Differential Attainment at the FRCR Exams According to Demographic and Socioeconomic Factors

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Abstract:

Background:
In recent years there has been an increase in the postgraduate education literature showing that there are barriers to postgraduate exam success and career progression in medical training for some trainee groups compared to others; widely referred to as 'differential attainment'. To date, there is little published data on whether differential attainment or award gaps exists in UK radiology training, or what contributes to FRCR success.
In this longitudinal cohort study, we aimed to evaluate the relationship between demographic and socioeconomic factors with performance at the FRCR exams.

Method:
Longitudinal retrospective cohort study of UK radiology trainees attempting FRCR Part 1 between 2014 and 2021 *(n = 1,857)* with linked socioeconomic, demographic and FRCR 2A and 2B results. Chi-square tests assessed univariate associations between age, gender, ethnicity, and socioeconomic variables, with performance at each exam. Multivariate logistic regression analyses examined likelihood of FRCR performance after adjusting for other variables.

Results:
During the study period, 79.3% (1,466/1,851) of Part 1 candidates passed at their first attempt. Of these, 63.7% (599/940) subsequently passed 2A at first attempt and 77.2% (482/624) passed 2B. We found significant associations between gender, ethnicity, and age at first attempt with performance at each of the exams ($p<.005$ for all). Among socioeconomic variables, significant associations with FRCR performance were seen for parental education level, entitlement to free school meals, state-funded school (<.0.05 for Part 2A), and more deprived Index of Multiple Deprivation (<0.05 for Part 1 and 2A).
After adjusting for demographic factors, trainees of lower socioeconomic factors did not have a significantly lower likelihood of exam success.

Discussion:
Our study demonstrates that significant group-level award gaps exists for candidates with protected characteristics and other socioeconomic factors. These can act as barriers to career progression and should be addressed. We hope our findings can be used to leverage and guide the implementation of interventions to support these groups.

Introduction:

In recent years there has been an increase in the postgraduate education literature showing that there are barriers to postgraduate exam attainment and career progression in medical training for some trainee groups compared to others; widely referred to as 'differential attainment'.[2-4] Studies of medical and surgical specialty exams have shown that exam pass rates vary by demographic factors (gender, ethnicity, age, graduate status and prior education) and socioeconomic background.[5-8] The General Medical Council (GMC) and Royal Colleges have a legal obligation to ensure fairness in training and to tackle inequalities in training programmes under the 2010 Equality Act.[11,12] There is also a moral obligation to address such differences in performance due to the high personal, professional, social and financial costs of repeat exam attempts.

Understanding where differential attainment exists is therefore essential for assessing the need for, and directing, targeted educational support and interventions. To date, while the RCR express their commitment to identifying and addressing differential attainment in Radiology, very little has been understood of the contributing factors to FRCR success. This has been in part due to a lack of available diversity data on radiology trainees, with reporting of diversity variables historically having been voluntary.[9,10] Further, where diversity data has been reported, socioeconomic factors have not been accounted for - socioeconomic status being a key confounder when considering attainment.[5]

In this longitudinal cohort study, we aimed to evaluate the relationship between demographic and socioeconomic factors with performance at the FRCR exams. Identifying predictive factors is key to understanding group-level barriers to career progression within radiology. It will also enable the option to increase support and resources to trainees potentially at risk of failure, facilitating equity of opportunity.

Methods:

This was a longitudinal retrospective cohort study using data from the UK Medical Education Database (UKMED). UKMED links educational outcomes for all trainees within the UK by regularly cross-linking data from a multitude of sources, including the General Medical Council and the Higher Education Statistics Authority (HESA) Limited. Further information on the database is available at www.ukmed.ac.uk.[11]

All data was stored and analysed securely using a Safe Haven. In line with the HESA standards (www.hesa.ac.uk), all counts presented have been rounded to the nearest 5 to ensure person-level anonymity.

Study Population and FRCR results:

Anonymised data were extracted for all UK medical graduates who attempted the FRCR Part 1 exam between 2014 and 2021. International Medical Graduates were not included as longitudinal socioeconomic data for these trainees were not available in the database - this

is because the data is collected by the Higher Education Statistics Agency (HESA) at application to medical school in the UK.[12]

FRCR Part 1 is split into two modules, Physics and Anatomy, and a 'pass' is required at each module to be eligible to proceed to the Part 2A exam. Therefore, for the purposes of this study, a 'fail' on either module was classified as an overall 'fail'. In other words, a pass at both modules at first attempt was required to classify as a 'pass'.

