AUSTRALIAN COMMISSION
ON SAFETY AND QUALITY IN HEALTH CARE

Australian Government
Australian Institute of
Health and Welfare

Exploring Healthcare Variation in Australia:

Analyses Resulting from an OECD Study

The Australian Commission on Safety and Quality in Health Care (the Commission) coordinated Australia's participation in this Organisation for Economic Cooperation and Development (OECD) study, with support from all states, territories and the Commonwealth and technical input by the Australian Institute of Health and Welfare.

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Preface

By world standards Australia has an excellent healthcare system staffed by highly qualified, dedicated and hard-working people. Yet Australians with the same health conditions, concerns or problems do not necessarily receive the same health care. Depending on where they live, or which health service or health professional they consult, these patients may be managed differently.

This is referred to as healthcare variation. For example, among a group of patients with the same condition some may have no active treatment; some may be treated in the community and others in a hospital; some may have surgery, while others may receive medication.

Why does variation matter?

Some variation in how health care is provided is desirable because of differences in health status of populations, preferences of individual patients and groups, or because of innovation and to improve practice.

However, variation that is unrelated to patients' needs or preferences – termed *unwarranted variation* – has also been observed. Professor John Wennberg, who founded the pioneering Dartmouth Atlas of Health Care and has championed research into variation for decades, noted that "much of the variation … is accounted for by the willingness and ability of doctors to offer treatment rather than differences in illness or patient preference".[1]

Unwarranted variation raises questions about quality, equity and efficiency in health care. For instance, it may mean some people have less access to health care compared with others. It may suggest that factors other than patients' needs or preferences are driving treatment decisions. It may indicate that some people are having unnecessary and potentially harmful tests or treatments, while others are missing out on necessary interventions.

Unwarranted variation may also mean that scarce health resources are not being put to best use. As countries face increasing pressure on health budgets, there is growing interest in reducing unwarranted variation in order to improve equity of access to appropriate services, the health outcomes of populations, and the value derived from investment in health care.

Determining if variation is indeed unwarranted can be challenging, particularly without routine information on patient needs and preferences. Information on the outcomes of treatment is also critical.

About this paper

The overall aim of examining variation is to improve the quality and appropriateness of health care, and generate the most value for patients and the community. Awareness is an important first step in identifying and addressing unwarranted variation; if the existence of variation is unknown, the discussion and investigation of whether it is unwarranted cannot commence.[2(p15)]

This paper aims to stimulate a national discussion on healthcare variation, particularly how to determine which variation is unwarranted and how any unwarranted variation can be reduced. It is also a starting point for more detailed work aimed at identifying unwarranted practice variation in a range of condition, treatment and population groups.

In 2012 the Organisation for Economic Cooperation and Development (OECD) undertook an international study of healthcare variation involving a number of countries. The admission types and interventions selected from the OECD list for examination in Australia were:

1. Overnight medical admissions
2. Admissions for hip fracture (for calibration purposes)[a]
3. Orthopaedic care
   a. Knee replacement
   b. Knee arthroscopy
4. Obstetric and gynaecological care
   a. Caesarean section
   b. Hysterectomy
5. Cardiac care
   a. Cardiac catheterisation
   b. Coronary artery bypass graft (CABG)
   c. Percutaneous coronary interventions (PCI): angioplasty and stenting

The Australian Commission on Safety and Quality in Health Care (the Commission), coordinated Australia's participation in this study, with support from all states, territories and the Commonwealth, and technical input by the Australian Institute of Health and Welfare (AIHW). The final report on this international study will be published by the OECD in 2014. This paper presents a more detailed picture of the Australian results and includes some additional analysis of cardiac care data, and data for hysterectomy (excluding admissions with any cancer diagnosis). Australia's data on overnight medical admissions are not included here.

Results are provided as age and sex standardised admission rates, and are for the year 2010–11. Results are grouped by Medicare Local of patient residence (i.e. based on where a patient lived in 2010–11, as opposed to where they received treatment).[b] While the clinical activities examined here are generally undertaken in hospital settings, the chain of events leading to the intervention are often initiated by a referral from the primary care sector. The consultation between patient and primary care provider is therefore a key point for discussion of treatment options including treatment alternatives.

This set of analyses uses Medicare Local of patient residence to explore patterns of variation within Australia. However, the approach can be used to explore variation across any specified geographical boundaries.

a Admission for hip fracture was selected by the OECD as a way to calibrate results because discretionary factors relating to patient preference, clinician practice or health service organisation are unlikely to influence admission rates as much as for the other, more discretionary interventions in the study.

b More information about Medicare Locals is provided in Part B and in Appendix 3.

How you can contribute

This paper forms a key part of the Commission's efforts to assist health services and jurisdictions to continue to improve the quality and appropriateness of care, and builds on the AIHW's reporting of aspects of healthcare variation over many years.[3 4 5]

Feedback and comment on this paper will enable the Commission to build on the preliminary work presented here. This will include investigating variation in a broader range of clinical topic areas. The Commission will work with consumers, clinicians, jurisdictions and health services to develop a suite of programs, resources and tools.

Please use the following questions to guide your response.

Consultation questions

1. What is your position/role and your area of interest or expertise? (e.g. consumer, clinician, cardiology, policy)
2. Is the information provided on the selected interventions in this paper useful in helping to identify variation? What further information or analysis is needed to identify potentially unwarranted variation?
3. Is the presentation of the information, the tables and graphs, useful? How could the presentation be improved?
4. How should geographic groupings of patient residence be made in future – which units of analysis would be most helpful to explore healthcare variation in future?
5. What can the Commonwealth, state and territory governments, private healthcare providers, primary and community health care providers and Local Hospital Networks do to reduce unwarranted variation?
6. What role can clinicians and clinician organisations play to reduce unwarranted variation?
7. What role can consumer organisations play to reduce unwarranted variation?
8. Are you aware of any local activity to identify and reduce unwarranted healthcare variation?
9. Production of a national Atlas of Variation is planned for 2014–15. Which groups and organisations should be involved?
10. What areas or themes (conditions, treatments, interventions,) should be explored for the atlas? What specific aspects or activity in these areas should be explored?

You can provide your comments and feedback by email or post by **20 July 2014**.

Email: **medicalpracticevariation@safetyandquality.gov.au**

Post: Healthcare variation, GPO BOX 5480, Sydney NSW 2001

Part A: Introduction

Healthcare variation

Variation in how health care is provided to, and utilised by, population groups or regions has been documented since the 1930s.[6-8] It has been demonstrated at a clinician level (between healthcare providers), at the service level (between different health services) and at a geographic level (between regions and countries).[9 10]

The persistence of healthcare variation is driven by a range of complex and interacting factors. Some variation is warranted, and reflects differences in population need, and cultural or patient preferences. In some circumstances variation reflects innovation in practice and delivery of care.

However, much variation is unwarranted, and is not based on the needs or preferences of patients and populations. This means that some patients are having unnecessary or potentially harmful care, while others are missing out on care that may be helpful.

There are three key challenges:

- To distinguish between variation that is warranted and that which is unwarranted (this leads to questions regarding the outcomes and the value of health care).
- To routinely collect information on patient outcomes. While outcomes may be investigated in medical trials, this generally ceases once procedures become routine and extended to populations that may have different health profiles to those for whom the procedure was originally trialled.[c]
- To routinely collect information on, and respect patient preferences in the decision to use medical care.[11]

c See Part H, Other responses and future work (page 65) for further discussion on outcomes of care.

The history of variation: tonsillectomies in children

In 1938, a Scottish doctor, J. Alison Glover, published a landmark paper documenting and investigating large variation in the rate of tonsillectomies among children.[6]

Dr Glover, the son of a doctor, wrote that when he had been a schoolboy in the late 1800s, he could not recall a single boy who had undergone the operation at either of the two schools he had attended. His paper traced how the operation became so popular that, by the late 1930s, about half of the boys at both of his old schools had had their tonsils removed.

Dr Glover's research showed unexplained large variation in the operation's use (boys and wealthier children were more likely to have it), and he questioned its presumed benefits. He suggested that the risk of children dying from the operation was higher than was commonly appreciated, and was especially a concern for children returning to poor living conditions after surgery.

Differences in the uptake of the operation defied any explanation. He wrote, "save that of variations of medical opinion on the indications for operation". He said: "One cannot avoid the conclusion that there is a tendency for the operation to be performed as a routine prophylactic ritual for no particular reason and with no particular result."

In recognition of his pioneering work, the term "the Glover Phenomenon" was coined in the late 1940s to describe variation in the delivery of medical services that cannot be explained by patient need. While tonsillectomies are no longer as common as in Glover's day, studies continue to show considerable variation in their use.[12]

Such variation may be more likely where there is uncertainty about the merits of an intervention, allowing more room for the varying opinions of doctors and surgeons to influence practice.

What drives variation in health care?

Variation in health care is related to differences in patients' needs for health care, in demand and in supply. Demand and supply factors may reflect national culture, healthcare education, and organisational structures, as well as beliefs and traditions.

Need-related factors include the wide-ranging determinants of population health, burden of disease, demographics, socioeconomic status, and environmental issues.

Demand-related factors are more subjective. They are influenced by culture and education, by beliefs and by affordability of health care. Demand is also influenced by the information available to patients.

Supply-related and **health system** factors include distribution and accessibility of services, clinical decision making and referral patterns, and payment and remuneration structures. For instance, in the United States, regions where medical procedures are performed in centres owned by physicians have intervention rates that are twice as high as those performed in centres where physicians have no direct financial interest.[13 14]

Variation may also be driven by chance (**random variation**), or simply reflect **data** inaccuracies such as incorrect coverage, coding or data processing errors.

A framework for considering variation which incorporates the following three categories has been suggested.[15]

- There should be little variation when care is demonstrably **effective**; backed by strong scientific evidence of efficacy, of proven value, with no significant tradeoffs, and where the benefits of the intervention so far outweigh the risks that almost all patients with specific medical conditions should receive them. (An example is prescribing beta-blockers for heart attack patients.) However, even when there are evidence-based guidelines, clinicians may vary in their attitudes and practices about the recommendations, and there is evidence that underuse of effective care is widespread.[16]
- When care is **preference-sensitive**, for example, when competing treatment options have different risks and benefits that individual patients may evaluate differently, variation may reflect differences in patient or clinician preferences, cost or affordability.
- Variation in care may also be **supply-sensitive**. The more resources, equipment and workforce that are available, the more they will be used. Often there is no evidence that this leads to better outcomes than in areas where less intervention occurs. For example, rates of cholecystectomy in the United States and the United Kingdom increased considerably following the introduction of laparoscopic (keyhole) surgery in the 1990s, without new evidence to suggest that more operations were needed.[17] Correlation between hospital bed supply or access to care, and admission rates have been observed internationally.[18-20]

One of the limitations of this framework is the practical difficulty in identifying patient preferences. Moreover, patient preferences are often influenced by medical opinion, which blurs the distinction between preference-sensitive and supply-sensitive care.[17]

Medical practice continues to be characterised by a great deal of uncertainty concerning the potential benefits and risks of different diagnostic tests and treatment options for any given patient. Uncertainty may contribute to variation in health care, and is neatly captured by David Eddy:

> "Uncertainty creeps into medical practice through every pore. Whether a physician is defining a disease, making a diagnosis, selecting a procedure, observing outcomes, assessing probabilities, assigning preferences, or putting it all together, [they are] walking on very slippery terrain. It is difficult for nonphysicians, and for many physicians, to appreciate how complex these tasks are, how poorly we understand them, and how easy it is for honest people to come to different conclusions."[21(p75)]

Another, similar, framework categorises medical interventions according to the health benefit they bring to the patient as follows.[22]

- **Effective care** includes procedures/activities where there is strong evidence of effectiveness or cost-effectiveness. There is consensus about the conditions for which they should be used and the desirable rate of the intervention or activity corresponds to the prevalence of the relevant conditions in a population.
- Care with **uncertain benefit** includes healthcare activities where effectiveness or cost-effectiveness has been demonstrated for a sub-group of patients, but where there are uncertain risks and benefits for other patient groups. Although "appropriate rates" of these activities are by essence difficult to define, very high or low rates may help flag areas needing further investigations.
- **Lower-value care** includes healthcare activities where effectiveness has not been convincingly demonstrated.

As Canadian health economist Bob Evans has noted, uncertainty at a group level does not necessarily mean that individual practitioners are uncertain. Individual doctors may feel sure of the correctness of their recommended treatment even though each makes different decisions based on their experience, knowledge and interpretation of the evidence.[23]

For these reasons, studies of geographic variation such as the one presented in this paper should be seen more as prompts for further investigation rather than as providing unequivocal evidence for medical provider preference.

Australian and international examples of examining variation

For many years, Australia has been reporting on healthcare variation, particularly within the hospital setting, for both performance and statistical purposes. In 1996, admission rates for selected procedures was a performance indicator reported by state and territory in the *First national report on health sector performance indicators*.[24] Australian Health Ministers agreed that a similar measure be reported regularly in *Australia's Health* as an indicator of health system performance under the National Health Performance Framework).[4] The National Health Performance Authority, established in 2011, also reports on variation in waiting times for cancer surgery by public hospitals and potentially preventable hospitalisations by Medicare Local.

In addition, data on variation in rates of selected procedures have been reported for many years in *Australian Hospital Statistics* by state and territory, socioeconomic status and remoteness),[5] and several specific projects measuring variation have been undertaken. For example, in 1991 the AIHW reported on variations in surgery rates.[3] An examination of hysterectomy rates for two states by local government area was undertaken in 1999 using 1995–1996 data.[25]

The most detailed reporting on healthcare variations at state level has been in New South Wales (where just under one-third of Australia's population reside). A NSW Health Care Atlas produced in 2010 analysed practice pattern variation using public and private hospital data, analysed on a population basis by Area Health Service (AHS) of residence, for the period 1 July 2005 to 30 June 2008. Substantial variation in preference sensitive surgery rates, chronic medical admission rates and readmission rates were found throughout New South Wales.

The Dartmouth Health Atlas (**www.dartmouthatlas.org**) assembles data on many aspects of health care across small geographical areas in the United States.

The Atlas of Healthcare Variation (**www.hqsc.govt.nz/our-programmes/health-quality-evaluation/projects/atlas-of-healthcare-variation/**) is produced by the Health Quality and Safety Commission New Zealand to prompt debate and raise questions about health service use and provision amongst clinicians, users and providers of health services about why any differences exist, and to stimulate improvement through this debate.

The NHS Atlas of Variation series (**www.rightcare.nhs.uk/index.php/nhs-atlas**) aims to support local decision making to increase the value that a population receives from the resources spent on their health care. Following publications in 2010 and 2011, a series of themed atlases has been produced focusing on specific conditions or populations in more depth (including children and young people, diabetes, kidney disease, and diagnostic testing).

Part B: How to interpret this information

This report uses hospital admission data, sourced from the National Hospital Morbidity Database, analysed by the Medicare Local of the patient's residence. While this particular set of analyses use Medicare Local of patient residence to explore patterns of variation within Australia, the approach can be used to explore variation across any specified geographical boundaries.

Data for each of the interventions measured is selected based on the procedure undertaken in a hospital admission. Data for hip fractures (used for calibration purposes) is based on the principal diagnoses recorded for a patient's hospital admission. Data represent a count of admissions with at least one procedure listed for that intervention, not a count of all procedures in the list. That is, if there is admission in which two hip replacements are made, it will be counted as one admission. See Appendix 3 for further information.

Analysis by Medicare Local and peer group

Medicare Locals were chosen as the geographic unit of analysis because the chain of events leading to the intervention in hospital are often initiated by a referral from the primary care sector. The consultation between patient and primary care provider is therefore a key point for discussion of treatment options including treatment alternatives. The 61 Australian Medicare Locals were established in 2012. A map is provided in Figure 1.

Medicare Locals vary considerably in population size (40,000 to 800,000), demographics, health and socioeconomic status, geographic area and remoteness. Variation between Medicare Locals in terms of affordability, availability and accessibility of primary and acute care has also been documented.[26]

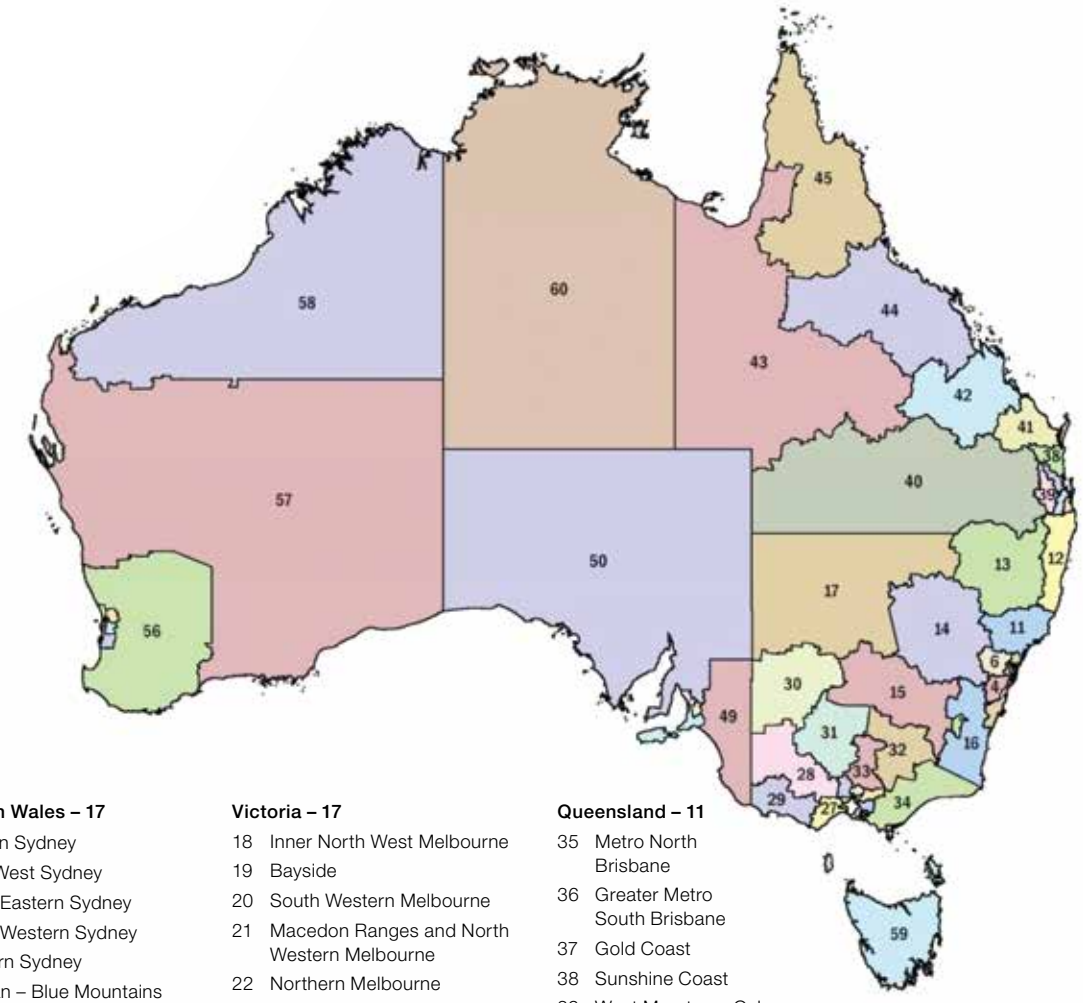
In a recent analysis of the performance of primary healthcare organisations, the National Health Performance Authority identified seven clusters of Medicare Locals (called peer groups) to enable more comparable reporting. The peer groups were established based on three criteria: (a) proximity of each Medicare Local to major metropolitan cities; (b) proximity to major hospitals; and (c) socioeconomic status.

This grouping enables fairer comparisons of Medicare Locals and also allows summary comparisons between peer groups to be made. The seven peer groups and their respective Medicare Locals are presented on page 10 (refer to Figure 1 for geographic locations). These peer groups are used to present data throughout this paper.

Table 1 Medicare Locals by peer group with identification number

1. Metro 1	No.		No.
Eastern Sydney	1	Inner North West Melbourne	18
Inner West Sydney	2	Bayside	19
Northern Sydney	7	Inner East Melbourne	23
Sydney North Shore and Beaches	8	Australian Capital Territory	61
2. Metro 2			
South Eastern Sydney	3	Central Adelaide and Hills	47
South Western Melbourne	20	Southern Adelaide-Fleurieu-Kangaroo Island	48
Eastern Melbourne	24	Perth Central and East Metro	51
Metro North Brisbane	35	Perth North Metro	52
Greater Metro South Brisbane	36	Fremantle	53
Gold Coast	37	Bentley-Armadale	54
3. Metro 3			
South Western Sydney	4	South Eastern Melbourne	25
Western Sydney	5	West Moreton-Oxley	39
Macedon Ranges and North Western Melbourne	21	Northern Adelaide	46
Northern Melbourne	22	–	
4. Regional 1			
Nepean-Blue Mountains	6	Frankston-Mornington Peninsula	26
Central Coast NSW	9	Barwon	27
Illawarra-Shoalhaven	10	Sunshine Coast	38
Hunter	11	Perth South Coastal	55
5. Regional 2			
North Coast NSW	12	Goulburn Valley	32
New England	13	Hume	33
Western NSW	14	Gippsland	34
Murrumbidgee	15	Darling Downs-South West Queensland	40
Southern NSW	16	Wide Bay	41
Grampians	28	Country South SA	49
Great South Coast	29	South West WA	56
Loddon-Mallee-Murray	31	Tasmania	59
6. Rural 1			
Far West NSW	17	Townsville-Mackay	44
Lower Murray	30	Country North SA	50
Central Queensland	42	–	
7. Rural 2			
Central and North West Queensland	43	Kimberley-Pilbara	58
Far North Queensland	45	Northern Territory	60
Goldfields-Midwest	57	–	

Figure 1 Map of Medicare Locals



New South Wales – 17

1 Eastern Sydney
2 Inner West Sydney
3 South Eastern Sydney
4 South Western Sydney
5 Western Sydney
6 Nepean – Blue Mountains
7 Northern Sydney
8 Sydney North Shore and beaches
9 Central Coast NSW
10 Illawarra – Shoalhaven
11 Hunter
12 North Coast NSW
13 New England
14 Western NSW
15 Murrumbidgee
16 Southern NSW
17 Far West NSW

Northern Territory – 1

60 Northern Territory

Australian Capital Territory – 1

61 Australian Capital Territory

Victoria – 17

18 Inner North West Melbourne
19 Bayside
20 South Western Melbourne
21 Macedon Ranges and North Western Melbourne
22 Northern Melbourne
23 Inner East Melbourne
24 Eastern Melbourne
25 South Eastern Melbourne
26 Frankston – Mornington Peninsula
27 Barwon
28 Grampians
29 Great South Coast
30 Lower Murray
31 Loddon – Mallee – Murray
32 Hume
33 Goulburn Valley
34 Gippsland

South Australia – 5

46 Northern Adelaide
47 Central Adelaide and Hills
48 Southern Adelaide – Fleurieu – Kangaroo Island
49 Country South
50 Country North

Queensland – 11

35 Metro North Brisbane
36 Greater Metro South Brisbane
37 Gold Coast
38 Sunshine Coast
39 West Moreton – Oxley
40 Darling Downs – South West QLD
41 Wide Bay
42 Central Queensland
43 Central and North West QLD
44 Townsville – Mackay
45 Far North QLD

Western Australia – 8

51 Perth Central East Metro
52 Perth North metro
53 Fremantle
54 Bentley – Armadale
55 Perth South Coastal
56 South West WA
57 Goldfields – Midwest
58 Kimberley – Pilbara

Tasmania – 1

59 Tasmania

Source: Medicare Local Boundaries Review. DoHA, 2013.

Presentation of data

The populations of Medicare Locals differ both in size and structure, for example, they contain different proportions of men and women of various ages. The total number of interventions will be affected by the population structure – if a particular intervention is more common in men over 75 years of age, and one Medicare local has a larger proportion of men over 75 than is usually the case, that Medicare Local might appear to be doing an excess number of procedures, when it is in fact only doing them at the same rate as other Medicare Locals, but it happens to have more men over 75 within it.

If populations are to be compared, there has to be some way of smoothing out population differences, to enable fair comparisons. This can be done by way of age and sex standardisation.

The following measures are used in this paper.

- **Age and sex standardised rates:** Age and sex directly standardised rates were calculated for all data[d] using the 30 June 2001 Australian population as the standard population. The formula used to calculate age and sex standardised rates is provided in Appendix 3.

- **Systematic component of variation (SCV):** SCVs are calculated using the number of observed admissions relative to the number that is expected in a Medicare Local, based on the age and sex specific rates observed for the whole population (all Medicare Locals combined). The SCV increases as the average difference between the observed number and the expected number of admissions in a Medicare Local increases. The formula used to calculate the SCV is provided in the Appendix 3.

  In the calculation of the SCV, a mathematical modelling process is used to adjust for the fact that random variation will be more important as a factor influencing variation when populations are small rather than large. All measurement processes are subject to random variation; small differences in day-by-day factors will influence whether at any one moment, a specific patient undergoes a specific procedure. Those small differences are inevitable. But the impact of day-to-day differences will be magnified within small populations. The SCV deals with this issue by using a mathematical modelling technique to even out the predictable variation due to differences between population size.

  Though the method of generation is more complex than many other measures of variation, the SCV is considered more robust than other measures of variation, because the noise generated when populations of varying sizes are compared, is modelled out, allowing fairer comparisons of the rates of the specific interventions of interest.[17]

  A higher component reflects greater variation in the data between Medicare Locals due to factors other than different age and sex structures. Generally, SCVs greater than five are regarded as indicative of high variation, and SCVs greater than 10 as indicative of very high variation.[9]

Results are presented graphically in the following ways.

- **Maps:** For each intervention and diagnosis, age and sex standardised rates in each of the 61 Medicare Locals were ranked from lowest to highest and then split into five equal groups, with the Lowest category representing those Medicare Locals with the lowest rates and the Highest category representing those Medicare Locals with the highest rates.

  Separate maps are produced to display Medicare Locals within greater metropolitan areas that are not clearly visible in the Australia map. The display of metropolitan areas has been based on the peer groupings used by Australia's National Health Performance Authority.[26]

- **Caterpillar graphs:** These graphs show the variation by Medicare Local for each intervention or diagnosis. Medicare Locals are arranged by peer group. Within each peer group, Medicare Locals are ordered, or 'positioned', from lowest to highest age and sex standardised rate. The age and sex standardized rate for each peer group is indicated by a black line. A set of more detailed plots identifying each Medicare Local are also provided for each intervention and condition.
- **Bar graphs:** Bar graphs show age and sex standardised admission rates for an intervention or diagnosis by hospital sector for each Medicare Local. Medicare Locals are ordered from highest to lowest admission rate.

d Caesarean section and hysterectomy data are age standardised only.

Analysis by hospital sector

In Australia, hospital services are provided by both public and private hospitals. Analysis in this report was undertaken for all hospital separations and by hospital sector. Public hospital data include care and/or treatment of a patient in a public hospital (including public and private patients) and private data include any care and/or treatment in a private hospital (including public and private patients).

With the exception of caesarean section, all rates (for public hospitals, private hospitals and total) by Medicare Local have been calculated with the Medicare Local population as the denominator. This is because the focus of the report is variation in practice among Medicare Locals, measured as the number of hospital separations or procedures per 1,000 population (age standardised).

For caesarean section, a count of live births is used as the denominator for all rates (public hospitals, private hospitals and total). This count is based on the total number of hospital (public and private) birth episodes of mothers living in each Medicare Local, which included at least one live birth. The number of births is used as the denominator for caesarean sections as this effectively adjusts for the variation in the number of births per 1,000 population among Medicare Locals. That is, the variation in caesarean section rates shown for Medicare Locals is due to factors other than variation in birth rates.

In tables and graphs, rates are presented for public and private hospitals combined, and separately for public hospitals and for private hospitals. The rates for public and private hospitals (separately) are calculated using the same denominator as for public and private hospitals combined. This is because the intent of this analysis is to illustrate the extent to which each sector contributes to the overall variation, rather than to describe the variation within each sector.

Hence the total age and sex standardised rate published in tables or graphs represent the sum of the public and private hospital components.

Limitations of data and method: summary

There are several limitations of the data and methods used to generate the results presented in this paper. This section provides a summary, with more detail presented in Appendix 3.

- The data presented in this report were collected prior to the establishment of Medicare Locals in Australia.
- The results describe variation in procedures and activities across Medicare Locals. It is not possible to conclude what proportion of this variation is unwarranted, or comment on the relative performance of one Medicare Local compared to another.
- Hospital data presented in this report do not include episodes of non-admitted care provided in outpatient clinics. As there is no standardised admissions policy across states and territories, analysis of variation across Medicare Locals for some procedures should take into account possible differences in admission practice and policies among providers and/or states and territories. For example, procedures such as knee arthroscopy or cardiac catheterisation can be provided as either non-admitted or admitted care.
- Some data have been suppressed to protect confidentiality where the presentation could identify a patient, or where rates are likely to be highly volatile, for example, when the denominator is very small.
- Because of the nature of the mapping used, the Medicare Local data for some individual records may not be accurate, however the overall distribution of the data by Medicare Local is considered useful for the purposes of these analyses.

Part C: Overview of variation for the specified conditions and interventions

Admission rates for hip fracture and selected interventions were analysed by Medicare Local of patient residence for the year 2010–11. This section summarises the key findings of the analysis.

Variation between Medicare Locals was evident across all interventions and conditions. The amount of variation, expressed by the 'fold-difference' or ratio of the highest to lowest admission rate, was smallest for caesarean sections (a 1.6-fold variation) and largest for cardiac catheterisation (a 7.4-fold variation) (Table 2).

The systematic component of variation (SCV) was highest for cardiac catheterisation (SCV of 12.6) and lowest for caesarean section (SCV of 1.0) (Figure 2).

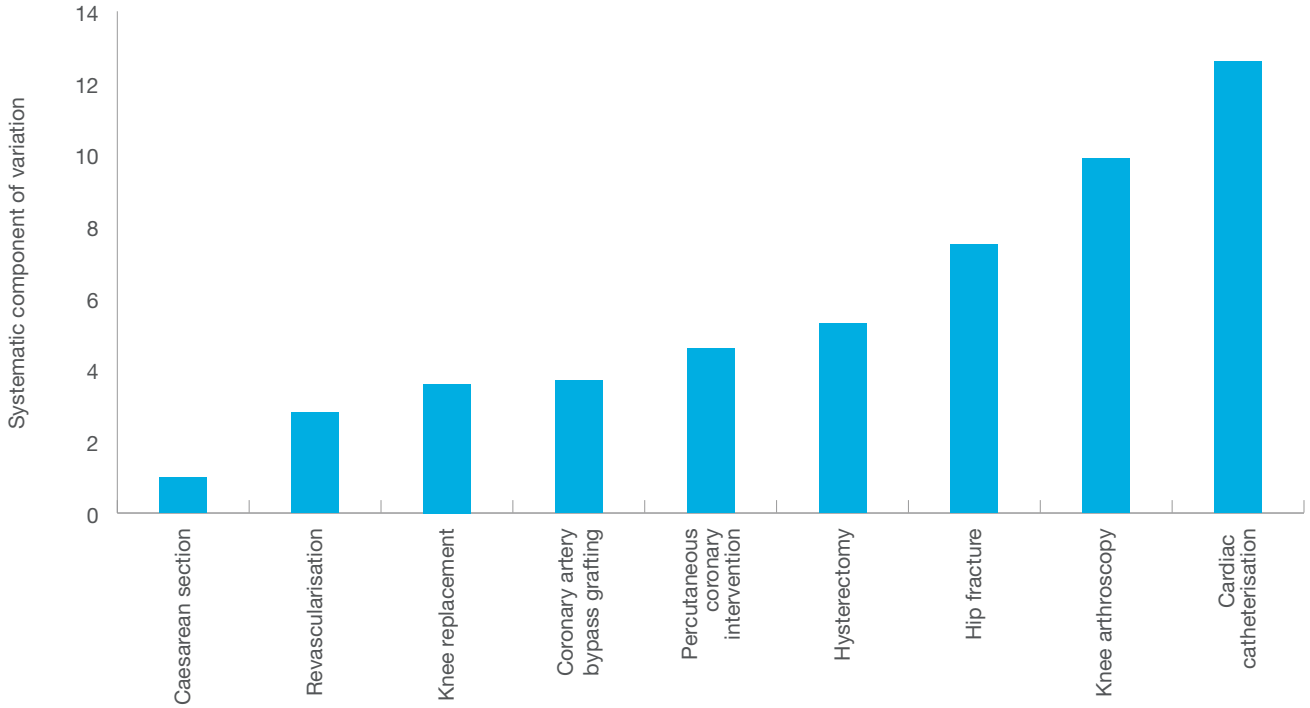
Table 2 Summary measures of variation among Medicare Locals, 2010–11

	National age and sex standardised rate (ASR)[a]	Lowest Medicare Local ASR	Highest Medicare Local ASR	Fold difference[b]	SCV
Hip fracture (for calibration purposes)	102	50	253	5.1*	7.5
Orthopaedic care					
Knee replacement	221	140	330	2.4	3.6
Knee arthroscopy	382	232	726	3.1	9.9
Obstetric and gynaecological care					
Caesarean section	313	243	392	1.6	1.0
Hysterectomy (without any diagnosis of cancer)	2.8	1.7	5.2	3.1	5.3
Cardiac care					
Cardiac catheterisation	596	210	1,551	7.4*	12.6
Percutaneous coronary intervention	214	135	393	2.9	4.6
Coronary artery bypass grafting	69	32	105	3.3	3.7
Coronary artery bypass grafting and/or percutaneous coronary intervention	280	203	447	2.2	2.8

a Data are age standardised for caesarean section and hysterectomy (without any diagnosis of cancer).

b Ratio of highest to lowest ASR.

* Removal of outliers reduces the fold difference to 2.7 for hip fracture and 5.1 for cardiac catheterisation.



