Procedural skills of Australian general practice registrars: A cross-sectional analysis


Background and objectives

Procedural skills are an essential component of general practice vocational training. The aim of this study was to investigate the type, frequency and rural or urban associations of procedures performed by general practice registrars, and to establish levels of concordance of procedures performed with a core list of recommended procedural skills in general practice training.

Methods

A cross-sectional analysis of a cohort study of registrars’ consultations between 2010 and 2016 was undertaken. Registrars record 60 consecutive consultations during each six-month training term. The outcome was any procedure performed.

Results

In 182,782 consultations, 19,411 procedures were performed. Procedures (except Papanicolaou [Pap] tests) were performed more often in rural than urban areas. Registrars commonly sought help from supervisors for more complex procedures. The majority of procedures recommended as essential in registrar training were infrequently performed.

Discussion

Registrars have low exposure to many relevant clinical procedures. There may be a need for greater use of laboratory-based training and/or to review the expectations of the scope of procedural skills in general practice.

The provision of clinical procedural services has been, and remains, an integral part of general practice. In Australia, as in many other countries, general practitioners’ (GPs’) provision of procedures is especially important in rural areas.1,2 As the future primary care workforce, it is imperative that general practice registrars learn and refine procedural skills.3 A number of institutions and organisations have sought to develop a list of core procedural skills for general practice registrars.4–7 In 2011, Sylvester et al8 developed (via a Delphi process) a list of 112 core procedures, plus a supplementary list containing 79 other procedures, to be used as a resource on which to base general practice procedures training curricula. The 112 core procedures were deemed those that a general practice registrar should have experience in performing during their general practice training. Although this core list has not been adopted by relevant organisations, such as The Royal Australian College of General Practitioners (RACGP), in their curricula, it provides a useful indication for procedural skills reasonable for registrars to be taught.

Although a number of such general practice procedure checklists exist, little is known about general practice trainees’ actual performance of clinical procedures, especially in Australian settings. A study from Germany found that general practice trainees expressed difficulty in independently performing a number of common general practice procedures.9 Other studies from US have shown incongruity between program director expectations and intern self-reported ability to perform common procedures in family medicine and surgery programs.10,11

The aims of this study were to investigate the type and frequency with which clinical procedures are performed by Australian general practice registrars; establish the level of concordance of registrars’ performance of procedures with a list of core clinical procedural skills developed for the Australian general practice training context;8 and establish associations of performing procedures with rurality of practice and general practice registrars’ in-consultation seeking supervisor advice or assistance.
Method
We performed a cross-sectional analysis of data from the longitudinal Registrar Clinical Encounters in Training (ReCEnT) study. ReCEnT is an ongoing, multicentre cohort study of general practice registrars’ in-consultation clinical and educational experiences. Participants were registrars who were enrolled (2010–2015) with five of Australia’s 17 general practice regional training providers (RTPs) across five of Australia’s six states, and (from 2016) with three of Australia’s nine regional training organisations (RTOs) in three states (in late 2015, there was a major restructure of Australian general practice training).

In ReCEnT, registrars undertake data collection once in each of three six-month training terms (or per 12-month term for part-time registrars) as an integral part of their educational program. In one RTP, some registrars undertaking a non-compulsory fourth general practice-based term also contributed data.

Informed consent is obtained for registrars’ de-identified data used for research purposes. Initial data collection includes information on the registrars’ demographic and characteristics of the practice where they work. Data are recorded by each registrar, each training term. Registrars also record detailed data of 60 consecutive clinical consultations per term via a paper-based encounter form. Data collection is performed approximately mid-way through the term. As data collection is intended to reflect ‘normal’ general practice activity, consultations in a specialised clinic (eg vaccination clinic) are excluded. Only office-based (ie not home visits, nursing home visits, hospital-based) consultations are recorded. The in-consultation data encompass four broad areas:
- patient demographics
- diagnoses or problems managed
- investigations or management (including referral and follow-up)
- educational training aspects (whether the registrar sought in-consultation advice or information from their clinical supervisor or from other sources, or generated learning goals).

The list of the procedures recorded in ReCEnT was adopted from the core list (n = 112), which was developed by Sylvester et al, plus the additional general practice procedures included in that project (n = 79). When defining ‘procedure’, we used the same criteria used by Sylvester et al to define a general practice clinical procedure (Box 1).

