The provision of general surgery in rural Australia: a narrative review

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General surgery is the most common surgical specialty in rural Australia, providing breast, skin, endocrine, gastrointestinal, colorectal and trauma surgery. It requires knowledge of the whole field of surgery, particularly the ability to provide an extended scope of emergency care dependent upon community need.[1,2] Rural residents make up 29% of the Australian population; however, only 19.5% of general surgeons live and work rurally, often serving populations across large geographical distances.[3]

Rural Australians have an increased burden of surgical disease and fewer surgeons to provide general surgical care compared with metropolitan Australians, and inequity exists in both the ability and timeliness to access general surgical care, resulting in poorer health outcomes for rural Australians.[4,5] This review explores the factors affecting the provision of general surgery in rural Australia and discusses the evidence for improving access to general surgical care for rural Australians.

Summary

- Rural surgery is most commonly provided by general surgeons to the 29% of people (7 million) living in rural Australia.
- The provision of rural general surgery to enable equitable and safe surgical care for rural Australians is a multifaceted issue concerning recruitment, training, retention, surgical procedures and surgical outcomes.
- Sustaining the rural general surgical workforce will be dependent upon growing an increased number of resident rural general surgeons, as well as changed models of care, with a need for ongoing review to track the outcomes of these changes.
- To increase recruitment, rural general surgical training must improve to be less stressful for trainees and to be incorporated alongside a rural-facing generalist curriculum.
- Rural general surgical outcomes (excluding some oncology conditions) achieve comparable results to metropolitan centres.
- Access to, and outcomes of, surgical oncology services continues to be inequitable for rural Australians and should be a major focus for improved service delivery.

Methods

PubMed, Embase, Scopus and CINAHL were searched by two researchers (JAP and JB) from database inception until November 2022. Searches were restricted to the English language and full text articles. The keywords "Australia", "rural", "regional", "remote", "general surgery", "access" and "delivery" were manipulated with Boolean operators as shown in the Supporting Information. Rural was defined according to the Australian Statistical Geography Standard – Remoteness Area (ASGS-RA) code.[6] Any location classified as RA2–RA5 was considered rural, as this is what the Royal Australasian College of Surgeons (RACS) uses as an indicator of rurality (determined according to population and distance to services), as shown in Box 1.[6]

Workforce

General surgery suffers from urban excess and rural deficit. The RACS 2021 annual activities report showed that 381 general surgeons worked rurally (RA2+), compared with 1572 metropolitan (RA1) general surgeons.[3] In 2021, 86% of Australia rural general surgeons were male, 38% were overseas-trained, and 21% were over 55 years old.[7] In smaller rural centres (RA3+) specialists were more likely to be male (84%), older (44% were aged > 64 years), overseas-trained (38%), and less likely to work privately (8%) than large regional centres.[8] Compared with their metropolitan counterparts, rural general surgeons cater for a greater surgeon to population ratio, with an extended scope of practice, and on average perform double the number of operations, primarily due to the provision of endoscopy services.[9] For example, rural South Australia (SA) has an endoscopist to population ratio of 1:55 000 compared with 1:500 for residents of Adelaide, with rural colonoscopies predominantly provided by general surgeons.[10] A smaller workforce and greater patient ratios result in general surgeons having a greater workload — rural specialists work up to 1.8 times more hours per week on average than metropolitan specialists.[8] On-call requirements can be onerous; for example, in Western Australia (WA), up to 83% of rural general surgeons perform on-call duties, at least 50% are on-call for one in four days (or fewer), and 7.5% are on-call for one in two days (or fewer).[11] Rural surgeons may,

1 Australian Statistical Geography Standard – Remoteness Area (ASGS-RA) code, classification and examples[6]

Category	Classification	Examples
RA1	Major cities of Australia	Melbourne, Sydney, Perth, Newcastle, Geelong, Adelaide, Brisbane
RA2	Inner regional Australia	Bendigo, Mackay, Dubbo, Albury, Tamworth, Toowoomba, Bunbury, Mount Gambier, Hobart
RA3	Outer regional Australia	Darwin, Townsville, Cairns, Mildura, Broken Hill, Port Augusta, Burnie
RA4	Remote Australia	Port Lincoln, Alice Springs, Broome, Katherine, Mount Isa, Port Hedland, Bicheno
RA5	Very remote Australia	Kununurra, Coober Pedy, Tenant Creek, Longreach, Carnarvon, King Island

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however, have a lower quantity of after-hours referrals when covering a smaller population catchment seen in more remote areas. Despite increased working requirements, in a 2014 survey rural general surgeons' overall job satisfaction did not differ substantially from their metropolitan colleagues.[8]