Subsequently, the 2A and 2B results of the same cohort were extracted between 2018 and 2021. Prior to 2018, the FRCR 2A exam was made up of 6 separate exam modules taken by candidates at various intervals. As of 2018, the format changed to a single exam. Therefore, to be able to reliably compare the performance of candidates, data for the FRCR Part 2A exam was extracted between 2018 and 2021 only.

A summary of the FRCR exams is provided in **Table 1.**

Table 1. The FRCR examinations.[10]

First FRCR (Part 1): A two-part written knowledge test. The first part assesses recognition of anatomical structures on clinical imaging, and the second part assesses knowledge of radiological physics.
Final FRCR A (Part 2A): A Single Best Answer (SBA) test (spread over two days) assessing radiological and pathological knowledge spanning the breadth of radiology subspecialties.
Final FRCR B (Part 2B): A tripartite assessment of 'Reporting', 'Rapid Reporting', and a case-based oral viva of image-based pathology.

Only the first attempts at all FRCR Part 1, 2A and 2B exam results were extracted for evaluation, as these have been shown to be most predictive of future success in postgraduate exams. [13,14] All variables were linked to FRCR performance on an individual level by UKMED.

Demographic Variables:
Demographic variables included were age at exam, gender, ethnicity and undergraduate- versus graduate-entry to medical school.

Measures of Socioeconomic Status:
Measures of socioeconomic status included secondary school-type (fee-paying versus non-fee paying), education level achieved by a parent (university educated versus not), entitlement to income support, entitlement to free school meals, the participation of local areas (POLAR) quintile, and the index of multiple deprivation (IMD) quintile.

The POLAR quintile classifies geographic UK areas into quintiles based on the proportions of young people who enter higher education, ranging from 1 (lowest participation) to 5

(highest participation). The IMD quintile is a measure of relative deprivation of a small geographic area; ranging from 1 (most deprived) to 5 (least deprived). In order to maximize sample sizes and therefore statistical power, the POLAR and IMD quintiles were dichotomised into 1 and 2 versus 3, 4 and 5, in keeping with other similar studies.[5,15,16] Since both quintiles are based on postcodes, only the postcode of applicants to undergraduate studies were used, to avoid the post-code representing a university accommodation.

Statistical analysis:
All analyses were performed using STATA (Statacorp, TX, USA). Univariate Chi2 tests were used to assess for significant associations between individual characteristics and FRCR success. Characteristics that were significantly associated with success at FRCR were carried forward in multivariate logistic regression models to identify predictors that were independent of other variables.

Spearman's Rho correlation coefficients were calculated for each measure of socioeconomic status (**Suppl. Table 1**). Where a high correlation coefficient was found between two variables, only one was entered into logistic regression models: access to free school meals was carried forward instead of income support. There was a large statistically significant correlation between age at exam sitting and being a graduate on entry to medicine ($r = 0.44$, $p < 0.001$). Therefore, age at exam sitting was taken forward in regression models.

Statistical significance was set at alpha level = 0.05. All analyses were performed on a complete case bases for reproducibility of results by others.

Ethics:
UKMED have received ethics exemption from Queen Mary's University of London Ethics of Research Committee on behalf of all UK medical schools for research projects that exclusively use UKMED data. Further details can be found here: (https://www.ukmed.ac.uk/documents/UKMED_research_projects_ethics_exemption.pdf).

Results:

Between 2014 and 2021, 1,851 candidates who met inclusion criteria attempted the FRCR Part 1 exam. Of this cohort, 79.2% (1,466/1,851) passed at their first attempt. A total of 940 candidates later attempted FRCR 2A between 2018-2021, of which 63.7% (599/940) passed at first attempt. Of these, 624 candidates subsequently attempted FRCR 2B, of which 77.2% (482/624) passed at their first attempt. The sociodemographic characteristics of the cohort are shown in Table 2.

