Quality Spine Care in Australasia

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Bryan Ashman and John Chen Li Tat

Healthcare in Australia and Singapore

Population Demographics

In 2016 there were 23 million people in Australia with a population density of just 3 people per square kilometre due to the large landmass of the island (7.6 million square km) and the sparsely populated centre of the country. About 90% live in urban centres within 100 kilometres of the coastline, and of these three quarters live in the five mainland capital cities. Two thirds of the population are aged between 15 and 65 years and 15% are older than 65. Detached houses are home to 75%, while the rest live in apartments. The average household has 2.6 people and an income of AU$650 per capita per week [1].

Singapore is also an island nation with over 5 million people living in just 700 square kilometres, a population density of 7000 per square km. Three quarters are aged between 15 and 65, and only 9% are older than 65 years. The population is completely urbanised with more than 80% living in high-rise apartments and an average household size of 3.3 people. The average income is SG$1400 per capita per week [2].

Australian Healthcare System

Australia has a universal healthcare system called Medicare which provides free medical care and subsidised medicines to Australian residents. There is also a

B. Ashman (✉)
Division of Surgery, Canberra Hospital, Garran, ACT, Australia
e-mail: bryan.ashman@act.gov.au

J. Chen Li Tat
Department of Orthopaedic Surgery, Singapore General Hospital, Singapore, Singapore

private health industry providing access to care through private hospitals, clinics and insurance. Spending on healthcare in Australia in 2016 was almost 10% of the national gross domestic product, about AU$120 billion or AU$5000 per capita. The majority of the funding is provided by governments, national and state, with about one third from the private sector. Of the total, about 50% is spent on hospital-based care, 20% on visits to a doctor, 15% on pharmaceuticals and a further 15% on community public health and aged care [3].

Singapore Healthcare System

In Singapore, the health system is also universal but not free of charge. The government provides subsidies for public healthcare by compulsory nationalised health insurance (Medisave). These subsidies vary from small out-of-pocket expenses to very large gaps between fees and rebates. The private health system provides services to those who can afford private treatment and is utilised by the government to reduce waiting lists in the public system. Spending on healthcare in Singapore in 2015 was 5% of GDP, about SG$20 billion or SG$4000 per capita. The government component of this was only 2% of GDP due to the low subsidies compared to out-of-pocket expenses [4]. In 2014, the Singapore health system was rated as the world's most efficient by Bloomberg [5].

Spinal Disorders as a Population Health Problem in Australasia

The Australian Institute of Health and Welfare reported in 2017 on the incidence of musculoskeletal conditions in the Australian population [6]. These were predominantly chronic arthritis and spinal pain, each about 50%, and accounted for 10% of the burden of disease (defined as 'living with illness and injury or dying prematurely'). Only cancer (20%), cardiovascular disease (15%) and mental or substance abuse disorders (12%) ranked higher. The unit of measurement was disability-adjusted life years (DALYs) and was derived from the self-reported disability from a national census of health conducted by the Australian Bureau of Statistics in 2015. When considering only living with disability and not premature death, chronic arthritis and back pain were second only to mental health problems as a cause of difficulties with self-care, work or social enjoyment. Patients with spinal pain were more likely to rate their condition as severe (50%) than those with arthritis (40%). Risk factors associated with disability were obesity for arthritis (45%) and occupational exposure to lifting for spinal pain (20%). Chronic spinal pain affected about 20% of the Australian population during 2015 and accounted for AU$1.2 billion of healthcare expenditure and an estimated AU$3.5 billion in lost productivity due to 80% of sufferers being of working age [7].

The Singapore Burden of Disease and Injury Working Group published data in 2014 [8]. Musculoskeletal diseases were responsible for 5.6% of the total disease and injury burden in Singapore up to 2010, with only 5% of this burden due to

premature mortality. Between 2004 and 2010, there was a 28.5% increase in musculoskeletal disease burden: 29.8% increase in disability burden and 7.1% increase in premature mortality burden. Crude and age-standardised overall burden per head of population increased by 18.8% and 5.4%, respectively. Rheumatoid arthritis was by far the largest contributor, accounting for 43% of the overall burden from musculoskeletal disease followed by osteoarthritis (27%). Rheumatoid arthritis was the 12th leading cause in overall burden and ranked 7th in overall DALYs for women. Osteoarthritis was the 16th leading cause in overall burden and was the 15th leading cause of overall burden in women.

