



## ORIGINAL RESEARCH

# Rural emergency care facilities may be adapting to their context: A population-level study of resources and workforce

Tim Baker FACEM<sup>1</sup>  | Katie Moore MPH<sup>2</sup> | Jolene Lim PhD<sup>2</sup> |  
Cerissa Papanastasiou BHLthSc(Hons)<sup>2</sup> | Sally McCarthy FACEM<sup>3</sup> |  
Franco Schreve FACEM<sup>4</sup> | Mary Lawson BS, (Hons)<sup>5</sup> | Vincent Versace PhD<sup>6</sup> 

<sup>1</sup>Deakin University Centre for Rural Emergency Medicine, Warrnambool, Victoria, Australia

<sup>2</sup>Australasian College for Emergency Medicine, West Melbourne, Victoria, Australia

<sup>3</sup>University of New South Wales, Sydney, New South Wales, Australia

<sup>4</sup>Western Health, Footscray, Victoria, Australia

<sup>5</sup>Deakin University School of Medicine, Geelong, Victoria, Australia

<sup>6</sup>Deakin University Rural Health, Warrnambool, Victoria, Australia

## Correspondence

Tim Baker, Deakin University Centre for Rural Emergency Medicine, Warrnambool, Vic., Australia.  
Email: [tim.baker@deakin.edu.au](mailto:tim.baker@deakin.edu.au)

## Abstract

**Objective:** To provide a structured understanding of rural hospital-based emergency care facility workforce and resources.

**Design:** The resources of regional training hubs were used to survey eligible emergency care facilities in their surrounding region.

**Setting:** Rural emergency care facilities manage more than one third of Australia's emergency presentations. These emergency care facilities include emergency departments and less-resourced facilities in smaller towns.

**Participants:** Hospital facilities located outside metropolitan areas that report emergency presentations to the Australian Institute of Health and Welfare.

**Interventions:** A survey tool was sent by email.

**Main outcome measures:** Presence of human, diagnostic and other resources as reported on a questionnaire.

**Results:** A completed questionnaire was received from 195 emergency care facilities. Over 60% of Small hospitals had on-call doctors only. General practitioners/generalists and nurses with extended emergency skills were found in all hospital types. Emergency physicians were present across all remoteness areas, but more commonly seen in larger facilities. All Major/Large facilities and most Medium facilities reported having onsite pathology and radiology. Point of care testing and clinician radiography were more commonly reported in smaller facilities. Among Small hospitals, Very Remote hospitals were more likely than Inner Regional hospitals to have an onsite doctor in the emergency care facility and/or a high dependency unit.

**Conclusion:** Smaller and more remote facilities appear to adapt by using different workforce structures and bedside investigations.

**KEYWORDS**

diagnostic imaging, emergency workforce, point of care testing, rural and remote health services, rural emergency medicine

**1 | INTRODUCTION**

Rural Australia has more than 400 hospital-based emergency care facilities (ECFs).<sup>1</sup> This includes accredited emergency departments (EDs) in regional base hospitals<sup>2</sup> and less-resourced facilities providing 24-hour emergency care to towns of less than 15 000 people.<sup>3</sup> Together, they manage more than a third of all Australia's emergency presentations.<sup>4</sup> There is a belief that smaller sites manage only minor ailments and transfer most patients to larger centres.<sup>5</sup> This perspective is not entirely accurate. Even the smallest rural facilities see critically ill patients,<sup>6,7</sup> while more than 90% of patients assessed at these facilities are discharged home or admitted to the local hospital.<sup>8</sup> For the patients requiring transfer, rural ECFs are their community's front door to a jurisdiction's critical care system.<sup>9</sup>

While the resources in New Zealand's rural ECFs have been surveyed,<sup>10</sup> we could not find a similar Australian body of work. The Australian rural emergency literature is more exploratory and scattered.<sup>11</sup> Australian rural ECFs do not always have the 24-hour medical cover, emergency specialist involvement and onsite diagnostic resources mandated for accredited emergency departments.<sup>12</sup> Rural generalists<sup>13-15</sup> and international medical graduates<sup>15</sup> are the predominant medical workforce. Nurses are often required to assess patients in the ED without onsite medical back up.<sup>16-19</sup> Major rural emergency departments employ nurse practitioners and registrars, but less than urban departments.<sup>20</sup> Radiology departments and pathology laboratories may be absent or only available during standard business hours.<sup>5,7,21-24</sup> Onsite critical care and surgical backup are also limited<sup>14,24,25</sup> and resources vary with community size and remoteness.<sup>3</sup>

A more structured understanding of workforce and resources, including how they change with hospital size and remoteness, will help to inform current initiatives in rural emergency care.<sup>26</sup> Elucidating these dynamics will assist activities such as the ongoing development of standards for rural hospital-based ECFs<sup>3,27</sup> and postgraduate medical qualifications for rural emergency care.<sup>28-30</sup>

To achieve a greater level of understanding, we developed the rural ECF Workforce and Resources Questionnaire. Using this tool, the objectives of this cross-sectional study are to document the workforce and resources available to hospital-based emergency facilities in rural Australia and to describe how they vary by remoteness and hospital size.