Table 2. *Cohort characteristics of the study population by FRCR exam.*

Cohort Characteristic	Part 1 Total n = 1,851	Part 2A Total n = 940	Part 2B Total n = 624

Gender			
Male	1,108 (59.9%)	577 (61.4%)	403 (64.6%)
Female	743 (40.1%)	363 (38.6%)	221 (35.4%)
Ethnicity			
White	899 (48.6%)	437 (46.5%)	292 (46.8%)
Asian or Asian British	621 (33.6%)	330 (35.1%)	215 (34.5%)
Black of Black British	59 (3.2%)	32 (3.4%)	18 (2.9%)
Other ethnic groups	103 (5.6%)	49 (5.2%)	35 (5.6%)
Mixed	68 (3.7%)	34 (3.6%)	26 (4.2%)
Unknown	101 (5.5%)	58 (6.2%)	38 (6.1%)
Sexual Orientation			
Heterosexual	1,429 (77.2%)	721 (76.6%)	475 (76.1%)
Homosexual	28 (1.5%)	9 (1.0%)	8 (1.3%)
Bisexual	10 (0.5%)	7 (0.7%)	3 (0.5%)
Other	5 (0.3%)	3 (0.3%)	1 (0.2%)
Unknown	379 (20.5%)	201 (21.4%)	137 (22.0%)
Age at First Attempt			
<35	1,733 (93.6%)	828 (8.1%)	533 (85.4%)
>/= 35	114 (6.2%)	112 (11.9%)	91 (15.0%)
Unknown	4 (0.22)	0 (0.0%)	0 (0.0%)
Graduate on Entry to Medicine			
Non-graduate	1,526 (82.4%)	776 (82.6%)	533 (85.4%)
Graduate	302 (16.3%)	154 (16.4%)	86 (13.8%)
Unknown	23 (1.2%)	10 (1.1%)	5 (0.8%)
Parental Education			
University-educated parent	567 (30.6%)	366 (38.9%)	291 (46.6%)
No university-educated parent	237 (12.8%)	139 (14.8%)	104 (16.7%)
Unknown	1,047 (56.6%)	435 (46.3%)	229 (36.7%)
POLAR quintile			
III-V – Highest participation neighbourhoods	1,387 (74.9%)	703 (74.8%)	472 (75.6%)

I-II – Lowest participation neighbourhoods	211 (11.4%)	109 (11.6%)	71 (11.4%)
Unknown	253 (13.7%)	128 (13.6%)	81 (13.0%)
School Type			
State-funded school	1,084 (58.6%)	556 (59.2%)	366 (58.7%)
Fee-paying school	452 (24.4%)	238 (25.3%)	170 (27.2%)
Unknown	315 (17.0%)	146 (15.5%)	88 (14.1%)
Income Support			
No	644 (34.8%)	406 (43.2%)	323 (51.8%)
Yes	106 (5.7%)	62 (6.6%)	43 (6.9%)
Unknown	1,101 (59.5%)	472 (50.2%)	258 (41.4%)
Free School Meals			
No	710 (38.4%)	444 (47.2%)	347 (55.6%)
Yes	76 (4.1%)	47 (5.0%)	34 (5.5%)
Unknown	1,065 (57.5%)	449 (47.8%)	243 (38.9%)
IMD Quintile			
III-V – Least deprived	1,241 (67.0%)	626 (66.1%)	427 (68.4%)
I-II – Most deprived	358 (19.3%)	192 (20.4%)	117 (18.8%)
Unknown	252 (13.6%)	127 (13.5%)	80 (12.8%)

Univariate associations between sociodemographic factors and first attempt FRCR results are demonstrated in **Table 3**. Significant associations are shown between FRCR Part 1, 2A and 2B pass rates with gender, ethnicity, and age at first attempt ($p<.005$) Male trainees had significantly higher pass rates at the Part 1 and 2A exams, but lower pass rates at the 2B exam. Compared to trainees of Black or Asian ethnicity, trainees of white ethnicity had higher pass rates at each exam. Only 40.6% (13/32) of Black trainees passed the 2A exam at first attempt, compared to 72.3% (316/437) of White trainees. Similar trends were seen by age; 42.0% (47/112) of trainees over the age of 35 passed the 2A exam at first attempt, compared to 66.7% of trainees under the age of 35 (552/828).

Among socioeconomic variables, significant associations with FRCR performance were seen for parental education level, entitlement to free school meals, state-funded school (<.0.05 for Part 2A), and more deprived IMD quintile (<0.05 for Part 1 and 2A).

