

Emergency department referral patterns of Australian general practitioner registrars: a cross-sectional analysis of prevalence, nature and associations

Nigel Catzikiris^{1,2,8} BHLth, Research Assistant

Amanda Tapley^{1,2} MMedStats, Senior Research Officer

*Simon Morgan*¹ MPH, FRACGP, Medical Educator

*Mieke van Driel*³ PhD, FRACGP, Head of Discipline

Neil Spike^{4,5} PhD, FRACGP, Director of Training

Elizabeth G. Holliday^{2,6} PhD, Senior Statistician

*Jean Ball*⁶ GDipMedStats, Statistician

Kim Henderson^{1,2} GDipMedSc(HSocSc), ReCEnT Project Manager

*Lawrie McArthur*⁷ PhD, FRACGP, Head of Education

Parker Magin^{1,2} PhD, FRACGP, Director

¹GP Synergy, NSW and ACT Research and Evaluation Unit, 20 McIntosh Drive, Mayfield West, NSW 2304, Australia. Email: Amanda_tapley@gpsynergy.com.au; lochswilly@gmail.com; kim_pinkerton@gpsynergy.com.au; parker_magin@gpsynergy.com.au

²School of Medicine and Public Health, University of Newcastle, University Drive, Callaghan, NSW 2308, Australia.

³Discipline of General Practice, School of Medicine, University of Queensland, Level 8 Health Sciences Building, Royal Brisbane and Women's Hospital, Brisbane, Qld 4029, Australia.

⁴Eastern Victoria GP Training, 15 Cato Street, Hawthorn, Vic. 3122, Australia.
 Email: neil.spike@evgptraining.com.au

⁵Department of General Practice, The University of Melbourne, 200 Berkeley Street, Carlton, Vic. 3053, Australia.

⁶Public Health Research Program, Hunter Medical Research Institute, Locked Bag 1000, New Lambton, NSW 2305, Australia. Email: Elizabeth.Holliday@hmri.com.au; Jean.Ball@hmri.com.au

⁷Discipline of General Practice, University of Adelaide, 183 Melbourne Street, North Adelaide, SA 5006, Australia.
 Email: lawrie.mcarthur@adelaide.edu.au

⁸Corresponding author. Email: nigel_catzikiris@gpsynergy.com.au

Abstract

Objective. Limited international evidence suggests general practice registrars' emergency department (ED) referral rates exceed those of established general practitioners (GPs). The aim of the present study was to fill an evidence gap by establishing the prevalence, nature and associations of Australian GP registrar ED referrals.

Methods. A cross-sectional analysis was performed of the Registrar Clinical Encounters in Training (ReCEnT) cohort study of GP registrars' consultation experiences, between 2010 and 2015. The outcome factor in logistic regression analysis was referral to an ED. Independent variables included patient-level, registrar-level, practice-level and consultation-level factors.

Results. In all, 1161 GP registrars (response rate 95.5%) contributed data from 166 966 consultations, comprising 258 381 individual problems. Based on responses, 0.5% of problems resulted in ED referral, of which nearly 25% comprised chest pain, abdominal pain and fractures. Significant ($P < 0.05$) associations of ED referral included patient age <15 and >34 years, the patient being new to the registrar, one particular regional training provider (RTP), in-consultation information or assistance being sought and learning goals being generated. Outer regional-, remote- or very remote-based registrars made significantly fewer ED referrals than more urban registrars. Of the problems referred to the ED, 45.5% involved the seeking of in-consultation information or assistance, predominantly from supervisors.

Conclusions. Registrars' ED referral rates are nearly twice those of established GPs. The findings of the present study suggest acute illnesses or injuries present registrars with clinical challenges and real learning opportunities, and highlight the importance of continuity of care, even for acute presentations.

What is known about the topic? A GP's decision concerning continued community- versus hospital-based management of acute presentations demands careful consideration of a suite of factors, including implications for patient care and resource expenditure. General practice vocational training is a critical period for the development of GP registrars' long-term patterns of practice. Although limited international evidence suggests GP registrars and early career GPs refer patients to the ED at a higher rate than their more experienced peers, these studies involved small subject numbers and did not investigate associations of registrars making an ED referral. Relevant Australian studies focusing on GP registrars' ED referral patterns are lacking.

What does this paper add? The present ongoing cohort study is the first to establish the patterns of ED referrals made by Australian GP registrars, encompassing five general practice RTPs across five states, with participating registrars practising in urban, rural, remote and very remote practices. Several significant associations were found with GP registrars making ED referrals, including patient age, continuity of care, the registrar's RTP, assistance sought by the registrar and rurality of the registrar's practice.

What are the implications for practitioners? The higher likelihood of GP registrars seeing acute presentations than their more established practice colleagues, coupled with a demonstrated association of registrars seeking in-consultation assistance for such presentations, highlights the importance of GP supervisor accessibility in facilitating ED referral appropriateness and in the development of registrars' safe clinical practice.

