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Title:

General practice training in regional and rural Australia: a cross-sectional analysis of the ReCEnT study

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General practice training in regional and rural Australia: a cross-sectional analysis of the ReCEnT study

Objective

We aimed to investigate registrar, practice and consultation characteristics associated with varying degrees of GP registrars practice rurality.

Design

A cross-sectional analysis of twelve rounds of data collection (2010-2015) from the longitudinal Registrar Clinical Encounters in Training (ReCEnT) study, an ongoing, cohort study of Australian GP registrars. The principal analysis used was a generalised ordered logistic regression.

Setting/Participants

GP registrars in training practices with five of 17 general practice regional training providers in five Australian states.

Main outcome measure

Degree of rurality of the practice in which the registrar undertook training terms, calculated from the practice postcode using the Australian Standard Classification-Remoteness Area (ASGC-RA) classification.

Results

1,161 registrars contributed data for 166,998 patient consultations (response rate 95.5%). Of these, 56.9% [95% CI:56.7-57.2] were in major city practices (ASGC-RA1), 25.7% [95% CI:25.5-25.9] were in

inner-regional practices (ASGC-RA2) and 17.4% [95% CI:17.2-17.5] were in outer-regional/rural practices (ASGC-RA3-5). Several statistically significant associations ($p < 0.001$) were found within regional/rural practices (ASGC-RA2-5), when compared with major city practices (ASGC-RA1). These registrar characteristics included being in Term 1, being medically trained overseas, and having worked at the practice previously; patient characteristics included the patient being an existing patient, being older ($p < 0.001$ for 65+ years & $p = 0.004$ for 35-64 years) and being Aboriginal or Torres Strait Islander; and consultation characteristics included performance of procedures.

Conclusion(s)

Our findings suggest that registrars are undertaking rural practice early in their general practice training and are being exposed to a rich and challenging mix of clinical and educational practice.

Key Words –

Interpersonal continuity of care, Rurality, Vocational training, Education

“What is already known on this subject”

- Shortages and maldistribution of primary health care workforce contribute to inequities in health and access for regional and rural Australians.
- General practice vocational training aims to address this maldistribution.

“What this paper adds”

- GP registrar consultations in regional and rural locations are more likely than urban consultations to involve procedures, interpersonal continuity of care, older patients, and Aboriginal or Torres Strait Islander patients.
- These associations suggest regional and rural training locations provide a rich clinical and educational experience for general practice registrars.

Word count 2135

Background

Rural and regional Australian populations experience up to seven years less life expectancy than in urban areas, higher suicide rates, and decreasing rates of cancer survival(1). Access to primary care is the most important healthcare systems determinant of communities' health, efficiency and equity

of healthcare(2). Shortages and maldistribution of the general practice (GP) workforce, and the subsequent impact upon access to health care, are longstanding issues for Australian primary healthcare delivery(3).

Continued recruitment and retention of practitioners in regional and rural areas will attenuate these health and access inequalities(4). The Australian GP vocational training program is a major contributor in addressing the rural-urban GP maldistribution via the training location obligation policy(5). Evidence shows mandatory rural rotations result in rural retention after training(5, 6).

As well as serving workforce imperatives, rural GP training offers particular training experiences(7) including increased exposure to complex medical and surgical care(8), as well as unique learning experiences for registrars, including increased scope of practice(9). Rural practice may also entail considerable challenges and stressors for registrars, including perceived greater workload and responsibility(7), burnout(9) and perceived higher risk of occupational violence(10).

Understanding the epidemiology of registrars' training experience in rural and regional areas, compared to urban areas, is important for Australian GP training and for rural communities. We aimed to investigate registrar, practice and consultation characteristics associated with the degree of GP registrars' practice rurality.

Methods

The study was conducted within the Registrar Clinical Encounters in Training (ReCEnT) project.

ReCEnT

ReCEnT is an ongoing multi-site cohort study of GP registrars, in five of Australia's Regional Training Providers (RTPs) from five Australian states (from 2010-2015), NSW, QLD, SA, TAS and VIC. From 2016, ReCEnT is conducted in three of the nine Regional Training Organisations within Australia, however this data was not used for this study. Australian GP registrars train in an apprenticeship-like model(11). The population analysed includes Australian College of Rural and Remote Medicine registrars completing Primary Rural and Remote training in community primary care, and Royal Australian College of General Practitioners registrars in one of three compulsory general practice terms.

Registrars complete data collection, once in each of three six-month training terms (or per twelve-month term for part-time registrars), as a routine component of their education and training program. They may also provide consent for their data to be used for research purposes.

Data collection includes registrars' demographic data, as well as practice characteristics. Registrars record details of 60 consecutive clinical consultations per term via a paper-based case report form. Only office-based consultations are recorded (not home-visits or nursing home visits), and specialised clinics, such as flu-needle clinics, or women's health clinics, are not recorded. The consultation data includes patient demographics, diagnoses/problems managed, investigations/management and educational training aspects. The methodology is detailed further elsewhere(12).

Outcome factor

The outcome factor was the degree of 'rurality of the practice' in which the registrar completed their training terms. This was calculated from the postcode of the practice using the Australian Standard Geographical Classification-Remoteness Area (ASGC-RA) classification(13). Due to small numbers of registrars in practices in outer regional, remote and very remote areas, these were combined to make three categories for analysis: major city (ASGC-RA1: 'urban'), inner regional (ASGC-RA2: 'regional'), and outer-regional/remote/very-remote (ASGC-RA3-5: 'rural'). For the purpose of discussion, these final two categories will be combined and termed regional/rural.

Independent variables

Independent variables related to the practice, registrar, patient, consultation and consultation-outcomes. See Table 2 for these variables.

Statistical analysis

This was a cross-sectional analysis of 12 rounds of data (2010-15) from the longitudinal ReCEnT study, conducted at the consultation level.

