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Relationship between sociodemographic factors and specialty destination of UK trainee doctors: a national cohort study

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Abstract

OBJECTIVES: Many countries are driving forward policies to widen the socio-economic profile of medical students and to train more medical students for certain specialties. However, little is known about how socio-economic origin relates to specialty choice. Nor is there a good understanding of the relationship between academic performance and specialty choice. To address these gaps, our aim was to identify the relationship between socio-economic background, academic performance and accepted offers into specialty training.

DESIGN: Longitudinal, cohort study using data from the UK medical education database (UKMED: https://www.ukmed.ac.uk/).

PARTICIPANTS: 6065 (60% females) UK doctors who accepted offers to a specialty training (residency) post after completing the 2-year generic foundation programme (UKFP) between 2012 and 2014.

MAIN OUTCOME MEASURES: Chi-square tests were used to examine the relationships between sociodemographic characteristics, academic ability and the dependent variable, specialty choice. Multiple data imputation was used to address the issue of missing data. Multinomial regression was employed to test the independent variables in predicting the likelihood of choosing a given specialty.

RESULTS: Participants pursuing careers in more competitive specialties had significantly higher academic scores than colleagues pursuing less competitive ones. After controlling for the presence of multiple factors, trainees who came from families where no parent was educated to a degree level had statistically significant lower odds of choosing careers in medical specialties relative to general practice [OR=0.78, 95% CI, 0.67-0.92]. Students who entered medical school as school leavers, compared with mature students, had odds 1.2 times higher [95%CI, 1.04-1.56] of choosing surgical specialties than general practice.

CONCLUSIONS: The data indicates a direct association between trainees' socio-demographic characteristics, academic ability and career choices. The findings can be used by medical school, training boards and workforce planners to inform recruitment and retention strategies.

Word count: 287

Strengths and limitations of this study.

- This is one of the first studies in a UK setting to look at the association between socio-economic background, academic performance and specialty (residency) choice.
- This is a nation-wide, multi-cohort study of the career decisions of doctors who successfully completed first stage of generic postgraduate training and were eligible to apply for a specialty post.
- The study used the UK Foundation Programme (UKFP) selection score, part of which is measured two years before specialty training, and is not purely a measure of academic prowess.
- We only had data on career choice of those who applied for specialty training in F2, meaning that the sample represented approximately half of those completing the UK Foundation training each year.

Background

Matching medical workforce supply to health need is a global issue.[1-5] Although the absolute number of doctors in many countries continues to grow[6], the medical workforce is unevenly distributed geographically and some specialties are more popular than others. The precise nature of this issue differs by context, but in countries like Australia, Canada, UK and the USA, for example, there has been a reported decline of doctors who choose careers in community-based specialties, general practice/family medicine and mental health relative to hospital-based specialties.[4,7,8]

Research has examined how factors such as geographical location, gender, career aspiration, work-life balance and perceived financial rewards play a crucial role in determining the career choice of healthcare workforce. [9-15] Other studies have looked at the relationship between socio-economic origin and where doctors practice.[16,17] However, very little is known about the extent to which individuals' socio-economic origin and academic ability relate to their specialty choice.

This is important for various reasons. We know from previous research that early academic achievement is associated with socio-economic background, and that early academic performance predicts performance in later years of postgraduate training,[18,19] There is also evidence that different groups perform differently at medical school and during selection to postgraduate medical training.[20,21] What we do not know is the relationship between academic performance and career choices although this is likely to be an important factor in medical careers decision making given that some specialties are more competitive than others.

To date, studies examining UK doctors' career choices have tended to be mostly descriptive in nature, typically focusing on gender and ethnicity differences but neglecting other socio-demographic variables.[22-27] In a recent exception to this, Santana and Chalkley found that doctors who attended privately-funded (high) schools (where school is a proxy for socioeconomic status) were 1.8 and 1.4 times more likely to train in surgical or medical specialties (relative to general practice) respectively than those who attended a state funded (high) school.[28] However, this study did not examine the relationship between performance at medical school and medical career (specialty) choice.

We were interested in whether specialty choice is influenced by socio-economic background, academic ability, or a combination of both. This question is timely because of recent investment and policy drivers in the UK to widen the socio-economic profile of medical students and to train more medical students specifically to work in certain specialties, in particular general practice and psychiatry.[29] However, there is not a linear relationship between number of medical students and workforce distribution. While small-scale studies have shown that there is an association between doctors from certain socio-demographic background and preference for certain specialties, [16,30,31] increasing the number of students in medical schools alone, without considering the effect of other factors such as speciality culture and perceived attractiveness, could lead to unintended consequences, such as training even more doctors who wish to work in urban specialist practice. Moreover, concerns about continued disadvantage in medical education and training, for students who come from non-traditional backgrounds, have been raised before.[32] This leads to questions about whether specialty destination also differs on the basis of socioeconomic class or other contextual markers, including academic ability.

To address these gaps in knowledge, the aim of this study was to identify the relationship between socio-economic background, performance at the point of selection into the first stage of generic postgraduate training in the UK (the Foundation Programme – see later) and accepted offers into specialty (residency) training.

Methods

Background to this study

Our context is the UK's postgraduate medical training pathway. UK medical students spend between four and six years at medical school before they enter foundation training, the generic two-year training programme (the Foundation Programme: FP) which bridges the gap between finishing medical school and becoming eligible to apply for specialty (residency) training. At the end of the first year of the FP, doctors who have successfully achieved their competencies gain full registration with the General Medical Council (GMC). Following this, the second year of the FP (F2) is the first opportunity for doctors to apply for a specialty training post. Specialty training has two entry routes which vary by discipline: some recruit via core training programmes relevant to a range of higher specialty outcomes, e.g. core medicine and core surgery. In this route those completely "core" training then apply for a higher specialty training post (which is required to complete their training to consultant level). Others enter directly to "run through" training, which ends with the completion of training and eligibility for consultant status.

Approximately half of doctors who completed the foundation programme in 2017 applied for a training post in F2 and progressed directly into specialty or core training. The others took time out of training, typically applying for a non-training medical post/job, fellowship/academic post, or went to work overseas.[33] The majority of the doctors who take time out of training return within three years.[33] However, this pattern of behaviour presents a challenge at policy level, because it is difficult to extrapolate the number of doctors who will move into the next phase of training simply by using the number of students in medical schools or those in foundation training. Similarly, forecasting career choices based on early career preferences made at medical school is problematic because these may change over time.[34]

Data description

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 and assessment, postgraduate selection, assessment and training outcomes.[35]

Our cohort comprised 13731 students (43% male, 57% female) who graduated from 33 UK medical schools between 2012 and 2014 and were eligible to apply for postgraduate training. Of these 13731 graduates, 12517 applied for allocation to the Foundation Programme (FP). 1214 trainees applied for the Academic Foundation Programme (AFP) but were excluded from the current analysis because the AFP has a different, completely separate, selection process from the "standard" FP. In the cohort under study, 6484 trainees (2932 males and 3552 females, 47.1% of the sample) had not applied for a specialty post at the time of the data extract. Thus, this study focuses on the 6065 (60% females) trainees who accepted offers to level 1 (the first year of) specialty training on completion of their FP. Supplementary file 1 *(insert link to supplementary file 1_data sources)* shows a schematic flowchart of the data sources.

The UKMED also contains self-declared demographic data such as age, gender and ethnicity. An individual's ethnicity is grouped as either White (the majority ethnic group) or from minority ethnic groups such as Asian, Black, or mixed race. In addition, the UKMED contains variables that relate to academic performance and socio-economic status – with the latter used in previous research examining factors that influence educational achievement of students from different backgrounds, particularly in terms of widening participation.[20,36-38] These socio-economic variables include: parental postcode at the time the student applied to medical school; parental occupation (derived from National Statistics Socioeconomic Classification); receipt of income support; entitlement to free school meals; Participation of Local Area (POLAR), which is an indicator of the participation of young people in higher education by geographic area; Index of Multiple Deprivation (IMD), which is an area measure of socioeconomic status routinely used in UK education and health services research; type of school (state-funded or independent); and parental education. We also included place of medical qualification in the analysis (UK country: England, Scotland, Wales and Northern Ireland).

Outcome data

In addition to the socio-demographic and academic performance data, the UKMED also includes career choice data from ORIEL[39], a centralised online system for managing specialty recruitment and career progression in medical training. Doctors who have full registration with the GMC and who have successfully completed the FP are eligible to apply for more than one specialty post anywhere in the UK via a competitive national selection process. Specialty posts are offered on the basis of ranking, and individuals can only accept one post at any given time.

We identified 56 medical training pathways in ORIEL (e.g., orthopaedic surgery, general practice, renal medicine, otolaryngology). These pathways are the route to specialist registration for doctors as defined by the Royal college curricula of the General Medical Council.[40] For the purposes of analysis, we collapsed and re-classified these 56 pathways into seven categories, following advice from NHS Education Scotland (personal communication, Dec 2017). Therefore, the outcome measure was a specialty choice in one of the following categories: Anaesthesia and Emergency Medicine; Diagnostics; General Practice (GP); Medical Specialties; Surgical Specialties; Mental Health; Obstetrics, Gynaecology and Medical Paediatrics. A full list of re-classification of the specialties is provided in supplementary file 2 *(insert link to supplementary file 2_specialty re-classification).*

The second outcome measure was the UK Foundation Programme (UKFP) selection score, a combined measure of individual student's academic performance across all years of medical school and during the selection process into the first phase of postgraduate training. The UKFP score is the sum of the Education Performance Measure (EPM) and performance on a uniform Situational Judgement Test (SJT). The EPM is worth a maximum of 50 points and comprises three parts; medical school performance (calculated in deciles, 34-43 points); additional degrees, 0-5; and other educational achievements such as publications and presentations, 0-2. The SJT is also worth up to 50 points.[41] 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. Note that the Situational Judgement Test (SJT) component of the UKFP application score for the graduating cohort of 2012 (n=3177) was used on a pilot basis and did not contribute to allocation or scoring. Finally, we looked at the association between UKFP application score and specialty choice.

Statistical analyses

We used the median and interquartile range to describe the UK Foundation Programme selection scores across several sociodemographic factors. We used Kruskal-Wallis and Mann-Whitney U tests to compare these scores across independent groups. We used Pearson's chi-square tests (and Fisher's exact test where necessary) to test for associations between sociodemographic factors and specialty choice. We conducted a multinomial regression to test whether independent variables could be used to predict the likelihood of trainees choosing a given specialty in relation to general practice (the reference group). Only those variables that showed significant associations at the bivariate level and appeared not to measure overlapping constructs were entered into the regression model. For example, the variables parental occupation and parental education appear to measure broadly the same construct – socio-economic status. Therefore, only one socio-economic status variable – parental education - was tested in the regression model.

In order to address a large amount of missing data in a key variable, we used regression based multiple imputation to simulate five imputed datasets, and used these to account for the missing data. Regression coefficients were obtained using non-imputed data (complete case analysis). Pooled multinomial regression estimates were also obtained as weighted averages of the estimates from these five simulated datasets. All the data analyses were completed using IBM SPSS Statistics for Windows, Version 24 (IBM Corp., Armonk, NY, USA).

Patient and Public Involvement

Patients and the general public were not involved in the design of this research. Access to the data was limited to specific members of the research team via a safe haven (to ensure adherence to the highest standards of security, governance and confidentiality when storing, handling and analysing identifiable data). Ethics approval was not required because the focus of this study was a secondary analysis of anonymised data.[35]

Results

Out of the 6,065 doctors who accepted offers for a training post, the most popular choice was General Practice (n=2341, 38.6%), and the least popular training was Mental Health (n=261, 4.3%).

Table 1 shows the relationship between UK Foundation Programme (UKFP) application score and Level (Year) 1 specialty offers. In general, trainees who accepted offers for a post in obstetrics, gynaecology and paediatrics had the highest UKFP application scores (median = 83.20, IQR = 78.95 – 87.24) compared to those who applied for other specialities. Those applying for a mental health training position had the lowest UKFP selection scores (median = 80.00, IQR = 76.90 – 83.60).

