Responses to clinical uncertainty in Australian general practice trainees: a cross-sectional analysis

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CONTEXT Tolerance for ambiguity is essential for optimal learning and professional competence. General practice trainees must be, or must learn to be, adept at managing clinical uncertainty. However, few studies have examined associations of intolerance of uncertainty in this group.

OBJECTIVES The aim of this study was to establish levels of tolerance of uncertainty in Australian general practice trainees and associations of uncertainty with demographic, educational and training practice factors.

METHODS A cross-sectional analysis was performed on the Registrar Clinical Encounters in Training (ReCEnT) project, an ongoing multi-site cohort study. Scores on three of the four independent subscales of the Physicians' Reaction to Uncertainty (PRU) instrument were analysed as outcome variables in linear regression models with trainee and practice factors as independent variables.

RESULTS A total of 594 trainees contributed data on a total of 1209 occasions. Trainees in earlier training terms had higher scores for 'Anxiety due to uncertainty', 'Concern about bad outcomes' and 'Reluctance to disclose diagnosis/treatment uncertainty to patients'. Beyond this, findings suggest two distinct sets of associations regarding reaction to uncertainty. Firstly, affective aspects of uncertainty (the 'Anxiety' and 'Concern' subscales) were associated with female gender, less experience in hospital prior to commencing general practice training, and graduation overseas. Secondly, a maladaptive response to uncertainty (the 'Reluctance to disclose' subscale) was associated with urban practice, health qualifications prior to studying medicine, practice in an area of higher socio-economic status, and being Australian-trained.

CONCLUSIONS This study has established levels of three measures of trainees' responses to uncertainty and associations with these responses. The current findings suggest differing 'phenotypes' of trainees with high 'affective' responses to uncertainty and those reluctant to disclose uncertainty to patients. More research is needed to examine the relationship between clinical uncertainty and clinical outcomes, temporal changes in tolerance for uncertainty, and strategies that might assist physicians in developing adaptive responses to clinical uncertainty.

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INTRODUCTION

A degree of uncertainty is inevitable in medicine.[1,2] Epstein and Hundert[3] have described tolerance of ambiguity and anxiety as a key dimension of clinical competence, and tolerance of uncertainty is seen as an essential skill for the general practitioner (GP).[4] Doctors who feel more challenged by uncertainty generate more costs for the health system.[5] Intolerance of uncertainty is also associated with increased test ordering,[6,7] which has the potential to cause patient harm,[8] as well as financial implications. Furthermore, doctors who deal better with uncertainty are likely to practise with less cost to their own health and well-being.[9] A low tolerance for uncertainty has also been associated with burnout in a cohort of general practice trainees[10] and emergency medicine residents.[11] Indeed, in a study of emergency physicians, low tolerance for uncertainty was the strongest predictor of burnout.[12] An educationally relevant aspect of intolerance of uncertainty is anxiety. Anxiety and stress have been associated with impairments in learning.[13–15]

The response from educators has been to include patient-centred communication training and bedside teaching around ambiguity in medical school, as well as role-modelling and reflective practice strategies.[16,17] Tolerance for ambiguity has even been touted as a possible selection criterion for medical school, with commentators hypothesising that students who begin medical school with a higher tolerance for uncertainty will have greater tolerance for it by the end of medical school through a positive feedback loop.[18] The Physician Response to Uncertainty (PRU) scales were developed to examine the emotional, cognitive and coping behaviours that doctors use in relation to clinical uncertainty.[19] However, despite the acknowledged importance of tolerance of uncertainty and efforts to include it in medical curricula, few studies have examined its associations. In two studies, female physicians and doctors in training reported greater anxiety about uncertainty.[19,20] In a Finnish study, experienced GPs (with at least 5 years of experience) reported a greater tolerance for uncertainty than less experienced GPs (fewer than 5 years of experience).[21] Anxiety from uncertainty was also associated with fewer working hours in a cohort of GPs.[20] However, studies investigating associations of tolerance of uncertainty have been small in scale and examined a limited number of associations.