Note: Refer to Section B for further information on the calculation and interpretation of the SCV.

Figure 2 Systematic component of variation by types of admissions presented, 2010–11

Results do not show any other consistent patterns between factors such as by state or territory, or remoteness.

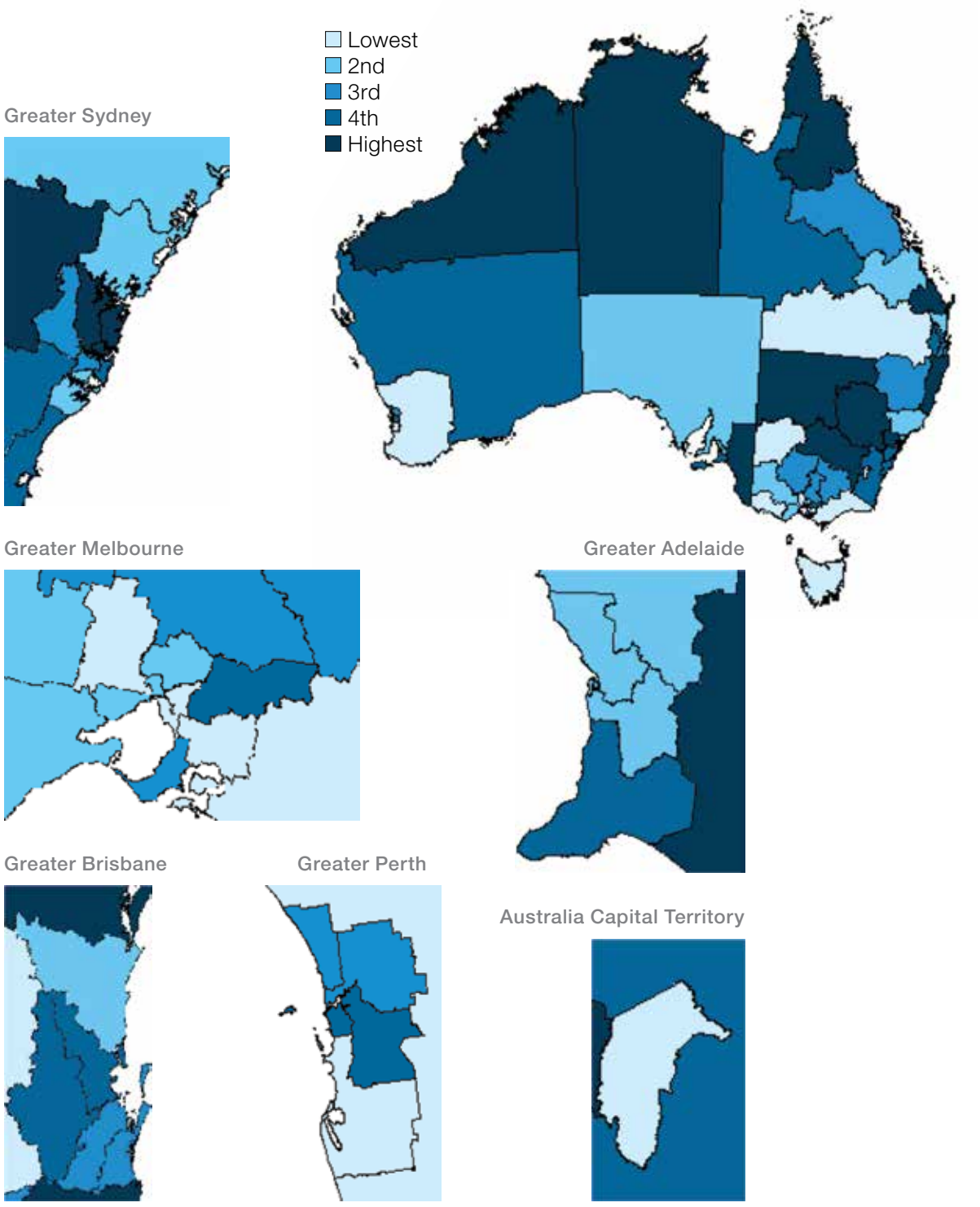
Sixty-seven per cent of admissions for knee replacement, and 81 per cent of admissions for knee arthroscopy occurred in the private sector. Variation for these procedures between Medicare Locals was higher in public hospitals (7-fold for knee replacement and 11-fold for arthroscopy) than in the private sector (3-fold difference for both procedures).

The majority (55 per cent) of admissions for cardiac catheterisation (a procedure used to diagnose heart conditions including coronary heart disease) took place in the private sector. The reverse was observed for revascularisation interventions performed to address coronary heart disease; approximately 60 per cent of admissions for coronary artery bypass grafting, and 55 per cent for coronary angioplasty and stenting took place in public hospitals.

Procedures undertaken in the outpatient setting are not captured by these data, and may affect rates observed for knee arthroscopy and cardiac catheterisation, procedures which can occur in both admitted and non-admitted care.

Part D: Admissions for hip fracture

Map 1 Admissions for hip fracture



Note: The five groups are based on age and sex standardised rates. The range within each group is as follows: Lowest (50.0–93.9); 2nd (94.0–101.0); 3rd (101.1–105.9); 4th (106.0–113.5); Highest (113.6–253.0).

Source: AIHW analysis of National Hospital Morbidity Database.

Map 1 Admissions for hip fracture per 100,000 population by Medicare Local, 2010–11

Hip fracture (calibration condition)

A hip fracture is a break occurring at the top of the thigh bone (femur), near the pelvis (Figure 3). In 2007–08 over 17,000 Australians aged 40 years and over broke their hip.[27] Hip fracture will most often result in surgery, either internally fixating, or 'pinning', the fracture, or performing a hip replacement. This will depend on the precise location and extent of the break, other factors such as the patient's age, comorbidities and functional status, as well as the preference of the patient, and of the clinical team.

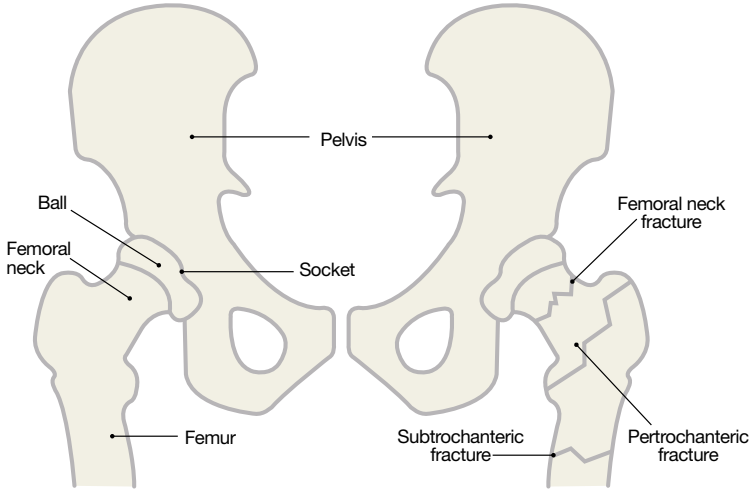


Figure 3 Hip anatomy and hip fracture types [28]

Admission for hip fracture was selected by the OECD as a way to calibrate results because discretionary factors relating to patient preference, clinician practice or health service organisation are unlikely to influence admission rates as much as for the other, more discretionary interventions in the study.

Description of variation

In 2010–11, the national standardised rate of admission for hip fracture was 102 per 100,000 population. An SCV of 7.5 was calculated, and there was a 5-fold difference between the highest admission rate (253 admissions per 100,000 population for Kimberley-Pilbara, in north-west Western Australia) and the lowest (50 per 100,000 for Perth South Coastal) (Table 2).[e] Removing the Kimberley-Pilbara result reduces the difference to 2.7-fold.

Twelve per cent of total admissions occurred in private hospitals. Due to the low numbers, private admissions are not presented in this section.

Table 3 Summary results for admissions for hip fracture, 2010–11

Hip fracture	Total admissions	Age and sex standardised rate (ASR)	Lowest ASR	Highest ASR	Fold difference	SCV
Total	**19,343**	**102**	**50**	**253**	**5.1**	**7.5**

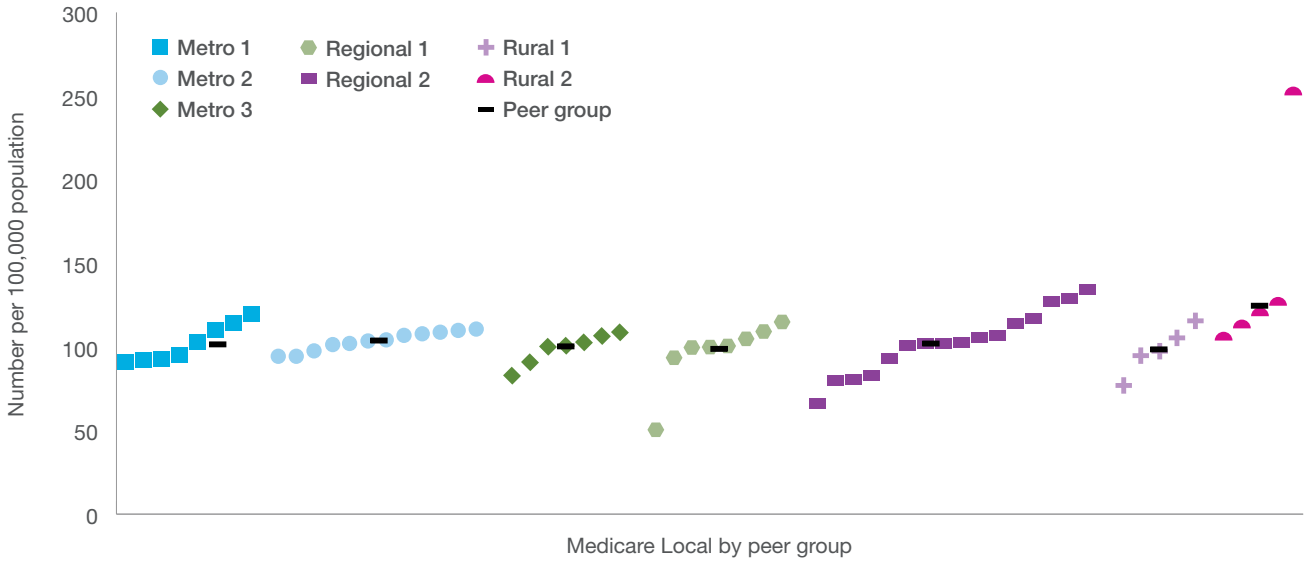
Note: Data are for emergency admissions for people aged 15 years and over with a principal diagnosis ICD-10-AM code of S72.00–S72.05; S72.08; S72.2; S72.10–11.

Source: AIHW analysis of National Hospital Morbidity Database.

e The rates presented here exclude admissions that involved patients transferred from another hospital. This method assumes the hip fracture was recorded in the first admission and better estimates the incidence of hip fracture requiring hospitalisation for hip fracture by Medicare Local.

Admission rates are presented in Figure 4. When data for the Kimberley-Pilbara (Rural 2), a clear outlier, were removed the standardised rate for Rural 2 decreased from 125 to 118 admissions per 100,000 population, still higher than the other six peer group averages, which ranged from 99 to 104.

Variation was evident within groups, particularly regional and rural groupings (Figure 4). The Australian Capital Territory, Tasmania and most Medicare Locals in Victoria had the lowest rates of admission for hip fracture compared with other Medicare Locals (Map 1). See Appendix 2 for more detailed figures identifying individual Medicare Locals.



Notes:

1. Rates are age and sex standardised to the 30 June 2001 Australian population.
2. Peer groups were established based on three criteria: (a) proximity of each Medicare Local to major metropolitan cities; (b) proximity to major hospitals; and (c) socioeconomic status. See Section B for further information.

Source: AIHW analysis of National Hospital Morbidity Database.

Figure 4 Admissions for hip fracture per 100,000 population by Medicare Local and peer group

Comment and options for action

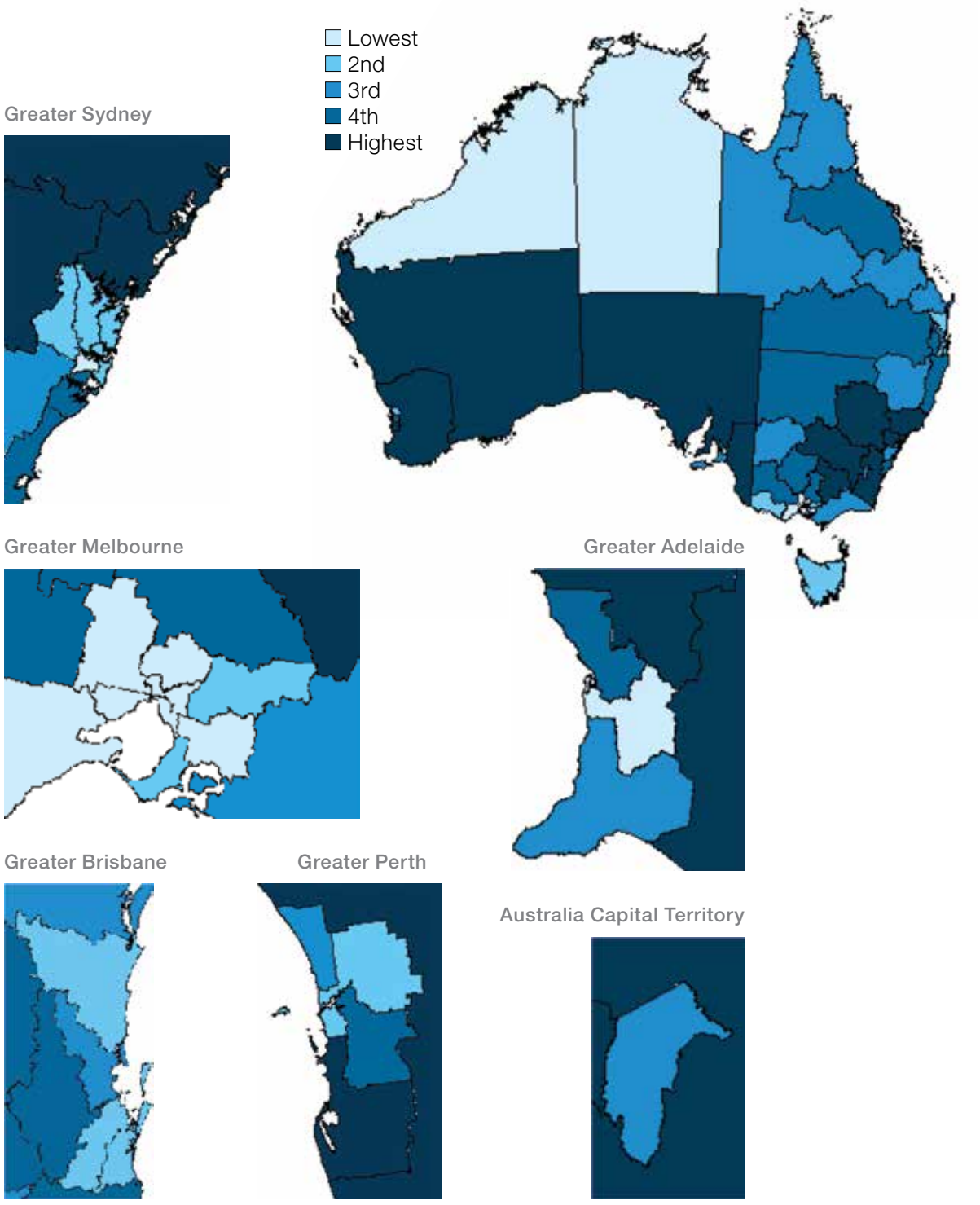
Although hip fracture was chosen as a calibration condition, the results indicate a degree of variation in age and sex-standardised rates in admissions for hip fracture between Medicare Locals. This could be due to a range of demographic, epidemiological and environmental factors (for example, levels of osteoporosis and obesity). Aboriginal and Torres Strait Islander Australians are also more likely than other Australians to fracture their hip.[28 29]

Kimberley-Pilbara, the clear outlier, is one of the largest Medicare locals in geographic area (920,000 square kilometres) with one of the smallest populations (84,316). Indigenous Australians comprise approximately 30 per cent of the population in this region. Further investigation is required, including analysis of additional years of data to see if this result is consistent over time. The WA Department of Health is currently exploring the potential reasons for this higher than expected rate of hip fracture in the Kimberley-Pilbara Medicare Local.

Future work may focus on exploring variation in the interventions used to manage hip fractures as well as variation in specific age-groups.

Part E: Orthopaedic care

Map 2 Admissions for knee replacement



Note: The five groups are based on age and sex standardised rates. The range within each group is as follows: Lowest (140–182); 2nd (183–217); 3rd (218–241); 4th (242–261); Highest (262–330).

Source: AIHW analysis of National Hospital Morbidity Database.

Map 2 Admissions for knee replacement per 100,000 population by Medicare Local, 2010–11

Knee replacement

Knee replacement (also known as knee arthroplasty) is a surgical procedure that removes diseased parts of the bones forming the joint, and replaces the joint with a prosthesis (Figure 5).

The most common reasons for the procedure are pain or mobility problems caused by osteoarthritis. Other types of arthritis, haemophilia or disorders of bone growth may also cause problems leading to knee replacement.

Without replacement surgery, a severely osteoarthritic knee joint may continue to deteriorate until it is very difficult to perform normal weight-bearing activities. Alternative treatments include:

- weight loss
- physiotherapy or other physical therapies, hydrotherapy
- use of walking aids
- non-steroidal anti-inflammatory drugs (NSAIDs)
- corticosteroid injections.

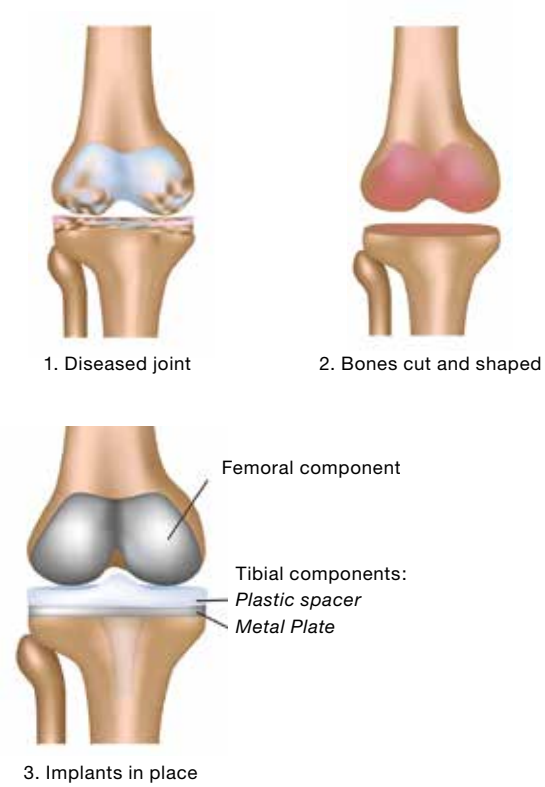


Figure 5 Total knee replacement

Description of variation: knee replacement

In 2010–11, the national standardised rate of admission for knee replacement was 221 per 100,000 population.

Rates for Medicare Locals ranged from 140 admissions per 100,000 population (Inner North West Melbourne) to 330 admissions (Country North SA), a 2.4-fold variation (Table 4).

Table 4 Summary measures for admissions for knee replacement by hospital sector, 2010–11

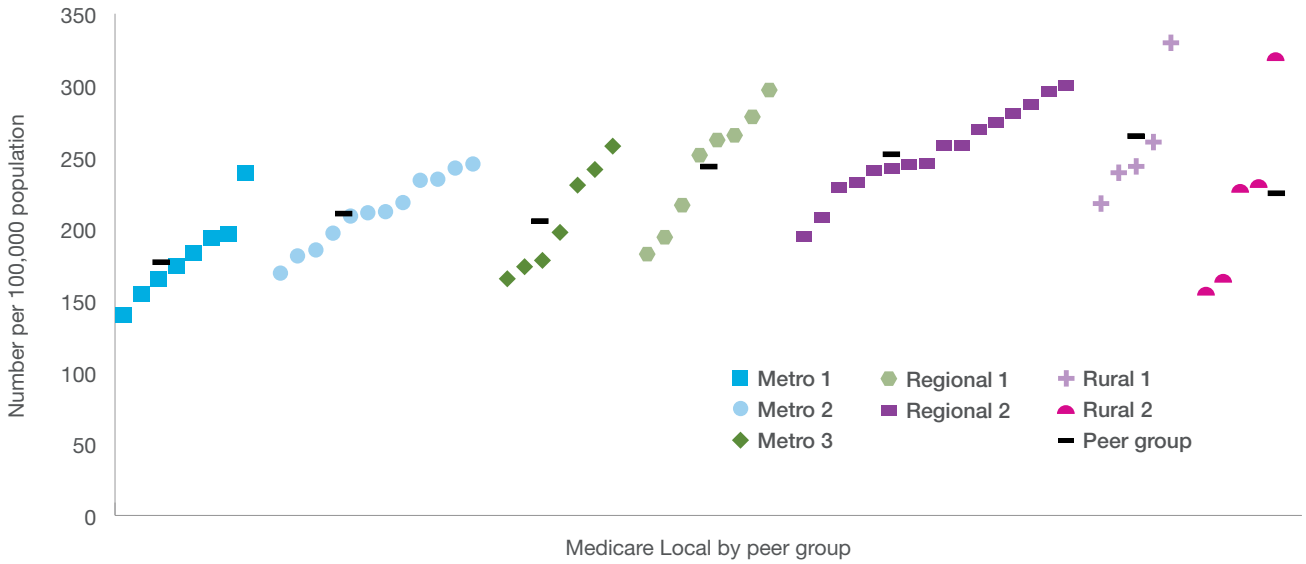
Knee replacement	Total admissions	Age and sex standardised rate (ASR)[a]	Lowest ASR	Highest ASR	Fold difference	SCV
Public hospitals	14,251	73	25	177	7.1	18.4
Private hospitals	28,802	147	82	229	2.8	4.3
Total	**43,053**	**221**	**140**	**330**	**2.4**	**3.6**

a Total does not equal the sum of components due to rounding.

Note: Data are for admissions for people aged 15 years and over with at least one of the following ICD-10-AM ACHI procedure codes: 49527–00; 49554–00; 49530–00; 49533–00; 49530–01; 49517–00; 49518–00; 49519–00; 49534–01; 49521–00; 49521–01; 49521–02; 49521–03; 49524–00; 49524–01.

Source: AIHW analysis of National Hospital Morbidity Database.

Medicare Locals with the lowest overall rates (lowest fifth) were predominantly in metropolitan areas, and those with the highest rates (highest fifth) were in regional and rural areas (Map 2, Figure 6). Variation in rates was similar in all seven Medicare Local peer groups (Figure 6). See Appendix 2 for more detailed figures identifying individual Medicare Locals.



Notes:

1. Rates are age and sex standardised to the 30 June 2001 Australian population.
2. Peer groups were established based on three criteria: (a) proximity of each Medicare Local to major metropolitan cities; (b) proximity to major hospitals; and (c) socioeconomic status. See Section B for further information.

Source: AIHW analysis of National Hospital Morbidity Database.

Figure 6 Admissions for knee replacement per 100,000 population by Medicare Local and peer group, 2010–11

Admissions by hospital sector

Two-thirds of admissions for knee replacements occurred in private hospitals (Table 4). Variation in public sector admissions by Medicare Local was 7-fold with a SCV of 18, compared to 2.8-fold and a SCV of 4.3 in private sector admissions (Figure 7).

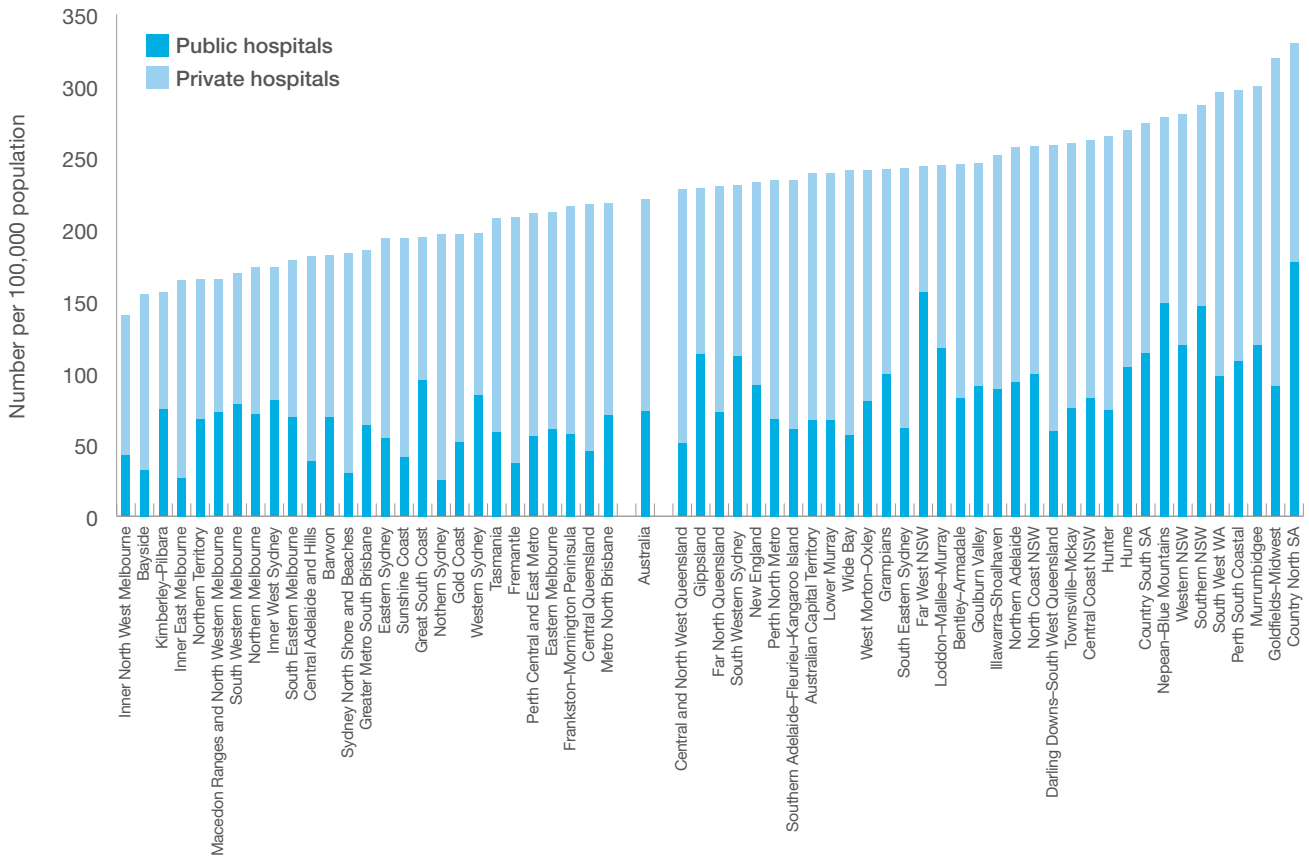
There was no clear relationship between the aggregate rates for Medicare Locals and the proportion reported by hospital sector.

Comment and options for action

Results indicate that, in 2010–11, variation in admissions for knee replacement between Medicare Local populations was low compared to the other interventions. Potential factors driving variation in this intervention include burden of disease, particularly osteoarthritis, as well other determinants of health, such as obesity. The difference in the level of variation between public and private admissions is noteworthy. The SCV for public admissions was 18 while the corresponding figure was 4 for private admissions, which accounted for two thirds of cases nationally in 2010–11.

Dixon and colleagues analysed differences in knee replacement rates across population categories in Australia, and found that males and females living in the most disadvantaged areas were more likely than those living in least disadvantaged areas to have a knee replacement for osteoarthritis (+10 per cent for men and +16 per cent for women). Residents living in regional Australia were more likely to have knee replacement than those in major cities (+35 per cent for males and +13 per cent for females). However, women living in remote Australia were less likely to have knee replacement than those in major cities (-15 per cent) and rates for men were similar. Indigenous Australians were found to have knee replacements rates at half the rate of non-indigenous Australians.[30]

In the absence of routine measurement of treatment outcomes or knowledge about patient preferences it is difficult to identify the appropriate rates for knee replacement compared with other alternatives. Future work may focus on gathering information linking the intervention with patient outcomes to help identify unwarranted variation and inform policy action to reduce it.

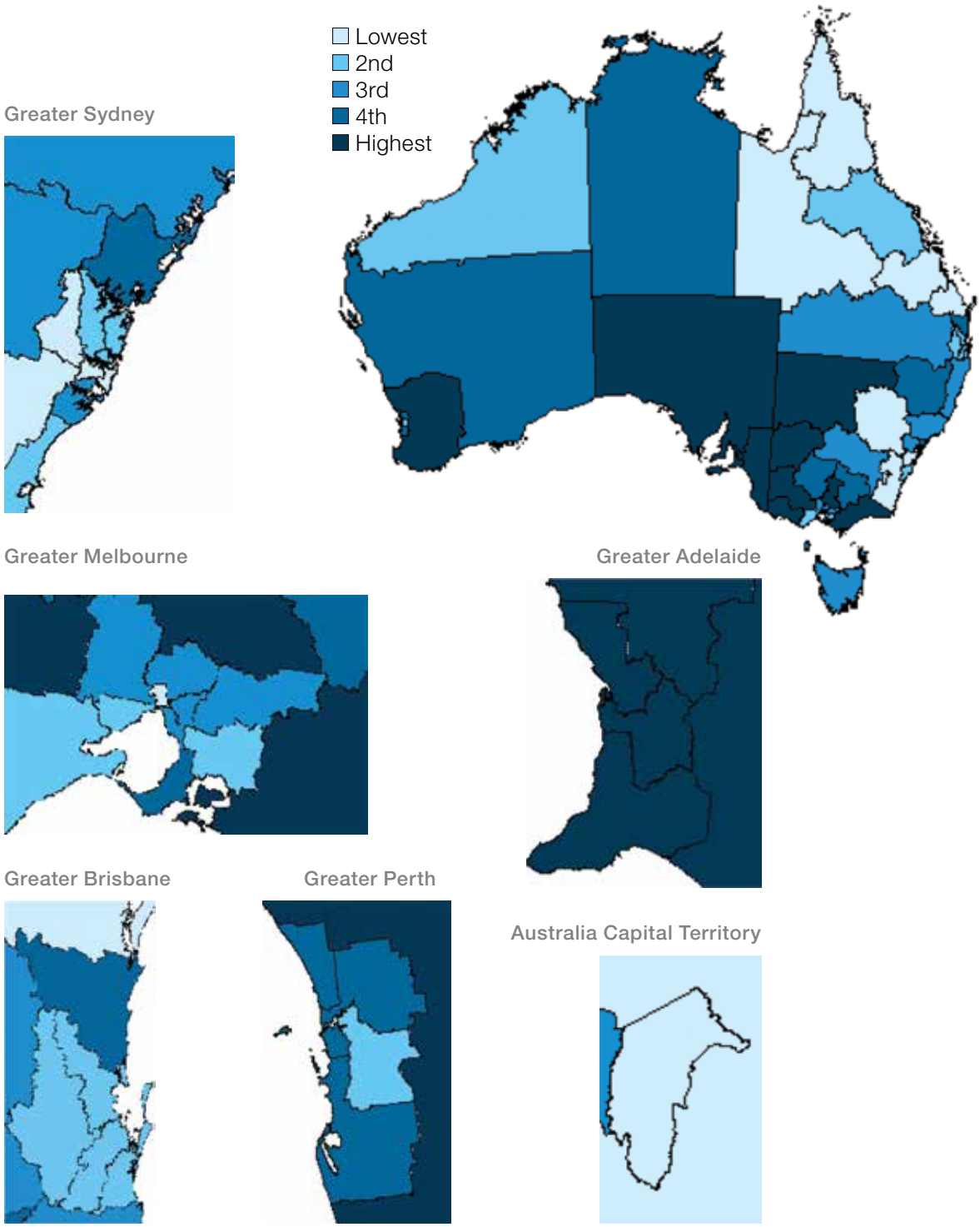


Note: Rates are age and sex standardised to the 30 June 2001 population.

Source: AIHW analysis of National Hospital Morbidity Database.

Figure 7 Admissions for knee replacement per 100,000 population by Medicare Local and hospital sector, 2010–11

Map 3 Admissions for knee arthroscopy



Note: The five groups are based on age and sex standardised rates. The range within each group is as follows: Lowest (232–300); 2nd (301–354); 3rd (355–406); 4th (407–491); Highest (492–726).

Source: AIHW analysis of National Hospital Morbidity Database.

Map 3 Admissions for knee arthroscopy per 100,000 population by Medicare Local, 2010–11

Knee arthroscopy

Knee arthroscopy is a procedure used to examine and, if necessary, repair the inside of the knee joint.

During arthroscopy two thin probes are inserted into the joint through two separate punctures at the front of the knee. One is a fibre-optic telescope with an attached camera so that a picture can be projected on a monitor.

The other probe usually has an attached cutting device to enable trimming and removal of loose or floating tissue if necessary.

In isolation, arthroscopy can be used to evaluate and treat cartilage problems, such as a torn meniscus, or removal of loose bodies from the knee joint. Arthroscopy is also used to guide more extensive procedures such as reconstruction of the knee.

