-standardised, several SA3s in the Northern Territory were consistently suppressed because the population in one or more age and sex groups used for standardisation was fewer than 30. As a result, the Northern Territory requested that consideration be given to relaxing this suppression rule. The AIHW developed a sensitivity analysis to investigate the volatility of the rates of the affected SA3s. For consistency, this sensitivity analysis was conducted for all data at the SA3 level – that is, not just results from Northern Territory SA3s. A refined sensitivity analysis used in this report is summarised in Box 1.

Rates were suppressed because of volatility and/or confidentiality, and publishable rates (including those published with caution) are presented in the report as whole numbers. The exception was the DDDs/1,000/day, which are presented with two decimal places.

Box 1: Summary of sensitivity analysis

For each indicator and each SA3 that was suppressed as a result of a low (below-threshold) denominator for one or more age- and sex-specific groups (affected SA3), the following analysis was undertaken:

1. The numerator was increased by 1 in each of the groups with a low denominator to generate a simulated rate.
2. All rates, including the simulated rates, were rounded to whole numbers.
3. All publishable SA3 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 SA3 rates for non-affected SA3s and the actual rates for affected SA3s were ranked from lowest to highest and split into deciles.
5. The allocated decile of the simulated rate (step 3) was compared with the allocated 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 with the actual rates (the most extreme scenario). This was a conservative approach 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 allocated for the simulated and actual rate; 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; 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 has been published with caution. This is because the rate is considered potentially more volatile than other published SA3 rates. The rates published with caution are not included in the calculation of the total magnitude of variation, and are represented in the report with an asterisk (tables), hollow circle or rectangle (graphs) and dotted area (maps).

Presentation of data in Australia maps, capital city areas maps and time series graphs

Rounded rates for SA3s were ranked from lowest to highest and then split into 10 categories (deciles). The deciles are displayed using various shades of colour, where darker colours represent higher rates and lighter colours represent lower rates. Each decile may not have the same number of SA3s if there was more than one SA3 with the same rate at the boundary of a decile. Where this occurred, SA3s with the same rate were assigned to the same decile.

Identification of highest and lowest rate areas

SA3s with the highest and lowest rates have been identified for each indicator. Having regard to the overall distribution of the rates, selection of SA3s was made from the histogram column by column, with the aim of identifying at least the 10 highest and lowest rate areas for SA3s. The selection of SA3s was also dependent on the width of the column in the histogram, and the choice of what width to use was somewhat arbitrary. For some indicators, fewer than 10 SA3s are listed. This is because inclusion of the next column of the histogram would have resulted in a list of SA3s too long for publication.

Identification of consistently high and low rate areas

SA3s with consistently high or consistently low rates have been identified for PBS indicators analysed for 2013–14 to 2016–17. Consistently high or consistently low is defined as those SA3s that fall in the top 10% or bottom 10% of all SA3s for all four years.

Glossary

Aboriginal Community Controlled Health Service	A primary healthcare service initiated and operated by the local Aboriginal community to deliver holistic, comprehensive and culturally appropriate health care to the community that controls it.
age and sex standardisation	The removal of the influence of age and sex when comparing rates between populations with different age and sex structures. The current standard population is the Australian estimated resident population as at 30 June 2001. Rates in the Atlas are expressed per 100,000 people.
carer	A person who provides unpaid care and support to a family member or friend who has a disability, chronic condition, terminal illness or general frailty. Includes parents and guardians caring for children.
Clinical Care Standard	A small number of quality statements that describe the care patients should be offered by health professionals and health services for a specific clinical condition or defined clinical pathway in line with current best evidence. Clinical Care Standards play an important role in delivering appropriate care and reducing unwarranted variation because they identify and define the care people should expect to be offered or receive, regardless of where they are treated in Australia. Further information is available at www.safetyandquality.gov.au/our-work/clinical-care-standards.
clinician	A healthcare provider trained as a health professional. Includes registered and non-registered practitioners, and teams of health professionals who spend most of their time providing direct clinical care.
consumer	Patient, potential patient, carer or organisation representing consumer interests.
data linkage	Used synonymously with ‘data integration’ and ‘record matching’, data linking or linkage refers to the bringing together of information from more than one source that relates to the same individual or institution.