Uncertainty is particularly prevalent in the general practice environment, where undifferentiated illness is commonplace and where patients generally present earlier in their illness than in hospital settings.[19,22] Further, given this and that uncertainty in emergency medicine and general practice training has been associated with adverse clinician outcomes (burnout[10,11]), GP trainees represent a group in which tolerance of uncertainty is of particular interest. The levels of particular responses to uncertainty, and their associations, in this population are important research issues. The aim of this study was to establish levels of tolerance of uncertainty in Australian general practice trainees and its associations with demographic, educational and training practice factors.

METHODS

This study was conducted within the Registrar Clinical Encounters in Training (ReCEnT) project. ReCEnT is an ongoing, multi-site, cohort study. Participants were general practice trainees from four of Australia's 17 GP regional training providers (RTPs) across four Australian states during 2011–2013. The RTPs are government-funded, not-for-profit, geographically defined organisations that deliver Australian general practice vocational training.

The methodology of the ReCEnT study has been described in detail elsewhere.[23] Briefly, trainees provide data once during each 6-month training term (or 12-month term for part-time doctors) as a routine part of their educational programme.[24] Thus, trainees contribute data during their three compulsory general practice training terms. Some trainees in one RTP provided data during an optional fourth general practice term. Trainees may consent to the use of these data for research as well as educational purposes.

Data collected included information on the demographics, education and work experience of participating trainees, and the characteristics of the practices in which they were working each term. These variables are recorded by each trainee via a questionnaire administered at the beginning of training and a further questionnaire administered during each training term. In-consultation data

collected in the ReCEnT project were not utilised in this analysis.

Outcome factors

The outcome factors in this analysis were scores on the first three of the four subscales (domains) of the PRU instrument.[19,25] A technical fault in our printing of the questionnaire resulted in a lack of complete data for the fourth subscale ('Reluctance to disclose mistakes to physicians'). The three subscales, each with items to be ranked on a 6-point Likert scale, measure a doctor's affective response to uncertainty (the first two subscales) and a component of coping or adaptation (the third subscale). The subscales are:

1 'Anxiety due to uncertainty about diagnosis/treatment' (five items; maximum possible score: 30);
2 'Concern about a bad outcome for the patient' (three items; maximum possible score: 18), and
3 'Reluctance to disclose diagnosis/treatment uncertainty to patients' (five items; maximum possible score: 30).

Each subscale is scored by summing physicians' responses to each item in the scale. For scoring, responses on the scale range from 'strongly disagree' (scored as 1) to 'strongly agree' (scored as 6), and relevant items are reverse-scored. The subscales are distinct constructs and no overall score for 'uncertainty' is calculated. Higher subscale scores represent a higher level of the construct being measured. The PRU subscales have shown good psychometric properties, with Cronbach's alpha values ranging from 0.74 to 0.85.[25,26]

Independent variables

Trainee demographic and educational factors were age, gender, training term (Terms 1–4), place of basic medical qualification (Australia or overseas), full-time/part-time status, health qualifications prior to studying medicine, whether the trainee had postgraduate medical qualifications (e.g. Master of Public Health), whether the trainee also did other clinical non-GP work, whether the trainee did other medical non-clinical work (such as education or research), whether the trainee had previously worked at his or her current practice, and number of years of hospital work the trainee had completed. The RTP with which the trainee trained was also an independent variable.

Training practice factors were degree of rurality (major city, inner regional, outer regional, remote), practice size (number of full-time equivalent GPs), whether the practice routinely bulk bills (i.e. there is no financial cost to the patient for the consultation), and the socio-economic status of the suburb in which the practice was located. Practice postcode was used to define the Australian Standard Geographical Classification–Remoteness Area classification (ASGC-RA; degree of rurality) of the practice location[27] and the practice location's socio-economic index for area relative index of disadvantage (SEIFA).[28]

Statistical analyses

This was a cross-sectional analysis from the longitudinal ReCEnT study. Analysis was performed on five rounds of data during 2011–2013 (during which the PRU scales were included in trainees' questionnaires). Analysis was conducted at the level of trainees' individual completions of the PRU. Data were analysed using STATA Version 13.1 (StataCorp LP, College Station, TX, USA) and SAS Version 9.4 (SAS Institute, Inc., Cary, NC, USA).

