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Expectations, preferences and physicians' specialty choice

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Abstract

The specialty of general practice in many countries faces a problem of insufficient recruitment and excessive exit. This has prompted research into the determinants of retention and recruitment, including investigation of the career characteristics physicians most desire. We conceptualise junior physicians' choice of medical specialty as the outcome of a process concerning preferences over career attributes and expectations regarding the combinations of attributes each medical specialty offers. We investigate these career preferences and expectations via a Best Worst Scaling study conducted at the time junior physicians in England were making their specialty choices. We identify the career attributes most desired by junior physicians and the relative importance of monetary and non-pecuniary attributes. We find systematic differences in career preferences between those applying to general practice and those applying to other specialties. We find the expectations of a career in general practice, among junior physicians not applying to that speciality, differ from those of physicians applying to the speciality and the experience of a sample of current GPs. Junior physicians not applying to general practice strongly desire job characteristics that they do not associate with general practice, but which current GPs do associate with the specialty. This suggests that realigning such inaccurate expectations of general practice could offer a route to increase recruitment to the specialty.

1. Introduction

Matching the supply of physicians trained in appropriate medical specialities to the needs of the healthcare sector is a problem in many countries. The problems of mismatching are particularly acute with respect to primary care and in particular general practice (family medicine). In many developed countries, general practice is characterised by under recruitment and high rates of exit, causing a crisis of under provision.

The US is described as "entering an era of primary care workforce shortages" (Bodenheimer and Pham, 2010), with the Association of American Medical Colleges predicting a shortfall of between 7,300 and 43,100 primary care physicians by 2030 (Markit, 2017). In Australia, the number of full-time-equivalent GPs (per head of population) increased by 2.4% between 2005-2015 whilst the equivalent figure for all specialists was 22%; for every new GP there are nearly 10 new specialists (Scott, 2017) The UK government has committed to recruit 5000 more GPs by 2020 with a target of 50% of postgraduate medical training places being allocated to general practice. Despite this, the proportion of graduates opting for general practice is declining rather than increasing (Alberti et al., 2017) amid claims that Health Education England "lacks a credible plan for ensuring that there are enough GPs" (Limb, 2017).

These problems have focussed interest on the choice of specialty among junior physicians. The allocation of junior physicians to specialties has considerable welfare implications, with the potential for an inefficient distribution of physicians over specialties resulting in worse health outcomes and higher costs than is optimal (Nicholson and Propper, 2012).

Health care is a labour market in which wages do not adjust to clear the market, although expectations of future earnings (Nicholson, 2002) affect applications and eventual placements. Wage differentials explain some of the variation in specialty choice among junior physicians (Bhattacharya, 2005) but there is increasing interest in the impact of non-pecuniary factors on junior physicians' choice of specialty (Scott, 2001, Sivey et al., 2012).

The specialty in which doctors seek to practise is determined, *inter alia*, by their preferences over the specialties to which they can apply. These preferences over specialties can be decomposed and considered as preferences over job characteristics (Lancaster, 1966). Considered in this way, junior physicians' choice of career specialty is a function of their preferences over job characteristics and their expectations of the bundle of characteristics each specialty will deliver. These considerations will include pecuniary and non-pecuniary characteristics.

The impact of variation in financial returns on junior physicians' choice of medical specialty has been analysed extensively (Mckay, 1990, Hurley, 1991, Bhattacharya, 2005). The role of non-pecuniary factors has been more recently studied (Scott, 2001, Dorsey et al., 2003, Sivey et al., 2012) with lifestyle factors such as free time for leisure and control over weekly work hours identified as affecting speciality choice.

This paper identifies the job characteristics that junior physicians most desire using a representative sample of junior physicians in England. The preference data, collected via a Best Worst Scaling (BWS) study, was acquired at the time the junior physicians were submitting their applications for specialty training.

Further, the paper reports on the junior doctors' expectations of a career in general practice, with expectation parameters estimated for the job characteristics used in the preference study. That is, the relative desirability of job characteristics is estimated, and those characteristics are mapped against junior physicians' expectations of what a career in general practice will deliver.

This investigation of preferences and expectations allows two questions concerning the problem of under recruitment to general practice to be investigated:

- do those applying for specialist training in general practice have different preferences to those who do not?
- do those applying for specialist training in general practice have different expectations of a career in general practice to those who do not?

The paper contributes to the literature on medical career choice in five ways. First, it contributes to the literature on non-pecuniary job attributes which have been identified as a major influence on junior physicians' choice of specialism. As Sivey et al. (2012) note, while potential earnings have been identified as a significant determinant of

speciality choice "the size of the elasticity is usually rather small suggesting that a range of other factors play a role" (see also Nicholson and Propper (2012)).

Though expected future earnings can usually be calculated, Sivey et al. (2012) remark that data on other non-pecuniary attributes are usually unobserved or captured in the constant term in specialty choice models (Nicholson, 2002): 814) meaning that it is "difficult to ascertain *what it is* about a particular specialty that doctors value" (our emphasis).

The focus on non-pecuniary job attributes is of value since it has not always been possible for relative earnings to adjust in response to recruitment problems. Alternative responses, focussing on non-pecuniary attributes, are a potentially attractive alternative approach to addressing under-recruitment.

Second, the use of the Best Worst Scaling (BWS) methodology (Marley and Louviere, 2005) allows the relative importance of a large number of job characteristics to be considered. We include 36 attributes within the analysis, 35 of which are non-pecuniary. This is substantially more than Scott (2001) and Sivey et al. (2012) who both include seven attributes and Ramos et al. (2017) who include eight.

The use of BWS methodology has advantages over other methods previously used to investigate these issues. For example, BWS avoids problems associated with the scale use bias that Likert scale questions (used by, for example, Smith et al. (2015), Al-Nuaimi et al. (2008)) are prone to. Also, unlike the Likert approach, BWS forces discrimination among items.

Third, this study uses preference data which has merit since doctors' observed medical specialty can be a misleading proxy for their most preferred specialty, as first preference careers may not be realized (Nicholson, 2002). The stated preference data used in this study has the additional advantage of being collected at the time when junior doctors were applying for specialty training. This timing can be plausibly expected to reduce recall error and increase the salience of the career attributes to respondents.

Fourth, as well as investigating what junior physicians want from their future medical career, the study is the first to systematically investigate expectations of what a career in general practice would entail. This allows analysis of the interplay between

expectations of general practice and career preferences as potential contributors to the recruitment crisis.

Finally, the paper includes formal testing for differences in career preferences and expectations between those junior physicians applying to general practice and those applying to other specialties.

Identifying desirable job traits which junior physicians only weakly associate with general practice provides potential opportunities for increasing recruitment if the weak association is erroneous. We investigate this issue using an additional BWS1 dataset completed by currently practising General Practitioners. Models estimated on the combined data permits the identification of desirable job characteristics which junior physicians under-associate with general practice. These results can inform attempts to increase recruitment to general practice.

The remainder of the paper as structured as follows: Section 2 provides an overview of the survey design, hypotheses tested, statistical models estimated and data collection process; Section 3 contains results which are discussed in Section 4 with Section 5 concluding the paper.

2. Methods

2.1 Survey Design

The centrepiece of the survey comprised Best-Worst Scaling (BWS) choice tasks. BWS has variants denoted as case 1, 2 (see Erdem and Campbell (2017)) and 3 (see Pedersen et al. (2016)). In case 1 the items which comprise the choice tasks are single dimension items, whereas BWS cases 2 and 3 are extensions of case 1 in which items are multi-dimensional options. Best-Worst Scaling case 1 (BWS1) is a form of choice experiment originating with Louviere and Woodworth (1990) as an extension of Thurstone's Method of Paired Comparisons (Thurstone, 1927). BWS1 allows the derivation of measures on a difference scale with known properties (Marley and Louviere, 2005).

A BWS1 study requires survey respondents to consider sets of items. Each set (typically containing four or five items) is a subset of the full set of items under consideration. Respondents choose the "best" and "worst" item in each subset. This pair of choices provides a preference ordering over many of the possible pairs in the sets; in a set of 5 items the best and worst choices define the ordering over 7 of the possible 10 pairs within the set.

Respondents make choices from multiple sets of items, with those combinations determined by an experimental design. The data can be analysed, typically using counts or via estimation of random utility choice models (McFadden, 1974) to provide a ranking of the full set of items and ratio-scaled 'importance scores'.