The proportion of consultations in regional and rural practice was calculated with 95% confidence intervals adjusted for repeated measures within registrars.

We aimed to answer the questions:

- i. What are the associations of seeing a patient in a regional/rural practice?
- ii. How do consultations in regional/rural practices differ from consultations in urban practices?
- iii. How do outcomes from these consultations in regional/rural practices differ from consultations in urban practices?

To investigate our research questions, three regression models were built, one for each question, each with the outcome factor 'rurality of practice'.

Regression models were built in a sequential order to determine associations with the outcome.

To examine question i) patient, practice and registrar independent variables were entered in the regression model.

To examine question ii) the above variables were entered into the new model along with consultation variables.

To examine question iii) all variables entered in the two previous models were entered into the new model along with additional consultation-outcome variables.

The rationale for building three models was that evaluation of the demographic associations of urban-versus-regional-versus-rural consultations may be affected by inclusion in the model of factors operating once the consultation is progressing (consultation variables). Similarly, evaluation of the content of the consultation may be affected by the inclusion in this model of actions arising from the consultation (outcome variables).

An ordered logistic regression was used to accommodate three ordered outcome levels. This type of regression analysis combines outcome levels to perform multiple binary logistic regression models to estimate the effects. In this case we dichotomise urban vs regional/rural consultations; and then urban/regional vs rural consultations.

Univariate and multivariable generalised ordered logistic models were created. This regression technique was used to allow a less restrictive model than ordinal logistic regression, as assumptions of proportional odds were violated for some variables(14). Partial proportional odds models were thus fitted, allowing the proportional odds assumption to be relaxed for variables violating the assumption of proportional odds (at $p < 0.05$ based on a Wald test). Variables demonstrating proportional odds thus have a single parameter estimate for the model (assumed equal for the two possible dichotomisations of the ordered outcome variable), while those violating proportional odds have two distinct estimates. Repeated measures within registrars were adjusted for using a robust variance estimator to adjust standard errors for the presence of clustering.

Variables with a univariate p-value of < 0.20 were included in the adjusted regression models, and if no longer significant (at p-value < 0.05) were tested for removal from the final model.

Predictors were considered statistically significant if the p-value was < 0.05 .

Analyses were programmed using Stata 13.1 (Statacorp, Texas, USA).

Ethics Approval

Results

Data was collected during 12 project rounds of ReCEnT (2010-2015), including 1,161 registrars (response rate 95.5%), 2,812 registrar-rounds and 166,998 registrar-patient consultations.

Registrar and practice characteristics are presented in Table 1.

Descriptive results of our outcome variable registrars' degree of 'rurality of practice' are shown in Table 2.

Characteristics associated with rurality of practice are presented in Table 3, with univariate and multivariable regression models presented in Table 4.

There were several significant associations of registrar, patient and consultation characteristics within regional/rural practices that were statistically significant, when compared with urban practice. These included consultations in regional/rural practices being more likely to be undertaken by overseas trained doctors (Australian-trained OR 0.22), by registrars who had worked at the practice before (OR 2.41), by full-time registrars (OR 1.72 rural vs urban/regional only) and by registrars in their first general practice term (OR 0.64 Term 2; 0.67 Term 3, both compared to Term 1).

There were also statistically significant associations of registrars in regional/rural practices (compared with urban practices) being more likely to see patients aged 35-64-years (OR 1.08) and 65+-years (OR 1.3), but less likely to see patients 15-34-years (OR 0.91) all compared to patients aged 0-14-years. Consultations were also less likely to be with patients of non-English speaking backgrounds (OR 0.2), more likely to be with Aboriginal and Torres Strait Islander patients (OR 2.1), and less likely to be with patients new to the registrar (OR 0.91).

Regional/rural consultations were statistically significantly more likely to include procedures, rural consultations being even more likely than regional consultations (OR 1.1 regional/rural vs urban; 1.21 rural vs urban/regional).

Discussion

Main findings and comparison with existing literature

Registrars in regional practices made up a quarter of all registrars (25.7%), with 17.4% in rural practices, and 56.9% in urban practices. Less than 3% were working in remote or very remote

practices. This is compared to 2015/16 Australian workforce data showing 18% of established GPs working in regional practices and approximately 10% in rural practices(15).

We identified multiple associations of regional/rural registrars' practice; most notably registrars being more likely to have worked at the practice before, and to see patients they have seen before. Thus, regional/rurally-trained registrars appear to have greater continuity of patient care - a defining characteristic of general practice(16). Previous ReCEnT analyses suggest GP registrar experiences of interpersonal continuity of care may not be optimal(17), so regional and rural practice may be valuable in increasing registrars' in-training exposure to continuity. Similarly, our previous work has established that registrars have a relative deficit compared to established GPs in experience of older patient care(18), so our findings showing that registrars practicing rurally see a greater proportion of older patients is again valuable in-training exposure.

Registrars in regional/rural practices were also more likely to see Aboriginal and Torres Strait Islander patients, but less likely to see patients of non-English speaking background (despite the association of regional/rural practice with registrars having trained overseas), reflecting the demographics of rural areas(19). Additionally, registrars in regional/rural practices were more likely to perform procedures. These associations suggest a rich clinical experience and are consistent with qualitative findings of registrar rural experience and of rural GP work generally (more "stimulating and challenging"(7) and having a broader scope of clinical practice(20)).

A further finding was that registrars in their first general practice training term were more likely to be training in regional/rural practices than those in subsequent terms.

We found no gender difference in registrars training in regional/rural practices. While this is consistent with some previous studies(21, 22), there is contrary evidence that rural-area registrars or rural-interested registrars are more likely to be male(23).

Having received medical training overseas was associated with regional-area, reflecting Section 19AB of the Health Insurance Act 1973 restriction to districts of workforce shortage, including regional training practices.