For each of the three outcomes, univariate and multivariate linear regressions were used to assess associations, with estimation performed within the generalised estimating equation (GEE) framework to account for repeated measures within trainees. An exchangeable working correlation structure was assumed. All covariates with a p-value of < 0.20 in the univariate analysis were included in the multiple regression model.

Mean substitution was used to reduce the number of missing values for all three outcomes, dependent upon no more than half of the items being missing. When one or two individual items were missing in each of the 'Anxiety due to uncertainty about diagnosis/treatment' and 'Reluctance to disclose diagnosis/treatment uncertainty to patients' subscales (each with five items), the mean of the non-missing items was substituted for the missing items. If one item was missing in the 'Concern about a bad outcome for the patient' subscale (three items), the mean of the non-missing two items was substituted for the missing item. Total scores for each outcome for each participant were calculated with the mean-substituted data included.

In a post hoc analysis, we calculated Cohen's d as a measure of effect size of independent variables

significantly associated with scores on the relevant subscales.

Ethical approval: This study was granted ethics approval by the University of Newcastle Human Research Ethics Committee (ref. H-2009–0323).

RESULTS

There were 1209 PRU completions, contributed by 594 trainees. The response rate during the five rounds of data collection reported here was 93.6%. Most trainees were female (66.0%) and had qualified in Australia (74.4%). The majority of trainees worked in a major city (60.1%). Demographic data for trainees and practices are summarised in Table 1.

Modest amounts of data (8%–11%) were missing in each subscale. After mean substitution was used to impute missing values, 7% of data for the total score were missing for the 'Anxiety due to uncertainty', 'Bad outcome' and 'Reluctance to disclose to patients' subscales. Pearson correlation coefficients were 0.60 between 'Anxiety' and 'Bad outcome' scores and 0.24 between 'Anxiety', 'Reluctance' and 'Bad outcome' scores.

The mean ± standard deviation (SD) scores on the three subscales were as follows: 'Anxiety due to uncertainty about diagnosis/treatment', 17.65 ± 4.95; 'Concern about a bad outcome for the patient', 9.95 ± 3.40, and 'Reluctance to disclose diagnosis/treatment uncertainty to patients', 13.41 ± 3.66 (Table 1).

Associations of uncertainty

The descriptive statistics and univariate associations of trainee and practice factors for the three subscales are presented in Tables S1, S2 and S3, respectively (online). The simple (univariate) and adjusted (multivariable) associations of trainee and practice factors with each PRU subscale are presented in Tables 2, 3, 4. Cohen's *d*-values for significant associations ranged from 0.19 to 0.35 for 'Anxiety due to uncertainty', from 0.14 to 0.32 for 'Concern about a bad outcome' and from 0.20 to 0.50 for 'Reluctance to disclose'. These indicated small to moderate effect sizes.

In the multivariable analyses, variables significantly associated with higher 'Anxiety due to uncertainty about diagnosis/treatment' were: the trainee being

Table 1 Characteristics of trainees and 'trainee rounds' (trainee and practice pairings by term) and Physicians' Reaction to Uncertainty (PRU) subscale scores

Trainee (*n* = 594) characteristic*	
Female, *n* (%)	392 (66.0%)
Qualified as a doctor in Australia, *n* (%)	442 (75.4%)
Previous health qualifications prior to studying medicine, *n* (%)	69 (11.8%)
Trainee age, years, mean ± SD	32.7 ± 6.5
Previous hospital experience, years, mean ± SD	3.2 ± 3.2
Postgraduate medical qualifications, *n* (%)	158 (26.9%)
Practice pairing variables (*n* = 1209)	
Performs other clinical, non-GP, work	162 (13.4%)
Performs other education/research work	75 (6.2%)
Trainee worked at the practice previously	371 (31.1%)
Trainee training term	
Term 1	440 (36.4%)
Term 2	450 (37.2%)
Term 3	261 (21.6%)
Term 4	58 (4.8%)
Trainee works full-time†	927 (78.5%)
Number of GPs working at practice, *n* (%)	
1–5	378 (32.0%)
≥ 6	805 (68.1%)
Rurality of practice, *n* (%)	
Major city	727 (60.1%)
Inner regional	329 (27.2%)
Outer regional, remote or very remote	153 (12.7%)
SEIFA Index (decile) of practice, mean ± SD	5.5 ± 2.9
Practice routinely bulk bills, *n* (%)‡	210 (17.5%)
Trainees' PRU subscale scores (*n* = 1126), mean ± SD	
Anxiety due to uncertainty	17.65 ± 4.95
Concern about bad outcome	9.95 ± 3.40
Reluctance to disclose uncertainty to patients	13.41 ± 3.66