**What is already known on this subject:**

- Rural emergency care facilities manage more than one third of Australia's emergency presentations. Even the smallest facilities see critically ill and injured patients
- Rural emergency care facilities are often described by the human, diagnostic, and critical care resources that they lack

**What this study adds:**

- Emergency facility staffing models vary with the hospital peer group
- Although the availability of onsite pathology and radiology departments decreases with hospital size, point-of-care testing and clinician radiography increase
- Among emergency care facilities at small hospitals, remote emergency care facilities have more medical, diagnostic and critical care resources than regional emergency care facilities

**2 | METHODS**

All hospital facilities reporting emergency presentations to the Australian Institute of Health and Welfare (AIHW) at the time of survey distribution<sup>31</sup> were included if they were located in Australian Standard Geographical Classification Remoteness Area (ASGC-RA) 2-5 (Remoteness areas: Inner Regional; Outer Regional; Remote; and Very Remote).<sup>32</sup>

The AIHW divides these facilities into EDs and Emergency Services. Although the facilities in larger hospitals are all classified as EDs, even the smallest facility is designated as an ED if it provides episode-level data to the AIHW National Non-admitted Patient Emergency Department Care Database. In some jurisdictions, all small facilities report to the database, in others none do. This inconsistency makes the distinction less useful, therefore both AIHW EDs and Emergency Services are referred to in this article as ECFs.

The Modified Monash Model<sup>33</sup> was not used as it combines remoteness and town size (which sometimes, but not always, aligns with hospital size). This study looks at

the effect of remoteness and facility size separately and in combination.

At the time of the survey, 28 facilities located outside major cities were accredited by the Australasian College for Emergency Medicine (ACEM). These facilities are not part of the program (see below) that administered the survey, and so did not have a questionnaire sent to them. The resources and workforce at these 28 accredited facilities are already known.<sup>34</sup>

This project was conceptualised as a census of all eligible ECFs, and the survey tool was developed after a review of the literature and with input from the ACEM Rural Regional and Remote Committee and other rural clinicians. Unfortunately, the response rate of 40% has resulted in this being closer to a population-based study without sampling than a true census. Section one asked a series of yes/no questions about workforce models and asked about the hours medical staff were rostered to be present in the emergency facility. Section 2 asked similar questions about nursing staff. Section 3 asked mainly yes/no questions about resource availability.

Initially Project Support Officers at ACEM's 44 Emergency Education and Training (EMET) program hubs<sup>35</sup> contacted potential participants at sites in their network directly or provided the contact details to the research team to contact. For sites that were not part of ACEM's EMET program and networks, contact information was sourced by the research team, from various online directories. Potential participants included ECF Directors, ECF Nurse Unit Managers, or Directors of Nursing. Potential participants who expressed an interest were sent a formal email invitation, with the survey tool as an attachment. Participation was voluntary with return of the survey by email implying consent.

Site-specific research governance authorisation was sought, where requested, from local health districts and networks. Western Australia Country Health Services did not approve the contacting of all services in their jurisdiction and instead allowed the questionnaire to be sent to a random sample of 10% of facilities (6 in total). Approvals were obtained at different times, resulting in survey distribution between July 2016 and June 2017 to individual participating sites.

Data are analysed by remoteness (ASGS-RA) and facility size. It would be preferable to denote facility size by a nationwide classification of emergency facility size or role delineation. Unfortunately, although suggested classification structures exist,<sup>5,12</sup> there is no national list of emergency facilities allocated by any of these systems.<sup>1</sup> As a proxy for facility size, the hospital peer group using the National Hospital Performance Authority's system is used.<sup>36</sup> At the time of the survey, it grouped hospitals as Major, Large and Medium Regional, Small, Private and Other. The 'Other' peer group was comprised of

multi-purpose centres (usually combined acute care and community care services) and a group of un-peered remote hospitals with large emergency facilities attached to hospitals with very few inpatient beds or resources (for example, Tennant Creek Hospital). Data analysis was performed using IBM SPSS Statistics, version 25 (IBM Corp.). Differences in distribution between responding and non-responding facilities were examined using Fisher's exact test. Confidence intervals of proportions were calculated using the Wilson method as it is as reliable as the Agresti-Coull method in samples over 40 and more reliable in smaller samples under 40.<sup>37</sup> Boferroni corrections were applied for multiple comparisons in [Table 1](#).

## 2.1 | Ethics approval

Initial ethics approval was from the Deakin University Human Research Ethics Committee (HEAG-H 114\_2016). As required, further jurisdictional ethics approvals were sought from the Human Research Ethics Committees of the South Australian Department for Health and Ageing, Western Australia Country Health Services, Queensland Health and Hunter New England Local Health District.

## 3 | RESULTS

### 3.1 | Emergency care facilities included

Rural Australia at the time of the survey had 503 hospitals with ECFs, including 4 private EDs. Fifty-four of 60 facilities in Western Australia were excluded due to ethics requirements. Of the remaining 421 eligible facilities, 359 accepted the survey invitation and 195 completed surveys were received (See [Table 1](#) for participating hospitals and [Figure S1](#)). All Large/Medium hospitals were located in an Inner or Outer regional area, except one in a Remote area. Small and Other hospitals were distributed across all remoteness categories. One Major hospital was presented in the sample and was located in an Inner Regional area.