-----Insert Table 1 around here-----

Table 2 shows the relationship between demographic factors, specialty offers and median performance on the UK Foundation Programme selection process. UKFP scores were significantly lower for men, mature students (compared to those who entered medicine directly after high school), those with non-managerial/non-professional parental occupation, no parent with a degree, those who received free school meals or income support, being from an area of low participation (POLAR) and those not of White ethnic group. However, the sizes of these statistically significant differences in median UKFP scores were small. For example, trainees who had ever received free school meals when they were in primary or secondary education (a proxy of low socio-economic status) had significantly lower UKFP scores [median=82.4, IQR (78.5 – 86.4)] compared to those who never received free school meals [median=83.9, IQR (80.3 – 87.6)]. There was no statistically significant association between school type, graduate status or UK domicile and performance on the UKFP scores.

Associations between specialty choice and sociodemographic variables were all statistically significant at p<0.001 with the exception of the contextual variables of parental occupation (p=0.002), free school meals (p=0.018), income support (p=0.010) and participation of local area (p=0.024).

There were significant differences in specialty choice by gender. Higher percentages of females than males chose careers in general practice, obstetrics, gynaecology and medical paediatrics than would be expected if all were similar. On the other hand, higher percentages of males than females chose careers in surgical specialties, diagnostics, anaesthesia and emergency medicine. The highest proportion of females was observed in obstetrics, gynaecology and medical paediatrics (78.9%), the lowest in surgical specialties (38.0%).

Significantly higher percentages of those doctors who choose medical specialties (74.5%) entered medical school as school leavers (rather than as graduates). In contrast, higher percentages of those who chose diagnostics (41.8%), general practice (38.4%) and mental health (39.5%) were mature students. This pattern of specialty choice was also reflected in those who entered medical school as graduates (note not all mature students entering medical school are graduates).

Seventy-six percent (76%) of trainees had attended state-funded schools. Trainees choosing anaesthesia and emergency medicine, general practice and obstetrics, gynaecology and medical paediatrics were slightly more likely to have been to a state-funded school or college (77.8%, 78.9% and 77.9%, respectively) than those who choose diagnostics, surgical specialties or mental health.

The highest percentages of trainees with a parent/guardian from the nonprofessional occupations [NS-SEC II-IV] were observed in mental health (15.0%) and general practice (12.4%). Trainees from family backgrounds where no parent was educated to a degree level accounted for 31% of trainees. Their representation was also notably higher in those who chose mental health (38.4%) and general practice (36.5%).

Trainees who came from backgrounds where they had received free school meals when they were in primary or secondary education represented less than 9% of the population under study. The highest percentage of trainees whose families were, at some point, recipients of income support was observed in general practice (15.8%), and their lowest representation was in obstetrics, gynaecology and paediatrics (11.1%).

The association between ethnicity and specialty choice shows that the percentage of trainees of Asian background was higher than expected in diagnostics (27.2%) and surgical specialties (26.3%). In contrast, the percentage of White trainees was lowest in surgical specialties (60.2%).

-----Insert Table 2 around here-----

Results of Multinomial Logistic Regression:

We conducted a multinomial regression to predict the likelihood of trainees choosing a given specialty in relation to general practice (the largest, and thus the reference group). Of the 6065 trainees who accepted specialty training post, 3242 (53.5%) had missing data for UKFP application score. Table 3 shows the results of the multinomial regression models based on non-imputed (complete case analysis) and imputed data. The results (as represented by the odds ratios) between complete case and imputed analyses did not vary substantially in terms of direction and magnitude for any of the included sociodemographic variables. This suggested that the missing UKFP application scores did not have the effect of biasing the results.

Model 1 comprised 2823 cases for six predictor variables; gender, school type, parental education, ethnicity (re-classified into white vs black and ethnic minority (BME)), income support, and UKFP application score and only complete cases. The Pearson Chi-square goodness-of-fit test for model 1 indicated that the model was a good fit to the data, p<0.001. The reference groups for the control variables (therefore not shown in table 3) were female gender, trainees who entered medical school as mature students (aged 21 and above), trainees with a parent educated to degree level, those who attended privately funded (high) school and trainees who identified their ethnicity as White. Model 2 comprised 6065 cases and had the same predictor variables as Model 1, but it was based on imputed data for UKFP application score. Model 3 was run on all cases presented in Model 1, except for the effect of UKFP application score. Therefore, the number of cases for Model 3 was brought back to 6065 entries after omitting the effect of UKFP application score. Odds ratios greater than 1 indicate a greater likelihood of trainee trainees choosing a specific specialty rather than the reference group, general practice. Similarly, odds ratios of less than 1 denote a lesser likelihood of trainees choosing a specialty other than the reference group.

Model 2 shows that after controlling the presence of multiple factors, including the UKFP application score, males had significantly higher odds of choosing anaesthesia and emergency medicine (OR=1.9, CI 1.61-2.25); diagnostics (OR=2.0, CI, 1.44-2.80); medical specialties (OR=1.41, CI, 1.23-1.63); mental health (OR=1.57, CI, 1.27-2.04) and surgical specialties (OR=3.31, CI, 2.74-4.00) than general practice. However, for males the odds of choosing careers in obstetrics and gynaecology reduced by 45% (OR=0.55, CI, 0.44-0.67), relative to females, compared to general practice. Those who entered medical school as school leavers, compared with mature students, had odds 1.2 times higher (CI, 1.04-1.48) of choosing anaesthesia and emergency medicine, 1.7 times higher (CI, 1.48-

2.01) of choosing medical specialties, 1.4 times higher (CI, 1.17-1.75) of choosing obstetrics and gynaecology, and 1.2 times higher (CI, 1.04-1.56) of choosing surgical specialties than general practice. Trainees who came from families where no parent had a degree, compared with those who had at least one parent with a degree, had odds ratios of 0.78 (CI, 0.67-0.92) (22% decrease) for choosing medical specialties relative to general practice. The odds of choosing a specialty other than general practice for trainees who attended state funded (high) school, compared to those who attended privately funded (high) school, were multiplied by a factor of 0.82 (CI, 0.68-0.98) (18% decrease) for medical specialties; 0.66 (CI, 0.49-0.90) (44% decrease) for mental health and 0.73 (CI, 0.56-0.95) (27% decrease) for surgical specialties.

The odds of trainees who identified as non-White, compared to White, to choose a specialty other than general practice were multiplied by a factor of 0.51 (CI, 0.42-0.63) (49% decrease) for anaesthesia and emergency medicine and 0.68 (CI, 0.55-0.85) (32% decrease) in obstetrics and gynaecology. However, those from BME, compared to White trainees, had odds 1.4 times higher (CI, 1.10-1.65) of choosing surgical specialties compared to general practice. Model 3 shows that when all the variables were incorporated into the model, except for the effect of UKFP application score, the association between ethnicity and career choice in anaesthesia and emergency medicine (OR 0.46, CI 0.37-0.58), and mental health (0.68, CI 0.48-0.95) remained statistically significant.

Discussion

To the best of our knowledge, this is the first study in a UK setting to look at the association between socio-economic background, performance and specialty choice in doctors making their specialty (residency) career decisions. Our analysis indicates that socio-economic background and academic performance are important factors in predicting career choices and pathways. We found that trainees who pursued careers in more competitive specialties had significantly higher academic and selection (into the UKFP) scores than colleagues who pursued less competitive ones. We also found that doctors who entered medical school as mature students and those from lower socio-economic backgrounds had significantly lower performance on the academic and selection measures, and were more likely to choose careers in General Practice (GP) and Mental Health relative to other specialties.

General practice has struggled to fill its training places over the last few years.[50] This recruitment issue is coupled with an aging GP workforce and fewer GP trainees wishing to work full-time after full qualification.[51,52] Our multivariate analysis suggests that increasing the number of mature students and students from lower socio-economic (non-traditional) backgrounds could help GP recruitment.

Our results could be interpreted as students who come from non-traditional backgrounds tending to perform less well, have significantly lower academic scores (as evidenced by our findings), and not applying for certain specialties as they do not believe they can compete for a training post with those who performed better on the UKFP.[32] However, weaker performance may be due to financial rather than ability differences: medical students from less affluent backgrounds may opt out of intercalated degrees or medical electives abroad because of cost, despite these being factors that contribute towards attainment at medical school and score/ranking on the UKFP.[59-61] The influence of additional educational attainments on specialty post offers requires further examination as does exploring personal reasons for making specialty choices.

These patterns may also indicate that "disadvantage continues" in that those doctors who come from non-traditional backgrounds are less likely to obtain training posts in what are perceived as the most competitive specialties.[53,54] Our study corroborates other non-UK studies and anecdotal evidence highlighting the challenges faced by doctors in terms of pursuing certain medical careers.[55] However, is this finding due to lack of confidence, feeling one does not fit with a particular specialty, and/or is it related to those from non-traditional backgrounds performing less well early in their careers (i.e. at medical school and in the selection process for the UKFP)?[56-58] Further research is required.

Finally, GP training is much shorter than many other specialties, and therefore may have fewer financial demands on trainees than other pathways.[42-44] This may appeal to more mature trainees/residents who are likely to have greater financial and domestic commitments than younger ones.[45,46] A recent report looking at how doctors progress through postgraduate training also highlighted how mature and graduate entry trainees are concerned with getting through training as quickly as possible.[47] Similarly, this urgency to get through training quickly may also appeal to those from lower socio-economic backgrounds who may be more concerned with paying back their student loan than those from more affluent groups.[48,49]

The differences we noted in gender and ethnicity are consistent with the wider literature. For example, our results resonates with other studies that show how doctors from Black and Minority Ethnic (BME) groups perform less well in academic and recruitment outcomes compared to White doctors.[19,62-64] After controlling for the effect of academic attainment, the association between ethnicity and specialty choice was no longer significant for most specialties, except in anaesthesia and emergency medicine (49% decrease) and obstetrics and gynaecology (32% decrease). This echoes findings from a previous study by Woolf *et al* which reported how negative relationships between senior doctors and trainees discouraged some of the BME trainees from pursuing careers in anaesthetics.[63] Our data also indicate that BME trainees have increased odds of choosing careers in surgical specialties compared to general practice. This might be dependent of the other confounding factors that have not been explained by the regression model. These factors may include cultural and family influence,[65,66] trainees' perception of the specialty, experience during medical school, influence of role models or mentors and personal career needs.[27] This requires further research.

The strength of this study is that it is the first to use the UK Medical Education Database (UKMED) to examine the associations between socio-demographic factors, academic ability and specialty career choices. The UKMED enabled a nation-wide, multi-specialty and multi-cohort analysis. However, we must also acknowledge some potential limitations of the study. Firstly, in our previous research on selection into postgraduate (F2) training we reported how some of the contextual markers included in the analysis overlap, particularly socioeconomic class, ethnicity and place of medical qualification.[32] We believe that these have a similar effect on specialty choice given the links between place, poverty and ethnicity in the UK.[67,68] Second, we used the UKFP selection score as an indicator of academic performance. As outlined earlier, this score comprises an individual's performance at medical school plus outstanding academic features such as an additional degree or publications, and a situational judgement test (SJT, the other 50%). In short, it is an indicator, part of which is measured two years before specialty training, and is not purely a measure of academic prowess. However, we used this for several reasons. First, the UKFP competency outcome measures do not differentiate at the level we needed for the analysis. Alternative outcome measures may have included specialty interview score or ranking during the specialty selection process, but UKMED did not hold this data at the time of the study. In short, we used the best measure available at the time. As UKMED expands, future studies may wish to rerun this study with alternative outcome measures such as those mentioned above. The nature of specialty selection in the UK is that eligible doctors can apply for many different specialties and different posts. We did not have information on applications, only on offers (i.e. where an individual had been successful in his or her application). Finally, our sample represented approximately half of those completing the UKFP in each year group because we only had data on specialty choice from those who applied for specialty training in F2. We know that work has recently been commissioned to explore if those who apply for a training post in F2 are different (in terms of socio-demographics) to those who delay application in order to take time out of training (e.g. work overseas for a period of time, take a service or an academic post). This forthcoming analysis will show if our sample is representative of the wider group.