GP = general practitioner; SEIFA = Socioeconomic Index for Area Relative Index of Disadvantage; SD = standard deviation.
Numbers may not add to 594 or 1209 due to missing data.
* Trainee variables (calculated from 594 trainees). All other variables are calculated on the basis of trainee and practice pairings by term (*n* = 1209).
† Eight or more sessions per week.
‡ The practice routinely bulk-bills (that is, there is no financial cost to the patient for the consultation).

Table 2 Associations of scores on outcome subscale 'Anxiety due to uncertainty about diagnosis/treatment': simple (univariate) and adjusted (multiple) linear regression

	Simple		Adjusted		Adjusted means*		
Variable Class	**Coefficient (95% CI)**	**p-value**	**Coefficient (95% CI)**	**p-value**	**Mean (95% CI)**	**Mean difference**	**Mean difference (95% CI)**
Trainee gender							
Female	1.82 (1.05–2.59)	< 0.001	1.75 (0.98–2.53)	< 0.001	18.09 (17.39–18.79)		
Male					16.34 (15.53–17.14)	Male minus Female	−1.75 (−2.53 to −0.98)
Trainee age	−0.07 (−0.13 to −0.01)	0.034	−0.06 (−0.13 to 0.01)	0.073			
Qualified as doctor in Australia							
No					17.94 (17.05–18.83)	No minus Yes	1.45 (0.56–2.34)
Yes	−1.01 (−1.87 to −0.15)	0.021	−1.45 (−2.34 to −0.56)	0.001	16.49 (15.81–17.16)		
Postgraduate medical qualifications							
No					17.01 (16.38–17.65)	No minus Yes	−0.40 (−1.25 to 0.45)
Yes	0.57 (−0.30 to 1.44)	0.20	0.40 (−0.45 to 1.25)	0.35	17.41 (16.51–18.31)		
Other education/research work							
No					17.42 (16.89–17.96)	No minus Yes	0.42 (−0.52 to 1.36)
Yes	−0.92 (−1.94 to 0.11)	0.080	−0.42 (−1.36 to 0.52)	0.38	17.00 (16.00–18.01)		
Training term/post							
Term 1					18.01 (17.30–18.71)	Term 1 minus Term 2	−0.02 (−0.48 to 0.45)
Term 2	−0.48 (−0.89 to −0.07)	0.021	0.02 (−0.45 to 0.48)	0.94	18.02 (17.35–18.70)		
Term 3	−2.05 (−2.54 to −1.56)	< 0.001	−1.60 (−2.13 to −1.07)	< 0.001	16.40 (15.70–17.11)	Term 3 minus Term 2	−1.62 (−2.10 to −1.14)
Term 4	−2.47 (−3.46 to −1.47)	< 0.001	−1.59 (−2.64 to −0.53)	0.003	16.42 (15.33–17.50)	Term 4 minus Term 2	−1.61 (−2.56 to −0.66)
Worked at practice previously							
No					17.69 (17.01–18.36)	No minus Yes	0.94 (0.47–1.42)
Yes	−1.19 (−1.63 to −0.76)	< 0.001	−0.94 (−1.42 to −0.47)	< 0.001	16.74 (16.03–17.46)		

CI = confidence interval.
* Adjusted means and adjusted mean differences provide covariate-adjusted estimates of group means and group mean differences in 'Anxiety due to uncertainty about diagnosis/treatment' between the levels of each categorical variable.