### 3.2 | Facility size

Yearly ECF attendances varied from a median of 22 213 for Major and Large regional hospital ECFs (IQR: 13 500-25 000), 13 136 for Medium regional hospital ECFs (IQR: 7200-19 000), 3504 for Other regional hospitals (IQR: 732-16 000), to 1584 for Small hospitals (IQR: 883-3769; [Figure 1](#)). The greatest variation was observed in the 'Other' peer group.

Both Small and Other peer group facilities reported a median of 2 treatment cubicles in the ECF (Small IQR:

TABLE 1 Geographic location and the hospital peer group of participating, non-participating and not-surveyed emergency care facilities

	Surveyed		Not surveyed (ACEM accredited)	Total
	Participating	Not participating		
	Count (%)	Count (%)		
State/Territory <sup>a</sup>				
Total	195	280	28	503
New South Wales	61 (31.3)	73 (26.1)	7 (25.0)	141 (28.0)
Northern Territory	3 (1.5)	0 (0)	2 (7.1)	5 (1.0)
Queensland	47 (24.1)	84 (30.0)	7 (25.0)	138 (27.4)
South Australia	32 (16.4)	30 (10.7)	0 (0)	62 (12.3)
Tasmania	1 (0.5)	2 (0.7)	3 (10.7)	6 (1.2)
Victoria	45 (23.1) <sup>b</sup>	30 (10.7)	6 (21.4)	81 (16.1)
Western Australia	6 (3.1)	61 (21.8) <sup>b</sup>	3 (10.7)	70 (13.9)
Remoteness Area <sup>c</sup>				
Total	195	280	28	503
Inner Regional	61 (31.3)	81 (28.9)	21 (75.0)	163 (32.4)
Outer Regional	84 (43.1)	105 (37.5)	6 (21.4)	195 (38.8)
Remote	27 (13.8)	45 (16.1)	1 (3.6)	73 (14.5)
Very Remote	23 (11.8)	49 (17.5)	0 (0)	72 (14.3)
Hospital peer group <sup>d</sup>				
Total	195	280	28	503
Major regional	1 (0.5)	1 (0.4)	23 (82.1)	25 (5.0)
Large regional	8 (4.1)	5 (1.8)	3 (10.7)	16 (3.2)
Medium regional	32 (16.4) <sup>b</sup>	28 (10.0)	1 (3.6)	61 (12.1)
Small	140 (78.1)	214 (76.4)	1 (3.6)	355 (70.6)
Private	1 (0.5)	3 (1.1)	0 (0)	4 (0.8)
Other	13 (6.7)	29 (10.4)	0 (0)	42 (8.3)

<sup>a</sup>Significant difference in State/Territory distribution of participating and non-participating facilities (Fisher's exact test value 50.266,  $P < .001$ ).

<sup>b</sup>Denotes significantly higher pairwise value after Bonferroni correction for multiple comparisons.

<sup>c</sup>No significant difference in the distribution of participating and non-participating facilities by Australian Standard Geographic Classifications (Fisher's exact test value 3.112,  $P = .376$ ).

<sup>d</sup>Significant difference in the distribution of participating and non-participating facilities by National Hospital Performance Authority hospital peer group (Fisher's exact test value 22.405,  $P < .001$ ).

2-3, Other IQR: 2-8). Larger peer groups reported more cubicles (Medium: 7, IQR: 2-12; Major/Large: 12, IQR: 9-15).