Additional keywords: emergency medicine, family practice, general practice, physician practice patterns, referral and consultation.

Received 11 January 2017, accepted 28 September 2017, published online 9 November 2017

Introduction

Up to 8% of emergency department (ED) presentations are referred from general practice.¹ Compared with general practice, ED offers expertise and equipment more closely targeted to the management of acute serious illness. However, for low-acuity morbidities not requiring this intensive level of acute care, presentation to the ED generates avoidable healthcare costs.² Furthermore, excessive ED demand can lead to compromised health care outcomes.³ Thus, the decision of general practitioners (GPs) to refer acute presentations to the ED rather than manage them themselves (in the community) demands careful consideration of patient safety and care, as well as health resource use.

Determining whether to refer a patient for specialised management involves a complex interplay of factors related to the individual GP, specialist, practice, patient and their relatives.^{4,5} Particularly for acute presentations, this may occur within a time-pressured environment. Considerable inter-GP differences have been observed in referral rates to the ED,⁶ with some research exploring links between this variation and referral 'appropriateness',⁵ with appropriateness to be determined by the potential urgency or severity of the presentation rather than the final diagnosis within ED.⁷ In Australia, the Australian College of Emergency Medicine (ACEM) has determined that poor GP decision making leading to inappropriate referrals is not a substantive factor in ED 'overcrowding'.⁸ Nevertheless, there is strong opinion that improved understanding of the epidemiology of ED referral patterns of Australian GPs can inform GP-relevant strategies to address ED demand: for example, training, feedback and peer support of appropriate GP ED referral decision making have been advocated.⁹

A segment of the GP population of particular interest with regard to referral behaviour is that of GP registrars (trainees). Registrars are at a formative stage of their clinical careers, establishing potentially lifelong practice patterns. Limited international studies indicate that ED referral rates of registrars¹⁰ and referral rates of other early career GPs¹¹ are significantly higher than those of longer-established GPs. However, Australian studies, and any studies establishing associations of registrars' ED referrals, are lacking.

The aim of the present study was to address this evidence gap by establishing the prevalence, nature and associations of Australian GP registrar ED referrals.

Methods

The present study was a cross-sectional analysis of the in-practice clinical experiences of GP registrars participating in the Registrar Clinical Encounters in Training (ReCEnT) study. The ReCEnT study has been described in detail elsewhere.¹² Briefly, this ongoing multisite cohort study captures clinical consultation data of GP registrars from five of Australia's 17 general practice regional training providers (RTPs) across five states and encompassing urban, rural, remote and very remote practices.

Registrars in general practice training posts operate within an apprenticeship-like model but with considerable autonomy, including billing, prescribing, test ordering and referral capabilities equivalent to their more experienced GP peers. They do have recourse to advice and assistance at any time from a senior GP supervisor (or another GP within the practice as their delegate).

The present analysis involves data from 12 data collection rounds between 2010 and 2015.

Procedures

ReCEnT data collection is undertaken as an integral educational component of each participant's GP training program.^{13,14} Registrars may also provide optional informed consent for their data to be made available for research purposes. Registrars complete three 6-month (full-time equivalent) compulsory general practice training terms. Midway through each term, registrars record (via paper-based patient encounter forms) demographic, clinical and educational data from 60 consecutive, office-based general practice consultations. Prior to each data collection round, each registrar provides demographic data of themselves and their current practice. Some registrars at one RTP also completed data collection during a fourth optional GP term.

Outcome factor

The outcome factor in the present study was whether, for a diagnosis or problem managed (hereafter 'problem'), the registrar made a referral to an ED. Non-ED hospital referrals were excluded from the analysis.

Independent variables

Other variables in the present analysis related to the registrar, patient, practice and consultation. Registrar factors were age, gender, training term, having worked at the practice before that training term, place of medical qualification (Australia or international) and full-time/part-time status. Patient factors were age, gender, Aboriginal and Torres Strait Islander status, non-English speaking background status, new patient to the practice and new patient to the registrar. Practice factors included RTP, rurality, socioeconomic status of the practice location, practice size (i.e. the number of GPs) and whether the practice routinely bulk-billed (i.e. the patient incurred no financial cost for the consultation). Practice postcode was used to define the Australian Standard Geographical Classification–Remoteness Area (ASGC-RA) classification¹⁵ (degree of rurality) and the Socioeconomic Index for Areas (SEIFA) Index of Disadvantage¹⁶ of the practice location. The consultation factors were consultation duration, number of problems, the problem being a chronic disease, whether the problem was new to the registrar and whether the registrar ordered pathology, imaging or follow-up. Educational consultation factors included whether the registrar sought clinical information or assistance for the problem (from their supervisor, a specialist, other health professional or from electronic or hard-copy resources) and whether the registrar generated learning goals pertaining to the problem.