Improving the rural general surgical workforce will require an increased indexation of already known strategies. Increasing the critical mass of Australian rural general surgeons, both locally trained and international graduates (who are retained long term), can immediately improve the on-call demands and local professional networks. Other solutions will require delivery of continual professional development that is local and rurally relevant, and ensuring rural positions are attractive to younger surgeons, particularly to female surgeons, who may be more likely than their male counterparts to desire part-time or flexible contracts.[12]

Models of care

The provision of rural general surgery services across Australia relies on a number of models, including resident general surgeons, hub-and-spoke models of care, and outreach, which consists of fly in-fly out surgeons.[4] Resident general surgeons have long been considered the gold standard, but it is critical to recognise that rural is not one homogenous classification across Australia, and there are notable differences in RA2–RA5 communities, with remoteness particularly felt in the Northern Territory (NT) and WA, where there may need to be different solutions, including more outreach services.[6] Currently, the RACS estimates a population to surgeon ratio of 1:14 084 for general surgery.[2]

For example, in 1998, SA reported only seven resident general surgeons, despite 39 rural hospitals with active operating theatres.[13] Comparatively, in WA, for example, only two of seven rural health regions were serviced by resident general surgeons at ratios consistent with the RACS guidelines in 2017. Fourteen of 16 rural WA hospitals were dependent upon fly in-fly out surgeons.[11] Outreach surgery enables rural patients to have consultations and surgery delivered closer to home, albeit in lower resource environments.[14] Evidence shows that regular state-based outreach services improve the provision of general surgery with improved patient safety and communication, less travel and cost to the patient, and an increase in local consultations, operations and open access endoscopy. This has been effective across diverse states and territories, ranging from Victoria to the NT.[15,16] Telehealth is also a useful tool. Alongside regular in-person consults, telehealth has been shown to save time and money and improve access for rural patients who require bariatric surgery.[17]

Sustaining access to general surgery services for rural Australia will likely use various models, with outreach important to provide appropriate on-call and leave cover for resident general surgeons. However, outreach arrangements can lead to burnout to the providing surgeon due to long distance travel and long working hours, and also lead to a lack of local collegial support over time due to the transient nature of this workforce.[4,14,15] Over time, outreach models of care can result in poorer local infrastructure and erosion of quality local health care.[18] Despite this, solutions to professional isolation could also include rural–metropolitan surgical networks to ensure professional development, ready locum coverage and multidisciplinary team (MDT) environments with quality audit assurance for the rural general surgeon.[4] An example of a successful hub-and-spoke model exists in Echuca, Victoria, where there are no resident general surgeons but about eight visiting surgeons who provide elective surgery, after-hours on-call, and outpatient clinics in 48-hour intervals.[19]

Multidisciplinary team

The provision of rural general surgery is reliant upon ancillary services. Rural general surgeons work closely with general practitioners for referrals and also work with rural generalists who provide anaesthesia and post-operative and emergency care.[14,15,20] Despite this, the capacity of rural surgeons to practise at their highest scope of practice can be limited by lack of other co-located specialist services (intensive care, radiology, oncology services).[21]

The MDT is an important support for rural general surgeons, who often liaise with metropolitan surgeons, particularly via telephone, for hepatobiliary, neurosurgery and oncological advice.[22,23] For example, in Victoria, rurality was originally not found to be a barrier for general surgeons to interact with a multidisciplinary cancer meeting; however, a more recent study in 2021 identified fewer multidisciplinary meetings and significantly less access to thoracic surgical expertise for rural patients compared with metropolitan patients.[24,25]

The importance of ancillary services is shown in the breast cancer literature, where time to diagnosis and treatment of breast cancer did not vary with rurality, but there are higher rates of mastectomy and decreased rates of breast reconstruction in rural areas due to an absence of local radiation and medical oncology services and plastic surgeons.[26-28] Rural general surgeons would benefit from breast reconstruction training and mentoring, although this may be difficult to achieve, as rural surgeons would require periods away from their practice for oncoplastic training.[29] For rural patients with breast cancer (living > 100 km from radiotherapy), the higher rate of mastectomy is largely influenced by the location of their treatment services, not cancer pathology.[30]

Improving MDTs will require both Commonwealth and state government investment to ensure a whole-of-hospital service. There have been successful initiatives, such as the NT Plastic Surgeons Program, where breast cancer services and training can be done locally.[31] The success of this program has been attributed to the development of strong governance, training and development for all team members, unit redesign and a strong professional network.[31] The Australian Society of Plastic Surgeons have also successfully achieved a similar model in Tasmania, where five to six part-time plastic surgeons filled 2.5 full-time positions.[32] This work needs to be extended across Australia, with an understanding that rural general surgeons do not operate in isolation. Whole-of-hospital service investment would also require further development of medical imaging services encompassing interventional radiology, nuclear medicine, efficient technology transfer and increased recruiting of radiologists. Recognising a need for increased rural outpatient appointments may also require greater primary care engagement as highlighted by successful outreach services.[15]