Table 3. *Univariate analyses assessing the association between FRCR results and candidate sociodemographic factors.*

Cohort Characteristics	Part 1 n = 1851		2A n = 940		2B n = 624	
	Pass	**n/total**	**Pass**	**n/total**	**Pass**	**n/total**
Gender						
Male	82.6%	915/1,108	66.4%	383/577	74.2%	299/403
Female	74.2%	551/743	59.5%	216/363	82.8%	183/221
Missing		*n = 0*		*n = 0*		*n = 0*
p-value		**<.001**		**0.03**		**0.01**
Ethnicity						
White	84.7%	761/899	72.3%	316/437	83.2%	243/292
Asian or Asian British	73.3%	455/621	55.8%	184/330	69.8%	150/215
Black of Black British	62.7%	37/59	40.6%	13/32	55.6%	10/18
Other ethnic groups	73.8%	76/103	53.1%	26/49	80.0%	28/35
Mixed	82.4%	56/68	73.5	25/34	88.5%	23/26
Missing		*n = 101*		*n = 58*		*n = 38*
p-value		**<.001**		**<.001**		**0.001**
Sexual Orientation						
Heterosexual	79.2%	1,132/1,429	63.8%	459/720	77.3%	367/475
Homosexual	82.1%	23/28	88.9%	8/9	87.5%	7/8
Bisexual	90.0%	9/10	57.1%	4/7	100%	3/3
Other	60.0%	3/5	33.3%	1/3	100%	1/1
Missing		n = 379		n = 201		n = 137
p-value		0.58		0.28		0.65
Age at First Attempt						
<35	80.0%	1,386/1,733	66.7%	552/828	80.7%	
=>35	67.5%	77/114	42.0%	47/112	57.1%	52/91
Missing		n = 4		n = 0		n = 0
p-value		**0.002**		**<.001**		**<.001**
Graduate on Entry to Medicine						

Non-graduate	80.0%	1,223/1,526	66.6%	517/776	78.1%	416/533
Graduate	75.8%	229/302	51.3%	79/154	73.3%	63/86
Missing		n = 23		n = 10		n = 5
p-value		0.09		**<.001**		0.32
Parental Education						
University-educated parent	82.7%	469/567	68.3%	250/366	80.1%	233/291
No university-educated parent	76.0%	180/237	58.3%	81/139	70.2%	73/104
Missing		n = 1,047		n = 435		n = 229
p-value		**0.03**		**0.03**		**0.04**
POLAR quintile						
III-V – Highest participation neighbourhood	80.0%	1,110/1,387	65.6%	461/703	78.6%	371/472
I-II – Lowest participation neighbourhood	76.3%	161/211	57.8%	63/109	73.2%	52/71
Missing		n = 253		n = 128		n = 81
p-value		0.21		0.11		0.31
School Type						
State-funded school	78.1%	847/1,084	62.2%	346/556	77.9%	285/366
Fee-paying school	81.6%	369/452	72.3%	172/238	78.8%	134/170
Missing		n = 315		n = 146		n = 88
p-value		0.12		**0.007**		0.80
Income Support						
No	81.2%	523/644	66.8%	271/406	78.6%	254/323
Yes	74.5%	79/106	64.5%	40/62	76.7%	33/43
Missing		n = 1,101		n = 472		n = 258
p-value		0.11		0.73		0.78
Free School Meals						
No	82.3%	584/710	68.0%	302/444	79.5%	276/347

Yes	67.1%	51/76	48.9%	23/47	64.7%	22/34
Missing		n =1,065		n = 449		n = 243
p-value		**0.001**		**0.009**		**0.046**
IMD Quintile						
III-V – Least deprived	81.5%	1,011/1,241	68.0%	422/621	78.7%	336/427
I-II – Most deprived	72.6%	260/358	53.1%	102/192	75.2%	88/117
Missing		n = 252		n = 127		n = 80
		<.001		**<.001**		0.42

Multivariate logistic regression analyses predicting success at the FRCR exams are demonstrated in **Table 4**. These show that after adjusting for other sociodemographic variables, those of Asian/Asian British ethnicity were significantly less likely to pass each of the FRCR exams compared to trainees of white ethnicity. Exam candidates of Black/Black British ethnicity were a fifth as likely to pass the FRCR 2A exam compared to trainees of white ethnicity (OR: 0.21, CI: 0.05-0.81). Further, compared to male candidates, female candidates were significantly less likely to pass the Part 1 exam (Odds Ratio: 0.57, 95% Confidence Interval: 0.39-0.84).

The remaining socioeconomic factors were not significant predictors of exam performance after adjusting for other variables.

Table 4. *Multivariate logistic regression analyses predicting the likelihood of a 'pass' result at the first attempt of the FRCR exams, accounting for other sociodemographic variables. Only variables significant (p<0.05) at univariate analyses were brought forward.*
CI: Confidence Interval.