Full-time training was associated with working rurally, consistent with previously-demonstrated perceived barriers to working rurally being lack of part-time or job-share work options(21).

Strengths and limitations

This data has been collected from a broad range of locations across all ASGC-RA categories. Additionally, the large number of consultations, together with the range of variables collected, ensured that we had power to examine associations of multiple consultation, patient, practice and registrar variables. Another strength is the high response rate – unusual for studies of GPs(24).

We lack data from Western Australian, Northern Territory and the Australian Capital Territory registrars. However, we believe that the results are broadly generalisable to Australian registrars as RTP programs are similar across Australia and our sample's demographics are similar to the national registrar population(25).

A potential limitation inherent in this study is the self-recording of registrars' activities. However, we feel this is unlikely to affect our results as our outcome is not self-report, rather derived from actual practice location.

Implications for policy and practice

GP registrars constitute 11% of the GP workforce by head-count and make a disproportionate contribution to regional and rural (compared to urban) workforce(15). Proportions of GP registrars and overall headcounts for both GPs and GP registrars have been increasing over time, in particular in outer regional/remote areas. Therefore, these findings are of importance in understanding the composition of the overall rural workforce landscape and inform rural workforce policy.

Our findings emphasize the educational as well as workforce implications of policies mandating regional/rural registrar training experience. For example, our findings related to interpersonal continuity of care; care of older persons and people who identify as Aboriginal and Torres Strait Islander; and performance of office procedures all support previous qualitative findings relating to the richness of the educational experience in rural areas (though we note that we also found lesser experience of working with NESB patients).

Junior registrars (term 1 registrars) were more likely to be working in regional/rural areas. As above, we have found evidence for regional/rural training location providing a singularly rich educational experience. There may be educational utility in early-in-training 'immersion' in the educationally-rich complexities of regional/rural practice.

Implications for further research

Closer understanding of differences in clinical experience and educational utility between urban and regional/rural training could be provided by qualitative methodologies or focussed questionnaire-based studies. Our broad-brush epidemiological data suggests that these differences might be

considerable. Further work could also explore the relative educational utility of stages of training for regional/rural practice.

A further area for research would be to link rural training location and experience to subsequent clinical behaviours to determine rural training experience effects on future clinical practice.

Conclusions

These findings suggest a richness of clinical and educational practice in registrars' regional/rural training experience. There should be consideration of how training organisations could maximise these training opportunities through structural approaches.

Table 1: Characteristics of participating registrars

Registrar characteristics (n=1156)		n (%)
Registrar gender	Male	390 (33.7%)
Qualified as doctor in Australia	Yes	913 (80.0%)
Registrar -round characteristics (n=2736)		

Registrar characteristics (n=1156)		n (%)
Registrar works full-time	Yes	2087 (78.0%)
Age (years)	Mean $\pm$ SD	32.6 $\pm$ 6.4
Term	Term 1	1061 (38.8%)
	Term 2	984 (36.0%)
	Term 3	691 (25.3%)
Registrar worked at practice previously	Yes	727 (27.0%)
Practice routinely bulk bills	Yes	490 (18.0%)
No. GPs working at the practice	1-4	919 (34.4%)
	5 or more	1754 (65.6%)
Rurality	Major city	1558 (57.0%)
	Inner regional	702 (25.7%)
	Outer regional / remote / very remote	474 (17.3%)
SEIFA decile	Mean $\pm$ SD	5.5 $\pm$ 2.9

Table 2: Descriptive results of Registrars' rurality of practice

Practice Location	n	%	95% CI
Urban (RA 1)	92446	56.9	56.7-57.2
Regional (RA 2)	41754	25.7	25.5-25.9
Rural (RA3-5)	28166	17.4	17.2-17.5
Outer regional (RA 3)	23965	1.6	14.4-14.8
Remote (RA 4)	3512	2.2	2.1-2.2
Very Remote (RA 5)	959	0.6	0.55-0.63

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Table 3: Characteristics associated with Rurality of practice (*number of consultations*(n)=162,914)

Variable	Class	Rurality of Practice n(%)			Global variable p-value*	
		Urban (1) (n=92,446)	Regional (2) (n=41,754)	Rural (3) (n=28,166)	Regional/Rural vs Urban	Rural vs Urban/Regional
Practice Variables						
Practice Size	Small	27,951 (30.7)	14,094 (34.9)	12,615 (46.3)		
	Large	63,057 (69.3)	26,238 (65.1)	14,655 (53.7)	<0.001	<0.001
Practice routinely bulk bills	No	71,646 (78.0)	36,383 (87.6)	24,385 (86.8)		
	Yes	20,202 (22.0)	5,131 (12.4)	3,722 (13.2)	<0.001	0.026
RTP	1	19,360 (20.9)	20,703 (49.6)	3,169 (11.3)		
	2	12,141 (13.1)	1,434 (3.4)	9,897 (35.1)		
	3	0 (0)	10,935 (26.2)	8,944 (31.8)		
	4	60,945 (65.9)	7,906 (18.9)	0 (0)		
	5	0 (0)	776 (1.9)	6,156 (21.9)	<0.001	0.65
Practice has internet access	No	837 (0.9)	835 (2.0)	896 (3.2)		
	Yes	91,310 (99.1)	40,739 (98.0)	27,270 (96.8)	0.002	0.003
Practice has practice nurses	No	4,012 (4.4)	1,193 (2.9)	1,254 (4.5)		
	Yes	87,716 (95.6)	39,901 (97.1)	26,792 (95.5)	0.33	0.60
SEIFA decile	mean (SD)	6.1 (3.0)	5.5 (2.5)	3.5 (1.9)	<0.001	<0.001