Other independent variables recorded related to:
- Patient – age, gender, Aboriginal or Torres Strait Islander status, non-English speaking background, new to the practice or new to the registrar
- Registrar – age, gender, part-time or full-time workload, training term, Australian graduate or international medical graduate (IMG), previous training in the practice
- Practice – rurality, practice size, socioeconomic status (SES), billing, RTP
- Consultation – if the registrar sought in-consultation advice, assistance or information related to the procedure from their supervisor or other physicians in the practice, new problem, number of procedures, duration of consultation.

Box 1. Criteria used for defining a general practice clinical procedure

| Discrete activity performed on a patient |
| Requires knowledge and psychomotor or manual skill |
| Diagnostic or therapeutic |
| May or may not require the use of equipment |
| Invasive or noninvasive |
| Excludes manual skills which are part of routine clinical examination |
| Excludes purely interpretive skills |
| Excludes complex surgical procedures that require a general anaesthetic |

Statistical methods
Descriptive analyses were used to describe the frequency of the individual procedures performed per 10,000 patient consultations.

Associations of performing procedures with independent variables were tested using chi-square analyses. Analyses were performed at the level of problem or diagnosis rather than consultation. We performed two primary analyses and tested the association of registrars performing a procedure for a problem with:
- Practice geographic location (rurality) – We classified the five categories of the ASGC-RA to three levels (‘Major cities’, ‘Inner regional’ and ‘Outer regional, remote, very remote’)
- Accessing advice or assistance from their supervisor.

Secondary analyses were undertaken to test the association of performing procedures with the remaining aforementioned independent variables.

For primary analyses, P values <0.05 were considered statistically significant. For the secondary analysis, multiple comparisons (n = 19) were adjusted for using a Bonferroni adjustment, with an adjusted P value of <0.003 determining statistical significance.

All analyses were conducted using Stata statistical software (version 13.1).

Ethics approval
The ReCEnT project has approval from the University of Newcastle’s Human Research Ethics Committee (reference: H-2009-0323).

Results
A total of 1299 registrars (response rate: 95.8%) contributed 3077 registrar-rounds of data collection and 182,782
Table 1. Characteristics of registrars and practices

<table>
<thead>
<tr>
<th>Registrar characteristics (n = 1294)</th>
<th>n (%) [95% confidence interval (CI)]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>848 (65.5%) [62.9, 68.1]</td>
</tr>
<tr>
<td>Male</td>
<td>446 (34.5%) [31.9, 37.1]</td>
</tr>
<tr>
<td>Qualified as a doctor in Australia</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>1070 (83.5%) [81.3, 85.4]</td>
</tr>
<tr>
<td>No</td>
<td>212 (16.5%) [14.6, 18.7]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Registrar-round characteristics (n = 3001)</th>
<th>Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>32.6 ± 6.4</td>
</tr>
<tr>
<td>Registrar training term</td>
<td></td>
</tr>
<tr>
<td>Term 1</td>
<td>1198 (39.9%) [38.2, 41.7]</td>
</tr>
<tr>
<td>Term 2</td>
<td>1013 (33.8%) [32.1, 35.5]</td>
</tr>
<tr>
<td>Term 3</td>
<td>790 (26.3%) [24.8, 27.9]</td>
</tr>
<tr>
<td>Registrar worked at the practice previously</td>
<td>771 (26.1%) [24.5, 27.7]</td>
</tr>
<tr>
<td>Registrar works full-time</td>
<td>2272 (77.4%) [75.9, 78.9]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Practice characteristics (n = 3077)</th>
<th>Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Practice routinely bulk bills*</td>
<td>531 (17.8%) [16.5, 19.2]</td>
</tr>
<tr>
<td>Number of full-time equivalent GPs working at the practice</td>
<td>1003 (34.3%) [32.6, 36.0]</td>
</tr>
<tr>
<td>6+</td>
<td>1923 (65.7%) [64.0, 67.4]</td>
</tr>
<tr>
<td>Rurality of practice</td>
<td></td>
</tr>
<tr>
<td>Major City</td>
<td>1712 (57.1%) [55.3, 58.9]</td>
</tr>
<tr>
<td>Inner Regional</td>
<td>786 (26.2%) [24.7, 27.8]</td>
</tr>
<tr>
<td>Outer regional, remote, very remote</td>
<td>500 (16.8%) [15.4, 18.1]</td>
</tr>
<tr>
<td>Socioeconomic Index for Area: Relative Index of Disadvantage</td>
<td>5.5 ± 2.9</td>
</tr>
</tbody>
</table>

*‘Bulk bills’ means no financial cost to the patient*

Overall, 19,411 procedures were performed by registrars from 2010 to 2016. Table 1 shows registrar and practice demographics.

