

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

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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.¹² 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.¹³ 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,⁸ plus the additional general practice procedures included in that project ($n = 79$). When defining 'procedure', we used the same criteria used by Sylvester et al⁸ to define a general practice clinical procedure (Box1).

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 problems, duration of consultation.

The practices' postcodes were used to define the Australian Standard Geographical Classification – Remoteness Area (ASGC-RA) classification (degree of rurality) and the Socio-Economic Index for Areas's (SEIFAs) index of disadvantage of the practice location.¹⁴

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

Box 1. Criteria used for defining a general practice clinical procedure⁸

- 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

Table 1. Characteristics of registrars and practices

Registrars and registrar-round characteristics		n (%) [95% confidence interval (CI)]
Registrar characteristics (n = 1294)		
Gender	Female	848 (65.5%) [62.9, 68.1]
	Male	446 (34.5%) [31.9, 37.1]
Qualified as a doctor in Australia	Yes	1070 (83.5%) [81.3, 85.4]
	No	212 (16.5%) [14.6, 18.7]
Registrar-round characteristics (n = 3001)		
Age (years)	Mean ± SD	32.6 ± 6.4
Registrar training term	Term 1	1198 (39.9%) [38.2, 41.7]
	Term 2	1013 (33.8%) [32.1, 35.5]
	Term 3	790 (26.3%) [24.8, 27.9]
Registrar worked at the practice previously	Yes	771 (26.1%) [24.5, 27.7]
Registrar works full-time	Yes	2272 (77.4%) [75.9, 78.9]
Practice characteristics (n = 3077)		
Practice routinely bulk bills*	Yes	531 (17.8%) [16.5, 19.2]
Number of full-time equivalent GPs working at the practice	1–5	1003 (34.3%) [32.6, 36.0]
	6+	1923 (65.7%) [64.0, 67.4]
Rurality of practice	Major City	1712 (57.1%) [55.3, 58.9]
	Inner Regional	786 (26.2%) [24.7, 27.8]
	Outer regional, remote, very remote	500 (16.8%) [15.4, 18.1]
Socioeconomic Index for Area: Relative Index of Disadvantage	Mean ± SD	5.5 ± 2.9

*Bulk bills' means no financial cost to the patient

consultations (283,616 problems or diagnoses) from 2010 to 2016. Table 1 shows registrar and practice demographics.

Overall, 19,411 procedures were performed by registrars during this period. Procedures were performed in 9.9% (95% confidence interval [CI]: 9.8, 10.1) of consultations for 6.8% (95% CI: 6.7, 6.9) of problems or diagnoses managed. Table 2 presents the number and rate per 10,000 consultations of the 30 most commonly performed procedures. Numbers and rates are presented by AGSC–RA derived level of rurality, and for all areas combined. The full list of procedures performed by registrars is available as Appendix 1 (available online only). The most commonly performed procedures were

intramuscular injection, Papanicolaou (Pap) test and cryotherapy. Eighty-five per cent of the procedures from Sylvester's list of core general practice vocational training procedures (n = 112) were performed by the registrars. The frequency of the majority of these, however, was very low (Appendix 1; available online only). For the list of all procedures (core list plus supplementary list; n = 191), one-third of procedures was not performed by the registrars. These could mostly be considered hospital-based procedures (eg obstetric procedures, emergency department procedures; Box 2). An anomaly was the insertion of intrauterine devices (IUDs), which is not included in the core procedural skills list, but performed in 21 registrar consultations.

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

Procedure	All areas		Major cities		Inner regional		Outer regional, remote, very remote	
	N	per 10,000 encounter	N	per 10,000 encounter	N	per 10,000 encounter	N	per 10,000 encounter
Procedure	5778	316.1	3424	330.0	1262	258.9	1082	359.0
Pap smear	4160	227.6	2526	243.5	1046	214.6	585	194.1
Cryotherapy	1968	107.7	1107	106.7	500	102.6	358	118.8
Application of wound dressings	880	48.1	522	50.3	239	49.0	119	39.5
Syringe external auditory canal	712	39.0	394	38.0	172	35.3	145	48.1
Excision of superficial skin lesions	622	34.0	254	24.5	202	41.4	166	55.1
Set up and record 12 lead electrocardiography	550	30.1	195	18.8	180	36.9	173	57.4
Taking of high vaginal swab	443	24.2	257	24.8	107	21.9	79	26.2
Venepuncture	398	21.8	117	11.3	40	8.2	234	77.6
Punch biopsy of skin lesion	373	20.4	157	15.1	115	23.6	100	33.2
Incision and drainage of abscess	277	15.2	150	14.5	61	12.5	66	21.9
Subcutaneous injection	238	13.0	149	14.4	49	10.1	40	13.3
Insertion of Implanon rod	215	11.8	106	10.2	56	11.5	53	17.6
Suture of superficial skin laceration	207	11.3	120	11.6	53	10.9	34	11.3
Spirometry	165	9.0	81	7.8	31	6.4	53	17.6
Removal of Implanon rod	128	7.0	62	6.0	41	8.4	25	8.3
Removal of subcutaneous foreign body	112	6.1	58	5.6	29	5.9	25	8.3
Removal of ear wax	108	5.9	65	6.3	23	4.7	20	6.6
Shave biopsy of skin lesion	106	5.8	47	4.5	36	7.4	23	7.6
Wound debridement	100	5.5	47	4.5	35	7.2	18	6.0
Soft tissue injury strapping	98	5.4	66	6.4	17	3.5	15	5.0
Throat swab	93	5.1	46	4.4	25	5.1	22	7.3
Wound swab	92	5.0	47	4.5	25	5.1	20	6.6
Application of forearm back-slab	70	3.8	40	3.9	20	4.1	10	3.3
Perform peak flow measurement	69	3.8	50	4.8	16	3.3	3	1.0
Application of forearm cast	59	3.2	33	3.2	14	2.9	12	4.0
Removal of corneal foreign body	58	3.2	25	2.4	16	3.3	17	5.6
Epley manoeuvre for benign positional vertigo	51	2.8	37	3.6	9	1.8	5	1.7
Excision of sebaceous cyst	49	2.7	28	2.7	12	2.5	9	3.0
Intravenous access	48	2.6	15	1.4	12	2.5	21	7.0

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.¹⁵ 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.⁸ 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) perform 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
 Bier's block
 Biphase positive airway pressure (BIPAP)
 Bone marrow aspiration
 Cardiopulmonary (CPR; child)
 Circumcision
 Cricothyroidotomy
 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 laryngeal mask
 Insertion of nasopharyngeal airway
 Insertion of oral airway
 Intercostal nerve block
 Interosseous needle insertion
 Jet insufflation
 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
 Scalp clip attachment
 Sigmoidoscopy
 Suprapubic aspiration (child)
 Suprapubic catheterisation
 Synchronised direct current (DC) cardioversion (adult)
 Synchronised direct current (DC) (child)
 Thoracocentesis
 Tibial nerve block
 Umbilical catheter
 Urethral catheterisation (child)
 Urethral catheterisation of a female
 Vacuum extraction

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Competing interests and funding: The project was funded in 2010–15 by General Practice Training Valley to Coast, the Victorian Metropolitan Alliance, General Practice Training Tasmania, Tropical Medicine Training and Adelaide to Outback GP Training Program. These organisations were funded by the Australian Government. In 2016, the project was funded by the Australian Department of Health (commissioned research grant) and supported by GP Synergy Regional Training Organisation.

Provenance and peer review: Not commissioned, externally peer reviewed.

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