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Relationship between sociodemographic factors and selection into UK postgraduate medical training programmes: a national cohort study

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ABSTRACT

Introduction Knowledge about allocation of doctors into postgraduate training programmes is essential in terms of workforce planning, transparency and equity issues. However, this is a rarely examined topic. To address this gap in the literature, the current study examines the relationships between applicants' sociodemographic characteristics and outcomes on the UK Foundation Training selection process.

Methods A longitudinal, cohort study of trainees who applied for the first stage of UK postgraduate medical training in 2013–2014. We used UK Medical Education Database (UKMED) to access linked data from different sources, including medical school admissions, assessments and postgraduate training. Multivariable ordinal regression analyses were used to predict the odds of applicants being allocated to their preferred foundation schools.

Results Applicants allocated to their first-choice foundation school scored on average a quarter of an SD above the average of all applicants in the sample. After adjusting for Foundation Training application score, no statistically significant effects were observed for gender, socioeconomic status (as determined by income support) or whether applicants entered medical school as graduates or not. Ethnicity and place of medical qualification were strong predictors of allocation to preferred foundation school. Applicants who graduated from medical schools in Wales, Scotland and Northern Ireland were 1.17 times, 3.33 times and 12.64 times (respectively), the odds of applicants who graduated from a medical school in England to be allocated to a foundation school of their choice.

Conclusions The data provide supportive evidence for the fairness of the allocation process but highlight some interesting findings relating to 'push-pull' factors in medical careers decision-making. These findings should be considered when designing postgraduate training policy.

Strengths and limitations of this study

► This is one of the first studies to use linked individual-level data from the UK Medical Education Database, enabling longitudinal analysis and comparisons across previously discreet datasets.
► A large-scale study that focuses on the time of exit from medical school and selection to the next stage of postgraduate medical training in the UK.
► The sample did not include international medical graduates or students who sat an aptitude test other than the UK Clinical Aptitude Test at the time of applying to medical school.
► We did not examine outcomes by individual medical schools because of non-convergence issues with statistics models.

last 30 years, the UK medical student body has become increasingly diverse in terms of gender, ethnicity and age, but not in terms of socioeconomic background (an individual's or family's economic and social position in relation to others, based on income, education and occupation[5]). Indeed, a recent independent review concluded that: 'Medicine has a long way to go when it comes to making access fairer, diversifying its workforce and raising social mobility.[6]

Much research has examined the barriers associated with selection into medical school for those from lower socioeconomic groups.[7 8] While getting a medical school place is the first hurdle in medical education and training, those who successfully complete medical school then face many other selection challenges for postgraduate education and training. The precise nature of these differ by context—in some countries, like the UK and Australia, medical graduates apply for early-stage training programmes of 1 or 2 years, then apply for specialty training. In other countries, such as the USA and Japan,

BACKGROUND

Efforts to minimise the barriers against entry into medicine have had mixed success, despite policy and investment drives.[1–4] In the

those graduating from medical schools apply directly for residency (specialty) training.

Yet, relatively little is known about the relationship between individual characteristics, such as socioeconomic background and outcomes on selection processes for post-graduate medical training. The few studies addressing this tend to focus on selection into specialty training, and relate to the ethnic differences in the academic attainment of doctors,[9 10] gender or country of primary medical qualification.[11 12] To the best of our knowledge, there has been no research looking at the relationships between individual characteristics and allocation into the first stage of postgraduate medical education in the UK, Foundation Training. This is a generic 2-year training programme which bridges the gap between medical school and being eligible to apply for specialty (including general practice/family medicine) training. Successful completion of the first year of Foundation Training (FY1) is needed for full medical registration. The process of assigning applicants to positions is based on a matching algorithm between allocation score and applicant choice. Applicants with the highest ranking are most likely to receive their first choice of training post. The UK Foundation Programme Office (UKFPO) reports that around 20% of applicants do not get allocated to their first-choice foundation school, and 12% of applicants in 2016 were allocated to a foundation school that was lower than their fifth preference.[13]

In 2009, the Department of Health in England commissioned a review of selection to the Foundation Programme. The aim of this review was to recommend a reliable, robust, valid, feasible and sustainable method for allocation which would minimise the risk of successful legal challenge.[14] A new tool, the situational judgement test (SJT), was introduced, replacing the old 'white space' questions on an online application form. Scores from the SJTs and the standardised Educational Performance Measure (EPM) (see methods section) are added together to form the Foundation Training application score.