Variable	Class	Rurality of Practice n(%)			Global variable p-value*	
		Urban (1) (n=92,446)	Regional (2) (n=41,754)	Rural (3) (n=28,166)	Regional/Rural vs Urban	Rural vs Urban/Regional
Registrar Variables						
Age of registrar	mean (SD)	31.9 (6.1)	34.0 (6.6)	33.1 (6.5)	<0.001	0.38
Registrar gender	Male	31,727 (34.3)	13,005 (31.2)	12,367 (43.9)	0.48	0.003
	Female	60,719 (65.7)	28,749 (68.9)	15,799 (56.1)		
Registrar full-time or part-time	Part-time	20,897 (23.0)	9,506 (23.4)	4366 (16.0)	0.19	0.006
	Full-time	69,993 (77.0)	31,114 (76.6)	22,904 (84.0)		
Training term/post	Term1	35,304 (38.2)	15,906 (38.1)	11,731 (41.7)	0.13	0.002
	Term2	32,976 (35.7)	14,754 (35.3)	10,587 (37.6)		
	Term3	24,166 (26.1)	11,094 (26.6)	5,848 (20.8)		
Qualified as doctor in Australia	No	9,490 (10.4)	15,717 (37.7)	7,787 (28.0)	<0.001	0.003
	Yes	81,916 (89.6)	25,977 (62.3)	20,019 (72.0)		
Worked at the practice before	No	73,185 (80.4)	27,412 (66.6)	16,124 (58.4)	<0.001	<0.001
	Yes	17,827 (19.6)	13,758 (33.4)	11,503 (41.6)		
Pathway enrolled in	Rural	836 (0.9)	20,988 (50.8)	20,783 (74.1)	<0.001	<0.001
	General	91,550 (99.1)	20,347 (49.2)	7,265 (25.9)		

Variable	Class	Rurality of Practice n(%)			Global variable p-value*	
		Urban (1) (n=92,446)	Regional (2) (n=41,754)	Rural (3) (n=28,166)	Regional/Rural vs Urban	Rural vs Urban/Regional
Has previous university qualifications in health-related field	No	76,198 (82.9)	36,264 (87.6)	22,915 (82.1)		
	Yes	15,740 (17.1)	5,131 (12.4)	5,013 (17.9)	0.24	0.41
Has postgraduate qualifications	No	65,327 (71.1)	29,721 (71.3)	19,265 (69.2)		
	Yes	26,607 (28.9)	11,973 (28.7)	8,557 (30.8)	0.82	0.59
Does other medical work	No	78,566 (85.0)	35,181 (84.3)	21,373 (75.9)		
	Yes	13,880 (15.1)	6,573 (15.7)	6,793 (24.1)	0.02	<0.001
Years working in hospital	mean (SD)	3.0 (2.8)	3.6 (3.5)	3.1 (3.1)	0.02	0.76
Patient Variables						
Patient age	0-14	16,779 (18.4)	6,779 (16.5)	4,369 (15.7)		
	15-34	26,557 (29.1)	10,036 (25.5)	6,414 (23.1)		
	35-64	34,097 (37.4)	15,878 (38.7)	10,876 (39.1)		
	65+	13,724 (15.1)	8,355 (20.4)	6,143 (22.1)	<0.001	<0.001
Patient gender	Male	34,429 (38.2)	15,423 (38.0)	11,025 (40.2)		
	Female	55,649 (61.8)	25,215 (62.1)	16,413 (59.8)	0.29	0.006
ATSI	No	86,576 (99.0)	38,562 (98.8)	25,729 (96.6)		

Variable	Class	Rurality of Practice n(%)			Global variable p-value*	
		Urban (1) (n=92,446)	Regional (2) (n=41,754)	Rural (3) (n=28,166)	Regional/Rural vs Urban	Rural vs Urban/Regional
NESB	Yes	835 (1.0)	465 (1.2)	904 (3.4)	<0.001	<0.001
	No	79,242 (90.2)	38,408 (97.2)	26,470 (98.1)		
Patient/practice status	Yes	8,649 (9.8)	1,097 (2.8)	504 (1.9)	<0.001	<0.001
	Existing Patient	35,082 (38.8)	17,746 (43.6)	13583 (49.2)		
	New to registrar	48,690 (53.9)	20,305 (49.9)	12,282 (44.5)		
	New to practice	6,604 (7.3)	2,618 (6.4)	1,765 (6.4)	<0.001	<0.001
Consultation Variables						
Consultation duration	<6 minutes	2,585 (3.0)	1,416 (3.6)	1,068 (4.1)		
	6-19 minutes	55,564 (63.6)	25,138 (64.0)	16,936 (64.5)		
	20-40 minutes	27,126 (31.0)	11,817 (30.1)	7,631 (29.1)		
	41+ minutes	2,121 (2.4)	929 (2.4)	610 (2.3)	0.02	0.03
Number of problems	Mean (SD)	1.6 (0.8)	1.5 (0.8)	1.6 (0.8)	0.60	0.78
Any sources of information used during the consultation	No	72,697 (78.6)	32,252 (77.2)	22,323 (79.3)		
	Yes	19,749 (21.4)	9,502 (22.8)	5,843 (20.7)	0.53	0.39
Any imaging ordered	No	82,194 (88.9)	36,965 (88.5)	25,162 (89.3)		