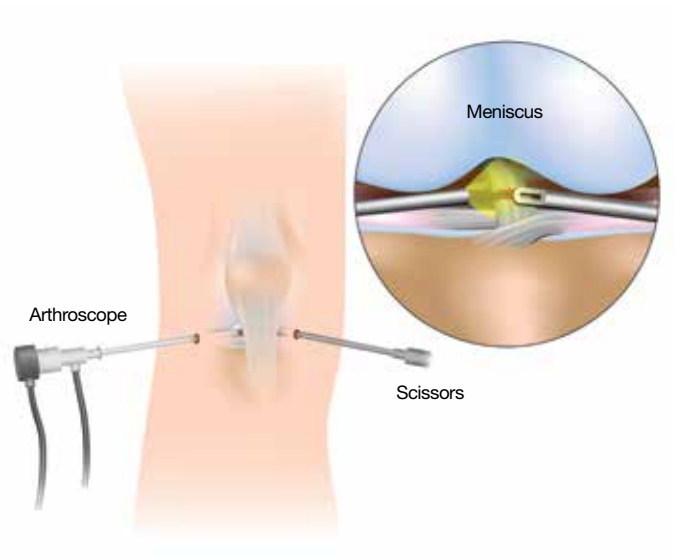


Figure 8 Knee arthroscopy

Cochrane reviews have shown that arthroscopy is of little benefit if the underlying cause of the problems is osteoarthritis.[31] A more recent trial showed no benefit from arthroscopic removal of torn meniscus fragments in patients without knee osteoarthritis but with a degenerative meniscal tear.[32]

Alternatives to diagnostic arthroscopy include imaging such as magnetic resonance and X-ray. Therapeutic alternatives include conservative treatment such as exercise and physiotherapy.

Description of variation

In 2010–11, the Australian standardised rate of admission for knee arthroscopy was 382 per 100,000.

Rates across Medicare Locals ranged from 232 admissions per 100,000 population (Inner West Sydney) to 726 admissions per 100,000 (Country North SA), a 3-fold variation (Table 5).

Table 5 Summary measures for admissions for knee arthroscopy by hospital sector, 2010–11

Knee arthroscopy	Total admissions	Age and sex standardised rate (ASR)[a]	Lowest ASR[b]	Highest ASR[b]	Fold difference	SCV
Public hospitals	13,773	75	26	277	10.7	89.5
Private hospitals	57,314	308	183	568	3.1	7.1
Total	**71,087**	**382**	**232**	**726**	**3.1**	**9.9**

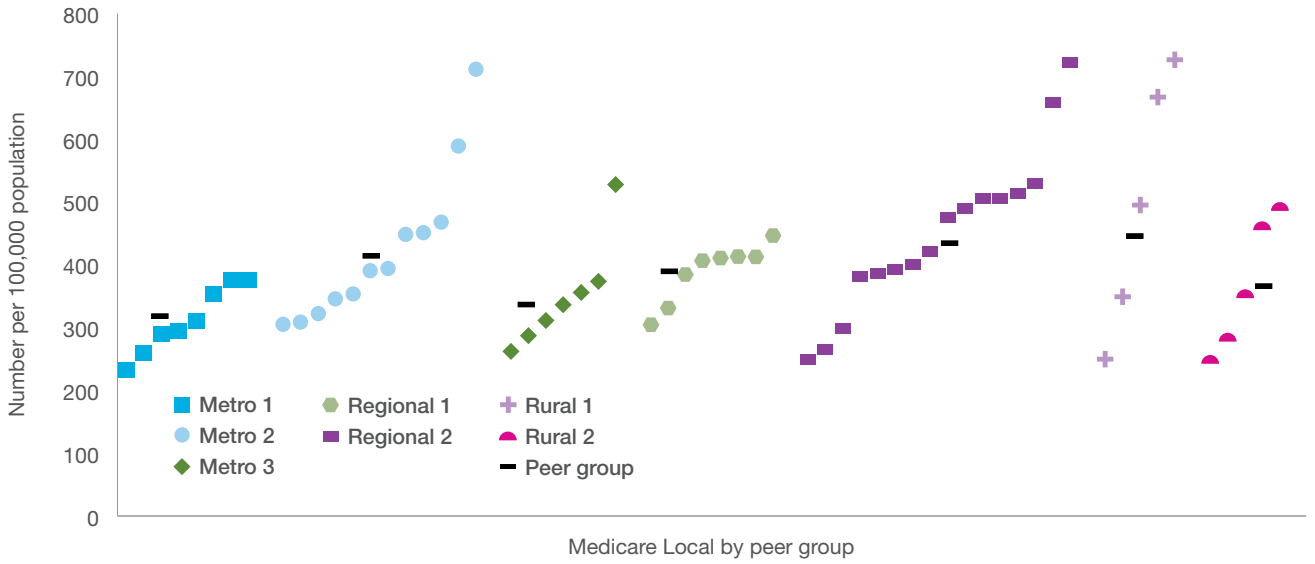
a Total does not equal the sum of components due to rounding.

b Private hospitals analysis excludes data for one Medicare Local with a small number of admissions.

Note: Data are for admissions for people aged 15 years and over with at least one of the following ICD-10-AM ACHI procedure codes: 49557–00; 49503–00; 49560–03; 49562–01; 49561–01; 49557–02.

Source: AIHW analysis of National Hospital Morbidity Database.

When Medicare Locals were grouped into peer groups, the admission rate was lowest for Metro 1 and highest for Rural 1. Variation of Medicare Local rates was greatest within the Metro 2, Regional 2 and Rural 1 Medicare Local peer groups (Figure 9). Five out of eight of the Medicare Locals with the highest rates were in South Australia. See Appendix 2 for more detailed figures identifying individual Medicare Locals.



Notes:

1. Rates are age and sex standardised to the 30 June 2001 Australian population.
2. Peer groups were established based on three criteria: (a) proximity of each Medicare Local to major metropolitan cities; (b) proximity to major hospitals; and (c) socioeconomic status. See Section B for further information.

Source: AIHW analysis of National Hospital Morbidity Database.

Figure 9 Admissions for knee arthroscopy by Medicare Local and peer group, 2010–11

Admissions by hospital sector

Four out of five admissions for knee arthroscopy occurred in private hospitals (Table 5). As with knee replacement, no clear relationship between the overall Medicare Local rate and the proportion reported by sector was observed (Figure 10).

Variation in private sector admissions was 3.1-fold with a SCV of 7.

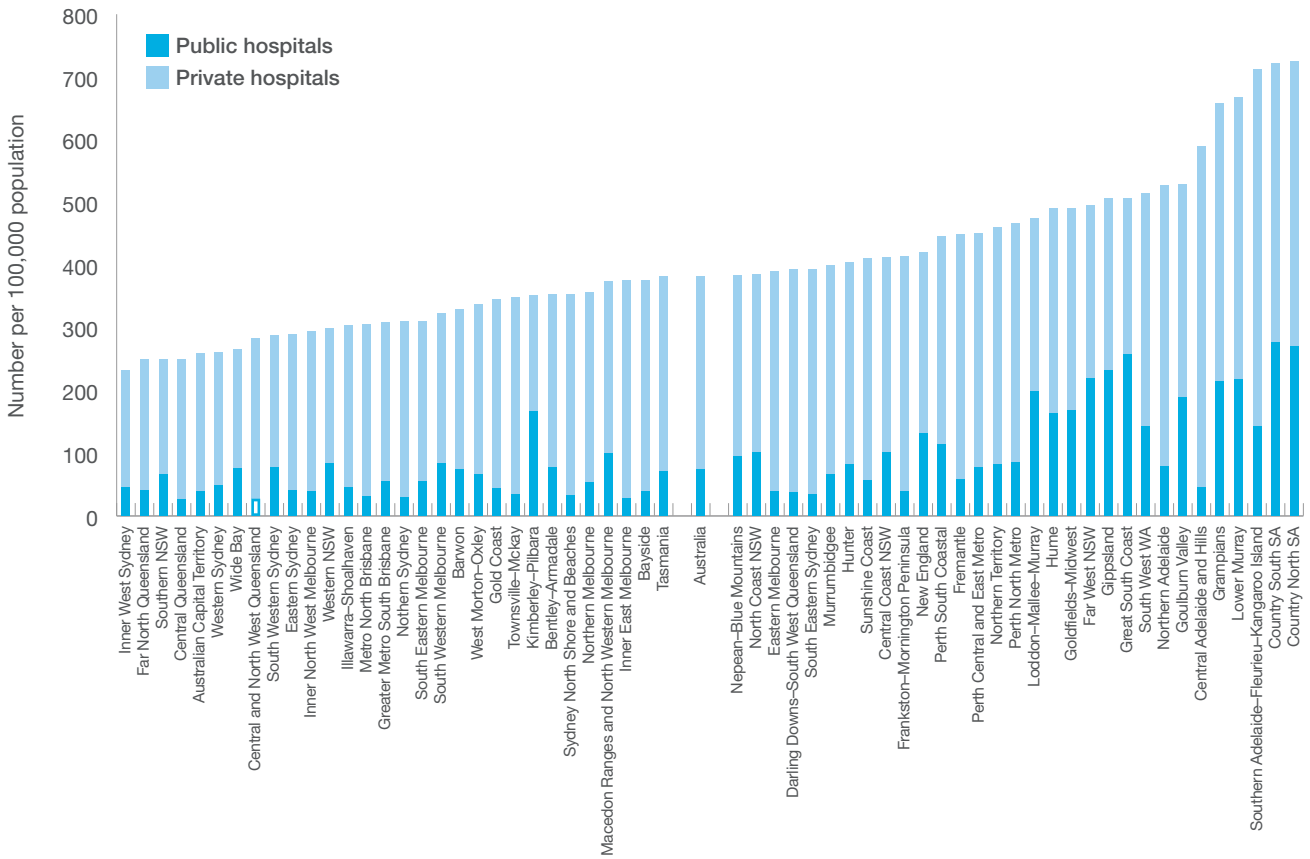
Comment and options for action

Variation in admissions for knee arthroscopy was comparatively high and warrants further investigation, particularly as the efficacy of arthroscopy in managing osteoarthritis has been questioned[31] and a range of alternatives exist.

Eighty per cent of arthroscopies were performed in the private setting. Waiting times in the public sector may influence private sector rates. However, these results should be interpreted with caution as data do not:

- include patients who underwent knee arthroscopy in an outpatients setting (day cases)
- count private patients in public hospitals as private, and vice versa.

In the absence of routine measurement of outcome it is difficult to identify the appropriate rates for this interventions compared with other alternatives. Future work may focus on gathering information linking knee arthroscopy with patient presentation and outcomes to help identify unwarranted variation and inform policy action to reduce it. In the case of knee arthroscopy, investigating variation in rates where it is used to treat osteoarthritis or degenerative disease may be indicated.



Notes:

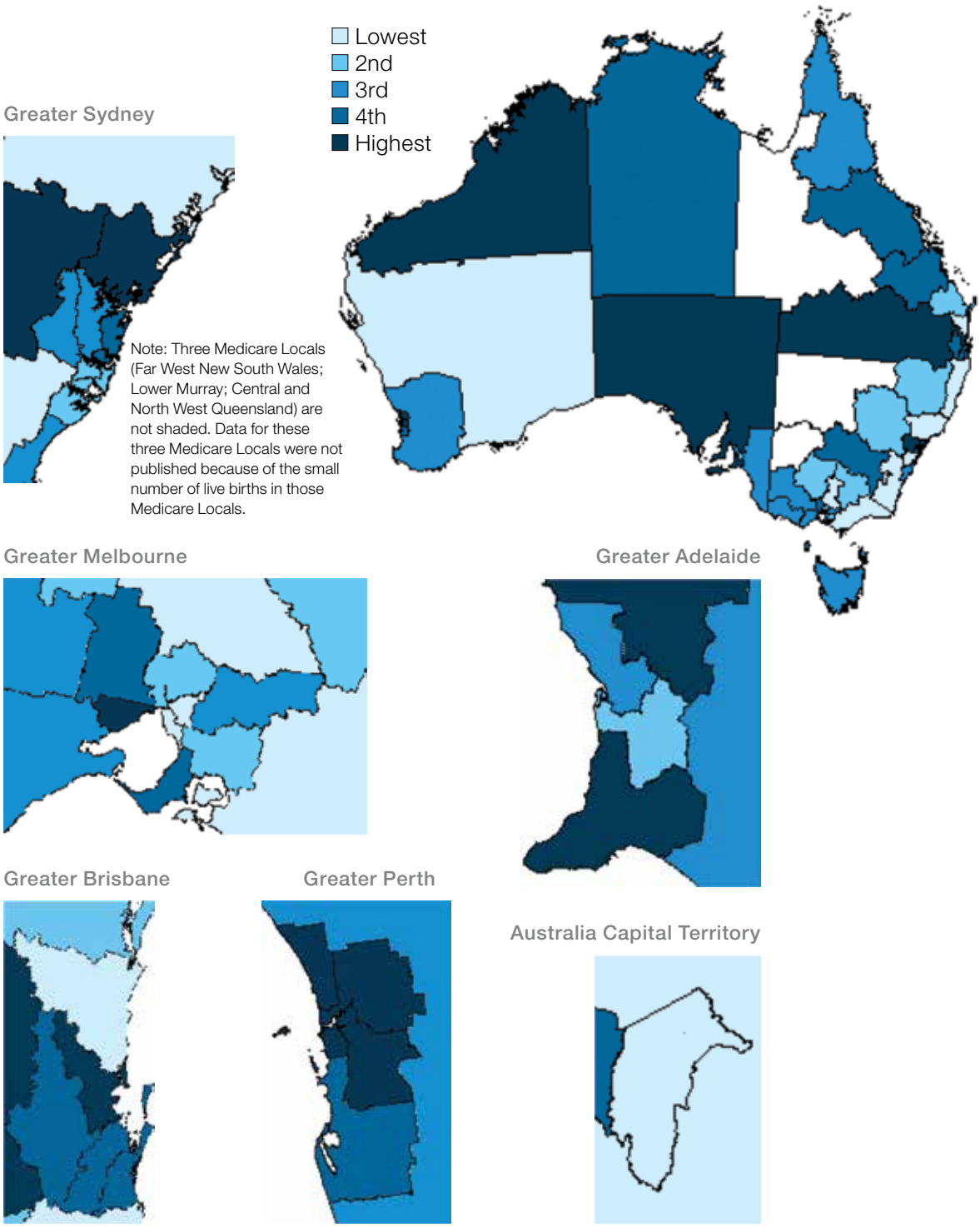
1. Rates are age and sex standardised to the 30 June 2001 Australian population.
2. Data for rates based on a small number of admissions are unshaded.

Source: AIHW analysis of National Hospital Morbidity Database.

Figure 10 Admissions for knee arthroscopy per 100,000 population by Medicare Local and hospital sector, 2010–11

Part F: Obstetric and gynaecological care

Map 4 Caesarean section



Note: The five groups are based on age standardised rates. The range within each group is as follows: Lowest (243–286); 2nd (287–298); 3rd (299–323); 4th (324–336); Highest (337–392).

Source: AIHW analysis of National Hospital Morbidity Database.

Map 4 Caesarean sections per 1,000 live births by Medicare Local, 2010–11

Caesarean section

A caesarean section is a surgical procedure to enable birth through a cut made in the mother's abdominal wall and the wall of the uterus. A caesarean section may be planned (elective), or unplanned (emergency) if there are problems during labour. Both elective and emergency caesareans are included in the results presented here.

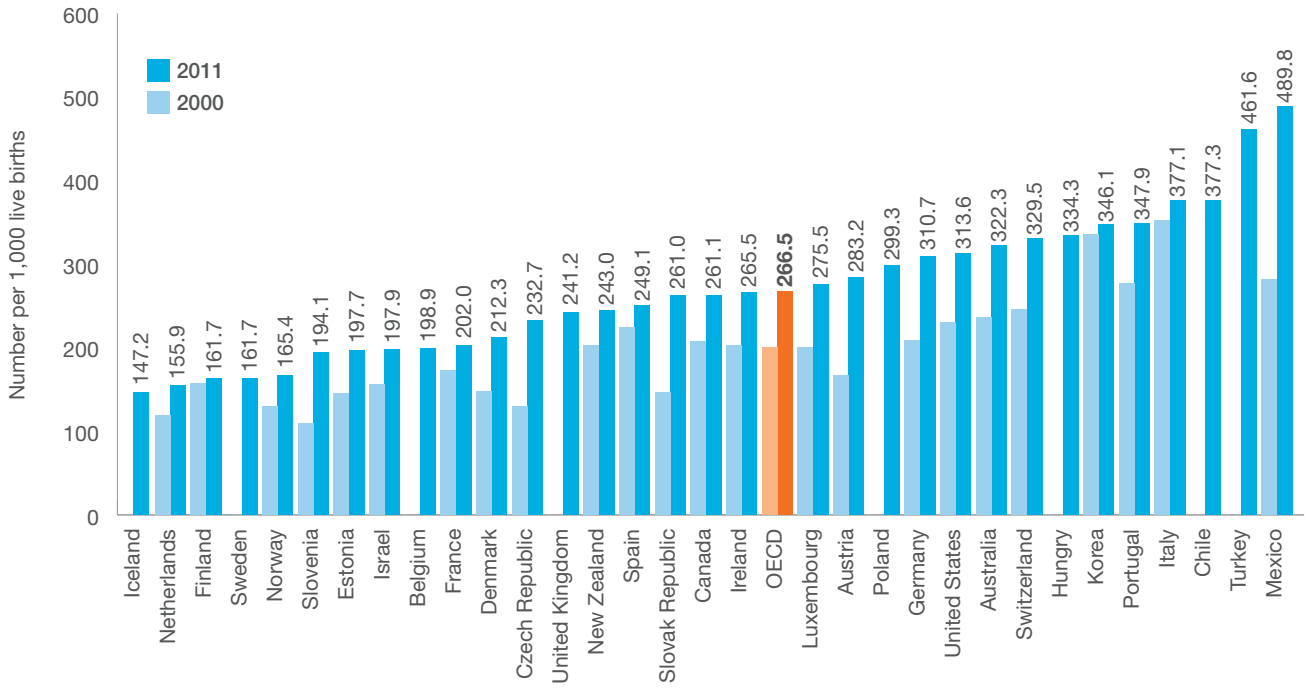
There are several reasons why mothers and their obstetricians decide on elective caesarean birth. The decision will be based on a combination of the particular situation and personal preferences. Reasons may include a previous c-section, pre-existing health problems, position of the baby in the womb, or birth involving three or more babies.

There can be several reasons for an unplanned (emergency) caesarean birth including the baby's position in the womb, lack of progression of labour, distressed baby or a prolapsed umbilical cord.

Australia has a high rate of caesarean section compared to the OECD average (Figure 11).[9]

The main factors thought to be associated with variation in rates of caesarean section include public/private care mix, models of maternity care, socioeconomic status, age, obesity, access to specialist care, and variation in thresholds for performing operative delivery by individual practitioners.

In this paper, the number of live births is used as the denominator for all rates (public, private and total) as this effectively adjusts for the variation in the number of births per 1,000 population among Medicare Locals. That is, the variation in caesarean section rates shown for Medicare Locals will be due to factors other than variation in overall birth rates.



Note: Rates are age standardised to the OECD standard population.
Source: OECD Health Statistics 2013, http://search.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=DELSA/HEA/WD/HWP(2013)2&docLanguage=En

Figure 11 Age standardised rates of caesarean sections per 1,000 live births

Description of variation

In 2010–11, the national standardised rate for caesarean section was 313 per 1,000 live births (Table 6). The count of live births used for the denominator for all rates (public hospitals, private hospitals and total) is based on the total number of hospital (public and private) birth episodes that included at least one live birth for mothers living in a Medicare Local.

Rates in Medicare Locals ranged from 243 caesarean sections per 1,000 live births (Goldfields-Midwest) to 392 per 1,000 (Fremantle), a 1.6-fold national variation (Table 6).

Compared with other interventions analysed, variation among Medicare Locals was low with an SCV of 1.0 (Table 6).

There was no clear relationship between rates of caesarean section and geographic location (Map 4), and a similar degree of variation was observed in all Medicare Local peer groups (Figure 13). See Appendix 2 for more detailed figures identifying individual Medicare Locals.

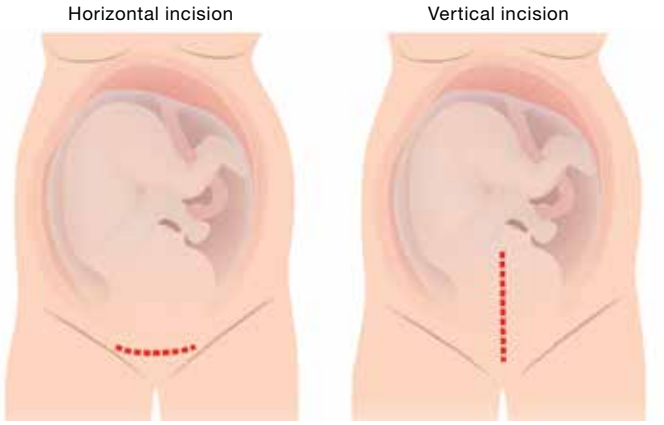


Figure 12 Caesarean section

Table 6 Summary measures for caesarean section by hospital sector, 2010–11

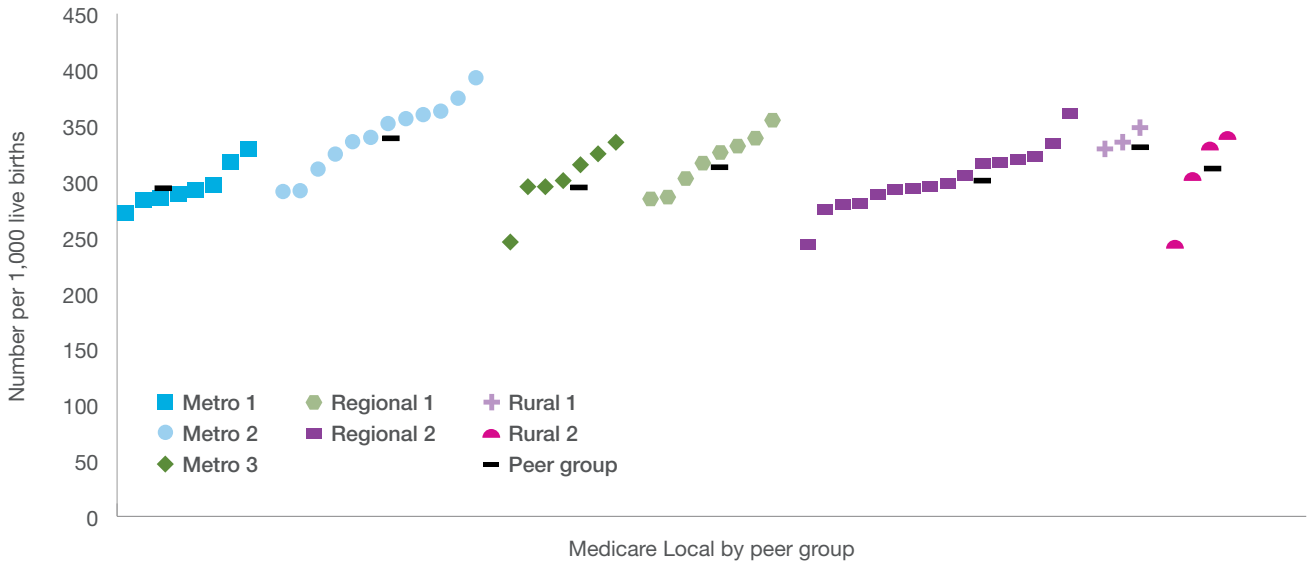
Caesarean section	Total admissions	Age standardised rate (AR)[a]	Lowest AR[b]	Highest AR[b]	Fold difference	SCV
Public hospitals	59,067	203	126	300	2.4	4.9
Private hospitals	34,324	111	6	219	36.5	20.7
Total	**93,391**	**313**	**243**	**392**	**1.6**	**1.0**

a Total does not equal the sum of components due to rounding.

b Data for three Medicare Locals (Far West New South Wales; Lower Murray; Central and North West Queensland) were excluded from analysis because of volatility due to small denominator.

Note: Data are for admissions for females aged 15 years and over with at least one of the following ICD-10-AM ACHI procedure codes: 16520–00; 16520–01; 16520–02; 16520–03.

Source: AIHW analysis of National Hospital Morbidity Database.



Notes:

1. Rates are age standardised to the 30 June 2001 Australian population.
2. Peer groups were established based on three criteria: (a) proximity of each Medicare Local to major metropolitan cities; (b) proximity to major hospitals; and (c) socioeconomic status. See Section B for further information.

Source: AIHW analysis of National Hospital Morbidity Database.

Figure 13 Caesarean sections per 1,000 live births by Medicare Local and peer group, 2010–11

Rates by hospital sector

Approximately two-thirds of all caesarean sections occurred in public hospitals. Variation in private hospital admissions by Medicare Local was 36.5-fold with an SCV of 20.7 (Table 6). Rates across most Medicare Locals were similar despite different proportions being reported for public and private sectors (Figure 14).

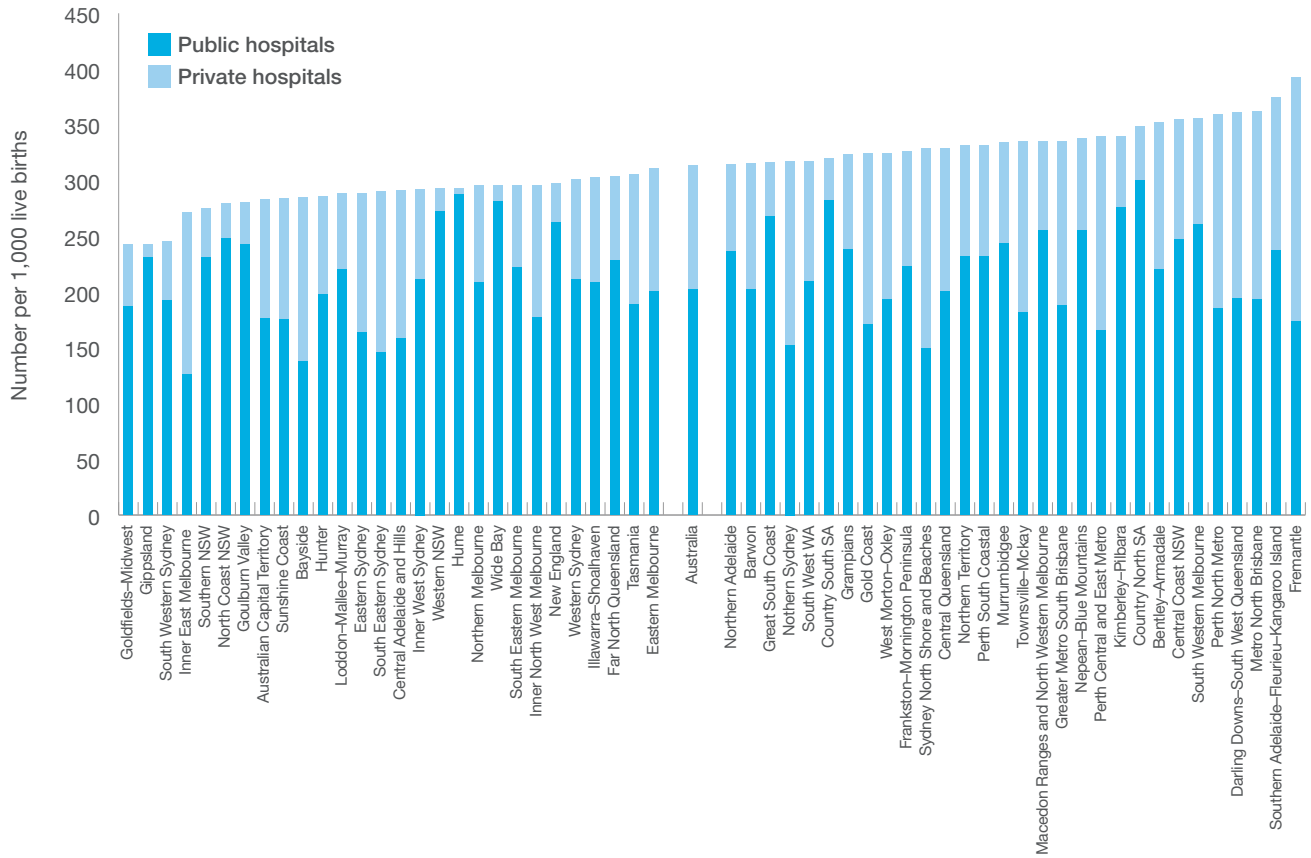
The rates of caesarean section by hospital sector provided here may differ from rates published elsewhere because of the denominator used. When rates by hospital sector are calculated using the number of birth episodes involving a live birth in each hospital sector (compared with the total number of episodes involving a live birth), results have shown that caesarean section rates are higher in private hospitals than public hospitals. For example, in 2010, the caesarean section rate was 43 per cent for women in private hospitals compared with 28 per cent in public hospitals.[33]

Comment and options for action

Of the interventions examined in this paper, variation was lowest for caesarean sections rates, although Australia's overall rate for this procedure is high compared to other developed countries.

Examination of caesarean section rates by hospital of birth (rather than Medicare Local of patient residence) reveals a different level and pattern of variation. For example, a 2013 study of found a 4-fold variation in casemix-adjusted caesarean section rates by hospital in New South Wales.[34]

Further investigation is required to determine the specific drivers of the relatively high caesarean section rates in Australia. Future work could examine variation in elective and emergency caesarean section rates, and the effect of factors such as maternal obesity and maternal requests as a drivers of variation in the rates of this procedure.



Notes:

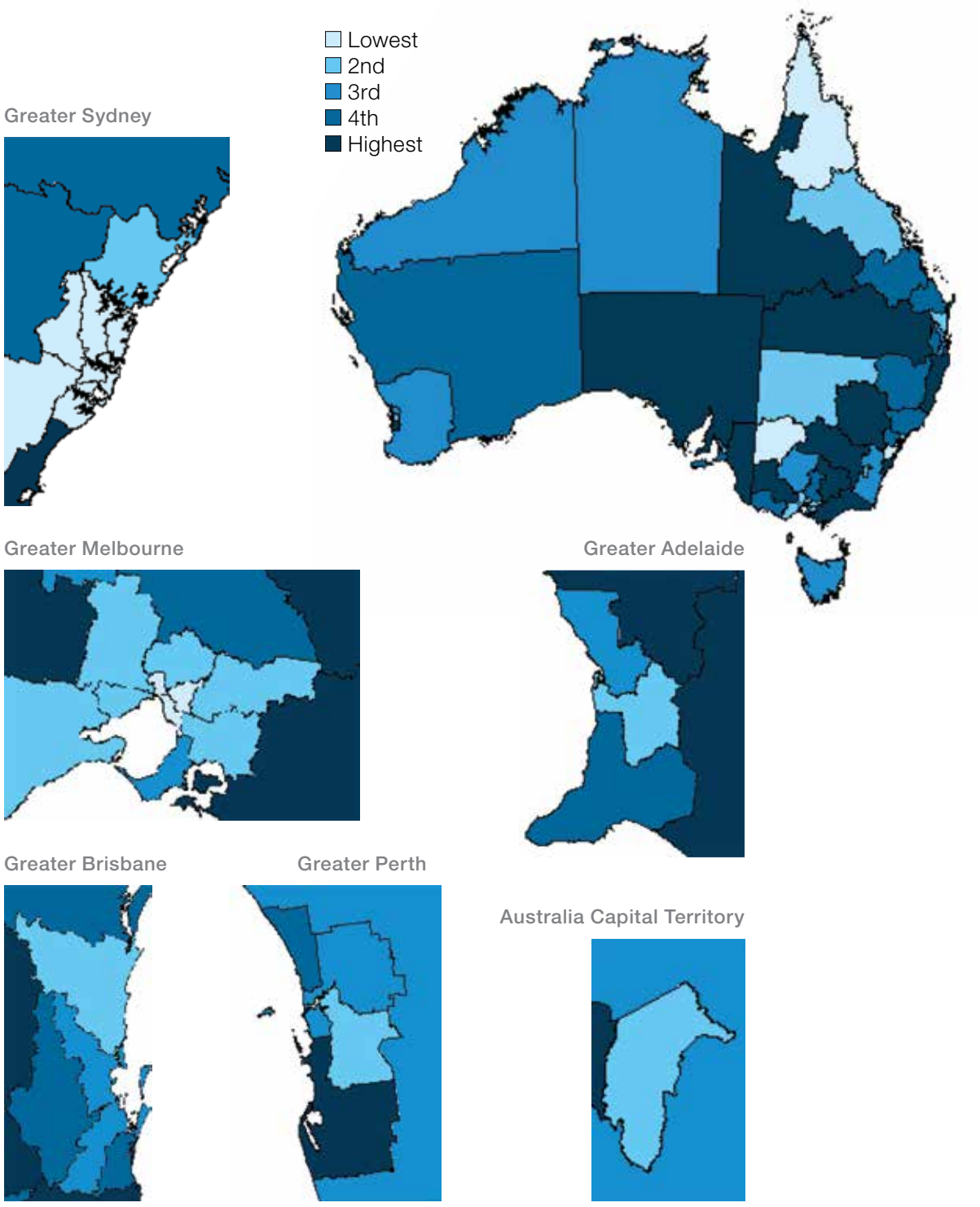
1. Rates are age standardised to the number of women who had live births recorded in the National Hospital Morbidity Database in 2001–02.

2. Data for three Medicare Locals (Far West New South Wales; Lower Murray; Central and North West Queensland) were excluded from analysis because of volatility due to small denominator.

Source: AIHW analysis of National Hospital Morbidity Database.

Figure 14 Caesarean sections per 1,000 live births by Medicare Local and hospital sector, 2010–11

Map 5 Admissions for hysterectomy



Note: The five groups are based on age standardised rates. The range within each group is as follows: Lowest (1.68–2.41); 2nd (2.43–2.68); 3rd (2.71–2.99); 4th (3.00–3.26); Highest (3.35–5.20).

Source: AIHW analysis of National Hospital Morbidity Database.

Map 5 Admissions for hysterectomy without any diagnosis of cancer per 1,000 population by Medicare Local, 2010–11

Hysterectomy

A hysterectomy is an operation to remove the uterus. The operation is performed through a surgical incision or cut to the abdomen, by 'keyhole surgery' or through the vagina.

There are a number of uterine conditions for which a hysterectomy can be recommended. Some are benign, others malignant. Benign, or non-cancerous conditions, include uterine fibroids, endometriosis, adenomyosis, uterine prolapse, and heavy periods that cannot be controlled by other treatments. Malignant, or cancerous conditions, include cancer of the cervix, and cancer of the uterus.