The purpose of this study was to investigate the relationship between individual characteristics and allocation to Foundation Training. In seeking to understand the social equity and fairness of the postgraduate selection process, the present study tests the hypothesis that persistent inequalities continue to exist even after non-traditional students have gained access into medical school. Since students from low socioeconomic backgrounds face financial, social and cultural barriers to higher education in general,[15] we envisage that those who enter medicine face similar challenges. For example, because of the extra financial burden, students from less affluent backgrounds may opt out of intercalated degrees or medical electives abroad despite these being factors that contribute towards attainment at medical school and future progress.[16–18] Our aim, therefore, was to determine if the allocation of trainees to their preferred foundation schools differs on the basis of socioeconomic class or other individual characteristics.

METHODS

This is a longitudinal, cohort study of students who entered UK medical schools in 2007 and 2008, and who commenced their postgraduate training in 2013 and 2014. We used linked individual-level data from the UK Medical Education Database (UKMED: https://www.ukmed.ac.uk/) as the basis for this study. UKMED allows the analysis of data from a number of sources, including medical school admissions, assessment and postgraduate training. UKMED also contains demographic data such as age, gender, ethnicity, and whether the individual was a school leaver or graduate at the time of entry to medical school. Variables relating to socioeconomic status are also available. These have been used widely in previous UK research examining factors that influence educational achievement of different types of pupils, particularly in terms of widening participation.[19–22] They included: parental occupation (derived from National Statistics Socioeconomic Classification); entitlement to free school meals (FSM); income support; participation of local areas (POLAR), which is an indicator of the participation of young people in higher education by UK geographical area; type of school (state funded or independent) and parental education. We also included place of medical graduation (UK country: England, Scotland, Wales and Northern Ireland) into the analysis.

Twenty-one foundation schools offered postgraduate training at the time of the study. Applicants rank their choice of the foundation school in order of preference (1–21), and allocation to Foundation training (offers) is based on an algorithm of the Foundation Training application score. This score is the sum of the overall medical school performance (EPM) and performance on the SJT. The EPM and SJT have a maximum score of 100 points, and an applicant's score out of 100 is their application score. The SJT is worth up to 50 points.[23] The EPM is also worth a maximum of 50 points and comprises three parts: medical school performance (34–43), additional degrees, 0–5 and other educational achievements such as publications and prizes, 0–2. All students are ranked according to medical school performance and are then grouped into deciles with those in the lowest decile receiving 34 points and the highest decile receiving 43 points. This could be thought of as a baseline medical school performance of 33 points awarded to all students with 1–10 additional points corresponding to each decile of performance. Although the EPM and SJT together have a maximum score of 100 points, and an applicant's score out of 100 is their UKFPO application score. All applicants who have a satisfactory SJT are offered a foundation place. All things being equal, high performing applicants would be offered a place at a foundation school that was high on their preference list, and lower scoring applicants would be offered places at a foundation school that was lower in their order of preference. As a number of applicants can withdraw from the Foundation programme for various reasons, this sample contain only those who commenced Foundation Training in 2013 and 2014.

The Foundation Training (UKFP) application scores were not normally distributed. For that reason, we converted the application score into a 'percentile rank' to help us determine the individual ranking in relation to others within the sample. This allowed us to evaluate the effect of a change of one decile group. We used Kruskal-Wallis, and where necessary, Mann-Whitney U tests to compare the scores across independent groups. We also transformed the rank of the foundation school allocated into an ordinal dependent variable. The following values were assigned: (1) for being allocated to the applicant's first-choice foundation school; (2) for allocation to a second or third choice and (3) for allocation to a foundation school outside the applicant's top three choices. X^2 tests were used to examine the relationship between applicants' sociodemographic characteristics and the dependent variable, choice of foundation school. Standardised z scores for the Foundation Training application scores were calculated to permit comparison across the ordinal dependent variable. Finally, a multivariable ordinal logistic regression was used to estimate the effect of several factors against the outcome measure. The variable, UK country of medical qualification, was also fitted in the models to take account of various unmeasured characteristics associated with regional variation across the four UK countries which are not otherwise represented in the models. Its inclusion had the effect of greatly improving the model's predictive power based on log likelihoods. All the data analyses were done using IBM SPSS Statistics for Windows, V.24 (IBM).