Variable	Class	Rurality of Practice n(%)			Global variable p-value*	
		Urban (1) (n=92,446)	Regional (2) (n=41,754)	Rural (3) (n=28,166)	Regional/Rural vs Urban	Rural vs Urban/Regional
Any referrals made	Yes	10,252 (11.1)	4,789 (11.5)	3,004 (10.7)	0.82	0.08
	No	76,519 (82.8)	34,517 (82.7)	23,514 (83.5)		
Any pathology ordered	Yes	15,927 (17.2)	7,237 (17.3)	4,652 (16.5)	0.52	0.09
	No	71,984 (77.9)	32,427 (77.7)	21,632 (76.8)		
Any learning goals generated	Yes	20,462 (22.1)	9,327 (22.3)	6,534 (23.2)	0.18	0.07
	No	70,702 (78.4)	28,631 (71.1)	19,994 (73.6)		
Any follow-up organised	Yes	19,445 (21.6)	11,637 (28.9)	7,160 (26.4)	<0.001	0.10
	No	42,343 (45.8)	17,967 (43.0)	11,945 (42.4)		
Any medications prescribed	Yes	50,103 (54.2)	23,787 (57.0)	16,221 (57.6)	0.003	0.07
	No	39,031 (42.2)	16,473 (39.5)	11,509 (40.9)		
Any procedures done	Yes	53,415 (57.8)	25,281 (60.6)	16,657 (59.1)	<0.001	0.53
	No	83,492 (90.3)	37,929 (90.8)	24,856 (88.3)		
Any chronic disease seen	Yes	8,954 (9.7)	3,825 (9.2)	3,310 (11.8)	0.11	<0.001
	No	69,022 (74.7)	29,621 (70.9)	19,934 (70.8)		
	Yes	23,424 (25.3)	12,133 (29.1)	8,232 (29.2)	<0.001	0.001

* univariate generalised ordered logistic regression global Wald statistic p-value (with standard errors adjusted for clustering)

Table 4: Associations of registrars' rurality of practice from univariate and multivariable logistic regression.

		Univariate				Multivariable			
		Regional/Rural vs Urban		Rural vs Urban/Regional		Regional/Rural vs Urban		Rural vs Urban/Regional	
Variable	Class	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P
Model (i)									
Practice Variables									
Bulk billing practice	Yes	0.52 (0.39-0.68)	<0.001	0.65 (0.45-0.95)	0.03	0.40 (0.29-0.54)	<0.001	0.74 (0.52-1.05)	0.09
Practice size	Large	0.68 (0.56-0.82)	<0.001	0.55 (0.42-0.71)	<0.001	0.62 (0.51-0.77)*		<0.001	
Practice SEIFA decile		0.84 (0.81-0.87)	<0.001	0.68 (0.64-0.72)	<0.001	0.84 (0.81-0.88)	<0.001	0.67 (0.63-0.71)	<0.001
Registrar Variables									
Gender registrar	Female	0.92 (0.72-1.16)	0.48	0.64 (0.47-0.86)	0.003	0.96 (0.75-1.23)*		0.77	
Qualified as doctor in Australia	Yes	0.23 (0.17-0.31)	<0.001	0.60 (0.43-0.84)	0.003	0.22 (0.16-0.31)	<0.001	0.86 (0.58-1.26)	0.43
Registrar term	2	0.98 (0.91-1.06)	0.66	0.97 (0.88-1.06)	0.48	0.64 (0.54-0.74)*		<0.001	
	Referent: 1 3	0.90 (0.78-1.03)	0.13	0.72 (0.59-0.89)	0.002	0.67 (0.55-0.81)*		<0.001	
Registrar full-time or Part-time	Full-time	1.16 (0.93-1.45)	0.19	1.58 (1.14-2.18)	0.006	1.13 (0.87-1.47)	0.36	1.72 (1.21-2.43)	0.002
Does other medical work	Yes	1.34 (1.05-1.71)	0.02	1.77 (1.33-2.35)	<0.001	1.29 (0.99-1.70)	0.064	1.89 (1.39-2.57)	<0.001
Worked at the practice before	Yes	2.38 (2.05-2.76)	<0.001	2.27 (1.90-2.71)	<0.001	2.41 (2.00-2.92)*		<0.001	

		Univariate				Multivariable			
		Regional/Rural vs Urban		Rural vs Urban/Regional		Regional/Rural vs Urban		Rural vs Urban/Regional	
Variable	Class	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P
Years worked in hospital		1.05 (1.01-1.09)	0.02	0.99 (0.93-1.05)	0.76	0.98 (0.94-1.03)*		0.46	
Patient Variables									
Patient age	15-34	0.93 (0.88-0.98)	0.009	0.95 (0.88-1.01)	0.10	0.91 (0.86-0.97)	0.002	0.97 (0.91-1.04)	0.43
Referent: 0-14	35-64	1.18 (0.13-1.24)	<0.001	1.17 (1.10-1.25)	<0.001	1.08 (1.02-1.13)*		0.004	
	65+	1.59 (1.46-1.73)	<0.001	1.50 (1.35-1.67)	<0.001	1.30 (1.19-1.42)*		<0.001	
Patient with non-English speaking background	Yes	0.23 (0.19-0.27)	<0.001	0.23 (0.17-0.30)	<0.001	0.20 (0.16-0.26)*		<0.001	
Patient ATSI	Yes	2.21 (1.74-2.80)	<0.001	3.38 (2.68-4.27)	<0.001	2.10 (1.60-2.76)*		<0.001	
Patient/practice status	New to registrar	0.75 (0.71-0.80)	<0.001	0.69 (0.64-0.75)	<0.001	0.91 (0.86-0.96)*		0.001	
Referent: Existing Pt	New to practice	0.74 (0.68-0.81)	<0.001	0.74 (0.66-0.84)	<0.001	0.95 (0.87-1.04)	0.28	1.08 (0.96-1.21)	0.20
Model (ii)									
Consultation Variables									
Consultation duration	<6 minutes	1.27 (1.12-1.44)	<0.001	1.27 (1.08-1.50)	0.004	1.22 (1.08-1.38)*		0.002	
Referent: 6-19 minutes	20-40 minutes	0.95 (0.88-1.01)	0.12	0.93 (0.85-1.02)	0.14	0.95 (0.88-1.02)*		0.14	
	41+ minutes	0.96 (0.82-1.11)	0.58	0.95 (0.79-1.15)	0.62	0.97 (0.83-1.12)*		0.66	