Associations – Primary analyses

Overall, performing procedures was significantly associated with registrars working in an ‘Outer regional, remote, very remote’ location, compared with ‘Major city’ and ‘Inner regional’ locations (8%; 95% CI: 7.7, 8.2 versus 6.7%; 95% CI: 6.6, 6.9) versus 6.4% (95% CI: 6.2, 6.5; P < 0.001). Relatively fewer Pap tests, however, were performed with increasing practice rurality (Table 2).

Performing procedures was significantly associated with registrars seeking help from their supervisor (9%; 95% CI: 8.6, 9.4 versus 6.7%; 95% CI: 6.6, 6.8; P < 0.001).

Regarding the type of procedures for which registrars commonly sought supervisors’ help, most could be characterised as ‘complex’, ‘advanced’ or ‘invasive’, and requiring a higher level...
Table 2. List of the 30 most common procedures performed by registrars

<table>
<thead>
<tr>
<th>Procedure</th>
<th>All areas</th>
<th>Major cities</th>
<th>Inner regional</th>
<th>Outer regional, remote, very remote</th>
</tr>
</thead>
<tbody>
<tr>
<td>Procedure</td>
<td>N per 10,000 encounter</td>
<td>N per 10,000 encounter</td>
<td>N per 10,000 encounter</td>
<td>N per 10,000 encounter</td>
</tr>
<tr>
<td>Pap smear</td>
<td>5778</td>
<td>316.1</td>
<td>3424</td>
<td>330.0</td>
</tr>
<tr>
<td>Cryotherapy</td>
<td>4160</td>
<td>227.6</td>
<td>2526</td>
<td>243.5</td>
</tr>
<tr>
<td>Application of wound dressings</td>
<td>1968</td>
<td>107.7</td>
<td>1107</td>
<td>106.7</td>
</tr>
<tr>
<td>Syringe external auditory canal</td>
<td>880</td>
<td>48.1</td>
<td>522</td>
<td>50.3</td>
</tr>
<tr>
<td>Excision of superficial skin lesions</td>
<td>712</td>
<td>39.0</td>
<td>394</td>
<td>38.0</td>
</tr>
<tr>
<td>Set up and record 12 lead electrocardiography</td>
<td>622</td>
<td>34.0</td>
<td>254</td>
<td>24.5</td>
</tr>
<tr>
<td>Taking of high vaginal swab</td>
<td>550</td>
<td>30.1</td>
<td>195</td>
<td>18.8</td>
</tr>
<tr>
<td>Venepuncture</td>
<td>443</td>
<td>24.2</td>
<td>257</td>
<td>24.8</td>
</tr>
<tr>
<td>Punch biopsy of skin lesion</td>
<td>398</td>
<td>21.8</td>
<td>117</td>
<td>11.3</td>
</tr>
<tr>
<td>Incision and drainage of abscess</td>
<td>373</td>
<td>20.4</td>
<td>157</td>
<td>15.1</td>
</tr>
<tr>
<td>Subcutaneous injection</td>
<td>277</td>
<td>15.2</td>
<td>150</td>
<td>14.5</td>
</tr>
<tr>
<td>Insertion of Implanon rod</td>
<td>238</td>
<td>13.0</td>
<td>149</td>
<td>14.4</td>
</tr>
<tr>
<td>Suture of superficial skin laceration</td>
<td>215</td>
<td>11.8</td>
<td>106</td>
<td>10.2</td>
</tr>
<tr>
<td>Spirometry</td>
<td>207</td>
<td>11.3</td>
<td>120</td>
<td>11.6</td>
</tr>
<tr>
<td>Removal of Implanon rod</td>
<td>165</td>
<td>9.0</td>
<td>81</td>
<td>7.8</td>
</tr>
<tr>
<td>Removal of subcutaneous foreign body</td>
<td>128</td>
<td>7.0</td>
<td>62</td>
<td>6.0</td>
</tr>
<tr>
<td>Removal of ear wax</td>
<td>112</td>
<td>6.1</td>
<td>58</td>
<td>5.6</td>
</tr>
<tr>
<td>Shave biopsy of skin lesion</td>
<td>108</td>
<td>5.9</td>
<td>65</td>
<td>6.3</td>
</tr>
<tr>
<td>Wound debridement</td>
<td>106</td>
<td>5.8</td>
<td>47</td>
<td>4.5</td>
</tr>
<tr>
<td>Soft tissue injury strapping</td>
<td>100</td>
<td>5.5</td>
<td>47</td>
<td>4.5</td>
</tr>
<tr>
<td>Throat swab</td>
<td>98</td>
<td>5.4</td>
<td>66</td>
<td>6.4</td>
</tr>
<tr>
<td>Wound swab</td>
<td>93</td>
<td>5.1</td>
<td>46</td>
<td>4.4</td>
</tr>
<tr>
<td>Application of forearm back-slab</td>
<td>92</td>
<td>5.0</td>
<td>47</td>
<td>4.5</td>
</tr>
<tr>
<td>Application of forearm cast</td>
<td>70</td>
<td>3.8</td>
<td>40</td>
<td>3.9</td>
</tr>
<tr>
<td>Perform peak flow measurement</td>
<td>69</td>
<td>3.8</td>
<td>50</td>
<td>4.8</td>
</tr>
<tr>
<td>Application of forearm cast</td>
<td>59</td>
<td>3.2</td>
<td>33</td>
<td>3.2</td>
</tr>
<tr>
<td>Removal of corneal foreign body</td>
<td>58</td>
<td>3.2</td>
<td>25</td>
<td>2.4</td>
</tr>
<tr>
<td>Epley manoeuvre for benign positional vertigo</td>
<td>51</td>
<td>2.8</td>
<td>37</td>
<td>3.6</td>
</tr>
<tr>
<td>Excision of sebaceous cyst</td>
<td>49</td>
<td>2.7</td>
<td>28</td>
<td>2.7</td>
</tr>
<tr>
<td>Intravenous access</td>
<td>48</td>
<td>2.6</td>
<td>15</td>
<td>1.4</td>
</tr>
</tbody>
</table>
of skills. For example, injection and/or aspiration of shoulders (registrars sought their supervisor’s assistance or advice in 57.6% of such episodes), wedge excision for ingrown toenail (45.5%), and injection and/or aspiration of knee joint (45.5%). Procedures for which registrars infrequently sought help (<5% of episodes) included simpler procedures, such as intramuscular injection, Pap test, dry needling and removal of ear wax (data not shown in tabular form).