Patient and public involvement
Patients and the general public were not involved in the design of this research. Ethics approval was not required because the focus of this study was a secondary analysis of anonymised data.

RESULTS
The UKMED database comprises 13 763 students who sat the UK Clinical Aptitude Test (UKCAT) of 2006–2008, commenced their medical studies in 2007–2009 and applied for postgraduate training in 2012 and 2014. For this study, the graduating cohort of 2012 (n=3702) was removed from the sample because the SJT component of the UKFP selection process was piloted that year, and did not contribute towards the Foundation Training application score. In addition, nearly 11.6% (n=1594) students were excluded from the analysis because they were on the Academic Foundation Programme (AFP), which has a different, and completely separate, selection process. Applicants to the AFP are nominated by their graduating medical school, and recruitment is coordinated at regional level and takes place nearly 6 months before the national application process.

Thus, the final eligible sample included 8467 Foundation Programme doctors (applicants who had accepted a place and commenced their training in 2013 or 2014).

Table 1 displays their sociodemographic characteristics in relation to application scores. The table also shows the numbers and percentages of doctors and the preference category of their allocated foundation schools. Frequency data shows that 71.3% of doctors were allocated to their first-choice foundation school; 15.0% to their second or third choice and 13.7% to a foundation school that was not one of their top three choices.

X^2 tests showed statistically significant associations between certain sociodemographic characteristics and category of allocation to foundation school. Female applicants were significantly more likely (p<0.001) than male applicants to be allocated to a higher choice foundation school (73% vs 69% first choice). Students who attended state-funded (high) schools, and those who entered medical school as graduates were significantly more likely to be allocated to a higher choice foundation school than students who attended privately funded school (p<0.01) (74% vs 67% first choice), or those who came into medical schools as typical school leavers vs graduates (p=0.016) (76% vs 70% first choice). A significantly larger proportion of applicants coming from families that were at some point recipients of income support (p=0.028), and those entitled to FSM (p=0.043) did not get a place in a higher choice foundation school (65% vs 73% and 70% vs 73% first choice, respectively). Applicants from white ethnic backgrounds were significantly more likely to be allocated to a higher choice foundation school than black or Asian applicants (p<0.001) (79% vs 47% and 56% first choice, respectively). The majority (93%) of non-Caucasian applicants had graduated from medical schools in England (93%), and nearly the same proportion accepted a Foundation Training post (90%) at an English foundation school.

The z-score of the Foundation Training application score for the first-choice group was 0.25 indicating that those applicants who were allocated to a foundation school of their first choice scored on average a quarter of a standard deviation above the average of all applicants in the sample.

Although differences in allocation to preferred school would be expected to reflect the individuals' selection scores (table 2), other sociodemographic factors might also be influential. Therefore, we performed an ordinal regression analysis to determine whether the odds of applicants getting allocated to a preferred foundation school differed significantly for different groups. Variables that were not significantly associated with allocation to foundation school during univariate analysis, using a conservative p<0.10, were removed from the regression models. Where two or more measured independent variables appeared to measure the same constraint, we only included the variable which we thought contributed more to the explanation of the dependent variable. For example, since a majority of the students on FSM also come from families that are a recipient of income support, the FSM variable was dropped from the regression models. Application scores were divided into deciles

Table 1 Relationship between trainees' demographic variables, performance during the UK FP selection process and allocation results.