Problems were coded according to the International Classification of Primary Care, 2nd edition (ICPC-2) classification system.¹⁷ Chronic diseases were coded via an existing classification system derived from the ICPC-2.¹⁸

For descriptive purposes, individual ICPC-2 codes were grouped with clinically congruent codes to create clinically meaningful problem categories. This grouping was performed collaboratively by two members of the research team (PM, NC), one a GP.

Statistical analysis

The present study was a cross-sectional analysis of data from the longitudinal ReCEnT study. The proportion of problems for

which the registrar made an ED referral was calculated with 95% confidence intervals (CIs), accounting for clustering of repeated measures of registrars.

Of those problems for which the registrar sought in-consultation information or assistance, the proportion of information or assistance sought from the registrar's supervisor was calculated with 95% CIs, also accounting for clustering.

Analyses were conducted at the level of the problem rather than consultation, because registrars make ED referrals for individual problems.

Simple and multiple logistic regressions were performed with the dependent variable 'registrar made an ED referral'. All independent variables with $P < 0.20$ in univariate analysis were included in the multiple regression model. Covariates with a small effect size and no longer significant ($P < 0.05$) in the multivariable model were tested for removal from the model. If no substantive change was observed to the resulting model, the covariate was removed from the final model. The logistic regression was within a generalised estimating equations framework to account for the repeated measures on registrars. The significance level for all analyses was set at two-tailed $P < 0.05$. Analyses were performed using Stata v13.1 (StataCorp, College Station, TX, USA) and SAS v9.4 (SAS Institute, Cary, NC, USA).

Ethics approval

The ReCEnT study has approval from the Human Research Ethics Committee, University of Newcastle (Reference H-2009-0323).

Results

In all, 1161 registrars (response rate 95.5%) contributed data on 166 966 consultations, entailing management of 258 381 problems. The characteristics of participating registrars and their practices are given in Table 1.

Of all problems, 0.5% (95% CI 0.4–0.5) were referred to ED. The most common reasons for referral were chest pain, abdominal pain and fractures. These made up nearly 25% of ED referrals. The 12 most common reasons for referral (see Table 2) comprised 44.4% of all ED referrals.

Univariate associations of ED referrals are presented in Table 3 and the results of univariate and multivariable logistic regression analyses are presented in Table 4. Significant patient factor multivariable associations with making an ED referral were: patient age 0–14 years (odds ratio (OR) 1.48, 95% CI 1.18–1.86), 35–64 years (OR 1.28; 95% CI 1.06–1.56) and ≥ 65 years (OR 2.21; 95% CI 1.73–2.82), compared with reference age 15–34 years, and the patient being new to the registrar (OR 1.34; 95% CI 1.13–1.59). Registrars practising in outer regional, remote or very remote areas were significantly less likely to make an ED referral compared with those within major cities (OR 0.64; 95% CI 0.44–0.94). A registrar being enrolled with one particular RTP was significantly associated with making an ED-referral (OR 1.78 (95% CI 1.39–2.28) for RTP 4 compared with RTP 1). Key consultation factors significantly associated with making an ED referral included the problem being new (OR 3.14; 95% CI 2.59–3.79), the registrar seeking information or assistance from another health professional or an electronic or hard copy resource (OR 2.77; 95% CI 2.27–3.38)

Table 1. Demographics of participating registrars and their practices
Data are presented as *n* (%) or as the mean \pm s.d. GPs, general practitioners;
SEIFA, Socioeconomic Index for Areas – Index of Disadvantage¹⁵

Registrar variables (<i>n</i> = 1161)	
Registrar age (years)	32.7 \pm 6.4
Registrar gender	
Male	391 (33.7)
Female	770 (66.3)
Qualified as a doctor in Australia	
No	230 (20.0)
Yes	920 (80.0)
Registrar term or practice term variables (<i>n</i> = 2812)	
Registrar training term	
Term 1	1061 (37.7)
Term 2	984 (35.0)
Term 3	691 (24.6)
Term 4	76 (2.7)
Registrar worked at the practice previously	
No	1982 (71.7)
Yes	784 (28.3)
Registrar works fulltime	
No	610 (22.2)
Yes	2140 (77.8)
Does the practice routinely bulk bill	
No	2295 (82.1)
Yes	500 (17.9)
No. GPs working at the practice	
1–4	940 (34.3)
5+	1804 (65.7)
Rurality of practice	
Major city	1594 (56.7)
Inner regional	735 (26.2)
Outer regional or remote	481 (17.1)
SEIFA (decile) of practice	5.5 \pm 2.9

Table 2. Problems most frequently referred to the emergency department (ED) by general practitioner registrars

LRTIs, lower respiratory tract infections; SAH, subarachnoid haemorrhage

Ranked frequency	Problem	No. referrals	% Total ED referrals
1	Chest pain	129	10.71
2	Abdominal pain	106	8.80
3	Fracture	52	4.32
4	Cellulitis or other skin infections	36	2.99
5	Asthma	28	2.33
6	Fever or pyrexia	28	2.33
7	Abscess (excluding dental)	27	2.24
8	Musculoskeletal injury (excluding back)	27	2.24
9	Pneumonia and other LRTIs	26	2.16
10	Transient ischaemic attack, stroke, SAH	26	2.16
11	Gastroenteritis	25	2.08
12	Atrial fibrillation, palpitations, other tachy- or bradyarrhythmias	24	1.99

and the registrar generating learning goals relating to the ED-referred problem (OR 1.35; 95% CI 1.09–1.66).