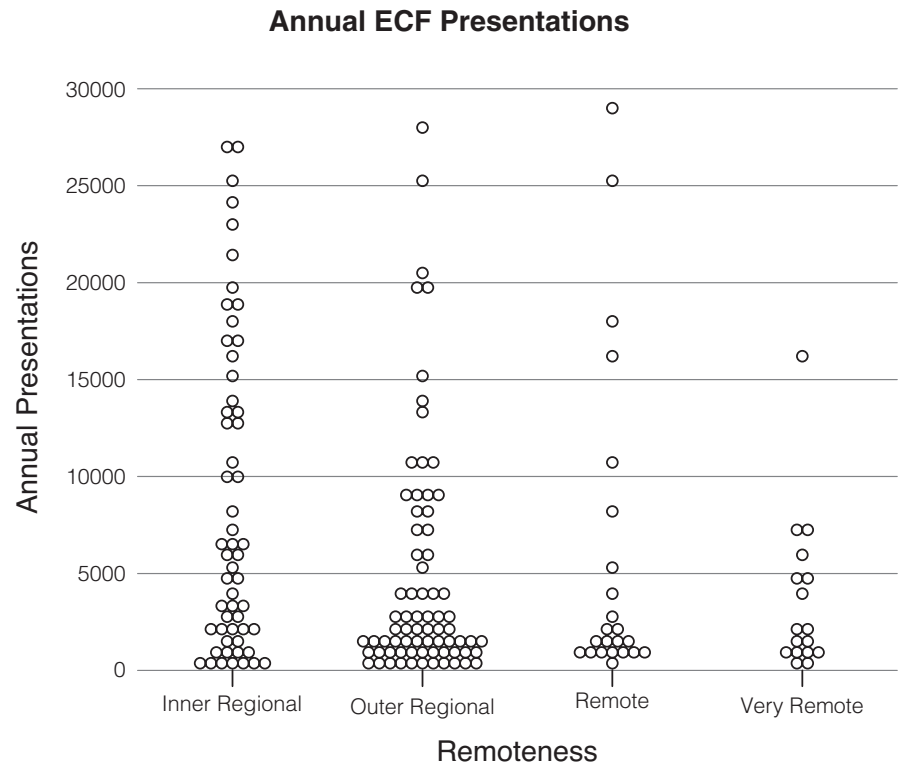
### 3.3 | Workforce

Emergency facility staffing models varied across hospital peer group (Table 2). Major and Large regional hospitals predominantly had doctors based in the emergency facility. This model became less common as hospitals became smaller, where doctors were more likely to be based elsewhere in the hospital and attend the ECF only when needed. Over 60% ( $n = 88$ ) of Small hospitals had on-call doctors only. Eight percent of ECFs<sup>16</sup> had no regular medical staff, with 14 of these 16 facilities being located

in Inner or Outer Regional areas. These were among the smallest facilities based on their median annual presentations (564, IQR: 398-1398). Interestingly, for Small hospitals as the location became more remote, having medical doctors based in the ECF became more common (Inner Regional: 3%, 95% CI: 1-17; Outer Regional: 13%, 95% CI: 7-23; Remote: 13%, 95% CI: 5-32; Very Remote: 32%, 95% CI: 15-34; See Table S1).

Larger hospitals were more likely to have a nurse based in the ECF at all times (Major/large: 100%, 95% CI: 70-100; Medium: 78%, 95% CI: 61-89). In contrast, over two-thirds of Small facilities did not have a nurse based in the ECF (69%, 95% CI: 61-76) and instead utilised nursing staff based elsewhere in the hospital who only attended the ECF when needed.

**FIGURE 1** Annual emergency care facility (ECF) attendances by National Health Performance Authority hospital peer groups. Each circle represents the yearly attendance at a single ECF. Attendance figures were provided by 171 of a possible 195 hospitals. The single large private hospital in the dataset was added to the Major/Large group



**TABLE 2** Model of medical staffing at emergency care facilities (ECFs) compared by the hospital peer group

	Hospital peer group				
	Major/large <sup>a</sup> n = 10	Medium n = 32	Other n = 13	Small n = 140	All facilities n = 195
	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)
ECF-based doctor at least some shifts	100 (72-100)	69 (51-82)	38 (18-64)	13 (9-20)	29 (23-35)
Always an ECF-based doctor	90 (60-98)	44 (28-61)	23 (8-50)	2 (1-6)	15 (11-21)
ECF-based + hospital-based <sup>b</sup> doctors	0 (0-28)	6 (2-20)	0 (0-23)	1 (0-5)	2 (1-5)
ECF-based + hospital-based + on-call doctors	10 (2-40)	0 (0-11)	0 (0-23)	2 (1-6)	2 (1-5)
ECF-based + on-call doctors	0 (0-28)	19 (9-35)	15 (4-42)	8 (4-14)	10 (6-15)
Hospital-based doctor at least some shifts (but never ECF based)	0 (0-28)	6 (2-20)	0 (0-23)	16 (11-23)	12 (8-18)
Always a hospital-based doctor	0 (0-28)	3 (1-16)	0 (0-23)	5 (2-10)	4 (2-8)
Hospital-based + on-call doctors	0 (0-28)	3 (1-16)	0 (0-23)	11 (7-17)	8 (5-13)
On-call doctors only	0 (0-28)	25 (13-42)	23 (8-50)	63 (55-70)	51 (44-58)
No doctor coverage	0 (0-28)	0 (0-11)	39 (18-64)	8 (4-14)	8 (5-13)

Note: Combination occurs when different staffing models are used on different shifts (for example, day shift and night shift).

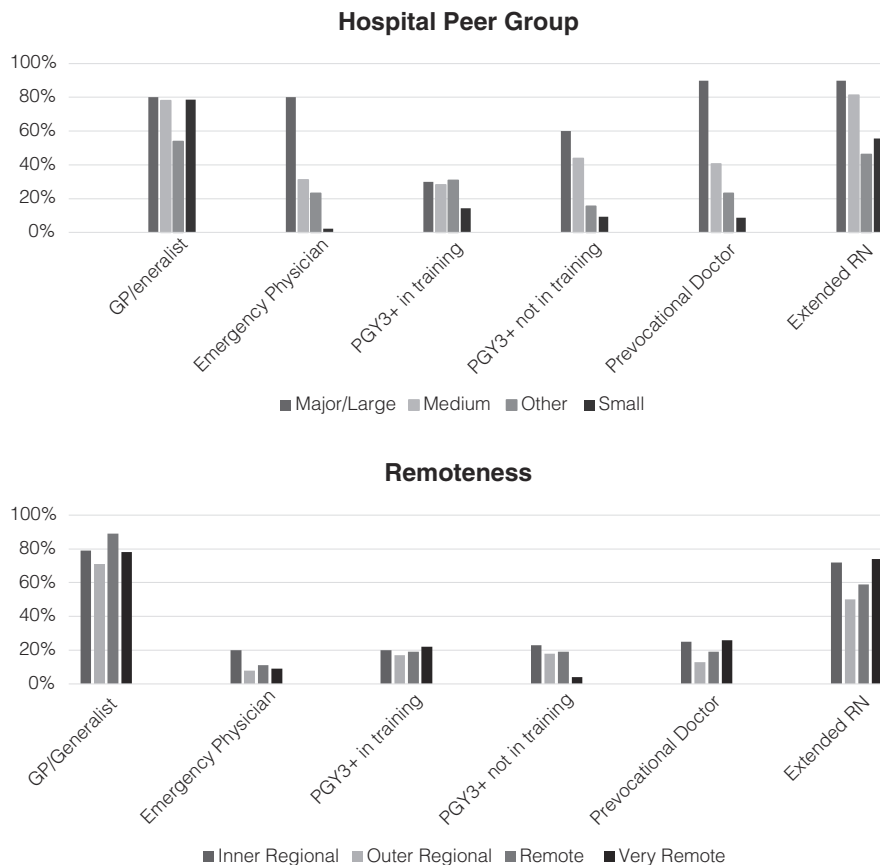
<sup>a</sup>One large private emergency department re-classified as Major/Large. Confidence intervals are calculated using Wilson interval method.