Low back and neck pain maintained its rank as a leading health problem with the most disability second only to ischaemic heart disease. The rates of years lived with disability (YLDs) from 2005 to 2016 for low back and neck pain increased 25.5% during this period.

The annual years of healthy life lost per 100,000 people from low back pain in Singapore has increased by 21.6% since 1990, an average of 0.9% a year, and in 2016 had reached an average of 498 years lost for all age groups. The health burden of low back pain peaks at age 80+ and for men was 714 lost years in 2013, with women having an even higher rate of 1053 lost years.

Measuring the Quality of Health Care

In 1990 the US Institute of Medicine defined quality in healthcare as 'the degree to which health services for individuals and populations increase the likelihood of desired health outcomes' [9]. This definition encompasses all healthcare professionals in all settings of care and implies that not all individuals or groups have equitable access to healthcare and not all outcomes are good. Whether an outcome is desired or not depends on the value placed on it by the individual. Undesired outcomes can be avoided by minimising errors and choosing care that is appropriate, safe and evidence-based using current technology.

To decide if care is appropriate and safe, measurements of quality are required. At the healthcare provider level, quality measures can be considered under the categories of *structure* (capacity to deliver care), *process* (actual care delivery) or *outcomes* (the result of the care) [10]. For funders of healthcare, measures of effectiveness, efficiency and equity are important. At the level of the individual, though, measures of safety, timeliness, getting better and returning to health are more relevant [11].

Outcome measures are related to the delivery of care and the results of that care. Although it can be argued that the quality of care delivery is actually a process issue, the occurrence of adverse events directly related to care delivery is more appropriately measured as an outcome. Adverse event data can be obtained from medical records or from patient reports. Metrics like mortality rates, complication rates and readmissions are the usual data reported by healthcare providers. Direct measures of care quality rely on patient-reported experience measures (PREMs), like timeliness and coordination of care, and outcome measures (PROMs) such as pain, limitation

of function and quality of life. The effectiveness of healthcare can therefore be measured both by negative indicators (adverse outcomes) reported by health providers and by positive indicators (reduced pain, reduced disability and improved quality of life) reported by patients themselves.

Quality Reporting of Healthcare in Australasia

The first report on adverse events in Australian hospitals was published in 1995 [12]. This study reviewed the medical records of over 14,000 admissions to 28 hospitals in 1992 and found that about 17% of these admissions were associated with an adverse event caused by the healthcare delivery which either resulted in a disability or prolonged the hospital stay for the patient. One in seven of these adverse events led to a permanent disability and a further 5% of the patients died. The authors estimated that more than half of the adverse events were probably preventable. The mean increase in length of stay was 7 bed-days.

Subsequent studies in hospitals in New Zealand, Japan, Singapore, the UK and Denmark showed an average rate of 10% of hospital admissions associated with adverse events and a WHO study in 2012 of developing countries showed a similar finding [13]. As a result of the outcome study in Australia, the Australian Commission on Safety and Quality in Health Care was established in 2000 and currently accredits every hospital in Australia against ten safety and quality standards on a triennial basis. It has published a range of tools to help analyse routine data collected by individual hospitals, including a classification of Hospital-Acquired Diagnoses (CHADx) which relate complications and adverse events to subgroups of patients or clinical units [14].

A separate organisation, the Australian Council on Healthcare Standards, reports annually on 360 healthcare indicators. In the years 2005–2012, more indicators improved than worsened, and in the latest report (2009–2016), this trend continued with 71 indicators improving and 42 deteriorating. Significant improvements were seen in reduced adverse events for day surgery patients, reduced complications of colonoscopy, less deep infections after CABG surgery and an increase in peer review of serious adverse events in maternity services to almost 100%. Notable worsening in indicators occurred in hypothermia in the post-anaesthetic recovery period, major viscus injury during gynaecological surgery and the use of physical restraint for mental health patients [15].