Cohort Characteristic	**Part 1 (713)**		**2A (436)**		**2B (352)**	
	Odds Ratio	**CI**	**Odds Ratio**	**CI**	**Odds Ratio**	**CI**
Gender						
Man	Reference	-	Reference	-	Reference	-
Woman	0.57	0.39-0.84	0.71	0.46-1.11	1.36	0.77-2.40
Ethnicity						
White	Reference	-	Reference	-	Reference	-

Asian or Asian British	0.43	0.28-0.65	0.30	0.19-0.48	0.31	0.17-0.56
Black of Black British	0.40	0.13-1.20	0.21	0.05-0.81	0.43 [0.09-2.13]	0.09-2.13
Other ethnic groups	1.05	0.30-3.76	0.65	0.17-2.49	0.39	0.11-1.37
Mixed	0.58	0.21-1.61	1.07	0.25-4.51	2.09	0.25-17.56
Age at First Attempt						
<35	Reference	-	Reference	-	Reference	-
=>35	0.37	0.18-0.75	0.20	0.09-1.22	0.34	0.15-0.78
Parental Education						
University-educated parent	Reference	-	Reference	-	Reference	-
No university-educated parent	0.68	0.45-1.03	0.75	0.45-1.23	0.74	0.41-1.35
School Type						
State-funded school			Reference	-		
Fee-paying school			1.07	0.45-1.23		
Free School Meals						
No	Reference	-	Reference	-	Reference	-
Yes	0.73	0.40-1.35	0.80	0.38-1.68	0.67	0.27-1.66
IMD Quintile						
III-V – Least deprived	Reference	-	Reference	- -		
I-II – Most deprived	0.75	0.47-1.20	0.68	0.40-1.15		

Discussion

Given the high stakes involved and the impact on the radiology workforce, there is great interest from candidates, trainers, and training programmes in understanding what factors are associated with success at FRCR. Our study demonstrates significant group-level award gaps by protected characteristics and socioeconomic factors. These can act as barriers to

career progression and should be addressed. We hope our findings can be used to leverage and guide the implementation of interventions to support these groups.
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Gender

We found that women were significantly less likely to pass the Part 1 and 2A exams, even after accounting for other sociodemographic factors. While similar findings have been seen for the written component of the postgraduate surgical exam (MRCS Part A), other studies of postgraduate specialty exams show that women tend to perform better or equal to men.[5,6,13,17] The underlying reasons for these discrepancies are unclear. It is possible that there is an underlying bias in the question style of the FRCR Part 1 and 2A exams. However more likely is that women face systematic barriers in exam preparation. Further qualitative work is needed to determine the underlying barriers, and whether increased access to Less-Than-Full-Time training in recent years will impact gender-based award gaps in the future.[18]

Of note, women had significantly higher pass rates for the FRCR 2B exam compared to men. It may be that female candidates perform better at this oral and reporting-style assessment, compared to the single-best answer format of the Part 1 and 2A exams. Dewhurst et al showed similar results for the internal medicine postgraduate exam (MRCP), with women significantly outperforming men in the Clinical Skills Assessment.[6] Ellis et al showed that men significantly outperformed women at the written MRCS Part A exam, but no significant gender difference for the clinical MRCS Part B exam. In our study being female was not significantly predictive of 2B success after adjusting for other variables.

Age

Compared to candidates under the age of 35, those over 35 were significantly less likely to pass each of the exams, after adjusting for other variables. Similar results have been seen for trainees taking the MRCS and MRCP exams.[5,6,13,14] This age-gap in attainment may be explained by greater family, financial or caring responsibilities or gaps in training due to parental or research leave. Of note, graduate medical students have been shown to perform at an equal level to non-graduate medical students in medical school, suggesting that this is likely an age-related barrier (rather than a reflection of graduate-entry medicine). [22]

Ethnicity

In keeping with multiple studies of other postgraduate specialty exams, we saw a significant association between ethnicity and FRCR success.[5-8,19,20] Compared to White trainees, trainees of Black or Asian ethnicity were significantly less likely to pass the 2A exam, after adjusting for socioeconomic factors. Trainees of Black ethnicity were a fifth as likely to pass the 2A exam at first attempt compared to trainees of white ethnicity. Asian trainees were less than a third as likely to pass 2A. The wider body of literature shows that ethnicity-based disparities in attainment begin in secondary school and continue through medical school and postgraduate training, suggesting that there are systematic and structural barriers to equal attainment.[7,21] Further, our findings support that non-white trainees face challenges that are independent of their socioeconomic background.