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defined daily dose (DDD)	A measurement unit created by the World Health Organization. The DDD is defined as the assumed average maintenance dose per day for a medicine used for its main indication in adults, and does not necessarily correspond to the recommended or prescribed daily dose. Therapeutic doses for individual patients and patient groups will often differ from the DDD because they will be based on individual characteristics such as age, weight, ethnic differences, type and severity of disease, and pharmacokinetic considerations. Use of DDDs allows comparisons of medicine dispensing independent of differences in price, preparation and quality per prescription. Expressing medicine dispensing in DDDs per thousand people per day (DDDs/1,000/day) allows the aggregation of data for medicines that have differing daily doses.
episode coning	An MBS funding arrangement that applies to GPs outside hospital requesting of multiple tests for the same patient on the same day. If more than three items are requested by a GP per patient attendance, benefits are paid only for the three items with the highest fees. The arrangement means that if a test is requested with three other more expensive tests, it is 'coned out' and may not be included in the MBS dataset.
episode of care	A period of care in a hospital. This 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 in type of care (for example, from acute care to rehabilitation).
health literacy	The Commission separates health literacy into two components: individual health literacy and the health literacy environment. Individual health literacy is the skills, knowledge, motivation and capacity of a person to access, understand, appraise and apply information to make effective decisions about health and health care, and take appropriate action. The health literacy environment is the infrastructure, policies, processes, materials, people and relationships that make up the health system, and affect the way in which people access, understand, appraise and apply health-related information and services. It reflects the demands and complexity of the health system and society at large.
HealthPathways	An online manual used by clinicians to help make assessment, management and specialist request decisions. Rather than being traditional guidelines, each pathway is an agreement between primary and specialist services on how patients with particular conditions will be managed in the local context.
health services	Services delivering health care, including general practices, community health centres, medical specialists, nursing services, allied health services, public and private hospitals, day procedure services, Aboriginal Community Controlled Health Services, community nursing and Hospital in the Home.
hospital	All public and private acute and psychiatric hospitals, freestanding day hospital facilities, and alcohol and drug treatment centres. Includes hospitals specialising in dentistry, ophthalmology, and other acute medical or surgical care. May also include hospitals run by the Australian Defence Force and correctional authorities, and those in Australia's offshore territories. Excludes outpatient clinics and emergency departments.
hospital admission	The administrative process of becoming a patient in a hospital.
Local Hospital Network	States and territories each have different descriptions of the governance structure providing health services. These include local health networks, Local Hospital Networks, local health districts, boards and area health services. Where the term 'Local Hospital Network' is used, it refers to the description of any of these terms as relevant to states and territories (see http://meteor.aihw.gov.au/content/index.phtml/itemId/491016).

Medicare Benefits Schedule (MBS)	A listing of the Medicare services subsidised by the Australian Government.
My Health Record	A secure online summary of an individual's health information. Individuals can control what goes into it, and who is allowed to access it. They can choose to share their health information with doctors, hospitals and other healthcare providers.
National Hospital Morbidity Database (NHMD)	The AIHW National Hospital Morbidity Database (NHMD) is a compilation of episode-level records from admitted patient morbidity data collection systems in Australian hospitals. The database collects information about care provided to admitted patients in all public and private acute and psychiatric hospitals, freestanding day hospital facilities, and alcohol and drug treatment centres in Australia. Hospitals operated by the Australian Defence Force and correctional authorities, and hospitals in Australia's offshore territories are not in scope but may be included. More information is available in the Technical Supplement.
National Perinatal Data Collection (NPDC)	The AIHW National Perinatal Data Collection (NPDC) is a national collection of data on pregnancy and childbirth. The data are based on births reported to the perinatal data collection in each state and territory in Australia. A standard de-identified extract is provided to the AIHW each year to form the NPDC. More information is available in the Technical Supplement.
National Safety and Quality Health Service (NSQHS) Standards	Evidence-based standards that address the major safety and quality issues that affect a large number of patients in areas where there is variation and it is known that practices can be improved. The primary aims of the NSQHS Standards are to protect the public from harm and to improve the quality of health care. They were developed by the Commission in collaboration with states and territories, technical experts, clinicians, patients and carers, and a range of other stakeholders. The NSQHS Standards (first edition) were released in 2011, and the second edition was released in 2017.
Pharmaceutical Benefits Scheme (PBS)	An Australian Government program that subsidises medicines.
pharmaceutical treatment (or medicine)	A chemical substance given with the intention of preventing, curing, controlling or alleviating disease, or otherwise improving the physical or mental welfare of people. Includes prescription, non-prescription and complementary medicines, regardless of administration route (for example, oral, intravenous, intra-articular, transdermal or intra-uterine).
population	The Atlas uses population estimates based on the ABS estimated resident population at 30 June of a reporting year, based on the 2011 and 2016 Census of Population and Housing. The population of Aboriginal and Torres Strait Islander Australians was a projected population based on the Aboriginal and Torres Strait Islander population from the 2011 Census.
primary care	Relates to the treatment of non-admitted patients in the community. It is usually the first point of contact people have with the health system.
Primary Health Network	Primary Health Networks connect health services across local communities so that patients, particularly those needing coordinated care, have the best access to a range of healthcare providers, including practitioners, community health services and hospitals. They work directly with general practitioners, other primary care providers, secondary care providers and hospitals. Primary Health Networks began to operate on 1 July 2015 to replace Medicare Locals.
principal diagnosis	The diagnosis established after study to be chiefly responsible for occasioning an episode of admitted patient care, an episode of residential care or an attendance at the health care establishment, as represented by a code.