| | Group total | UKFP application score | | | | | | Allocation to foundation school | | | | | | |
| | | EPM | | SJT | | (EPM+SJT+additional degrees+publications) | | First choice | | Second or third choice | | Not in top three | | |
	n	Median (IQR)	P values	Median (IQR)	P values	Median (IQR)	P values	n	Row %	n	Row %	n	Row %	P values
Gender														
Female	4815	39.0 (36.0–41.0)	<0.001	41.0 (38.7–43.1)	<0.001	82.2 (78.2–86.1)	<0.001	3533	73.4	689	14.3	593	12.3	<0.001
Male	3652	38.0 (36.0–40.0)		40.0 (37.8–42.1)		80.7 (76.8–84.6)		2501	68.5	580	15.9	571	15.6	
Age category														
School leaver (17–20)	7526	39.0 (36.0–41.0)	0.584	40.6 (38.6–42.7)	<0.001	81.6 (77.6–85.4)	0.302	5346	71	1151	15.3	1029	13.7	0.081
Mature (21+)	941	39.0 (36.0–41.0)		40.1 (37.7–42.5)		81.8 (77.6–86.0)		688	73.1	118	12.5	135	14.3	
Highest qualification on entry														
Graduate	647	39.0 (36.0–41.0)	0.132	40.5 (38.2–42.8)	0.665	82.9 (78.8–87.0)	<0.001	491	75.9	75	11.6	81	12.5	0.016
Non-graduate	7820	39.0 (36.0–41.0)		40.6 (38.3–42.7)		81.5 (77.4–85.3)		5543	70.9	1194	15.3	1083	13.8	
Type of secondary school attended														
State-funded school or college	5307	39.0 (36.0–41.0)	0.001	40.6 (38.3–42.7)	0.567	81.7 (77.6–85.5)	0.578	3920	73.9	738	13.9	649	12.2	<0.001
Fee-paying school	2398	38.0 (36.0–41.0)		40.6 (38.4–42.8)		81.7 (77.7–85.7)		1616	67.4	411	17.1	371	15.5	
Parental occupation														
I-Managerial and professional occupations	6027	39.0 (36.0–41.0)	0.008	40.7 (38.4–42.8)	**<0.001**	81.9 (77.8–85.7)	<0.001	4372	72.5	881	14.6	774	12.8	0.149
II–V occupations	677	38.0 (36.0–41.0)		40.1 (37.8–42.4)		80.4 (76.7–84.0)		476	70.3	96	14.2	105	15.5	
Free school meal														
Yes	576	38.0 (36.0–40.0)	<0.001	40.0 (37.8–42.0)	**<0.001**	80.2 (76.5–84.5)	<0.001	375	65.1	88	15.3	113	19.6	<0.001
No	6696	39.0 (36.0–41.0)		40.7 (38.4–42.8)		81.9 (77.9–85.8)		4888	73	986	14.7	823	12.3	
Income support														
Yes	986	38.0 (36.0–41.0)	0.003	40.2 (37.9–42.3)	**<0.001**	80.9 (76.7–84.8)	<0.001	689	69.9	144	14.6	153	15.5	0.027
No	5962	39.0 (36.0–41.0)		40.7 (38.6–42.9)		82.0 (78.0–85.9)		4341	72.8	879	14.7	742	12.4	
Parent education														
University-educated parent	5388	39.0 (36.0–41.0)	0.004	40.7 (38.4–42.8)	**<0.001**	82.0 (78.0–86.0)	<0.001	3883	72.1	817	15.2	688	12.8	0.402
No parent with a university degree	2135	39.0 (36.0–41.0)		40.4 (38.2–42.3)		81.1 (77.1–84.8)		1556	72.9	298	14	281	13.2	
Participation of local areas (POLAR 2&3)														
Low participation neighbourhood (POLAR 2&3)	382	38.0 (36.0–41.0)	0.24	40.2 (37.8–42.7)	0.53	80.8 (76.5–84.6)	0.007	285	74.6	40	10.5	57	14.9	0.043
Other neighbourhood	7417	39.0 (36.0–41.0)		40.6 (38.4–42.7)		81.8 (77.7–85.7)		5325	71.8	1114	15	978	13.2	
Ethnicity														