Surgical death audits are carried out in all states in Australia under the Royal Australasian College of Surgeons' Australian and New Zealand Audit of Surgical Mortality. Any surgical death occurring during hospitalisation is referred for analysis by the treating surgeon, and results are published annually. In a recent report based on the Victorian audits since 2007, Chen et al. identified that about 15% of surgical deaths were potentially preventable [16].

Alternative ways of measuring healthcare are to look at appropriateness of care and variability in care provision. Both of these approaches have been the subject of research and reporting in Australia. Appropriate care implies compliance by

healthcare providers with evidence-based or consensus-based guidelines and variability in care suggests factors such as geographic location, socioeconomic status or provider preference influence the provision of healthcare.

In 2012, a study called CareTrack Australia reported on a sample of over 35,000 health encounters by 1100 patients with 22 common conditions in 2009–2010 and determined the percentage of encounters at which appropriate care had been recommended [17]. This study was based on a previous US study which found that overall only 55% of patients had received appropriate care in 1999 [18]. In the Australian study, the best compliance was seen for coronary artery disease (90% in 131 patients with 769 encounters) and one of the worst was antibiotic use (19% for 78 patients with 153 encounters).

The Australian Commission on Safety and Quality in Health Care released the first Australian Atlas of Healthcare Variation in 2015 which clearly showed geographical variation in six clinical areas that appeared unwarranted in that it exceeded the variation expected by health conditions in different populations or personal preferences [19]. The key findings were:

- An 11 times difference in antibiotic prescribing rates in areas with the highest to areas with the lowest and for amoxicillin alone a 20 times difference.
- A 30 times difference in colonoscopy rates
- An inappropriately high number of CT scans for low back pain and a ten times difference from highest to lowest rates
- A nine times difference in prostatic biopsy rates
- A five times variation in knee arthroscopy rates and over 30,000 procedures done for osteoarthritis in people over 55 years old during 2012–2013
- Five hundred thousand prescriptions for psychotropic medication for children with ADHD and a 75 times variation in rates
- Fifteen million prescriptions for antidepressants for adults with high rates in the over 65 years of age group
- Fourteen million prescriptions for narcotic analgesics with a ten times variation in rates

A second Atlas was published in 2017, and in the surgical category, lumbar spinal fusions and decompressions had the highest rates of variability [20]. This will be discussed below.

Measuring the Quality of Spine Care

Outcome measures for the treatment of low back pain are numerous and in general unstandardised. Clement et al. [21] defined a set of outcome metrics for low back pain using a Delphi technique involving an international group of experts (including a former spinal surgery patient). They identified that for comparison purposes, any outcome set should be available in multiple languages, allow for case-mix adjustments for specific disease groups and reflect what matters most to patients. They focussed on

degenerative lumbar conditions and recommended a specific set of patient-reported outcome metrics (Table 12.1) and adverse clinical events (Table 12.2).

The expert group also recognised the importance of documenting pre-existing risk factors such as smoking status, BMI and medical comorbidities and, for surgical patients, the anaesthetic status and any previous surgery. Finally, while acknowledging the impact of psychosocial factors on treatment for LBP, they did not recommend formal psychometric testing, suggesting that these indicators are captured in some of the domains of the disability and quality of life tools.

Reports on spine care outcomes using PROMs and adverse events are almost exclusively restricted to research study publications. The implication is that low level evidence based on small case numbers or biased results cannot be generalised to whole populations of similar patients.

Spine Registries

Registries of spine care exist in many countries and are described in a separate chapter of this book. Although evidence is now available from one of the longest established registries (SweSpine) that patient outcomes can be influenced by utilising registry data, most registries have a high likelihood of being perceived as biased

Table 12.1 Patient-reported outcome measures

Outcome	Measurement tool	Definition
Pain	Numeric rating score	Average pain over last week (back and leg) rated 0 to 10
Disability	Oswestry disability index	Ten domains, six options from 'no problem' to 'severe impairment'
Quality of life	EQ5D-3L	Five domains, three options from 'no problem' to 'severe impairment'
Work status	Normal hours and duties, reduced hours or duties, not at work	Current status and time off due to LBP
Analgesic use	Narcotic or non-opioid	None, sometimes, regularly