Table 3 Associations of scores on outcome subscale 'Concern about a bad outcome for the patient': simple (univariate) and adjusted (multiple) linear regression

		Simple		Adjusted		Adjusted means*		
Variable	**Class**	**Coefficient (95% CI)**	**p-value**	**Coefficient (95% CI)**	**p-value**	**Mean (95% CI)**	**Mean difference**	**Mean difference (95% CI)**
Trainee gender	Female	0.87 (0.34–1.40)	0.001	0.82 (0.28–1.36)	0.003	9.85 (9.39–10.32)		
	Male					9.03 (8.51–9.56)	Male minus Female	−0.82 (−1.36 to −0.28)
Trainee age		−0.08 (−0.11 to −0.04)	< 0.001	−0.03 (−0.08 to 0.02)	0.20			
Previous hospital experience (years)		−0.16 (−0.24 to −0.08)	< 0.001	−0.13 (−0.22 to −0.04)	0.004			
Other education/ research work	No					9.63 (9.33–9.92)	No minus Yes	0.36 (−0.32 to 1.05)
	Yes	−0.47 (−1.18 to 0.23)	0.19	−0.36 (−1.05 to 0.32)	0.29	9.26 (8.56–9.96)		
Training term/post	Term 1					9.95 (9.47–10.42)	Term 1 minus Term 2	0.23 (−0.11 to 0.57)
	Term 2	−0.21 (−0.52 to 0.09)	0.17	−0.23 (−0.57 to 0.11)	0.18	9.72 (9.28–10.15)		
	Term 3	−0.69 (−1.05 to −0.33)	< 0.001	−0.69 (−1.07 to −0.31)	< 0.001	9.26 (8.80–9.72)	Term 3 minus Term 2	−0.46 (−0.79 to −0.13)
	Term 4	−1.26 (−1.93 to −0.60)	< 0.001	−1.10 (−1.86 to −0.34)	0.005	8.85 (8.12–9.58)	Term 4 minus Term 2	−0.87 (−1.54 to −0.19)
Worked at practice previously†	No					9.46 (9.02–9.90)	No minus Yes	0.03 (−0.31 to 0.38)
	Yes	−0.34 (−0.65 to −0.04)	0.027	−0.03 (−0.38 to 0.31)	0.86	9.43 (8.97–9.88)		

CI = confidence interval; RTP = regional training provider; SEIFA = socio-economic index for area relative index of disadvantage.
* Adjusted means and adjusted mean differences provide covariate-adjusted estimates of group means and group mean differences in 'Concern about a bad outcome for the patient' between the levels of each categorical variable.
† The covariate 'worked at practice previously' was tested for removal from the multivariable model. Its removal altered the model and therefore this covariate was included in the final multivariable model.

female; the trainee having qualified as a doctor outside Australia; being in Terms 1 or 2 rather than Terms 3 or 4, and not having previously worked at the current practice. With regard to 'Concern about a bad outcome for the patient', significant associations were: the trainee being female; being in Terms 1 or 2 rather than Terms 3 or 4, and having fewer years of hospital practice prior to entering general practice. 'Reluctance to disclose diagnosis/ treatment uncertainty to patients' was significantly associated with: qualification as a doctor in Australia; having health qualifications prior to studying medicine; working in a major city compared with an outer regional or remote/very remote area (and working in an inner regional area compared with an outer regional or remote/very remote area); working in an area of higher socio-economic status, and being in Term 1 compared with Term 3.