In addition to the BWS choice tasks the survey asked respondents about their speciality training application, their experiences during both medical education and training and their demographics.

Choice of job attributes

The BWS tasks included 36 job characteristics. These were based on a career planning handbook 'Roads to Success' (Elton and Reid, 2010). This handbook is provided for junior physicians to assist in career planning and medical speciality choice. The 36 job characteristics chosen for the BWS tasks were based on those used in Exercise 1 in the handbook which features 36 'work values'. Junior physicians are directed to consider the importance of those values and use that consideration in choosing their specialty.

Survey design was an iterative process involving a review of the relevant literature, discussion of factors affecting career choices with F2s and general practitioners (GPs) working alongside junior physicians. The survey was piloted in depth with five doctors of similar career stage and further refinement was based on their feedback. The 36 attributes are shown in Table 1.

Three BWS1 exercises were undertaken. The first exercise asked junior physicians to select the job characteristic they most wanted and least wanted from their future career. The second exercise asked the same junior physicians to select the job characteristic they most and least associated with a career in general practice. The third exercise asked practising General Practitioners to select the job characteristic they most and least associated with a career in general practice.

The experimental design, via which the 36 attributes were combined in choice sets, was identical for all 3 BWS1 exercises and comprised 20 versions or blocks, each comprising15 sets. The design, generated using Sawtooth Software's Maxdiff Designer (Sawtooth Software, 2007), balanced how often each attribute appeared with each other attribute, and the position of the attribute in the set, to avoid ordering effects. An image of the choice task from the preference BWS1 exercise is shown in Figure 1.

Table 1. Job characteristics used in BWS1 questionnaires

Job Characteristic	Label
Able to maintain a good work-life balance	wk-life
Having control over where geographically I work	geogcont
Working as part of a team	team
A role in which you help individuals, groups, society	helping
Always learning new things	learning
Some flexibility as to when you carry out responsibilities	managtime
Having a variety of responsibilities	variety
Not working extended or anti-social hours	sochours
Being known as having special knowledge or skills	expertise
Being able to teach others	teach
Lots of direct contact with patients	contact
Being stretched and facing new problems	challeng
Feeling appreciated	recog
Knowing your work will always be there for you	jobsec
Making important clinical decisions under pressure	excite
Having access to advice from expert colleagues	advice
Thinking of new ideas/ways of doing things	creativity
Providing continuity of care for patients	contcare
Working in a Hospital based specialty	hosp
Opportunity to work part time	ptime
Performing specialist procedures (surgical, diagnostic etc)	specialist
Responsibility for supervising others	supervise
Working in a well-known unit/service	wellknown
The possibility of earning a higher salary	money
A predictable work routine	predict
Working with a particular patient group	particpatients
A good chance of promotion	promo
A high-status position	respect
A low risk of litigation	litigation
Being able to work alone	independ
Performing tasks which require great precision	precision
Being involved in research	research
A rapid pace of work	pace
Opportunity to manage a clinical service	manag
Working in a community-based role	community
A speciality to which entry is competitive	compet

Figure 1. Example BWS1 choice set

Considering only the 5 attributes or characteristics shown below,

• which ONE do you **MOST want** in your future medical work

and

• which ONE do you **LEAST want** in your future medical work

Most Want		Least Want
○	**Community** [working in a community-based role]	○
○	**Pace** [a rapid pace of work]	○
○	**Part Time** [opportunity to work part time]	○
○	**Supervision** [responsibility for supervising others]	○
○	**Team** [working as part of a team]	○

2.2 Data Collection

The first sample in the study comprised junior physicians. They were physicians who had completed medical school and were in their 2nd and final year of preliminary practice and applying to enter specialty training at the time of the survey.

The sample were subsequently subdivided into those who indicated they had already, or would, apply to general practice as a first preference, and those whose first preference was another specialty. These junior physician groups are denoted hereafter as GPA (general practice applicants) and NGPA (not general practice applicants).

The junior physician survey was conducted between November 2015 and February 2016. Recruitment to the online survey was via email invitation circulated by the 17 Foundation Schools in England (institutions that deliver the two-year workplace-based training which forms a bridge between medical school and speciality training). The invitations asked second year Foundation School junior physicians to contribute to research into how 'Foundation Doctors make career decisions'. Additional publicity was circulated by the researchers via social media.

The second sample in the study (denoted as cGP) comprises currently practising General Practitioners. Recruitment occurred between March and September 2016 via invitations at conferences and social media posts.

2.3 Sequential Best Worst Choice Models

Models of specialty preferences

We estimate sequential best-worst choice models (Marley and Louviere, 2005, Lancsar et al., 2013) using Latent Gold Choice 5.1. We define the latent utility (y^*_{ism}) associated with career characteristic m by individual i, as having a deterministic component, β_m, and a stochastic element captured by the error term (ε_{ism}) where s indicates whether a choice is a best or worst choice:

$$y^*_{ism} = \beta_m + \varepsilon_{ism} \quad (1)$$

We allow for heterogeneity in the standard deviation of the error process ($\sigma_{\varepsilon_{ism}}$) due to observable characteristics :

$$\sigma_{\varepsilon_{ism}} \propto \exp(-w'_{is}\gamma) \quad (2)$$

where ($\exp(-w'_{is}\gamma)$) is the scale factor, denoted by λ hereafter, which is inversely proportional to the standard deviation of the errors (assuming the stochastic element follows a type I extreme value IID distribution). **w** is a vector of characteristics of respondents (eg applying to general practice) and choices (eg best or worst choice). The functional form in (2) ensures the error variance is positive (Vermunt, 2013).

We assume a sequential best worst choice, estimating a model in which the probability that attribute m_1 is selected as best is given by:

$$\pi_{ism_1} = \frac{\exp(\beta_{m_1}\lambda)}{\sum_{r=1}^{M}\exp(\beta_r\lambda)} \qquad s = best \quad (3)$$

and the probability that attribute m_2 is selected as worst, conditional upon the choice of best, is given by:

$$\pi_{ism_2|m_1} = \frac{\exp(-\beta_{m_2}\lambda)}{\sum_{r\neq m_1}^{M}\exp(-\beta_r\lambda)} \qquad s = worst \quad (4)$$

Note that in (4) the deterministic component is scaled by -1 since the least preferred option is being chosen. The probability of selecting m1 as the best and m2 as the worst is given by:

$$\pi_{ij,m_1,m_2} = \pi_{ij,m_1}\pi_{ij,m_2|m_1} \tag{5}$$

To test for equal preferences between junior physicians applying to general practice (GPA) and those not (NGPA) we restate the deterministic component of the utility function in (1) as:

$$\beta_m = \beta_m^{ngpa} + GPA_i\alpha_m \tag{6}$$

where GPA_i =1 if person i is applying to general practice as a first choice, and zero otherwise. The utility function is additive:

$$\beta_m^{gpa} = \beta_m^{ngpa} + \alpha_m \tag{7}$$

such that $\alpha_m = 0$ implies equal preferences, for attribute m, between the two groups of junior physicians.

Models of association with General Practice

The second BWS1 exercise concerns job characteristics most/least associated with general practice. The modelling process is analogous to that for preferences. We define the latent association (z_{ism}^*) of job characteristic m with general practice, by individual i, as having a deterministic component, τ_m, and a stochastic element captured by the error term (ϕ_{ism}) where s denotes whether it is a most associated, or a least associated, choice:

$$z_{ism}^* = \tau_m + \phi_{ism} \tag{8}$$

As with the preference model, heterogeneity in the standard deviation of the error process ($\sigma_{\phi_{ism}}$) is modelled as a function of characteristics of choice type and respondent:

$$\sigma_{\phi_{ism}} \propto \exp(w_{is}'\varphi) \tag{9}$$

where ($\exp(w_{is}'\varphi)$) is the scale factor, denoted by μ hereafter. The probability of selecting job characteristic m1 as most associated with general practice is given by:

$$\emptyset_{ism_1} = \frac{exp[\tau_{m1}\mu]}{\sum_{r=1}^{M} exp[\tau_r\mu]} \qquad s = \textit{most associated} \tag{10}$$

and the probability that attribute m2 is selected as least associated with general practice, conditional upon the choice of m1, is given by:

$$\emptyset_{ism_2|m_1} = \frac{exp[-\tau_{m2}\,\mu]}{\sum_{r\neq m_1}^{M} exp[-\tau_r\,\mu]} \qquad s = \textit{least associated} \qquad (11)$$

To test for equality of association of attribute m with General Practice, between different groups (GPA and NGPA junior physicians and current GPs) we restate the deterministic component of the association function in (8) as:

$$\tau_m = \tau_m^{ngpa} + GPA_i\,\rho_m + cGP_i\,\vartheta_m \qquad (12)$$

where cGP_i =1 if person i is a current GP, and zero otherwise, and GPA_i =1 if person i is applying to general practice as a first choice, and zero otherwise. The association of attribute m with General Practice for GPA junior physicians is given by:

$$\tau_m^{gpa} = \tau_m^{ngpa} + \rho_m \qquad (13)$$

and the association of attribute m with General Practice for current GPs is given by:

$$\tau_m^{cgp} = \tau_m^{ngpa} + \vartheta_m \qquad (14)$$

The estimated β (and τ) terms from the sequential best worst logit models, normalised to have mean zero, are transformed into ratio-scaled importance scores using the transformation:

$$\frac{e^{\beta_m}}{(e^{\beta_m} + (\psi - 1))} \qquad (15)$$

where ψ is the number of attributes comprising each set (ψ =5).