Table 12.2 Adverse outcomes of treatment

Outcome	Definition
Mortality	Death inhospital
Nerve root injury	Iatrogenic
Vascular injury	Required intervention
Dural tear	With CSF leak
Deep wound infection	Required IV antibiotics
Pulmonary embolus	Proven by imaging study
Readmission after discharge	Within 30 days for any reason
Reoperation	Any time after index surgery for any reason
Other	Wound haematoma, medical complications, etc.

because of industry or government sponsorship, membership of spine societies by data contributors or enrolling only surgical patients, and therefore outcomes are not seen as generalizable to all patients with low back pain [22]. In Australia, a pilot spine care registry has been started by the Spine Society of Australia and Monash University but will enrol only surgical patients initially. At Singapore General Hospital, a spine outcomes registry was established for lumbar cases in 1998 and cervical cases in 2002. At the end of 2017, there were almost 10,000 lumbar and 2,000 cervical patients. The registry receives institutional funding coupled with research grants to support a staff of allied health personnel who assist in the outcomes assessments with the patients. Patient-reported outcomes measures (PROMs) are interpreted for the patients in their local vernacular language. The PROMs used are disease-specific instruments such as the Oswestry Disability Index, North American Spine Society (NASS), Neck Disability Index, AAOS Cervical instrument and Short Form 22 for adolescent idiopathic scoliosis. Quality of life measures used are the Short Form 36 and NASS patient satisfaction scores. These outcome measures are collected preoperatively and post-operatively at weekly intervals of 6, 12 and 24 weeks and at the 2nd and 5th years and up to 10 years post-surgery. Perioperative morbidity and mortality statistics are captured and reported separately from registry data per episode of hospital admission. The vast repository of data from the registry has helped fuel the research into the outcomes of surgical treatments from degenerative spinal disorders, with 22 studies reported in peer-reviewed international journals by the end of 2017.

Appropriateness of Care for Low Back Pain

A study by Williams et al. of usual care by Australian general practitioners (GPs) for patients with low back pain found no improvement in compliance with evidence-based guidelines after the release of the NHMRC guidelines in 2004 [23]. Only 20% of patients received appropriate investigations, medications and advice [24]. As mentioned above, the CareTrack Australia study in 2012 examined the appropriateness of care for 22 common conditions, including low back pain [17]. In a separate analysis of the low back pain subset in the CareTrack study, Ramanathan outlined the indicators used in the study for compliance with the NHMRC guidelines:

- Patients presenting with low back pain have their medical history documented at presentation.
- Patients presenting with low back pain have a physical examination performed and documented at presentation.
- Patients presenting with low back pain have had a neurological examination of the lower limbs performed.
- Patients presenting with low back pain have been asked about/assessed for:
  - Spine fractures (trauma, history of previous fracture, prolonged use of steroids)
  - Cancer (history of cancer, unexplained weight loss, immunosuppression)

–   Infection (fever, IV drug use)
–   Cauda equina syndrome
•   Patients with acute low back pain were *not* advised to rest
•   Patients with acute low back pain were *not* recommended to have lumbar supports, traction or TENS
•   Patients with acute low back pain were *not* prescribed steroids or antidepressants

She identified that barriers to adherence to clinical guidelines include lack of awareness or familiarity, lack of agreement with the guidelines, lack of willingness to change practice or an expectation that patients will not comply. However, in the low back pain group of 164 patients with 6588 encounters, 72% had received appropriate care based on existing guidelines [25]. Unlike the Williams study which only looked at GPs as care providers, in the CareTrack study, the healthcare providers were a mixture of GPs, allied health practitioners and hospital doctors, and this rate correlated with the LBP subset in the US study of 69% [18]. GPs, though, had the lowest compliance rate at 54% of 1557 encounters compared to allied health providers at 83% of 4639 encounters.