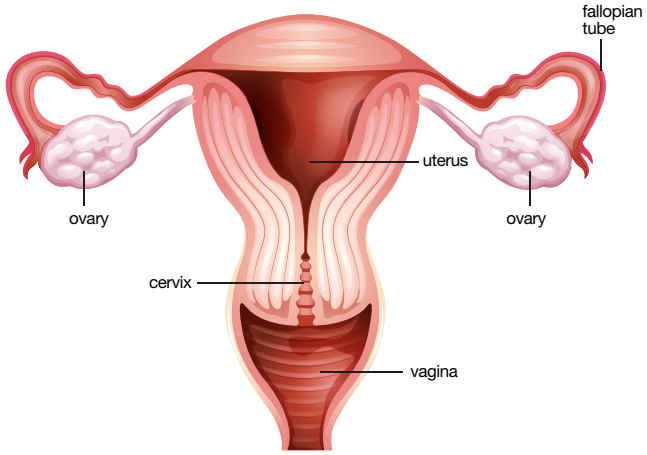
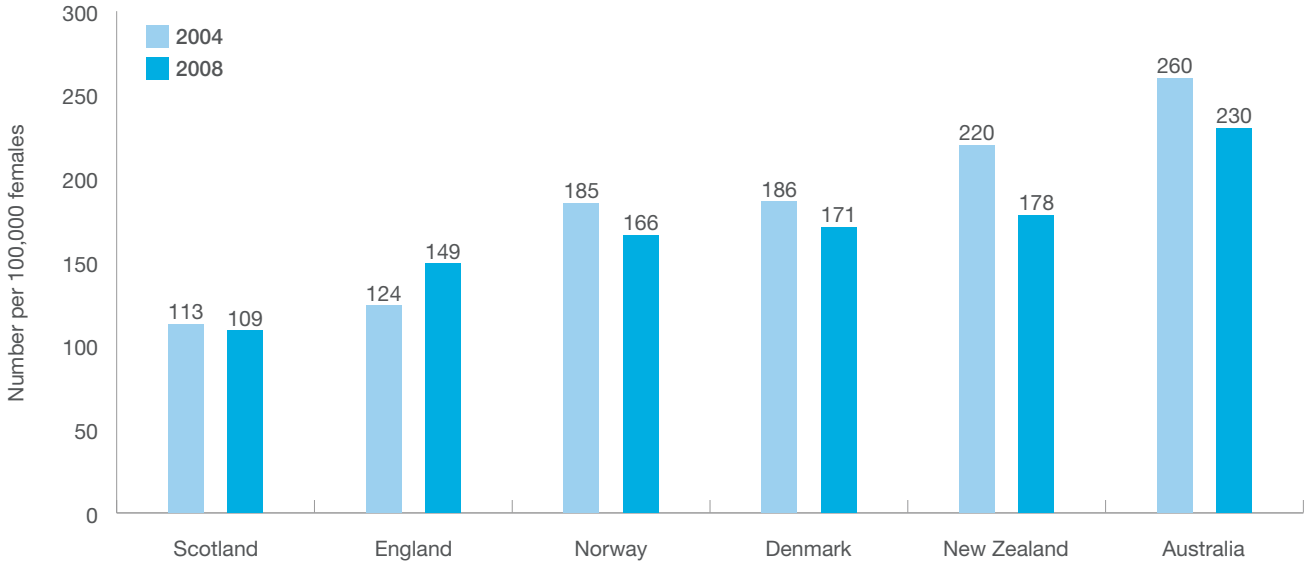


Figure 15 Female reproductive anatomy

Although the OECD study examined variation in all hysterectomies, the analysis here focuses mainly on analysis of hysterectomies without any diagnosis of cancer.[g] This is because for patients with specific cancers hysterectomy is generally considered the preferred treatment.

Australia has higher a higher rate of hysterectomy (including cancer diagnosis) than many other OECD countries, although rates have decreased over the last 20 years (Figure 16). This decrease may be due to the use of alternative treatments.[9]

A hysterectomy is a major operation, and is recommended when other surgical treatments or medication treatments may not be possible, or have not helped alleviate the patient's symptoms.



Note: Rates are age standardised to the OECD standard population.
Source: *Source*: OECD Health Statistics 2013, http://search.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=DELSA/HEA/WD/HWP(2013)2&docLanguage=En

Figure 16 Age standardised rates of hysterectomy per 100,000 females

g Excludes admissions with any of the following ICD-10-AM diagnoses codes: C00-C96 Malignant neoplasms, D45, D46, D47.1 and D47.3.

Description of variation

In 2010–11, the national standardised rate of admission for hysterectomy without any diagnosis of cancer was 2.8 per 1,000 female population. Rates for Medicare Locals ranged from 1.7 (Inner West Sydney) to 5.2 admissions per 1,000 females (Grampians), a 3-fold variation.

The group of Medicare Locals with the lowest overall rates (lowest fifth) were all situated within the greater metropolitan Sydney and Melbourne areas, with the five Medicare Locals with the lowest rates all within the Metro 1 peer group.

Most Medicare Locals with the highest overall rates (highest fifth) were situated in non-metropolitan areas of Australia (Map 5, Figure 17). See Appendix 2 for more detailed figures identifying individual Medicare Locals.

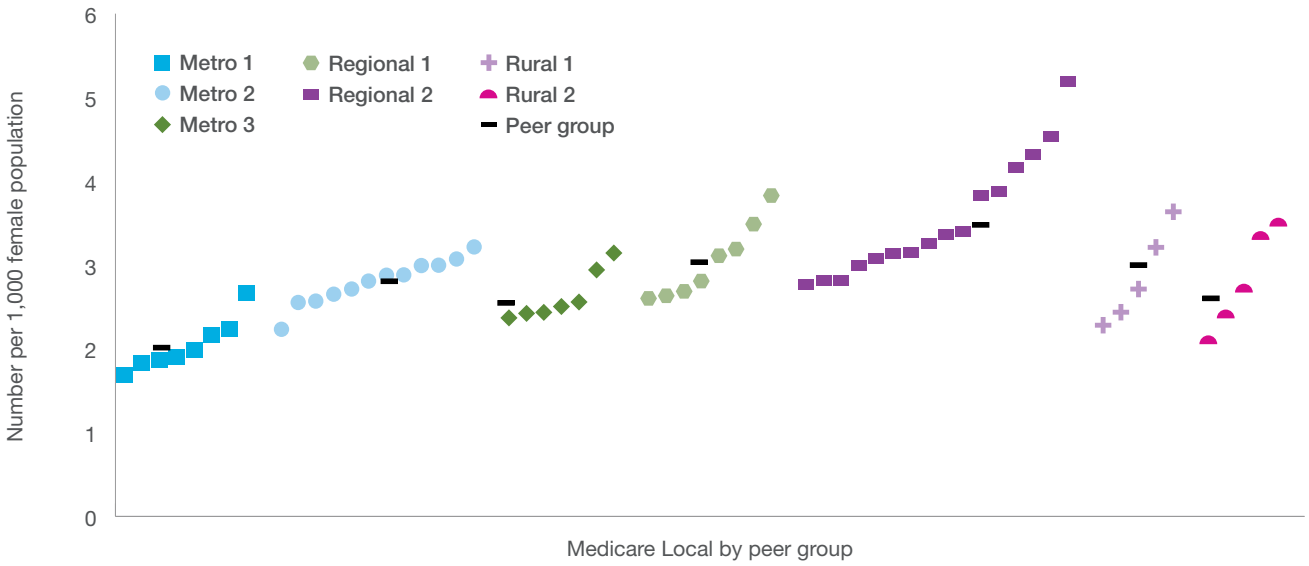
Table 7 Summary measures for admissions for hysterectomy without any diagnosis of cancer by hospital sector, 2010–11

	Total admissions	Age standardised rate (AR)[a]	Lowest AR	Highest AR	Fold difference	SCV
Public hospitals	11,271	1.2	0.4	3.3	8.3	27.8
Private hospitals	13,959	1.5	0.7	3	4.3	8.8
Total	**25,230**	**2.8**	**1.7**	**5.2**	**3.1**	**5.3**

a Total does not equal the sum of components due to rounding.

Note: Includes admissions for females aged 15 years and over with at least one of the following ICD-10-AM ACHI procedure block codes: 1268–1269 or one of the following procedure codes: 90450–00; 90450–01; 90450–02.

Source: AIHW analysis of National Hospital Morbidity Database.



Notes:

1. Rates are age standardised to the 30 June 2001 Australian population.
2. Peer groups were established based on three criteria: (a) proximity of each Medicare Local to major metropolitan cities; (b) proximity to major hospitals; and (c) socioeconomic status. See Section B for further information.

Source: AIHW analysis of National Hospital Morbidity Database.

Figure 17 Admissions for hysterectomy without any diagnosis of cancer per 1,000 female population by Medicare Local and peer group, 2010–11

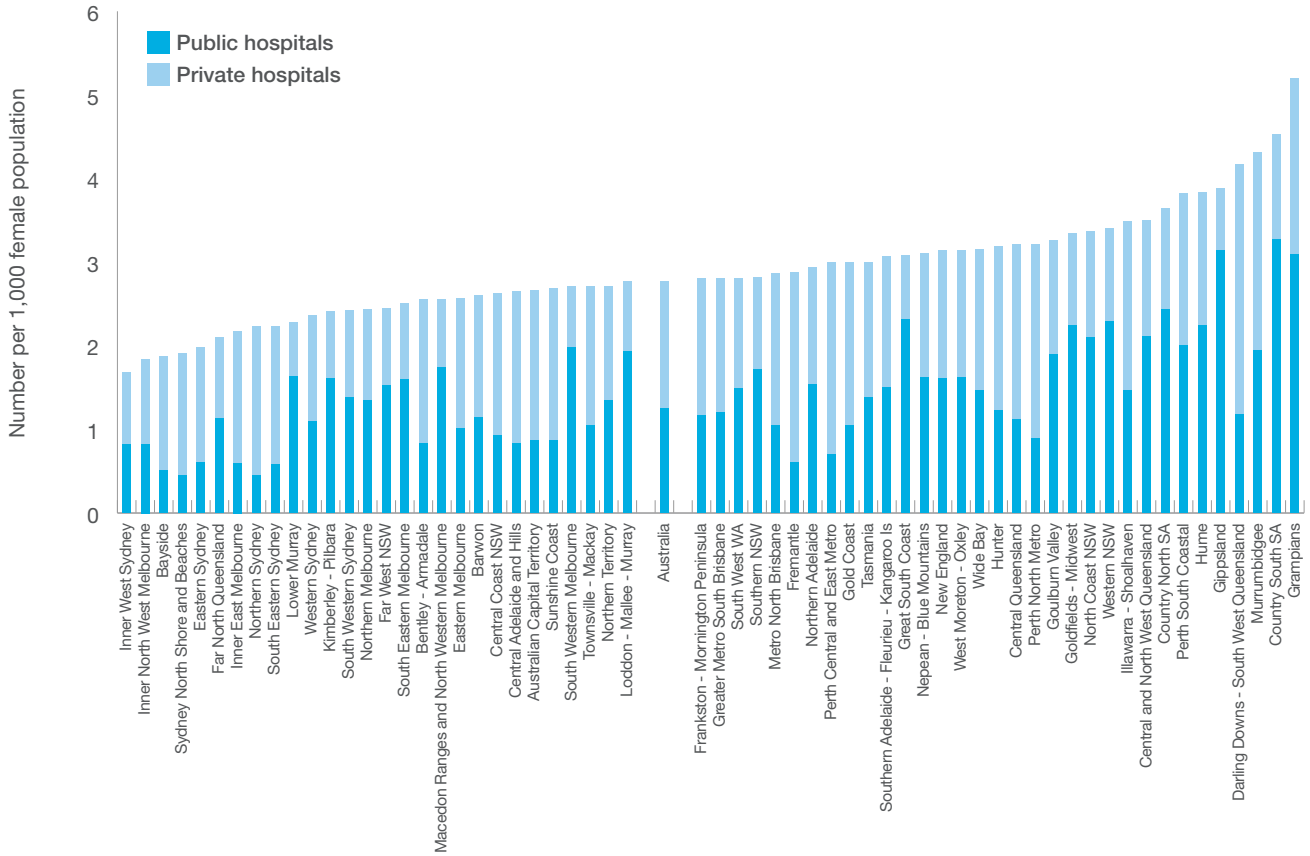
Admissions by hospital sector

Just over half the admissions for hysterectomy (other than for cancer) occurred in the private sector. There was no clear pattern between overall admission rates and proportions performed by sector (Figure 18).

Comment and options for action

Higher rates of hysterectomy were observed in non-metropolitan populations. This pattern has been observed previously. A study examined rates of hysterectomy excluding cancer diagnoses in 1996–97 for New South Wales, Victoria and the Australian Capital Territory. The Statistical Local Area of patient residence was the unit of analysis. This study showed consistently higher rates for rural women compared with urban women and a strong inverse relationship between an area's socio-economic status and hysterectomy rate.[8]

Variation in admission rates for hysterectomy other than for cancer is slightly higher than for all hysterectomies, which may be expected given the existence of more alternative medical treatment for the latter (e.g. Mirena intrauterine device; endometrial ablation).



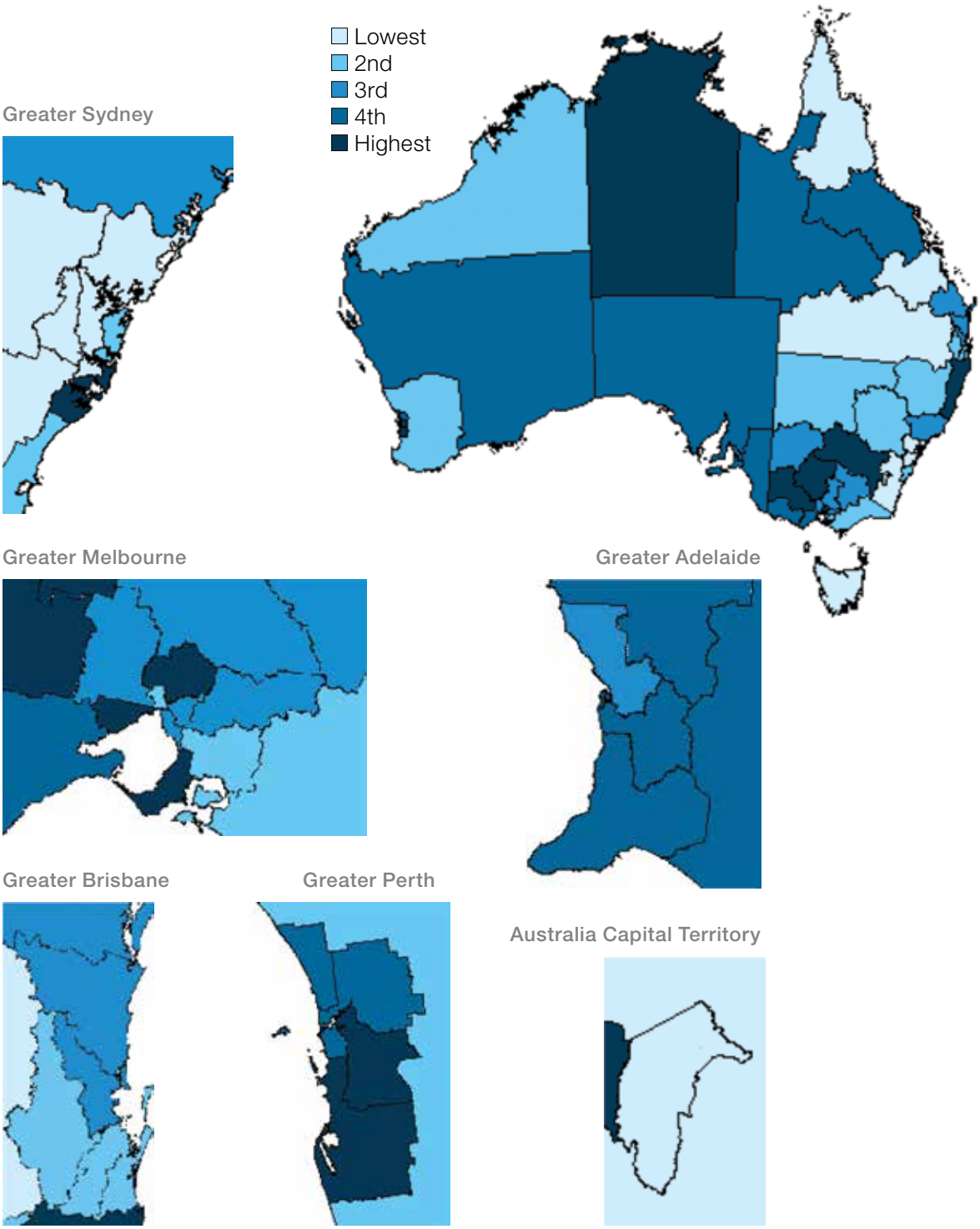
Note: Rates are age standardised to the 30 June 2001 Australian population.

Source: AIHW analysis of National Hospital Morbidity Database.

Figure 18 Admissions for hysterectomy (without any diagnosis of cancer) per 1,000 female population by Medicare Local and hospital sector, 2010–11

Part G: Cardiac care

Map 6 Admissions for cardiac catheterisation



Note: The five groups are based on age and sex standardised rates. The range within each group is as follows: Lowest (210–471); 2nd (472–556); 3rd (557–645); 4th (646–719); Highest (720–1,551).

Source: AIHW analysis of National Hospital Morbidity Database.

Map 6 Admissions for cardiac catheterisation per 100,000 population by Medicare Local, 2010–11

Coronary heart disease (CHD)

CHD is a chronic disease during which 'plaque' builds up inside the coronary arteries which supply oxygen-rich blood to the heart.

Over time, this plaque can harden or rupture. Hardened plaque narrows the coronary arteries and reduces the flow of oxygen-rich blood to the heart. This can cause chest pain or discomfort (angina).

If the plaque ruptures, a blood clot can form on its surface. A large blood clot can mostly or completely block blood flow through a coronary artery. This is the most common cause of a heart attack. Over time, ruptured plaque also hardens and narrows the coronary arteries.

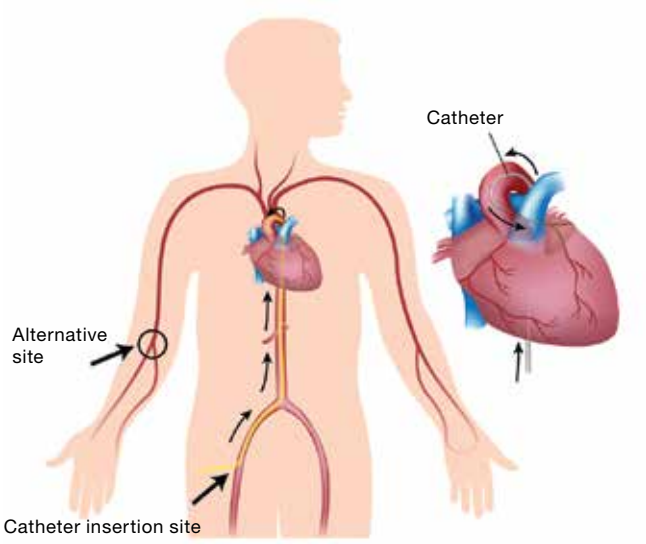


Figure 19 Cardiac catheterisation

Cardiac catheterisation

Cardiac catheterisation is a procedure used to diagnose heart conditions. A long, thin, flexible tube (catheter) is put into a blood vessel in the arm, groin, or neck and threaded to the heart. A dye is injected through the catheter to show any restrictions in blood flow on a monitor using x-ray.

Cardiac catheterisation is a diagnostic procedure, which may be performed in the outpatient setting. As the data used in this analysis contain admitted patient episodes only, procedures performed in the non-admitted setting are not captured here.

Description of variation

In 2010–11, the national standardised rate of admission for cardiac catheterisation was 596 per 100,000 population.

There was over a 7-fold difference between the highest rate (1,551 admissions per 100,000 in Murrumbidgee) and the lowest rate (210 admissions per 100,000 population in Inner West Sydney). Murrumbidgee was a clear outlier in these results (Table 8).

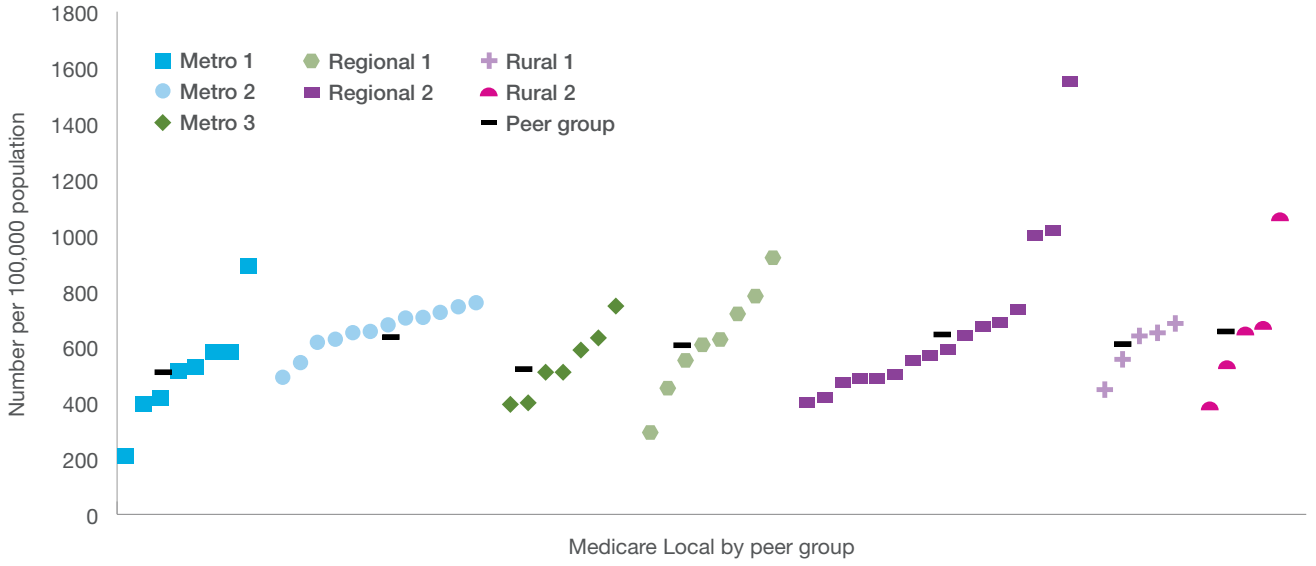
There was variation in all Medicare Local peer groups, and no clear relationship between remoteness and admission rates was observed (Figure 20, Map 6). See Appendix 2 for more detailed figures identifying individual Medicare Locals.

Table 8: Summary measures for admissions for cardiac catheterisation by hospital sector, 2010–11

Cardiac Catheterisation	Total admissions	Age and sex standardised rate (ASR)	Lowest ASR	Highest ASR	Fold difference	SCV
Public hospitals	47,376	272	55	527	9.6	17.4
Private hospitals	56,805	324	95	1,024	10.8	23.9
Total	**104,181**	**596**	**210**	**1,551**	**7.4**	**12.6**

Note: Includes data for people aged 20 years and over and admissions with at least one of the following ICD-10-AM ICD-10-AM ACHI procedure codes: 38200–00; 38218–01; 38203–00; 38218–00; 38206–00; 38218–02.

Source: AIHW analysis of National Hospital Morbidity Database.



Notes:

1. Rates are age and sex standardised to the 30 June 2001 Australian population.

2. Peer groups were established based on three criteria: (a) proximity of each Medicare Local to major metropolitan cities; (b) proximity to major hospitals; and (c) socioeconomic status. See Section B for further information.

Source: AIHW analysis of National Hospital Morbidity Database.

Figure 20 Admissions for cardiac catheterisation per 100,000 populations by Medicare Local and peer group, 2010–11

Admissions by hospital sector

Just over half (55 per cent) of all admissions for cardiac catheterisation occurred in private hospitals (Table 8). There was no clear pattern between the overall Medicare Local admission rate and the proportion of patients admitted by sector (Figure 21).

Comment and options for action

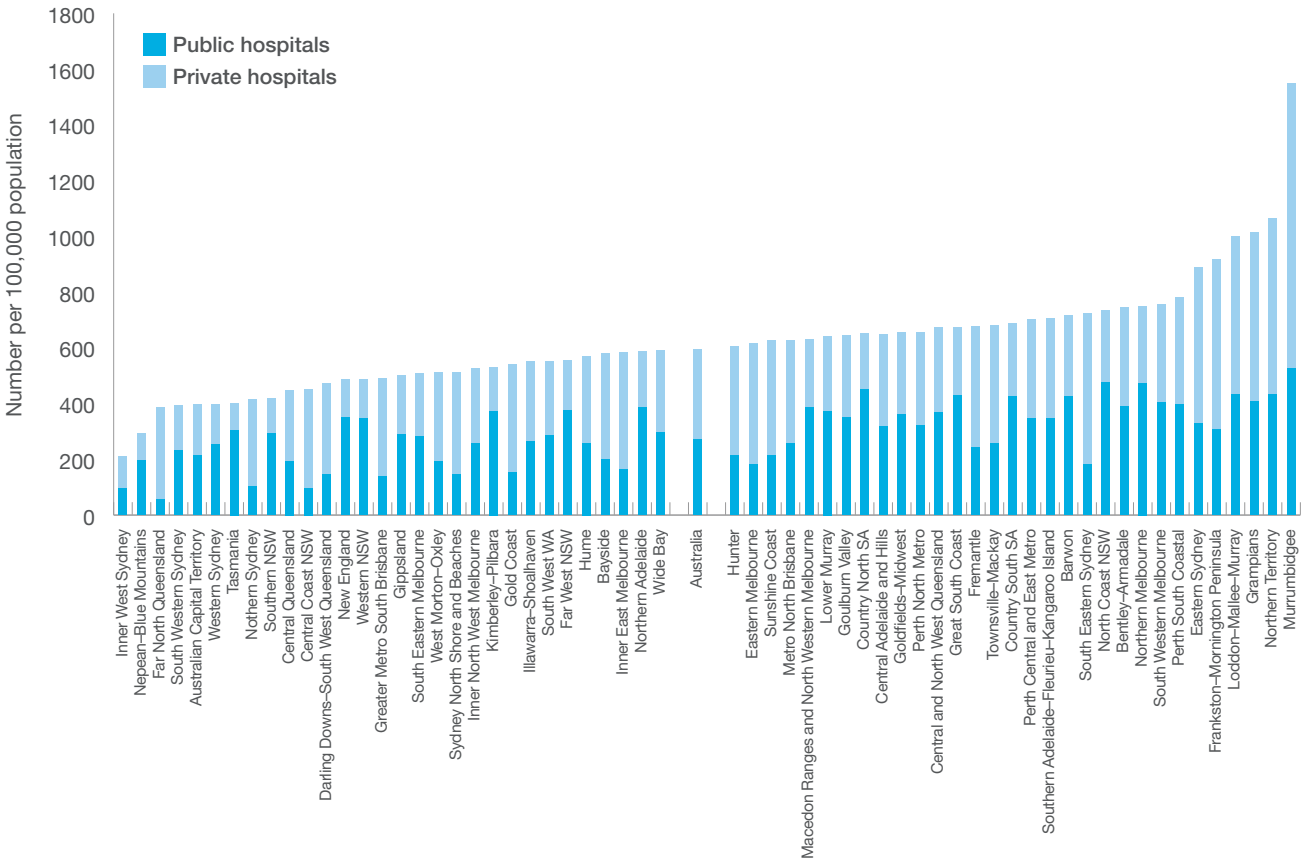
Variation in cardiac catheterisation rates between Medicare Local populations was highest of all interventions examined here. This procedure can also be performed in the outpatient setting and the national rate is likely to be an underestimate.

A considerably higher admission rate for this intervention was observed in the Murrumbidgee, a NSW Medicare Local in the Regional 2 peer group.

The results indicate that more than two catheterisations took place for every revascularisation intervention (percutaneous coronary intervention and/or coronary artery bypass grafting). Cardiac catheterisation is an invasive procedure that carries both a small procedural risk and a radiation burden because of the x-ray used in the procedure. While it is a diagnostic test, expert clinicians consulted in relation to these results suggest it should be approached more as an essential prerequisite to revascularisation – patients should only undergo invasive coronary angiography when there is a high likelihood, based on clinical criteria and non invasive testing, that revascularisation will be the best option for the patient. Local healthcare planners may wish to investigate the ratio between catheterisation and revascularisation.

A mix of factors can influence geographical variation in rates of cardiac catheterisation. These include the burden of coronary heart disease in populations, supply of services and clinical preference.

Additional work should examine if admission rates for these procedures correlate with levels of CHD in given populations or geographic areas.

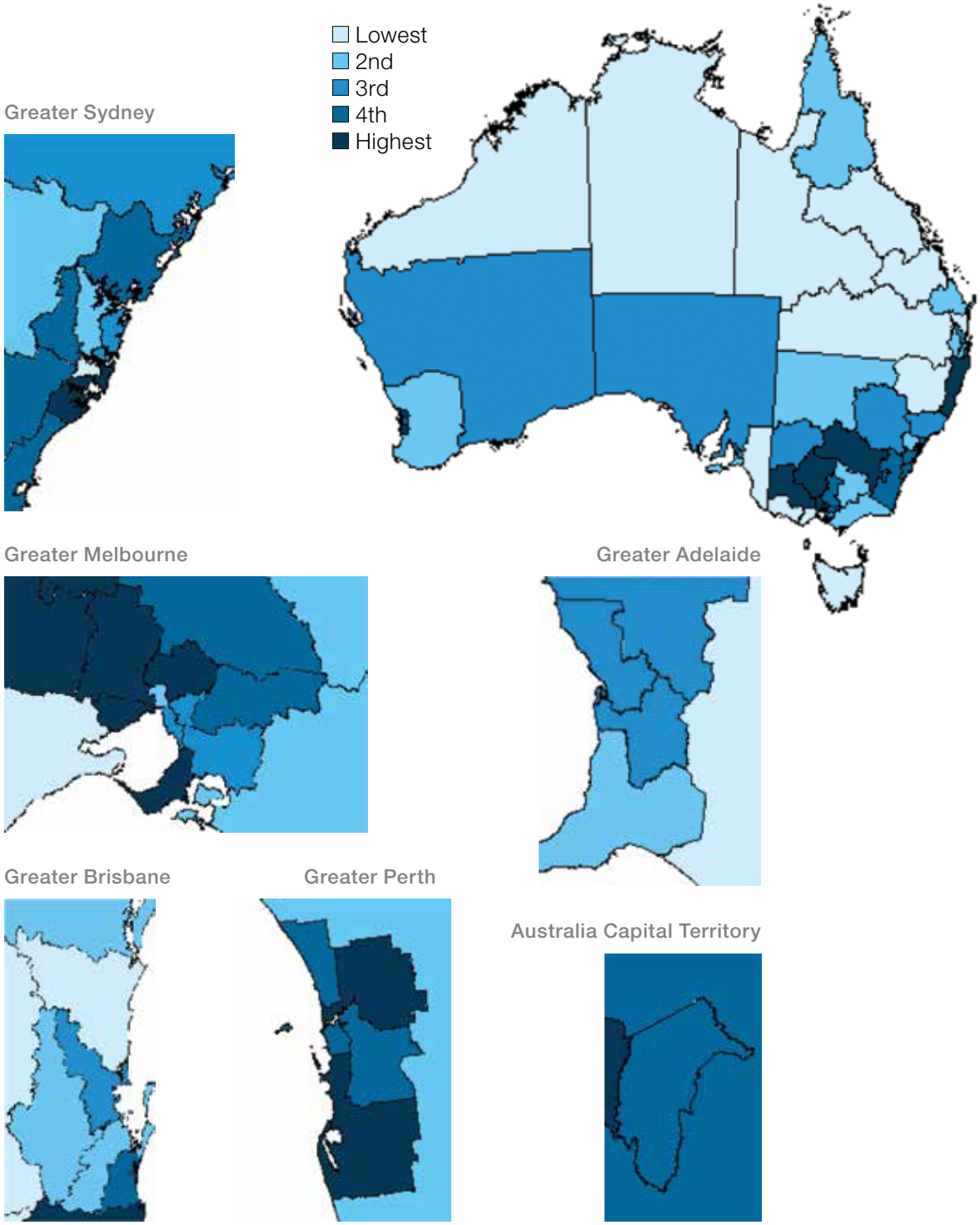


Note: Rates are age and sex standardised to the 30 June 2001 Australian population.

Source: AIHW analysis of National Hospital Morbidity Database.

Figure 21 Admissions for cardiac catheterisation per 100,000 population by Medicare Local and hospital sector, 2010–11

Map 7 Admissions for percutaneous coronary interventions (PCI)



Note: The five groups are based on age and sex standardised rates. The range within each group is as follows: Lowest (135–171); 2nd (172–193); 3rd (194–213); 4th (214–243); Highest (244–393).

Source: AIHW analysis of National Hospital Morbidity Database.

Map 7 Admissions for PCI per 100,000 population by Medicare Local, 2010–11

Percutaneous coronary intervention

Percutaneous coronary intervention (PCI), also called a percutaneous transluminal coronary angioplasty (PTCA) or stenting, is a less invasive revascularisation procedure than a coronary artery bypass graft (CABG) (see page 50, Map 8).

During PCI a catheter (a thin flexible tube) is used to place a small structure called a stent that opens up narrowed blood vessels in the heart.

The catheter is inserted into blood vessels either in the groin or in the arm, and threaded to the heart where the coronary artery is narrowed (see cardiac catheterisation).

When the tip is in place, a balloon tip covered with a stent is inflated. The balloon tip compresses the plaque and expands the stent. Once the plaque is compressed and the stent is in place, the balloon is deflated and withdrawn. The stent stays in the artery, holding it open.

PCI is can be conducted at the same time as a cardiac catheterisation. In this case, the admission is counted once in the data for catheterisation (presented above and once in the data for PCI below).