In-consultation information and/or assistance was sought by registrars for the diagnosis and/or management of 45.5% (95% CI 42.7–48.4%) of those problems subsequently referred to the

ED. The registrar's supervisor (or another GP in the practice) was the source of information and/or assistance for 65.8% (95% CI 61.9–69.5%) of all sources of information or assistance sought for all ED-referred problems. Table 5 presents sources used by registrars.

Discussion

Main findings and relation to previous literature

GP registrars referred their patients to ED at a frequency of 5 per 1000 problems seen, almost twice the rate of that of established GPs in an earlier Australian study,¹⁹ and comparable to the findings of a previous, albeit limited and non-contemporary, study of UK registrars.¹⁰ A likely contributing factor to the relatively high proportion of patients referred in the present study is the common delegation within Australian general practice of acute or unscheduled presentations to a practice's registrars. This is reflected in the significant association of ED referrals with patients being 'new to the registrar'. This finding is also consistent with limited patient continuity of care found in Australian GP registrars' practice.²⁰ Lack of familiarity with individual patient contexts of these new presentations may lead to lower thresholds for referral.^{10,21–23}

Clinical experience has been found to build greater certainty in a clinician's decision making.²³ Conversely, uncertainty is a known contributor to GP referral rates,^{4,5,24} including those to the ED.^{9,25} Higher levels of clinical uncertainty and lower tolerance of uncertainty in these early career GPs may be expected to further contribute to lower thresholds for referral than more experienced GPs. However, registrar seniority (training term) was not associated with making fewer ED referrals in the present analyses. Temporal inferences are limited from the present cross-sectional study, and other unmeasured confounders (such as allocation of more serious presentations to more senior registrars) may explain our observations. It is also plausible that registrars' uncertainty in emergency presentations may not attenuate appreciably during the relatively short course of Australian GP vocational training (minimum 18 months within clinical general practice). This may be so because, compared with many other aspects of community-based practice, registrars are likely to have had ample exposure to ED patients and acute serious illness during prevocational training ED experience (having completed at least one ED term is a requirement for undertaking a general practice term). Levels of uncertainty regarding acute serious presentations may be relatively modest compared with less serious, but less familiar, conditions, even for Term 1 registrars.

The significant association of patients under 15 years of age (compared with those aged 15–34 years) being referred to the ED by GP registrars mirrors referral patterns of established GPs (albeit at higher rates).²⁶ This may reflect lower registrar confidence in managing paediatric patients, a consequence of reduced exposure to paediatric consultations during vocational training²⁷ coupled with the pressure of concerned parents' expectations.^{28,29} This finding may also reflect a higher proportion of paediatric presentations being of high acuity compared with those of 15- to 34-year-old patients.³⁰

The association of older age with ED referrals is consistent with the lower physiological reserve and greater health care complexity of this age group compared with the reference age

Table 3. Characteristics associated with emergency department (ED) referrals

Unless indicated otherwise, data are presented as *n* (%). NESB, non-English-speaking background; RTP, regional training provider; SIEFA, Socioeconomic Index for Areas – Index of Disadvantage;¹⁵ FTE, full-time equivalent

	ED referral		<i>P</i> -value
	No (<i>n</i> = 257 177)	Yes (<i>n</i> = 1204)	
Patient characteristics			
Age (years)			
0–14	35 073 (14)	288 (24)	<0.001
15–34	65 982 (26)	233 (20)	
35–64	102 451 (40)	369 (31)	
65+	49 802 (20)	291 (25)	
Gender			
Male	92 687 (37)	508 (44)	<0.001
Female	157 772 (63)	659 (56)	
Aboriginal and Torres Strait Islander			
No	238 704 (98)	1103 (98)	0.19
Yes	3713 (1.5)	23 (2.0)	
NESB			
No	227 856 (93)	1032 (91)	0.076
Yes	16 700 (6.8)	104 (9.2)	
Status			
Existing patient	111 432 (44)	376 (32)	<0.001
New to registrar	122 583 (49)	675 (58)	
New to practice	17 017 (6.8)	120 (10)	
Registrar characteristics			
Gender			
Male	85 277 (33)	443 (37)	0.062
Female	171 900 (67)	761 (63)	
Full- or part-time			
Part-time	57 202 (23)	280 (24)	0.53
Full-time	194 404 (77)	902 (76)	
Term			
1	99 286 (39)	466 (39)	0.29
2	88 477 (34)	447 (37)	
3	62 700 (24)	262 (22)	
4	6714 (2.6)	29 (2.4)	
Worked at practice previously			
No	181 274 (72)	881 (75)	0.13
Yes	71 918 (28)	297 (25)	
Qualified as a doctor in Australia			
No	50 439 (20)	250 (21)	0.56
Yes	204 415 (80)	950 (79)	
Practice characteristics			
Practice size			
Small (1–5 FTE GPs)	87 456 (35)	358 (30)	0.029
Large (6+ FTE GPs)	163 636 (65)	824 (70)	
Practice routinely bulk bills			
No	210 122 (82)	984 (82)	0.85
Yes	45 705 (18)	209 (18)	
Rurality			
Major city	146 135 (57)	757 (63)	0.004
Inner regional	66 818 (26)	292 (24)	
Outer regional remote and very remote	44 120 (17)	154 (13)	