		Univariate				Multivariable			
		Regional/Rural vs Urban		Rural vs Urban/Regional		Regional/Rural vs Urban		Rural vs Urban/Regional	
Variable	Class	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P
Chronic disease	Yes	1.21 (1.14-1.28)	<0.001	1.15 (1.06-1.24)	0.001	1.06 (0.99-1.12)	0.08	0.98 (0.91-1.06)	0.67
Procedure performed	Yes	1.06 (0.99-1.14)	0.11	1.27 (1.15-1.39)	<0.001	1.10 (1.02-1.19)	0.01	1.21 (1.10-1.33)	<0.001
Model (iii)									
Consultation Outcome Variables									
Learning goal/s generated	Yes	1.41 (1.25-1.58)	<0.001	1.14 (0.98-1.34)	0.10	1.06 (0.94-1.20)*		0.33	
Pathology ordered	Yes	1.03 (0.99-1.08)	0.18	1.06 (1.00-1.13)	0.07	1.07 (1.02-1.13)*		0.003	
Referral made	Yes	0.98 (0.94-1.03)	0.52	0.95 (0.89-1.01)	0.09	0.95 (0.91-1.01)*		0.08	

* Variable did not violate proportional odds – only one OR and p-value given across all three outcome variable levels

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Table 1: Characteristics of participating registrars

Registrar characteristics (n=1156)		n (%)
Registrar gender	Male	390 (33.7%)
Qualified as doctor in Australia	Yes	913 (80.0%)
Registrar -round characteristics (n=2736)		
Registrar works full-time	Yes	2087 (78.0%)
Age (years)	Mean $\pm$ SD	32.6 $\pm$ 6.4
Term	Term 1	1061 (38.8%)
	Term 2	984 (36.0%)
	Term 3	691 (25.3%)
Registrar worked at practice previously	Yes	727 (27.0%)
Practice routinely bulk bills	Yes	490 (18.0%)
No. GPs working at the practice	1-4	919 (34.4%)
	5 or more	1754 (65.6%)
Rurality	Major city	1558 (57.0%)
	Inner regional	702 (25.7%)
	Outer regional / remote / very remote	474 (17.3%)
SEIFA decile	Mean $\pm$ SD	5.5 $\pm$ 2.9

Table 2: Descriptive results of Registrars' rurality of practice

Practice Location	n	%	95% CI
Urban (RA 1)	92446	56.9	56.7-57.2
Regional (RA 2)	41754	25.7	25.5-25.9
Rural (RA3-5)	28166	17.4	17.2-17.5
Outer regional (RA 3)	23965	1.6	14.4-14.8
Remote (RA 4)	3512	2.2	2.1-2.2
Very Remote (RA 5)	959	0.6	0.55-0.63

Table 3: Characteristics associated with Rurality of practice (*number of consultations*(n)=162,914)

Variable	Class	Rurality of Practice n(%)			Global variable p-value*	
		Urban (1) (n=92,446)	Regional (2) (n=41,754)	Rural (3) (n=28,166)	Regional/Rural vs Urban	Rural vs Urban/Regional
Practice Variables						
Practice Size	Small	27,951 (30.7)	14,094 (34.9)	12,615 (46.3)		
	Large	63,057 (69.3)	26,238 (65.1)	14,655 (53.7)	<0.001	<0.001
Practice routinely bulk bills	No	71,646 (78.0)	36,383 (87.6)	24,385 (86.8)		
	Yes	20,202 (22.0)	5,131 (12.4)	3,722 (13.2)	<0.001	0.026
RTP	1	19,360 (20.9)	20,703 (49.6)	3,169 (11.3)		
	2	12,141 (13.1)	1,434 (3.4)	9,897 (35.1)		
	3	0 (0)	10,935 (26.2)	8,944 (31.8)		
	4	60,945 (65.9)	7,906 (18.9)	0 (0)		
	5	0 (0)	776 (1.9)	6,156 (21.9)	<0.001	0.65
Practice has internet access	No	837 (0.9)	835 (2.0)	896 (3.2)		
	Yes	91,310 (99.1)	40,739 (98.0)	27,270 (96.8)	0.002	0.003
Practice has practice nurses	No	4,012 (4.4)	1,193 (2.9)	1,254 (4.5)		
	Yes	87,716 (95.6)	39,901 (97.1)	26,792 (95.5)	0.33	0.60
SEIFA decile	mean (SD)	6.1 (3.0)	5.5 (2.5)	3.5 (1.9)	<0.001	<0.001

Variable	Class	Rurality of Practice n(%)			Global variable p-value*	
		Urban (1) (n=92,446)	Regional (2) (n=41,754)	Rural (3) (n=28,166)	Regional/Rural vs Urban	Rural vs Urban/Regional
Registrar Variables						
Age of registrar	mean (SD)	31.9 (6.1)	34.0 (6.6)	33.1 (6.5)	<0.001	0.38
Registrar gender	Male	31,727 (34.3)	13,005 (31.2)	12,367 (43.9)	0.48	0.003
	Female	60,719 (65.7)	28,749 (68.9)	15,799 (56.1)		
Registrar full-time or part-time	Part-time	20,897 (23.0)	9,506 (23.4)	4366 (16.0)	0.19	0.006
	Full-time	69,993 (77.0)	31,114 (76.6)	22,904 (84.0)		
Training term/post	Term1	35,304 (38.2)	15,906 (38.1)	11,731 (41.7)	0.13	0.002
	Term2	32,976 (35.7)	14,754 (35.3)	10,587 (37.6)		
	Term3	24,166 (26.1)	11,094 (26.6)	5,848 (20.8)		
Qualified as doctor in Australia	No	9,490 (10.4)	15,717 (37.7)	7,787 (28.0)	<0.001	0.003
	Yes	81,916 (89.6)	25,977 (62.3)	20,019 (72.0)		
Worked at the practice before	No	73,185 (80.4)	27,412 (66.6)	16,124 (58.4)	<0.001	<0.001
	Yes	17,827 (19.6)	13,758 (33.4)	11,503 (41.6)		
Pathway enrolled in	Rural	836 (0.9)	20,988 (50.8)	20,783 (74.1)	<0.001	<0.001
	General	91,550 (99.1)	20,347 (49.2)	7,265 (25.9)		