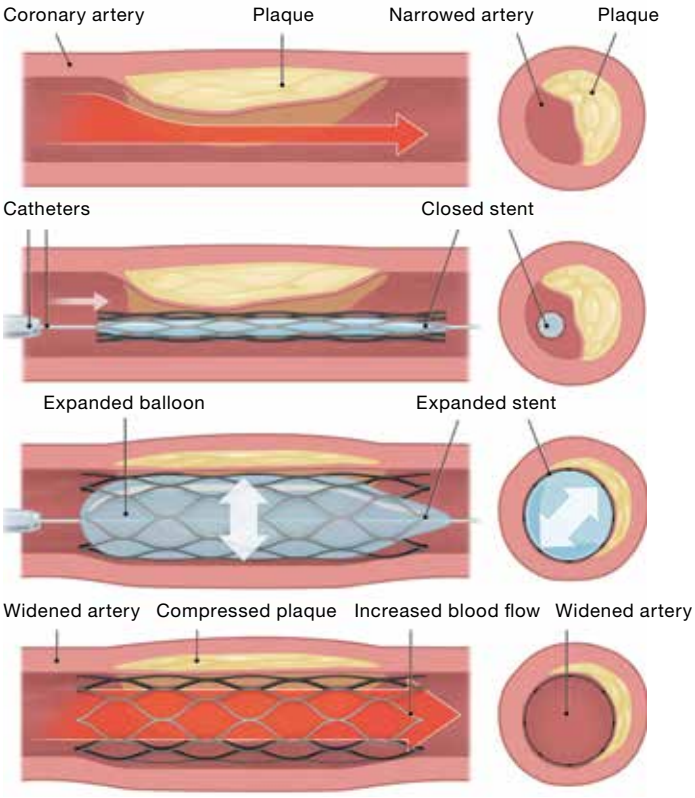


Figure 22 Percutaneous coronary intervention*

*A stent is not always put in place during a PCI.

Description of variation

In 2010–11, the national standardised rate for admissions for PCI was 214 per 100,000 population (Table 9).

Rates for Medicare Locals ranged from 135 admissions per 100,000 population (Northern Territory) to 393 admissions per 100,000 (Loddon-Mallee-Murray), a 3-fold variation.

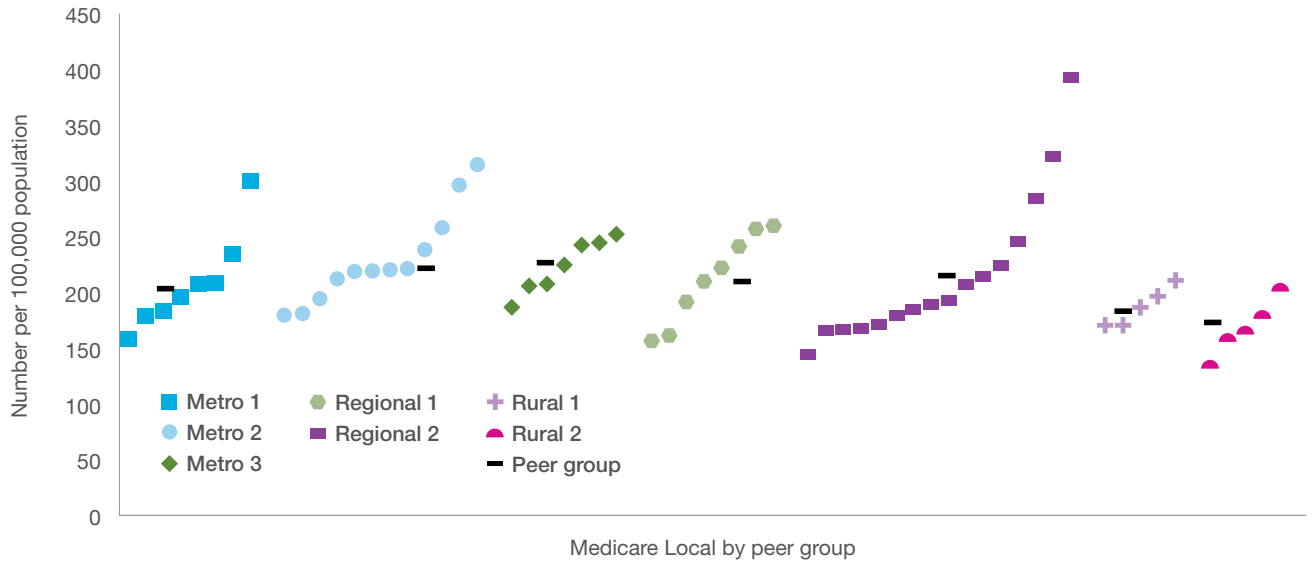
When Medicare Locals were arranged into peer groups, the rate for admissions for PCI was lowest for Rural 1 and Rural 2, and variation within peer groups was greatest in Regional 2 (Map 7, Figure 23). See Appendix 2 for more detailed figures identifying individual Medicare Locals.

Table 9 Summary measures for admissions for PCI by hospital sector, 2010–11

Coronary angioplasty and stenting	Total admissions	Age and sex standardised rate (ASR)	Lowest ASR	Highest ASR	Fold difference	SCV
Public hospitals	20,853	120	71	190	2.7	5.1
Private hospitals	16,581	94	26	219	8.4	18.8
Total	**37,434**	**214**	**135**	**393**	**2.9**	**4.6**

Note: Includes admissions for people aged 20 years and over with at least one of the following ICD-10-AM ACHI procedure block codes: 669–671.

Source: AIHW analysis of National Hospital Morbidity Database.



Notes:

1. Rates are age and sex standardised to the 30 June 2001 Australian population.

2. Peer groups were established based on three criteria: (a) proximity of each Medicare Local to major metropolitan cities; (b) proximity to major hospitals; and (c) socioeconomic status. See Section B for further information.

Source: AIHW analysis of National Hospital Morbidity Database.

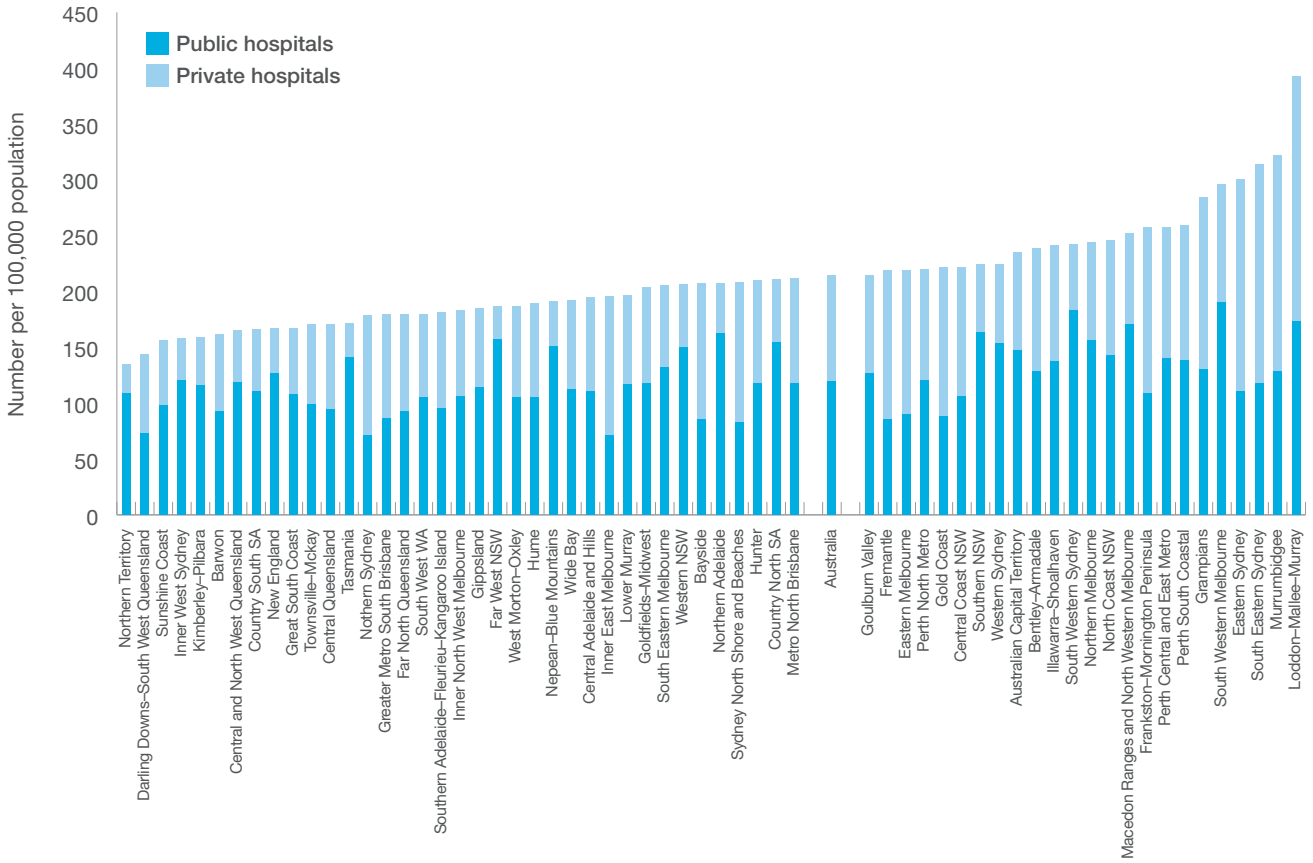
Figure 23 Admissions for PCI per 100,000 population by Medicare Local and peer group, 2010–11

Admissions by hospital sector

Just over half (55 per cent) of the admissions occurred in the public sector (Table 9). There was no clear pattern between the total Medicare Local admission rate and the proportion of patients admitted by sector (Figure 24). There was considerable variation in private sector rates between Medicare Locals, with an SCV of 18.8 (Table 9).

Comment and options for action

Consolidated comment for revascularisation interventions is provided on page 59.

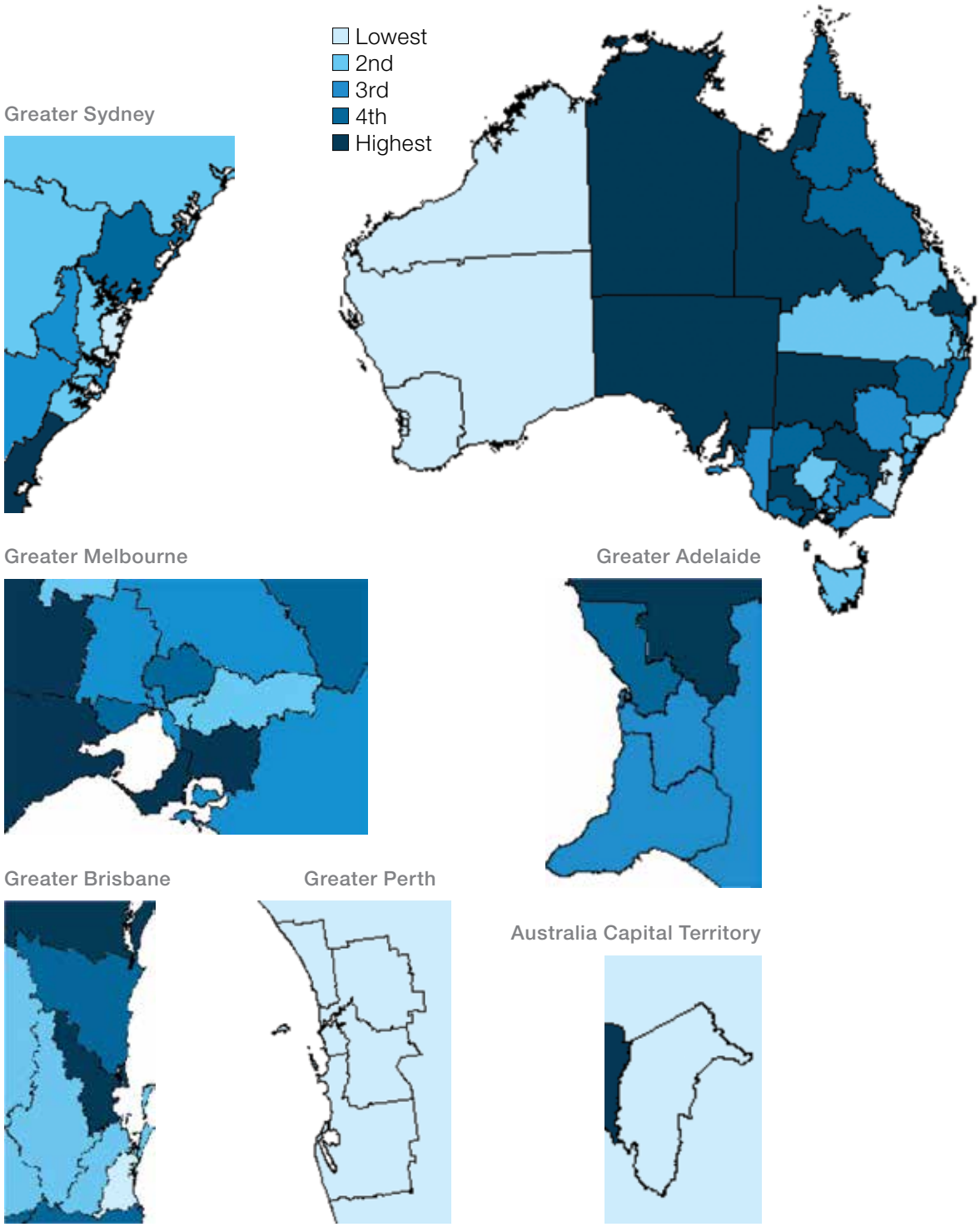


Note: Rates are age and sex standardised to the 30 June 2001 Australian population.

Source: AIHW analysis of National Hospital Morbidity Database.

Figure 24 Admissions for PCI per 100,000 population by Medicare Local and hospital sector, 2010–11

Map 8 Admissions for coronary artery bypass grafting (CABG)



Note: The five groups are based on age and sex standardised rates. The range within each group is as follows: Lowest (32–58); 2nd (59–67); 3rd (68–73); 4th (74–82); Highest (83–105).

Source: AIHW analysis of National Hospital Morbidity Database.

Map 8 Admissions for coronary artery bypass grafting per 100,000 population by Medicare Local, 2010–11

Coronary artery bypass grafting (CABG)

Coronary artery bypass grafting (CABG) is a type of surgery that improves blood flow to the heart. Surgeons use CABG to treat people who have severe coronary heart disease.

During CABG, a healthy artery or vein from the body is connected, or grafted, to the blocked coronary artery. The grafted artery or vein bypasses the blocked portion of the coronary artery. This creates a new path for oxygen-rich blood to flow to the heart muscle.

Surgeons can bypass multiple coronary arteries during one surgery (e.g. 'triple bypass').

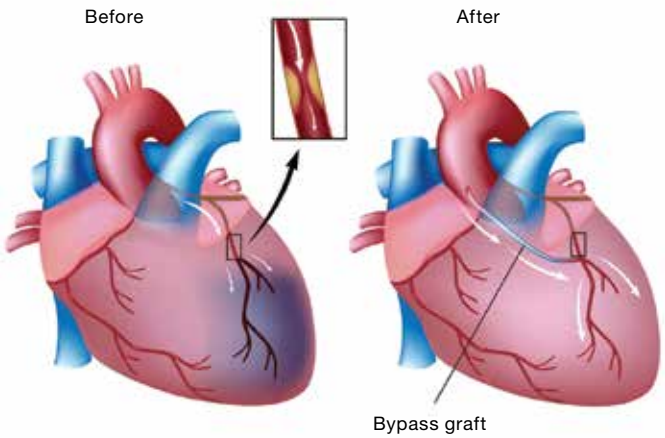


Figure 25 Coronary artery bypass grafting

CABG is one treatment for coronary heart disease. Other options include percutaneous coronary intervention (PCI). The decision to opt for CABG will depend on factors such as the anatomical extent of the disease (if several vessels are involved, a CABG is clinically more indicated), clinician preference and training, as well as patient preferences and access to required services.

Description of variation: CABG

In 2010–11, the national standardised rate for admission for coronary artery bypass grafting was 69 per 100,000 population (Table 10).

The highest admission rate for a Medicare Local (105 per 100,000 in Grampians) was 3.3 times as high as the lowest (32 per 100,000 in Fremantle). Compared with most other Medicare Locals, rates of admissions for CABG were lower for Medicare Locals in Western Australia (including the greater Perth metropolitan area) and the Australian Capital Territory (Map 8).

Variation was evident in all seven Medicare Local peer groups. Rates were slightly lower for the Metro 1 and Metro 2 groups (Figure 26). See Appendix 2 for more detailed figures identifying individual Medicare Locals.

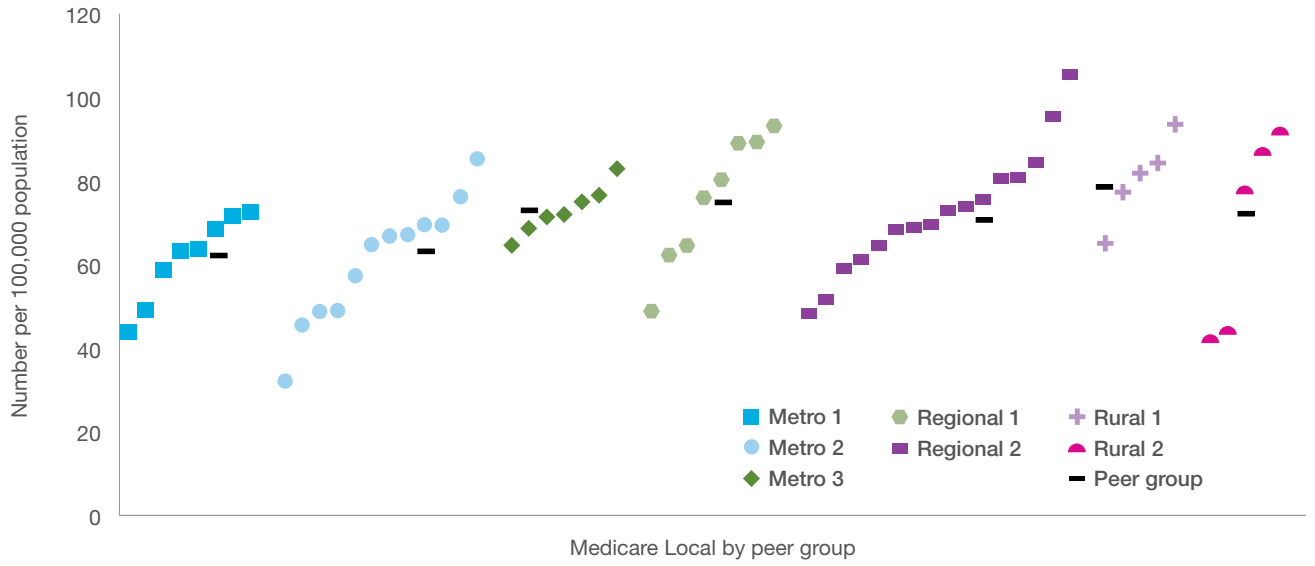
Table 10 Summary measures for admissions for coronary artery bypass grafting by hospital sector, 2010–11

Coronary artery bypass grafting	Total admissions	Age and sex standardised rate (ASR)	Lowest ASR[a]	Highest ASR[a]	Fold difference	SCV
Public hospitals	7,125	41	12	85	7.1	10.9
Private hospitals	5,023	28	3	51	17.0	12.6
Total	**12,148**	**69**	**32**	**105**	**3.3**	**3.7**

a Analysis excludes 5 Medicare Locals (private hospitals) and 1 Medicare Local (public hospitals) because of the small number of admission.

Note: Includes admissions for people aged 20 years and over with at least one of the following ICD-10-AM ICD-10-AM ACHI procedure blocks: 672–679.

Source: AIHW analysis of National Hospital Morbidity Database.



Notes:

1. Rates are age and sex standardised to the 30 June 2001 Australian population.

2. Peer groups were established based on three criteria: (a) proximity of each Medicare Local to major metropolitan cities; (b) proximity to major hospitals; and (c) socioeconomic status. See Section B for further information.

Source: AIHW analysis of National Hospital Morbidity Database.

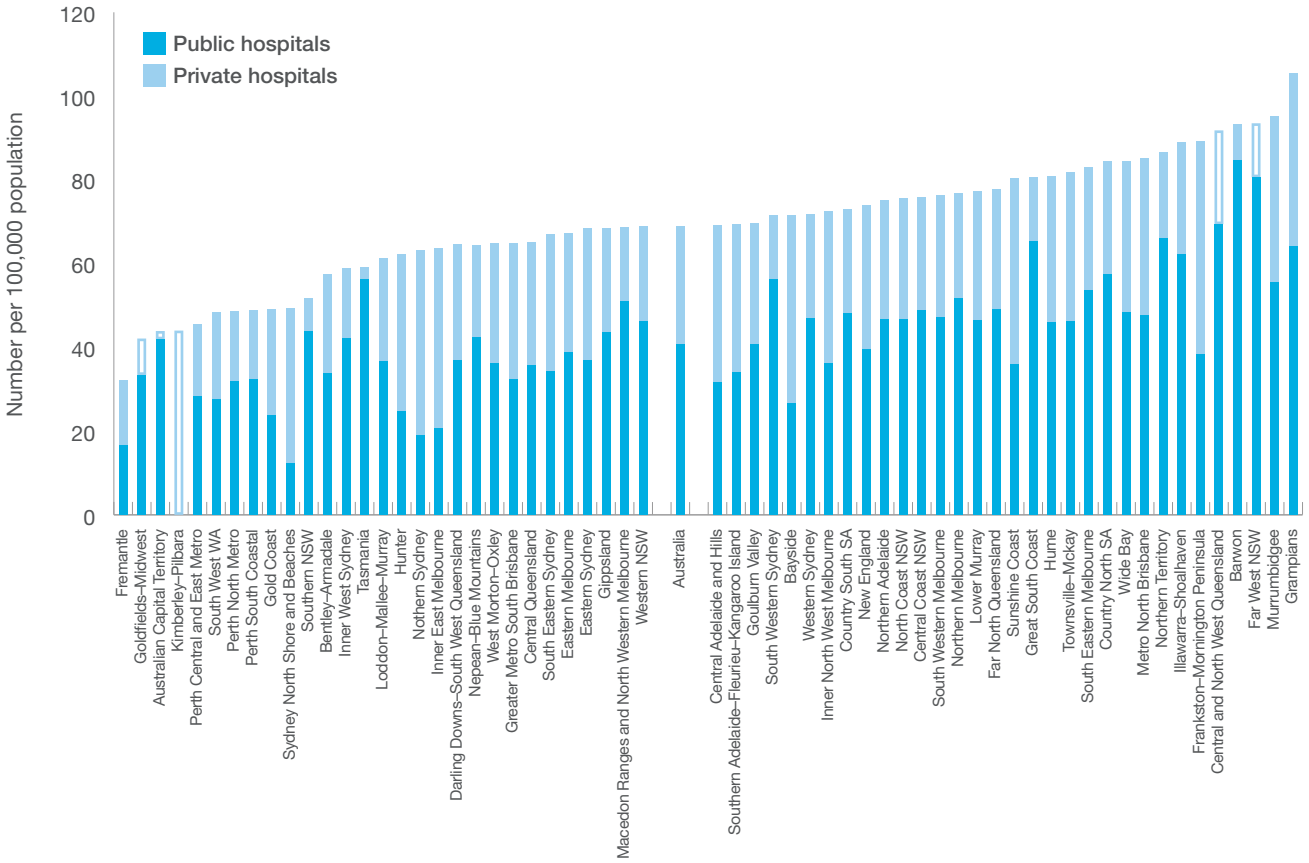
Figure 26 Admissions for coronary artery bypass grafting by Medicare Local and peer group, 2010–11

Variation by hospital sector

Around 60 per cent of admissions for CABG occurred in the public sector (Table 10). For most of the Medicare Locals with the lowest overall rates, rates were similar despite different proportions of admissions being reported for private and public hospitals. There was no clear relationship between the aggregate rates for Medicare Locals and the proportion reported by sector (Figure 27).

Comment and options for action

Consolidated comment for revascularisation interventions is provided on page 59.



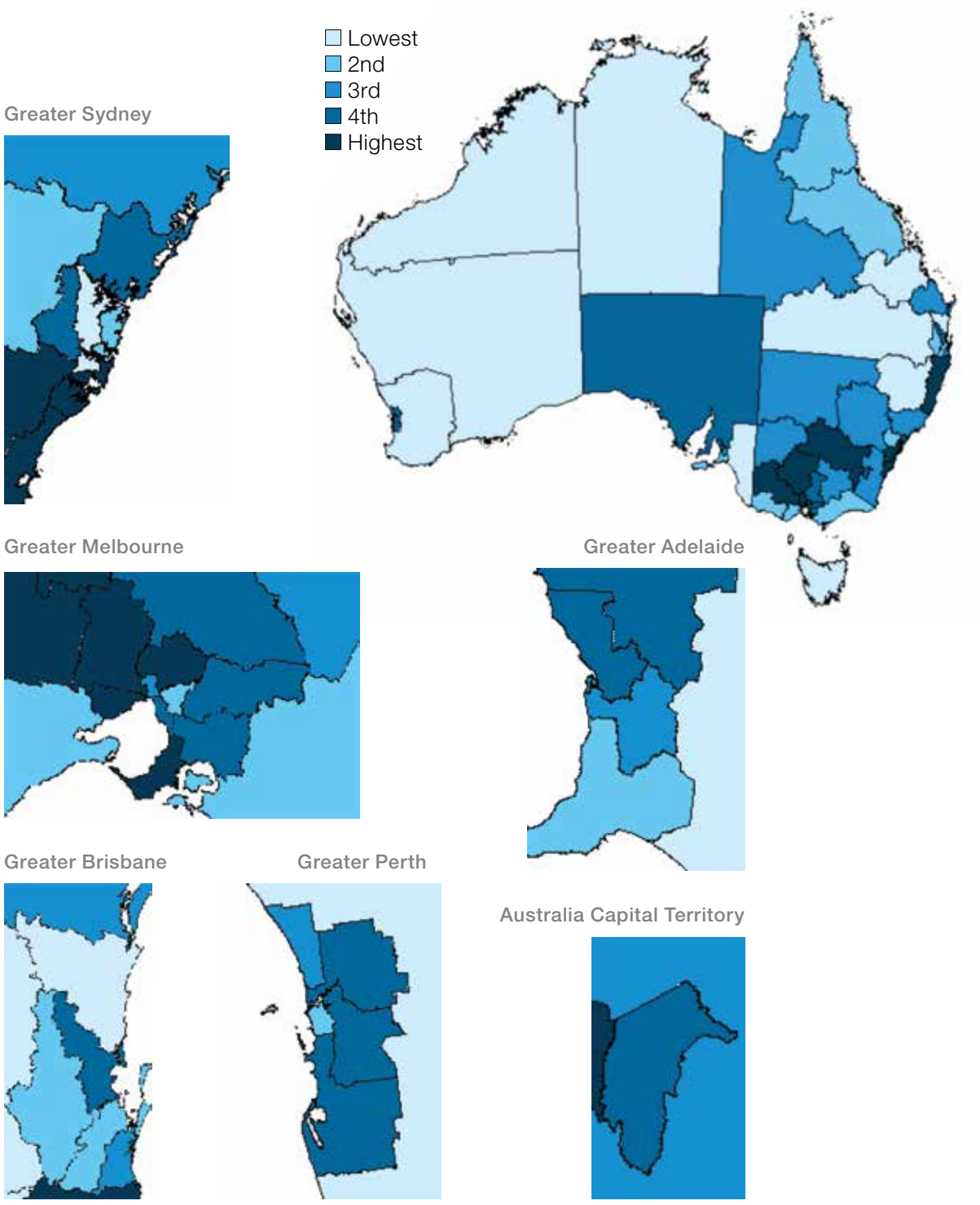
Notes:

1. Rates are age and sex standardised to the 30 June 2001 Australian population.
2. Data for rates based on a small number of admissions are unshaded.

Source: AIHW analysis of National Hospital Morbidity Database.

Figure 27 Admissions for coronary artery bypass grafting by Medicare Local and hospital sector, 2010–11

Map 9 Admissions for revascularisation (CABG and/or PCI)



Note: The five groups are based on age standardised rates. The range within each group is as follows: Lowest (203–242); 2nd (243–257); 3rd (258–272); 4th (273–303); Highest (304–447).

Source: AIHW analysis of National Hospital Morbidity Database.

Map 9 Admissions for revascularisation (CABG and/or PCI) by Medicare Local, 2010–11

Description of variation

PCI and CABG are both interventions aimed at coronary heart disease and there may be a degree of substitution between the two. It is therefore useful to examine variation in combined admission rates for the two revascularisation interventions. This analysis includes admissions where at least one of either intervention was undertaken. In a very small number of cases (less than 0.05 per cent) both types of procedures were undertaken in the same admission.

In 2010–11, the national standardised rate for admission for PCI and/or CABG was 280 per 100,000 population (Table 11). The SCV for PCI and CABG combined (2.8) was smaller than the SCV for PCI only (4.6) and CABG (3.7) (Tables 9–10).

Kimberley-Pilbara had the lowest combined rate of admissions for PCI and/or CABG (203 per 100,000 population) and Loddon-Mallee-Murray had the highest (407 per 100,000), a 2-fold variation (Table 11).

Table 11 Summary measures for admissions coronary artery bypass grafting and/or coronary angioplasty and stenting by hospital sector, 2010–11

PCI and/or CABG	Total admissions	Age and sex standardised rate (ASR)	Lowest ASR	Highest ASR	Fold difference	SCV
Public hospitals	27,835	159	89	240	2.7	4.8
Private hospitals	21,516	121	33	242	7.3	14.1
Total	**49,351**	**280**	**203**	**447**	**2.2**	**2.8**

Note: Includes admissions for people aged 20 years and over.

Source: AIHW analysis of National Hospital Morbidity Database.

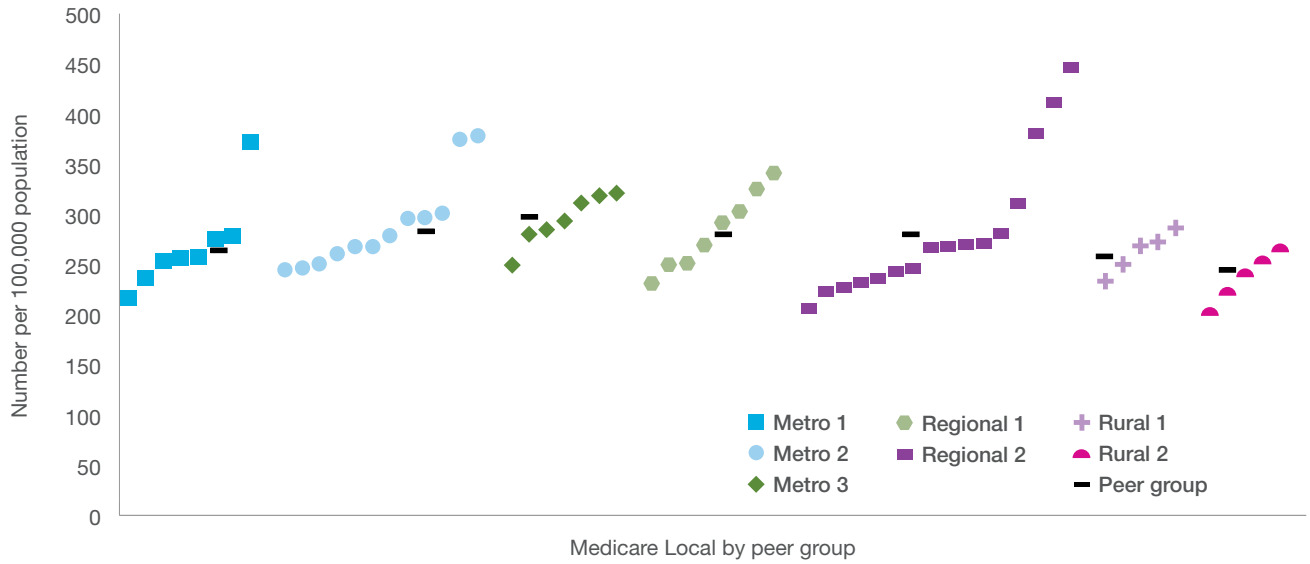
Admissions rates for each Medicare Local peer group were similar. Variation of Medicare Local rates within each peer group was greatest in Regional 2, and smallest for Rural 1 and Rural 2 (Figure 28). See Appendix 2 for more detailed figures identifying individual Medicare Locals.

Admissions by sector

Fifty eight per cent of these admissions were performed in the public sector. Most Medicare Local rates were similar, despite different proportions being reported for public and private sectors (Figure 29). The SCV was 14.1 for private sector hospital admissions, compared to 4.8 for public admissions (Table 11).

Comment and options for action

Consolidated comment for revascularisation interventions is provided on page 59.