Continued

Table 1 Continued

| | Group total | UKFP application score | | | | | | Allocation to foundation school | | | | | | |
| | | EPM | | SJT | | (EPM+SJT+additional degrees+publications) | | First choice | | Second or third choice | | Not in top three | | |
	n	Median (IQR)	P values	Median (IQR)	P values	Median (IQR)	P values	n	Row %	n	Row %	n	Row %	P values
Asian or Asian British	1941	37.0 (35.0–40.0)	<0.001	39.6 (37.2–41.8)	<0.001	79.6 (75.7–83.5)	<0.001	1089	56.1	387	19.9	465	24	<0.001
Black or black British	218	36.0 (35.0–39.0)		38.7 (36.2–41.1)		78.2 (74.1–81.8)		103	47.2	49	22.5	66	30.3	
Mixed	320	38.0 (36.0–40.0)		40.5 (38.0–42.6)		81.3 (77.7–85.1)		220	68.8	49	15.3	51	15.9	
Other ethnic groups	272	37.0 (35.0–40.0)		39.6 (37.2–41.5)		80.0 (75.9–84.1)		140	51.5	64	23.5	68	25	
White	5693	39.0 (37.0–41.0)		41.0 (38.8–43.1)		82.5 (78.6–86.2)		4472	78.6	712	12.5	509	8.9	
Domicile														
England	6305	38.0 (36.0–41.0)	0.011	40.2 (37.8–42.4)	0.43	81.8 (77.8–85.7)	<0.001	4309	68.3	1046	16.6	950	15.1	<0.001
Northern Ireland	430	38.0 (36.0–40.0)		40.5 (38.2–42.8)		79.8 (75.8–83.7)		375	87.2	29	6.7	26	6	
Scotland	776	39.0 (37.0–41.0)		40.7 (38.6–42.9)		82.0 (78.3–86.0)		701	90.3	45	5.8	30	3.9	
Wales	313	39.0 (36.0–41.0)		40.7 (38.4–42.7)		80.9 (76.9–85.3)		244	78	37	11.8	32	10.2	
Place of medical qualification														
England	6796	38.0 (36.0–41.0)	0.543	40.1 (37.5–42.2)	<0.001	81.7 (77.6–85.5)	<0.001	4585	67.5	1141	16.8	1070	15.7	<0.001
Northern Ireland	278	39.0 (37.0–41.0)		40.6 (38.4–42.8)		79.7 (75.0–83.7)		248	89.2	17	6.1	13	4.7	
Scotland	1021	39.0 (36.0–41.0)		41.1 (38.5–43.3)		81.7 (77.8–85.6)		909	89	67	6.6	45	4.4	
Wales	372	38.0 (36.0–41.0)		40.6 (38.3–42.7)		81.1 (77.4–86.0)		292	78.5	44	11.8	36	9.7	
Programme type														
5-year standard degree programme	8165	39.0 (36.0–41.0)	<0.001	40.6 (38.3–42.7)	<0.001	81.7 (77.6–85.6)	<0.001	5838	71.5	1219	14.9	1108	13.6	0.104
4-year graduate entry route	60	36.0 (34.0–39.0)		39.2 (36.6–41.5)		79.5 (75.5–83.1)		40	66.7	9	15	11	18.3	
6-year widening access route	242	38.0 (36.0–40.0)		39.3 (36.3–41.9)		78.5 (74.5–82.9)		156	64.5	41	16.9	45	18.6	
UKFP application score														
								6034	71.3	1269	15	1164	13.8	<0.001
Average score (raw)								82.85		80.18		75.23		
Standardised score (SD)								0.254 (.93)		−0.214 (.77)		−1.083 (.65)		

EPM, Educational Performance Measure; SJT, Situational Judgement Test; UKFP, UK Foundation Programme.

Table 2	Selection scores across the three allocation groups						
		EPM decile *			SJT		
	N (%)	Mean	SD	P values	Mean	SD	P values
First choice	6034 (71.3)	39.16	2.67	<0.001	41.05	3.18	<0.001
Second or third choice	1269 (15.0)	37.82	2.45		39.68	3.05	
Outside top 3	1164 (13.7)	36.07	1.91		37.35	3.17	

*Excludes points accrued from other sources, that is, additional degrees, publications, presentations and prizes.
EPM, Educational Performance Measure; SJT, situational judgement Test.

according to percentile rank we had calculated to determine individual's score relative to others in the sample. Thus, applicants in the highest (90th–100th percentile) rank were assigned a value of 1, those in the second highest (80th–89th percentile) rank were assigned a value of 2 and so on until those in the bottom (0–10th percentile) were assigned a value of 10. We could then evaluate the effect of a change of one decile group.