In conclusion, this study contributes to the evidence that there is a direct association between socio-economic background, academic ability and career choices. This intelligence can be used by medical school, training boards and workforce planners to inform recruitment and retention strategies. For example, since the study has shown that students who come from non-traditional backgrounds are more likely to work in general practice, we argue that recruiting more and supporting students from such backgrounds might help increase the number of doctors applying for general practice. Finally, more research is needed to examine the postgraduate training environment and workforce distribution to ensure that social accountability and fairness are upheld at all levels of training.

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COMPETING INTERESTS AND FUNDING

This study is part of Ben Kumwenda's doctoral programme of research funded by the UKCAT Research Panel, of which JC is a member. KW is the Special Advisor (Recruitment) for the UK's Foundation Programme (UKFPO).

ETHICAL PERMISSION

The Chair of the local ethics committee ruled that formal ethical approval was not required for this study given the fully anonymised data was held in safe haven, and all students who sit UKCAT and GAMSAT are informed that their data and results will be used in educational research. All students applying for the UKFPO also sign a statement confirming that their data may be used anonymously for research purposes. No patients or the general public were involved in this research.

AUTHOR CONTRIBUTIONS

JC led the funding bid which was reviewed by KW, BK and PJ. KW and PJ advised on the nature of the data. BK managed the data, carried out the data analysis under the supervision of GJP and JC, and wrote the first manuscript. GJP advised on all the statistical analysis. JC guided the first draft of the introduction and discussion sections of this paper. BK wrote the methods and results sections. JC edited the drafts. All authors reviewed and agreed on the final draft of the paper.

DATA SHARING

UK Medical Education Database ("UKMED") UKMEDP 026 extract generated on 12/08/2016. Approved for publication on 27/03/2017. UKMED bears no responsibility for data analysis or interpretation. The dataset is held in safe haven and only members of the research, BK, GP and JC had access to the data. The data includes information derived from that collected by the Higher Education Statistics Agency Limited ("HESA") and provided to the GMC ("HESA Data").

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CONSENT FOR PUBLICATION

Not applicable.

Table 1: The relationship between UK Foundation Programme (UKFP) application score and Level (Year) 1 specialty offers (2013 and 2014 data only).

Table 1			UKFPO application score		
	Count	%	Median	Percentile 25	Percentile 75
Anaesthesia and Emergency Medicine	771	12.7	82.50	79.10	86.60
Diagnostics	153	2.5	82.09	78.60	87.20
GP[†]	2341	38.6	80.90	76.90	84.85
Medical Specialties	1358	22.4	82.60	78.60	86.80
Mental Health	261	4.3	80.00	76.90	83.60
Obstetrics, Gynaecology and Med Paediatrics	583	9.6	83.20	78.95	87.25
Surgical Specialties	598	9.9	82.85	78.60	86.65
Did not apply	6484	(47.1)	---	---	---

[†] Includes fewer than 10 trainees who applied for Public Health

Table 2	Relationship between sociodemographic variables, performance on the UKFP selection process, and Level 1 specialty training programme offers: 2013 and 2014 cohort.																		
	Overall Distribution		UK Foundation Programme Application Score		Anaesthesia and Emergency Medicine		Diagnostics		General Practice†		Medical Specialties		Mental Health		Obs Gynae and Med Paediatrics		Surgical Specialties		
	N	N %	Median (IQR)	P Value	N	N %	N	N %	N	N %	N	N %	N	N %	N	N %	N	N %	P Value
Gender																			
Male	2408	39.7	82.9 (79.2 – 86.6)	<0.001	367	47.6	77	50.3	795	34.0	558	41.1	117	44.8	123	21.1	371	62.0	<0.001
Female	3657	60.3	84.3 (80.7 – 87.9)		404	52.4	76	49.7	1546	66.0	800	58.9	144	55.2	460	78.9	227	38.0	
Age Category																			
School Leavers	4022	66.3	83.8 (80.1 – 87.5)	<0.001	506	65.6	89	58.2	1443	61.6	1012	74.5	158	60.5	406	69.6	408	68.2	<0.001
Mature	2043	33.7	82.6 (78.5 – 86.6)		265	34.4	64	41.8	898	38.4	346	25.5	103	39.5	177	30.4	190	31.8	
Graduate on Entry																			
Non-graduate	4377	72.2	83.7 (80.7 – 87.4)	0.054	548	71.1	102	66.7	1593	68.0	1086	80.0	171	65.5	438	75.1	439	73.4	<0.001
Graduate on entry	1688	27.8	83.1 (79.2 – 87.1)		223	28.9	51	33.3	748	32.0	272	20.0	90	34.5	145	24.9	159	26.6	
School Type																			
State-funded or college	3960	76.0	83.7 (80.0 – 87.5)	0.660	533	77.8	89	72.4	1635	78.9	821	72.3	160	71.7	373	77.9	349	70.4	<0.001
Privately funded school	1252	24.0	83.7 (80.0 – 87.3)		152	22.2	34	27.6	436	21.1	314	27.7	63	28.3	106	22.1	147	29.6	
Parental Occupation																			
I - Managerial & Prof	3762	89.8	84.0 (80.2 – 87.6)	<0.001	509	92.0	98	91.6	1392	87.6	887	91.6	142	85.0	372	91.6	362	90.5	0.002
II - IV Other Occupations	428	10.2	82.5 (78.9 – 86.6)		44	8.0	9	8.4	197	12.4	81	8.4	25	15.0	34	8.4	38	9.5	
Free School Meals																			
No	4644	91.4	83.9 (80.3 – 87.6)	<0.001	594	90.7	114	91.9	1823	90.3	1036	92.9	198	90.4	458	94.8	421	90.1	0.018

	Yes	438	8.6	82.4 (78.5 – 86.4)		61	9.3	10	8.1	196	9.7	79	7.1	21	9.6	25	5.2	46	9.9	
Income Support																				
	No	4159	85.7	84.0 (80.3 – 87.6)	<0.001	548	85.6	99	82.5	1619	84.2	931	88.2	180	87.8	416	88.9	366	83.2	0.010
	Yes	693	14.3	82.9 (79.0 – 86.8)		92	14.4	21	17.5	304	15.8	125	11.8	25	12.2	52	11.1	74	16.8	
Parent Degree																				
	No	1791	34.1	83.1 (79.5 – 87.0)	<0.001	205	30.0	41	31.3	799	38.4	333	29.2	84	36.5	170	34.2	159	32.7	<0.001
	Yes	3459	65.9	84.1 (80.3 – 87.7)		479	70.0	90	68.7	1284	61.6	806	70.8	146	63.5	327	65.8	327	67.3	
Participation of local area (POLAR)																				
	Low Participation	334	6.1	83.2 (79.1 – 87.2)	<0.001	53	7.4	11	8.3	141	6.4	53	4.5	18	7.6	20	4.0	38	7.3	0.024
	High Participation	5169	93.9	83.7 (80.0 – 87.5)		666	92.6	122	91.7	2079	93.6	1113	95.5	218	92.4	485	96.0	486	92.7	
Ethnicity																				
	Asian or Asian British	1372	22.7	81.8 (78.1 – 85.3)	<0.001	106	13.8	41	27.2	577	24.8	336	25.0	59	22.7	97	16.6	156	26.3	<0.001*
	Black or Black British	126	2.1	79.9 (75.7 – 83.7)		4	0.5	4	2.6	56	2.4	29	2.2	3	1.2	8	1.4	22	3.7	
	Mixed	218	3.6	82.7 (79.3 – 87.0)		25	3.3	2	1.3	69	3.0	60	4.5	10	3.8	20	3.4	32	5.4	
	Other Ethnic Groups	158	2.6	82.1 (78.5 – 86.2)		15	2.0	6	4.0	44	1.9	51	3.8	4	1.5	13	2.2	25	4.2	
	White	4158	68.9	84.6 (81.0 – 88.1)		619	80.5	98	64.9	1584	68.0	869	64.6	184	70.8	445	76.3	359	60.4	
UK Domicile																				
	England	4537	82.3	83.7 (80.0 – 87.4)	0.118	591	82.0	112	83.6	1821	81.9	963	82.4	191	80.6	419	82.8	440	83.5	0.004
	Northern Ireland	248	4.5	83.6 (79.5 – 87.5)		34	4.7	3	2.2	87	3.9	77	6.6	3	1.3	28	5.5	16	3.0	
	Scotland	480	8.7	84.4 (80.6 – 87.7)		68	9.4	13	9.7	207	9.3	82	7.0	29	12.2	38	7.5	43	8.2	
	Wales	251	4.6	83.8 (79.3 – 87.0)		28	3.9	6	4.5	108	4.9	46	3.9	14	5.9	21	4.2	28	5.3	

Table 3: Multinomial Logistic Regression Results (Odds Ratio) for Specialty Choice. [a]

[UK] Place of Medical Qualification																			
Northern Ireland	170	2.8	84.5 (81.5 – 87.5)	<0.001	14	1.8	3	2.0	68	2.9	57	4.2	1	0.4	18	3.1	9	1.5	0.018
Scotland	665	11.0	84.3 (80.6 – 88.0)		92	11.9	18	11.8	253	10.8	141	10.4	39	14.9	54	9.3	68	11.4	
Wales	321	5.3	86.1 (81.2 – 89.4)		37	4.8	6	3.9	137	5.9	62	4.6	15	5.7	30	5.1	34	5.7	
England	4909	80.9	83.5 (79.8 – 87.2)		628	81.5	126	82.4	1883	80.4	1098	80.9	206	78.9	481	82.5	487	81.4	
Russell Group																			
No	2049	33.8	83.1 (79.3 – 86.8)	<0.001	257	33.3	49	32.0	922	39.4	374	27.5	95	36.4	166	28.5	186	31.1	<0.001
Yes	4016	66.2	83.8 (80.1 – 87.6)		514	66.7	104	68.0	1419	60.6	984	72.5	166	63.6	417	71.5	412	68.9	
Programme Type																			
5-Year Standard Entry	4956	81.7	83.7 (80.0 – 87.4)	<0.001	628	81.5	109	71.2	1854	79.2	1177	86.7	202	77.4	489	83.9	497	83.1	<0.001*
4-Year Graduate Entry	1036	17.1	80.1 (76.1 – 83.7)		137	17.8	42	27.5	457	19.5	165	12.2	54	20.7	88	15.1	93	15.6	
6-Year WA Route	73	1.2	80.7 (76.9 _ 84.7)		6	0.8	2	1.3	30	1.3	16	1.2	5	1.9	6	1.0	8	1.3	
Foundation School [Region]																			
London Area	1623	26.8	84.9 (81.8 – 88.1)	<0.001	204	26.5	43	28.1	565	24.1	395	29.1	60	23.0	169	29.0	187	31.3	<0.001
Northern Ireland	175	2.9	84.5 (80.2 – 87.5)		16	2.1	2	1.3	70	3.0	62	4.6	0	0.0	19	3.3	6	1.0	
Rest of England	2591	42.7	81.1 (77.3 – 85.8)		343	44.5	67	43.8	1039	44.4	550	40.5	117	44.8	252	43.2	223	37.3	
Scotland	612	10.1	83.7 (79.7 – 87.3)		86	11.2	15	9.8	249	10.6	119	8.8	37	14.2	47	8.1	59	9.9	
South of England	763	12.6	83.7 (80.7 – 87.1)		86	11.2	20	13.1	283	12.1	173	12.7	35	13.4	75	12.9	91	15.2	
Wales	301	5.0	81.0 (74.8 – 86.5)		36	4.7	6	3.9	135	5.8	59	4.3	12	4.6	21	3.6	32	5.4	