2.4 Hypothesis Testing

We test the hypotheses of equal preferences over job characteristics and equal expectations of a career in general practice between the NGA and NGPA junior physicians. We also test the hypothesis of equal expectations of general practice between the NGPA junior physicians and current GPs. These hypotheses are tested using Likelihood Ratio (LR) tests based on models in which the restrictions of equality of preferences (or expectations) are imposed.

For Hypothesis H1 (equality of preferences among junior physicians) the null hypothesis is defined as:

$$H_0^1: \ (\boldsymbol{\beta}^{\text{ngpa}} - \boldsymbol{\beta}^{\text{gpa}}) = 0 \tag{16}$$

This is equivalent to a test of $\boldsymbol{\alpha} = 0$. H_0^1 will be rejected if the preferences over the set of job characteristics differ significantly between those who apply to general practice and those who do not.

If H_0^1 is rejected, equality of preference can be tested for specific attributes, using tests of the form:

$$\beta_m^{ngpa} - \beta_m^{gpa} = 0 \tag{17}$$

For Hypothesis H2 (equality of expectations among junior physicians) the null hypothesis is defined as:

$$H_0^2: \ (\boldsymbol{\tau}^{\text{ngpa}} - \boldsymbol{\tau}^{\text{gpa}}) = 0 \tag{18}$$

This is equivalent to a test of $\boldsymbol{\rho} = 0$. H_0^2 will be rejected if the expectations of general practice among junior physicians applying to general practice differ significantly from those who do not. If H_0^2 is rejected, equality of expectations can be tested for specific attributes, using tests of the form:

$$\tau_m^{ngpa} - \tau_m^{gpa} = 0 \tag{19}$$

For Hypothesis H3 (equality of NGPA junior physician expectations and current GP experience) the null hypothesis is defined as:

$$H_0^3: \ (\boldsymbol{\tau}^{cgp} - \boldsymbol{\tau}^{ngpa}) = 0 \tag{20}$$

This is equivalent to a test of $\boldsymbol{\vartheta}$=0. H_0^3 will be rejected if the expectation parameters of junior physicians not applying to general practice differ significantly from the equivalent association parameters of a sample of current GPs.

This relationship between junior doctors' expectations and current GPs' associations is also explored at the level of individual job characteristics. That is, we test for the under-association of each job characteristic with general practice, for those job characteristics that junior physicians most desire. Formally, we test:

$$\tau_m^{ngpa} - \tau_m^{cgp} < 0 \qquad (21)$$

which is implemented by testing whether $\vartheta_m > 0$ for each of the ten (for the sake of brevity) most desired job characteristics (those with the highest β^{ngpa} values).

3. Results

3.1 Descriptives

A total of 816 junior physicians completed the survey. 783 (96%) of these responses were sufficiently complete. The junior physicians sample represents 11% of the English Foundation Schools' cohort of 7,397 (The Foundation Programme, 2016). The sample of currently working GPs who completed the BWS1 exercise on the association of job characteristics to general practice comprised 168 people.

Appendix Tables A1 and A2 report demographic statistics for both samples, and specialty application details, respectively. The speciality application details (Table A2) from the survey are presented alongside results from the Foundation Programme's 2016 Career Destination Report. The sample of junior physicians comprises 62% females (GPA: 69%, NGPA: 60%). The equivalent population value is 56%. The sample of current GPs is 63% female compared to 54% of all GP providers in England. Hence females are over-represented in both samples.

21% of our sample of junior physicians reported applying, or intending to apply, to general practice as a first preference. Table A2 indicates that 31% of all applications nationally were to general practice. Any comparison of these two values should take account of the fact that physicians typically apply to multiple specialities, taking account of factors such as the probability of a successful application (Nicholson, 2002) and hence applying to 'insurance' options. Our sample value of 21% first preferences for general practice matches the finding that 20% of the cohort reporting upon entry into training, that they intended to apply to general practice (The Foundation Programme, 2016)

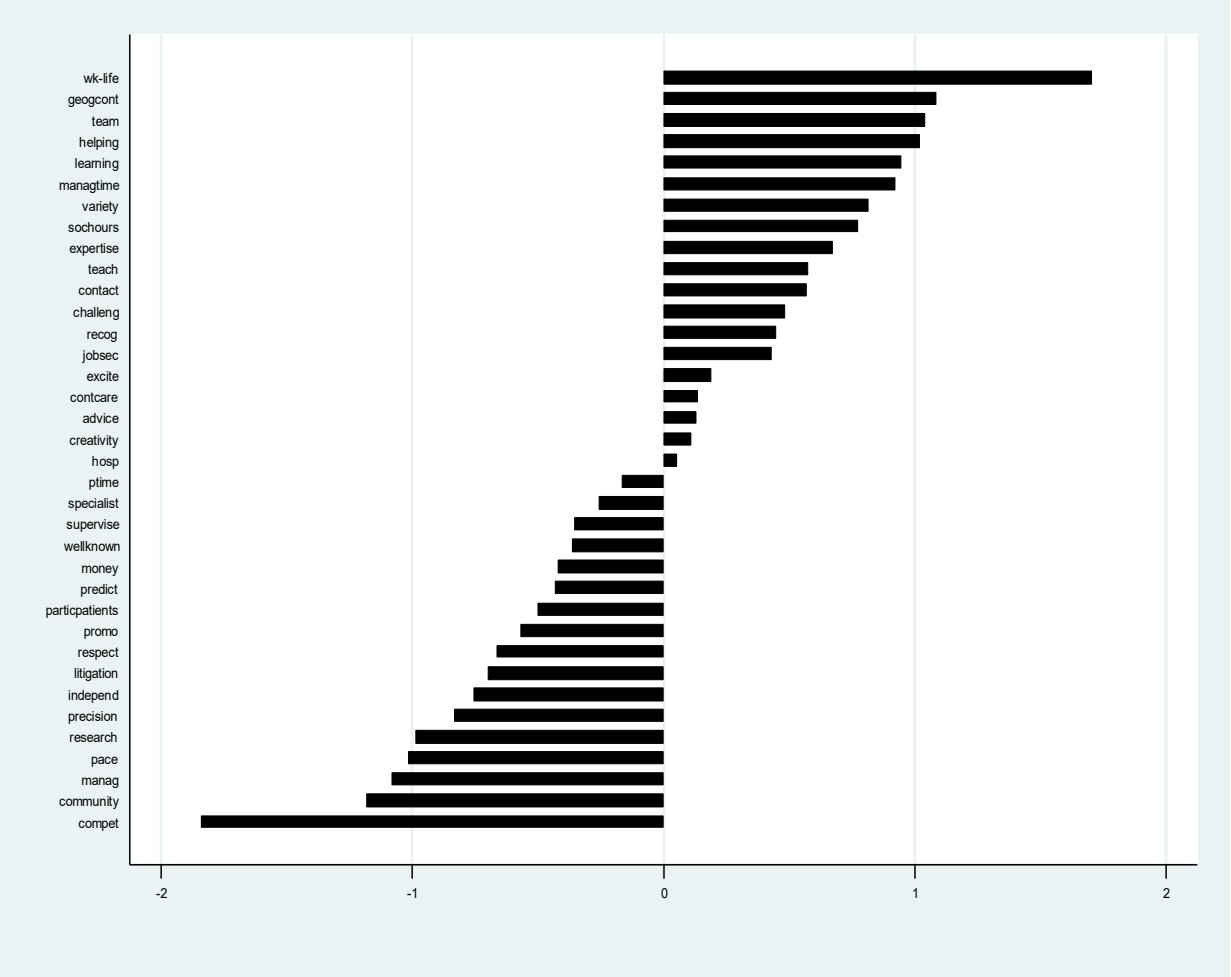
3.2 Regression Results

We identify the job characteristics that junior physicians most desire from their future career. Table 2 reports coefficients from the estimation of the two heteroscedastic sequential best worst logit models. Model 1 is an aggregate model estimated on a pooled sample of junior physicians. The coefficients are displayed graphically in Figure 2. Table 1 also displays ratio-scaled importance scores, derived via the transformation in (13).