Associations – Secondary analyses

Appendix 2 (available online only) shows the associations of registrars’ performing procedures with independent variables.

Discussion

In this study, we established the type and frequency of procedures performed by Australian general practice registrars and compared it with a list of procedures developed by Sylvester et al8 that is deemed to be core to general practice training. To our knowledge, this is the first study in Australia investigating the scope of procedures performed by general practice registrars.

We found that the frequency with which the majority of core procedures were performed was low, with only three procedures (ie intramuscular injection, Pap test and cryotherapy) with a rate above 100 per 10,000 encounters. Data from one RTO suggest registrars conduct approximately 60 patient consultations per week over the training period (including data for part-time and full-time registrars; personal communication from Amanda Tapley). Our findings, together with this consideration, raise the possibility of many registrars not having adequate procedural exposure to become competent in many basic procedural skills on entering independent practice. In addition, there was a lack of technically more advanced procedures (eg fracture-related procedures) performed by registrars.

These findings are also particularly concerning as some registrars will be practising in rural centres where a lack of competency in procedural skills could significantly limit their practice and, in the case of some skills, may have implications for patient safety. Previous research has found that the number of rural GPs offering procedural services, and the complexity of these services, has been in gradual decline over the past three decades.16 A possible lack of early career GPs’ competency in procedural skills may contribute to this decline.

Australian general practice data16 report 11.4 procedures per 100 problems managed by Australian GPs in 2015–16. This is higher than our general practice registrar data. Although the difference might represent patients self-selecting to see own GPs rather than a trainee to have a procedure, it may also be influenced by different definitions of procedure between studies.

