The independent effect of age of general practitioner on clinical practice

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ABSTRACT

Objective: To establish the extent to which general practitioner age alone explains variations in patient morbidity and treatment patterns.

Setting: An on-going, national survey of general practice activity in Australia.

Participants: A random sample of 5013 GPs with a minimum of 375 general practice Medicare items claimed in the previous 3 months. Each GP contributed details of 100 consecutive encounters, with about 1000 GPs sampled each year between 1998 and 2003.

Main outcome measures: Effect of practitioner age on GP activity after removing the influence of measured confounding factors: doctor, patient and practice characteristics; number of problems; and morbidity managed at encounters.

Results: GP age played a significant role in practice style. In comparison with young GPs (< 35 years), older GPs provided more home visits ($P < 0.001$) and attendances at residential aged-care facilities ($P = 0.044$); were more likely to manage chronic problems ($P < 0.001$); had higher prescribing rates ($P < 0.001$), and lower rates of pathology ordering ($P < 0.001$) and non-pharmacological treatments ($P < 0.001$). Individual body system management rates also differed significantly between younger and older GPs.

Conclusion: A GP's age plays a significant role in determining practice style. Our results have implications in terms of the ageing GP population and in the wider context of the ageing medical labour force.

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General practice style is influenced by age, qualifications and sex of practitioner, and patient population. Researchers in Canada found a link between physicians' age and quality of care,[1] and recent Australian research showed an association between age and length of consultation.[2]

A 2004 study found that the Australian general practice workforce aged significantly between 1991 and 2003,[3] and as there are now more general practitioner registrar positions than there are applicants for training,[4,5] the trend towards an older GP workforce is likely to continue. Continuity of care is important to patients,[6,7] and a high percentage remain with their chosen GP over time,[8,9] so patients often grow older with their GP, and there is evidence that patient population influences practice style.[10] Change over time in medical education is another factor.[11,12]

Given these trends, we can assume that newcomers to the general practice workforce will possess similar characteristics to the younger GPs currently practising, but it is difficult to predict how much that will influence their style as they and their patients age. One study found that young GPs' antibiotic prescribing patterns gradually converge towards the mean,[13] and another found remarkable consistency in diagnostic recording over time.[10]

A recent systematic review of studies that included length of time in medical practice and quality of care found that increasing practitioner experience often had a negative effect on performance.[14] Trends in hypertension management,[15] standards of care for diabetes mellitus,[16] adoption of new procedures,[17] and inappropriate prescribing[18] were among the topics examined.

We sought to isolate GP age from other measurable factors and examine its independent effect on practice method and the patient encounter. We used data from a quarter of the practising GP population in Australia to compare those from different age groups for their characteristics, their patient clusters, and the morbidity they managed.[19]

METHODS

This is a secondary analysis of data from the BEACH (Bettering the Evaluation and Care of Health) program, a continuous national study of general practice activity in Australia.[19] In brief, about 20 different GPs participate per week, each recording details of 100 consecutive doctor–patient encounters. They also provide their demographic and practice characteristics. Data from April 1998 to March 2003, provided by 5013 GPs, were used. Participating GPs were divided into five age groups for analysis. Problems managed were classified according to the International Classification of Primary Care, version 2 (ICPC-2).[20]

Analysis

Univariate descriptive analyses, using SAS version 8.2 (SAS Institute Inc, Cary, NC, USA), show the unadjusted differences between GP age groups. Association of GP age group and GP characteristics were tested using χ^2 analysis. Patient and encounter characteristics, problems managed, and treatments are reported as rates per 100 encounters or problems, with robust 95% confidence intervals, adjusted for the study cluster design. Non-overlapping CIs indicate significant differences.

General linear modelling using Stata statistical software, release 7.0 (StataCorp, College Station, Tex, USA) was used to compare the

1 Models used in logistic regression analysis

Model A: for encounter and treatment outcomes

The covariates controlled for were:

- *GP and practice characteristics*: sex, sessions worked per week, place of graduation (Australia or overseas), FRACGP status, practice size, practice location (urban or rural);
- *Patient characteristics*: sex, age, Commonwealth health care cardholder, Veterans' Affairs cardholder, non-English-speaking background, new patient to practice;
- *Number of problems managed at encounter* (1 to 4); and
- *Specific morbidity managed:* at least one problem managed by ICPC-2 chapter.