The results of multivariate ordinal regression are shown in table 3. Three separate models were fitted; model 1 without controlling for the effect of application score, model 2 after accounting for the effect of the application score and model 3 after accounting for the effect of the application score and the allocated foundation school competition ratio. The ordinal regression is an extension of the binary logistic regression. The ORs represent each of the cut-off points, and the odds are expressed as a single cumulative OR for each group. The β results in table 3 are log ORs. Negative values represent a reduction in the odds of being allocated a preferred choice. Positive values represent an increase in odds of being allocated a preferred choice. As log ORs are difficult to interpret, we present the OR, the exponential of β, in the text. In model 3, for every unit increase of the Foundation Training 'decile' application score rank (1 best, 10 worst), the odds of an applicant getting allocated to a foundation school they had ranked higher in their order of preference decreased, as it was multiplied by a factor of 0.58 ($\beta=-0.551$, p<0.001). In lay terms, after considering other factors, the lower an individual's application score, the less likely they are to get their preferred choices of foundation school.

The models confirmed that there are significant effects in allocation to preferred school related to certain sociodemographic variables. Notably, model 3 shows that after controlling for the presence of multiple factors, including the application score and the foundation school competition ratio, the following groups had significantly lower odds of being allocated to their higher choice foundation schools: those from non-white ethnic groups; those who attended privately funded (high) school; who came from areas with high proportion of young people in higher education (POLAR); who graduated from an English medical school.

The odds of an applicant of Asian ethnic group to be allocated to a foundation school that they had ranked of higher preference was 0.66 times ($\beta=-0.410$, p<0.001)

that of a white applicant (just over half the odds). Similarly, given that the other variables in the model are held constant, the odds of a black applicant to be allocated to a foundation school of higher choice in the ranking order of preference were 0.61 times or approximately over half the odds of a white applicant ($\beta=-0.490$, p<0.001). Despite obtaining similar application scores, applicants who attended privately funded (high) schools had lower odds, by a factor of 0.77, compared to those who attended state-funded schools ($\beta=-0.258$, p<0.001). The odds for applicants who came from areas of high participation of young people in higher education (POLAR) to be allocated to a foundation school of their preferred choice were 0.66 times ($\beta=-0.413$, p<0.001) or 34% lower than applicants who came from areas of low participation. We also compared places of primary medical qualification by UK country. All other things being equal, the odds of applicants who graduated from medical schools in Wales ($\beta=0.153$, p=0.353) Scotland ($\beta=1.172$, p<0.001) and Northern Ireland ($\beta=2.537$, p<0.001) were 1.17 times, 3.22 times and 12.64 times (respectively), the odds of applicants who graduated from a medical school in England to be allocated to a foundation school of higher preference. After adjusting for Foundation Training application score, no statistically significant effects were observed for gender, socioeconomic status (as determined by income support) or whether applicants entered medical school as graduates, or not.

DISCUSSION

This large-scale study of two cohorts of applicants for the first stage of postgraduate medical training in the UK provides reassuring data. First, there is a clear relationship between an individual's performance on foundation school selection (their application score), and whether or not they are allocated to their first choice of foundation school. Second, the foundation school selection process does not appear to discriminate against applicants from lower socioeconomic groups. On the other hand, after controlling for the effect of the application scores, our analysis indicated that certain sociodemographic factors—ethnicity, type of (high) school attended, being from an area of high educational participation and (UK) country of medical qualification—are strong predictors of allocation to preferred choices.

Table 3 Proportional odds model for selecting trainees into their preferred foundation school