DISCUSSION

Summary of main findings and comparison with existing literature

Seniority in training was strongly associated with attenuated scores across all three uncertainty domains. Otherwise, our findings demonstrate that

Table 4 Associations of scores on outcome subscale 'Reluctance to disclose diagnosis/treatment uncertainty to patients': simple (univariate) and adjusted (multiple) linear regression

	Simple		Adjusted		Adjusted means*		
Variable Class	**Coefficient (95% CI)**	**p-value**	**Coefficient (95% CI)**	**p-value**	**Mean (95% CI)**	**Mean difference**	**Mean difference (95% CI)**
Trainee gender							
Female	0.66 (0.09–1.24)	0.023	0.53 (−0.04 to 1.09)	0.0681	13.04 (12.38–13.70)		
Male					12.51 (11.78–13.25)	Male minus Female	−0.53 (−1.09 to 0.04)
Trainee age	−0.08 (−0.12 to −0.03)	< 0.001	−0.03 (−0.08 to 0.01)	0.1726			
Qualified as doctor in Australia							
No					12.17 (11.35–13.00)	No minus Yes	−1.21 (−1.90 to −0.51)
Yes	1.75 (1.14–2.36)	< 0.001	1.21 (0.51–1.90)	0.0006	13.38 (12.77–13.99)		
Previous health qualifications							
No					12.25 (11.76–12.73)	No minus Yes	−1.06 (−2.02 to −0.09)
Yes	0.99 (0.06–1.92)	0.037	1.06 (0.09–2.02)	0.0313	13.31 (12.29–14.33)		
Other education/research work							
No					13.15 (12.59–13.70)	No minus Yes	0.74 (−0.01 to 1.48)
Yes	−0.85 (−1.59 to −0.10)	0.027	−0.74 (−1.48 to 0.01)	0.0522	12.41 (11.52–13.29)		
Training term/post							
Term 1					13.19 (12.53–13.85)	Term 1 minus Term 2	0.38 (−0.02 to 0.78)
Term 2	−0.27 (−0.62 to 0.09)	0.14	−0.38 (−0.78 to 0.02)	0.061	12.81 (12.17–13.44)		
Term 3	−0.66 (−1.10 to −0.23)	0.003	−0.74 (−1.21 to −0.27)	0.002	12.45 (11.77–13.13)	Term 3 minus Term 2	−0.36 (−0.73 to 0.02)
Term 4	−0.47 (−1.28 to 0.34)	0.26	−0.52 (−1.46 to 0.41)	0.27	12.66 (11.64–13.69)	Term 4 minus Term 2	−0.14 (−1.01 to 0.73)
Worked at practice previously†							
No					12.73 (12.07–13.39)	No minus Yes	−0.09 (−0.47 to 0.30)
Yes	−0.32 (−0.65 to 0.02)	0.062	0.09 (−0.30 to 0.47)	0.66	12.82 (12.15–13.49)		
Rurality							
Inner regional	−0.56 (−1.08 to −0.03)	0.040	−0.32 (−0.90 to 0.25)	0.27	13.18 (12.41–13.94)		

Table 4 (Continued)

	Simple		Adjusted		Adjusted means*		
Variable Class	**Coefficient (95% CI)**	**p-value**	**Coefficient (95% CI)**	**p-value**	**Mean (95% CI)**	**Mean difference**	**Mean difference (95% CI)**
Rurality (cont)							
Major city					13.50 (12.80–14.20)	Major city minus Inner reg	0.32 (−0.25 to 0.90)
Outer regional/ remote/ very remote	−2.09 (−2.81 to −1.38)	< 0.001	−1.84 (−2.70 to −0.99)	< 0.001	11.66 (10.79–12.52)	Outer reg/rem minus Inner reg	−1.52 (−2.38 to −0.66)
Regional training provider							
RTP 2	0.02 (−0.87 to 0.91)	0.97	0.57 (−0.34 to 1.48)	0.2223	13.10 (12.28–13.92)		
RTP 3	−0.34 (−1.20 to 0.52)	0.44	0.18 (−0.78 to 1.15)	0.7092	12.72 (11.81–13.63)	RTP 4 minus RTP 2	−0.38 (−1.40 to 0.63)
RTP 4	0.89 (0.25–1.53)	0.006	0.22 (−0.47 to 0.92)	0.5258	12.76 (11.91–13.61)	RTP 5 minus RTP 2	−0.34 (−1.22 to 0.54)
RTP 1					12.53 (11.73–13.34)	RTP 1 minus RTP 2	−0.57 (−1.48 to 0.34)
SEIFA index	vv0.15 (0.08–0.21)	< 0.001	0.09 (0.02–0.16)	0.010			