<sup>b</sup>Hospital-based means present in the hospital for all of their shift, but only attending the ECF when required.

Most facilities employed more than one clinician type with all facilities employing registered nurses. General practitioners/generalists and nurses with extended emergency skills were likely to be present in all hospital types and across all remoteness areas (Figure 2). Emergency physicians were more commonly seen in larger facilities.

They are half as common outside Inner Regional areas, noting confidence intervals overlap (Inner Regional: 20%, 95% CI: 12-31; Outer Regional: 8%, 95% CI: 4-16; Remote: 11%, 95% CI: 4-28; Very Remote: 9%, 95% CI: 2-27). The effect of remoteness on other clinician types was not as pronounced as the impact of the hospital type. Prevocational





**FIGURE 2** Clinician types at rural emergency care facilities by hospital peer group and remoteness.  $n = 195$  facilities. More than one clinician type can be employed in an emergency facility. GP/Generalist = Fellow of the Australian College of General Practice or the Australian College of Rural and Remote Medicine. Emergency Physician = Fellow of the Australasian College for Emergency Medicine, PGY3+ in training = doctor in postgraduate year 3 or above and in a specialist training program (including general practice or rural generalist program), PGY3+ not in training = doctor in postgraduate year 3 or above and not in a training program. Prevocational Doctor = intern or doctor in second postgraduate year, Extended RN = Registered nurse with emergency medicine postgraduate certificate or prescribing endorsement or nurse practitioner

doctors and doctors of postgraduate year 3 and above not in a generalist or specialist training program were also more likely to be reported in larger facilities.

More than 50% of small hospitals had agreements with the local ambulance service for paramedics to help care for patients in the ECF (56%, 95% CI: 48-64).

### 3.4 | Diagnostic resources

All Major/Large facilities and most Medium facilities reported having onsite pathology and radiology (Figure 3). On the contrary, other diagnostic options (i.e. point of care testing and clinician radiography) were more commonly reported in smaller facilities. It is also noteworthy that Small hospitals in regional areas were less likely to have onsite diagnostic resources than facilities in remote areas (Absence of pathology: Inner Regional: 23%, 95% CI: 12-41; Outer Regional 13%, 95% CI 7-23; Remote: 9%, 95% CI: 2-27; Very Remote: 0%, 95% CI: 0-17. Absence of

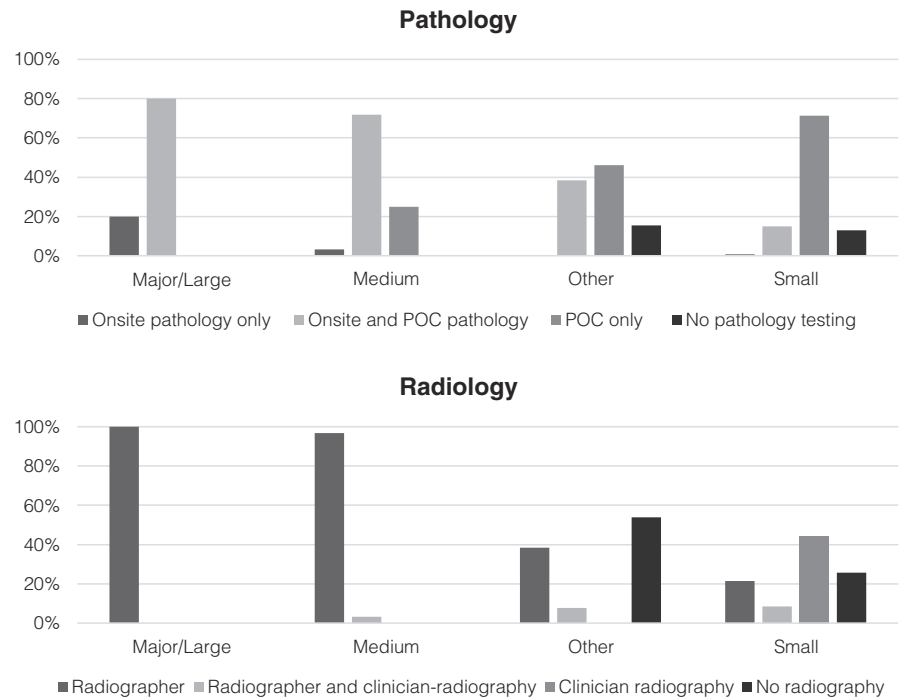
radiography: Inner Regional 30%, 95% CI 17-48; Outer Regional: 31%, 95% CI: 21-43; Remote: 22%, 95% CI: 10-42; Very Remote: 17%, 5%CI: 1-25; See Table S2).