Model B: for problem-managed outcomes

The covariates controlled for were:

- *GP and practice characteristics* (as in Model A);
- *Patient characteristics* (as in Model A); and
- *Number of problems managed at encounter* (1 to 4) (as in Model A). ◆

GP age groups on various outcomes, after adjusting for potential confounding variables. We used multiple logistic regression to analyse all (categorical) outcomes, and results are expressed as odds ratios, with 95% CIs which adjust for the survey design, with the youngest GPs (aged < 35 years) as the reference group. The adjusted Wald test was used to assess if GP age group was significantly related to the outcome in the presence of the other covariates in the model. Models were built with covariates fitted depending on the outcome of interest (Box 1).

Ethics approval

The project was approved by the Human Research Ethics Committee of the University of Sydney and the Health Ethics Committee of the Australian Institute of Health and Welfare.

RESULTS

The association between the number of years in general practice and age of GP yielded a high correlation ($r = 0.89$, $P < 0.001$), confirming reports by other researchers.[18] For this study, the two variables can be considered interchangeable.

The GPs (Box 2)

Male GPs represented less than half of those younger than 35 years, but the proportion rose steadily with age. Most GPs worked 6–10 sessions per week, and working 11 or more sessions per week was more likely among 55–64 year olds. Few young GPs (2.8%) were in solo practice, with the proportion increasing with age. In contrast, almost two-thirds of GPs younger than 35 years were in large practices, and about 30% of the youngest group worked in rural practice. Ninety per cent of the youngest GPs were Australian graduates, and 82% held FRACGP.

2 General practitioner characteristics by age of GP

	General practitioner age (years)					
	< 35 (*n* = 361; 7.2%)	35–44 (*n* = 1508; 30.1%)	45–54 (*n* = 1713; 34.0%)	55–64 (*n* = 944; 18.8%)	⩾ 65 (*n* = 487; 9.7%)	*P*
Male GPs	48.2%	56.6%	67.8%	78.7%	92.0%	< 0.001
Sessions per week						
< 6	12.8%	19.2%	11.6%	12.4%	27.4%	< 0.001
6–10	77.7%	68.6%	69.4%	64.5%	58.2%	
⩾ 11	9.5%	12.2%	18.9%	23.0%	14.3%	
Practice size						
Solo	2.8%	8.2%	17.8%	27.5%	31.3%	< 0.001
2–4 GPs	33.3%	37.6%	42.5%	41.4%	35.6%	
⩾ 5 GPs	63.9%	54.3%	39.6%	31.1%	33.1%	
Rural practice	29.6%	27.3%	25.0%	24.3%	18.9%	< 0.001
Graduated in Australia	90.3%	81.4%	75.5%	60.9%	60.4%	< 0.001
FRACGP	82.3%	44.5%	24.5%	14.5%	16.6%	< 0.001

The patients (Box 3)

The proportion of encounters with male patients rose steadily as age of GP increased.