Table 2. Preferences over job characteristics: heteroscedastic sequential best-worst conditional logit

	Model 1 All junior physicians				Model 2 NGPA physicians (β^{ngpa})			GPA interaction (α)		
	Coefficient	**S.E.**	**Rank**	**Importance Scores**	**Coefficient**	**S.E.**		**Coefficient**	**S.E.**	**P-value**
wk-life	3.546	0.089	1	7.091	3.496	0.093		1.944	0.158	0.000
geogcont	2.926	0.088	2	5.208	2.859	0.093		1.902	0.150	0.000
team	2.878	0.087	3	5.065	3.059	0.091		0.683	0.151	0.000
helping	2.862	0.087	4	5.018	2.835	0.093		1.675	0.147	0.000
learning	2.788	0.086	5	4.800	2.948	0.091		0.708	0.149	0.000
managtime	2.763	0.086	6	4.727	2.748	0.091		1.687	0.149	0.000
variety	2.656	0.087	7	4.421	2.748	0.092		1.106	0.149	0.000
sochours	2.615	0.087	8	4.306	2.394	0.093		2.560	0.151	0.000
expertise	2.515	0.090	9	4.031	2.900	0.093		-0.482	0.152	0.002
teach	2.417	0.086	10	3.771	2.536	0.091		0.768	0.152	0.000
contact	2.407	0.086	11	3.745	2.336	0.093		1.795	0.149	0.000
challeng	2.325	0.089	12	3.535	2.600	0.090		-	-	-
recog	2.290	0.085	13	3.448	2.375	0.091		1.004	0.151	0.000
jobsec	2.269	0.084	14	3.396	2.289	0.090		1.279	0.151	0.000
excite	2.029	0.091	15	2.839	2.413	0.096		-0.676	0.152	0.000
contcare	1.978	0.084	16	2.730	1.705	0.089		2.650	0.150	0.000
advice	1.973	0.081	17	2.719	1.999	0.089		0.909	0.149	0.000
creativity	1.952	0.085	18	2.675	2.114	0.092		0.405	0.153	0.008
hosp	1.892	0.086	19	2.552	2.400	0.090		-1.435	0.150	0.000
ptime	1.676	0.086	20	2.143	1.496	0.092		2.109	0.154	0.000
specialist	1.583	0.089	21	1.983	2.062	0.097		-1.122	0.155	0.000
supervise	1.485	0.077	22	1.826	1.558	0.087		0.439	0.152	0.004
wellknown	1.477	0.080	23	1.813	1.537	0.089		0.670	0.155	0.000
money	1.422	0.079	24	1.730	1.356	0.088		1.198	0.156	0.000
predict	1.408	0.080	25	1.709	1.193	0.087		2.058	0.153	0.000
particpatients	1.339	0.077	26	1.610	1.383	0.088		0.551	0.152	0.000
promo	1.274	0.074	27	1.522	1.319	0.084		0.479	0.152	0.002
respect	1.177	0.075	28	1.397	1.213	0.086		0.527	0.151	0.001
litigation	1.141	0.073	29	1.353	1.065	0.083		1.065	0.156	0.000
independ	1.084	0.074	30	1.286	0.919	0.083		1.594	0.156	0.000
precision	1.007	0.075	31	1.200	1.266	0.087		-0.577	0.152	0.000
research	0.853	0.074	32	1.043	1.050	0.087		-0.382	0.153	0.013
pace	0.823	0.071	33	1.015	0.913	0.078		-	-	-
manag	0.759	0.072	34	0.957	0.658	0.083		1.016	0.155	0.000
community	0.657	0.072	35	0.871	0.046	0.081		3.636	0.163	0.000
compet	-	-	-	0.467	-	-		-	-	-
Scale parameters	**Coefficient**	**S.E.**					**Coefficient**	**S.E.**		
Worst	-0.050	0.028					-0.117	0.027		
GPA	0.094	0.032								
Observations/class members	783						616 NGPA	167 GPA		
Number of parameters	37						69			
Log-likelihood	-30515.904						-29406.021			

Figure 2. Preferences over Job Characteristics (Model 1)



These preference results indicate that maintaining a good work-life balance [wk-life] is the most desired job attribute, followed by having geographical control over where one works [geog] and working as part of a team [team]. These non-pecuniary attributes are more important than a higher salary [money] by factors of between 3 [geog, team] and 4 [wk-life] times.

The importance of work-life balance and working hours is also evident in the high ranking of flexibility in the timing of one's work [managtime] and avoiding anti-social hours [sochours] which are ranked 6th and 8th respectively, both more than 2.5 times as important as a higher salary [money]. Among the least desired characteristics are having the opportunity to manage a clinical service [manag] and working in a community-based role [community].

We note that there is no statistical difference in the scale term (and hence in error variance) between best and worst choices, but that GPA junior physicians' choices are characterised by lower error variance (scale term = 1.1) relative to NGPA physicians.

Model 1 represents a restricted model in which the equality of preferences is imposed. An unrestricted model, in which all but one (for identification) of the estimated β_m preference parameters of GPA and NGPA physicians are free to vary, was estimated (Model 1b in Appendix Table A3). A likelihood ratio (LR) test of Model 1 against the unrestricted model (1b) indicates that the data reject the restrictions (LR=2219.813; $\chi^2_{0.05,34}$= 48.602); physicians applying to general practice have systematically different career preferences to those who do not.

Further LR tests indicate the data supported constraining the preferences for only 2 attributes to be the same between GPA and NGPA physicians ([pace] and [challeng]). A parsimonious model with these restrictions imposed (Model 2) is reported in Table 2, with this model preferred to unrestricted Model 1b (LR=0.0476; $\chi^2_{0.05,2}$= 5.991).

Table 3. Association of job characteristics with a career in general practice: heteroscedastic sequential best-worst conditional logit model