Variable	Class	Rurality of Practice n(%)			Global variable p-value*	
		Urban (1) (n=92,446)	Regional (2) (n=41,754)	Rural (3) (n=28,166)	Regional/Rural vs Urban	Rural vs Urban/Regional
Has previous university qualifications in health-related field	No	76,198 (82.9)	36,264 (87.6)	22,915 (82.1)		
	Yes	15,740 (17.1)	5,131 (12.4)	5,013 (17.9)	0.24	0.41
Has postgraduate qualifications	No	65,327 (71.1)	29,721 (71.3)	19,265 (69.2)		
	Yes	26,607 (28.9)	11,973 (28.7)	8,557 (30.8)	0.82	0.59
Does other medical work	No	78,566 (85.0)	35,181 (84.3)	21,373 (75.9)		
	Yes	13,880 (15.1)	6,573 (15.7)	6,793 (24.1)	0.02	<0.001
Years working in hospital	mean (SD)	3.0 (2.8)	3.6 (3.5)	3.1 (3.1)	0.02	0.76
Patient Variables						
Patient age	0-14	16,779 (18.4)	6,779 (16.5)	4,369 (15.7)		
	15-34	26,557 (29.1)	10,036 (25.5)	6,414 (23.1)		
	35-64	34,097 (37.4)	15,878 (38.7)	10,876 (39.1)		
	65+	13,724 (15.1)	8,355 (20.4)	6,143 (22.1)	<0.001	<0.001
Patient gender	Male	34,429 (38.2)	15,423 (38.0)	11,025 (40.2)		
	Female	55,649 (61.8)	25,215 (62.1)	16,413 (59.8)	0.29	0.006
ATSI	No	86,576 (99.0)	38,562 (98.8)	25,729 (96.6)		

Variable	Class	Rurality of Practice n(%)			Global variable p-value*	
		Urban (1) (n=92,446)	Regional (2) (n=41,754)	Rural (3) (n=28,166)	Regional/Rural vs Urban	Rural vs Urban/Regional
NESB	Yes	835 (1.0)	465 (1.2)	904 (3.4)	<0.001	<0.001
	No	79,242 (90.2)	38,408 (97.2)	26,470 (98.1)		
Patient/practice status	Yes	8,649 (9.8)	1,097 (2.8)	504 (1.9)	<0.001	<0.001
	Existing Patient	35,082 (38.8)	17,746 (43.6)	13583 (49.2)		
	New to registrar	48,690 (53.9)	20,305 (49.9)	12,282 (44.5)		
	New to practice	6,604 (7.3)	2,618 (6.4)	1,765 (6.4)	<0.001	<0.001
Consultation Variables						
Consultation duration	<6 minutes	2,585 (3.0)	1,416 (3.6)	1,068 (4.1)		
	6-19 minutes	55,564 (63.6)	25,138 (64.0)	16,936 (64.5)		
	20-40 minutes	27,126 (31.0)	11,817 (30.1)	7,631 (29.1)		
	41+ minutes	2,121 (2.4)	929 (2.4)	610 (2.3)	0.02	0.03
Number of problems	Mean (SD)	1.6 (0.8)	1.5 (0.8)	1.6 (0.8)	0.60	0.78
Any sources of information used during the consultation	No	72,697 (78.6)	32,252 (77.2)	22,323 (79.3)		
	Yes	19,749 (21.4)	9,502 (22.8)	5,843 (20.7)	0.53	0.39
Any imaging ordered	No	82,194 (88.9)	36,965 (88.5)	25,162 (89.3)		

Variable	Class	Rurality of Practice n(%)			Global variable p-value*	
		Urban (1) (n=92,446)	Regional (2) (n=41,754)	Rural (3) (n=28,166)	Regional/Rural vs Urban	Rural vs Urban/Regional
Any referrals made	Yes	10,252 (11.1)	4,789 (11.5)	3,004 (10.7)	0.82	0.08
	No	76,519 (82.8)	34,517 (82.7)	23,514 (83.5)		
Any pathology ordered	Yes	15,927 (17.2)	7,237 (17.3)	4,652 (16.5)	0.52	0.09
	No	71,984 (77.9)	32,427 (77.7)	21,632 (76.8)		
Any learning goals generated	Yes	20,462 (22.1)	9,327 (22.3)	6,534 (23.2)	0.18	0.07
	No	70,702 (78.4)	28,631 (71.1)	19,994 (73.6)		
Any follow-up organised	Yes	19,445 (21.6)	11,637 (28.9)	7,160 (26.4)	<0.001	0.10
	No	42,343 (45.8)	17,967 (43.0)	11,945 (42.4)		
Any medications prescribed	Yes	50,103 (54.2)	23,787 (57.0)	16,221 (57.6)	0.003	0.07
	No	39,031 (42.2)	16,473 (39.5)	11,509 (40.9)		
Any procedures done	Yes	53,415 (57.8)	25,281 (60.6)	16,657 (59.1)	<0.001	0.53
	No	83,492 (90.3)	37,929 (90.8)	24,856 (88.3)		
Any chronic disease seen	Yes	8,954 (9.7)	3,825 (9.2)	3,310 (11.8)	0.11	<0.001
	No	69,022 (74.7)	29,621 (70.9)	19,934 (70.8)		
	Yes	23,424 (25.3)	12,133 (29.1)	8,232 (29.2)	<0.001	0.001

* univariate generalised ordered logistic regression global Wald statistic p-value (with standard errors adjusted for clustering)

Table 4: Associations of registrars' rurality of practice from univariate and multivariable logistic regression.