† Includes <0.5% who applied for Public Health

	Anaesthesia and Emergency Medicine			Diagnostics			Medical Specialties			Mental Health			Obstetrics and Gynaecology (includes Medical Paediatrics)			Surgical Specialties		
		95% Confidence Interval for Exp(B)			95% Confidence Interval for Exp(B)			95% Confidence Interval for Exp(B)			95% Confidence Interval for Exp(B)			95% Confidence Interval for Exp(B)			95% Confidence Interval for Exp(B)	
	Exp(B)	Lower Bound	Upper Bound	Exp(B)	Lower Bound	Upper Bound	Exp(B)	Lower Bound	Upper Bound	Exp(B)	Lower Bound	Upper Bound	Exp(B)	Lower Bound	Upper Bound	Exp(B)	Lower Bound	Upper Bound
Model 1 [using non-imputed data (complete case analysis)]																		
UKFP Application Score	1.05**	1.03	1.08	1.07*	1.02	1.12	1.07**	1.05	1.09	0.98	0.94	1.02	1.06**	1.03	1.09	1.08**	1.05	1.12
Male	2.31**	1.76	3.04	2.16*	1.31	3.57	1.85**	1.49	2.31	1.74*	1.15	2.65	0.56*	0.39	0.80	4.11**	3.03	5.57
School leaver (<21 Years)	0.92	0.64	1.33	1.12	0.53	2.35	1.82*	1.30	2.55	0.65	0.38	1.10	2.73**	1.57	4.74	1.31	0.83	2.07
Parental education (No degree)	0.60*	0.44	0.81	0.59	0.33	1.07	0.65**	0.51	0.83	0.78	0.50	1.24	0.85	0.61	1.18	0.80	0.58	1.11
State funded (high) school	0.85	0.62	1.16	0.66	0.38	1.13	0.78*	0.61	0.99	0.61*	0.38	0.96	0.92	0.65	1.30	0.57*	0.41	0.79
Non-white	0.49**	0.36	0.67	1.18	0.70	1.99	0.90	0.71	1.13	0.43*	0.26	0.70	0.52**	0.36	0.75	1.22	0.90	1.66
Model 2 [using multiple imputation to account for missing data in UKFP selection score in model 1]																		
UKFP Application Score	1.02*	1.01	1.04	1.02	0.97	1.08	1.02*	1.01	1.04	0.99	0.96	1.01	1.02*	1.00	1.05	1.04*	1.01	1.06
Male	1.90**	1.61	2.25	2.01*	1.44	2.80	1.41**	1.23	1.63	1.57*	1.21	2.04	0.55**	0.44	0.67	3.31**	2.74	4.00
School leaver (<21 Years)	1.24*	1.04	1.48	0.81	0.57	1.14	1.73**	1.48	2.01	0.90	0.69	1.18	1.43*	1.17	1.75	1.23*	1.04	1.56
Parental education (No degree)	0.72	0.59	0.88	0.77	0.51	1.13	0.78*	0.67	0.92	0.97	0.73	1.29	0.92	0.72	1.16	0.85	0.68	1.05
State funded (high) school	0.94	0.76	1.17	0.71	0.45	1.13	0.82*	0.68	0.98	0.66*	0.49	0.90	0.95	0.74	1.21	0.73*	0.56	0.95
Non-white	0.51**	0.42	0.63	1.19	0.82	1.70	1.14	0.99	1.33	0.80	0.60	1.07	0.68*	0.55	0.85	1.35*	1.10	1.65
Model 3 [using complete analysis, without controlling for the effect of UKFP selection score]																		
Male	1.98**	1.65	2.38	2.19*	1.51	3.19	1.46**	1.25	1.70	1.73*	1.30	2.31	0.51**	0.40	0.66	3.47**	2.80	4.29
School leaver (<21 Years)	1.18	0.96	1.44	0.87	0.58	1.32	1.75**	1.46	2.09	0.76	0.56	1.03	1.65**	1.29	2.10	1.23	0.97	1.57
Parental education (No degree)	0.73*	0.60	0.88	0.72	0.48	1.08	0.72**	0.61	0.85	0.95	0.71	1.29	0.91	0.73	1.13	0.80	0.64	1.00
State funded (high) school	0.93	0.74	1.17	0.76	0.49	1.18	0.80*	0.67	0.96	0.59*	0.42	0.82	1.02	0.79	1.32	0.68*	0.53	0.86
Non-white	0.46**	0.37	0.58	1.05	0.70	1.57	0.80*	0.68	0.95	0.68*	0.48	0.95	0.51**	0.39	0.66	0.99	0.79	1.24

Odds ratio indicate the likelihood of getting a post in a given specialty relative to general practice, the reference group.
Reference categories for the control variables are female, mature students, trainees with parents educated to degree level, privately funded (high) school and white ethnicity.
** $p<0.001$; * $p<0.05$

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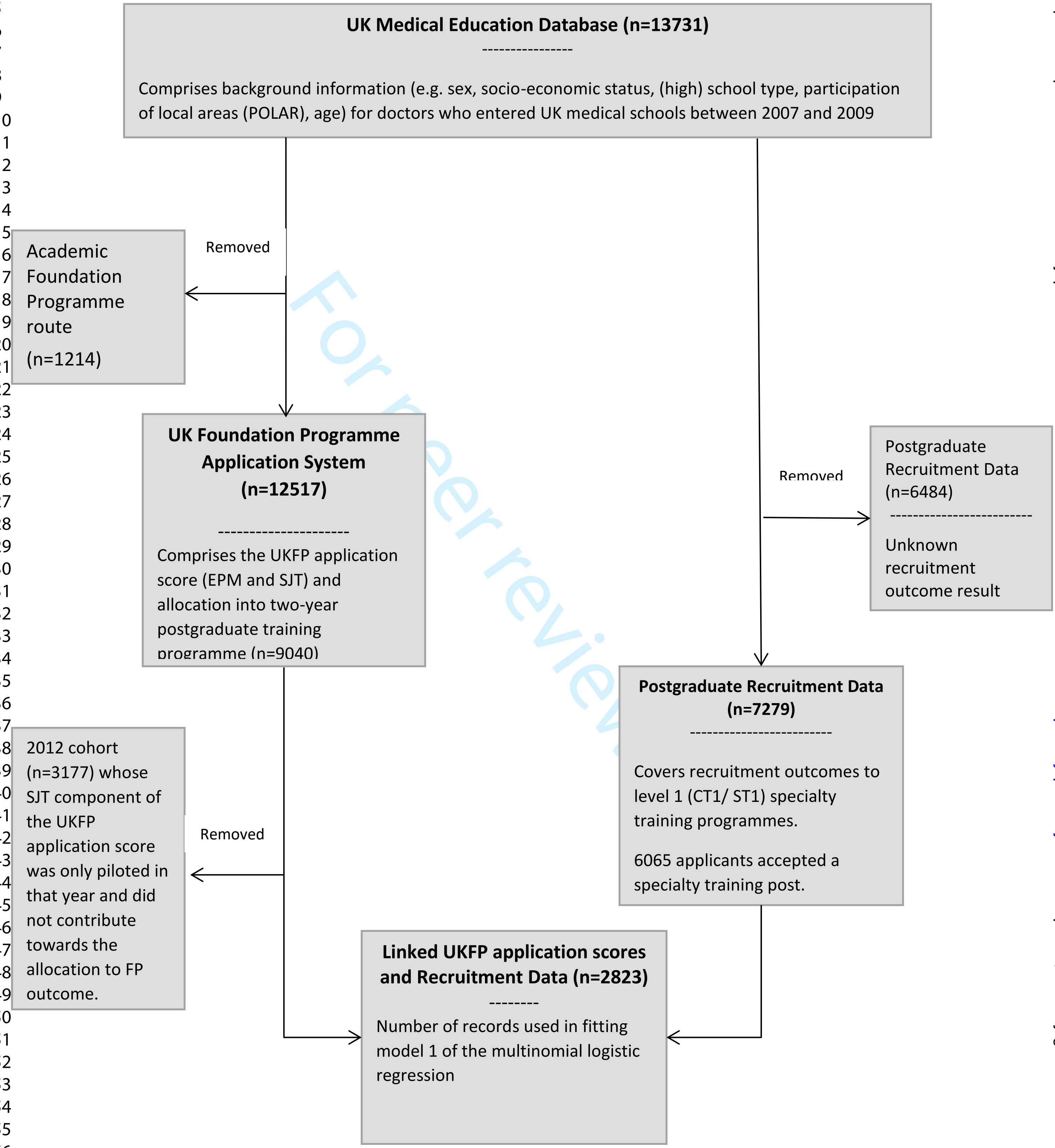
Figure 1: A schematic overview of the data sources



Supplementary File: Specialty re-classification

ORIEL Specialty	Specialty (NEW)
Anaesthetics	Anaesthesia and emergency medicine
Emergency Medicine	
Clinical radiology	Diagnostics
Haematology	
Hepatology	
Histopathology	
Immunology	
Medical microbiology	
General Practice	GP and public health
Public health medicine	
Acute Internal Medicine	Medical specialties
Acute Medicine	
Clinical oncology	
Clinical pharmacology and therapeutic	
Dermatology	
Endocrinology and diabetes mellitus	
Gastroenterology	
General (internal) medicine	
Genito-urinary medicine	
Geriatric medicine	
Infectious diseases	
Intensive care medicine	
Medical oncology	
Medical ophthalmology	
Neurology	
Occupational medicine	
Ophthalmology	
Palliative medicine	
Rehabilitation medicine	
Renal medicine	
Respiratory Medicine	
Rheumatology	
Stroke Medicine	
Child and adolescent psychiatry	Mental health
Forensic psychiatry	
General psychiatry	
Liaison Psychiatry	
Old age psychiatry	
Psychiatry of learning disability	
Community Child Health	Obs Gynae and Med Paediatrics
Obstetrics and gynaecology	

Paediatric Rheumatology	
Paediatric surgery	
Paediatrics	
Cardio-thoracic surgery	Surgical specialties
Cardiology	
General surgery	
Neurosurgery	
Oral and maxillo-facial surgery	
Otolaryngology	
Plastic surgery	
Trauma and orthopaedic surgery	
Urology	
Vascular surgery	

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cohort studies*

Section/Topic	**Item #**	**Recommendation**	**Reported on page #**
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	1-3
Objectives	3	State specific objectives, including any prespecified hypotheses	3
Methods			
Study design	4	Present key elements of study design early in the paper	4-7
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	4
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	4-5
		(*b*) For matched studies, give matching criteria and number of exposed and unexposed	n/a
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	5-6
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	*n/a*
Bias	9	Describe any efforts to address potential sources of bias	n/a
Study size	10	Explain how the study size was arrived at	4-5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	6-7
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	6-7
		(*b*) Describe any methods used to examine subgroups and interactions	6-7
		(*c*) Explain how missing data were addressed	7
		(*d*) If applicable, explain how loss to follow-up was addressed	n/a
		(*e*) Describe any sensitivity analyses	n/a
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	n/a
		(b) Give reasons for non-participation at each stage	n/a
		(c) Consider use of a flow diagram	n/a
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	8-9
		(b) Indicate number of participants with missing data for each variable of interest	n/a
		(c) Summarise follow-up time (eg, average and total amount)	n/a
Outcome data	15*	Report numbers of outcome events or summary measures over time	n/a
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	8-11
		(*b*) Report category boundaries when continuous variables were categorized	n/a
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	n/a
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	n/a
Discussion			
Key results	18	Summarise key results with reference to study objectives	12-14
Limitations			
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	13-14
Generalisability	21	Discuss the generalisability (external validity) of the study results	14
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	n/a

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Relationship between sociodemographic factors and specialty destination of UK trainee doctors: a national cohort study

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Relationship between sociodemographic factors and specialty destination of UK trainee doctors: a national cohort study

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Abstract

OBJECTIVES: Many countries are driving forward policies to widen the socio-economic profile of medical students and to train more medical students for certain specialties. However, little is known about how socio-economic origin relates to specialty choice. Nor is there a good understanding of the relationship between academic performance and specialty choice. To address these gaps, our aim was to identify the relationship between socio-economic background, academic performance and accepted offers into specialty training.

DESIGN: Longitudinal, cohort study using data from the UK medical education database (UKMED: https://www.ukmed.ac.uk/).

PARTICIPANTS: 6065 (60% females) UK doctors who accepted offers to a specialty training (residency) post after completing the 2-year generic foundation programme (UKFP) between 2012 and 2014.