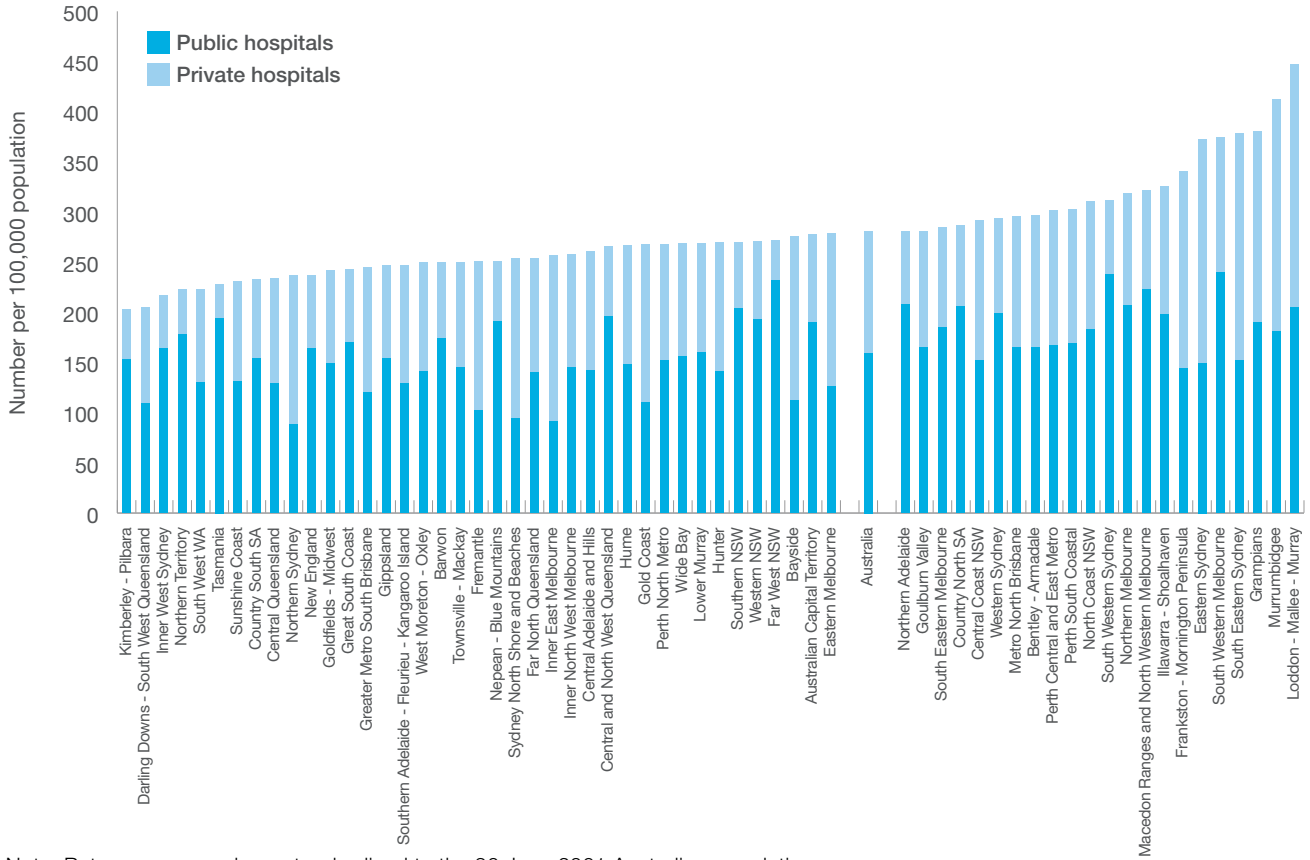


Notes:

1. Rates are age and sex standardised to the 30 June 2001 Australian population.
2. Peer groups were established based on three criteria: (a) proximity of each Medicare Local to major metropolitan cities; (b) proximity to major hospitals; and (c) socioeconomic status. See Section B for further information.

Source: AIHW analysis of National Hospital Morbidity Database.

Figure 28 Admissions for PCI and/or CABG by Medicare Local and peer group, 2010–11

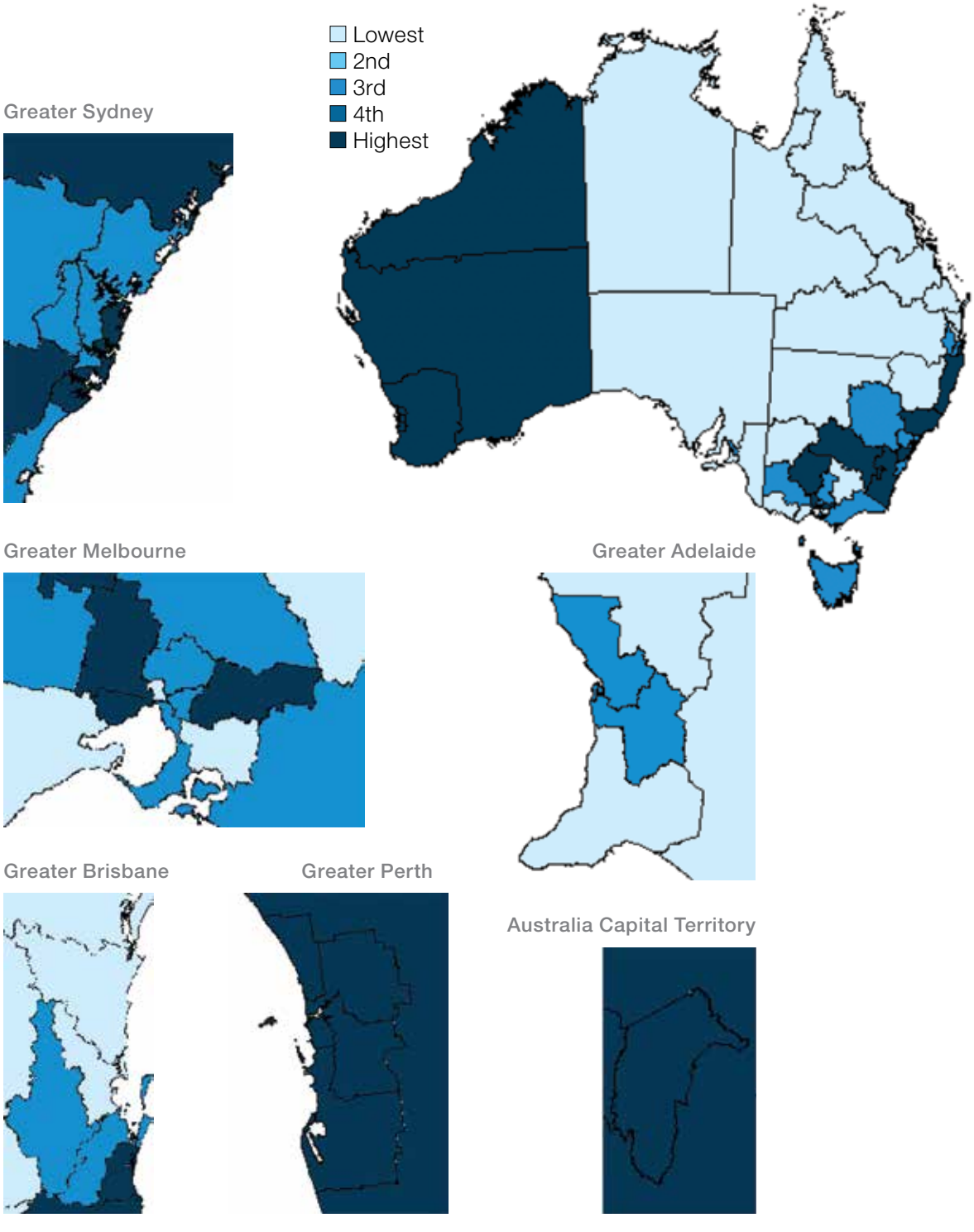


Note: Rates are age and sex standardised to the 30 June 2001 Australian population.

Source: AIHW analysis of National Hospital Morbidity Database.

Figure 29 Admissions for CABG and/or PCI per 100,000 population by Medicare Local and hospital sector, 2010–11

Map 10 Ratio of PCI to CABG admissions



Note: The three groups are based on the ratio of age and sex standardised rates. The range within each group is as follows: Lowest (1.6–2.6); Middle (2.7–3.2); Highest (3.3–6.8).

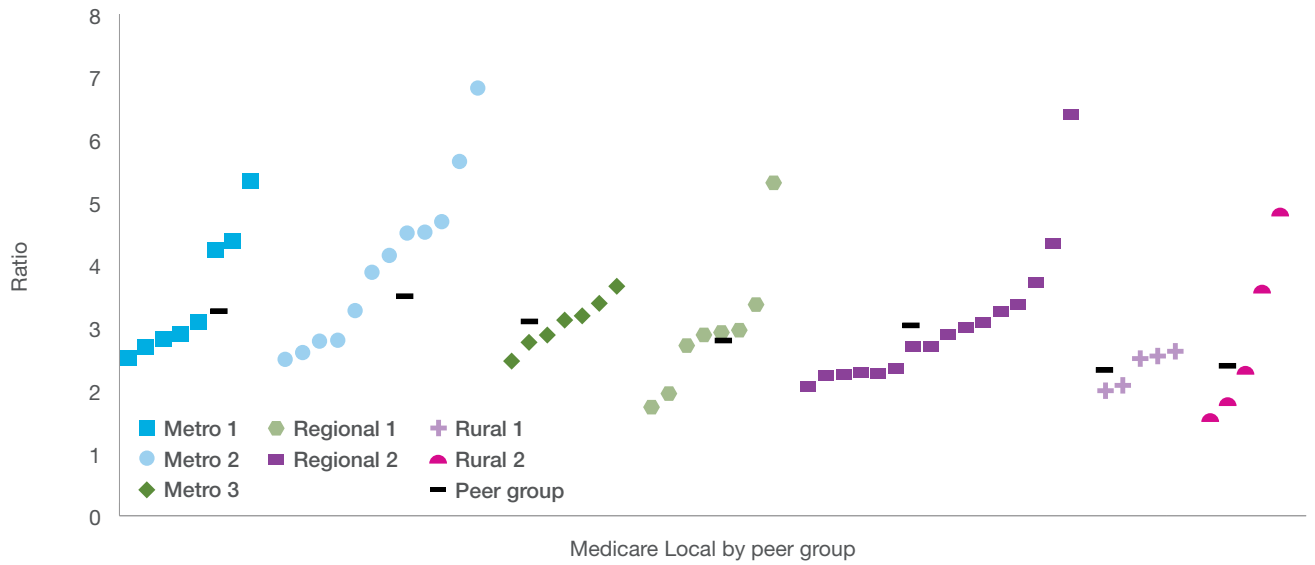
Source: AIHW analysis of National Hospital Morbidity Database.

Map 10 PCI:CABG ratio by Medicare Local, 2010–11

Description of variation: PCI to CABG ratio

The PCI: CABG ratio provides another way to explore variation in these two revascularisation procedures. The national average ratio for 2010–11 was 3.08.

The highest ratio (6.8) is observed in Fremantle, 4.5 times higher than the lowest ratio observed in the Northern Territory (1.5). Western Australian Medicare Locals and those in south-eastern Australia have higher ratios than other Medicare Locals. Generally, slightly lower ratios are observed in rural Medicare Local populations than in metropolitan and regional populations (Figure 30). See Appendix 2 for more detailed figures identifying individual Medicare Locals.



Note: Peer groups were established based on three criteria: (a) proximity of each Medicare Local to major metropolitan cities; (b) proximity to major hospitals; and (c) socioeconomic status. See Section B for further information.

Source: AIHW analysis of National Hospital Morbidity Database

Figure 30 Ratio of PCI and CABG admissions by Medicare Local and peer group, 2010–11

There is no observable correlation between admission rates for PCI and rates for CABG in Medicare Locals (Figure 31). PCI to CABG ratios by hospital sector were not investigated.

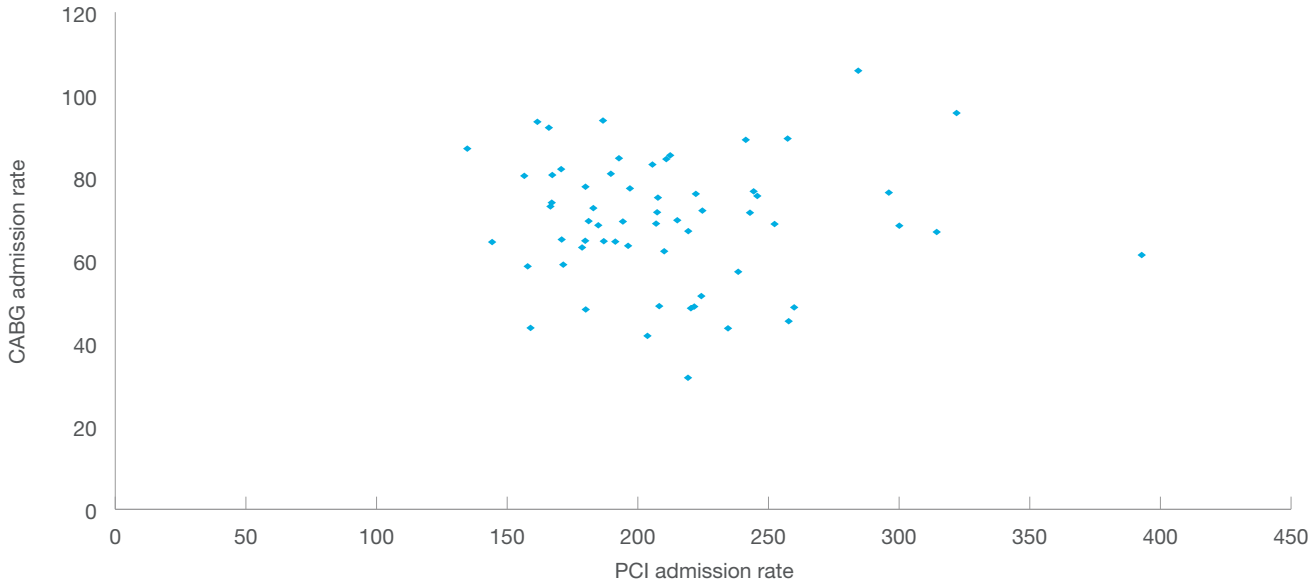
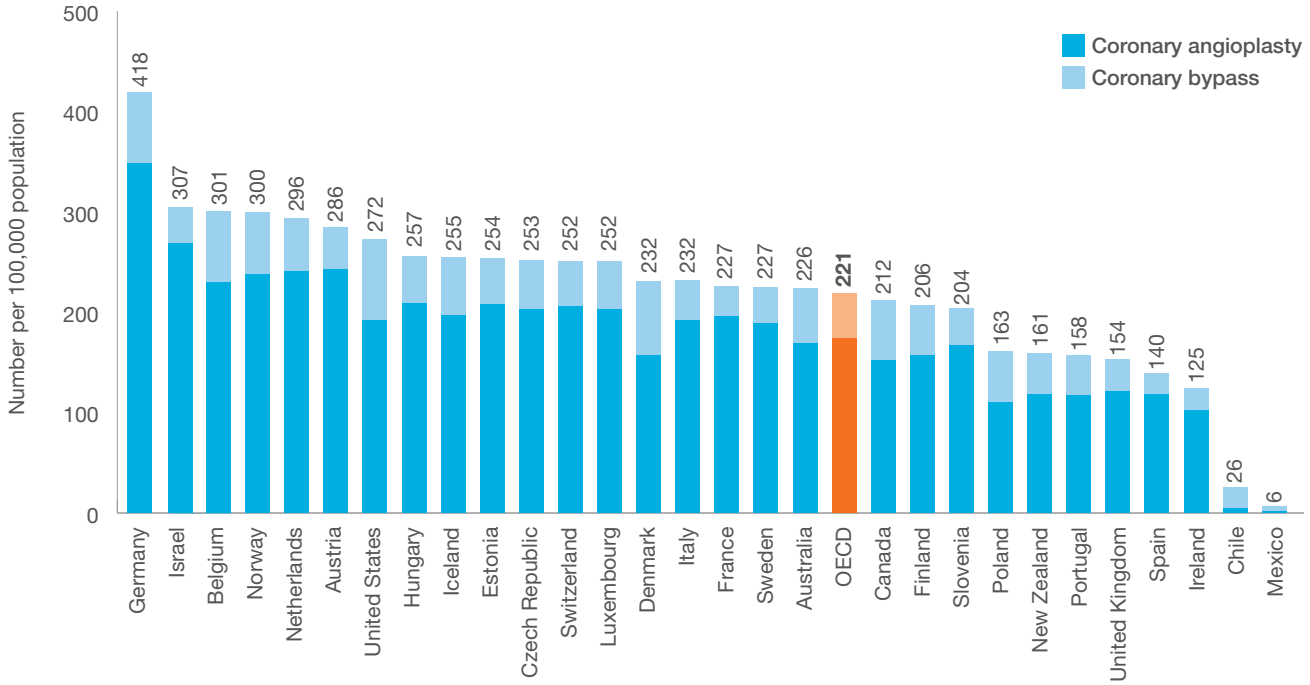


Figure 31 Scatter plot of admission rates for PCI versus CABG by Medicare Local, 2010–11

Comment and options for action: revascularisation

A complex mix of factors can influence geographical variation in rates of revascularisation interventions. These include burden of coronary heart disease in populations (including the anatomical extent of disease, that is how many coronary vessels are involved), comorbidities, remoteness and clinical preference. Rates of revascularisation procedures in Australia are similar to the OECD average (Figure 32).



Note: Rates are age and sex standardised to the OECD stardard population.

Source: OECD Health Statistics 2013, http://search.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=DELSA/HEA/WD/HWP(2013)2&docLanguage=En

Figure 32 Age and sex standardised PCI and CABG rates per 100,000 population

Results presented here suggest that in 2010–11 three PCI were performed for every CABG in Australia. The highest observed ratio in a Medicare Local population was 6.8. Local healthcare planners and clinical care networks may wish to review whether the PCI to CABG ratio is appropriate in their area.

Some studies demonstrate that patients with diabetes and multi-vessel coronary disease and patients with complex multi-vessel disease have better outcomes with CABG than with PCI but such patients often end up having PCI.[35 36] Similarly, there is evidence of limited benefit of elective PCI versus medical therapy.[37 38] High rates of PCI and high PCI/CABG ratios may need further investigation to determine appropriateness.

Based on the data analysed here, there is little evidence of a substitution effect between the two revascularisation interventions examined; rates of admission for PCI in Medicare Local populations appear to be independent of admissions for CABG, and vice versa (see Figure 31).

Future work could examine if admission rates for these procedures correlate with levels of coronary heart disease in given populations or geographic areas.

Part H: Reflection and discussion

These results demonstrate variation between Medicare Local populations in admission rates for the interventions studied. The variation may be partly explained by demographic features, burden of disease, and personal preferences influencing healthcare use in Medicare Local populations. However some variation may also be unwarranted.

What is the 'appropriate rate' for an intervention?

The different health 'need' or disease burden of populations will drive rates of various medical procedures and interventions. It is important not to assume that more appropriate clinical decisions are necessarily made in areas with low admission rates.[39 40] Equally, a high rate of a particular procedure is not necessarily better; it does not guarantee that those patients who will benefit do receive the treatment, nor that those who will not do not.

As Canadian health economist Bob Evans has noted: "If variations represent evidence of inappropriate care, which care is inappropriate? Are the regions, or institutions, or practitioners with high rates over-providing, or are the low ones under-providing, or does the 'best' rate lie somewhere in the middle (or beyond either end)?".[23]

The appropriate rate must rely on knowledge of clinical outcomes, which is often lacking. Indeed, studies of discretionary admissions in the USA in the 1980s found no systematic relationship between rates of appropriateness and overall admission rates: high proportions of admissions were classed as inappropriate or equivocal for areas with both high and low admission rates.[41 42]

Research in the Trent region of England found that, despite its low rates of admission for coronary angiography and coronary artery bypass operations (when compared with the USA and England as a whole), British doctors, using their own criteria, deemed only about half of these to have been appropriate.[43]

Consistency in how patient admissions are defined is also important in order to enable accurate comparisons in true admission rates across the country. At the moment there may be inconsistent practice in this regard between states and territories, potentially influencing the results of national studies such as this one.

Variation and value

A heightened focus on patient safety combined with increased pressure on public finances and healthcare budgets has elevated the importance of value.

Value is the relationship between outcomes and costs, and is maximised when the best possible outcomes are achieved at the least possible cost (in this sense value is similar to productivity). Costs include money and resources such as staff time, expertise and infrastructure. However, another important cost is *opportunity cost* defined as the benefit forgone by investing resources in a specific activity. While in a world of finite resources there will always be an opportunity cost, it is important to allocate resources in a manner that will maximise benefits and minimise total opportunity costs (i.e. maximise value), a concept referred to as allocative efficiency.[h]

In health care, opportunity costs are borne by patients whose needs are not met because resources were deployed elsewhere. Minimising opportunity costs means investing in interventions that are higher value (which may often be preventative, or health-promoting measures that may even be outside of the scope of 'health care') and disinvesting in areas of lower-value.[i] While interventions may be effective, not all are high-value (see Figure 33).

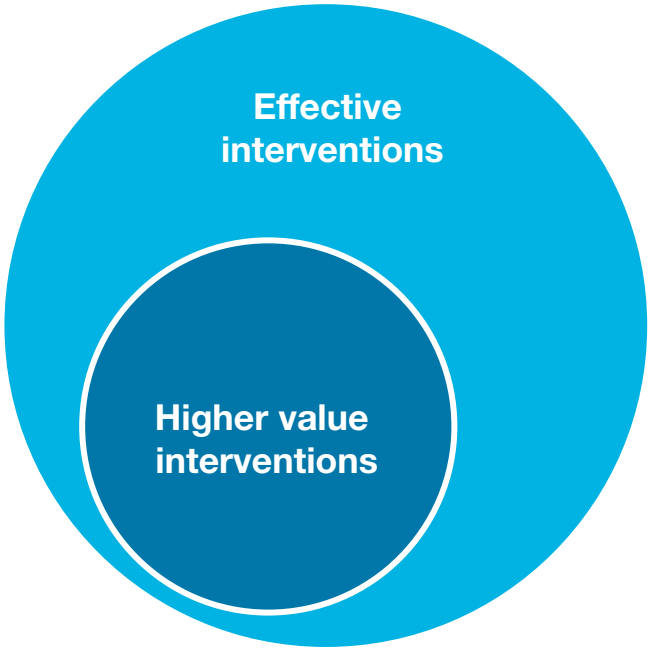


Figure 33 Higher value interventions as a subset of effective interventions[44]

Porter describes value in health care in the following terms: "Value should always be defined around the customer, and in a well-functioning health care system, the creation of value for patients should determine the rewards for all other actors in the system. Since value depends on results, not inputs, value in health care is measured by the outcomes achieved, not the volume of services delivered, and shifting focus from volume to value is a central challenge … Since value is defined as outcomes relative to costs, it encompasses efficiency. Cost reduction without regard to the outcomes achieved is dangerous and self-defeating, leading to false "savings" and potentially limiting effective care."[45(p2477)]

Understanding variation and its causes, and reducing unwarranted variation are critical in maximising value.

h The value of an activity is not static, and diminishes and sometimes increases as more resources are devoted to it (i.e. the next quantum of resources invested in X will not generate the same benefit than the previous quantum). This must be considered when thinking about allocative efficiency.

i This applies to known interventions, and does not extend to research aimed at finding high-value interventions or measures.

Current local activity and response to observed variation

The **Commonwealth** Reviews of the Medicare Benefits Schedule (MBS) systematically examine MBS items to ensure that they reflect contemporary evidence, improve health outcomes for patients and represent value for money. Although these are not initiatives solely directed at identifying and addressing unwarranted variation, they contribute to this goal. The Reviews have a primary focus on improving health outcomes and the financial sustainability of the MBS, through consideration of:

- patient safety risk;
- limited health benefit; and/or
- inappropriate use (under or over use).

More information is available at **www.msac.gov.au/internet/msac/publishing.nsf/Content/reviews-lp**

The **Australian Capital Territory** currently does not have any ongoing local activity which measures or targets healthcare variation. The jurisdiction is currently examining approaches to improve patient flow through its hospital systems and expects to examine variation as a potential factor in hospital access in the near future. For more information, please contact Dr Girish Talaulikar at **girish.talaulikar@act.gov.au**

A number of **New South Wales** statutory authorities including NSW Cancer Institute, NSW Bureau of Health Information and the Clinical Excellence Commission publish reports on variation in processes and outcomes of care annually. Publication is seen as an important lever to ensure appropriateness of care and address variations in clinical outcomes.

Additionally, the NSW Agency for Clinical Innovation uses this information to develop strategies to support and reinforce these improvements. The current program of work includes action to reduce variation in outcomes for rare cancer surgeries, acute AMI and stroke mortality and outcomes for patients admitted with fractured neck of femur. Following a NSW Bureau of Health Information report in December 2013 pneumonia will now be added to the work program.

For more information, please contact Dr Nigel Lyons at **nigel.lyons@aci.health.nsw.gov.au**

The **Northern Territory** is following with interest work happening in other jurisdictions to understand variation across specific procedures and preventable hospitalisations. As the Northern Territory comprises one Medicare Local, it relies on identifying other Medicare Locals with similar socio-demography to understand variation.

The Northern Territory now intends to undertake work to identify variation in selected procedures across its healthcare facilities. For more information, please contact Mr Deane Wilks at **deane.wilks@nt.gov.au**

Queensland has targeted a reduction in unwarranted variation, particularly in adverse patient outcomes to ensure Queenslanders receive safe and high-quality care. Several initiatives exemplify these efforts, including the monitoring of patient outcomes and utilisation through the Variable Life Adjusted Display (VLAD) program, establishment of 18 statewide clinical networks, and statewide clinical guidelines and pathways.

The results presented in this paper are being considered by the statewide clinical network groups and other formed clinical working groups to identify and establish the cause of the variation and to determine appropriate action to reduce the variation where unwarranted. Healthcare variation is being considered together with patient outcome data as well as other measures (process, clinician and patient preferences) to ensure optimal outcomes for Queensland patients.

For more information, please contact Ms Kirstine Sketcher-Baker at **kirstine.sketcher-baker@health.qld.gov.au**

South Australia is focusing on reducing unwarranted variation and the volume of unsafe, avoidable and low priority public hospital service utilisation to maximise value across the healthcare system and improve patient outcomes. The aim is to redirect resources to the clinical activities that generate the best value for the population, preserving access to treatment for those who are most in need and could most benefit and reducing unnecessary risks associated with hospital stays.

A Clinical Commissioning Advisory Committee has been established comprising clinical leads from across the health system, and representatives from the Clinical Networks and Clinical Senate and Surgical Services Task Group to:

- provide clinical advice and leadership across the Health System on clinical service redesign
- guide consistent clinical practice in accordance with agreed commissioning priorities.

Using national benchmarks for public and private hospital utilisation, OECD data, and patient outcome data including Classification of Hospital Acquired Diagnoses (CHADx) and the Variable Life Adjusted Display (VLAD) method, an initial set of priority areas have been identified: cardiology, respiratory medicine, neurology, orthopaedics, ENT, non-subspecialty/general medicine and breast surgery.

Under the auspices of a clinical lead for each area, work groups will develop end-to-end evidence based pathways that will inform patient care across the continuum and promote consistent practice. It is anticipated that the pathways will address patient expectations, GP referral processes, outpatient requirements, emergency presentations, admission to hospital and discharge processes, and GP and community follow-up. South Australia is also running local data for complications of care which will further enrich the projects and help to identify other areas of opportunity.

For more information, please contact Ms Shelley Horne at **shelley.horne@health.sa.gov.au**

Tasmania has commenced a comparative analysis of mortality and preventable hospitalisations between local health networks (Tasmanian Health Organisations). It is expected that this will assist with interpreting the findings of healthcare variation presented here as part of the OECD study.

For more information, please contact Ms Kelly Shaw at **kelly.shaw@dhhs.tas.gov.au**

Victoria has identified clinical practice variation as potentially a useful tool to improve the efficiency and effectiveness of the public hospital system, as part of the Sustainable Hospitals Initiative.

The first step is using the OECD/AIHW methodology to re-analyse the results using public hospital catchments. This work is currently under way. This re-analysis will facilitate better engagement with clinicians about this variation and the underlying drivers. The data includes procedures performed in private hospitals as well as public hospitals, and in some cases the procedures in the private sector make up the majority (e.g. knee arthroscopies).

The next step will be to further extend the analysis using other interventions and conditions, and will be guided by clinician feedback.

For more information, please contact Dr Martin Lum at **martin.lum@health.vic.gov.au**

Western Australia has been working towards decreasing unwarranted variation in care by using a number of different methods, both tested and innovative, aimed at improving evidence-based care. For a number of years, WA Health has had a strong focus on a network approach to developing evidence-based models of care for use within the public health system. Over 70 models of care have been developed to date, including models for acute coronary syndromes and elective joint replacement.

WA Health has recently introduced an incentive payment program for the provision of evidence-based care in priority safety and quality areas. The Performance-based Premium Payment Program was piloted in 2012/13 and is being run in 2013/14 with payments for: fragility hip fracture; acute stroke unit care; and management of acute myocardial infarction.

For more information, please contact Ms Clare Mullen at **clare.mullen@health.wa.gov.au**

Other responses and future work

Identifying appropriate responses to healthcare variation requires a more complete understanding of the reasons for, and consequences of, different utilisation rates, and a detailed understanding of patterns of illness and patient preferences. More information on the outcomes of care is required.

Reporting of healthcare variation

Internationally, there is a move towards detailed, public reporting of healthcare variation, and a focus on greater engagement of the community, patients, health professionals, services and managers in exploring reasons for variation.

The first step in reducing unwarranted variation in health care is the systematic and routine collation, analysis and publication of variation.

This document has focused on variation in procedures undertaken in hospitals. It is also important to focus on variation in community and primary care, not least because the pathways to specialist intervention often begin there.

The Australian Government, in the 2013/14 Budget, identified funds to work with the Commission on exploring variations in community care as part of an *Australian Atlas of Healthcare Variation*.[46] The Commission will investigate and map healthcare variation in a range of conditions, treatments and investigations across healthcare settings and sectors starting in 2014.

So that action can be taken to reduce any unwarranted variation, the geographical areas used to report variation needs to align with accountability and capacity to intervene. For this reason future work on variation will try to use the most appropriate unit of analysis for each intervention, condition or other clinical topic area.

Outcomes of care

A lack of routine information on outcomes of care is the key limitation of work on healthcare variation.

At present there is no consistent approach between state and territory jurisdictions in the use and monitoring of healthcare interventions or pathways. Mechanisms such as clinical quality registries link clinical and service activity to outcomes.[47] For most procedures examined in this paper, there is no systematic way of monitoring outcomes of care in Australia. Linking care inputs and processes with outcomes can provide information to help determine the appropriate rate for an intervention.

Patient outcomes should begin to be integrated into routine data collection processes, and there may be advantages in a more coordinated, national, approach to tracking outcomes of care in a variety of modalities, treatments and interventions.

Continuous feedback

It is also important that information on various aspects of healthcare be fed back to the clinical organisations, to healthcare professionals who are responsible for referring patients for treatment or testing, to healthcare professionals who are responsible for planning and (shared) decision-making about treatments and to consumers.

There is evidence that access to information can be a powerful driver of quality improvement in health care, provided it is timely, reliable and meaningful, and presented in a manner that can be understood by the intended audience.[48]

Clinical engagement and leadership

Involvement of clinical leaders and clinicians in efforts to inform the analysis of variation is essential. They provide important input into the collection, analysis and dissemination of related data, as well as in developing and implementing appropriate responses, at policy, service and clinical levels. Peer review, for example, has been shown to be an effective strategy in reducing unwarranted healthcare variation.[49]

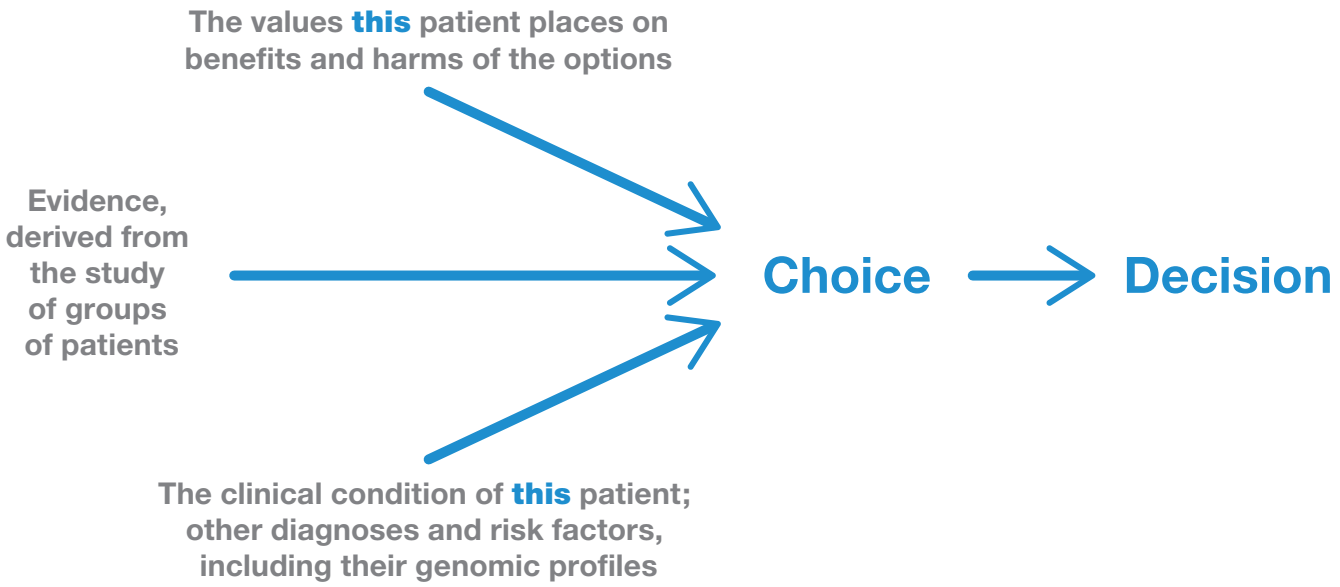
Shared decision making

Shared decision making allows patients to examine the likely benefits and harms of available screening, treatment, or management options, communicate their values and preferences and select the best course of action for their own circumstances. This is particularly important when the evidence is uncertain, or there are multiple options with different probabilities of risk and benefit (see Figure 34).

Patients who are fully informed about the implications of various options and how these align with their own values will often make different choices – there is some evidence, for example, that they are less likely to opt for surgery than control groups.[17 50] Shared decision making is therefore widely seen as a strategy for promoting patient centred care and reducing unwarranted variation.

If shared decision making is to occur, patients and clinicians need to have ready access to evidence about treatment options, understandable information about probability of risk and benefit and guidance on weighing pros and cons of different options. The clinical culture must support patient engagement.[51] The Commission is starting a program of work to increase access to tools and resources that will assist with shared decision making.