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regulation 24 prescription	A PBS prescription that, in certain circumstances, allows a pharmacy to supply all repeats simultaneously.
remoteness categories	Categories of geographical remoteness are based on the ABS Australian Statistical Geography Standard (ASGS) 2016. The ABS ASGS 2016 remoteness categories divide Australia into broad geographic regions that share common characteristics of remoteness for statistical purposes. More information is available in the Technical Supplement.
same-day hospitalisation	Occurs when a patient is admitted and separated from hospital on the same date.
secondary care	Health care for patients referred from primary health care (for example, by general practitioners). Includes care provided by hospitals and medical specialists.
separation	An 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 in type of care (for example, from acute care to rehabilitation). In the Atlas, a separation is referred to as a hospitalisation.
socioeconomic disadvantage	Local areas are grouped into socioeconomic quintiles based on the 2016 Index of Relative Socio-Economic Disadvantage (IRSD) at the Statistical Area Level 1 (SA1) level. The IRSD is derived from census variables relating to disadvantage, such as low income, low educational attainment, unemployment and dwellings without motor vehicles. Information from the ABS Socio-Economic Indexes for Areas (SEIFA) and the IRSD was used to calculate the socioeconomic status at the SA3 level in the Atlas. SEIFA includes four summary measures created from 2016 Census information. The indexes can be used to explore different aspects of socioeconomic conditions by geographic areas. For each index, every geographic area in Australia is given a SEIFA number that shows how disadvantaged that area is compared with other areas. Each index summarises a different aspect of the socioeconomic conditions of people living in an area. For example, they provide more general measures of socioeconomic status than are given by measuring income or unemployment alone.
Statistical Area Level 3 (SA3)	A geographical area built from a whole SA2 and designed for the output of regional data, including 2016 Census data. As defined in the ABS Australian Statistical Geography Standard 2016, SA3 geography incorporates the territories of Jervis Bay, Cocos (Keeling) Islands, Christmas Island and Norfolk Island. The aim of SA3s is to create a standard framework for analysing ABS data at the regional level through clustering groups of SA2s that have similar regional characteristics. There are 340 spatial SA3s, covering the whole of Australia without gaps or overlaps. SA3s usually have a population of between 30,000 and 130,000 people. At 30 June 2016, a number of SA3s had populations below 30,000 and above 130,000. In the major cities, SA3s represent areas serviced by major transport and commercial hubs. They often closely align with large urban local government areas (for example, Gladstone, Geelong). In regional areas, they represent areas serviced by cities with populations of more than 20,000 people, or clusters of related suburbs around urban commercial and transport hubs within the major urban areas. In outer regional and remote areas, SA3s represent areas that are widely recognised as having a distinct identity, and similar social and economic characteristics. A small number of SA3s are termed ‘zero SA3s’. These have an effective design population of small numbers and represent very large national parks close to the outskirts of major cities.
telehealth	Health services delivered using information and communication technologies, such as videoconferencing.

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