	Model 3				Model 4				
	All junior physicians				NGPA physicians (τ^{ngpa})		GPA Interaction (ρ)		
	Coefficient	**S.E.**	**Rank**	**Importance Scores**	**Coefficient**	**S.E.**	**Coefficient**	**S.E.**	**P-value**
community	6.335	0.097	1	8.178	6.392	0.097	-0.627	0.129	0.000
contcare	6.074	0.095	2	7.753	6.003	0.090	-	-	-
contact	5.809	0.094	3	7.255	5.748	0.089	-	-	-
ptime	5.193	0.091	4	5.875	5.138	0.087	-	-	-
helping	5.047	0.091	5	5.517	4.995	0.087	-	-	-
wk-life	4.916	0.091	6	5.190	4.867	0.088	-	-	-
sochours	4.881	0.090	7	5.103	4.827	0.087	-	-	-
independ	4.835	0.090	8	4.987	4.895	0.089	-0.553	0.123	0.000
predict	4.663	0.090	9	4.558	4.750	0.090	-0.670	0.124	0.000
manag	4.594	0.090	10	4.387	4.699	0.090	-0.809	0.130	0.000
variety	4.587	0.090	11	4.370	4.537	0.087	-	-	-
managtime	4.564	0.090	12	4.313	4.511	0.087	-	-	-
geogcont	4.535	0.091	13	4.242	4.485	0.088	-	-	-
jobsec	4.499	0.091	14	4.154	4.447	0.087	-	-	-
learning	3.755	0.089	15	2.523	3.603	0.091	0.497	0.131	0.000
money	3.665	0.090	16	2.357	3.813	0.091	-0.910	0.131	0.000
challeng	3.590	0.088	17	2.225	3.493	0.090	0.272	0.129	0.036
teach	3.444	0.087	18	1.982	3.399	0.084	-	-	-
supervise	3.173	0.087	19	1.586	3.211	0.090	-0.353	0.129	0.006
advice	3.037	0.085	20	1.413	2.998	0.083	-	-	-
pace	3.034	0.086	21	1.409	2.999	0.084	-	-	-
team	2.887	0.085	22	1.241	2.754	0.088	0.459	0.127	0.000
wellknown	2.844	0.085	23	1.195	2.803	0.083	-	-	-
particpatients	2.802	0.086	24	1.151	2.767	0.084	-	-	-
recog	2.766	0.085	25	1.115	2.729	0.083	-	-	-
creativity	2.747	0.084	26	1.096	2.633	0.086	0.386	0.125	0.002
litigation	2.629	0.085	27	0.986	2.692	0.088	-0.468	0.124	0.000
respect	2.445	0.083	28	0.834	2.414	0.081	-	-	-
promo	2.443	0.083	29	0.833	2.412	0.081	-	-	-
excite	2.046	0.081	30	0.576	1.908	0.084	0.566	0.125	0.000
expertise	1.758	0.081	31	0.438	1.732	0.079	-	-	-
research	1.640	0.080	32	0.391	1.667	0.083	-0.262	0.118	0.027
precision	1.284	0.079	33	0.277	1.323	0.082	-0.266	0.122	0.029
compet	1.033	0.078	34	0.217	1.012	0.077	-	-	-
specialist	0.914	0.079	35	0.193	0.901	0.078	-	-	-
hosp	-	-	-	0.078	-	-	-	-	-
Scale parameters	**Coefficient**	**S.E.**					**Coefficient**	**S.E.**	
Worst	0.194	0.020					0.200	0.020	
GPA	-0.071	0.021							
Observations/class members	783						616 NGPA	167 GPA	
Number of parameters	37						50		
Log-likelihood	-23227.121						-23107.911		

We now consider expectations of general practice. Model 3, reported in Table 3, is a restricted model with a single expectation parameter estimated for each attribute. In this model the job characteristics most associated with a career in general practice are working in a community-based role [community], providing continuity of care [contcare] and having lots of direct contact with patients [contact]. The opportunity to work part time, maintaining a good work-life balance and a predictable work routine were strongly associated with a career in general practice.

An unrestricted model, in which all but one of the estimated τ_m expectation parameters of GPA and NGPA physicians are free to vary, was estimated (Model 3b, Appendix Table A4). A likelihood ratio (LR) test of Model 3 against the unrestricted Model 3b indicates that the data reject the restrictions(LR =259.565; $\chi^2_{0.05,34}$= 48.602); expectations of general practice differ between those physicians applying to the specialty and those who are not.

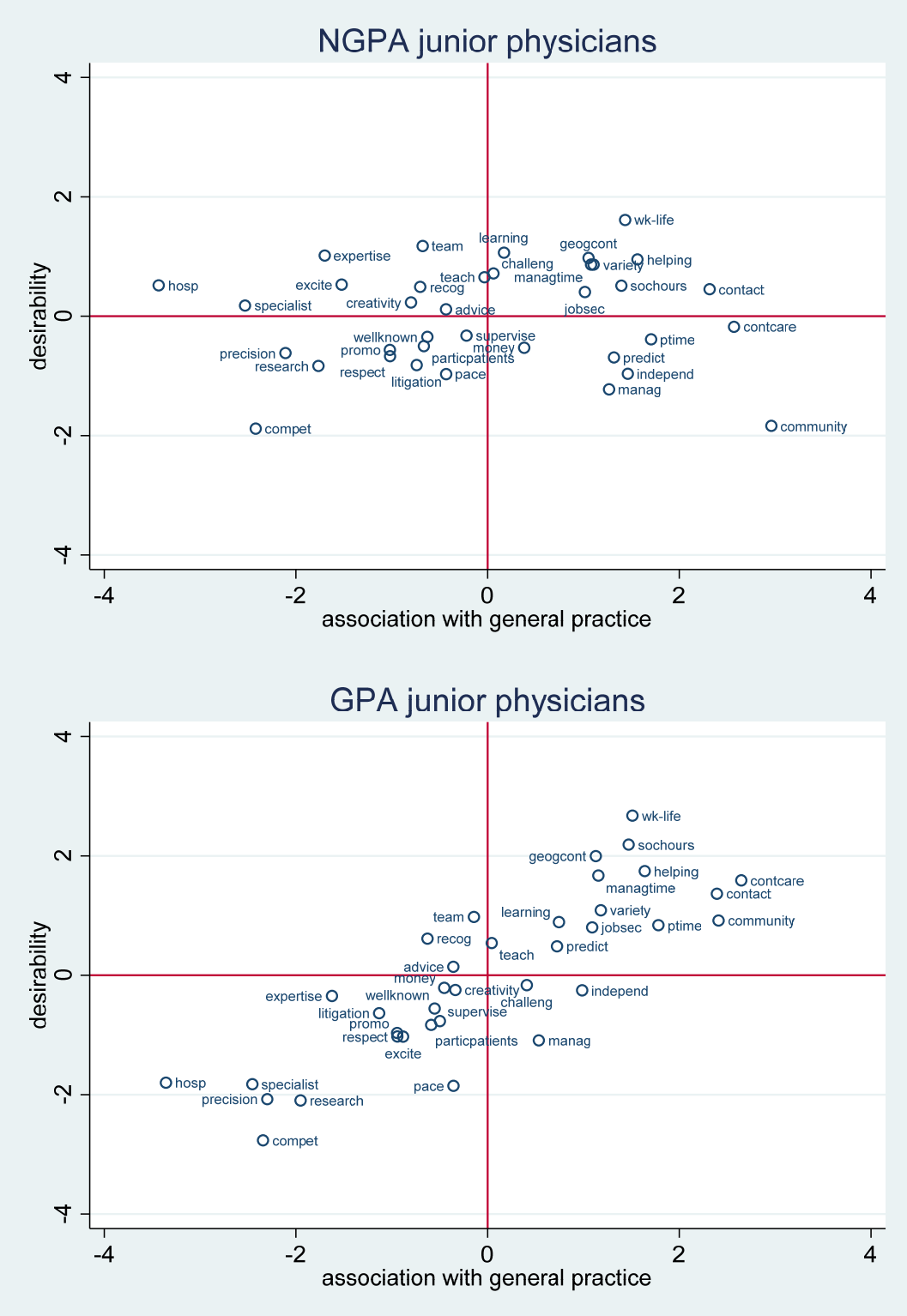
The data supported constraining the expectations for 21 attributes to be the same between GPA and NGPA physicians. This parsimonious model (Model 4) is reported in Table 3. These test results indicate a far greater degree of shared expectations than was the case for shared preferences. Of the ten job characteristics that GPA and NGPA junior physicians most associate with general practice, seven are common to both groups and six of those seven expectation parameters are the same. A parsimonious model with these restrictions imposed (Model 4) is reported in Table 3, with this model preferred to unrestricted Model 3b (LR=21.145; $\chi^2_{0.05,21}$= 32.671).

The relationship between expectations and preferences over job characteristics is further illustrated in Figure 3 in which expectations are plotted against preferences, for the GPA and NGPA samples separately. The plots display the zero-meaned logit coefficients, with the axes therefore denoting the mean levels of desirability, and association of job characteristics with general practice. There is a strong correlation between the job characteristics that GPA physicians associate with general practice and what they want from their career (correlation = 0.84), but no significant correlation for NGPA physicians (correlation = 0.06).

The preference-expectation plots in Figure 3 highlight job characteristics that NGPA physicians desire but only weakly associate with general practice including, *inter alia*,

working as part of a team [team], being known as having specialist knowledge or skills [specialist] and making important clinical decisions under pressure [excitement]. Job

Figure 3. Job characteristics desirability and association with general practice, by specialty choice



characteristics that NGPA physicians do not strongly desire (and may be averse to) but strongly associate with general practice include the opportunity to manage a clinical service [manag], working alone [indep] and a predictable work routine [predict].