Figure 34 The key factors of shared decision making



How To Get Better Value Healthcare (2nd Edition). J. A. Muir Gray (2011). Offox Press.

Part I: Appendices

Appendix 1 Glossary and abbreviations

Glossary

Angiography
Medical imaging technique used to visualise the inside, or lumen, of blood vessels and organs of the body, with particular interest in the arteries, veins and the heart chambers

Arthroscopy
Diagnostic and sometimes therapeutic procedure of a joint using a fibre-optic cable inserted through small incisions in the skin and the joint capsule

Appropriateness
Degree to which health services for individuals and populations increase the likelihood of desired health outcomes and is consistent with current professional knowledge

Clinical microsystem
A group of healthcare professionals and support staff working together with a shared clinical purpose to provide care for a population of patients

Commission, the
Australian Commission on Safety and Quality in Health Care

Healthcare variation
Differences in how medical care is practiced or used between analytical units such as regions or population groups

Revascularisation
Restoration of blood flow to a body part or organ

Stent (stenting)
A mesh 'tube' inserted into a natural passage in the body to prevent or counteract a disease-induced, localised flow constriction (a form of percutaneous coronary intervention, or PCI)

Systematic component of variation (SCV)
A measure of variation that uses a mathematical modelling technique to even out the predictable variation due to differences between population size

Unwarranted variation
Variation in the use of health care services that cannot be explained by variation in patient characteristics or preferences

Watchful waiting
An approach to a medical problem in which time is allowed to pass before medical intervention or therapy is used

Abbreviations

ABS	Australian Bureau of Statistics
ACS	Acute coronary syndrome
AIHW	Australian Institute of Health and Welfare
AMI	Acute myocardial infarction
AR	Admission rate
ASR	Age and sex standardised rate
CABG	Coronary artery bypass grafting
CHD	Coronary heart disease
ERP	Estimated Resident Population
MI	Myocardial infarction
ML	Medicare Local
NHMD	National Hospital Morbidity Database
NSAIDs	Non-steroidal anti-inflammatory drugs
OECD	Organisation for Economic Cooperation and Development
PCI	Percutaneous coronary interventions
PTCA	Percutaneous transluminal coronary angioplasty (a form of PCI)
SCV	Systematic component of variation
SLA	Statistical Local Area

Appendix 2 Detailed figures

This Appendix presents variation for each condition and procedure by individual Medicare Local as well as peer group. Identifying numbers for Medicare Locals are presented again for reference.

Medicare Locals by peer group with identification number

1. Metro 1	No.		No.
Eastern Sydney	1	Inner North West Melbourne	18
Inner West Sydney	2	Bayside	19
Northern Sydney	7	Inner East Melbourne	23
Sydney North Shore and Beaches	8	Australian Capital Territory	61
2. Metro 2			
South Eastern Sydney	3	Central Adelaide and Hills	47
South Western Melbourne	20	Southern Adelaide-Fleurieu-Kangaroo Island	48
Eastern Melbourne	24	Perth Central and East Metro	51
Metro North Brisbane	35	Perth North Metro	52
Greater Metro South Brisbane	36	Fremantle	53
Gold Coast	37	Bentley-Armadale	54
3. Metro 3			
South Western Sydney	4	South Eastern Melbourne	25
Western Sydney	5	West Moreton-Oxley	39
Macedon Ranges and North Western Melbourne	21	Northern Adelaide	46
Northern Melbourne	22	–	
4. Regional 1			
Nepean-Blue Mountains	6	Frankston-Mornington Peninsula	26
Central Coast NSW	9	Barwon	27
Illawarra-Shoalhaven	10	Sunshine Coast	38
Hunter	11	Perth South Coastal	55
5. Regional 2			
North Coast NSW	12	Goulburn Valley	32
New England	13	Hume	33
Western NSW	14	Gippsland	34
Murrumbidgee	15	Darling Downs-South West Queensland	40
Southern NSW	16	Wide Bay	41
Grampians	28	Country South SA	49
Great South Coast	29	South West WA	56
Loddon-Mallee-Murray	31	Tasmania	59
6. Rural 1			
Far West NSW	17	Townsville-Mackay	44
Lower Murray	30	Country North SA	50
Central Queensland	42	–	
7. Rural 2			
Central and North West Queensland	43	Kimberley-Pilbara	58
Far North Queensland	45	Northern Territory	60
Goldfields-Midwest	57	–	

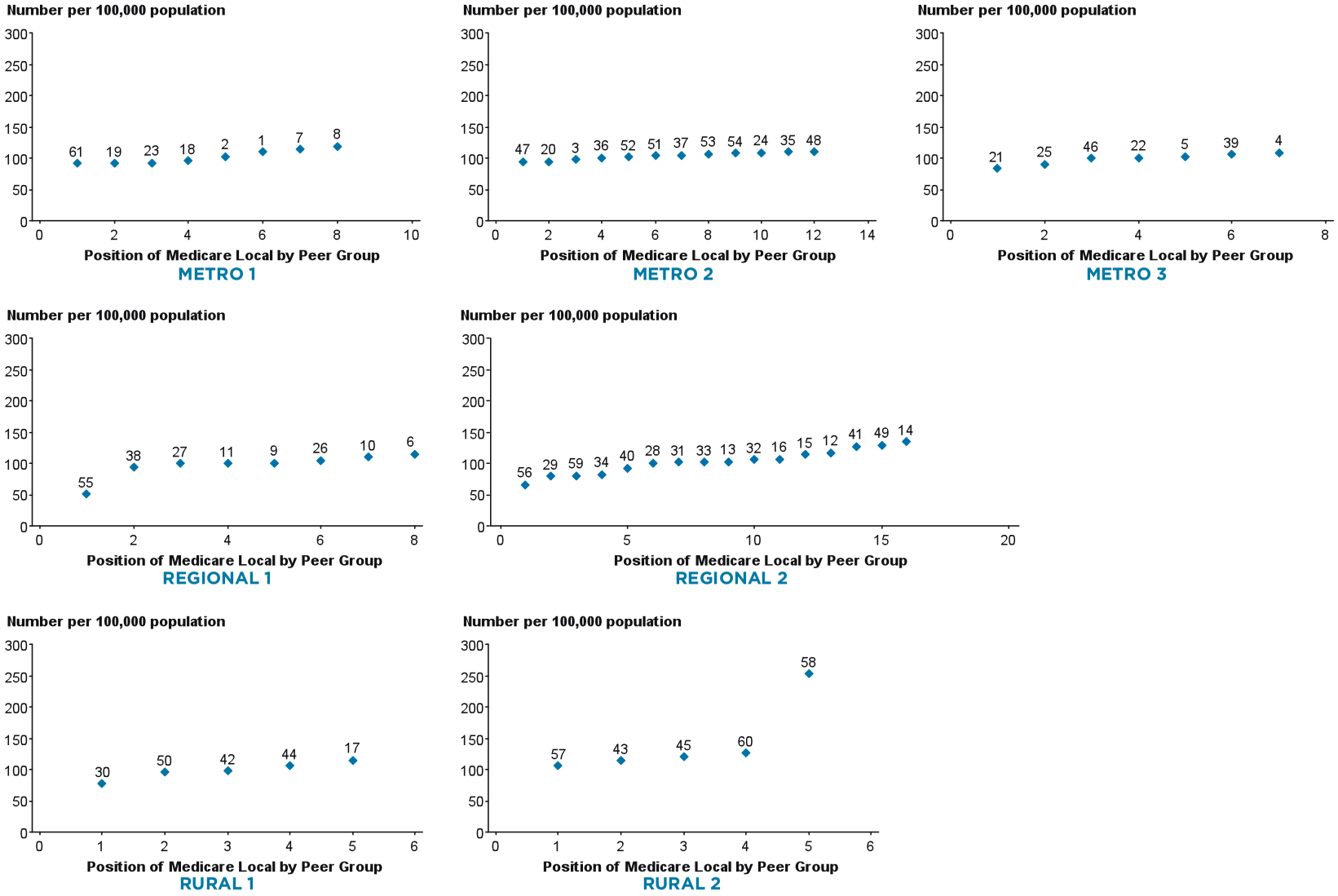


Figure A1 Admissions for hip fracture per 100,000 population by Medicare Local and peer group, 2010–11

Note: Rates are age and sex standardised to the 30 June 2001 population.

Source: AIHW analysis of National Hospital Morbidity Database.

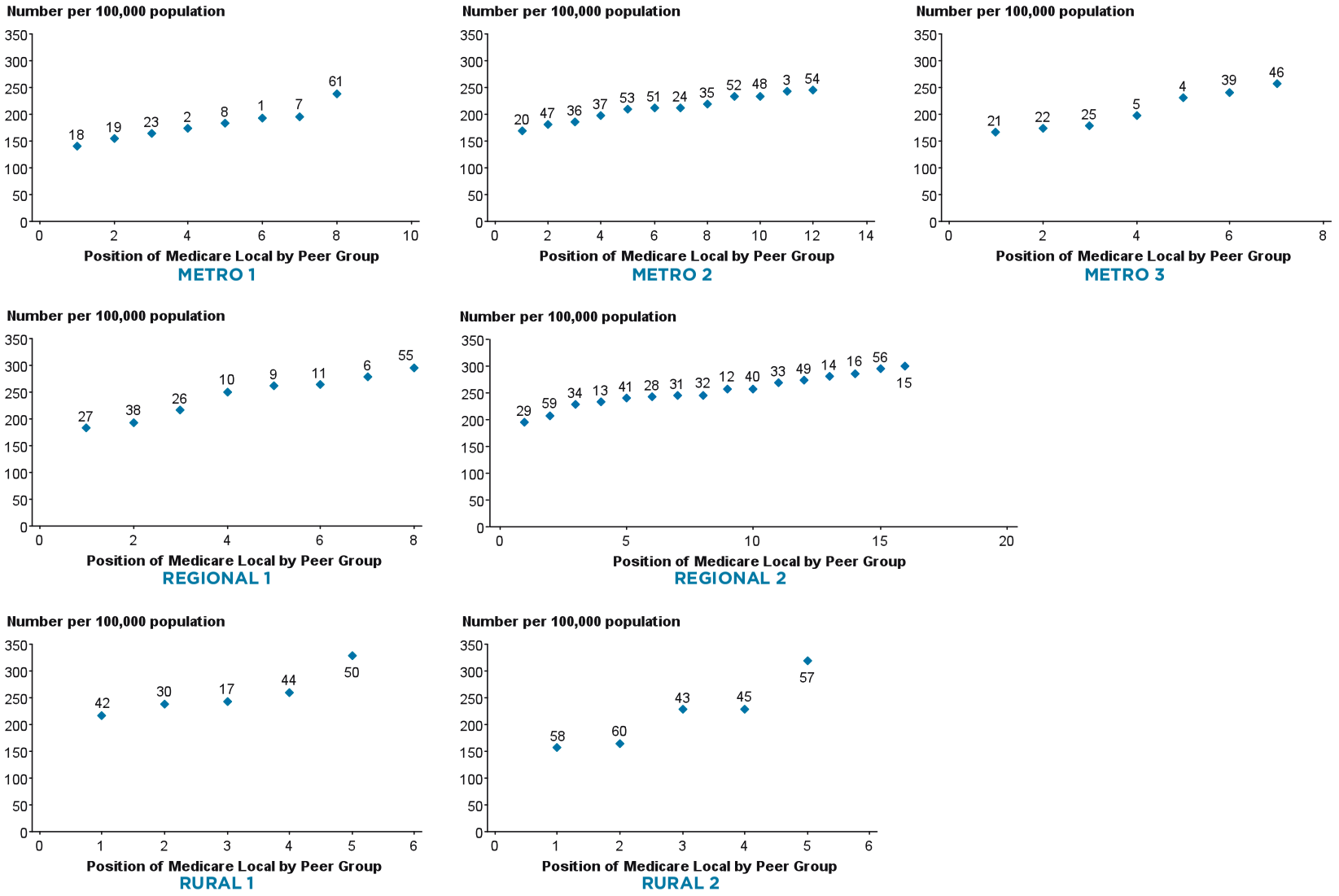


Figure A2 Admissions for knee replacement per 100,000 population by Medicare Local and peer group, 2010–11

Note: Rates are age and sex standardised to the 30 June 2001 population.

Source: AIHW analysis of National Hospital Morbidity Database.

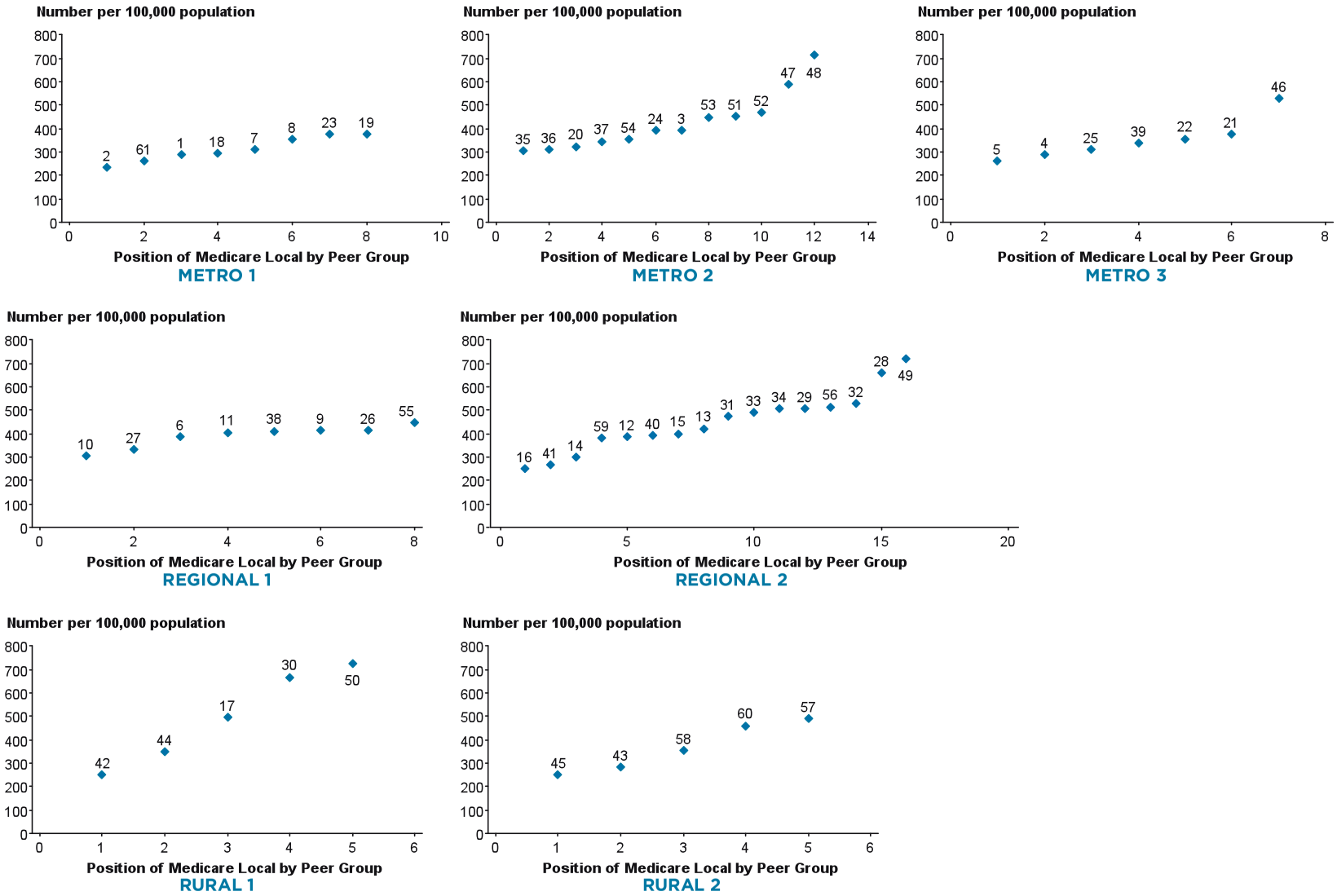


Figure A3 Admissions for knee arthroscopy per 100,000 population by Medicare Local and peer group, 2010–11

Note: Rates are age and sex standardised to the 30 June 2001 population.

Source: AIHW analysis of National Hospital Morbidity Database.

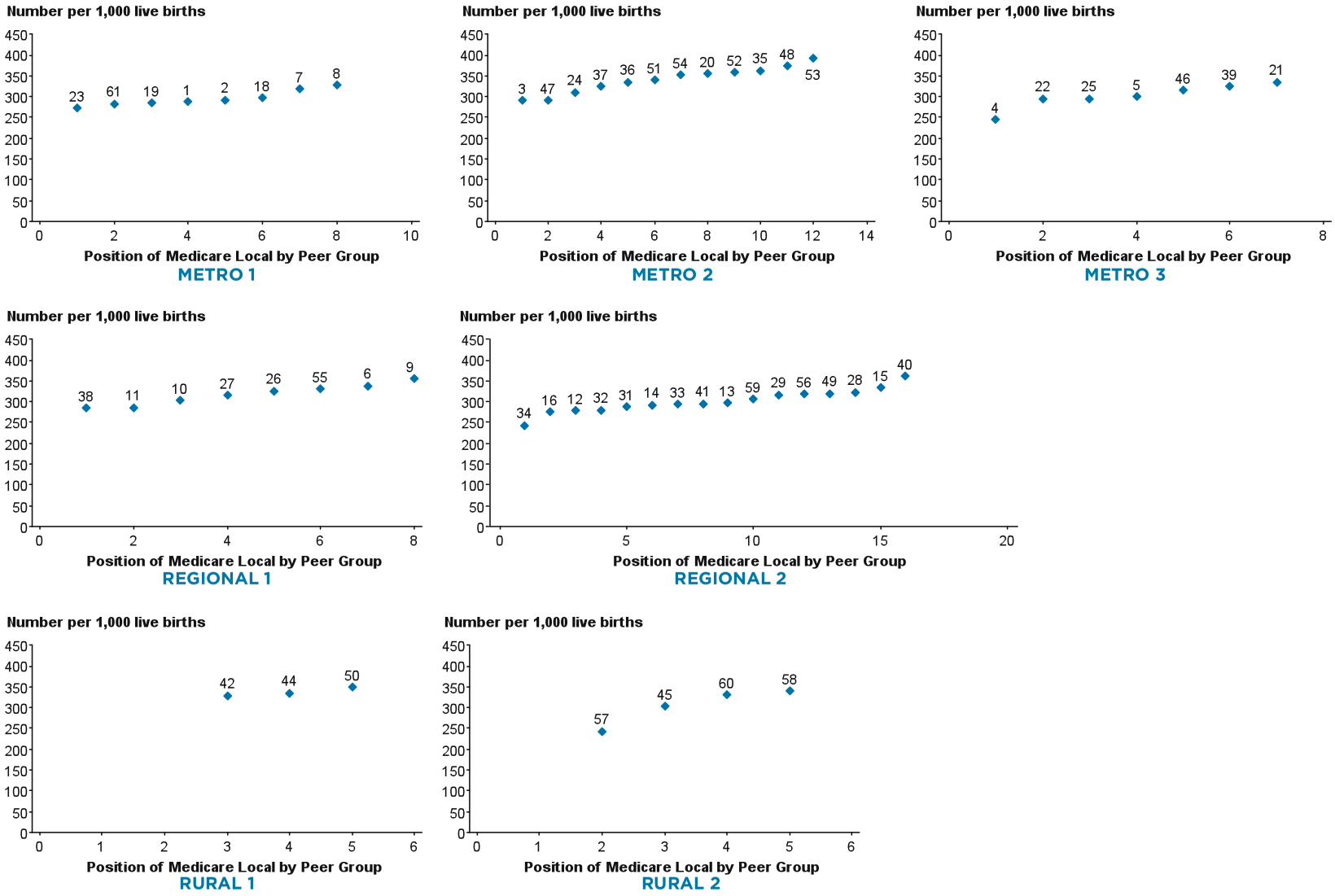


Figure A4 Caesarean sections per 1,000 live births by Medicare Local and peer group, 2010–11

Notes:

1. Rates are age standardised to the number of women who had live births recorded in the NHMD in 2001–02.

2. Data for three Medicare Locals (Far West New South Wales; Lower Murray; Central and North West Queensland) were excluded from analysis because of volatility due to small denominator.

Source: AIHW analysis of National Hospital Morbidity Database.

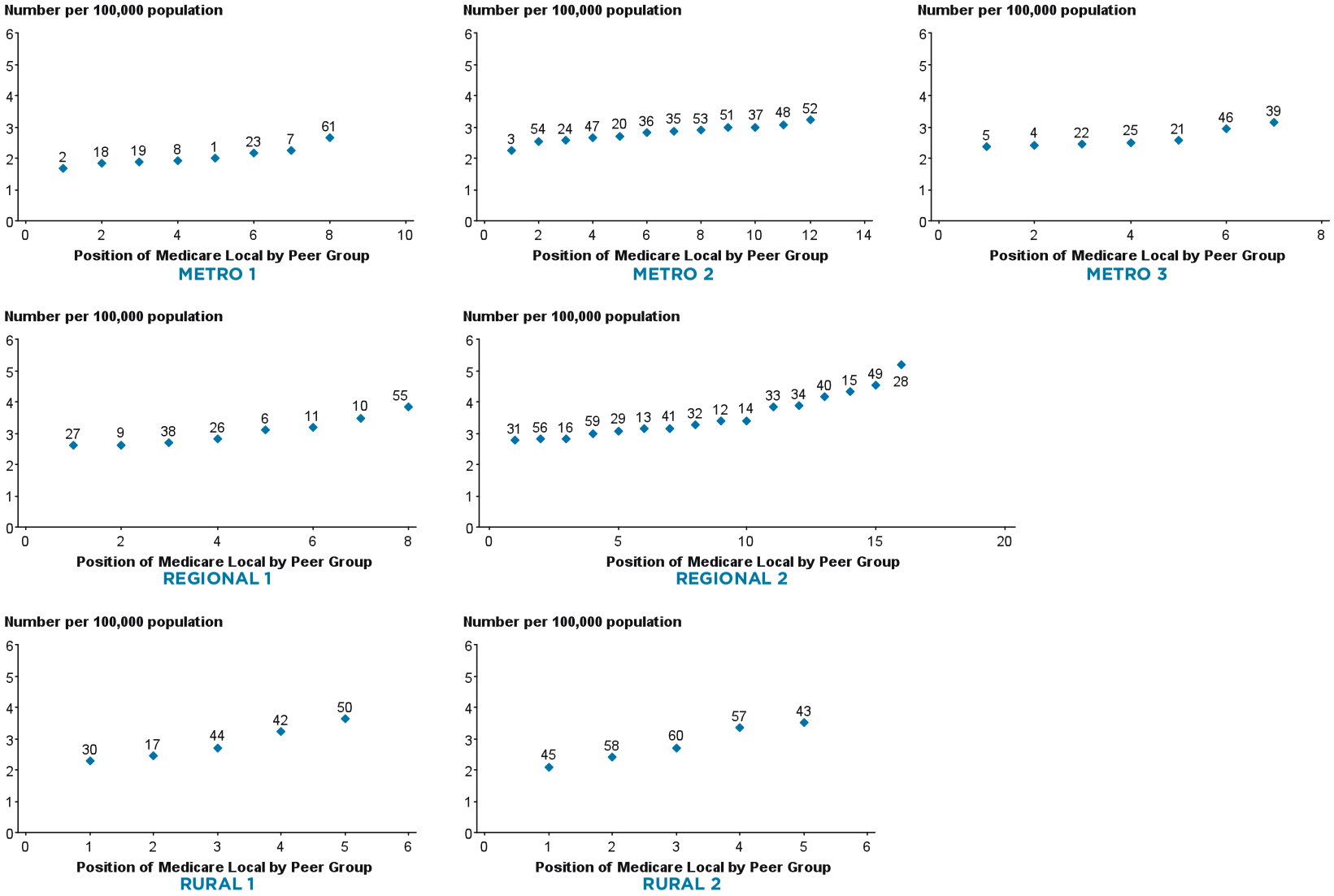


Figure A5 Admissions for hysterectomy without any diagnosis of cancer per 1,000 population by Medicare Local and peer group, 2010–11

Note: Rates are age standardised to the 30 June 2001 population.

Source: AIHW analysis of National Hospital Morbidity Database.

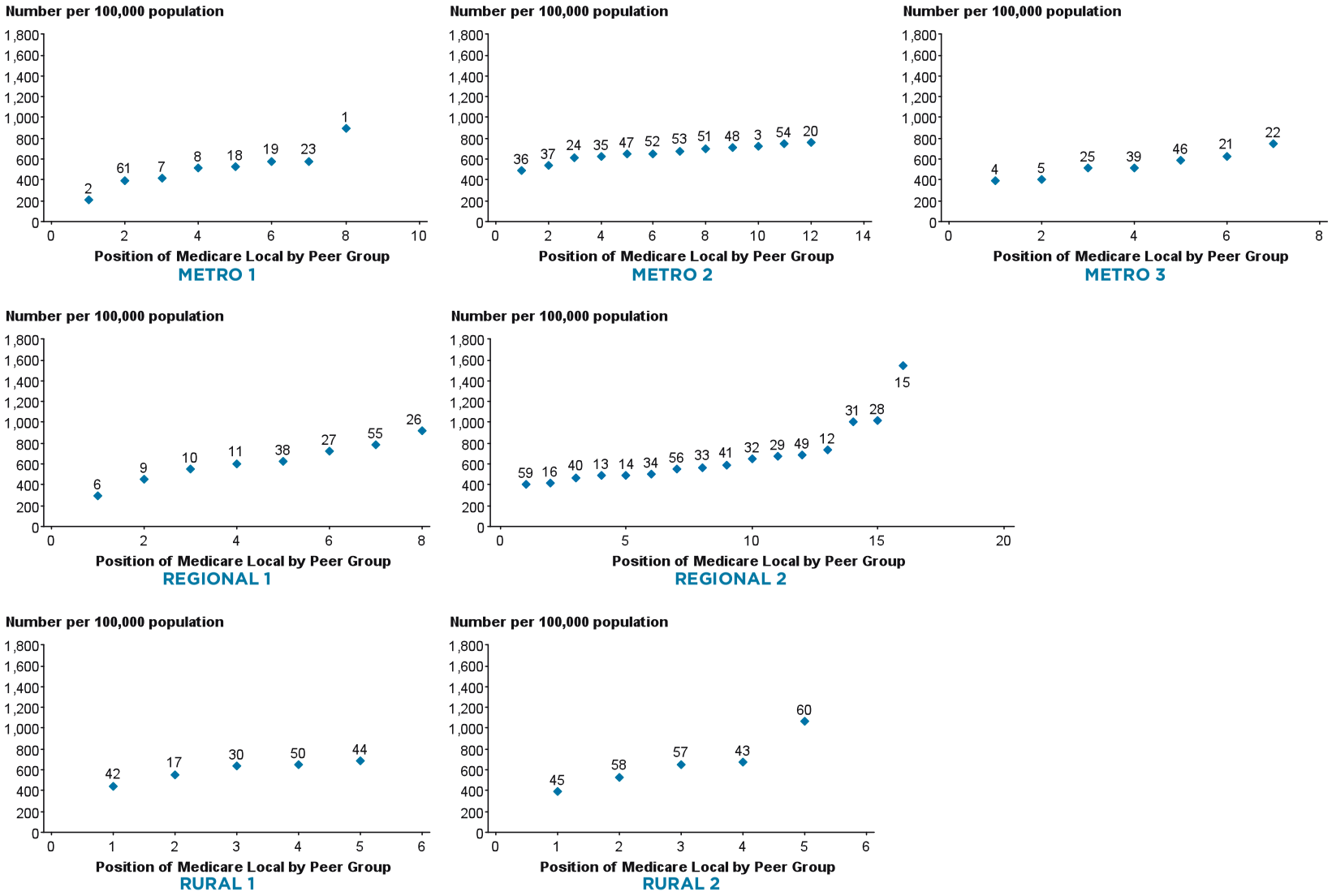


Figure A6 Admissions for cardiac catheterisation per 100,000 population by Medicare Local and peer group, 2010–11

Note: Rates are age and sex standardised to the 30 June 2001 population.

Source: AIHW analysis of National Hospital Morbidity Database.

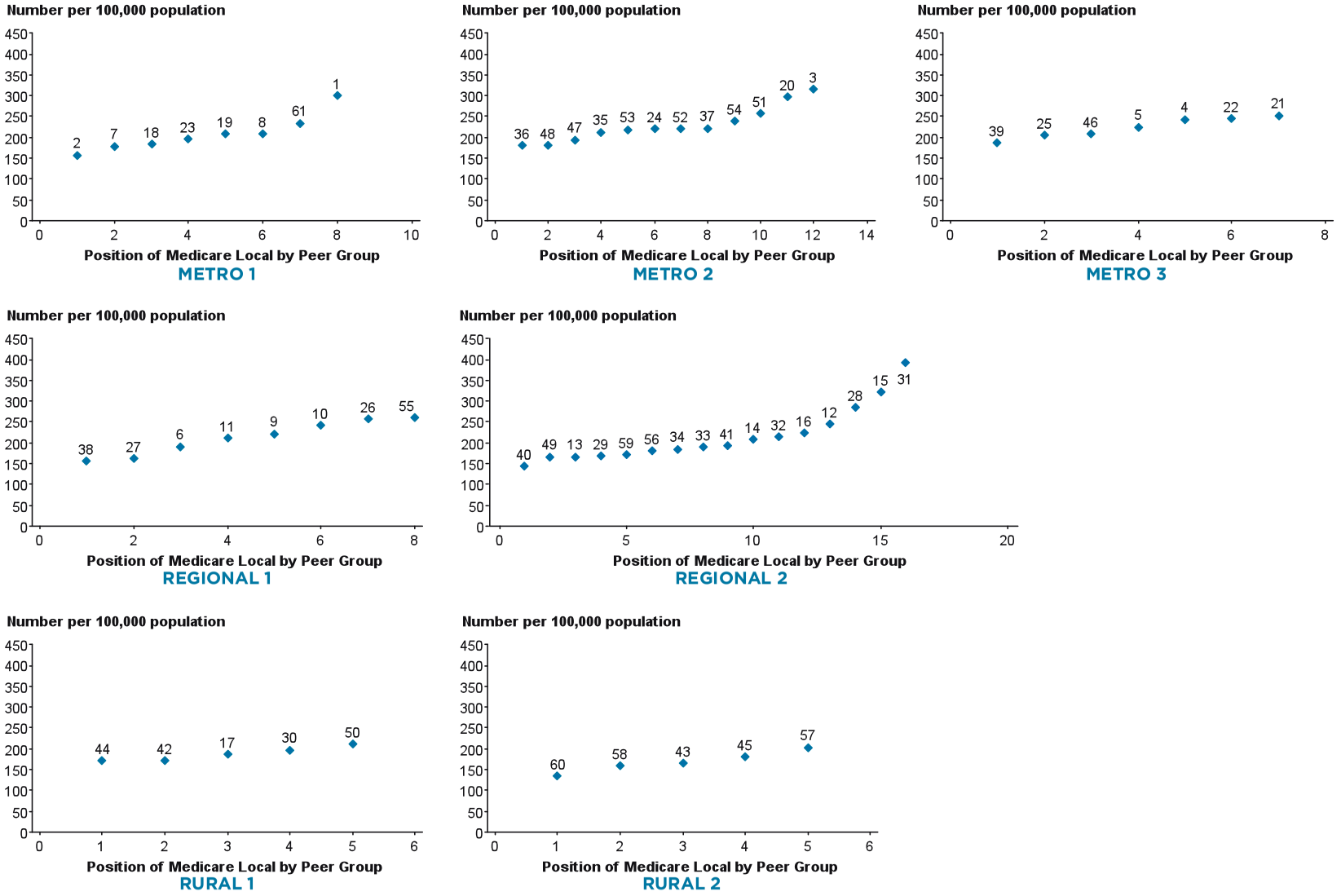


Figure A7 Admissions for PCI per 100,000 population by Medicare Local and peer group, 2010–11

Note: Rates are age and sex standardised to the 30 June 2001 population.

Source: AIHW analysis of National Hospital Morbidity Database.