3 Patient and encounter characteristics by age of GP (rate per 100 encounters [95% CI])

	General practitioner age (years)				
	< 35 (*n* = 36 100)	35–44 (*n* = 150 800)	45–54 (*n* = 171 300)	55–64 (*n* = 94 400)	⩾ 65 (*n* = 48 700)
The patients					
Male	37.7 (36.6–38.9)	38.0 (37.4–38.7)	40.4 (39.8–41.0)	43.9 (43.1–44.6)	47.9 (46.9–48.8)
Patient age (years)					
< 15	19.0 (18.1–19.9)	15.9 (15.5–16.4)	12.5 (12.1–12.9)	11.3 (10.7–11.8)	9.0 (8.3–9.6)
15–24	13.3 (12.5–14.0)	10.3 (10.0–10.6)	9.6 (9.3–9.9)	9.1 (8.7–9.5)	8.5 (7.9–9.2)
25–44	32.0 (31.0–33.0)	28.5 (28.0–29.0)	25.4 (24.9–25.9)	23.2 (22.5–23.8)	20.9 (19.8–21.9)
45–64	21.0 (20.3–21.7)	24.1 (23.7–24.5)	26.9 (26.5–27.3)	27.7 (27.2–28.3)	25.6 (24.9–26.4)
⩾ 65	14.7 (13.5–15.9)	21.2 (20.5–21.9)	25.6 (24.9–26.3)	28.8 (27.7–29.8)	36.0 (34.1–37.9)
Health care cardholder	32.2 (30.0–34.4)	37.1 (36.1–38.1)	40.0 (39.0–41.0)	40.8 (39.4–42.2)	45.7 (43.6–47.8)
Veterans' Affairs cardholder	2.0 (1.7–2.3)	3.0 (2.8–3.2)	3.4 (3.2–3.5)	4.0 (3.7–4.3)	5.2 (4.7–5.6)
Non-English-speaking background	7.0 (5.6–8.3)	7.2 (6.4–8.0)	9.1 (8.2–10.0)	10.3 (9.0–11.6)	11.1 (9.2–13.0)
New patient	10.7 (9.5–11.9)	9.3 (8.7–9.8)	8.7 (8.2–9.2)	8.5 (8.0–9.1)	10.9 (9.6–12.3)
The encounters					
Long surgery consultation	10.9 (9.9–11.8)	10.6 (10.1–11.1)	9.3 (8.9–9.8)	8.6 (8.0–9.3)	8.5 (7.5–9.5)
Home visit	0.6 (0.4–0.8)	1.2 (1.1–1.4)	1.8 (1.6–2.1)	1.8 (1.6–2.1)	3.6 (2.8–4.4)
Residential aged-care facility visit	0.4 (0.2–0.5)	0.7 (0.5–0.9)	1.0 (0.8–1.2)	1.2 (0.9–1.5)	2.0 (1.4–2.6)
Problems managed	142.2 (139.9–144.5)	149.7 (148.3–151.0)	148.9 (147.6–150.2)	146.4 (144.5–148.2)	148.3 (145.5–151.1)

4 Logistic regression modelling: encounter characteristic outcomes*

	General practitioner age (years)				Adjusted Wald test	
	35–44	45–54	55–64	⩾ 65	F	*P*
Long consultation	0.97 (0.86–1.09)	0.89 (0.79–1.01)	0.93 (0.81–1.08)	0.95 (0.79–1.13)	F(4,4836)=1.21	0.306
Home visits	1.35 (0.93–1.95)	1.65 (1.10–2.47)	1.50 (1.00–2.24)	2.29 (1.50–3.48)	F(4,4836)=4.91	< 0.001
Residential aged-care facility visits	1.56 (0.91–2.70)	1.70 (1.01–2.87)	1.91 (1.09–3.37)	2.56 (1.41–4.64)	F(4,4836)=2.45	0.044
At least one chronic problem managed	1.13 (1.06–1.20)	1.21 (1.13–1.28)	1.21 (1.13–1.29)	1.25 (1.16–1.35)	F(4,4899)=12.38	< 0.001
At least one prescription	0.99 (0.92–1.06)	1.04 (0.96–1.11)	1.21 (1.11–1.31)	1.50 (1.36–1.66)	F(4,4899)=34.22	< 0.001
At least one non-pharmacological treatment	0.91 (0.82–0.99)	0.86 (0.78–0.95)	0.79 (0.71–0.89)	0.76 (0.67–0.86)	F(4,4899)=7.12	< 0.001
At least one clinical treatment	0.86 (0.78–0.96)	0.82 (0.74–0.92)	0.77 (0.68–0.86)	0.76 (0.66–0.88)	F(4,4899)=5.52	< 0.001
At least one procedural treatment	1.04 (0.96–1.13)	1.01 (0.93–1.10)	0.95 (0.87–1.05)	0.83 (0.75–0.92)	F(4,4899)=7.77	< 0.001
At least one pathology order	1.08 (1.03–1.15)	1.00 (0.95–1.06)	0.90 (0.84–0.97)	0.81 (0.74–0.89)	F(4,4899)=18.59	< 0.001

* Regression using Model A (Box 1). Values are adjusted odds ratios (95% CIs), with the age group < 35 years being the reference. ◆

