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This research has been undertaken using data from the National Training Survey data set available on application from the General Medical Council.

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Summary

Objective: To analyse the distribution of socioeconomic and demographic characteristics of medical trainees across different specialties in the UK.

Design: Mixed logistic regression analysis of data from the National Training Survey 2013 to quantify evidence of systematic relationships between doctors' characteristics and the specialty they are training in, controlling for the correlation between these characteristics.

Setting: Data from the National Training Survey 2013, carried out by the General Medical Council.

Participants: Postgraduate medical trainees.

Main outcome measures: Odds ratios (calculated for both all trainees and a subsample of UK educated trainees) relating gender, age, ethnicity, place of studies, socioeconomic background and parental education to a trainee's specialty.

Results: There are systematic and substantial differences between specialties in respect of gender, ethnicity, age and socio-economic background. Being male, white British, from a better-off socio-economic background, trained in a UK university or having parents who have tertiary education increases the chances of being in surgical specialties relative to general practice. Being male, non-white, mature, trained in an overseas university, from a better-off socio-economic background, or having parents who have tertiary education increases the chances of being in psychiatric specialties relative to general practice. Measured relative to general practice the gender gap is largest for surgical specialities, the ethnicity gap is greatest for acute care, emergency medicine and anaesthetics and the age-gap is large and positive for psychiatry and large and negative for acute care, emergency medicine and anaesthetics.

Conclusions: Differences in the characteristics of trainees will feed into the composition of the practising profession. The persistent gender gap, the underrepresentation of those coming from the disadvantaged backgrounds and the inequity of educational background in some specialties will condition perceptions of the NHS and the medical profession. Our analysis contributes to a fuller understanding of the nature of these differences, which may be a matter for public concern and policy action. Remedial action if required will necessitate a better understanding of the processes of selection and self-selection into specialties that gives rise to these observed differences.

1. Introduction

Becoming a medical practitioner in the UK is a competitive process and represents a substantial investment of time and financial resources, much of that funded out of taxation, and its outcome determines the composition of the medical profession. There is growing concern that the profession should reflect not only appropriate skills but a balance of social, economic, gender and ethnicity[1]. Previous studies[2,3] have shown that applicants from disadvantaged and (or) from non-white ethnic backgrounds have less probability of receiving offers from medical schools. In addition the medical school attended constitutes an important determinant of specialty allocation.[4] Gender differences are also a cause for concern since the increase of the number of women entering the medical profession has not been translated into a proportional representation in every specialty.[5-8] As a result, there is a feminization of certain specialties (e.g. paediatrics, obstetrics or general practice) whilst some others (e.g. surgery or radiology) show predominance of male doctors. Additionally, the role of overseas education is potentially problematic if the restricted access[9] of overseas educated trainees to the 'popular' training posts creates an underclass within the NHS.[10,11]

These previous findings largely depend on observing the distributions of individuals' characteristics in different specialties. A limitation in observing the gender, socio-economic or other characteristics of a group of practitioners is that these factors are correlated. Thus if women doctors happen also to be more ethnically diverse, observing that they are under-represented in, for example, surgical specialities does not establish whether the discrepancy is one of gender or ethnicity. In this study, we use detailed individual-level data to establish separately, for a broad range of individual characteristics, the variation in each of these characteristics across specialities. We can thus identify which specialties exhibit disparities in respect of each of gender, ethnicity, socio economic background and educational background – and any combination of these.

2. Data and Methods

2.1. Data and variables

Our data comes from the National Training Survey 2013 (NTS). The NTS is a cross-sectional survey carried out each year by the General Medical Council and, from 2013 onwards, it also includes questions about doctor's socioeconomic background. The survey has a high response rate, 97.7% for 2013, which translates in a total of 52,797 doctors. However, due to the commitment to confidentiality of the responses followed by the GMC, our sample only is limited to 40,889 doctors. Whilst observations are not missing at random, a comparison between the mean statistics of the complete sample and our sample suggests that there are no major differences.

For each respondent there is information on their characteristics such as age, gender, ethnicity, and whether they completed their secondary and medical undergraduate studies in the UK. For UK graduates there is additional information concerning parental education and the type of secondary school attended (either *state*, *grammar* or *independent*) and if their household received income support at any point in their childhood.