Socioeconomic status

There was a significant association between FRCR performance at each of the exams with entitlement to free school meals, having a university-educated parent, and measures of socio-economic deprivation (Part 1 and 2A), with those of lower socioeconomic backgrounds having lower FRCR pass rates.[15] Similar trends were seen for all the socioeconomic variables, although they did not all reach statistical significance. There has been limited research on the impact of varying socioeconomic backgrounds on postgraduate medical training to date, however a prior study on MRCS exam performance demonstrated similar affluency-based disparities.[5] The underlying reasons may be due to an accumulated educational advantage - we know that students of more affluent backgrounds already perform better at medical school and prior attainment is the best predictor of future success in assessments.[21,23] The reasons behind this differential attainment may also reflect financial barriers that exist to FRCR success.[15,16] Not only is there a high personal cost of the exams themselves, but many trainees also attend costly courses, conferences, and purchase books.[24]

Mitigating Differential Attainment

The wider body of work on differential attainment in training show that attainment gaps cannot simply be explained by a *'learner deficit'* - differential outcomes have been shown to exist even after accounting for prior academic performance.[5] The disparities can also not be explained by examiner bias since the Part 1 and 2A exams are both computer-marked written assessments.

Rather than interventions aimed at the exams or individual trainees, prior qualitative work suggests that the most fruitful allocation of resources is likely to be focused on 1) supporting an inclusive learning environment at local training programmes, and 2) mitigating accrued systematic disadvantages faced by minority groups of trainees. Learning environments are crucially impacted by the relationships of students with their teachers and peers.[25] Postgraduate trainees learn best in supportive environments with trainers who mentor and believe in them, and are hindered by environments of bullying, discrimination, and lack of trust.[25] Negative experiences of learning environments also increase stress, risk of burnout and reduce well-being, which further compounded negative effects on learning.[25] Future qualitative work, such as focus group studies, can help to understand the underlying causes of the observed disparities within radiology specifically.

Areas of support for trainees may include developing formal mentorship schemes at local training programmes, financial support for exam preparation resources, and recruitment of consultants from diverse backgrounds. Trainers should also have access to time and resources to increase their own knowledge of how to best support these groups, for example through attendance at educational supervisor skills courses. Finally, establishing peer-to-peer networks of trainees from marginalised groups may be helpful, as trainees have been shown to seek peer support and advice from those of shared characteristics.[25]

To date, evidence of the effectiveness of specific interventions to address differential attainment is sparse and will include learning as part of the process. It is therefore essential that interventions have measurable outcomes that can be monitored.

Limitations

As a retrospective cohort study based on a large database, this study is limited by the availability and quantity of information collected in the dataset. Missing data exists for several variables; these were explicitly stated where present and all analyses were performed on a complete-case basis. Another limitation of the dataset is that variables are categorised e.g. ethnicity, which limits the granularity of conclusions however is essential for statistical power. The categorisations available in the database are representative of those used in the wider medical education literature. While it would be of interest to adjust for prior educational attainment, there were large numbers of missing data points for medical school performance measures for radiology trainees, thereby diminishing statistical power.

Finally, this study did not examine differential performance among international medical graduates. Longitudinal sociodemographic data on trainees is collected by the Higher Education Statistics Agency (HESA) at application to medical school in the UK. Therefore, such data is not available for international graduates. It will be important for future work on differential attainment to include these trainees where possible.

Conclusions:

Our study demonstrates significant group-level differential attainment at the FRCR exams by protected characteristics and socioeconomic factors that can act as barriers to career progression. While further work is needed to understand the causes of differential attainment, these findings can be used to guide the implementation of interventions to support these groups at national and local levels.

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Supplemental Table 1. Spearman's Rho
NEED TO REDO

	Income Support	Free School Meals	Parental Degree	Polar Quintile	School Type	IMD Quintile
Income Support	1.00	0.61	0.22	0.28	-0.13	0.30
Free School Meals	0.61	1.00	0.20	0.25	-0.08	0.31
Parental Degree	0.22	0.20	1.00	0.17	-0.18	0.14
Polar Quintile	0.28	0.25	0.17	1.00	-0.12	0.34
School Type	-0.13	-0.08	-0.18	-0.12	1.00	-0.14
IMD Quintile	0.30	0.31	0.14	0.34	-0.14	1.00