### 3.5 | Other resources

All Major and Large hospitals reported the availability of an intensive care unit (ICU) or high dependency unit (HDU; 100%, 95% CI: 72-100). These units were less common in other facilities (Absence of ICU/HDU: Medium: 50%, 95% CI 34-66; Other: 92%, 95% CI: 67-99; Small 95%, 95% CI: 90-98). Among Small hospitals, Inner Regional hospitals (100%, 95% CI: 89-100) were more likely to report the absence of critical care support than facilities in Very Remote hospitals (Very Remote: 89%, 95% CI 69-97; See Tables S1-S3).

All Major and Large (100%, 95% CI: 72-100), and most (94%, 95% CI: 80-98) Medium facilities, had an operational operating theatre (although not necessarily open

**FIGURE 3** Diagnostic resources at rural emergency care facilities by hospital peer group. Number of facilities in each hospital peer group: Major/large = 10; Medium = 32; Other = 13; small = 140. POC, point-of-care testing. Clinician radiography = radiography performed by licensed nurse or medical practitioner



24/7), with less than two-thirds of Small facilities (61%, 95% CI: 52-68) having one. Among Small hospitals, Inner Regional hospitals were more likely to have an operating theatre than facilities located in more remote regions (Inner Regional: 77%, 95% CI: 59-88; Outer Regional: 60%, 95% CI: 48-71; Remote: 48%, 95% CI: 29-67; Very Remote: 53%, 95% CI: 32-73; See Table S3).

## 4 | DISCUSSION

To the best of our knowledge, this is the first study that attempts to understand how the resources at Australia's ECFs vary with remoteness and facility size. This project demonstrates that while the ECFs at many larger rural hospitals have the requisite onsite clinicians and diagnostic resources to be classified as emergency departments,<sup>12</sup> as facilities become smaller, there are fewer onsite emergency clinicians and fewer resources. This is consistent with the rural-urban disparity reported for other facets of the Australian Healthcare System, including cardiac rehabilitation<sup>38</sup> and primary healthcare.<sup>39</sup>

Rural researchers often describe similar healthcare patterns using a deficit perspective<sup>40</sup> – highlighting only the urban resources that rural facilities lack. Role delineation statements also define smaller facilities as failing to meet the minimum resource standards of larger facilities.<sup>12</sup> This approach unhelpfully conceptualises rural healthcare organisations as a cut-down and dysfunctional version of urban healthcare.<sup>40,41</sup> A more constructive perspective would be to understand the differences as well as describing the deficit. Focussing on how rural services

have adapted to their context encourages problem-solving rather than merely problem describing.<sup>40</sup>

The rise of medical rural generalists is an example of adaptation to the rural context.<sup>14</sup> All types of ECFs employed generalist doctors. This concurs with AIHW data that generalists and other general practitioners outnumber other specialists in rural and remote areas.<sup>42</sup> Emergency specialists were also found across all remoteness areas, consistent with AIHW figures that 19% of emergency specialists work outside urban areas.<sup>43</sup> Emergency specialists were predominantly based at larger hospitals that meet the resource requirements of a traditional emergency department.

Our study observed that larger hospitals usually had doctors and nurses allocated specifically to the ECFs, while smaller sites often had no in situ staff, redeploying nurses from the wards and calling doctors from offsite as needed. The fewer daily presentations for these smaller sites would support this staffing model; however some studies have demonstrated the significant challenge this poses for nurses.<sup>9,44</sup> Such nurses often need to assess patients independently, as has been described elsewhere.<sup>9,44</sup> Suggested solutions for this include telemedicine support<sup>9</sup> and increased training for nurses.<sup>9,44-46</sup> In this study, nurses with extended skills were found in ECFs of all hospital sizes and remoteness levels.

In small rural facilities, onsite diagnostic services were replaced by clinician radiography and point of care testing. This often leads to rural facilities being called resource-poor.<sup>47</sup> In contrast to facilities in developing countries, however, they may be better conceptualised as resource-separated. In Australia, patients at rural ECFs are routinely transferred to urban centres for further investigation and

management.<sup>8,48,49</sup> Point-of-care testing in a rural setting has been reported to reduce the time taken to decide if transport is required and decrease the number of unnecessary transfers.<sup>22,50</sup>

The presence of diagnostic resources and onsite doctors is, perhaps counterintuitively, higher in remote small hospitals than in small hospitals closer to urban centres. This finding may be because the more difficult it is to transfer a patient, the more onsite resources prove their worth. Similarly, the increased critical care support available at these remote services may be due to the need to care for unstable patients for longer until help arrives.