Training rural general surgeons

Most general surgical trainees undertake rural rotations during their training as per the General Surgeons Australia curriculum.[33] The frequency and timing of rural placements continues to be debated. Providing dedicated rural training to

late-stage trainees has little effect on rural practice intentions, unless trainees had earlier rural exposure.[34] Nevertheless, skilled advanced trainees might reduce the on-call burden for rural general surgeons.[34]

In response to rural general surgery deficits, the Rural Surgical Training Program was conceived in 1996 with the aim of improving rural general surgery retention by offering increased rural training options and mentoring to a subset of general surgery trainees interested in rural practice. The program ended in 2007 and a subsequent cessation analysis suggested that the program failed to improve the rural workforce — 77% of program participants practised solely in metropolitan locations.[5] The cessation of the program resulted in a review of the factors enabling successful and sustained rural general surgical practice.[35,36] The primary barriers identified included inadequate preparation for rural placement, limited casemix to support learning outcomes, excessive workload and safe hour concerns, lack of peer support, and family unit considerations (poor accommodation, childcare amenities, financial burden).[36] Relocation for rural surgical training has also been shown to be associated with poorer mental health for trainees, including the stress of unknown location placement, social isolation, partner separation or partner stress.[35,36] By contrast, the incentives of rural surgical training include a broadened scope of training, high quality supervision, lifestyle and a positive workplace.[36] Rural general surgical trainees were also significantly more likely to learn endoscopy, have greater primary operator experience and operate unsupervised compared with their metropolitan counterparts.[37,38] They were also more likely to have more time on-call but with fewer overall working hours compared with metropolitan colleagues.[39]

It remains important that trainees have a positive experience on their rural rotations to encourage recruitment. Unfortunately, rural training locations can be professionally and personally stressful for trainees. Given dedicated rural training pathways have not been successful in increasing rural recruitment, Clancy has advocated for general surgery selection to give preference to trainees with rural origin, rural clinical school and prevocational work experience.[4] However, the relocation of rurally inclined trainees to metropolitan settings for long periods is known to diminish their rural intention.[40] This has renewed calls for more rural training hubs that satisfy rurally inclined training requirements alongside integration with tertiary training hubs.[4,41,42] This is particularly important as it would further strengthen rural–metropolitan surgical networks and provide subspecialist support to rural general surgeons. Clancy has also called for a generalist curriculum for general surgical training, with increasing acknowledgement that rural exposure is devalued by an urban-focused curriculum which undermines the health needs of rural Australians.[4] Currently, improvements in rural general surgical training are focused on increased rural selection, a Rural Coach Program for trainees, moving towards a rural facing curriculum, rural training hubs and flexible training opportunities. As yet, these programs have not been evaluated for their effectiveness.[12,43]

At present there are currently only three regional general surgery training hubs (two of which are based out of RA1 regions): south-west Victoria (Geelong, RA1), Newcastle and Gosford (RA1), and Northern Queensland (Townsville, RA3).[41] General surgery training hubs with a more rural base that satisfy training requirements and provide research opportunities could facilitate better rural immersion.[4,41,42] General surgery is increasingly becoming an academic specialty, yet rural location has been associated with poorer access to professional development opportunities and less engagement with evidence-based medicine.[4] This needs to be improved to ensure quality training opportunities for trainees.

Recruiting and retaining general surgeons rurally is multifaceted. Strategies include an increased focus on rural selection (rural origin, clinical school placement, prevocational work), increased rural general surgery training hubs and supporting the non-professional needs of surgeons and trainees (childcare, childhood education, partner's employments, relocation support).[12,43] There also needs to be a focus on income disparity for rurally based surgeons, who have fewer options for private practice.[12,43]

Extended and broad scope of practice

Rural general surgeons require a broad and extended scope of practice to meet local need given the lack of other surgical specialties. Although endoscopic and general surgical procedures dominate (upper gastrointestinal, colorectal, hepatobiliary, breast and endocrine), 5.4–28.3% of surgeries performed by rural general surgeons occur across the other eight surgical specialties, especially in emergency settings.[44-47] This is dependent on their confidence and comfort with performing these auxiliary procedures, which is largely dictated by their surgical training.[48] For example, neurosurgical operative confidence among general surgeons increases with distance from a neurosurgical centre.[23,49,50] Over seven years, rural general surgeons from Hamilton, Victoria, did 114 emergency neck of femur fracture operations locally, with outcomes consistent with national guidelines.[51] We suggest that both the general surgery and post-fellowship curriculum provide rural general surgery trainees with a broad scope of practice.[33,52] Apart from the Definitive Surgical Trauma Care course, there are very few opportunities for general surgeons to develop an extended scope of emergency skills. This could be an area of development for General Surgeons Australia.