CI = confidence interval; RTP = regional training provider; SEIFA = socio-economic index for area relative index of disadvantage.
* Adjusted means and adjusted mean differences provide covariate-adjusted estimates of group means and group mean differences in 'Reluctance to disclose diagnosis/treatment uncertainty to patients' between the levels of each categorical variable.
† The covariate 'worked at practice previously' was tested for removal from the multivariable model. Its removal altered the model and therefore this covariate was included in the final multivariable model.

two phenotypes can be distinguished. The 'phenotype' of the trainee with high scores on 'Anxiety due to uncertainty' or 'Concern about a bad outcome' (female, non-Australian-trained, not having worked at the practice previously, fewer years of hospital work prior to general practice terms) was very different from that of the trainee with high 'Reluctance to disclose uncertainty to patients' (Australian university-trained, with health qualifications prior to studying medicine, working in major cities or inner regional areas, and working in an area of higher socio-economic status).

Trainee PRU scores in this study were similar to those of established clinicians in previous studies.[19,29] In the original validation study,[19] 337 internal medicine physicians in Indiana gave a mean ± SD score of 18.8 ± 4.7 for 'Anxiety due to uncertainty', which is comparable with that in our cohort. In a study of surgeons treating patients with breast cancer, levels of anxiety due to uncertainty were again similar to those in our study (18.0 ± 8.2).[29] In the validation study,[19] scores on 'Concern about bad outcomes' (9.5 ± 3.1) and 'Reluctance to disclose uncertainty to patients' (13.6 ± 4.2) were also similar to those in our study. In a German adaption of the PRU, 93 GPs also had scores similar to those of our cohort across each subscale ('Anxiety due to uncertainty', 17.6 ± 6.2; 'Concern about bad outcomes', 8.2 ± 3.9; 'Reluctance to disclose uncertainty to patients', 14.9 ± 5.2). However, compared with scores by trainee clinicians in other studies, our trainees' scores may be lower. Internal medicine trainees in

the study by Gerrity[19] had significantly higher scores on each of these subscales than more senior clinicians.

The original version of the PRU included two subscales: 'Stress from uncertainty' and 'Reluctance to disclose uncertainty to others'.[25] Later work refined the PRU and produced the current instrument and its four subscales. The first two subscales, 'Anxiety due to uncertainty about diagnosis/treatment' and 'Concern about a bad outcome for the patient' (corresponding to 'Stress from uncertainty' in the original PRU), have been found to have comparatively high overlap.[26] Our findings of two distinct sets of associations can be seen to apply to, firstly, affective aspects of uncertainty ('Stress from uncertainty') and, secondly, to adaptation to uncertainty, although this is likely to be a problematic adaptation ('Reluctance to disclose diagnosis/treatment uncertainty to patients').

Strengths and limitations

Our study has several strengths. Our response rate was very high for a study of GPs[30] and the study presents findings for a large cohort of trainees from a selection of RTPs across four of Australia's six states that encompasses practices in locations that range from major cities to very remote sites. It is likely that our findings are generalisable to the GP training population in Australia. One of the strengths of our study was that we measured and included a number of potential confounders. This was not common in other studies, although gender was noted as a significant factor in several studies.[19,20]

However, this study has several limitations. As this is a cross-sectional analysis, it is not possible to draw conclusions about causality. We chose to use one validated measure of tolerance for uncertainty, but several other scales exist, some of which have been recently developed and have examined this construct from different perspectives.[31,32] Our finding in a cohort of general practice trainees may not be generalisable to other medical trainee cohorts.