Each trainee is also placed in one of thirteen categories of training according to their specialisation. We reduce this categorisation to six *specialties* to group options that have the same core training or that can be regarded as close substitutes.[12] The resulting specialities we analyse are:

1. Acute care, emergency medicine and anaesthetics (ACEM)
2. General Practice (GP)
3. Surgical (S)
4. Hospital based specialties including medical specialties, obstetrics and gynaecology, paediatrics and childcare, ophthalmology and occupational medicine (HBS)
5. Psychiatry (P)
6. Others including pathology, radiology and public health (O)

We also divide the data into two groups for analysis, a *general sample* containing all doctors in specialty training (N= 27,516) and a *UK sample* comprised of those who attended both secondary and university education in the UK (N= 18,588). Doctors carrying out foundation training (N=13373) are excluded from the analysis since they have not selected their specialty yet.

2.2. Methodology

The NTS 2013 can be regarded as a data set describing the outcome of the allocation of a junior doctor to a particular training post. Those outcomes result from a complex selection process that is a combination of doctors' preferences over posts and candidates' assessment of the board of selectors which is either the Royal Colleges or the Local Education and Training Boards.

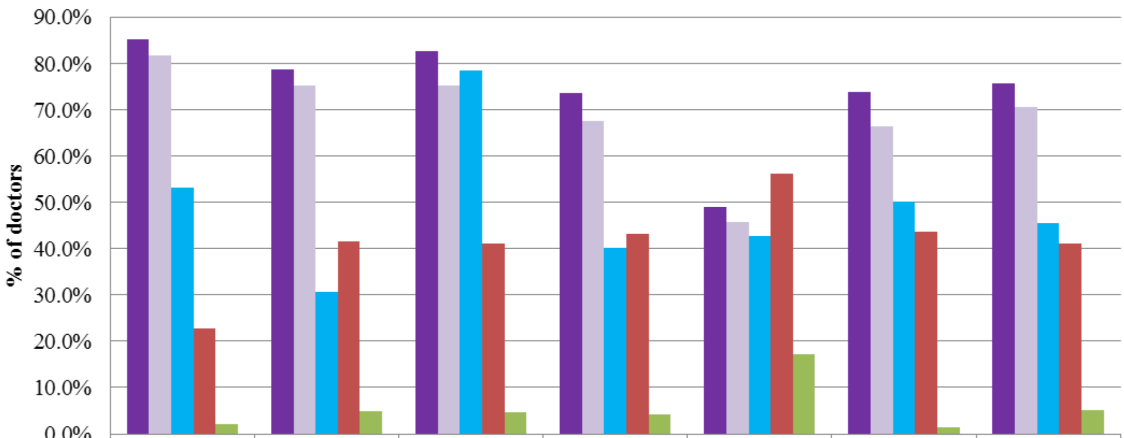
To establish evidence of systematic relationships between doctors' characteristics and specialty allocation we first depict descriptive statistics and then perform an individual-level multivariate analysis, by means of mixed logit regression.[13,14] Since specialties as they are defined within our data are mutually exclusive categories, a multinomial logit approach gives a natural means of establishing the effect of an individual's characteristics on the probability of observing them in one specialty, conditional on fixing their other characteristics. A mixed model permits us to relax some of the strong distributional assumptions implied by a fixed coefficient approach.

3. Results

3.1. Descriptive statistics

Figures 1 and 2 show the distributions of individuals' characteristics by specialty for the *general sample* and the *UK-educated sample* respectively. If doctors' preferences and selectors' judgements were uncorrelated with demographic and socioeconomic characteristics we would expect a similar distribution of characteristics in every specialty since in that case each specialty would appear as a random sample from the overall population of trainees. The figures show a very contrary picture.

Figure 1. Descriptive Statistics for the *general sample*.