Patient outcomes

Improving access to rural general surgery also needs to ensure a safe, outcome-based approach. There is a large volume of international literature that supports centralised care in high volume metropolitan centres, with an implicit assumption that rural patients have worse outcomes.[53] These assumptions are not born out in the Australian literature, with a recent study of surgical mortality in rural SA, for example, showing 0.3% of in-hospital mortality over a five-year period involving 26 996 general surgical patients, which is comparable to the 2020 Victorian statewide Audit of Surgical Mortality.[54] Of these 80 deaths, only five were attributed to surgical complications.[54] A 2018 study explored mortality after emergency abdominal surgery in a cohort of 237 patients over five years in Mount Gambier (RA2) and found that emergency laparotomy mortality rates were better than published international rates.[55] Furthermore, both appendicectomy and paediatric surgical outcomes in rural northern Australia were equivalent to national outcomes.[56,57]

Two retrospective studies reported no significant difference in post-operative pancreaticoduodenectomy or gastrectomy mortality in rural compared with metropolitan centres, despite only 7.4% of pancreaticoduodenectomies and 3.8% of gastrectomies being done rurally.[58,59] In Townsville, after introduction of a specialised hepatobiliary unit, there were no

significant differences in operative approach or complexity, nor in mortality or complication rates between the two periods (ie, before and after the specialised hepatobiliary service).[22] Similarly, a retrospective review of 66 consecutive liver resections following the introduction of the service rurally found comparable outcomes to published international series.[60]

This is in contrast to breast cancer surgery, with evidence highlighting poorer outcomes when breast cancer surgery was performed rurally, including greater probabilities of re-operation, mastectomy, delay to chemotherapy and poorer five-year survival of patients compared with surgeries done in metropolitan areas.[61,62] These outcomes relate more to a lack of pathology services than surgical expertise, with an absence of intraoperative frozen section pathology.[63] A survey of Australian breast surgeons highlighted that rural surgeons had variable engagement in MDT meetings, and less access to breast cancer nurses compared with metropolitan surgeons.[64,65] The poorer outcomes seen in breast cancer are most likely due to a lack of ancillary services, including oncology and radiation oncology rather than surgical expertise, which highlights the importance of rural centres having access to appropriate multidisciplinary support.

Compared with patients residing in metropolitan areas, a survey from Victoria found rural patients waited longer for both colonoscopies and surgery for colorectal cancer.[66] However, colonoscopies done in rural settings showed similar procedural findings and outcomes and outperformed national standards.[67] The majority of colorectal surgery done at rural centres was for cancer, and, when performed rurally, patients have been shown to have comparable surgical outcomes to metropolitan patients.[68-71]

Overall, rural general surgeons perform procedures with comparable outcomes to metropolitan centres. Improvements in breast cancer surgery will require additional oncological and reconstructive training for the rural general surgeon; an increased supply of other specialties working rurally, including radiation oncology, radiology and pathology; and greater MDT engagement.[63-65] Furthermore, this research to date has been unable to examine the impact of widespread nursing shortages, which are magnified rurally, and deficits of the rural allied health workforce, who are also critical contributors to the MDT.[72,73] Ongoing audit of rural general surgical services will be required to ensure that local provision of surgery is safe and equitable.

The rural workforce of the other specialties

Compared to other specialties, the recruitment and retention of rural primary care physicians across Australia, Canada and the United States relies on rural upbringing, personal attributes of being service-oriented, positive rural exposure, financial incentives, partner receptivity to rural living, and work–life balance, all factors identified in rural general surgery recruitment.[74] The Australian rural physician workforce has similar attributes to the rural general surgical workforce, with a greater likelihood of rural background or overseas training. Challenges for the rural physicians included leadership in fragile environments, a culture in medicine wherein rural work is often viewed as less valuable or skilled, professional isolation and poorer support networks than in metropolitan areas. Despite this, they report equivalent professional satisfaction to their metropolitan colleagues. Ostini and colleagues[75] identified that training a sustainable rural physician workforce would require connection to place, trainees invested in rural practice, training focusing on community need, rural immersion, investment in generalism, service and academic learning, linking rural training, and planning for a sustainable specialist role. This framework could be adapted to rural general surgery.