MAIN OUTCOME MEASURES: Chi-square tests were used to examine the relationships between sociodemographic characteristics, academic ability and the dependent variable, specialty choice. Multiple data imputation was used to address the issue of missing data. Multinomial regression was employed to test the independent variables in predicting the likelihood of choosing a given specialty.

RESULTS: Participants pursuing careers in more competitive specialties had significantly higher academic scores than colleagues pursuing less competitive ones. After controlling for the presence of multiple factors, trainees who came from families where no parent was educated to a degree level had statistically significant lower odds of choosing careers in medical specialties relative to general practice [OR=0.78, 95% CI, 0.67-0.92]. Students who entered medical school as school leavers, compared with mature students, had odds 1.2 times higher [95%CI, 1.04-1.56] of choosing surgical specialties than general practice.

CONCLUSIONS: The data indicates a direct association between trainees' socio-demographic characteristics, academic ability and career choices. The findings can be used by medical school, training boards and workforce planners to inform recruitment and retention strategies.

Word count: 287

Strengths and limitations of this study.

- This is one of the first studies in a UK setting to look at the association between socio-economic background, academic performance and specialty (residency) choice.
- This is a nation-wide, multi-cohort study of the career decisions of doctors who successfully completed first stage of generic postgraduate training and were eligible to apply for a specialty post.
- The study used the UK Foundation Programme (UKFP) selection score, part of which is measured two years before specialty training, and is not purely a measure of academic prowess.
- We only had data on career choice of those who applied for specialty training in Year 2 of the Foundation Programme F2, meaning that the sample represented approximately half of those completing the UK Foundation training each year.

Background

Matching medical workforce supply to health need is a global issue.[1-5] Although the absolute number of doctors in many countries continues to grow[6], the medical workforce is unevenly distributed geographically and some specialties are more popular than others. The precise nature of this issue differs by context, but in countries like Australia, Canada, UK and the USA, for example, there has been a reported decline of doctors who choose careers in community-based specialties, general practice/family medicine and mental health relative to hospital-based specialties.[4,7,8]

Research has examined how factors such as geographical location, gender, career aspiration, work-life balance and perceived financial rewards play a crucial role in determining the career choice of healthcare workforce. [9-15] Other studies have looked at the relationship between socio-economic origin and where doctors practice.[16,17] However, very little is known about the extent to which individuals' socio-economic origin and academic ability relate to their specialty choice.

This is important for various reasons. We know from previous research that early academic achievement is associated with socio-economic background, and that early academic performance predicts performance in later years of postgraduate training.[18,19] There is also evidence that different groups perform differently at medical school and during selection to postgraduate medical training.[20,21] What we do not know is the relationship between academic performance and career choices although this is likely to be an important factor in medical careers decision making given that some specialties are more competitive than others.

To date, studies examining UK doctors' career choices have tended to be mostly descriptive in nature, typically focusing on gender and ethnicity differences but neglecting other socio-demographic variables.[22-27] In a recent exception to this, Santana and Chalkley found that doctors who attended privately-funded (high) schools (where school is a proxy for socioeconomic status) were 1.8 and 1.4 times more likely to train in surgical or medical specialties (relative to general practice) respectively than those who attended a state (high) school.[28] However, this study did not examine the relationship between performance at medical school and medical career (specialty) choice. Another recent study looked specifically at the association between demographic and educational factors and junior doctors' decisions to apply for general practice (GP) training.[29] This study reported that the odds of applying to GP training were associated with particular demographic factors (being female, non-white or secondary educated in the UK increased the odds of application) and educational factors (non-graduate entry, intercalation and above-median academic performance during medical school) all decreased the odds of applying to GP training.[29]

We were interested in the associations between demographic and educational factors and junior doctors' decisions to apply for training in any specialty. Therefore, we investigated whether choice of specialty is influenced by socio-economic background, academic ability, or a combination of both. This question is timely because of recent investment and policy drivers in the UK to widen the socio-economic profile of medical students and to train more medical students specifically to work in certain specialties, in particular general practice and psychiatry.[30] However, there is not a linear relationship between number of medical students and workforce distribution. While small-scale studies have shown that there is an association between doctors from certain socio-demographic background and preference for certain specialties, [16,31,32] increasing the number of students in medical schools alone, without considering the effect of other factors such as speciality culture and perceived attractiveness, could lead to unintended consequences, such as training even more doctors who wish to work in urban specialist practice. Moreover, concerns about continued disadvantage in medical education and training, for students who come from non-traditional backgrounds, have been raised before.[33] This leads to questions about whether specialty destination also differs on the basis of socioeconomic class or other contextual markers, including academic ability.

To address these gaps in knowledge, the aim of this study was to identify the relationship between socio-economic background, performance at the point of selection into the first stage of generic postgraduate training in the UK (the Foundation Programme – see later) and accepted offers into specialty (residency) training.

Methods

Background to this study

Our context is the UK's postgraduate medical training pathway. UK medical students spend between four and six years at medical school before they enter foundation training, the generic two-year training programme (the Foundation Programme: FP) which bridges the gap between finishing medical school and becoming eligible to apply for specialty (residency) training. At the end of the first year of the FP, doctors who have successfully achieved their competencies gain full registration with the UK General Medical Council (GMC), recognising progression to postgraduate medicine. Following this, the second year of the FP (F2) is the first opportunity for doctors to apply for a specialty training post.

Fewer than half of doctors who completed the foundation programme in 2017 applied for a training post in F2 and progressed directly into specialty training. Many doctors applied for posts that were not directly aligned to specialty training programmes such as termed service posts, fellowships, or went to work overseas and or in pursuit of academic or other qualifications.[34] The majority of the doctors who take time out of training return within three years.[34] However, this pattern of behaviour presents a challenge at policy level. It suggests that training policy is misaligned with the expectations and aspirations of junior doctors, and because of this, it is difficult to extrapolate the number of doctors who will move into the next phase of training simply by using the number of students in medical schools or those in foundation training. Similarly, forecasting career choices based on early career preferences made at medical school is problematic because these may change over time.[35]

Data description

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 and assessment, postgraduate selection, assessment and training outcomes.[36]

Our cohort comprised 13731 students (43% male, 57% female) who graduated from 33 UK medical schools between 2012 and 2014 and were eligible to apply for postgraduate training. Of these 13731 graduates, 12517 applied for allocation to the Foundation Programme (FP). 1214 trainees applied for the Academic Foundation Programme (AFP) but were excluded from the current analysis because the AFP has a different, completely separate, selection process from the "standard" FP. In the cohort under study, 6484 trainees (2932 males and 3552 females, 47.1% of the sample) had not applied for a specialty post at the time of the data extract. Thus, this study focuses on the 6065 trainees (60% female) who accepted offers to level 1 (the first year of) specialty training on completion of their FP. Supplementary File 1 *(insert link to Supplementary File 1)* shows a schematic flowchart of the data sources.

The UKMED also contains self-declared demographic data such as age, gender and ethnicity. An individual's ethnicity is grouped as either White (the majority ethnic group) or from minority ethnic groups such as Asian, Black, or mixed race. In addition, the UKMED contains variables that relate to academic performance and socio-economic status – with the latter used in previous research examining factors that influence educational achievement of students from different backgrounds, particularly in terms of widening participation.[20,37-39] These socio-economic variables include: parental postcode at the time the student applied to medical school; parental occupation (derived from National Statistics Socioeconomic Classification); receipt of income support; entitlement to free school meals; Participation of Local Area (POLAR), which is an indicator of the participation of young people in higher education by geographic area; Index of Multiple Deprivation (IMD), which is an area measure of socioeconomic status routinely used in UK education and health services research; type of school (state or private); and parental education. We also included place of medical qualification in the analysis (UK country: England, Scotland, Wales and Northern Ireland).

Outcome data

In addition to the socio-demographic and academic performance data, the UKMED also includes career choice data from ORIEL[40], a centralised online system for managing specialty recruitment and career progression in medical training. Doctors who have full registration with the GMC and who have successfully completed the FP are eligible to apply for more than one specialty post anywhere in the UK via a competitive national selection process. Specialty posts are offered on the basis of ranking, and individuals can only accept one post at any given time.

We identified 56 medical training pathways in ORIEL (e.g., orthopaedic surgery, general practice, renal medicine, otolaryngology). These pathways are the route to specialist registration for doctors as defined by the Royal College and Faculty curricula approved by the UK General Medical Council.[41] For the purposes of analysis, we collapsed and re-classified these 56 pathways into seven categories, following advice from NHS Education Scotland (personal communication, Dec 2017). Therefore, the outcome measure was a specialty choice in one of the following categories: Anaesthesia and

Emergency Medicine; Diagnostics; General Practice (GP); Medical Specialties; Surgical Specialties; Mental Health; Obstetrics, Gynaecology and Medical Paediatrics. A full list of re-classification of the specialties is provided in Supplementary File 2 *(insert link to Supplementary File 2).*

The second outcome measure was the UK Foundation Programme (UKFP) selection score, a combined measure of individual student's academic performance across all years of medical school and during the selection process into the first phase of postgraduate training. The UKFP score is the sum of the Education Performance Measure (EPM) and performance on a uniform Situational Judgement Test (SJT). The EPM is worth a maximum of 50 points and comprises three parts; medical school performance (calculated in deciles, 34-43 points); additional degrees, 0-5; and other educational achievements such as publications and presentations, 0-2 (referred to as the AEA, or additional educational achievements). The SJT is also worth up to 50 points.[42] 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. Note that the Situational Judgement Test (SJT) component of the UKFP application score for the graduating cohort of 2012 (n=3177) was used on a pilot basis and did not contribute to allocation or scoring. Finally, we looked at the association between UKFP application score and specialty choice.

Statistical analyses

We used the median and interquartile range to describe the UK Foundation Programme selection scores across several sociodemographic factors. We used Kruskal-Wallis and Mann-Whitney U tests to compare these scores across independent groups. We used Pearson's chi-square tests (and Fisher's exact test where necessary) to test for associations between sociodemographic factors and specialty choice. We conducted a multinomial regression to test whether independent variables could be used to predict the likelihood of trainees choosing a given specialty in relation to general practice (the reference group). Only those variables that showed significant associations at the bivariate level and appeared not to measure overlapping constructs were entered into the regression model. For example, the variables parental occupation and parental education appear to measure broadly the same construct – socio-economic status. Therefore, only one socio-economic status variable – parental education - was tested in the regression model.

In order to address a large amount of missing data in a key variable, we used regression based multiple imputation to simulate five imputed datasets, and used these to account for the missing data. Regression coefficients were obtained using non-imputed data (complete case analysis). Pooled multinomial regression estimates were also obtained as weighted averages of the estimates from these five simulated datasets. All the data analyses were completed using IBM SPSS Statistics for Windows, Version 24 (IBM Corp., Armonk, NY, USA).

Patient and Public Involvement

Patients and the general public were not involved in the design of this research. Access to the data was limited to specific members of the research team via a safe haven (to ensure adherence to the highest standards of security, governance and confidentiality when storing, handling and analysing identifiable data). Ethics approval was not required because the focus of this study was a secondary analysis of anonymised data.[36]

Results

Out of the 6,065 doctors who accepted offers for a training post, the most popular choice was General Practice (n=2341, 38.6%), and the least popular training was Mental Health (n=261, 4.3%).

Table 1 shows the relationship between UK Foundation Programme (UKFP) application score and Level (Year) 1 specialty offers. In general, trainees who accepted offers for a post in obstetrics, gynaecology and paediatrics had the highest UKFP application scores (median = 83.20, IQR = 78.95 – 87.24) compared to those who applied for other specialities. Those applying for a mental health training position had the lowest UKFP selection scores (median = 80.00, IQR = 76.90 – 83.60).

-----Insert Table 1 around here-----

Table 2 shows the relationship between demographic factors, specialty offers and median performance on the UK Foundation Programme selection process. UKFP scores were significantly lower for men, mature students (compared to those who entered medicine directly after high school), those with non-managerial/non-professional parental occupation, no parent with a degree, those who received free school meals or income support, being from an area of low participation (POLAR) and those not of White ethnic group. However, the sizes of these statistically significant differences in median UKFP scores were small. For example, trainees who had ever received free school meals when they were in primary or secondary education (a proxy of low socio-economic status) had significantly lower UKFP scores [median=82.4, IQR (78.5 – 86.4)] compared to those who never received free school meals [median=83.9, IQR (80.3 – 87.6)]. There was no statistically significant association between school type, graduate status or UK domicile and performance on the UKFP scores.