(continued next column)

Table 3. (continued)

	ED referral		<i>P</i> -value
	No (<i>n</i> = 257 177)	Yes (<i>n</i> = 1204)	
RTP			
1	74 202 (29)	290 (24)	<0.001
2	35 924 (14)	158 (13)	
3	31 409 (12)	119 (9.9)	
4	105 283 (41)	598 (50)	
5	10 359 (4.0)	39 (3.2)	
Problem characteristics			
New problem seen			
No	105 383 (45)	186 (17)	<0.001
Yes	129 854 (55)	935 (83)	
Chronic problem			
No	201 335 (78)	953 (79)	0.82
Yes	55 399 (22)	251 (21)	
Sought help from any source			
No	218 490 (85)	656 (54)	<0.001
Yes	38 687 (15)	548 (46)	
Imaging ordered			
No	237 694 (92)	1045 (87)	<0.001
Yes	19 483 (7.6)	159 (13)	
Pathology ordered			
No	212 793 (83)	1065 (88)	<0.001
Yes	44 384 (17)	139 (12)	
Learning goals generated			
No	204 879 (83)	751 (66)	<0.001
Yes	41 007 (17)	389 (34)	
Follow-up ordered			
No	142 572 (55)	800 (66)	<0.001
Yes	114 605 (45)	404 (34)	
Medication prescribed			
No	140 080 (54)	897 (75)	<0.001
Yes	117 097 (46)	307 (25)	
Registrar age (years)			
Median [IQR]	31 [28, 35]	31 [28, 35]	
Mean ± s.d.	32 ± 33	31 ± 53	0.010
SEIFA			
Median [IQR]	5 [3, 8]	5 [3, 8]	
Mean ± s.d.	5 ± 3	5 ± 3	0.79
Consultation duration (min)			
Median [IQR]	17 [12, 24]	24 [17, 34]	
Mean ± s.d.	19 ± 10	27 ± 15	<0.001
No. problems			
Median [IQR]	2 [1, 3]	1 [1, 2]	
Mean ± s.d.	2 ± 1	1 ± 1	<0.001

group.²¹ The documented trend of younger adults using the ED as a general practice substitute³¹ and ‘bypassing’ general practice by ED self-referral could also be contributing to these results.

After adjusting for possible confounders (including rurality), we found that a significant difference in ED referral rates remained between registrars of two RTPs. Although inter-RTP differences in hospital accessibility (associated with greater ED admission rates²¹) may not be accounted for fully by ASGC-RA classification, this difference in ED referral rates may also reflect regional ‘cultural’ variability, both in general practice (including RTP-provided education) and in EDs.

The significant associations of ED-referred problems with being new problems, having fewer problems managed within the consultation, follow-up not being arranged and fewer tests

Table 4. Simple and multiple logistic regression analyses of associations with emergency department (ED) referrals
OR, odds ratio; CI, confidence interval; NESB, non-English-speaking background; RTP, regional training provider; FTE, full-time equivalent