2 Recommendations for sustainable provision of rural general surgery

- Workforce
  - Immediate increase of critical mass (ie, having enough people to actually provide and maintain a surgical service)
  - Selecting for rural (rural origin, rural clinical school, rural prevocational work)
  - Local and rurally relevant professional development
  - Flexible rural employment
- Models of care
  - Resident general surgeons supported by rural–metropolitan surgical networks
  - Hub-and-spoke models
  - Intermittent outreach and telehealth
- Multidisciplinary team
  - Increasing rural workforce of other surgical specialties
  - Increasing rural engagement with oncology, radiology and intensive care
- Training rural general surgeons
  - Generalist curriculum that values rural practice
  - Supportive and positive rural immersion
  - Rural training hubs
- Extended and broad scope of practice
  - Specific rural fellowships
  - Training to community need in surgical subspecialties
- Patient outcomes
  - Additional breast oncological and reconstructive training for rural general surgeons
  - Greater multidisciplinary team engagement (medical practitioners, nurses, allied health)
  - Regular audit and dedicated non-clinical time

Realities and future solutions

The recommendations for the sustainable provision of Australian rural general surgery are shown in Box 2.

Limitations

First, it is important to note that Australian rural towns are heterogenous in nature and the solutions to rural general surgical provision will not be uniform. Second, no time frames were put in place for this narrative review, and older studies might not provide an accurate reflection of current rural general surgical practice. Nevertheless, this review does provide context of how Australian rural general surgery has changed across time, noting that this has been a long-standing problem. Furthermore, this narrative review was very broad, which may have limited the depth of discussion. Finally, no interventional studies or clinical trials were available to assess the provision of general surgery in rural Australia, resulting in a low quality of evidence. Notable areas lacking evidence included the paucity of rural critical care staff and infrastructure and the role of interventional radiology supporting the provision of rural general surgery.

Conclusion

Improving access to general surgery in rural areas relies on an increase in workforce numbers, differing models of care and an improved focus on the wider MDT. Developing a training model that best meets community need has been a long-standing issue, and a renewed focus on selection, alongside a rurally focused

curriculum, may be needed to create a generation of rural general surgeons that provide an extended and broad scope of practice. Surgical outcomes, especially in oncological surgery, require a multidisciplinary approach to address rural need, and outcomes must be monitored to ensure equitable access to quality care.

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1 General Surgeons Australia. About us. Melbourne: GSA, 2022. https://www.generalsurgeons.com.au/about-us (viewed Feb 2024).

2 Royal Australasian College of Surgeons. Train for Rural: Rural Health Equity Strategy. Melbourne: RACS, 2021. https://www.surgeons.org/-/media/Project/RACS/surgeons-org/files/interest-groups-sections/Rural-Surgery/2-Train-for-Rural.pdf?rev=2e53ad7ecb3e4864be9dcc69e0556bb1&hash=6EF8D4FD8F5C13332C8C625D920E42C6 (viewed May 2023).

3 Royal Australasian College of Surgeons. Activities report 2021. Melbourne: RACS, 2022. https://www.surgeons.org/-/media/Project/RACS/surgeons-org/files/reports-guidelines-publications/workforce-activities-census-reports/2021-12-31_RACS_ActivitiesReport_2021_V4_Final.pdf?rev=7dced14774fa449e8a74b1023013998e&hash=528EC8EDAD1B41E0B2757EEECEAC97DF (viewed May 2023).

4 Clancy B. Royal Australasian College of Surgeons Rural Health Equity Strategic Action Plan: excellence through equity. *ANZ J Surg* 2022; 92: 1990-1994.

5 Chong A, Kiroff G. Preparing surgeons for rural Australia: the RACS Rural Surgical Training Program. *ANZ J Surg* 2015; 85: 108-112.

6 Department of Health and Aged Care. Australian Statistical Geography Standard – Remoteness Area [website]. Canberra: Commonwealth of Australia, 2021. https://www.health.gov.au/topics/rural-health-workforce/classifications/asgs-ra (viewed May 2023).

7 Department of Health and Aged Care. Health Workforce Dataset: Data Tool. Canberra: Commonwealth of Australia, 2020. https://hwd.health.gov.au/datatool/ (viewed May 2023).

8 O'Sullivan B, McGrail M, Russell D. Rural specialists: the nature of their work and professional satisfaction by geographical location of work. *Aust J Rural Health* 2017; 25: 338-346.