The low number of respondents in some categories (such as Large Remote hospitals) is a limitation of this study. Heterogeneity among 'Other' hospital peer group, which includes some ECFs in the group seeing 25 times more yearly presentations than others, makes interpretation of this group difficult relative to other groups. Ethics restrictions reducing the number of sites from Western Australia (6 out of the 60 eligible were included in the analyses) and differences in terminology between jurisdictions could also influence the findings. The exclusion of 28 facilities accredited by ACEM is also a limitation. If ACEM data for accredited departments were available, the availability of resources at Major and Large hospitals would likely have been higher. (As seen in Table 1, almost all accredited facilities were in Major or Large hospitals). The availability of resources in Major and Large facilities included in this study is already high, though.

This study shows that resources do not just dwindle with distance from large urban hospitals. The pattern is more complex, with different workforce arrangements and resources available according to hospital size and remoteness. Rural ECFs may be adapting to their context. To assess whether this adaptation is successful, further research needs to assess key performance indicators in smaller rural facilities as well as how well they integrate with retrieval systems and emergency care networks.

## ACKNOWLEDGEMENTS

The researchers would like to acknowledge the Australasian College for Emergency Medicine for facilitating this project. Open access publishing facilitated by Deakin University, as part of the Wiley - Deakin University agreement via the Council of Australian University Librarians.

## CONFLICT OF INTEREST

None declared.

## AUTHOR CONTRIBUTIONS

TB: conceptualization; data curation; formal analysis; investigation; methodology; project administration; writing – original draft; writing – review & editing. KM: conceptualization; investigation; methodology; project

administration; writing – review & editing. JL: data curation; visualization; writing – review & editing. CR: data curation; writing – review & editing. SM: conceptualization; writing – review & editing. FS: supervision; writing – review & editing. ML: supervision; writing – review & editing. VV: supervision; writing – review & editing.

## DISCLOSURES

None declared.

## ORCID

Tim Baker  <https://orcid.org/0000-0003-1893-5966>

Vincent Versace  <https://orcid.org/0000-0002-8514-1763>

## REFERENCES

- Baker T, Dawson S. How many emergency departments? *Emerg Med Australas*. 2014;26(2):212-213.
- Australasian College for Emergency Medicine. Position Statement: Rural Emergency Care. Australasian College for Emergency Medicine; 2019.
- Australian College of Rural and Remote Medicine. Recommended Minimum Standards for small rural hospital emergency departments. Australian College of Rural and Remote Medicine; 2019.
- Australian Institute of Health and Welfare. Emergency department care 2014–15: Australian hospital statistics. AIHW; 2015.
- Department of Health and Human Services. Capability framework for Victorian urgent, emergency and trauma care service. State Government of Victoria; 2019.
- Baker T, Dawson SL. What small rural emergency departments do: a systematic review of observational studies. *Aust J Rural Health*. 2013;21(5):254-261.
- Baker T, Dawson SL. Small rural emergency services still manage acutely unwell patients: a cross-sectional study. *Emerg Med Australas*. 2014;26(2):131-138.
- Kloot K, Baker TR. Building a research-ready database of rural emergency presentations: the RAHDaR pilot study. *Emerg Med Australas*. 2019;31(1):126-128.
- Victorian Department of Health and Human Services. Urgent care centres: Models of care toolkit. Victorian DHHS; 2017.
- Williamson M, Gormley A, Dovey S, Farry P. Rural hospitals in New Zealand: results from a survey. *N Z Med J*. 2010;123(1315):20-29.
- Brown JF. Hospital-based emergency nursing in rural settings. *Annu Rev Nurs Res*. 2008;26:117-141.
- Australasian College for Emergency Medicine. S12 Statement on the Delineation of Emergency Departments. ACEM; 2018.
- Pandit T, Ray R, Sabesan S. Review article: managing medical emergencies in rural Australia: a systematic review of the training needs. *Emerg Med Australas*. 2019;31(1):20-28.
- Robinson M, Slaney GM, Jones GI, Robinson JB. GP Proceduralists: 'the hidden heart' of rural and regional health in Australia. *Rural Remote Health*. 2010;10(3):1402-1415.
- Australian Medical Association. AMA Position Statement: Rural Workforce Initiatives 2017. Accessed 1 October 2021. <https://ama.com.au/position-statement/rural-workforce-initiatives-2017>
- Twigg DE, Cramer JH, Pugh JD. Nurse staffing and workload drivers in small rural hospitals: an imperative for evidence. *Online J Rural Nurs Health Care*. 2016;16(1):97-121.