Associations between specialty choice and sociodemographic variables were all statistically significant at p<0.001 with the exception of the contextual variables of parental occupation (p=0.002), free school meals (p=0.018), income support (p=0.010) and participation of local area (p=0.024).

There were significant differences in specialty choice by gender. Higher percentages of females than males chose careers in general practice, obstetrics, gynaecology and medical paediatrics than would be expected if all were similar. On the other hand, higher than expected percentages of males than females chose careers in surgical specialties, diagnostics, anaesthesia and emergency medicine. The highest proportion of females was observed in obstetrics, gynaecology and medical paediatrics (78.9%), the lowest in surgical specialties (38.0%).

Significantly higher percentages of those doctors who choose medical specialties (74.5%) entered medical school as school leavers (rather than as graduates). In contrast, higher percentages of those who chose diagnostics (41.8%), general practice (38.4%) and mental health (39.5%) were mature students. This pattern of specialty choice was also reflected in those who entered medical school as graduates (note not all mature students entering medical school are graduates).

Seventy-six percent (76%) of trainees had attended state-funded schools. Trainees choosing anaesthesia and emergency medicine, general practice and obstetrics, gynaecology and medical paediatrics were slightly more likely to have been to a state-funded school or college (77.8%, 78.9% and 77.9%, respectively) than those who choose diagnostics, surgical specialties or mental health.

The highest percentages of trainees with a parent/guardian from the non-professional occupations [NS-SEC II-IV] were observed in mental health (15.0%) and general practice (12.4%). Trainees from family backgrounds where no parent was educated to a degree level accounted for 31% of trainees. Their representation was also notably higher in those who chose mental health (38.4%) and general practice (36.5%).

Trainees who came from backgrounds where they had received free school meals when they were in primary or secondary education represented less than 9% of the population under study. The highest percentage of trainees whose families were, at some point, recipients of income support was observed in general practice (15.8%), and their lowest representation was in obstetrics, gynaecology and paediatrics (11.1%).

The association between ethnicity and specialty choice shows that the percentage of trainees of Asian background was higher than expected in diagnostics (27.2%) and surgical specialties (26.3%). In contrast, the percentage of White trainees was lowest in surgical specialties (60.2%).

-----Insert Table 2 around here-----

Results of Multinomial Logistic Regression:

We conducted a multinomial regression to predict the likelihood of trainees choosing a given specialty in relation to general practice (the largest, and thus the reference group). Of the 6065 trainees who accepted specialty training post, 3242 (53.5%) had missing data for UKFP application score. Table 3 shows the results of the multinomial regression models based on non-imputed (complete case analysis) and imputed data. The results (as represented by the odds ratios) between complete case and imputed analyses did not vary substantially in terms of direction and magnitude for any of the included sociodemographic variables. This suggested that the missing UKFP application scores did not have the effect of biasing the results.

Model 1 comprised 2823 cases for six predictor variables; gender, school type, parental education, ethnicity (re-classified into white vs black and ethnic minority (BME)), income support, and UKFP application score and only complete cases. The Pearson Chi-square goodness-of-fit test for model 1 indicated that the model was a good fit to the data, $p<0.001$. The reference groups for the control variables (therefore not shown in table 3) were female gender, trainees who entered medical school as mature students (aged 21 and above), trainees with a parent educated to degree level, those who attended privately funded (high) school and trainees who identified their ethnicity as White. Model 2 comprised 6065 cases and had the same predictor variables as Model 1, but it was based on imputed data for UKFP application score. Model 3 was run on all cases presented in Model 1, except for the effect of UKFP application score. Therefore, the number of cases for Model 3 was brought back to 6065 entries after omitting the effect of UKFP application score. Odds ratios greater than 1 indicate a greater odds of trainee trainees choosing a specific specialty rather than the reference group, general practice. Similarly, odds ratios of less than 1 denote a lesser odds of trainees choosing a specialty other than the reference group.

Model 2 shows that after controlling the presence of multiple factors, including the UKFP application score, males had significantly higher odds of choosing anaesthesia and emergency medicine (OR=1.9, CI 1.61-2.25); diagnostics (OR=2.0, CI, 1.44-2.80); medical specialties (OR=1.41, CI, 1.23-1.63); mental health (OR=1.57, CI, 1.27-2.04) and surgical specialties (OR=3.31, CI, 2.74-4.00) than general practice. However, for males the odds of choosing careers in obstetrics and gynaecology reduced by 45% (OR=0.55, CI, 0.44-0.67), relative to females, compared to general practice. Those who entered medical school as school leavers, compared with mature students, had odds 1.2 times higher (CI, 1.04-1.48) of choosing anaesthesia and emergency medicine, 1.7 times higher (CI, 1.48-2.01) of choosing medical specialties, 1.4 times higher (CI, 1.17-1.75) of choosing obstetrics and gynaecology, and 1.2 times higher (CI, 1.04-1.56) of choosing surgical specialties than general practice. Trainees who came from families where no parent had a degree, compared with those who had at least one parent with a degree, had odds ratios of 0.78 (CI, 0.67-0.92) (22% decrease) for choosing medical specialties relative to general practice. The odds of choosing a specialty other than general practice for trainees who attended state (high) school, compared to those who attended private (high) school, were multiplied by a factor of 0.82 (CI, 0.68-0.98) (18% decrease) for medical specialties; 0.66 (CI, 0.49-0.90) (44% decrease) for mental health and 0.73 (CI, 0.56-0.95) (27% decrease) for surgical specialties.

The odds of trainees who identified as non-White, compared to White, to choose a specialty other than general practice were multiplied by a factor of 0.51 (CI, 0.42-0.63) (49% decrease) for anaesthesia and emergency medicine and 0.68 (CI, 0.55-0.85) (32% decrease) in obstetrics and gynaecology. However, those from BME, compared to White trainees, had odds 1.4 times higher (CI, 1.10-1.65) of choosing surgical specialties compared to general practice. Model 3 shows that when all the variables were incorporated into the model, except for the effect of UKFP application score, the association between ethnicity and career choice in anaesthesia and emergency medicine (OR 0.46, CI 0.37-0.58), and mental health (0.68, CI 0.48-0.95) remained statistically significant.

Discussion

To the best of our knowledge, this is one of the few studies in a UK setting to look at the association between socio-economic background, performance and specialty choice in doctors making their specialty (residency) career decisions. Our analysis indicates that socio-economic background and, to a lesser extent, performance on the Foundation Programme selection measures are important factors in predicting career choices and pathways. We found that trainees who pursued careers in more competitive specialties had significantly higher Foundation selection scores than colleagues who pursued less competitive ones. We also found that doctors who entered medical school as mature students and those from lower socio-economic backgrounds had significantly lower performance on this measure, and were more likely to choose careers in General Practice (GP) and Mental Health relative to other specialties. This latter finding aligns with that of Gale et al., who found that doctors who entered medical school as graduate applicants, compared to non-graduates, were more likely to apply for GP training.[29]

General practice has struggled to fill its training places over the last few years.[43] This recruitment issue is coupled with an aging GP workforce and fewer GP trainees wishing to work full-time after full qualification. [44,45] Our multivariate analysis suggests that increasing the number of mature students and students from lower socio-economic (non-traditional) backgrounds could help GP recruitment.

Our results could be interpreted as students who come from non-traditional backgrounds tending to perform less well, have significantly lower Foundation Programme selection scores (as evidenced by our findings), and not applying for certain specialties as they do not believe they can compete for a training post with those who performed better on the UKFP.[33] However , the weaker performance of non-traditional students on Foundation Programme selection may be due to financial rather than ability differences. As indicated in the methods section, the UKFP application score comprises other parts that are not solely a measure of academic performance. For example, medical students from less affluent backgrounds may opt out of intercalated degrees or medical electives abroad because of cost, despite these being factors that contribute towards attainment at medical school and score/ranking on the UKFP.[46-48] The influence of additional educational attainments on specialty post offers requires further examination as does exploring personal reasons for making specialty choices.

These patterns may also indicate that "disadvantage continues" in that those doctors who come from non-traditional backgrounds are less likely to obtain training posts in what are perceived as the most competitive specialties.[49,50] Our study corroborates other non-UK studies and anecdotal evidence highlighting the challenges faced by doctors in terms of pursuing certain medical careers.[51] However, is this finding due to lack of confidence, feeling one does not fit with a particular specialty, and/or is it related to those from non-traditional backgrounds performing less well early in their careers (i.e. at medical school and in the selection process for the UKFP)?[52-54] Further qualitative research is required to explore the factors that attract or deter doctors from widening access backgrounds to apply for certain specialties.

Finally, GP training is much shorter than many other specialties and GP trainees tend to work in one place rather than rotating around (often geographically dispersed) hospitals. This may mean fewer financial demands on trainees than other pathways[55-57] and thus may appeal to more mature trainees/residents who are likely to have greater financial and domestic commitments than younger ones.[58,59] A recent report looking at how doctors progress through postgraduate training also highlighted how mature and graduate entry trainees are concerned with getting through training as quickly as possible.[60] Similarly, this urgency to get through training quickly may also appeal to those from lower socio-economic backgrounds who may be more concerned with paying back their student loan than those from more affluent groups.[61,62]

The differences we noted in gender and ethnicity are consistent with the wider literature. For example, our results resonates with other studies that show how doctors from Black and Minority Ethnic (BME) groups perform less well in academic and recruitment outcomes compared to White doctors.[19,63-65] However, after controlling for the effect of UKFP selection score, the association between ethnicity and specialty choice was no longer significant for most specialties, except in anaesthesia and emergency medicine (49% decrease) and obstetrics and gynaecology (32% decrease). This echoes findings from a previous study by Woolf *et al* which reported how negative relationships between senior doctors and trainees discouraged some of the BME trainees from pursuing careers in anaesthetics.[64] Our data also indicate that BME trainees have increased odds of choosing careers in surgical specialties compared to general practice. This might be dependent of the other confounding factors that have not been explained by the regression model. These factors may include cultural and family influence,[66,67] trainees' perception of the specialty, experience during medical school, influence of role models or mentors and personal career needs.[27] This also requires further qualitative research to explore the social and cultural capital[68] that non-traditional students bring with them into medical education and training.

The strength of this study is that it is one of the first to use the UK Medical Education Database (UKMED) to examine the associations between socio-demographic factors, academic ability and the full range of specialty career choices. The UKMED enabled a nation-wide, multi-specialty and multi-cohort analysis. However, we must also acknowledge some potential limitations of the study. Firstly, in our previous research on selection into postgraduate (F2) training we reported how some of the contextual markers included in the analysis overlap, particularly socioeconomic class, ethnicity and place of medical qualification.[33] We believe that these have a similar effect on specialty choice given the links between place, poverty and ethnicity in the UK.[69,70] Second, we used the UKFP selection score as an indicator of performance. As outlined earlier, this score comprises an individual's performance at medical school plus outstanding academic features such as an additional degree or publications, and a situational judgement test (SJT, the other 50%). In short, it is an indicator, measured two years before specialty training and is not purely a measure of academic prowess. However, we used this for several reasons. First, the UKFP competency outcome measures which assess progression during the UKFP do not differentiate at the level we needed for meaningful analysis. Alternative outcome measures may have included specialty interview score or ranking during the specialty selection process, but UKMED did not hold this data at the time of the study. Moreover, specialty selection scores are not directly comparable because different specialties use different selection processes. In short, we used the best measure available at the time. As UKMED expands, future studies may wish to rerun this study with alternative outcome measures such as those mentioned above.