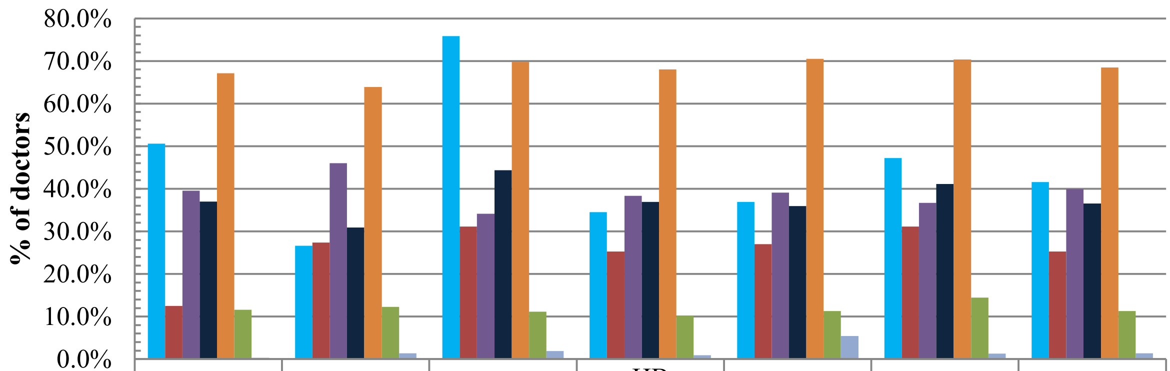
	AC & EM	GP	Surgical	HB Medical	Psychiatry	Others	Total
UK uni	85.2%	78.7%	82.8%	73.6%	48.9%	73.8%	75.7%
UK studies	81.7%	75.2%	75.3%	67.5%	45.8%	66.3%	70.6%
Male	53.2%	30.7%	78.4%	40.2%	42.8%	50.3%	45.5%
BME	22.8%	41.6%	41.2%	43.2%	56.2%	43.7%	41.1%
Mature	2.0%	5.0%	4.6%	4.2%	17.1%	1.5%	5.1%

In terms of gender 45.5% of the total sample consists of men but in surgical specialties male doctors make up 78.4% of the total while in general practice they constitute 30.7%. In terms of ethnicity, the greatest deviations from the overall percentage of black and minority ethnic doctors (41.1%) are observed for acute care and emergency medicine (22.8%) and for psychiatry (56.2%).

Similar differences emerge for where individuals attended university or completed their studies. For example the largest number of overseas students is observed in *Psychiatry* and the smallest in *AC & EM* and *Surgical* specialties respectively.

As Figure 2, relates to the *UK sample* there is additional information on socioeconomic variables. The type of secondary school has previously[15] been used as a proxy for socioeconomic background. In the United Kingdom around 7% of pupils attend independent schools, and of those, only 1% receives means-tested scholarships. Hence it is reasonable to associate doctors who attended an independent school with a high-income background. In general, medical trainees have attended an independent school in a larger proportion (36.6%) than the general UK population. There is again uneven distribution across specialties, *surgical specialties* being the group with the largest representation (44.4%) and *general practice* the smallest (30.9%). We observe the opposite for *state school* with the largest representation in *general practice* (46%) and the smallest from *surgical* trainees (34.01%). *Grammar schools* constitute the omitted category.

Figure 2. Descriptive Statistics for the *UK sample.*



	AC & EM	GP	Surgical	HB Medical	Psychiatry	Others	Total
Male	50.6%	26.7%	75.9%	34.5%	36.9%	47.2%	41.6%
BME	12.5%	27.4%	31.1%	25.3%	27.0%	31.2%	25.3%
State	39.6%	46.0%	34.1%	38.3%	39.1%	36.7%	39.9%
Independent	37.0%	30.9%	44.4%	36.9%	35.9%	41.1%	36.6%
Parent Uni	67.1%	63.9%	69.7%	68.1%	70.5%	70.3%	68.5%
Income Sup	11.6%	12.3%	11.1%	10.2%	11.3%	14.4%	11.3%
Mature	0.3%	1.4%	1.9%	0.9%	5.4%	1.3%	1.3%

Other socioeconomic characteristics present in the data are *parental education* and *income support*. The means of these across all trainees are 68.5% and 11.3% respectively. For these variables, there is relatively little variability across specialties.

3.2. Regression results

In order to quantify and establish whether the appearance of differences between specialties in figures 1 and 2 are statistically significant we estimated mixed logit models. In the regressions the omitted category is general practice and for each specialty we report the coefficient estimate, its associated t-value and the implied odds ratio. Individual characteristics are captured by dummy variables described below.