Patient age mirrored the age of GP: almost two-thirds of patients visiting GPs younger than 35 years were themselves younger than 45 years. GPs in the oldest age group saw patients aged 65 years and older at more than double the rate of the youngest GPs. The proportion of encounters with health care concession cardholders (government-subsidised pensioners) increased across age groups, except between 45–54- and 55–64-year-old GPs. Holders of Veterans' Affairs cards (returned service personnel and their families) increased through each GP age group. Encounters with patients from a non-English-speaking background were significantly more frequent among GPs aged 55 years and older, compared with GPs younger than 45 years. GPs younger than 35 years or 65 years and older

5 Significant differences in problems and treatments per 100 problems managed by age of GP

	General practitioner age (years)				
	< 35	35–44	45–54	55–64	⩾ 65
Problem type/treatment (rate per 100 problems managed [95% CI])					
	n = 51 326	*n* = 225 668	*n* = 255 070	*n* = 138 166	*n* = 72 225
New problems	40.3 (38.8–41.8)	36.2 (35.4–36.9)	34.1 (33.4–34.8)	32.9 (31.9–33.8)	30.3 (28.9–31.8)
Chronic problems	24.2 (23.2–25.2)	29.5 (29.0–30.0)	33.7 (33.2–34.3)	36.6 (35.7–37.4)	40.0 (38.8–41.3)
Medications prescribed	50.6 (48.8–52.3)	54.3 (53.3–55.2)	59.2 (58.2–60.2)	67.7 (66.2–69.2)	76.6 (74.3–78.9)
Non-pharmacological treatments	41.0 (38.7–43.3)	36.3 (35.3–37.3)	34.0 (33.1–34.9)	31.8 (30.5–33.1)	29.7 (28.0–31.4)
Pathology ordering	25.0 (23.8–26.1)	24.2 (23.5–24.8)	21.0 (20.4–21.5)	17.7 (16.9–18.4)	14.9 (13.8–16.0)
Problem category* (percentage of problems managed [95% CI])					
General and unspecified	11.9 (11.4–12.4)	11.4 (11.1–11.6)	10.2 (9.9–10.4)	8.9 (8.5–9.2)	7.5 (7.1–7.9)
Ear	3.4 (3.2–3.6)	3.0 (2.9–3.1)	2.8 (2.7–2.9)	2.8 (2.7–3.0)	2.8 (2.6–2.9)
Circulatory	7.7 (7.2–8.1)	9.8 (9.6–10.1)	11.4 (11.1–11.6)	12.9 (12.5–13.3)	14.5 (13.9–15.2)
Musculoskeletal	10.2 (9.7–10.8)	11.0 (10.7–11.2)	11.9 (11.6–12.2)	12.7 (12.2–13.1)	12.6 (12.1–13.1)
Neurological	2.4 (2.2–2.6)	2.6 (2.6–2.7)	2.8 (2.6–2.8)	2.8 (2.7–2.9)	2.9 (2.7–3.2)
Psychological	6.5 (6.1–7.0)	7.2 (7.0–7.5)	8.1 (7.8–8.4)	7.8 (7.4–8.1)	8.0 (7.5–8.6)
Respiratory	16.2 (15.5–16.9)	14.3 (14.0–14.6)	14.2 (13.8–14.5)	14.9 (14.4–15.3)	15.9 (15.2–16.6)
Skin	12.6 (12.1–13.2)	11.9 (11.6–12.2)	10.9 (10.7–11.2)	10.6 (10.3–10.9)	10.2 (9.9–10.6)
Endocrine and metabolic	5.6 (5.3–5.9)	6.3 (6.1–6.5)	6.8 (6.6–7.0)	7.3 (6.9–7.6)	7.5 (7.2–7.8)
Pregnancy and family planning	4.6 (4.2–5.0)	3.6 (3.4–3.8)	2.9 (2.7–3.0)	2.2 (2.0–2.4)	1.4 (1.2–1.6)
Female genital system	6.0 (5.5–6.5)	5.9 (5.6–6.1)	4.9 (4.7–5.1)	4.0 (3.7–4.3)	2.8 (2.5–3.1)
Male genital system	0.8 (0.7–0.8)	0.8 (0.8–0.9)	0.9 (0.9–1.0)	1.0 (1.0–1.1)	1.3 (1.0–1.5)
Social	0.6 (0.5–0.8)	0.7 (0.7–0.8)	0.7 (0.6–0.7)	0.5 (0.4–0.5)	0.3 (0.3–0.4)