In Singapore, a retrospective study of patients referred for physiotherapy treatment at a hospital musculoskeletal clinic for acute low back pain found that 93% of the patients had diagnostic imaging, but there was no difference in functional outcomes after treatment between patients with normal radiology and those with disc protrusions or degeneration [26]. Of the 94 patients referred during a 6-month period, 14 had no radiological abnormality, 42 had a disc protrusion on MRI and 21 had degenerative changes on plain x-ray films. Most of the patients were aged between 30 and 50 years, and 75% had previous low back pain episodes. All patients received manual therapy, back exercises and back pain education with functional improvement in the majority. Of those who improved, there was no significant difference between those with normal radiology and those with abnormalities on plain x-ray or MRI. The authors concluded that their study findings were consistent with international guidelines recommending against radiological investigations in patients presenting with acute low back pain with no sinister symptoms.

Variation in Surgery for Lumbar Degeneration

Variation in the rates of low back surgeries was identified in the first Australian Atlas of Healthcare Variation, and this variation was a focus of analysis in the second Atlas. The average rate of hospitalisations for lumbar spinal decompression between 2013 and 2015 was 81 per 100,000 adults with a range of 30–156. Rates were highest in areas surrounding major cities than in the cities themselves and lowest in remote areas of Australia and areas of low socioeconomic status. Rates were also high in areas of high socioeconomic status and in privately insured patients (81% of all hospitalisations) [20].

Lumbar spinal fusion was, in the past, restricted to the treatment of fractures and deformity, but now the commonest reason for spinal fusion in the USA is degeneration of the spine [27]. The rate of lumbar fusion in Australia is 26 per 100,000 adults

with a range from 10 to 69, in other words, 6.9 times as high in the highest area compared with the lowest. Nearly 90% of all fusions are done on private patients. This discrepancy between spinal fusion surgery performed in private versus public hospitals was the subject of a study in 2009 [28]. The authors found that the number of spinal fusion procedures performed in private hospitals in the most populated state in Australia (New South Wales) had increased 166% in the 10 years between 1997 and 2006 from 7.7 per 100,000 population to 20.5 per 100,000. The rate of spinal fusion procedures performed in public hospitals during the same time period had essentially remained unchanged at 2 per 100,000 population. The authors also noted that the figures for the private sector procedures did not include operations performed under worker's compensation insurance and speculated that the true rate is probably much higher as most worker's compensation procedures are performed in private hospitals but are not reported because the payments to hospitals by insurers are outside the national Medicare system.

A similar discrepancy was noted in the UK and prompted the National Institute for Health and Care Excellence to call for lumbar fusions to be permitted only as part of a randomised trial [29].

Summary

In Australasia, healthcare quality reporting is comprehensive but largely unintegrated. This lack of linked data about the quality and safety of care provided to individual patients was identified as a major drawback for effective healthcare improvement by a report from the Grattan Institute [30]. Healthcare providers and funders, both government and private, should share the data they collect with the hospitals and healthcare practitioners who deliver the care so that comparisons can be made and exemplary care shared with all. These data are about process, complications and patient experiences and should be reported in a transparent and accessible way. In turn, providers and hospitals have no access to patient outcomes after discharge from care. These metrics are held in registries or outcome studies and are available only to the contributors or researchers. So, actions to correct deficiencies in the standard of care are limited by the lack of integration of data because the people who can make changes do not have all the information. Integration of data at all levels of reporting should lead to better-quality healthcare for the people that matter the most, the individuals that receive that care.

References

  1. Australian Bureau of Statistics. Census 2016.
  2. Statistics Singapore. Singstat.gov.sg
  3. Duckett SJ. The Australian healthcare system. Melbourne.: OUP; 2004.

4. Global Burden of Disease Study 2016. Institute for Health Metrics and Evaluation, University of Washington, Seattle. http://ghdx.healthdata.org/gbd-2016

5. Most efficient healthcare around the world. Bloomberg.com

6. Australian Institute of Health and Welfare 2017. The burden of musculoskeletal conditions in Australia: a detailed analysis of the Australian Burden of Disease Study 2011. Australian Burden of Disease Study series no. 13. BOD 14. Canberra: AIHW.

7. Australian Institute of Health and Welfare 2016. Impacts of chronic back problems. Bulletin 137. Cat. no. AUS 204. Canberra: AIHW.

8. Singapore Burden of Disease Study Group. Epidemiology & Disease Control Division, Ministry of Health, Singapore, 2014.