9 Nelson PG. General surgical manpower, Victoria, Australia. *Aust N Z J Surg* 1991; 61: 576-588.

10 Choi MS, van der Mark MA, Hung K. The distribution and composition of colonoscopy providers in Australia. *Cureus* 2022; 14: e22104.

11 Shanmugakumar S, Playford D, Burkitt T, et al. Is Western Australia's rural surgical workforce going to sustain the future? A quantitative and qualitative analysis. *Aust Health Rev* 2017; 41: 75-81.

12 Paynter JA, O'Sullivan B, Qin KR, et al. Characterizing the female general surgery workforce in rural and regional Australia. *ANZ J Surg* 2023; 93: 2283-2284.

13 Bruening MH, Maddern GJ. The provision of general surgical services in rural South Australia: a new model for rural surgery. *ANZ J Surg* 1998; 68: 764-768.

14 Chittleborough TJ, Lourensz K, Elliott M, et al. Outreach surgical consulting services in North East Victoria. *Aust J Rural Health* 2013; 21: 325-328.

15 Gruen RL, Bailie RS, Wang Z, et al. Specialist outreach to isolated and disadvantaged communities: a population-based study. *Lancet* 2006; 368: 130-138.

16 Hughes-Anderson W, Rankin SL, House J, et al. Open access endoscopy in rural and remote Western Australia: does it work? *ANZ J Surg* 2002; 72: 699-703.

17 Maurice AP, Punnasseril JEJ, King SE, Dodd BJ. Improving access to bariatric surgery for rural and remote patients: experiences from a state-wide bariatric telehealth service in Australia. *Obes Surg* 2020; 30: 4401-4410.

18 Hussain R, Maple M, Hunter S, et al. The fly-in fly-out and drive-in drive-out model of health care service provision for rural and remote Australia: benefits and disadvantages. *Rural Remote Health* 2015; 15: 3068.

19 Echuca Regional Health. About us. Echuca: Echuca Regional Health, 2021. https://erh.org.au/about/ (viewed May 2023).

20 Venchiarutti RL, Tracy M, Clark JR, et al. Geographic variation in referral practices for patients with suspected head and neck cancer: A survey of general practitioners using a clinical vignette. *Aust J Rural Health* 2022; 30: 501-511.

21 Oh D, Wright C, Young CJ. Management of obstetric anal sphincter injury: Colorectal surgeons' perspectives in Australia and New Zealand. *Aust N Z J Obstet Gynaecol* 2021; 61: 16-21.

22 Yeh J, Palamuthusingam P, Cameron D, Avramovic J. Impact of establishing a specialized hepatobiliary unit on liver resections in a non-specialized tertiary centre in regional Australia. *ANZ J Surg* 2022; 92: 769-773.

23 Bishop CV, Drummond KJ. Rural neurotrauma in Australia: implications for surgical training. *ANZ J Surg* 2006; 76: 53-59.

24 Brims FJH, Kumarasamy C, Nash J, et al. Hospital-based multidisciplinary lung cancer care in Australia: a survey of the landscape in 2021. *BMJ Open Respir Res* 2022; 9: e001157.

25 Underhill C, Bartel R, Goldstein D, et al. Mapping oncology services in regional and rural Australia. *Aust J Rural Health* 2009; 17: 321-329.

26 Youl P, Philpot S, Moore J, Theile DE. Population-based picture of breast reconstruction in Queensland, *Australia. ANZ J Surg* 2021; 91: 695-700.

27 Flitcroft K, Brennan M, Costa D, Spillane A. Documenting patterns of breast reconstruction in Australia: the national picture. *Breast* 2016; 30: 47-53.

28 Hall SE, Holman CDJ. Inequalities in breast cancer reconstructive surgery according to social and locational status in Western Australia. *Eur J Surg Oncol* 2003; 29: 519-525.

29 Flitcroft K, Brennan M, Spillane A. Principles of patient-centred care and barriers to their implementation: a case study of breast reconstruction in Australia. *Support Care Cancer* 2020; 28: 1963-1981.

30 Collins IM, Lum C, Versace VL. Influence of socioeconomic factors and distance to radiotherapy on breast-conserving surgery rates for early breast cancer in regional Australia; implications of change. *Asia Pac J Clin Oncol* 2018; 14: e224-e230.

31 Australian Society of Plastic Surgeons. ASPS Darwin Workforce Project impact report: 2022 — the second year. Sydney: ASPS, 2022. https://plasticsurgery.org.au/wp-content/uploads/2023/05/Darwin-second-year-impact-report_FINAL.pdf (viewed May 2023).

32 Bryant K, Dean N. Innovation in rural workforce strategies by a national surgical society: the ASPS experience. *Australas J Plast Surg* 2021; 4: 3-5.