* Listed in order of ICPC-2 chapters.[20] ◆

6 Logistic regression modelling: morbidity managed*

Morbidity ICPC-2[20] chapter (at least one problem managed at encounter)	General practitioner age (years)				Adjusted Wald test	
	35–44	45–54	55–64	⩾ 65	F	*P*
General and unspecified	1.05 (0.99–1.11)	1.00 (0.94–1.07)	0.90 (0.84–0.97)	0.78 (0.71–0.84)	F(4,4899)=21.37	< 0.001
Ear	0.98 (0.91–1.05)	0.96 (0.89–1.03)	1.01 (0.94–1.10)	1.02 (0.93–1.11)	F(4,4899)=1.40	0.232
Circulatory	1.00 (0.94–1.07)	1.02 (0.95–1.05)	1.08 (1.01–1.16)	1.09 (1.01–1.18)	F(4,4899)=4.26	0.002
Musculoskeletal	1.02 (0.95–1.09)	1.05 (0.98–1.12)	1.05 (0.97–1.13)	1.02 (0.94–1.10)	F(4,4899)=1.10	0.353
Neurological	1.12 (1.04–1.21)	1.16 (1.07–1.26)	1.19 (1.09–1.30)	1.25 (1.12–1.39)	F(4,4899)=5.41	< 0.001
Psychological	1.09 (1.00–1.20)	1.24 (1.12–1.36)	1.22 (1.10–1.35)	1.26 (1.11–1.42)	F(4,4899)=9.19	< 0.001
Respiratory	0.89 (0.84–0.94)	0.88 (0.83–0.94)	0.92 (0.86–0.98)	1.02 (0.94–1.10)	F(4,4899)=9.67	< 0.001
Skin	0.98 (0.92–1.04)	0.90 (0.85–0.96)	0.88 (0.83–0.94)	0.84 (0.78–0.90)	F(4,4899)=10.54	< 0.001
Endocrine and metabolic	0.99 (0.93–1.06)	0.99 (0.93–1.06)	1.02 (0.94–1.10)	1.01 (0.94–1.10)	F(4,4899)=0.39	0.814
Pregnancy and family planning	1.02 (0.93–1.12)	1.00 (0.90–1.11)	0.95 (0.84–1.07)	0.78 (0.68–0.90)	F(4,4899)=5.29	< 0.001
Female genital system	1.08 (1.01–1.16)	1.09 (1.01–1.17)	1.11 (1.01–1.21)	1.06 (0.94–1.19)	F(4,4887)=1.63	0.163
Male genital system	1.04 (0.91–1.18)	1.08 (0.94–1.24)	1.10 (0.94–1.30)	1.17 (0.92–1.48)	F(4,4899)=0.74	0.568
Social	1.17 (0.97–1.42)	1.21 (0.96–1.51)	0.93 (0.71–1.21)	0.71 (0.52–0.97)	F(4,4899)=5.67	< 0.001

* Regression using Model B (Box 1). Values are adjusted odds ratios (95% CIs), with the age group < 35 years being the reference. ◆

were more likely to see new patients than GPs aged 45–64 years.

The encounters (Box 3 and Box 4)

Long surgery consultations were significantly more common among younger GPs, but not after adjustment. Before and after adjustment, older GPs reported significantly more home visits ($P < 0.001$), and more residential aged-care facility visits ($P = 0.044$) than the youngest group. There were fewer problems managed at encounters with GPs younger than 35 years than with all other age groups.

Problem type and treatments provided

New problems accounted for 40.3% of the youngest GPs' workload, and this proportion steadily decreased with increasing GP age, accounting for only 30.3% of the work of the oldest GP group (Box 5). In contrast, chronic problems, less often managed by younger GPs (24.2% of workload of those < 35 years), made up a significantly greater proportion of the workload with each step in age group, reaching 40.0% of the work of GPs aged 65 years and older.