Variable/parameter	Model 1 (R²=0.084)				Model 2 (R²=0.311)				Model 3 (R²=0.37)			
	Estimate(β)	Sig	95% CI for exp (coefficient)		Estimate(β)	Sig	95% CI for exp (coefficient)		Estimate(β)	Sig	95% CI for exp (coefficient)	
			Lower bound	Upper bound			Lower bound	Upper bound			Lower bound	Upper bound
Threshold												
Outside top three	−2.579	<0.001	−2.915	−2.243	−5.304	<0.001	−5.663	−4.945	−4.946	<0.001	−5.349	−4.543
Second or third choice	−1.565	<0.001	−1.895	−1.235	−4.086	<0.001	−4.433	−3.739	−3.651	<0.001	−4.042	−3.259
First choice	Ref				Ref							
UKFP selection score					−0.430	<0.001	−0.455	−0.405	−0.551	<0.001	−0.585	−0.517
Gender												
Female	Ref				Ref							
Male	−0.222	<0.001	−0.346	−0.098	−0.02	0.971	−0.121	0.116	−0.036	0.567	−0.158	0.086
Highest qualification on entry												
Graduate	0.226	0.111	−0.052	0.504	−0.059	0.651	−0.314	0.196	0.039	0.769	−0.223	0.302
Non-graduate	Ref				Ref							
Type of secondary school attended												
State-funded school or college	Ref				Ref							
Fee-paying school	−0.224	0.001	−0.357	−0.091	−0.307	<0.001	−0.435	−0.180	−0.258	<0.001	−0.389	−0.126
Income support												
Yes	−0.053	0.603	−0.253	0.147	0.025	0.768	−0.142	0.193	0.015	0.865	−0.157	0.187
No	Ref				Ref							
Participation of local areas (POLAR 2&3)												
Other neighbourhood	−0.274	0.094	−0.594	0.047	−0.495	0.001	−0.786	−0.203	−0.413	0.008	−0.717	−0.109
Low participation neighbourhood (POLAR 2&3)	Ref				Ref							
Ethnicity												
Asian or Asian British	−0.859	<0.001	−1.005	−0.712	−0.578	<0.001	−0.715	−0.441	−0.410	<0.001	−0.553	−0.267
Black or black British	−1.258	<0.001	−1.641	−0.875	−0.755	<0.001	−1.101	−0.409	−0.490	0.007	−0.848	−0.132
Mixed	−0.322	0.047	−0.639	0.005	−0.035	0.818	−0.337	0.266	0.076	0.632	−0.234	0.386
Other ethnic groups	−0.792	<0.001	−1.160	−0.424	−0.733	<0.001	−1.074	−0.392	−0.527	0.003	−0.879	−0.175
White	Ref				Ref							
(UK) place of medical qualification												
England	Ref				Ref							
Northern Ireland	0.770	0.000	0.430	1.111	2.031	<0.001	1.535	2.528	2.537	<0.001	2.010	3.063
Scotland	0.403	0.019	0.067	0.738	1.463	<0.001	1.219	1.706	1.172	<0.001	0.864	1.481
Wales	1.123	0.000	0.843	1.404	0.584	<0.001	0.282	0.886	0.153	0.353	−0.170	0.476
Foundation school competition ratio												

Table 3 Continued

Variable/parameter	Model 1 (R²=0.084)				Model 2 (R²=0.311)				Model 3 (R²=0.37)			
	Estimate(β)	Sig	95% CI for exp (coefficient) Lower bound	Upper bound	Estimate(β)	Sig	95% CI for exp (coefficient) Lower bound	Upper bound	Estimate(β)	Sig	95% CI for exp (coefficient) Lower bound	Upper bound
Group 1 (least competitive foundation school)									0.440	0.004	0.137	0.743
Comp ratio group 2									1.526	<0.001	1.178	1.875
Comp ratio group 3									2.010	<0.001	1.677	2.343
Comp ratio group 4									0.726	<0.001	0.406	1.045
Comp ratio group 5									0.325	0.056	−0.009	0.659
Comp ratio group 6									0.559	<0.001	0.283	0.836
Comp ratio 7									2.113	<0.001	1.783	2.443
Comp ratio 8									1.784	<0.001	1.373	2.195
Comp ratio 9									1.465	<0.001	1.155	1.776
Group 10 (most competitive foundation school)									Ref			

Model 1: model without UKFP selection score as the controlling factor.
Model 2: after adjusting for UKFP selection score.
Model 3: after adjusting for UKFP selection score and foundation school competition ratio.
UKFP, UK Foundation Programme.