The nature of specialty selection in the UK is that eligible doctors can apply for many different specialties and different posts. We did not have information on specialty applications, only on offers (i.e. where an individual had been successful in his or her application) because the data extract used in the analysis contained phase 1 of the UKMED data[36]. Our sample represented approximately half of those completing the UKFP in each year group because we only had data on specialty choice from those who applied for specialty training in F2. We know that work has recently been commissioned to explore if those who apply for a training post in F2 are different (in terms of socio-demographics) to those who delay application in order to take time out of training (e.g. work overseas for a period of time, take a service or an academic post). This forthcoming analysis will show if our sample is representative of the wider group. We could have included other measures of previous academic performance in the model. However, most of the other currently available measures are associated with selection into medical school and/or are not used in any later selection decisions. It may have been useful to split the UKFP selection score into its component parts (EPM, AEA, SJT) and compare each of these separately. Our reason for not doing so that in practice it is the total score that is used in selection decision, i.e. this is the measure used to allocate postgraduate programmes and from that jobs. However, examining these specific associations may be a fruitful area for further research given that the SJT and EPM are considered to measure different factors[71]. Further studies may also wish to look at specialty applications as well as offers as this will provide further insight into the career preferences of junior doctors from different socio-economic backgrounds.

In conclusion, this study contributes to the evidence that there is a direct association between socio-economic background, academic ability and career choices. This intelligence can be used by medical school, those organisations with responsibility for medical training and workforce planners to inform selection, recruitment and retention strategies. Finally, more research is needed to examine the postgraduate training environment and workforce distribution to ensure that social accountability and fairness are upheld at all levels of training.

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COMPETING INTERESTS

This study is part of Ben Kumwenda's doctoral programme of research funded by the UKCAT Research Panel, of which JC is a member. KW is the Special Advisor (Recruitment) for the UK's Foundation Programme (UKFPO).

FUNDING

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ETHICAL PERMISSION

The Chair of the local ethics committee ruled that formal ethical approval was not required for this study given the fully anonymised data was held in safe haven, and all students who sit UKCAT and GAMSAT are informed that their data and results will be used in educational research. All students applying for the UKFPO also sign a statement confirming that their data may be used anonymously for research purposes. No patients or the general public were involved in this research.

AUTHOR CONTRIBUTIONS

JC led the funding bid which was reviewed by KW, BK and PJ. KW and PJ advised on the nature of the data. BK managed the data, carried out the data analysis under the supervision of GJP and JC, and wrote the first manuscript. GJP advised on all the statistical analysis. JC guided the first draft of the introduction and discussion sections of this paper. BK wrote the methods and results sections. JC edited the drafts. All authors reviewed and agreed on the final draft of the paper.

DATA SHARING

UK Medical Education Database ("UKMED") UKMEDP 026 extract generated on 12/08/2016. Approved for publication on 27/03/2017. UKMED bears no responsibility for data analysis or interpretation. The dataset is held in safe haven and only members of the research, BK, GP and JC had access to the data. The data includes information derived from that collected by the Higher Education Statistics Agency Limited ("HESA") and provided to the GMC ("HESA Data").

Source: HESA Student Record 2007/2008 and 2008/2009 Copyright Higher Education Statistics Agency Limited. The Higher Education Statistics Agency Limited makes no warranty as to the accuracy of the HESA Data, cannot accept responsibility for any inferences or conclusions derived by third parties from data or other information supplied by it.

CONSENT FOR PUBLICATION

Not applicable.

Table 1: The relationship between UK Foundation Programme (UKFP) application score and Level (Year) 1 specialty offers (2013 and 2014 data only).

Table 1			UKFPO application score		
	Count	%	Median	Percentile 25	Percentile 75
Anaesthesia and Emergency Medicine	771	12.7	82.50	79.10	86.60
Diagnostics	153	2.5	82.09	78.60	87.20
GP†	2341	38.6	80.90	76.90	84.85
Medical Specialties	1358	22.4	82.60	78.60	86.80
Mental Health	261	4.3	80.00	76.90	83.60
Obstetrics, Gynaecology and Med Paediatrics	583	9.6	83.20	78.95	87.25
Surgical Specialties	598	9.9	82.85	78.60	86.65
Did not apply	6484	(47.1)	---	---	---
† Includes fewer than 10 trainees who applied for Public Health					

Table 2	Relationship between sociodemographic variables, performance on the UKFP selection process, and Level 1 specialty training programme offers: 2013 and 2014 cohort.																		
	Overall Distribution		UK Foundation Programme (UKFP) Application Score		Anaesthesia and Emergency Medicine		Diagnostics		General Practice†		Medical Specialties		Mental Health		Obs Gynae and Med Paediatrics		Surgical Specialties		
	N	N %	Median (IQR)	P Value*	N	N %	N	N %	N	N %	N	N %	N	N %	N	N %	N	N %	P Value**
Gender																			
Male	2408	39.7	82.9 (79.2 – 86.6)	<0.001	367	47.6	77	50.3	795	34.0	558	41.1	117	44.8	123	21.1	371	62.0	<0.001
Female	3657	60.3	84.3 (80.7 – 87.9)		404	52.4	76	49.7	1546	66.0	800	58.9	144	55.2	460	78.9	227	38.0	
Age Category																			
School Leavers	4022	66.3	83.8 (80.1 – 87.5)	<0.001	506	65.6	89	58.2	1443	61.6	1012	74.5	158	60.5	406	69.6	408	68.2	<0.001
Mature	2043	33.7	82.6 (78.5 – 86.6)		265	34.4	64	41.8	898	38.4	346	25.5	103	39.5	177	30.4	190	31.8	
Graduate on Entry																			
Non-graduate	4377	72.2	83.7 (80.7 – 87.4)	0.054	548	71.1	102	66.7	1593	68.0	1086	80.0	171	65.5	438	75.1	439	73.4	<0.001
Graduate on entry	1688	27.8	83.1 (79.2 – 87.1)		223	28.9	51	33.3	748	32.0	272	20.0	90	34.5	145	24.9	159	26.6	
School Type																			
State-funded or college	3960	76.0	83.7 (80.0 – 87.5)	0.660	533	77.8	89	72.4	1635	78.9	821	72.3	160	71.7	373	77.9	349	70.4	<0.001
Privately funded school	1252	24.0	83.7 (80.0 – 87.3)		152	22.2	34	27.6	436	21.1	314	27.7	63	28.3	106	22.1	147	29.6	
Parental Occupation																			
I - Managerial & Prof	3762	89.8	84.0 (80.2 – 87.6)	<0.001	509	92.0	98	91.6	1392	87.6	887	91.6	142	85.0	372	91.6	362	90.5	0.002
II-IV Other Occupations	428	10.2	82.5 (78.9 – 86.6)		44	8.0	9	8.4	197	12.4	81	8.4	25	15.0	34	8.4	38	9.5	
Free School Meals																			
No	4644	91.4	83.9 (80.3 – 87.6)	<0.001	594	90.7	114	91.9	1823	90.3	1036	9[illegible].9	198	90.4	458	94.8	421	90.1	0.018

Yes	438	8.6	82.4 (78.5 – 86.4)		61	9.3	10	8.1	196	9.7	79	7.1	21	9.6	25	5.2	46	9.9	
Income Support																			
No	4159	85.7	84.0 (80.3 – 87.6)	<0.001	548	85.6	99	82.5	1619	84.2	931	88.2	180	87.8	416	88.9	366	83.2	0.010
Yes	693	14.3	82.9 (79.0 – 86.8)		92	14.4	21	17.5	304	15.8	125	11.8	25	12.2	52	11.1	74	16.8	
Parent Degree																			
No	1791	34.1	83.1 (79.5 – 87.0)	<0.001	205	30.0	41	31.3	799	38.4	333	29.2	84	36.5	170	34.2	159	32.7	<0.001
Yes	3459	65.9	84.1 (80.3 – 87.7)		479	70.0	90	68.7	1284	61.6	806	70.8	146	63.5	327	65.8	327	67.3	
Participation of local area (POLAR)																			
Low Participation	334	6.1	83.2 (79.1 – 87.2)	<0.001	53	7.4	11	8.3	141	6.4	53	4.5	18	7.6	20	4.0	38	7.3	0.024
High Participation	5169	93.9	83.7 (80.0 – 87.5)		666	92.6	122	91.7	2079	93.6	1113	95.5	218	92.4	485	96.0	486	92.7	
Ethnicity																			
Asian or Asian British	1372	22.7	81.8 (78.1 – 85.3)	<0.001	106	13.8	41	27.2	577	24.8	336	25.0	59	22.7	97	16.6	156	26.3	<0.001*
Black or Black British	126	2.1	79.9 (75.7 – 83.7)		4	0.5	4	2.6	56	2.4	29	2.2	3	1.2	8	1.4	22	3.7	
Mixed	218	3.6	82.7 (79.3 – 87.0)		25	3.3	2	1.3	69	3.0	60	4.5	10	3.8	20	3.4	32	5.4	
Other Ethnic Groups	158	2.6	82.1 (78.5 – 86.2)		15	2.0	6	4.0	44	1.9	51	3.8	4	1.5	13	2.2	25	4.2	
White	4158	68.9	84.6 (81.0 – 88.1)		619	80.5	98	64.9	1584	68.0	869	64.6	184	70.8	445	76.3	359	60.4	
UK Domicile																			
England	4537	82.3	83.7 (80.0 – 87.4)	0.118	591	82.0	112	83.6	1821	81.9	963	82.4	191	80.6	419	82.8	440	83.5	0.004
Northern Ireland	248	4.5	83.6 (79.5 – 87.5)		34	4.7	3	2.2	87	3.9	77	6.6	3	1.3	28	5.5	16	3.0	
Scotland	480	8.7	84.4 (80.6 – 87.7)		68	9.4	13	9.7	207	9.3	82	7.0	29	12.2	38	7.5	43	8.2	
Wales	251	4.6	83.8 (79.3 – 87.0)		28	3.9	6	4.5	108	4.9	46	3.9	14	5.9	21	4.2	28	5.3	

Table 3: Multinomial Logistic Regression Results (Odds Ratio) for Specialty Choice. [a]

			Anaesthesia and		Diagnostics			Medical Specialties			Mental Health				Obstetrics and				Surgical Specialties
[UK] Place of Medical Qualification																			
Northern Ireland	170	2.8	84.5 (81.5 – 87.5)		14	1.8	3	2.0	68	2.9	57	4.2	1	0.4	18	3.1	9	1.5	
Scotland	665	11.0	84.3 (80.6 – 88.0)	<0.001	92	11.9	18	11.8	253	10.8	141	10.4	39	14.9	54	9.3	68	11.4	0.018
Wales	321	5.3	86.1 (81.2 – 89.4)		37	4.8	6	3.9	137	5.9	62	4.6	15	5.7	30	5.1	34	5.7	
England	4909	80.9	83.5 (79.8 – 87.2)		628	81.5	126	82.4	1883	80.4	1098	80.9	206	78.9	481	82.5	487	81.4	
Programme Type																			
5-Year Standard Entry	4956	81.7	83.7 (80.0 – 87.4)		628	81.5	109	71.2	1854	79.2	1177	86.7	202	77.4	489	83.9	497	83.1	
4-Year Graduate Entry	1036	17.1	80.1 (76.1 – 83.7)	<0.001	137	17.8	42	27.5	457	19.5	165	12.2	54	20.7	88	15.1	93	15.6	<0.001*
6-Year WA Route	73	1.2	80.7 (76.9 _ 84.7)		6	0.8	2	1.3	30	1.3	16	1.2	5	1.9	6	1.0	8	1.3	
Foundation School [Region]																			
London Area	1623	26.8	84.9 (81.8 – 88.1)		204	26.5	43	28.1	565	24.1	395	29.1	60	23.0	169	29.0	187	31.3	
Northern Ireland	175	2.9	84.5 (80.2 – 87.5)		16	2.1	2	1.3	70	3.0	62	4.6	0	0.0	19	3.3	6	1.0	
Rest of England	2591	42.7	81.1 (77.3 – 85.8)	<0.001	343	44.5	67	43.8	1039	44.4	550	40.5	117	44.8	252	43.2	223	37.3	<0.001
Scotland	612	10.1	83.7 (79.7 – 87.3)		86	11.2	15	9.8	249	10.6	119	8.8	37	14.2	47	8.1	59	9.9	
South of England	763	12.6	83.7 (80.7 – 87.1)		86	11.2	20	13.1	283	12.1	173	12.7	35	13.4	75	12.9	91	15.2	
Wales	301	5.0	81.0 (74.8 – 86.5)		36	4.7	6	3.9	135	5.8	59	4.3	12	4.6	21	3.6	32	5.4	

† Includes <0.5% who applied for Public Health

P Value* for association between selected demographic variables and UKFP application score.