9. Institute of Medicine. 1990. Medicare: a strategy for quality assurance, vol. 2. Kathleen Lohr, editor. Washington, DC: National Academy Press.

10. Donabedian A. Evaluating the quality of medical care. Milbank Mem Fund Q. 1966;44:166.

11. Agency for Healthcare Research and Quality. The National Healthcare Quality Report; 2003.

12. Wilson RML, Runciman WB, Gibberd RW, Harrison BT, Newby L, Hamilton JD. The quality in Australian health care study. Med J Aust. 1995;163:458–71.

13. Hamilton JD, Gibberd RW, Harrison BT. After the quality in Australian health care study, what happened? Med J Aust. 2014;201(1):23.

14. Jackson T, Michel JL, Roberts RF, Jorm CM, Wakefield JG. A classification of hospital-acquired diagnoses for use with routine hospital data. Med J Aust. 2009;191(10):544–8.

15. The Australian Council on Healthcare Standards. Australasian clinical indicator report: 2009–2016. 18th ed.

16. Chen A, Retegan C, Vinluan J, Beiles CB. Potentially preventable deaths in the Victorian audit of surgical mortality. ANZ J Surg. 2017;87:17–21.

17. Runciman WB, Hunt T, Hannaford NA, Hibbert PD, Westbrook JI, Coiera EW, Day RO, Hindmarsh DM, McGlynn EA, Braithwaite J. CareTrack: assessing the appropriateness of health care delivery in Australia. MJA. 2012;197(2):100–5.

18. McGlynn EA, Asch SM, Adams J, Keesey J, Hicks J, DeCristofaro A, Kerr EA. The quality of health care delivered to adults in the United States. N Engl J Med. 2003;348(26):2636–45.

19. Australian Commission on Safety and Quality in Health care. The First Australian Atlas of Healthcare Variation; 2015.

20. Australian Commission on Safety and Quality in Health Care. The First Australian Atlas of Healthcare Variation; 2017.

21. Clement RC, Welander A, Stowel C, Cha TD, Chen JL, Davies M, Fairbank JC, Foley KT, Gehrchen M, Hagg O, Jacobs WC, Kahler R, Khan SN, Lieberman IH, Morisson B, Ohnmeiss DD, Peul WC, Shonnard NH, Smuck MW, Solberg TK, Stromqvist BH, Van Hoof ML, Wasan AD, Willems PC, Yeo W, Fritzell P. A proposed set of metrics for standardised outcome reporting in the management of low back pain. Acta Orthop. 2015;86(5):523–33.

22. Van Hoof ML, Jacobs WCH, Willems PC, Wouters MWJM, De Kleuver M, Peul WC, Ostelo RWJG, Fritzell P. Evidence and practice in spine registries. Acta Orthop. 2015;86(5):534–44.

23. National Health and Medical Research Council. Evidence-based management of acute musculoskeletal pain. Canberra: NHMRC; 2004.

24. Williams CM, Maher CG, Hancock MJ, McAuley JH, McLachlan AJ, Britt H, Fahridin S, Harrison C, Latimer J. Low back pain and best practice care: a survey of general practice physicians. Arch Intern Med. 2010;170(3):271–7.

25. Ramanathan SAS. Appropriate care for low back pain in Australia: evidence, expert opinion, current practice and patient perspectives. PhD thesis, University of South Australia, 2016.

26. Goh MR, Po IYY, Olafsdottir K. Low back pain in Changi General Hospital: an observational study. Proc Singapore Health Care. 2010;19(3):175–82.

27. Rajaee S, Bae H, Kanim L, Delamarter R. Spinal fusion in the United States: analysis of trends from 1998 to 2008. Spine. 2012;37:67–76.

28. Harris IA, Dao ATT. Trends in spinal fusion surgery in Australia: 1997 to 2006. ANZ J Surg. 2009;79:783–8.

29. National Institute for Health and Care Excellence. Low back pain and sciatica in over 16s: assessment and management. Invasive treatments. NICE guideline NG59. Methods, evidence and recommendations. London: NICE; 2016.
30. Duckett S, Jorm C, Danks L. Strengthening safety statistics: how to make hospital safety data more useful. Melbourne: Grattan Institute; 2017.