	Univariate		Adjusted	
	OR (95% CI)	P-value	OR (95% CI)	P-value
Patient age (years; reference: 15–34 years)				
0–14	2.28 (1.90, 2.73)	<0.001	1.48 (1.18, 1.86)	<0.001
35–64	1.03 (0.87, 1.21)	0.72	1.28 (1.06, 1.56)	0.013
65+	1.67 (1.38, 2.04)	<0.001	2.21 (1.73, 2.82)	<0.001
Patient gender				
Female	0.78 (0.69, 0.89)	<0.001	0.89 (0.76, 1.04)	0.13
Aboriginal and Torres Strait Islander				
Yes	1.38 (0.85, 2.24)	0.19	1.76 (0.95, 3.27)	0.072
NESB				
Yes	1.26 (0.98, 1.63)	0.076	1.20 (0.91, 1.58)	0.20
Patient status (reference: patient seen by registrar before)				
New to practice	2.05 (1.61, 2.60)	<0.001	1.17 (0.87, 1.56)	0.29
New to registrar	1.60 (1.38, 1.86)	<0.001	1.34 (1.13, 1.59)	<0.001
Registrar worked at practice previously				
Yes	0.88 (0.74, 1.04)	0.13	1.19 (0.97, 1.46)	0.099
Practice size				
Small (1–5 FTE GPs)	0.84 (0.72, 0.98)	0.029	0.85 (0.70, 1.04)	0.11
Rurality (reference major city)				
Inner regional	0.85 (0.71, 1.01)	0.067	0.98 (0.76, 1.25)	0.85
Outer regional, remote or very remote	0.72 (0.58, 0.88)	0.0018	0.64 (0.44, 0.94)	0.021
RTP (reference: 1)				
2	1.12 (0.83, 1.51)	0.46	1.34 (0.93, 1.93)	0.12
3	0.97 (0.73, 1.28)	0.82	1.28 (0.89, 1.84)	0.18
4	1.42 (1.16, 1.75)	<0.001	1.78 (1.39, 2.28)	<0.001
5	0.95 (0.67, 1.36)	0.79	0.95 (0.52, 1.76)	0.88
New problem seen				
Yes	4.00 (3.37, 4.74)	<0.001	3.14 (2.59, 3.79)	<0.001
Sought help from any source				
Yes	4.76 (4.17, 5.44)	<0.001	2.77 (2.27, 3.38)	<0.001
Pathology ordered				
Yes	0.62 (0.50, 0.77)	<0.001	0.37 (0.28, 0.50)	<0.001
Follow-up ordered				
Yes	0.59 (0.51, 0.68)	<0.001	0.39 (0.33, 0.48)	<0.001
Learning goals generated				
Yes	2.70 (2.35, 3.11)	<0.001	1.35 (1.09, 1.66)	0.005
Medication prescribed				
Yes	0.40 (0.35, 0.47)	<0.001	0.33 (0.28, 0.40)	<0.001
Registrar age	1.00 (1.00, 1.00)	0.010	1.00 (1.00, 1.00)	0.80
Consultation duration	1.05 (1.05, 1.06)	<0.001	1.07 (1.06, 1.08)	<0.001
No. problems	0.40 (0.34, 0.46)	<0.001	0.34 (0.28, 0.40)	<0.001

ordered or medications prescribed were expected for high-acuity presentations requiring specialised ED management, with most of these observations also seen for established GPs.¹⁹

The significant association of ED referrals with the seeking of in-consultation information or assistance reflects the seriousness of these presentations and that the patient would still likely have been referred to the ED if seen by a senior GP rather than by the registrar. Assistance or information was sought primarily from a registrar's supervisor or another doctor in the practice (65.8% of all assistance sought). This is consistent with previous evidence in the registrar population that suggests that in-consultation information seeking is preferentially from human as opposed to non-human (hard-copy or online) resources for more complex or challenging clinical scenarios.³²

The finding that registrars were more likely to generate learning goals from ED-referred problems indicates these were

true learning experiences for the registrars, reflecting vocational training best-practice and self-directed learning rather than simple delegations of responsibility to ED colleagues. Furthermore, although expectedly fewer tests were ordered and medications prescribed in these acute presentations, demonstrable prehospital management by registrars was observed (pathology ordered in 12% of ED-referred cases and medications prescribed or administered in 25% of such cases). The statistically significant increase in consultation duration, despite fewer problems being managed, may be related to the seriousness of the problem being managed, but may also reflect registrars' active management (as opposed to purely expedient triage and discharge to the ED).

We found a striking difference in ED referrals in outer regional, remote and very remote regions compared with major cities (OR 0.64; 95% CI 0.44–0.94). This result should be treated with caution because it may reflect structural factors (see below).

Table 5. Sources of information, assistance or advice sought by registrars for emergency department (ED)-referred problems

Source	Frequency	Proportion of all sources of assistance ^A (%)	95% CI
Supervisor/other doctor in practice	417	65.77	61.9–69.5
Specialist	82	12.93	10.4–15.8
Other health professional	35	5.52	38.7–75.9
Electronic sources	73	11.51	9.1–14.3
Book(s)	13	2.05	1.1–3.5
Other	14	2.21	1.2–3.7
Total	634	100	

^AMore than one source of assistance may have been consulted for each ED-referred problem.

Study strengths and limitations

The strengths of the study included good generalisability to Australian GP vocational training given the involvement of five of 17 RTPs in five states across all rurality classifications from major city to very remote, and the markedly high response rate for GP studies.³³ The large number of variables measured in the ReCenT study allowed for adjustment for multiple potential confounding covariates.

A basic limitation of the present study is its cross-sectional nature and that causality cannot be inferred in the associations we found. Other limitations included the lack of data on the ‘appropriateness’ of referrals. We also lack data on the ‘outcomes’ of the referrals, including diagnostic and therapeutic outcomes and hospital admission. In addition, a scenario not addressed in our analysis was that of rural hospitals where local GPs have admitting rights for in-patient management and can thus admit patients directly, bypassing the ED altogether. This could account for our finding of ED referrals being less prevalent in outer regional, remote and very remote regions compared with major cities. Quantification of these direct referrals was beyond the scope of the present study.