The pattern observed for areas of high educational participation and fee-paying high school appear, on face value, to discriminate against those from higher socioeconomic groups. This seems counter-intuitive given previous research indicates that social class is one of the factors associated with admission to medical school[3 24 25] and specialty choice.[26–28] Several related factors may explain this finding. For example, different foundation schools have differing competition ratios. The 2016 competition ratio, which is the number with first-choice preference divided by the number of training programme places available, was highest in London area (1.49), compared with South of England (1.25), Scotland (1.12), Northern Ireland (0.97), Wales (0.93) and the Rest of England (0.65).[23] A large proportion of UK medical schools and medical students are situated around London and the South of England[29] and many medical students wish to do their Foundation Programme in a familiar region or have the opportunity to access training in the capital.[30] Related to this, London and the South of England are where much of the UK population is based, and many medical students and early career doctors prefer to train and work nearby their family and friends.[31 32] Finally, applicants from areas of high educational participation and from independent schools—and note there is a strong relationship between these two factors[33 34]—may be more likely to apply to highly competitive foundation schools (eg, London and the South of England). Taking these factors as a whole, London and the South of England are very popular places to train and work, and so there is more competition for places. Applicants who put these regions as their top choice(s) are therefore less likely to get their top choice(s). Interestingly, the less competitive foundation schools also have the highest number of 'home applicants', again supporting the suggestion that early career doctors wish to train and work near family and friends.[30 31]

Our finding that those from Black and minority ethnic (BME) backgrounds are less likely to be allocated their first-choice foundation school is consistent with the wider literature on postgraduate training showing that those from BME backgrounds tend to do less well in many different medical examinations.[9 10 35] However, it is evident that, even after controlling for the effect of the application score and foundation school competition ratio, those from ethnic minorities appear to be disadvantaged. This finding may also be linked with the geographical preferences discussed above because a higher proportion of the UK medical student population from BME backgrounds live in London and the Southeast of England.[29] It is clear that the marked differences observed in the ethnic profile of medical students across the UK countries also continues into the Foundation Training. Although we have not carried out a 'head-to-head' comparison of diversity across the foundation schools, UK demographic patterns suggest that these differences relate to student/ foundation doctor origin/home (ie, the proportion of BME groups differs across different UK countries and cities).

The merit of this study is that it is one of the first to use the UKMED database.[36–38] UKMED links several large datasets together, enabling longitudinal analysis and comparisons across previously discrete datasets. Another merit of the study is it is large scale and focus on the time of exit from medical school and selection to the next stage of postgraduate training in the UK. As with any study, there are limitations. Some of the markers included in the analysis overlap, particularly socioeconomic class, ethnicity and graduating from English medical schools. This is unavoidable given the links between place, poverty and ethnicity in the UK.[39 40] The wider literature also shows that there is a link between class and university preferences,[41 42] and there are hints in the medical education literature that this might also be the case for medical school preferences.[43] The nature of the data, coupled with the complexities of 'class' in the UK, mean we could not separate out the individual contributions of these intersecting factors on foundation allocation. Our sample did not include international medical graduates, or students who sat an aptitude test other than the UKCAT at the time of applying to medical school. The reason for this is simple: other medical schools' admissions aptitude test data is not yet held by UKMED. However, the UKCAT is sat by 85% plus of those applying for medical school in the UK (personal communication, UKCAT 29 November 2017) so represents the majority of applicants. We would have liked to examine outcomes by individual medical school rather than just UK country (eg, Scotland, England, etc) given previous research has highlighted that students from different medical schools perform differentially on postgraduate examinations.[35] We were unable to do so because of non-convergence issues with the statistical models. The UKFP SJT is relatively new but there are already some indicators of its psychometric properties, particularly predictive validity.[44 45] The nature of our study design means we have identified patterns but further, qualitative work is required to explore the reasons for these patterns. Future research could also usefully focus on the next stage of postgraduate training by examining the relationship between allocation to foundation school and later specialty training allocation.

In conclusion, this large-scale study has shown there is a clear relationship between an individual's performance on application to Foundation Programme (their application score), and whether or not they are allocated to their first choice of foundation school. Second, the UKFP allocation process does not appear to discriminate against applicants from lower socioeconomic groups. However, ethnicity, type of (high) school attended, being from an area of high educational participation and (UK) country of medical qualification are strong predictors of allocation to preferred choices. The data provide supportive evidence for the fairness of the allocation process but highlight some interesting findings relating to 'push-pull' factors in medical careers decision-making. These findings should be considered when designing postgraduate training policy since this is an important stage of

the trainee doctors' working careers. In particular, policy initiatives could focus on the benefits of training at a local foundation school.

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