33 General Surgeons Australia. Curriculum. Melbourne: GSA, 2022. https://www.generalsurgeons.com.au/education-and-training/curriculum (viewed May 2023).

34 Bruening MH, Anthony AA, Maddern GJ. Surgical rotations in provincial South Australia: the trainees' perspective. *ANZ J Surg* 2003; 73: 65-68.

35 Miller FJ, Miller CA, Fox AM, et al. Influence of training on the family. *ANZ J Surg* 2006; 76: 907-911.

36 Hippolyte-Blake D, Dreschler A, Rose A, et al. A qualitative study of the incentives and barriers that influence preferences for rural placements during surgical training in Australia. *ANZ J Surg* 2022; 92: 341-345.

37 Chan LS, Scholes NJW, Jones M. Skin excisions: not so simple for the regionally based general surgical trainee. *Aust J Rural Health* 2011; 19: 205-210.

38 Wong K, Birks D. Operative experience in the Victorian general surgical training programme. *ANZ J Surg* 2003; 73: 1036-1040.

39 O'Grady G, Loveday B, Harper S, et al. Working hours and roster structures of surgical trainees in Australia and New Zealand. *ANZ J Surg* 2010; 80: 890-895.

40 Eley DS, Synnott R, Baker PG, Chater AB. A decade of Australian Rural Clinical School graduates — where are they and why? *Rural Remote Health* 2012; 12: 1937.

41 General Surgeons Australia. Training Committee. Melbourne: GSA, 2023. https://www.generalsurgeons.com.au/training-committees (viewed May 2023).

42 Monash University. About the hubs. Melbourne: Monash University, 2022. https://www.monash.

edu/medicine/rural-health/hubs/about-us#:~:text=The%20regional%20training%20hub%20concept,phase%20of%20regional%20medical%20education (viewed May 2023).

43 McGrail MR, Doyle Z, Fuller L, et al. The pathway to more rural doctors: the role of universities. *Med J Aust* 2023; 219 (Suppl): S8-S13. https://www.mja.com.au/journal/2023/219/3/pathway-more-rural-doctors-role-universities

44 Bappayya S, Chen F, Alderuccio M, Schwalb H. Caseload distribution of general surgeons in regional Australia: is there a role for a rural surgery sub-specialization? *ANZ J Surg* 2019; 89: 672-676.

45 Campbell NA, Kitchen G, Campbell IA. Operative experience of general surgeons in a rural hospital. *ANZ J Surg* 2011; 81: 601-603.

46 Campbell NA, Franzi S, Thomas P. Caseload of general surgeons working in a rural hospital with outreach practice. *ANZ J Surg* 2013; 83: 508-511.

47 Liu J, Lei C, Reid J, et al. Extended scope of practice needed for Australian rural general surgeons: a review of South Australia's rural general surgical caseload and case mix. *ANZ J Surg* 2022; 93: 522-527.

48 Paynter JA, Qin KR, O'Brien A, et al. Rural general surgeon confidence with managing vascular emergencies: a national survey. *Aust J Rural Health* 2023; 31: 897-905.

49 Luck T, Treacy PJ, Mathieson M, et al. Emergency neurosurgery in Darwin: still the generalist surgeons' responsibility. *ANZ J Surg* 2015; 85: 610-614.

50 Gilligan J, Reilly P, Pearce A, Taylor D. Management of acute traumatic intracranial haematoma in rural and remote areas of Australia. *ANZ J Surg* 2017; 87: 80-85.

51 Udovicich C, Page D, Huq M, Clifforth S. Neck of femur fracture management by general surgeons at a rural hospital. *Australas Med J* 2015; 8: 154-160.

52 General Surgeons Australia. PFET Program in Rural Surgery. Melbourne: GSA, 2023. https://www.generalsurgeons.com.au/post-fellowship-education-training/rural-program (viewed May 2023).

53 Stewart GD, Long G, Tulloh BR. Surgical service centralisation in Australia versus choice and quality of life for rural patients. *Med J Aust* 2006; 185: 162-163. https://www.mja.com.au/journal/2006/185/3/surgical-service-centralisation-australia-versus-choice-and-quality-life-rural

54 Liu J, Ting YY, Trochsler M, et al. Analysis of surgical mortality in rural South Australia: a review of four major rural hospital in South Australia. *ANZ J Surg* 2022; 92: 1681-1691.

55 Tocaciu S, Thiagarajan J, Maddern GJ, Wichmann MW. Mortality after emergency abdominal surgery in a non-metropolitan Australian centre. *Aust J Rural Health* 2018; 26: 408-415.