		Univariate				Multivariable			
		Regional/Rural vs Urban		Rural vs Urban/Regional		Regional/Rural vs Urban		Rural vs Urban/Regional	
Variable	Class	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P
Model (i)									
Practice Variables									
Bulk billing practice	Yes	0.52 (0.39-0.68)	<0.001	0.65 (0.45-0.95)	0.03	0.40 (0.29-0.54)	<0.001	0.74 (0.52-1.05)	0.09
Practice size	Large	0.68 (0.56-0.82)	<0.001	0.55 (0.42-0.71)	<0.001	0.62 (0.51-0.77)*		<0.001	
Practice SEIFA decile		0.84 (0.81-0.87)	<0.001	0.68 (0.64-0.72)	<0.001	0.84 (0.81-0.88)	<0.001	0.67 (0.63-0.71)	<0.001
Registrar Variables									
Gender registrar	Female	0.92 (0.72-1.16)	0.48	0.64 (0.47-0.86)	0.003	0.96 (0.75-1.23)*		0.77	
Qualified as doctor in Australia	Yes	0.23 (0.17-0.31)	<0.001	0.60 (0.43-0.84)	0.003	0.22 (0.16-0.31)	<0.001	0.86 (0.58-1.26)	0.43
Registrar term	2	0.98 (0.91-1.06)	0.66	0.97 (0.88-1.06)	0.48	0.64 (0.54-0.74)*		<0.001	
	Referent: 1 3	0.90 (0.78-1.03)	0.13	0.72 (0.59-0.89)	0.002	0.67 (0.55-0.81)*		<0.001	
Registrar full-time or Part-time	Full-time	1.16 (0.93-1.45)	0.19	1.58 (1.14-2.18)	0.006	1.13 (0.87-1.47)	0.36	1.72 (1.21-2.43)	0.002
Does other medical work	Yes	1.34 (1.05-1.71)	0.02	1.77 (1.33-2.35)	<0.001	1.29 (0.99-1.70)	0.064	1.89 (1.39-2.57)	<0.001
Worked at the practice before	Yes	2.38 (2.05-2.76)	<0.001	2.27 (1.90-2.71)	<0.001	2.41 (2.00-2.92)*		<0.001	

		Univariate				Multivariable			
		Regional/Rural vs Urban		Rural vs Urban/Regional		Regional/Rural vs Urban		Rural vs Urban/Regional	
Variable	Class	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P
Years worked in hospital		1.05 (1.01-1.09)	0.02	0.99 (0.93-1.05)	0.76	0.98 (0.94-1.03)*		0.46	
Patient Variables									
Patient age	15-34	0.93 (0.88-0.98)	0.009	0.95 (0.88-1.01)	0.10	0.91 (0.86-0.97)	0.002	0.97 (0.91-1.04)	0.43
Referent: 0-14	35-64	1.18 (0.13-1.24)	<0.001	1.17 (1.10-1.25)	<0.001	1.08 (1.02-1.13)*		0.004	
	65+	1.59 (1.46-1.73)	<0.001	1.50 (1.35-1.67)	<0.001	1.30 (1.19-1.42)*		<0.001	
Patient with non-English speaking background	Yes	0.23 (0.19-0.27)	<0.001	0.23 (0.17-0.30)	<0.001	0.20 (0.16-0.26)*		<0.001	
Patient ATSI	Yes	2.21 (1.74-2.80)	<0.001	3.38 (2.68-4.27)	<0.001	2.10 (1.60-2.76)*		<0.001	
Patient/practice status	New to registrar	0.75 (0.71-0.80)	<0.001	0.69 (0.64-0.75)	<0.001	0.91 (0.86-0.96)*		0.001	
Referent: Existing Pt	New to practice	0.74 (0.68-0.81)	<0.001	0.74 (0.66-0.84)	<0.001	0.95 (0.87-1.04)	0.28	1.08 (0.96-1.21)	0.20
Model (ii)									
Consultation Variables									
Consultation duration	<6 minutes	1.27 (1.12-1.44)	<0.001	1.27 (1.08-1.50)	0.004	1.22 (1.08-1.38)*		0.002	
Referent: 6-19 minutes	20-40 minutes	0.95 (0.88-1.01)	0.12	0.93 (0.85-1.02)	0.14	0.95 (0.88-1.02)*		0.14	
	41+ minutes	0.96 (0.82-1.11)	0.58	0.95 (0.79-1.15)	0.62	0.97 (0.83-1.12)*		0.66	

		Univariate				Multivariable			
		Regional/Rural vs Urban		Rural vs Urban/Regional		Regional/Rural vs Urban		Rural vs Urban/Regional	
Variable	Class	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P
Chronic disease	Yes	1.21 (1.14-1.28)	<0.001	1.15 (1.06-1.24)	0.001	1.06 (0.99-1.12)	0.08	0.98 (0.91-1.06)	0.67
Procedure performed	Yes	1.06 (0.99-1.14)	0.11	1.27 (1.15-1.39)	<0.001	1.10 (1.02-1.19)	0.01	1.21 (1.10-1.33)	<0.001
Model (iii)									
Consultation Outcome Variables									
Learning goal/s generated	Yes	1.41 (1.25-1.58)	<0.001	1.14 (0.98-1.34)	0.10	1.06 (0.94-1.20)*		0.33	
Pathology ordered	Yes	1.03 (0.99-1.08)	0.18	1.06 (1.00-1.13)	0.07	1.07 (1.02-1.13)*		0.003	
Referral made	Yes	0.98 (0.94-1.03)	0.52	0.95 (0.89-1.01)	0.09	0.95 (0.91-1.01)*		0.08	

* Variable did not violate proportional odds – only one OR and p-value given across all three outcome variable levels

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