Implications for educational policy and future research

The marked variability in referral prevalence between two RTPs found in the present study is a suitable subject for further research because it will have important educational implications. Future research could also investigate the prevalence and associations of ‘inappropriate’ referrals and outcomes of referral (e.g. hospital admission, within-ED investigation and management, and patient satisfaction).

Conclusions

We have established ED referral patterns of GP registrars within five Australian RTPs, with referral rates nearly twice those of more experienced GPs. This difference may be due largely to GP practice structural factors of patient appointment scheduling. Our results of an association of ED referral with the patient being new to the registrar suggests that continuity of care in general practice may be of importance, even in acute presentations. Further associations established in our analysis highlight the learning opportunities provided to the registrars by these

acute presentations. Observed inter-RTP variability in referral patterns warrants further research.

Competing interests

None declared.

Acknowledgements

The authors acknowledge the contribution of the participating registrars and the Regional Training Providers (RTPs) who facilitated and supported the study. The RTPs were funded by the Australian Government. The ReCenT project was funded in 2010–15 by the five RTPs participating in this study (General Practice Training Valley to Coast, Victorian Metropolitan Alliance, General Practice Training Tasmania, Adelaide to Outback GP Training Program and Tropical Medical Training). From 2016, ReCenT has been funded by a research grant from the Australian Government Department of Health and supported by the GP Synergy Regional Training Organisation. Several of the authors were employed with the RTPs involved or are currently employed by the participating regional training organisations. The RTP organisations supported and facilitated the data collection, but did not have a role in analysis or interpretation or writing. The RTPs did not influence the decision to submit the final manuscript for publication.

References

- Codde J, Bowen S, Lloyd E. Analysis of demand and utilisation of metropolitan emergency departments in Western Australia. Perth: WA Department of Health; 2006.
- McWilliams A, Tapp H, Barker J, Dulin M. Cost analysis of the use of emergency departments for primary care services in Charlotte, North Carolina. *N C Med J* 2011; 72: 265–71.
- Forero R, Hillman KM, McCarthy S, Fatovich DM, Joseph AP, Richardson DB. Access block and ED overcrowding. *Emerg Med Australas* 2010; 22: 119–35. doi:10.1111/j.1742-6723.2010.01270.x
- Foot C, Naylor C, Imison C. The quality of GP diagnosis and referral. London: The King’s Fund; 2010.
- O’Donnell CA. Variation in GP referral rates: what can we learn from the literature? *Fam Pract* 2000; 17: 462–71. doi:10.1093/fampra/17.6.462
- Rossdale M, Kemple T, Pyne S, Calnan M, Greenwood R. An observational study of variation in GPs’ out-of-hours emergency referrals. *Br J Gen Pract* 2007; 57: 152–4.
- Ieraci S, Cunningham P, Talbot-Stern J, Walker S. Emergency medicine and ‘acute’ general practice: comparing apples with oranges. *Aust Health Rev* 2000; 23: 152–61. doi:10.1071/AH000152
- Australasian College for Emergency Medicine (ACEM). Submission to Australian Government: September 2014 after hours primary health care review. [Press release] Melbourne: ACEM; 2014. Available at: <https://acem.org.au/getattachment/0a5194c7-7785-44fa-9431-1294eb0ac3f2/Submission-to-After-Hours-Primary-Health-Care-revi.aspx> [verified 18 October 2017]
- Ingram JC, Calnan MW, Greenwood RJ, Kemple T, Payne S, Rossdale M. Risk taking in general practice: GP out-of-hours referrals to hospital. *Br J Gen Pract* 2009; 59: e16–24. doi:10.3399/bjgp09X394824
- Rashid A, Jagger C. Comparing trainer and trainee referral rates: implications for education and allocation of resources. *Br J Gen Pract* 1990; 40: 53–5.
- Vehviläinen AT, Kumpusalo EA, Voutilainen SO, Takala JK. Does the doctors’ professional experience reduce referral rates? Evidence from the Finnish referral study. *Scand J Prim Health Care* 1996; 14: 13–20. doi:10.3109/02813439608997063
- Morgan S, Magin PJ, Henderson KM, Goode SM, Scott J, Bowe SJ, Regan CM, Sweeney KP, Jackel J, van Driel ML. Study protocol: the Registrar Clinical Encounters in Training (ReCenT) study. *BMC Fam Pract* 2012; 13: 50. doi:10.1186/1471-2296-13-50