56 Swift K, Thompson F, Roeder L, et al. Appendicitis in Far North Queensland: a new take on an old story. *ANZ J Surg* 2022; 92: 114-120.

57 Quinn L, Read D. Paediatric surgical services in remote northern Australia: an integrated model of care. *ANZ J Surg* 2017; 87: 784-788.

58 Davis SS, Babidge WJ, Kiermeier A, Maddern GJ. Regional versus metropolitan pancreaticoduodenectomy mortality in Australia. *ANZ J Surg* 2019; 89: 1582-1586.

59 Davis SS, Noll D, Patel P, et al. Gastrectomy mortality in Australia. *ANZ J Surg* 2022; 92: 2109-2114.

60 Gray AD, Petrou G, Rastogi P, et al. Elective hepatic resection is feasible and safe in a regional centre. *ANZ J Surg* 2018; 88: E147-E151.

61 van Leeuwen MT, Falster MO, Vajdic CM, et al. Reoperation after breast-conserving surgery for cancer in Australia: statewide cohort study of linked hospital data. *BMJ Open* 2018; 8: e020858.

62 Hall S, Holman CDA, Sheiner H, Hendrie D. The influence of socio-economic and locational disadvantage on survival after a diagnosis of lung or breast cancer in Western Australia. *J Health Serv Res Policy* 2004; 9 (Suppl): 10-16.

63 Fox PN, Chatfield MD, Beith JM, et al. Factors delaying chemotherapy for breast cancer in four urban and rural oncology units. *ANZ J Surg* 2013; 83: 533-538.

64 Marsh C, Wang J, Kollias J, et al. Disparities in access to breast care nurses for breast surgeons: a National Breast Cancer Audit survey. *Breast* 2010; 19: 142-146.

65 Marsh CJ, Boult M, Wang JX, et al. National Breast Cancer Audit: the use of multidisciplinary care teams by breast surgeons in Australia and New Zealand. *Med J Aust* 2008; 188: 385-386. https://www.mja.com.au/journal/2008/188/7/national-breast-cancer-audit-use-multidisciplinary-care-teams-breast-surgeons

66 Bergin RJ, Thomas RJS, Whitfield K, White V. Concordance between Optimal Care Pathways and colorectal cancer care: identifying opportunities to improve quality and reduce disparities. *J Eval Clin Pract* 2020; 26: 918-926.

67 Watson MM, South Australian Rural Surgical Research Group, Watson DC, et al. Quality of rural colonoscopy outperforms key performance indicators in a multi-centre prospective clinical study. *ANZ J Surg* 2022; 93: 528-533

68 Hoskins W, Taylor P, Jacob A, et al. Colectomies performed at a rural Australian hospital: a 7-year analysis. *Aust J Rural Health* 2013; 21: 279-284.

69 Wichmann MW, McCullough TK, Beukes E, et al. Outcomes of laparoscopic colorectal cancer surgery in a non-metropolitan Australian hospital: audit of 120 patients with long-term follow-up results. *ANZ J Surg* 2022; 92: 3214-3218.

70 Wichmann MW, McCullough TK, Beukes E, et al. Colorectal cancer surgery in rural Australia can match outcomes in metropolitan hospitals: a 14-year study. *Med J Aust* 2021; 214: 186-187. https://www.mja.com.au/journal/2021/214/4/colorectal-cancer-surgery-rural-australia-can-match-outcomes-metropolitan

71 Udayasiri DK, MacCallum C, Da Silva N, et al. Impact of hospital geographic remoteness on overall survival after colorectal cancer resection using state-wide administrative data. *ANZ J Surg* 2020; 90: 1321-1327.

72 O'Sullivan BG, Worley P. Setting priorities for rural allied health in Australia: a scoping review. *Rural Remote Health* 2020; 20: 5719.

73 Mannix K. The future of Australia's nursing workforce: COVID-19 and burnout among nurses. Melbourne: University of Melbourne, 2021. https://www.unimelb.edu.au/__data/assets/pdf_file/0004/4085194/katelyn_mannix_report.pdf (viewed May 2023).

74 Parlier AB, Galvin SL, Thach S, et al. The road to rural primary care: a narrative review of factors that help develop, recruit, and retain rural primary care physicians. *Acad Med* 2018; 93: 130-140.

75 Ostini R, McGrail MR, Kondalsamy-Chennakesavan S, et al. Building a sustainable rural physician workforce. *Med J Aust* 2021; 215 (Suppl): S1-S33. https://www.mja.com.au/journal/2021/215/1/building-sustainable-rural-physician-workforce ■

Supporting Information

Additional Supporting Information is included with the online version of this article.