Implications for educational practice

Geller[18] has suggested that selecting medical school applicants for tolerance for uncertainty may address issues of imbalances in physician supply and lead to the provision of higher-quality care in complex health conditions. This same argument could be made for selection into general practice training programmes. Indeed, senior medical students who have a preference for low uncertainty tend to have more negative attitudes towards geriatric patients and patients with chronic pain, and are less likely to want to work in internal medicine, psychiatry and general practice compared with radiology, surgery and anaesthetics.[33]

However, tolerance of uncertainty is only one of many desirable characteristics of a GP vocational trainee (and of an established GP). Our study (although the cross-sectional findings should be interpreted with caution) suggests that trainees' distressed responses and maladaptive approach to uncertainty may attenuate with time. Therefore, rather than focusing on selecting applicants with high levels of tolerance of uncertainty into general practice training, it might be better to direct emphasis within training to the development of greater levels of tolerance of uncertainty and to the learning of strategies for functional rather than maladaptive coping with or dealing with uncertainty.[4,34,35]

Our findings demonstrate quite different sets of associations of an individual's affective response of uncertainty (anxiety and concern) and of a maladaptive approach to dealing with uncertainty (reluctance to disclose uncertainty to patients). An appreciation of these differing profiles or phenotypes may inform practical educational strategies. For example, being trained outside Australia was associated with the high 'affective' response phenotype and being Australian-trained was associated with the 'non-disclosure' phenotype, both of which may be, to some extent, culturally determined. However, a recent Australian study of GP trainees that compared temperament and character traits in international medical graduates and Australian medical graduates[36] found no significant difference in 'harm avoidance' (which included traits of anxiousness and intolerance of uncertainty and risk). Also contrary to our findings, GPs trained outside Australia are perceived to have difficulty in adjusting to 'a culture in which the doctor–patient relationship is more equitable'[37] and might be expected to have particular reluctance to disclose uncertainty to patients. Thus, further research is required to elucidate cultural considerations that may better inform educational approaches to addressing uncertainty.

One approach to managing clinical uncertainty has been to provide education on managing uncertainty.[38] Tools for managing uncertainty deal with minimising cognitive bias (such as in

Murtagh's diagnostic model[39]), consultation and communications skills such as safety-netting,[40] and the adoption of approaches based on shared decision making.[41] Both university and vocational training programmes commonly include education on these foundational skills. Despite this, GP trainees have reported struggling with uncertainty, which is an integral part of managing patients, such as those who present with medically unexplained symptoms.[42] Although group educational sessions with trainees to discuss clinical uncertainty and its management may be generic, individual trainee mentoring and practice allocation processes may benefit from taking our findings into account.

Implications for further research

Our study reveals several areas that warrant further research. Longitudinal studies could assess temporal trends in uncertainty within individuals as they progress through training and predictors of change in uncertainty during training. Further studies could examine the relationship between trainees' clinical uncertainty and clinical outcomes with reference to, for example, consultation time, prescribing, ordering of tests, requests for supervisor assistance, specialist referral and organisation of clinical follow-up. As GPs in the early years of their careers have less tolerance than more experienced GPs,[21] the early post-fellowship periods may be particularly important in the development of tolerance of uncertainty, and longitudinal studies of practitioners as they progress from trainee status to early post-fellowship may be of value in tracking this process and establishing predictors of adaptive change. Finally, this area of inquiry might benefit from research into educational interventions to attenuate stress from uncertainty and to promote adaptive responses to clinical uncertainty.

CONCLUSIONS

In our study of general practice trainees, tolerance for uncertainty was lower in women and in the earlier stages of training. Graduates trained outside Australia displayed a pattern of reactions to uncertainty that differed from that of trainees who had attended Australian universities. Previous work in a practice and additional years of hospital work also played a role in general practice trainees' responses to uncertainty. Training structures in general practice must address this issue and support trainees in developing greater tolerance of uncertainty. A close appreciation of the demography and associations of uncertainty in general practice trainees will inform such initiatives.

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SUPPORTING INFORMATION

Additional Supporting Information may be found in the online version of this article:

Table S1. Descriptive statistics and univariate associations of trainee and practice factors with 'anxiety due to uncertainty about diagnosis/treatment'.
Table S2. Descriptive statistics and univariate associations of trainee and practice factors with concern about a bad outcome for the patient.
Table S3. Descriptive statistics and univariate associations of trainee and practice factors with reluctance to disclose diagnosis/treatment uncertainty to patients.

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