- 13 Morgan S, Henderson K, Tapley A, Scott J, van Driel M, Thomson A, Spike N, McArthur L, Presser J, Magin P. How we use patient encounter data for reflective learning in family medicine training. *Med Teach* 2015; 37: 897–900. doi:10.3109/0142159X.2014.970626
- 14 Magin P, Morgan S, Henderson KM, Tapley A, Scott J, Spike NA, McArthur L, Presser J, Lockwood N, van Driel M. The Registrars' Clinical Encounters in Training (ReCEnT) project: educational and research aspects of documenting general practice trainees' clinical experience. *Aust Fam Physician* 2015; 44: 681–4.
- 15 Australian Bureau of Statistics. 1216.0 – Australian standard geographical classification (ASGC), July 2011. 2011. Available at: [http://www.ausstats.abs.gov.au/Ausstats/subscriber.nsf/0/32FBEDE1EA4C5800-CA25791F000F2E1C/\\$File/att98dqt.pdf](http://www.ausstats.abs.gov.au/Ausstats/subscriber.nsf/0/32FBEDE1EA4C5800-CA25791F000F2E1C/$File/att98dqt.pdf) [verified 18 October 2017].
- 16 Australian Bureau of Statistics. 2039.0 – Information paper: an introduction to socio-economic indexes for areas (SEIFA), 2006. 2008. Available at: <http://www.abs.gov.au/ausstats/abs@.nsf/mf/2039.0> [verified 18 October 2016].
- 17 Lamberts H, Woods M. International classification of primary care. Oxford: Oxford University Press; 1986.
- 18 O'Halloran J, Miller GC, Britt H. Defining chronic conditions for primary care with ICPC-2. *Fam Pract* 2004; 21: 381–6. doi:10.1093/fampra/cmh407
- 19 Charles J, Valenti L, Britt H. Referrals to A&E: changes over 5 years. *Aust Fam Physician* 2012; 41: 365.
- 20 Pearlman J, Morgan S, van Driel M, Henderson K, Tapley A, McElduff P, Scott J, Spike N, Thomson A, Magin P. Continuity of care in general practice vocational training: prevalence, associations and implications for training. *Educ Prim Care* 2016; 27: 27–36. doi:10.1080/14739879.2015.1101871
- 21 Bankart MJ, Baker R, Rashid A, Habiba M, Banerjee J, Hsu R, Conroy S, Agarwal S, Wilson A. Characteristics of general practices associated with emergency admission rates to hospital: a cross-sectional study. *Emerg Med J* 2011; 28: 558–63. doi:10.1136/emj.2010.108548
- 22 Mainous AG 3rd, Gill JM. The importance of continuity of care in the likelihood of future hospitalization: is site of care equivalent to a primary clinician? *Am J Public Health* 1998; 88: 1539–41. doi:10.2105/AJPH.88.10.1539
- 23 Buntinx F, Mant D, Van Den Bruel A, Donner-Banzhof N, Dinant GJ. Dealing with low-incidence serious diseases in general practice. *Br J Gen Pract* 2011; 61: 43–6. doi:10.3399/bjgp11X548974
- 24 Ringberg U, Fletten N, Førde OH. Examining the variation in GPs' referral practice: a cross-sectional study of GPs' reasons for referral. *Br J Gen Pract* 2014; 64: e426–33. doi:10.3399/bjgp14X680521
- 25 Calnan M, Payne S, Kemple T, Rosedale M, Ingram J. A qualitative study exploring variations in GPs' out-of-hours referrals to hospital. *Br J Gen Pract* 2007; 57: 706–13.
- 26 Charles J, Fahridin S, Britt H. Referrals to A&E. *Aust Fam Physician* 2008; 37: 505.
- 27 Freed GL, Spike N, Magin P, Morgan S, Fitzgerald M, Brooks P. The paediatric clinical experiences of general practice registrars. *Aust Fam Physician* 2012; 41: 529–33.
- 28 Hendry SJ, Beattie TF, Heaney D. Minor illness and injury: factors influencing attendance at a paediatric accident and emergency department. *Arch Dis Child* 2005; 90: 629–33. doi:10.1136/adc.2004.049502
- 29 Ryan M, Spicer M, Hyett C, Barnett P. Non-urgent presentations to a paediatric emergency department: parental behaviours, expectations and outcomes. *Emerg Med Australas* 2005; 17: 457–62. doi:10.1111/j.1742-6723.2005.00777.x
- 30 Freed GL, Gafforini S, Carson N. Age distribution of emergency department presentations in Victoria. *Emerg Med Australas* 2015; 27: 102–7. doi:10.1111/1742-6723.12368
- 31 Booz Allen Hamilton (Australia) Ltd. Key drivers of demand in the emergency department: a hypothesis driven approach to analyse demand and supply. Sydney: NSW Department of Health; 2007.
- 32 Magin P, Morgan S, Wearne S, Tapley A, Henderson K, Oldmeadow C, Ball J, Scott J, Spike N, McArthur L, van Driel M. GP trainees' in-consultation information-seeking: associations with human, paper and electronic sources. *Fam Pract* 2015; 32: 525–32. doi:10.1093/fampra/cmz047
- 33 Bonevski B, Magin P, Horton G, Foster M, Girgis A. Response rates in GP surveys – trialling two recruitment strategies. *Aust Fam Physician* 2011; 40: 427–30.