A number of associations of performing procedures found in this study are relevant to practice. We found that registrar performed more procedures in rural than in urban centres. However, Pap tests were performed by registrars at a lower rate in rural centres. A lower proportion of female registrars in ‘Outer regional, remote, very remote’ (personal communication from Amanda Tapley) may have influenced this finding.

We found that registrars often sought advice or assistance when performing what the authors of this study would consider more complex or advanced procedures. This is unsurprising as the very complexity of these procedures would mandate supervision during early experiences of learning and mastering any such procedure. However, the high proportions of episodes involving supervisor advice or assistance for the more complex or advanced procedures may also reflect the overall low frequency with which they were performed (with not enough individual procedures performed by individual registrars to achieve a level of proficiency necessary for independent, unsupervised performance of the procedure).

Strengths and limitations

Strengths of this study include the large number of consultations recorded and the use of a rigorously derived list of procedures relevant to general practice. The high response rate13 and inclusion of data from five Australian states across all rurality classifications, from major city to very remote areas, suggest excellent generalisability to the wider Australian general practice vocational training program.

A limitation of this study is that we do not know the supervisors’ skill levels or the available opportunities for registrars to perform particular procedures. Another limitation is that our data are limited to office-based consultations. We did not capture procedures done in hospitals by the relatively small proportion of registrars in rural and remote practices who have hospital-admitting privileges. This may also explain the lack of hospital-based procedures from the core and supplementary lists.8 Implications drawn from our data also do not take into account procedures experienced in hospital practice prior to general practice terms. In addition, our data cannot measure how well or safely these procedures were done by the registrars. Again, the small number of more advanced or complex procedures performed and the high proportions of these done with supervisor support suggest that there may be very limited competency acquired in these procedures.

Implications for policy and practice

Our findings suggest suboptimal registrar exposure to relevant clinical procedures. Responses may include greater use of laboratory-based training and encouraging supervisors to more often involve their registrars when they (the supervisor) preform procedures. Alternatively, our conception of the appropriate scope of procedural skills of graduates of general practice vocational training may need to be narrowed.
Box 2. Procedures not performed by registrars (n = 67)

- Allergy skin prick testing
- Application of full leg cast
- Application of walking heel to a plaster
- Artificial rupture of membranes
- Aspiration of hydrocoele
- Axillary nerve block
- Blinder's block
- Biphasic positive airway pressure (BIPAP)
- Bone marrow aspiration
- Cardiopulmonary resuscitation (CPR; child)
- Circumcision
- Circumcision analgesia
- Cutdown venous access
- Defibrillation
- Diagnostic peritoneal lavage
- Emergency use of mechanical ventilators
- Endometrial aspiration biopsy
- Endotracheal intubation (adult)
- Endotracheal intubation (child)
- Episiotomy and repair
- Femoral nerve block
- Forceps extraction
- Fracture haematoma block
- Gastric lavage
- Haemorrhoid banding
- Haemorrhoid injection
- Injection of carpal tunnel
- Injection of trigger finger
- Insertion of chest tube
- Insertion of tarsal mask
- Insertion of nasopharyngeal airway
- Insertion of oral airway
- Intercostal nerve block
- Intersosseous needle insertion
- Jet instillation
- Lumbar puncture
- Measurement of intra-ocular pressure
- Mouth to mask ventilation
- Mouth to mouth ventilation
- Needle cricothyroidotomy (child)
- Neonatal intubation
- Normal vaginal delivery
- Orogastric tube insertion
- Paracentesis
- Pericardiocentesis
- Pudendal block
- Rapid sequence induction
- Reduce ankle fractures
- Reduce wrist fractures
- Reduction of dislocated hip
- Reduction of dislocated patella
- Reduction of dislocated shoulder
- Reduction of paraphimosis
- Reduction tension pneumothorax
- Repair tendon laceration
- Scleropatch attachment
- Sigmoidoscopy
- Suprapubic aspiration (child)
- Suprapubic catheterisation
- Synchronous direct current (DC) cardioversion (adult)
- Synchronous direct current (DC) (child)
- Thoracocentesis
- Tibial nerve block
- Umbilical catheter
- Urethral catheterisation (child)
- Urethral catheterisation of a female
- Vacuum extraction

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