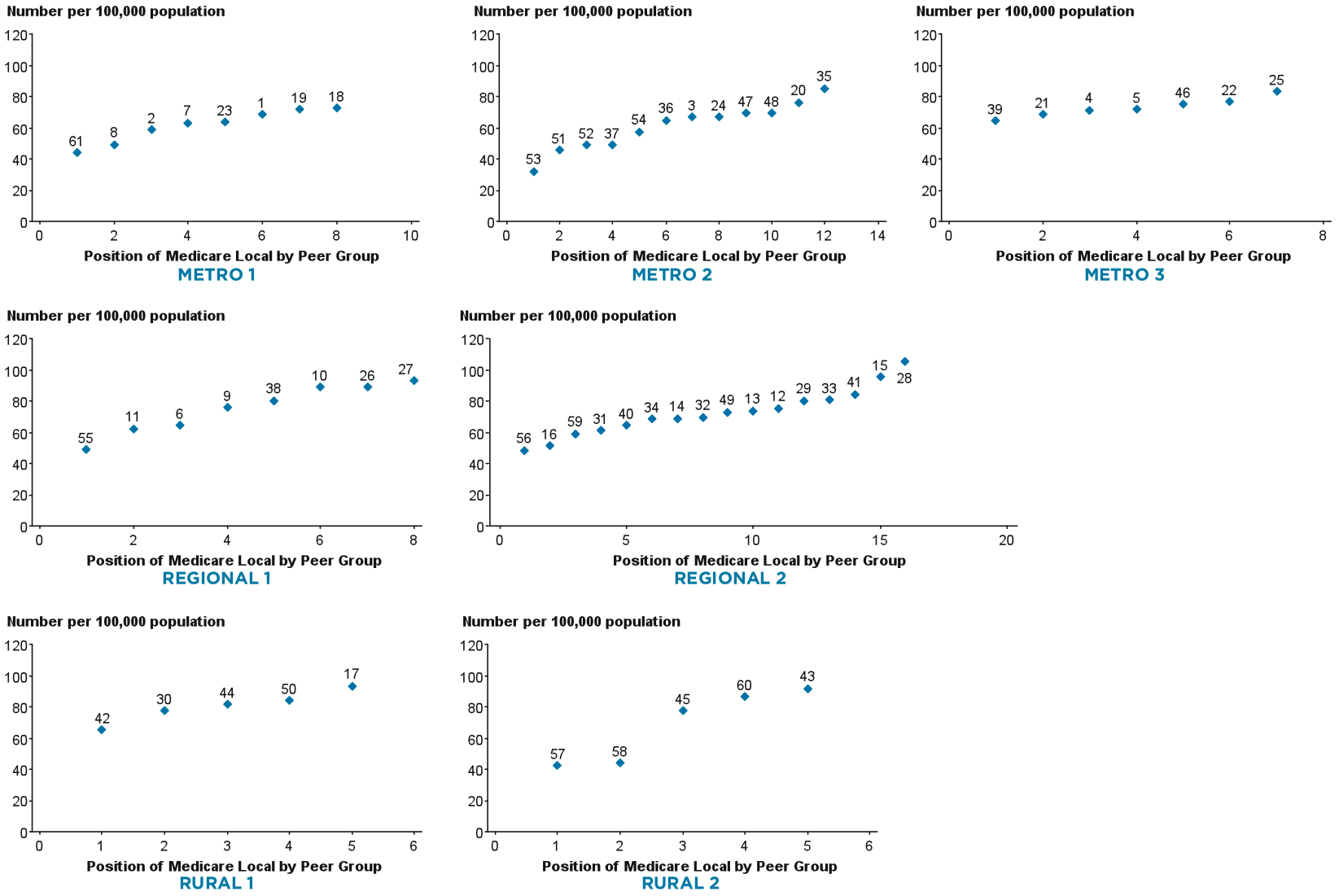


Figure A8 Admissions for coronary artery bypass grafting per 100,000 population by Medicare Local and peer group, 2010–11

Note: Rates are age and sex standardised to the 30 June 2001 population.

Source: AIHW analysis of National Hospital Morbidity Database.

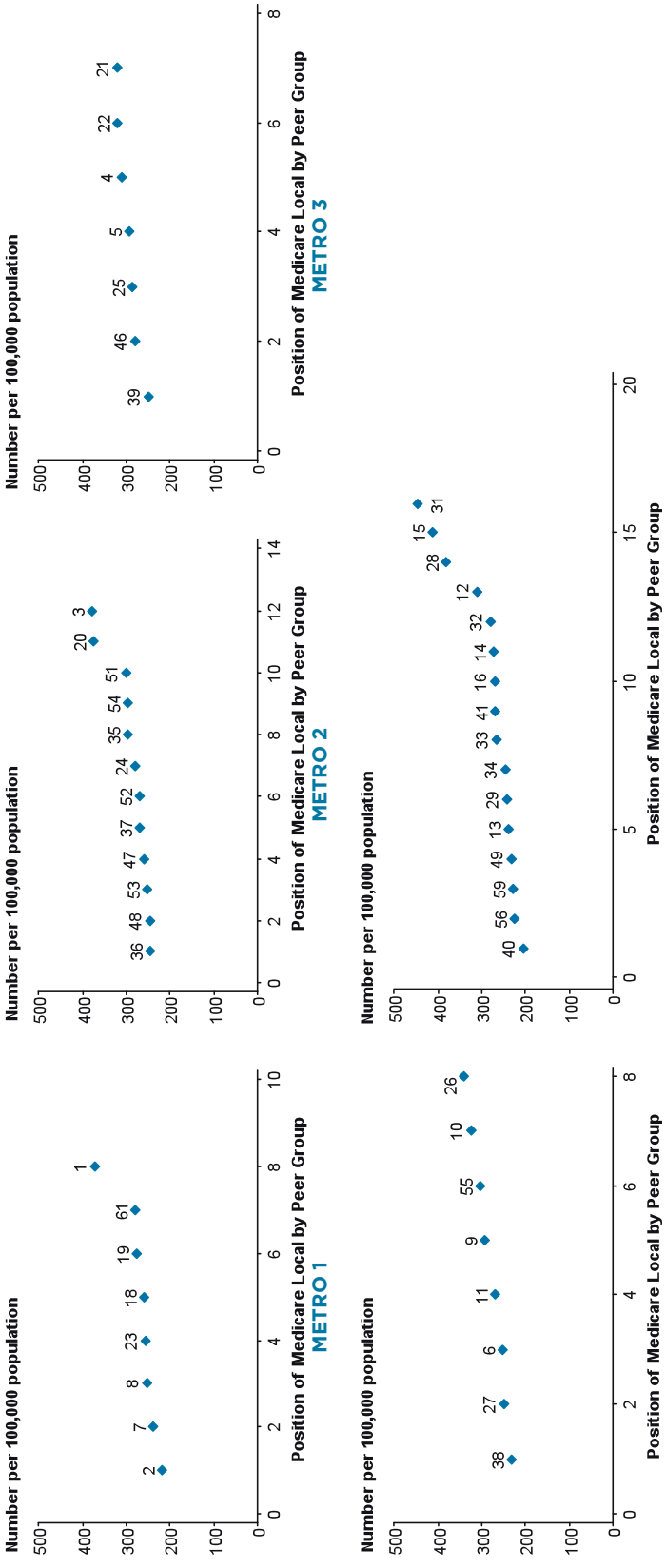


Figure A9 Admissions for coronary artery bypass graft and/or PCI per 100,000 population by Medicare Local and peer group, 2010–11

Note: Rates are age and sex standardised to the 30 June 2001 population.

Source: AIHW analysis of National Hospital Morbidity Database.

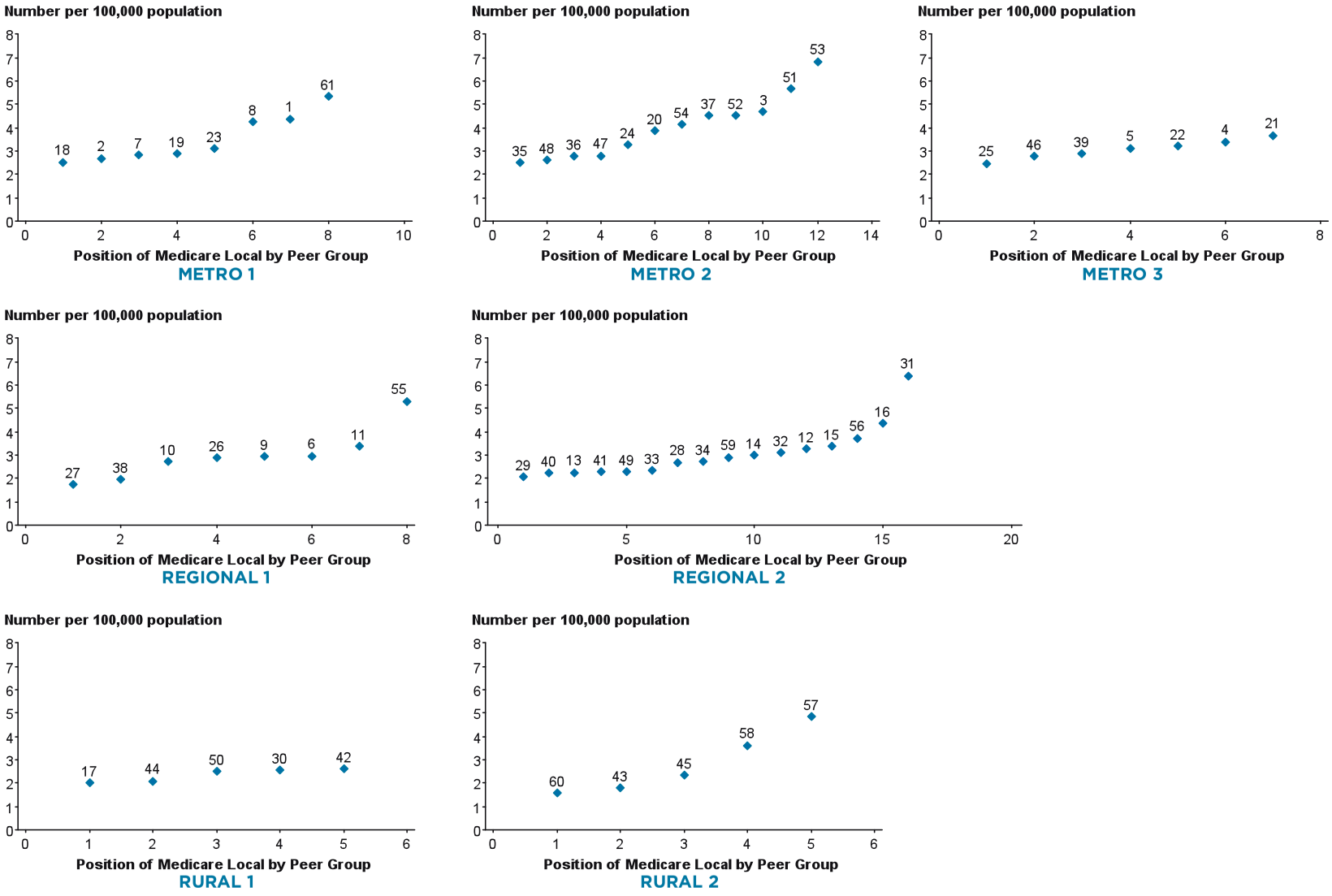


Figure A10 PCI : CABG ratio by Medicare Local and peer group, 2010–11

Note: Rates are age and sex standardised to the 30 June 2001 population.

Source: AIHW analysis of National Hospital Morbidity Database.

Appendix 3 Technical information

This Appendix provides detailed on information on the methodology used to generate the results presented in this paper, and the limitations of the data.

Data sources

The core set of data for the project, hospital admission rates, was sourced from the AIHW National Hospital Morbidity Database and cover the year 2010–11. Coverage for the selected interventions and conditions was very good, with data representing admissions from essentially all Australian hospitals.

Box 1: Data sources

National Hospital Morbidity Database (NHMD)

State and territory health authorities compile information on hospital admissions and supply it to the Australian Institute of Health and Welfare for collation into the National Hospital Morbidity Database. This database is an electronic record for each episode of care for essentially all hospitals in Australia, including public acute and psychiatric hospitals (public sector), and private free-standing day hospital facilities and other private hospitals (private sector). It includes demographic information on the people admitted to hospital (for example, age, sex, geographic location), the reasons for their hospital admission (for example, diagnoses), and the type of care they received (for example, procedures undertaken). For more information on the NHMD, see Appendix 3A.

Estimated Resident Population (ERP)

Australian Bureau of Statistics (ABS) Estimated Resident Population (ERP) data were used as the denominator for the majority of rates provided. The ERP is an official estimate of the Australian population by age and sex, based on census counts by place of usual residence, and updated to take into account births, deaths and overseas migration.

Analysis of data by Medicare Local

For the preparation of the statistics contained in this report, concordance files were required to assign the Statistical Local Area (SLA) or postcode on data to a Medicare Local, and to create Estimated Resident Populations by Medicare Locals for use as a denominator for rates. At the time of analysis concordance files to Medicare Locals were only available for the year 2010.[52]

For analysis of NHMD data, with geographical information on Statistical Local Area, the concordance file provided details of the corresponding Medicare Local for each SLA, and the SLA's surface area (in square kilometres) contained in that Medicare Local. In the majority of cases, the SLA mapped directly to a Medicare Local, however there were twelve SLAs that crossed over more than one Medicare Local. The AIHW allocated records with these SLAs to a Medical Local based on the proportion of the surface area of the SLA that was contained in each Medicare Local, not the proportion of the SLA population in the Medicare Local.

As the boundaries of SLAs can change annually and a Medicare Local concordance file was only available for 2010, additional concordance was required to assign 2008–09 hospital data (with 2008 SLAs) and 2009–2010 mortality data (with 2008 and 2009 SLAs) to Medicare Locals. This involved mapping SLAs for previous years to 2010 SLAs before assigning the SLA to a Medicare Local.

While the majority of 2010 SLAs mapped directly to a Medicare Local, 12 SLAs crossed over two Medicare Local boundaries. The AIHW allocated records with these SLAs to a Medicare Local based on the proportion of the SLA's area that was contained in each Medicare Local (area-based calculation), not the proportion of the SLA population in the Medicare Local (population-based calculation). For example, based on the information provided in Table A1, 1.5 per cent of the separations that occurred in the SLA of Ku-ring-gai (A) were allocated to the Medicare Local Sydney North Shore and Beaches and 98.5 per cent of the separations were allocated to the Medicare Local Northern Sydney. Because of the nature of the mapping used, the Medicare Local data for some individual records may not be accurate, however the overall distribution of the data by Medicare Local is considered useful for the analysis purposes here.

Table A1 Example of area-based concordance method

2010 SLA	2010 SLA name	Medicare Local code	Medicare Local name	Area sq kms	Per cent derived
105604500	Ku-ring-gai (A)	ML107	Northern Sydney	84.1	98.5
105604500	Ku-ring-gai (A)	ML108	Sydney North Shore and Beaches	1.3	1.5
Total				**85.4**	

Source: Per cent derived column calculated by AIHW based on area (sq km) information provided in the DoHA SLA to ML concordance file (DoHA 2013).

Statistical analysis by Medicare Local is very new in Australia and standard methods to assign existing geography units on data to Medicare Locals are still being agreed nationally. It is possible that future analysis by Medicare Locals could use alternative methods to those applied here.

Creating estimated resident populations (ERPs) by Medicare Locals

Data on ERPs by Medicare Local for use as a denominator in rates were not publically available when data for this report were analysed; therefore the AIHW developed ERPs by Medicare Local using the following files: ABS ERPs by SLA and the DoHA 2010 ML to SLA concordance. The same methodology used to assign hospital records to Medicare Locals was used to create ERPs by Medicare Locals.

At the time of drafting, statistical analyses by Medicare Local were very new in Australia and standard methods to assign records to Medicare Locals and create ERPs by Medicare Locals were still being agreed nationally. As other analyses by Medicare Locals could use alternative methods to those described above, data presented in this report may not be comparable to other data presented by Medicare Local.

Mapping of ICD-9-CM codes

The OECD specifications provided diagnosis and procedure codes for the selected hospital indicators according to the American ICD-9-CM classification, 6th edition. To allow for extraction of Australian data according to the OECD requirements, ICD-9-CM codes had to be mapped to the:

- International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Australian Modification (ICD-10-AM) 7th edition – the classifications used to report Australian hospital diagnosis information analysed in this report.
- Australian Classification of Health Interventions (ACHI) 7th edition – the classifications used to report Australian hospital health interventions and procedure information analysed in this report.

As there is no standard mapping file available for this process, ICD-10-AM mapping files located on the National Casemix and Classification Centre website were used to map formerly used Australian ICD-9-CM codes to the ICD-10-AM/ACHI, 1st edition.[53] Additional mapping was undertaken between ICD-10-AM/ACHI 1st edition, and subsequent editions to identify the relevant codes used for Australian data analysed in this report (2010–11).

This mapping may not produce the same result as a process that involved direct mapping from the American ICD-9-CM to ICD-10-AM 7th edition.

Statistical calculations and notes

Directly age and sex standardised rates

The directly age-standardised event rate ($ASR_{(dir)}$) for the Medicare Local populations being compared, is obtained by applying the event rates (r_i) (e.g. admission rates) for each age and sex group of the Medicare Local population to the standard population sizes for each age and sex group (N_i).

$$ASR_{(dir)} = \Sigma N_i r_i / \Sigma N_i$$

Thus, ($ASR_{(dir)}$) may be regarded as a weighted mean of the r_i using the N_i as weights. The age and sex standardised rate is usually expressed per 1,000 or 100,000 population.

The systematic component of variation

The systematic component of variation was calculated using the following formula.

$$SCV = \left[\frac{\Sigma_k \frac{(N_k - NExp_k)^2}{NExp_k^2} - \Sigma_k \frac{1}{NExp_k}}{n-1} \right] x100$$

Where:

N_k = Number of observed events for each Medicare Local.

$NExp_k$ = Number of expected events for each Medicare Local (see below for description of the calculation of expected value).

n = total number of Medicare Locals (61).

Σ_k = the sum over Medicare Locals.

The expected events in each Medicare Local ($NExp_k$) were calculated by summing all expected events per age (i) and sex (j) group within each Medicare Local using the following formula.

$NExpk_{ij} = (ASR_{ij} * Pop_{ijk})$.

Where:

ASR_{ij} = national age specific rate for age and sex group ij.

Pop_{ijk} = population of age and sex group ij in Medicare Local k.

Specific notes on the data for each intervention or condition

This section includes a description of how the data for each intervention or condition are computed, including the ICD-10-AM/ACHI 7th edition codes used. Information on any additional limitations of the data, not provided elsewhere in the report, are also included.

Hip fracture (calibration condition)

ICD-10-AM principal diagnosis code	Description
M84.45	Pathological fracture, not elsewhere classified, of pelvic region and thigh
S72.01	Fracture of intracapsular section of femur
S72.02	Fracture of upper epiphysis (separation) of femur
S72.04	Fracture of midcervical section of femur
S72.05	Fracture of base of neck of femur
S72.08	Fracture of other parts of neck of femur
S72.03	Fracture of subcapital section of femur
S72.10	Fracture of trochanteric section of femur, unspecified
S72.11	Fracture of intertrochanteric section of femur
S72.2	Subtrochanteric fracture
S72.00	Fracture of neck of femur, part unspecified

Excludes separations with an external cause code within the ICD-10-AM category of transport accidents (V00-V99).

Only includes separations where urgency of admission is emergency. The determination of emergency admissions may vary across states and territories and providers.

Knee replacement (including revision of knee replacement)

ICD-10-AM ACHI procedure code	Description
49527–00 [1524]	Revision of total arthroplasty of knee
49554–00 [1523]	Revision of total arthroplasty of knee with anatomic specific allograft
49530–00 [1523]	Revision of total arthroplasty of knee with bone graft to femur
49533–00 [1523]	Revision of total arthroplsty of knee with bone graft to femur and tibia
49530–01 [1523]	Revision of total arthroplasty of knee with bone graft to tibia
49517–00 [1518]	Hemiarthroplasty of knee
49518–00 [1518]	Total arthroplasty of knee, unilateral
49519–00 [1518]	Total arthroplasty of knee, bilateral
49534–01 [1518]	Total replacement arthroplasty of patellofemoral joint of knee
49521–00 [1519]	Total arthroplasty of knee with bone graft to femur, unilateral
49521–01 [1519]	Total arthroplasty of knee with bone graft to femur, bilateral
49521–02 [1519]	Total arthroplasty of knee with bone graft to tibia, unilateral
49521–03 [1519]	Total arthroplasty of knee with bone graft to tibia, bilateral
49524–00 [1519]	Total arthroplasty of knee with bone graft to femur and tibia, unilateral
49524–01 [1519]	Total arthroplasty of knee with bone graft to femur and tibia, bilateral

Knee arthroscopy

ICD-10-AM ACHI procedure code	Description
49557–00 [1501]	Arthroscopy of knee
49503–00 [1505]	Meniscectomy of knee
49560–03 [1503]	Arthroscopic meniscectomy of knee
49562–01 [1517]	Arthroscopic meniscectomy of knee with chondroplasty and multiple drilling or implant
49561–01 [1517]	Arthroscopic meniscectomy of knee with debridement, osteoplasty or chondroplasty
49557–02 [1503]	Arthroscopic excision of meniscal margin or plica of knee

Caesarean sections

ICD-10-AM ACHI procedure code	Description
16520–00 [1340]	Elective classical caesarean section
16520–01 [1340]	Emergency classical caesarean section
16520–02 [1340]	Elective lower segment caesarean section
16520–03 [1340]	Emergency lower segment caesarean section

Live births are defined by any one of the following ICD-10-AM diagnosis codes.

CD-10-AM diagnosis code	Description
Z37.0	Single live birth
Z37.2	Twins, both liveborn
Z37.3	Twins, one live born and one stillborn
Z37.5	Other multiple births, all liveborn
Z37.6	Other multiple births, some liveborn
Z37.9	Outcome of delivery, unspecified

The definition of a live birth is based on ICD-10-AM diagnosis codes relating to the outcome of the delivery, in particular, a delivery with at least one liveborn baby. For separations involving multiple births, the outcome of each baby (liveborn or stillborn) is not separately coded. Therefore, the numerator and denominator will include some separations that involve the delivery of a liveborn, and one or more stillborn babies.

Hysterectomy (without any diagnosis of cancer): hospital separations

ICD-10-AM ACHI procedure code	Description
90448–00 [1268]	Subtotal laparoscopic abdominal hysterectomy
35653–00 [1268]	Subtotal abdominal hysterectomy
90448–01 [1268]	Total laparoscopic abdominal hysterectomy
35653–01 [1268]	Total abdominal hysterectomy
90448–02 [1268]	Total laparoscopic abdominal hysterectomy with removal of adnexa
35653–04 [1268]	Total abdominal hysterectomy with removal of adnexa
35661–00 [1268]	Abdominal hysterectomy with extensive retroperitoneal dissection
35670–00 [1268]	Abdominal hysterectomy with radical excision of pelvic lymph nodes
35756–00 [1269]	Laparascopically assisted vaginal hysterectomy proceeding to abdominal hysterectomy
35756–03 [1269]	Laparascopically assisted vaginal hysterectomy proceeding to abdominal hysterectomy with removal of adnexa
35657–00 [1269]	Vaginal hysterectomy
35673–02 [1269]	Vaginal hysterectomy with removal of adnexa
35750–00 [1269]	Laparoscopically assisted vaginal hysterectomy
35753–02 [1269]	Laparoscopically assisted vaginal hysterectomy with removal of adnexa
35667–00 [1268]	Radical abdominal hysterectomy
35664–00 [1268]	Radical abdominal hysterectomy with radical excision of pelvic lymph nodes
35667–01 [1269]	Radical vaginal hysterectomy
35664–01 [1269]	Radical vaginal hysterectomy with radical excision of pelvic lymph nodes
90450–00 [989]	Anterior pelvic exenteration
90450–01 [989]	Posterior pelvic exenteration
90450–02 [989]	Total pelvic exenteration

The following is a list of the specific ICD-10-AM (7th Ed) diagnosis codes which are excluded.

ICD-10-AM diagnosis code	Description
C00–C96	Malignant neoplasms
D45	Polycythaemia vera
D46	Myelodysplastic syndrome
D47.1	Chronic myeloproliferative disease
D47.3	Essential (haemorrhagic) thromocythaemia

Cardiac catheterisation

ICD-10-AM ACHI procedure code	Description
38200–00 [667]	Right heart catheterisation
38218–01 [668]	Coronary angiography with right heart catheterisation
38203–00 [667]	Left heart catheterisation
38218–00 [668]	Coronary angiography with left heart catheterisation
38206–00 [667]	Right and left heart catheterisation
38218–02 [668]	Coronary angiography with left and right heart catheterisation

Coronary artery bypass grafting (CABG)

ICD-10-AM ACHI procedure code	Description
38497–04 [673]	Coronary artery bypass, using 1 other venous graft
38497–05 [673]	Coronary artery bypass, using 2 other venous grafts
38497–06 [673]	Coronary artery bypass, using 3 other venous grafts
38497–07 [673]	Coronary artery bypass, using ≥4 other venous grafts
38500–04 [678]	Coronary artery bypass, using 1other arterial graft
38503–04 [678]	Coronary artery bypass, using ≥2 other arterial grafts
90201–00 [679]	Coronary artery bypass, using 1 other graft, not elsewhere classified
90201–01 [679]	Coronary artery bypass, using 2 other grafts, not elsewhere classified
90201–02 [679]	Coronary artery bypass, using 3 other grafts, not elsewhere classified
90201–03 [679]	Coronary artery bypass, using ≥4 other grafts, not elsewhere classified
38497–00 [672]	Coronary artery bypass, using 1 saphenous vein graft
38500–02 [676]	Coronary artery bypass, using 1 radial artery graft
38500–03 [677]	Coronary artery bypass, using 1 epigastric artery graft
38497–01 [672]	Coronary artery bypass, using 2 saphenous vein grafts
38503–02 [676]	Coronary artery bypass, using ≥2 radial artery grafts
38503–03 [677]	Coronary artery bypass, using ≥2 epigastric artery grafts
38497–02 [672]	Coronary artery bypass, using 3 saphenous vein grafts
38497–03 [672]	Coronary artery bypass, using ≥ 4 saphenous vein grafts
38500–00 [674]	Coronary artery bypass, using 1 LIMA graft
38500–01 [675]	Coronary artery bypass, using 1 RIMA graft
38503–00 [674]	Coronary artery bypass, using ≥2 LIMA grafts
38503–01 [675]	Coronary artery bypass, using ≥ 2 RIMA grafts
38500–05 [679]	Coronary artery bypass, using 1 composite graft
38503–05 [679]	Coronary artery bypass, using 2 composite grafts

Percutaneous coronary intervention (PCI)

ICD-10-AM ACHI procedure code	Description
38505–00 [669]	Open coronary endarterectomy
38306–00 [671]	Percutaneous insertion of 1 transluminal stent into single coronary artery
38306–01 [671]	Percutaneous insertion of ≥2 transluminal stents into single coronary artery
38306–02 [671]	Percutaneous insertion of ≥2 transluminal stents into multiple coronary arteries
38306–03 [671]	Open insertion of 1 transluminal stent into single coronary artery
38306–04 [671]	Open insertion of ≥2 transluminal stents into single coronary artery
38306–05 [671]	Open insertion of ≥2 transluminal stents into multiple coronary arteries
38300–00 [670]	Percutaneous transluminal balloon angioplasty of 1 coronary artery
38303–00 [670]	Percutaneous transluminal balloon angioplasty of ≥2 coronary arteries
38300–01 [670]	Open transluminal balloon angioplasty of 1 coronary artery
38303–01 [670]	Open transluminal balloon angioplasty of ≥2 coronary arteries
38309–00 [669]	Percutaneous transluminal coronary rotational atherectomy [PTCRA], 1 artery
38312–00 [669]	Percutaneous transluminal coronary rotational atherectomy [PTCRA], 1 artery with insertion of 1 stent
38312–01 [669]	Percutaneous transluminal coronary rotational atherectomy [PTCRA], 1 artery with insertion of >=2 stents
38315–00 [669]	Percutaneous transluminal coronary rotational atherectomy [PTCRA], multiple arteries
38318–00 [669]	Percutaneous transluminal coronary rotational atherectomy [PTCRA], multiple arteries with insertion of 1 stent
38318–01 [669]	Percutaneous transluminal coronary rotational atherectomy [PTCRA], multiple arteries with insertion of >= 2 stents

CABG and/or PCI

This category includes any procedure codes in CABG or PCI.

Data exclusions

Hospital data exclude admissions where the patient's place of residence is within other territories (Cocos Islands, Christmas Island and Jervis Bay Territory) and admissions that meet any of the following criteria:

- has a care type of newborn (without qualified days); Hospital boarders or Posthumous organ procurement
- have missing or unknown values for age, sex or place of residence (Statistical Local Area).

Table C1: Separations excluded from analysis

Indicator	2010–11
Caesarean section	340
CABG	166
PCI	196
Catheterisation	392
Knee replacement (including revisions)	74
Knee arthroscopy	144
Hip fracture (excluding transfers)	99
Hysterectomy	60
Hysterectomy (excluding any cancer diagnosis)	38

Data suppression

Hospital data were suppressed according to the following rules, consistent with reporting of hospital statistics in *Australian Hospital Statistics*.

1) Suppress numbers less than 5.
2) Suppress rates based on a numerator of less than 10.
3) Suppress counts and rates where there is a denominator population less than 1,000.

Consequential suppression was applied as appropriate.

Appendix 3A: Data quality statement: 2010–11 National Hospital Morbidity Database

Reproduced Data Quality Statement from *Australian Hospital Statistics 2010–11*.[54]

Summary of key issues

- The National Hospital Morbidity Database (NHMD) is a comprehensive dataset that has records for all separations of admitted patients from essentially all public and private hospitals in Australia.
- A record is included for each separation, not for each patient, so patients who separated more than once in the year have more than one record in the NHMD.
- For 2010–11, almost all public hospitals provided data for the NHMD. The exception was a mothercraft hospital in the ACT. The great majority of private hospitals also provided data, the exceptions being the private day hospital facilities in the ACT, the single private free-standing day hospital facility in the NT, and a small private hospital in Victoria.
- Hospitals may be re-categorised as public or private between or within years.
- There is apparent variation between states and territories in the use of statistical discharges and associated assignment of care types.
- There was variation between states and territories in the reporting of separations for *Newborns* (without qualified days):
    - For 2010–11, private hospitals in Victoria did not report most *Newborn* episodes without qualified days, therefore the count of newborn episodes will be underestimated.
    - South Australian private hospitals are not required to provide records for *Newborn* episodes without qualified days.
    - For Tasmania, where a newborn's qualification status was considered qualified at any point during the episode of care, the entire episode was reported as qualified days. As a consequence, the average length of stay for *Newborn* episodes with qualified days only in Tasmanian public hospitals is not directly comparable with that in other states.
- Data on state of hospitalisation should be interpreted with caution because of cross-border flows of patients. This is particularly the case for the Australian Capital Territory. In 2010–11, about 23 per cent of separations for Australian Capital Territory hospitals were for patients who resided in New South Wales.
- Variations in admission practices and policies lead to variation among providers in the number of admissions for some conditions.
- Caution should be used in comparing diagnosis, procedure and external cause data over time, as the classifications and coding standards for those data can change over time. In particular, in 2010–11, there were significant changes in the coding of diagnoses for diabetes, obstetrics and imaging procedures.

Description

The NHMD is a compilation of episode-level records from admitted patient morbidity data collection systems in Australian hospitals. It is a comprehensive dataset that has records for all episodes of admitted patient care from essentially all public and private hospitals in Australia. The data supplied are based on the National Minimum Data Set (NMDS) for admitted patient care and include demographic, administrative and length of stay data, as well as data on the diagnoses of the patients, the procedures they underwent in hospital and external causes of injury and poisoning. In 2010–11, diagnoses and external causes of injury and poisoning were recorded using the seventh edition of the International statistical classification of diseases and related health problems, 10th revision, Australian Modification (ICD-10-AM). Procedures were recorded using the seventh edition of the Australian Classification of Health Interventions (ACHI).

The counting unit for the NHMD is the 'separation'. Separation is the term used to refer to the 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). The NHMD contains records from 1993–94 to 2010–11. For each reference year, the NHMD includes records for admitted patient separations between 1 July and 30 June.

Timeliness

The reference period for this data set is 2010–11. This includes records for admitted patient separations between 1 July 2010 and 30 June 2011. States and territories provided a first version of 2010–11 data to the AIHW at the end of December 2011. The data were published on 30 April 2012. Data provision and publication were in accordance with agreed timetables.

Relevance

The purpose of the NHMD is to collect information about care provided to admitted patients in Australian hospitals. The scope of the NHMD is episodes of care for admitted patients in all public and private acute and psychiatric hospitals, free standing day hospital facilities and alcohol and drug treatment centres in Australia. Hospitals operated by the Australian Defence Force, corrections authorities and in Australia's off-shore territories are not in scope but some are included.

The hospital separations data do not include episodes of non-admitted patient care provided in outpatient clinics or emergency departments. Patients in these settings may be admitted subsequently, with the care provided to them as admitted patients being included in the NHMD.

The NHMD is the source of information for 12 performance indicators for the National Healthcare Agreement and other national performance reporting.

Although the NHMD is a valuable source of information on admitted patient care, the data have limitations. For example, variations in admission practices and policies lead to variation among providers in the number of admissions for some conditions (such chemotherapy and endoscopies).

Accuracy

Although there are national standards for data on admitted patient care, statistics may be affected by variations in admission and reporting practices across states and territories.

There is apparent variation between states and territories in the use of statistical discharges and associated assignment of care types.

For 2010–11, principal diagnosis information was not provided for 882 public hospital separations and 3,306 private hospital separations.

There was variation between public and private hospitals and, for private hospitals, between states and territories in the timing of the implementation of the seventh edition ICD-10-AM coding standards for obstetrics cases in 2010–11. Therefore, the principal diagnosis data for obstetrics cases are not comparable between public and private hospitals, and are not comparable over time.

There was variation between states and territories in the reporting of separations for *Newborns* (without qualified days):

- For 2010–11, private hospitals in Victoria did not report most *Newborn* episodes without qualified days, therefore the count of newborns will be underestimated.
- South Australian private hospitals are not required to provide records for *Newborn* episodes without qualified days.
- For Tasmania, where a newborn's qualification status was considered qualified at any point during the episode of care, the entire episode was reported as qualified days. As a consequence, the average length of stay for Newborn episodes with qualified days only in Tasmanian public hospitals is not directly comparable with that in other jurisdictions.

Not all states provided information on the area of usual residence of the patient in the form of a Statistical Local Area (SLA) code for all presentations. In addition, not all states and territories provided the version of SLA specified in the NMDS.

Coherence

The NHMD includes data for each year from 1993–94 to 2010–11.

The data reported for 2010–11 are broadly consistent with data reported for the NHMD for previous years.

Time series presentations may be affected by changes in admission practices, particularly for same-day activity such as dialysis, chemotherapy and endoscopy.

Between 2009–10 and 2010–11:

- there was a decrease in private hospital separations for Victoria due to the reclassification of some same-day mental health care as non-admitted patient activity (which was previously classified as admitted patient activity).
- there was a decrease in separations (and patient days) for psychiatric care reported for Tasmanian public hospitals due to the categorisation of some care as residential care. In previous years, this care was categorised as admitted patient care.

Changes in the ICD-10-AM/ACHI classifications and the associated Australian Coding Standards may affect the comparability of the data over time. In particular, in 2010–11, there were significant changes in the coding of diagnoses for diabetes, obstetrics and imaging procedures.

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