17. Chen TM, Tescher P. Emergency department demographics at a small Australian rural hospital. *Rural Remote Health*. 2010;10(1):1318-1328.
18. Sullivan E, Francis K, Hegney D. Triage, treat and transfer: reconceptualising a rural practice model. *J Clin Nurs*. 2010;19(11-12):1625-1634.
19. Duckett S, Kenny A. Hospital outpatient and emergency services in rural Victoria. *Aust Health Rev*. 2000;23(4):115-125.
20. Gardner G, Gardner A, Middleton S, et al. Mapping workforce configuration and operational models in Australian emergency departments: a national survey. *Aust Health Rev*. 2018;42(3):340-347.
21. Glazebrook R, Chater B, Graham P, et al. Evaluation of the ACRRM national radiology program for Australian rural and remote medical practitioners. *Rural Remote Health*. 2005;5(3):349-357.
22. Spaeth BA, Shephard MDS, Omond R. Clinical application of point-of-care testing in the remote primary health care setting. *Qual Prim Care*. 2017;25(3):164-175.
23. Smith B. Small emergency departments: does size matter? *Emerg Med*. 2002;14(1):95-101.
24. Bennett NJ, Bull AL, Dunt DR, et al. A profile of smaller hospitals: planning for a novel, statewide surveillance program, Victoria, Australia. *Am J Infect Control*. 2006;34(4):170-175.
25. Larkins S, Evans R. Greater support for generalism in rural and regional Australia. *Aust Fam Physician*. 2014;43:487-490.
26. Strasser R. Learning in context: education for remote rural health care. *Rural and Remote Health*. 2016. <http://dx.doi.org/10.22605/rrh4033>
27. Australasian College for Emergency Medicine. Quality Standards for Emergency Departments and other Hospital-based Emergency Care Services. ACEM; 2015.
28. Australian College of Rural and Remote Medicine. Rural Generalist Curriculum. Australian College of Rural and Remote Medicine; 2020.
29. Royal Australian College of General Practitioners. The Fellowship in Advanced Rural General Practice: Guidelines for general practice registrars and practising GPs. The Royal Australian College of General Practitioners; 2020.
30. Australasian College for Emergency Medicine. Emergency Medicine Certificate and Diploma. Australasian College for Emergency Medicine; 2019.
31. Australian Institute of Health and Welfare. MyHospitals. About the data. Australian Institute of Health and Welfare; 2020. Accessed 1 October 2021. <https://www.aihw.gov.au/myhospitals>
32. Australian Bureau of Statistics. 1270.0.55.005 - Australian Statistical Geography Standard (ASGS): Volume 5 - Remoteness Structure, July 2016. ABS, 2016.
33. Department of Health. Modified Monash Model (MMM); 2019. Accessed 1 October 2021. <https://www.health.gov.au/health-topics/rural-health-workforce/classifications/mmm>
34. Australasian College for Emergency Medicine. S12 Statement on the Delineation of Emergency Departments. ACEM; 2015.
35. Australasian College for Emergency Medicine. Emergency Medicine Education and Training Melbourne. ACEM; 2020. Accessed 1 October 2021. <https://acem.org.au/Content-Sources/Advancing-Emergency-Medicine/National-Program/Emergency-Medicine-Education-and-Training>
36. Australian Institute of Health and Welfare. Australian hospital statistics 2011-12. Health services series. AIHW; 2013.
37. Brown LD, Cai TT, DasGupta A. Interval estimation for a binomial proportion. *Stat Sci*. 2001;16(2):101-117.
38. Clark RA, Coffee N, Turner D, et al. Application of geographic modeling techniques to quantify spatial access to health services before and after an acute cardiac event: the Cardiac Accessibility and Remoteness Index for Australia (ARIA) project. *Circulation*. 2012;125(16):2006-2014.
39. McGrail MR, Humphreys JS. Spatial access disparities to primary health care in rural and remote Australia. *Geospat Health*. 2015;10(2):358.
40. Bourke L, Humphreys JS, Wakerman J, Taylor J. From 'problem-describing' to 'problem-solving': challenging the 'deficit' view of remote and rural health. *Aust J Rural Health*. 2010;18(5):205-209.
41. Baker T. Small rural emergency departments are not simply cut-down large urban emergency departments. *Aust J Rural Health*. 2009;17(6):291.
42. Australian Institute of Health and Welfare. Medical practitioners workforce 2015; 2016.
43. Department of Health. Australia's Future Health Workforce - Emergency Medicine report Canberra, Australia. Commonwealth of Australia; 2017.
44. Muirhead S, Birks M. Roles of rural and remote registered nurses in Australia: an integrative review. *Aust J Adv Nurs*. 2020;37(1):21-33.
45. Arvier P, McDonagh T, Walker J. Training emergency medicine doctors for rural and regional Australia: can we learn from the Canadians? *CJEM*. 2006;8(3):228.
46. Rural Critical Care Taskforce. *NSW Rural Adult Emergency Clinical Guidelines*, 4th edn, V4.1. NSW Agency for Clinical Innovation, 2020.
47. Mellett T. Going bush: Australasian College for Emergency Medicine training in a rural centre. *Emerg Med Australas*. 2017;29(2):240-241.
48. Putland M, Noonan M, Olaussen A, Cameron P, Fitzgerald M. Low major trauma confidence among emergency physicians working outside major trauma services: inevitable result of a centralised trauma system or evidence for change? *Emerg Med Australas*. 2018;30(6):834-842.
49. Craig SS. Challenges in arranging interhospital transfers from a small regional hospital: an observational study. *Emerg Med Australas*. 2005;17(2):124-131.
50. Dahm MR, McCaughey E, Li L, et al. Point-of-care testing across rural and remote emergency departments in Australia: staff perceptions of operational impact. *Stud Health Technol Inform*. 2017;239:28-34.

## SUPPORTING INFORMATION

Additional supporting information may be found in the online version of the article at the publisher's website.

**How to cite this article:** Baker T, Moore K, Lim J, et al. Rural emergency care facilities may be adapting to their context: A population-level study of resources and workforce. *Aust J Rural Health*. 2022;30:393-401. doi:[10.1111/ajr.12846](https://doi.org/10.1111/ajr.12846)