Table 1 shows the results for all trainees. In terms of gender, we observe a positive significant effect of the variable *male* for all of the alternative specialties to general practice, confirming the relationships observed in the descriptive statistics. The greatest effect is associated with *surgical* specialties where male doctors are 9.09 times more likely to be allocated in a *surgical* specialty relative to the *general practice* option. The variable *BME* assumes a value of 1 if the trainee is of black or minority ethnic origin. We observe a negative estimate for all the categories with respect to the base outcome. In this case, the greatest effect is found in the *AC & EM* category, with an odds ratio of 0.36. The variable *Mature* has a value of 1 if the trainee is older than 40. The regression estimates for this variable also coincide with the results observed in the descriptive statistics. The greatest positive significant effect is found for *psychiatry* with an odds ratio of 2.82. The rest of the categories present negative coefficients and odds ratios less than one implying that being a mature doctor reduces the probability of being based in any of these specialities (relative to general practice).

Table 1. Mixlogit estimates for the *general sample*

	AC & EM		Surgical		HB Medical		Psychiatry		Other	
	MNL	Odd Ratio	MNL	Odd Ratio	MNL	Odd Ratio	MNL	Odd Ratio	MNL	Odd Ratio
Male	1.137	3.12	2.207	9.09	0.37	1.45	0.205	1.23	0.853	2.35
	(24.45)**		(34.74)**		(4.40)**		(2.46)*		(12.70)**	
BME	-1.031	0.36	-0.19	0.83	-0.092	0.91	-0.149	0.86	-0.115	0.89
	(18.07)**		(3.91)**		(2.01)*		(2.07)*		1.54	
Mature	-0.782	0.46	-0.198	0.82	-0.431	0.65	1.035	2.82	-1.615	0.20
	(5.52)**		1.91		(3.96)**		(4.08)**		(6.24)**	
UK University	0.013	1.01	0.512	1.67	-0.341	0.71	-1.486	0.23	-0.32	0.73
	0.2		(7.97)**		(4.73)**		(6.71)**		(3.75)**	
N	27,516									
Ll	-41,099.55									
* p<0.05; ** p<0.01										
General Practice is the base outcome										

Finally, the variable *UK University* (equal to 1 if the trainee graduated from a UK university) indicates a positive significant effect for the *surgical* specialties such that a UK-educated doctor is 1.67 times more likely to appear in this specialty with respect to *general practice.* The greatest negative effect is found for psychiatry with an odds ratio of 0.23.

Table 2 shows the results for the UK-educated trainees comprising 18,588 individuals, who both completed secondary school education and undergraduate studies in the United Kingdom. The estimates for the variables *male*, *BME* and *mature* present the same sign and results in odd ratios that are similar in magnitude to estimates in table 1.

Table 2. Mixlogit estimates for the *UK-educated sample*

	AC & EM		Surgical		HB Medical		Psychiatry		Other	
	MNL	Odd Ratio	MNL	Odd Ratio	MNL	Odd Ratio	MNL	Odd Ratio	MNL	Odd Ratio
Male	1.154	3.171	2.163	8.697	0.2	1.221	0.474	1.606	0.927	2.527
	(20.02)**		(38.40)**		0.7		(6.21)**		(11.36)**	
BME	-1.154	0.315	-0.134	0.875	-0.168	0.845	-0.101	0.904	0.061	1.063
	(13.53)**		(2.35)*		(2.62)**		1.24		0.7	
Mature	-1.672	0.188	-0.04	0.961	-0.761	0.467	1.347	3.846	-0.133	0.875
	(4.34)**		0.2		1.83		(6.95)**		0.39	
Grammar	0.183	1.201	0.226	1.254	0.311	1.365	0.243	1.275	0.183	1.201
	(2.82)**		(3.32)**		(2.82)**		(2.65)**		1.72	
Independent	0.375	1.455	0.587	1.799	0.376	1.456	0.273	1.314	0.461	1.586
	(6.33)**		(9.88)**		(4.74)**		(3.24)**		(4.99)**	
Parent Uni	0.137	1.147	0.227	1.255	0.329	1.390	0.274	1.315	0.158	1.171
	(2.54)*		(4.10)**		(3.07)**		(3.48)**		1.83	
N		18,588								
Ll		-27,604.14								
* p<0.05; ** p<0.01										
General Practice is the base outcome										

In respect of schooling variables (*state school* is omitted category), which we use to proxy socioeconomic background, we observe positive and significant estimates and odds ratios greater than 1 for all specialties with respect to *general practice*. The largest effect is found for *surgical* specialties where trainees who attended an independent school are 1.799 times more likely to be in surgical specialties relative to *general practice*. The smallest positive effect is associated to *psychiatry* with an associated odds ratio of 1.314. Overall, having attended an *independent or grammar* school reduces the probability to be based in *general practice* with respect to any other specialty. Finally, the results for parental education are positive but modest compared to the schooling estimates. Here the greatest effect in magnitude is related to *hospital based specialties* with an associated odds ratio of 1.39. No significant results were found for the variable *income support*.