The crisis in recruitment to general practice creates an incentive to understand whether correcting inaccurate expectations, among NGPA physicians, as to what a career in general practice offers a means to increase applications. To investigate this we compare the expectations of junior physicians against the experience of a sample of currently practising GPs. A particular focus here is whether junior physicians who do not apply to general practice under-associate job characteristics they desire with that specialty, that is, the experience would outperform the expectation.

Comparison of junior physician expectations and current GP experiences

Model 5 in Table 4 is the restricted model. An LR test of this against the unrestricted model (Model 5b in Appendix Table 5) indicates that the data reject the restrictions (LR =2383.176; $\chi^2_{0.05,34}$=48.602); junior physicians not applying to general practice have systematically different expectations of that specialty compared to the experience of a current GP sample.

The data supported constraining the expectation or association parameters for 8 attributes to be the same between NGPA junior physicians and the current GP sample. Model 6, in Table 4, reports the parameter estimates for this parsimonious model.

Table 4. Association of job characteristics with a career in general practice (current GPs and NGPAs): heteroscedastic sequential best-worst conditional logit

	Model 5		Model 6				
	cGPA and NGPA pooled		NGPA physicians (τ^{ngpa})		cGP interaction (ϑ)		
	Coefficient	**S.E.**	**Coefficient**	**S.E.**	**Coefficient**	**S.E.**	**P-value**
community	6.569	0.102	6.503	0.101	-1.755	0.133	0.000
contcare	6.407	0.101	6.146	0.098	-0.340	0.138	0.014
contact	6.143	0.100	5.856	0.092	-	-	-
ptime	5.386	0.097	5.252	0.093	-0.885	0.130	0.000
helping	5.337	0.097	5.085	0.090	-	-	-
independ	5.054	0.096	4.973	0.092	-1.196	0.133	0.000
variety	4.890	0.096	4.593	0.094	0.385	0.131	0.003
sochours	4.836	0.097	4.901	0.094	-2.240	0.127	0.000
manag	4.798	0.096	4.768	0.092	-1.457	0.129	0.000
wk-life	4.719	0.099	4.907	0.095	-2.925	0.125	0.000
geogcont	4.702	0.097	4.558	0.095	-0.617	0.136	0.000
jobsec	4.693	0.097	4.557	0.094	-0.813	0.136	0.000
managtime	4.677	0.097	4.585	0.094	-1.068	0.133	0.000
predict	4.650	0.097	4.826	0.093	-2.738	0.122	0.000
learning	4.015	0.095	3.668	0.094	0.751	0.133	0.000
challeng	3.981	0.095	3.550	0.092	1.436	0.132	0.000
money	3.736	0.096	3.879	0.094	-2.119	0.122	0.000
teach	3.682	0.093	3.462	0.086	-	-	-
pace	3.462	0.093	3.034	0.091	1.417	0.132	0.000
supervise	3.456	0.094	3.224	0.087	-	-	-
team	3.213	0.093	2.797	0.090	1.519	0.134	0.000
advice	3.161	0.091	3.033	0.089	-0.540	0.125	0.000
wellknown	3.069	0.092	2.899	0.090	-0.267	0.126	0.034
particpatients	3.028	0.092	2.873	0.091	-0.278	0.128	0.029
creativity	3.000	0.091	2.684	0.088	0.779	0.128	0.000
recog	2.934	0.092	2.741	0.085	-	-	-
litigation	2.790	0.092	2.748	0.090	-0.898	0.121	0.000
respect	2.594	0.090	2.393	0.083	-	-	-
promo	2.458	0.090	2.490	0.088	-1.240	0.120	0.000
excite	2.271	0.088	1.942	0.085	1.112	0.133	0.000
expertise	2.013	0.088	1.773	0.085	0.515	0.121	0.000
research	1.867	0.087	1.703	0.079	-	-	-
precision	1.524	0.086	1.413	0.078	-	-	-
compet	1.237	0.085	1.057	0.084	0.382	0.118	0.001
specialist	1.048	0.086	0.907	0.084	0.324	0.121	0.008
hosp	-	-	-	-	-	-	-
Scale parameters				**Coefficient**	**S.E.**		
Worst	0.116	0.021		0.137	0.02		
cGPA	-0.525	0.027					
Observations/class members	784			616 NGPA	168 cGP		
Number of parameters	37				63		
Log-likelihood	-24417.668				-23232.109		

The relationship between expectations and experience is further illustrated in Figure 4. This displays the BWS1 (Model 6) parameters for current GPs against those of the NGPA junior physicians. Job characteristics above the 45° line are more associated with general practice by the current GPs, and those below the line are more associated with general practice by the NGPA physicians. The axes of Figure 4 concern expectations. Preference information (from Model 2) is conveyed via the symbols: relatively desirable job characteristics ($\beta_m^{ngpa} > 0$) are denoted by '+' and relatively undesirable characteristics ($\beta_m^{ngpa} < 0$) by 'o'.

Figure 4. Expectations of general practice: NGPA junior physicians versus current GPs

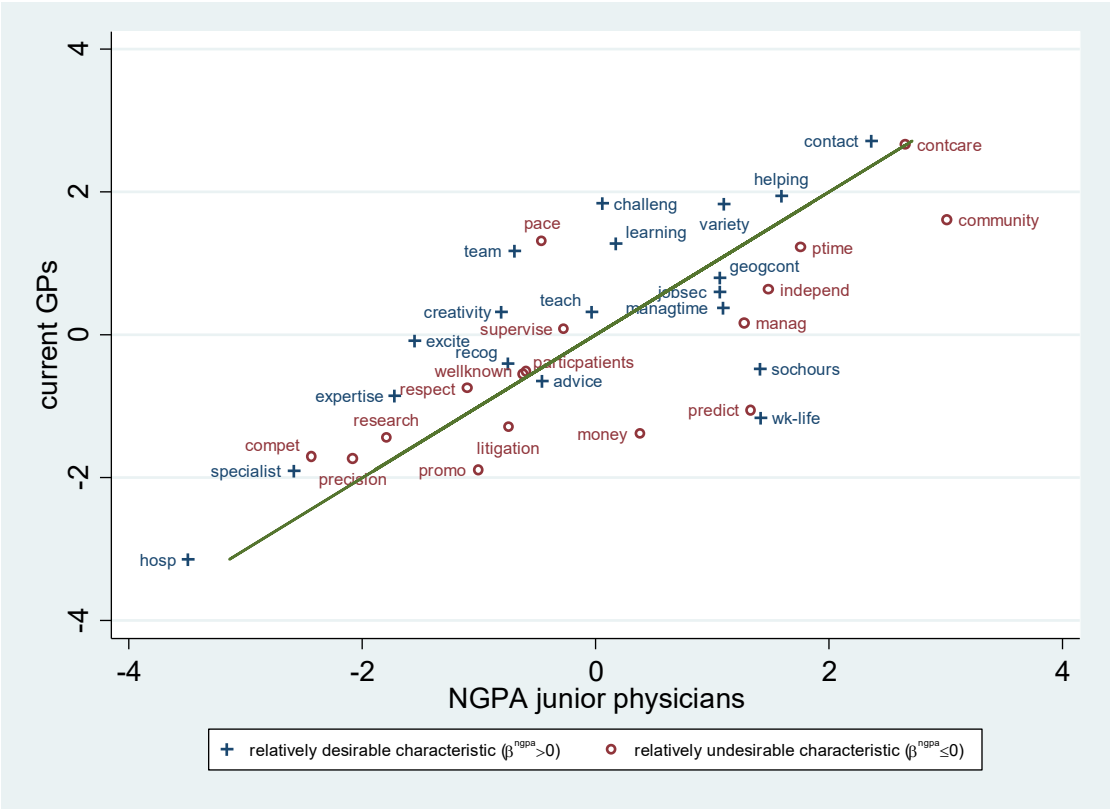


Figure 4 indicates that many job characteristics desired by those junior physicians not applying to general practice are more strongly associated with general practice by current GPs. These include working as part of team [team], being stretched and facing new problems [challeng], thinking of new ideas/ways of doing things [creativity] and making important clinical decisions under pressure [excite].

We investigate formally how these divergent expectations might inform attempts to increase recruitment to general practice. Table 5 reports results of tests of under-

association with general practice by NGPAs, for each of the ten job characteristics they most desire:

$$\tau_m^{ngpa} - \tau_m^{cgp} < 0 \qquad (24)$$

which is equivalent to $\vartheta_m > 0$.