After adjustment, the youngest GPs remained less likely to manage chronic problems (Box 4).

There were significant increases in prescribed medication rates per 100 problems managed through all age groups (Box 5). We tested encounters at which at least one prescription was written, and, after adjusting for measured confounding factors, found a significantly lower prescribing rate for GPs younger than 55 years compared with those aged 55 years and older (Box 4). On the other hand, non-pharmacological management was more frequently used by the youngest GPs (41.0 per 100 problems managed) and steadily declined with increasing GP age (Box 3). After adjustment, the likelihood of using non-pharmacological treatments remained higher among the youngest GPs (Box 4). Before (Box 5) and after adjustment (Box 4), pathology-ordering rates were higher for doctors in the younger age groups, while rates for GPs aged 65 years and older were low ($P < 0.001$).

Problems managed

Box 5 presents unadjusted, descriptive results of the problem categories that showed significant differences in management rates between GP age groups. Compared with the youngest GPs, older GPs were less likely to manage general, ear, skin, pregnancy/family planning, female genital, and social problems. They were more likely to manage circulatory, musculoskeletal, neurological, psychological, endocrine/metabolic, and male genital problems. The youngest and oldest GPs managed more respiratory problems than all other groups.

After adjustment, differences between younger and older GPs in problems managed remained substantially unchanged. There was no longer any difference in management rates of ear, musculoskeletal, endocrine/metabolic, and male and female genital problems. No new differences emerged after adjustment (Box 6).

DISCUSSION

An extensive literature review suggests this is the first large-scale study that specifically measures GP age alone, and with its sample size we can generalise results to the total GP population. It demonstrates that certain clinical actions are clearly related to GP age, after the influence of measured confounding factors are removed. That young GPs are more often female and hold FRACGP were two of the factors taken into account in the regression model. Age of patient was controlled for, as GPs attract patients close to their own age, affecting the morbidity managed. This in turn influences the treatments they choose, so we also adjusted for morbidity when examining treatment patterns.

Choudhry et al discussed the need for specific research into the association between length of time in practice and performance.[14] Our study addresses this issue by presenting a comprehensive view of the influence of GP age on the patient–doctor encounter. Most of the studies in the review by Choudhry et al focused on a single aspect or disease, 40% of them were published more than 10 years ago, and many of the study samples were self-selected. We report recent data from a large,

representative, random sample, and investigated multiple outcome measures.

However, our study is limited to the quantifiable details of GP encounters; intangible attributes such as manner of dealing with patients or diagnostic expertise are not measured. We are also limited to describing the current situation, although we surmise that, in the foreseeable future, assuming no major changes occur in policy or education, new graduates will have similar traits to the younger GPs in this study.

Younger GPs prescribing less and using more non-pharmacological treatments would be a long-term cost-saving element for the Australian Government only if they retain these habits as they age. In contrast, their high pathology ordering would lead to increased costs to government if they continue to order at this rate. One study found that an intervention group maintained their antibiotic prescribing behaviour after 5 years,[13] but by then the control group had acquired the same habits. This suggests that age, sex and training of young GPs are more influential than the effects of educational interventions.

The extensive use of non-pharmacological treatments (mainly advice and counselling) by young GPs and the high prescribing rates of older GPs could not be explained by patient mix or other GP characteristics. The high pathology ordering rates among young GPs may reflect their lower management rates of chronic problems, which might place them more often on an investigative pathway. Alternatively, it may reflect differences in levels of experience or fear of litigation. Perhaps with increased years in general practice they will test less often.

In problem management, several of the adjusted results were consistent with the univariate findings, indicating that age of GP alone was responsible for the differences. This could be seen in the management of circulatory, respiratory, skin, neurological and psychological problems. On the other hand, some descriptive findings disappeared after adjustment, particularly those that are clearly linked to patient characteristics, pointing to the high correlation between age of GP and age and sex of patient.

Our study provides solid evidence of the connection between practitioner experience and practice style, against which the link between experience and quality of care can be further considered. It provides a background for medical educators and those providing support and information to GPs during their careers. It is also relevant to issues of workforce planning, not just for general practice, but for other branches of medicine.

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COMPETING INTERESTS

None identified.

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