4. Discussion and conclusion

The NTS 2013 is a valuable data source for identifying and quantifying variation across specialties in regard to the socioeconomic and demographic characteristics of trainees; it offers nearly complete coverage of trainees and it contains a complete and rich vector of characteristics for each trainee, which facilitates multivariate analysis.

Our analysis shows that in respect of a number of socioeconomic and demographic characteristics there are substantial differences across specialties and that these differences persist after controlling for correlations between characteristics. Numerically the effects appear large with the odds of observing a male trainee in a surgical specialty more than nine times that of observing a male trainee in general practice. Significant differences exist in regard to gender, ethnicity, schooling background and parental education. All of these characteristics constitute potentially important signals of the representativeness of the medical profession and different specialties give very different signals. Surgical specialties will appear more male, more white British and more socio-economically privileged than general practice whilst psychiatric specialties will appear more male, more ethnically diverse, more mature, and more socio-economically privileged than general practice.

Our analysis confirms that the well-known[5-8] gender gap in certain specialties is also present in this new cohort of medical trainees. The gap is greatest between *general practice* and *surgical specialties*. The causes of these differences are not well understood. Previous literature[16,17] suggests that a combination of individuals' preferences over specialties (due to working schedules, training characteristics, and difficulties to conciliate work and family life) the impact of role models and the influence of medical school and foundation programmes all have roles to play. With an increasing number of women entering the medical profession the development of concrete and targeted policies aimed at addressing the gender gap should be a priority.

Our findings in regard to schooling variables are novel and show a potentially significant impact of the socioeconomic background in the specialty allocation process. In general, trainees from better-off socioeconomic backgrounds are less likely to be based in general practice than in any other specialty. This might be the result of differences in preferences between socioeconomic groups in terms of characteristics of the specialties, potential earnings and other non-pecuniary benefits of the alternatives. However, those differences might also have foundations in the secondary school, or as previous literature suggests[4] in the medical school attended. Additionally, another determinant of the observed differences between socioeconomic and different gender groups might be due to the existence of some form of non-direct discrimination. Junior doctors might self-select themselves into the less competitive training posts, by actively not applying[6,18] (e.g. female doctors and surgical posts) or by not investing in the necessary skills to be an admissible candidate (e.g. doctors from worse-off backgrounds might face a more costly access to required skills or they simply have higher informational costs). Future research could analyse in depth the existence of this type of discrimination by a careful analysis of the role of preferences, ability and qualifications in the allocation process. Setting the socio-economic differences between specialties aside, the over representation of individuals from socioeconomic advantaged backgrounds in a system that is mainly funded out of taxation might be at the expense of fostering inequality.

The large proportion of overseas doctors in the training scheme (approximately 30% of the total) could also be a cause for concern, especially when their distribution is clearly uneven across specialties. From an international perspective importing doctors from low-income countries might be seen as a brain drain and some authors stand for what is called 'Ethical Recruitment'[19] (avoiding active recruitment of healthcare professionals from developing countries). Additionally, from a national perspective, previous literature[10,11] suggested that overseas doctors getting the training positions that just a few doctors want (i.e. unpopular training posts such as those associated to psychiatric specialties) might be creating an “underclass” within the NHS. Future research could analyse quality of training experience and satisfaction for those overseas doctors with respect to the UK-educated, in order to test the hypothesis of the existence of an underclass.

Our study has a number of limitations: our data have a considerable number of missing not-at-random observations (around 22.5%) due partly to the confidentiality policy from the GMC and partly due to missing observations on some of the control variables. Future work could also attempt to include important missing elements in the analysis – such as medical school attended – and provide a richer and more detailed empirical evidence base.

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