Table 5. Tests of equality of association of most desired job characteristics with a career in general practice (current GPs and NGPAs)

NGPA Ranking	Characteristic	NGPA Expectation τ_m^{ngpa}	cGP Interaction (ϑ)	P-value (H_0: $\vartheta_m \leq 0$)
1	wk-life	4.907	-2.925	>0.999
2	team	2.797	1.519	<0.001
3	learning	3.668	0.751	<0.001
4	expertise	1.773	0.515	<0.001
5	geogcont	4.558	-0.617	>0.999
6	helping	5.085	-	-
7	managtime	4.585	-1.068	>0.999
8	variety	4.593	0.385	0.002
9	challeng	3.550	1.436	<0.001
10	teach	3.462	-	-

The results in Table 5 indicate that three of the top four job characteristics most desired by NGPAs (working as part of team [team], always learning new things [learning] and having specialist knowledge or skills [expertise]) are significantly under-associated with general practice when compared to the sample of current GPs. Two other job characteristics among the ten most desired attributes (being stretched and facing new problems [challeng] and having a variety of responsibilities [variety]) are also under associated by NGPAs. Two of the ten most desired job characteristics are over-associated with general practice by NGPAs: a good work-life balance and having flexibility as to when one carries out one's responsibilities.

4. Discussion

The investigation of the preferences and expectations of junior physicians reported in this study addresses both the broad question of what it is that physicians want from their future career and the specific issue of the crisis in recruitment to general practice in England.

The BWS1 results reveal that junior physicians regard a good work-life balance as the job characteristic most important to them, followed by having control over the geographical location of their work and working as part of a team. The results provide new insights on the importance, and relative ranking, of non-pecuniary job characteristics in determining physicians' choice of specialty. The possibility of earning a higher salary is ranked 24th of the 36 attributes considered.

Regarding the specific issue of recruitment to general practice, we find differences in expectations of what a career in general practice would entail between those who do, and do not, apply to that specialty. Physicians applying to general practice associate the specialty more with making important clinical decisions under pressure, working within a team, being stretched and facing new problems and continuing to learn new things. Physicians not applying to general practice associate the specialty more with a predictable work routine and managing a clinical service. Despite these differences in expectations over some attributes we find equality of expectation between the two groups of junior physicians for the majority (21) of the 36 job characteristics.

The two groups of physicians differ in career preferences also. Those differences extend over many more job characteristics than was the case for expectations; their preferences were equal for only 2 of the 36 job characteristics.

While both groups share the first ranking of a good work-life balance they have marked differences in preferences for many other attributes. Junior doctors wishing to specialise in general practice identify not working anti-social hours, continuity of care, lots of direct contact with patients and working in a community-based role as among their most desired career attributes but these are ranked 13th, 20th, 15th and 35th respectively by NGPA physicians. In contrast NGPA physicians rank working as part of a team, always learning new things and having specialist knowledge or skills as their 2^{nd,}

3rd and 4th most desired job characteristics, but these are ranked 9th, 11th, and 22nd by GPA physicians.

Identifying factors which junior physicians applying to other specialties desire from their career, but only weakly associate with general practice, provides insights on possible means by which recruitment could be increased. Three of the top four, and five of the ten job characteristics most desired by NGPAs are significantly under-associated with general practice when compared to the degree of association among a sample of current GPs.

Compensating physicians, whether financially or in terms of increases in non-pecuniary attributes, for undesirable job characteristics, is one option to increase applications to specialities experiencing shortages. An alternative approach to increase recruitment is to target inaccurately negative expectations of such specialities. That is, if (some) junior physicians under-associate job characterises they desire with general practice then correcting those misperceptions might serve to increase applications to general practice. For example, we find that working as part of a team is highly desired by junior physicians not applying to general practice, yet strongly under-associated with general practice when benchmarked against the experience of a sample of current GPs. This suggests that if junior physicians emerged from their training with an expectation that general practice offered considerable scope for teamwork then that might increase the attractiveness of the specialty. A similar logic applies to the extent to which one has a variety of responsibilities, or is stretched and faces new problems, within general practice.

Given the opportunities such an 'expectation gap' might offer to address recruitment, a larger scale assessment of current GPs characterisation of a general practice career, in terms of attributes that can be mapped against junior physicians preferences and expectations, is warranted. A better understanding of how junior physicians form their expectations of general practice (and other specialties) is also required. This is likely to involve the extent and nature of their exposure to those specialties during their medical training, hence Beverly et al's (2014) finding that the perceptions of first year medical students toward primary care were positively affected by a week-long course in the specialty.

Two notes of caution are required here. First, the sample of current GPs used to augment the study of junior physicians' preferences and expectations is a small,

convenience sample. It does however point to the possibility of systematic differences between what junior doctors expect from, and what practising GPs experience in, general practice.

The second issue concerns the potential for the realignment of expectations to increase applications to the undersubscribed specialities. The discussion thus far has focussed on the potential for the 'correcting' of expectations to increase recruitment. However inaccurate expectations cut both ways. Sivey et al's (2012) estimates of doctors' desired future wages were much higher than wages currently available to GPs and were close to the wages available to specialists. The BWS1 expectation results reported in this study indicate a good work-life balance is the most desired job attribute among junior physicians, but it is strongly over-associated with general practice. Any adjustment in expectations which results in a lowering of the expectation of such highly desirable attributes may dampen recruitment further.

5. Conclusions

Sustained under-recruitment to general practice, and high rates of exit, are combining to create a crisis in the provision of general practitioners in the UK. Despite a government commitment in 2015 to increase the number of general practitioners by 5,000 by 2020 18% of general practice training places remain unfilled (Matthews-King, 2017). The nature and extent of the problem, its prevalence internationally and its resilience in the face of initiatives to address it, focuses attention on the processes affecting recruitment to general practice.

The investigation of the preferences and expectations of junior physicians reported in this study addresses both the broad question of what it is that physicians want from their future career and the specific issue of the crisis in recruitment to general practice in England. We find systematic differences in both career preferences and expectations of general practice between junior physicians applying to general practice and those applying to other specialties.

Changing financial incentives is an obvious, if potentially expensive, means to increase recruitment to general particle. The results reported here suggest an alternative approach to increase recruitment: targeting the perceptions of general practice of those

junior physicians not applying to the speciality. More specifically, addressing their expectations of job characteristics which the strongly desire but currently under-associate with general practice. The growing shortage of physicians in specialties such as general practice means that understanding the nature of those expectations, their processes of formation, their accuracy and their role in the choice of medical speciality all warrant further investigation.

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Table A1. Sample summary statistics

	Junior Physicians			Current GPs
	GPA	NGPA	All	cGP
N	167	616	783	168
Female	0.69	0.60	0.62	0.63
Age range (%)				
26-40				41.67
< 25	0.60	0.65	0.64	
25-30	83.83	89.29	88.12	
31-35	11.38	7.79	8.56	
36-40	2.40	1.46	1.66	
41-55	1.80	0.81	1.02	44.05
56+	0.00	0.00	0.00	14.29
Years in practice				
Mean (SD)				14.34 (10.06)

Notes: GPA = ; NGPA =

Table A2. Sample stated applications compared with 2016 round 1 applications

	2016 Round 1 Applications		Stated Applications (our survey)		Difference	
	Number	Proportion of total	Number	Proportion of total	Difference	P-value
ACCS Emergency Medicine	760	4.79%	98	7.57%	2.78%	0.000
Anaesthetics (including ACCS Anaesthetics)	1263	7.97%	205	15.84%	7.88%	0.000
Cardiothoracic Surgery	61	0.38%	5	0.39%	0.00%	0.996
Clinical Radiology	1074	6.77%	35	2.70%	-4.07%	0.000
Community Sexual and Reproductive Health	121	0.76%	16	1.24%	0.47%	0.066
Core Medical Training (inc. ACCS Acute Medicine)	2516	15.87%	325	25.12%	9.25%	0.000
Core Psychiatry Training	745	4.70%	61	4.71%	0.02%	0.980
Core Surgical Training	1622	10.23%	92	7.11%	-3.12%	0.000
General Practice	4863	30.67%	271	20.94%	-9.73%	0.000
Histopathology	209	1.32%	15	1.16%	-0.16%	0.628
Neurosurgery	169	1.07%	10	0.77%	-0.29%	0.319
Obstetrics and Gynaecology	551	3.48%	47	3.63%	0.16%	0.767
Ophthalmology	436	2.75%	17	1.31%	-1.44%	0.002
Oral and Maxillo Facial Surgery	19	0.12%	1	0.08%	-0.04%	0.663
Paediatrics	708	4.47%	81	6.26%	1.79%	0.003
Public Health	738	4.65%	15	1.16%	-3.50%	0.000
Total	15855		1294			

Note: 37 respondents indicated that they would apply to 'broad based training' programmes. However, this training option was not available in 2016 so these responses have been omitted from this table.