P Value** for association between selected demographic variables and accepted specialty offer.

	Emergency Medicine												Gynaecology (includes Medical Paediatrics)					
		95% Confidence Interval for Odds Ratio			95% Confidence Interval for Odds Ratio			95% Confidence Interval for Odds Ratio			95% Confidence Interval for Odds Ratio			95% Confidence Interval for Odds Ratio			95% Confidence Interval for Odds Ratio	
	Odds Ratio	Lower Bound	Upper Bound	Odds Ratio	Lower Bound	Upper Bound	Odds Ratio	Lower Bound	Upper Bound	Odds Ratio	Lower Bound	Upper Bound	Odds Ratio	Lower Bound	Upper Bound	Odds Ratio	Lower Bound	Upper Bound
Model 1 [using non-imputed data (complete case analysis)] (n=2823)																		
UKFP Application Score	1.05**	1.03	1.08	1.07*	1.02	1.12	1.07**	1.05	1.09	0.98	0.94	1.02	1.06**	1.03	1.09	1.08**	1.05	1.12
Male	2.31**	1.76	3.04	2.16*	1.31	3.57	1.85**	1.49	2.31	1.74*	1.15	2.65	0.56*	0.39	0.80	4.11**	3.03	5.57
School leaver (<21 Years)	0.92	0.64	1.33	1.12	0.53	2.35	1.82*	1.30	2.55	0.65	0.38	1.10	2.73**	1.57	4.74	1.31	0.83	2.07
Parental education (No degree)	0.60*	0.44	0.81	0.59	0.33	1.07	0.65**	0.51	0.83	0.78	0.50	1.24	0.85	0.61	1.18	0.80	0.58	1.11
State (high) school	0.85	0.62	1.16	0.66	0.38	1.13	0.78*	0.61	0.99	0.61*	0.38	0.96	0.92	0.65	1.30	0.57*	0.41	0.79
Non-white	0.49**	0.36	0.67	1.18	0.70	1.99	0.90	0.71	1.13	0.43*	0.26	0.70	0.52**	0.36	0.75	1.22	0.90	1.66
Model 2 [using multiple imputation to account for missing data in UKFP selection score in model 1] (n=6065)																		
UKFP Application Score	1.02*	1.01	1.04	1.02	0.97	1.08	1.02*	1.01	1.04	0.99	0.96	1.01	1.02*	1.00	1.05	1.04*	1.01	1.06
Male	1.90**	1.61	2.25	2.01*	1.44	2.80	1.41**	1.23	1.63	1.57*	1.21	2.04	0.55**	0.44	0.67	3.31**	2.74	4.00
School leaver (<21 Years)	1.24*	1.04	1.48	0.81	0.57	1.14	1.73**	1.48	2.01	0.90	0.69	1.18	1.43*	1.17	1.75	1.23*	1.04	1.56
Parental education (No degree)	0.72	0.59	0.88	0.77	0.51	1.13	0.78*	0.67	0.92	0.97	0.73	1.29	0.92	0.72	1.16	0.85	0.68	1.05
State (high) school	0.94	0.76	1.17	0.71	0.45	1.13	0.82*	0.68	0.98	0.66*	0.49	0.90	0.95	0.74	1.21	0.73*	0.56	0.95
Non-white	0.51**	0.42	0.63	1.19	0.82	1.70	1.14	0.99	1.33	0.80	0.60	1.07	0.68*	0.55	0.85	1.35*	1.10	1.65

Model 3 [using complete analysis, without controlling for the effect of UKFP selection score] (n=6065)

Male	1.98**	1.65	2.38	2.19*	1.51	3.19	1.46**	1.25	1.70	1.73*	1.30	2.31	0.51**	0.40	0.66	3.47**	2.80	4.29
School leaver (<21 Years)	1.18	0.96	1.44	0.87	0.58	1.32	1.75**	1.46	2.09	0.76	0.56	1.03	1.65**	1.29	2.10	1.23	0.97	1.57
Parental education (No degree)	0.73*	0.60	0.88	0.72	0.48	1.08	0.72**	0.61	0.85	0.95	0.71	1.29	0.91	0.73	1.13	0.80	0.64	1.00
State (high) school	0.93	0.74	1.17	0.76	0.49	1.18	0.80*	0.67	0.96	0.59*	0.42	0.82	1.02	0.79	1.32	0.68*	0.53	0.86
Non-white	0.46**	0.37	0.58	1.05	0.70	1.57	0.80*	0.68	0.95	0.68*	0.48	0.95	0.51**	0.39	0.66	0.99	0.79	1.24

[a] Odds ratio indicate the odds of getting a post in a given specialty relative to general practice, the reference group.

Reference categories for the control variables are female, mature students, trainees with parents educated to degree level, privately funded (high) school and white ethnicity.

**p<0.001; * p<0.05

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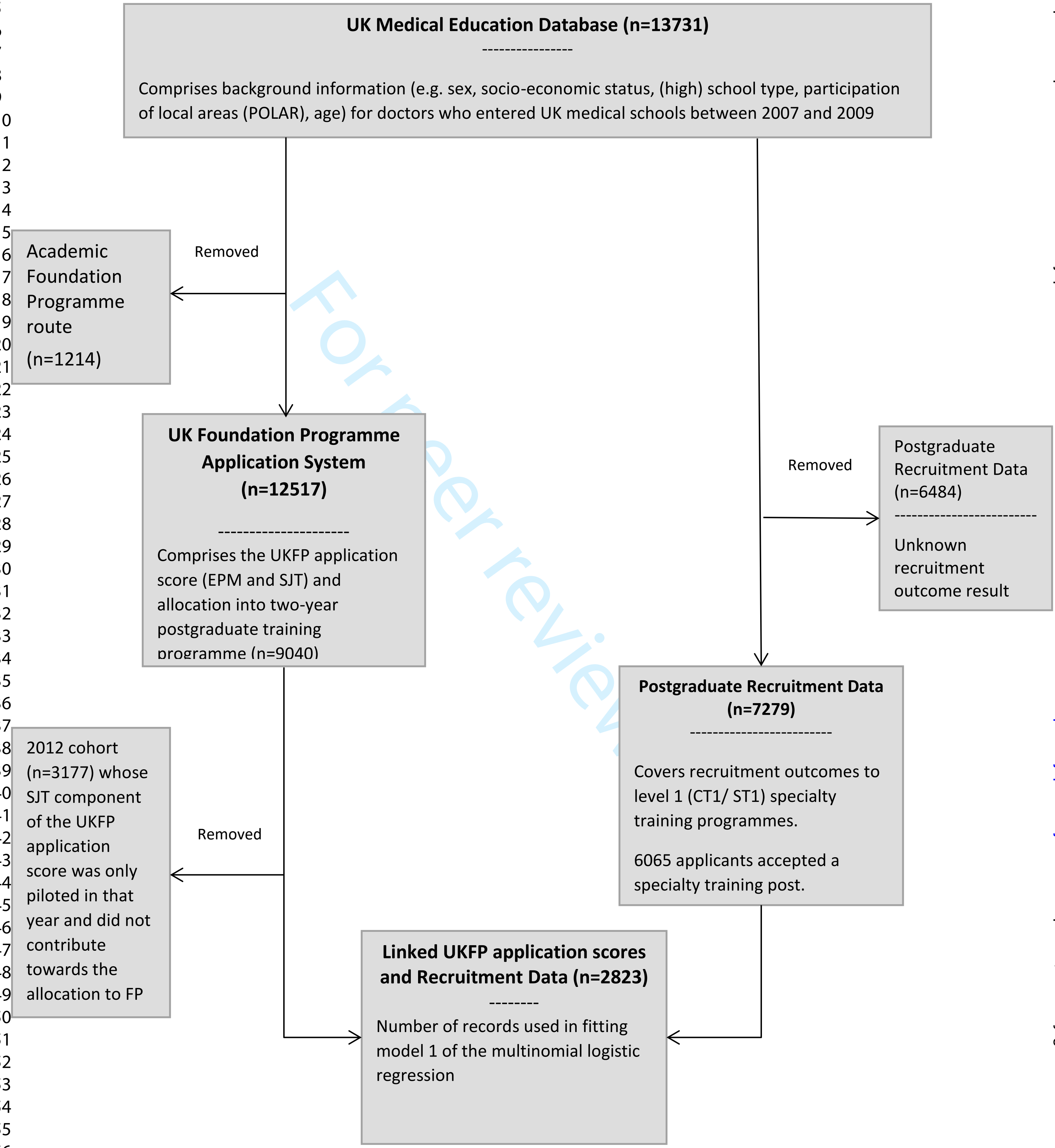
Supplementary File 1

Figure 1: A schematic overview of the data sources



Supplementary File 2

Specialty re-classification	
ORIEL Specialty	**Re-classified Specialty**
Anaesthetics	Anaesthesia and emergency medicine
Emergency Medicine	
Clinical radiology	Diagnostics
Haematology	
Hepatology	
Histopathology	
Immunology	
Medical microbiology	
General Practice	GP and public health
Public health medicine	
Acute Internal Medicine	Medical specialties
Acute Medicine	
Clinical oncology	
Clinical pharmacology and therapeutic	
Dermatology	
Endocrinology and diabetes mellitus	
Gastroenterology	
General (internal) medicine	
Genito-urinary medicine	
Geriatric medicine	
Infectious diseases	
Intensive care medicine	
Medical oncology	
Medical ophthalmology	
Neurology	
Occupational medicine	
Ophthalmology	
Palliative medicine	
Rehabilitation medicine	
Renal medicine	
Respiratory Medicine	
Rheumatology	
Stroke Medicine	
Child and adolescent psychiatry	Mental health
Forensic psychiatry	
General psychiatry	
Liaison Psychiatry	
Old age psychiatry	
Psychiatry of learning disability	
Community Child Health	Obs Gynae and Med Paediatrics
Obstetrics and gynaecology	
Paediatric Rheumatology	
Paediatric surgery	

Supplementary File 2

Paediatrics	
Cardio-thoracic surgery	Surgical specialties
Cardiology	
General surgery	
Neurosurgery	
Oral and maxillo-facial surgery	
Otolaryngology	
Plastic surgery	
Trauma and orthopaedic surgery	
Urology	
Vascular surgery	

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cohort studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	1-3
Objectives	3	State specific objectives, including any prespecified hypotheses	3
Methods			
Study design	4	Present key elements of study design early in the paper	4-7
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	4
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	4-5
		(*b*) For matched studies, give matching criteria and number of exposed and unexposed	n/a
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	5-6
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	*n/a*
Bias	9	Describe any efforts to address potential sources of bias	n/a
Study size	10	Explain how the study size was arrived at	4-5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	6-7
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	6-7
		(*b*) Describe any methods used to examine subgroups and interactions	6-7
		(*c*) Explain how missing data were addressed	7
		(*d*) If applicable, explain how loss to follow-up was addressed	n/a
		(*e*) Describe any sensitivity analyses	n/a
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	n/a
		(b) Give reasons for non-participation at each stage	n/a
		(c) Consider use of a flow diagram	n/a
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	8-9
		(b) Indicate number of participants with missing data for each variable of interest	n/a
		(c) Summarise follow-up time (eg, average and total amount)	n/a
Outcome data	15*	Report numbers of outcome events or summary measures over time	n/a
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	8-11
		(*b*) Report category boundaries when continuous variables were categorized	n/a
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	n/a
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	n/a
Discussion			
Key results	18	Summarise key results with reference to study objectives	12-14
Limitations			
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	13-14
Generalisability	21	Discuss the generalisability (external validity) of the study results	14
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	n/a

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.