Table A3. Preferences over job characteristics: heteroscedastic sequential best-worst conditional logit (full interaction model)

	Model 1b				
	NGPA physicians (β^{ngpa})		GPA interaction (α)		
	Coefficient	**S.E.**	**Coefficient**	**S.E.**	**P-value**
wk-life	3.492	0.095	1.970	0.200	0.000
team	3.055	0.093	0.709	0.194	0.000
learning	2.944	0.093	0.734	0.193	0.000
expertise	2.896	0.095	-0.456	0.194	0.018
geogcont	2.855	0.095	1.928	0.193	0.000
helping	2.831	0.095	1.701	0.192	0.000
managtime	2.744	0.094	1.713	0.193	0.000
variety	2.744	0.094	1.132	0.193	0.000
challeng	2.593	0.095	0.041	0.194	0.830
teach	2.532	0.094	0.794	0.195	0.000
excite	2.409	0.098	-0.651	0.193	0.001
hosp	2.396	0.093	-1.411	0.188	0.000
sochours	2.390	0.095	2.586	0.194	0.000
recog	2.371	0.094	1.030	0.193	0.000
contact	2.332	0.095	1.821	0.193	0.000
jobsec	2.285	0.092	1.305	0.194	0.000
creativity	2.110	0.094	0.431	0.195	0.027
specialist	2.058	0.099	-1.097	0.193	0.000
advice	1.995	0.091	0.935	0.193	0.000
contcare	1.701	0.092	2.676	0.193	0.000
supervise	1.554	0.089	0.464	0.192	0.016
wellknown	1.533	0.091	0.695	0.195	0.000
ptime	1.492	0.094	2.135	0.197	0.000
particpatients	1.379	0.090	0.576	0.192	0.003
money	1.352	0.090	1.224	0.196	0.000
promo	1.314	0.087	0.504	0.192	0.009
precision	1.262	0.089	-0.554	0.189	0.003
respect	1.209	0.088	0.552	0.192	0.004
predict	1.189	0.090	2.083	0.195	0.000
litigation	1.060	0.086	1.090	0.196	0.000
research	1.046	0.089	-0.358	0.191	0.060
independ	0.915	0.086	1.619	0.198	0.000
pace	0.908	0.086	0.029	0.187	0.870
manag	0.654	0.085	1.041	0.194	0.000
community	0.042	0.084	3.662	0.204	0.000
compet	-	-	-	-	-
Scale parameters		**Coefficient**	**S.E.**		
Worst		-0.117	0.027		
Observations/class members		616 NGPA	167 GPA		
Number of parameters			71		
Log-likelihood			-29405.997		

Table A4. Association of job characteristics with a career in general practice: heteroscedastic sequential best-worst conditional logit model (NGPA and GPA)

	Model 3b				
	NGPA physicians (τ^{ngpa})		GPA Interaction (ρ)		
	Coefficient	**S.E.**	**Coefficient**	**S.E.**	**P-value**
community	6.401	0.104	-0.649	0.206	0.002
contcare	6.048	0.101	-0.196	0.204	0.340
contact	5.762	0.100	-0.045	0.204	0.830
ptime	5.174	0.097	-0.161	0.201	0.420
helping	4.977	0.098	0.110	0.200	0.580
independ	4.902	0.096	-0.567	0.200	0.005
wk-life	4.826	0.099	0.210	0.202	0.300
sochours	4.822	0.097	0.046	0.201	0.820
predict	4.754	0.096	-0.676	0.200	0.001
manag	4.705	0.096	-0.822	0.202	0.000
variety	4.519	0.097	0.103	0.202	0.610
managtime	4.509	0.097	0.028	0.203	0.890
jobsec	4.483	0.098	-0.155	0.203	0.440
geogcont	4.482	0.098	0.026	0.202	0.900
money	3.820	0.097	-0.932	0.199	0.000
learning	3.608	0.097	0.491	0.203	0.016
challeng	3.496	0.096	0.275	0.201	0.170
teach	3.391	0.095	0.049	0.199	0.800
supervise	3.217	0.096	-0.369	0.198	0.062
advice	2.989	0.094	0.050	0.196	0.800
pace	2.988	0.095	0.063	0.198	0.750
wellknown	2.845	0.094	-0.182	0.194	0.350
particpatients	2.824	0.095	-0.237	0.195	0.220
team	2.758	0.094	0.452	0.199	0.023
litigation	2.698	0.094	-0.487	0.193	0.011
recog	2.694	0.094	0.161	0.198	0.410
creativity	2.640	0.092	0.365	0.196	0.063
promo	2.449	0.092	-0.155	0.192	0.420
respect	2.406	0.091	0.052	0.193	0.790
excite	1.916	0.090	0.533	0.193	0.006
expertise	1.749	0.090	-0.068	0.189	0.720
research	1.673	0.089	-0.287	0.185	0.120
precision	1.331	0.088	-0.293	0.185	0.110
compet	1.025	0.087	-0.056	0.184	0.760
specialist	0.894	0.088	0.032	0.188	0.860
hosp	-	-	-	-	-

Scale parameters	**Coefficient**	**S.E.**
Worst	0.198	0.020

Observations/class members	616 NGPA	167 GPA
Number of parameters		71
Log-likelihood		-23097.338

Table A5. Association of job characteristics with a career in general practice: heteroscedastic sequential best-worst conditional logit model (NGPA and cGP)

	Model 5b				
	NGPA physicians (τ^{ngpa})		cGP Interaction (ϑ)		
	Coefficient	**S.E.**	**Coefficient**	**S.E.**	**P-value**
community	6.491	0.105	-1.733	0.200	0.000
contcare	6.134	0.102	-0.315	0.205	0.120
contact	5.845	0.101	0.028	0.205	0.890
ptime	5.241	0.098	-0.865	0.199	0.000
helping	5.052	0.099	0.128	0.199	0.520
independ	4.964	0.097	-1.181	0.201	0.000
wk-life	4.898	0.100	-2.907	0.185	0.000
sochours	4.891	0.098	-2.216	0.192	0.000
predict	4.816	0.098	-2.720	0.185	0.000
manag	4.759	0.097	-1.440	0.196	0.000
variety	4.584	0.098	0.407	0.200	0.042
managtime	4.576	0.098	-1.058	0.200	0.000
geogcont	4.549	0.099	-0.595	0.201	0.003
jobsec	4.547	0.099	-0.790	0.202	0.000
money	3.872	0.099	-2.100	0.182	0.000
learning	3.660	0.099	0.770	0.201	0.000
challeng	3.543	0.097	1.454	0.201	0.000
teach	3.438	0.096	0.089	0.196	0.650
supervise	3.264	0.097	-0.188	0.197	0.340
pace	3.028	0.096	1.435	0.200	0.000
advice	3.026	0.095	-0.522	0.188	0.006
wellknown	2.892	0.095	-0.251	0.191	0.190
particpatients	2.864	0.096	-0.259	0.191	0.180
team	2.791	0.095	1.530	0.203	0.000
litigation	2.741	0.095	-0.875	0.183	0.000
recog	2.726	0.095	0.047	0.198	0.810
creativity	2.677	0.094	0.787	0.196	0.000
promo	2.485	0.093	-1.219	0.178	0.000
respect	2.443	0.093	-0.228	0.186	0.220
excite	1.936	0.091	1.123	0.198	0.000
expertise	1.766	0.091	0.530	0.188	0.005
research	1.700	0.090	0.005	0.178	0.980
precision	1.351	0.089	0.235	0.179	0.190
compet	1.050	0.089	0.404	0.176	0.022
specialist	0.901	0.089	0.340	0.178	0.057
hosp	-	-	-	-	-

Scale parameters	**Coefficient**	**S.E.**
Worst	0.141	0.021

Observations/class members	616 NGPA	168 cGP
Number of parameters		71
Log-likelihood		-23226.080