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Role of students' context in predicting academic performance at a medical school: a retrospective cohort study

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ABSTRACT

Objectives: This study examines associations between medical students' background characteristics (postcode-based measures of disadvantage, high school attended, sociodemographic characteristics), and academic achievement at a Russell Group University.

Design: Retrospective cohort analysis.

Setting: Applicants accepted at the University of Liverpool medical school between 2004 and 2006, finalising their studies between 2010 and 2011.

Participants: 571 students (with an English home postcode) registered on the full-time Medicine and Surgery programme, who successfully completed their medical degree.

Main outcome measures: Final average at year 4 of the medical programme (represented as a percentage).

Results: Entry grades were positively associated with final attainment ($p<0.001$). Students from high-performing schools entered university with higher qualifications than students from low-performing schools ($p<0.001$), though these differences did not persist at university. Comprehensive school students entered university with higher grades than independent school students ($p<0.01$), and attained higher averages at university, though differences were not significant after controlling for multiple effects. Associations between school type and achievement differed between sexes. Females attained higher averages than males at university. Significant academic differences were observed between ethnic groups at entry level and university. Neither of the postcode-based measures of disadvantage predicted significant differences in attainment at school or university.

Conclusions: The findings of this study suggest that educational attainment at school is a good, albeit imperfect, predictor of academic attainment at medical school. Most attainment differences observed between students either decreased or disappeared during university. Unlike previous studies, independent school students did not enter university with the highest grades, but achieved the lowest attainment at university. Such variations depict how patterns may differ between subjects and higher-education institutions. Findings advocate for further evidence to help guide the implementation of changes in admissions processes and widen participation at medical schools fairly.

Strengths and limitations of this study

- To the best of our knowledge, this is the first published retrospective cohort study that used both postcode-based measures of disadvantage along with educational background and demographic information to examine differences in participation and attainment of medical students.
- This study included only medical students at the University of Liverpool (UoL) enabling a more precise evaluation of the determinants of higher education (HE) performance and participation endorsing evidence-based decision-making in university admissions processes.
- The results and patterns observed may not be generalisable to other HE institutions, and must be interpreted in the context of the geographical and demographic population of the UoL.
- This study included only students who were successfully admitted and completed their medical degree, thereby restricting the extent to which findings are representative of all medical students.
- Trends relating to postcode-based measures of disadvantage (eg, Index of Multiple Deprivation) are based on aggregate data, and hence, may not necessarily relate to individuals themselves but rather to the areas in which they are based.

INTRODUCTION

Pervasive inequalities in participation in higher education (HE) are greatest in selective and oversubscribed programmes such as medicine.[1–6] In 2008, of seven socioeconomic groups included in the National Statistic Socio-economic Classification (NS-SEC), the three most affluent groups (ie, students with parents in professional occupations) accounted for 85% of medical students in the UK.[6] These differences in participation are largely associated with the well-documented gap in educational attainment between students from socioeconomically disadvantaged backgrounds and more privileged students.[6–13] Concomitantly, university admissions systems in the UK focus

predominantly on the academic records of prospective students, though the extent to which these are representative of students' academic potential has been questioned.[12–15] Consequently, this represents the main entry barrier for lower socioeconomic status (SES) applicants.[1 11–14 16–20]

Though numerous interventions have aimed to widen and extend access to under-represented groups in the UK medical student population, evidence suggests these have had limited impact.[1–6 21] The integration of school, domicile, 'neighbourhood' and socioeconomic contextual information into the university admission system more generally has been argued to offer a useful tool to assist widening participation by situating individual prior attainment within the context of the circumstances in which results were obtained.[22–27] The argument follows that inclusion of contextual data could enable universities to identify academic potential that may not be reflected in prior attainment alone, and most importantly, assist in making decisions about students from disadvantaged backgrounds.[18 19 28–34] However, though previous studies have examined associations between students' background characteristics and academic performance nationally and for individual universities,[10 17–19 28] there is a dearth of studies focusing specifically on medical students, and considering measures of disadvantage, alongside relative school performance to identify contextual effects on prior academic attainment.[1 25 27 34] Ensuring such impacts are understood, and then managed in an equitable way is critical to medical school admissions systems engendering greater social responsibility, given that students' life chances and opportunities can be impacted by such decisions.[1 34–39] Arguments for increasing diversity in medical schools also focus on the benefits that training in demographically heterogeneous populations has on doctors' understanding of others sociocultural backgrounds, which can improve the quality of medical care they provide.[21 32] Postadmission, it is also of great importance, that medical schools can identify and provide appropriate support structures for students with academic potential to perform well in their studies, and assist those that may require additional support.[2 37–39]

Given that differences have been identified in the sociodemographic composition of students even between elite universities, recognising these differences and exploring how trends in academic performance may vary, is important.[11 18 31 35 40–42] The present study at the University of Liverpool (UoL) investigates the extent to which students' contextual background influences academic performance in medical studies.

METHODS

Study context

This study uses data from the UoL, one of the six original 'red brick' civic universities and a founding member of the Russell Group. Traditionally, such elite universities in the UK have tended to have a greater proportion of students from more affluent backgrounds, and have higher entry requirements.[30 40 42 43] This, coupled with the fact that medicine is among the most competitive and selective programmes, with the highest entry requirements, is known to affect the composition of students.[2 43 44] Despite this, the university campus is based in Liverpool; a city with some of the most socioeconomically deprived areas in the UK, and has traditionally attracted a high proportion of applicants from lower SES backgrounds relative to the Russell Group average.

Data

Ethical approval was requested and granted by the UoL ethics committee. Data for the study were then obtained from the UoL central student database. This includes all necessary student background information, and tracks performance from the point of application through to graduation. The study focused on students entering the UoL between 2004/2005 and 2006/2007. This was the most recent entry year that allowed analysis of both entry and exit points. There were no significant changes to the university's admission policies or grading criteria during this time period, so data were stratified by year of entry, but also treated as a single data set. The data set contained sociodemographic (sex, age, ethnicity, disability, domicile), school attended, prior attainment, and HE performance information for 571 students. The full list of variables included in the analysis is described in table 1.

The 5-year Bachelor of Medicine and Bachelor of Surgery programme has an annual intake of approximately 280 students. However, specific exclusion criteria were applied that reduced the number of students included in the analyses. First, only data for students who successfully completed the full-time 5-year medical degree programmes were included in this study. Second, students' permanent home addresses/postcodes were used to generate the two area-based measures of disadvantage depicted in table 1: Participation of Local Areas (POLAR 3) and the Index of Multiple Deprivation (IMD). Students provide their home address/postcode, during the Universities and Colleges Admissions Service (UCAS) application process (usually this is their parents' home address). Correspondence from universities and UCAS is typically sent to students' home address. Owing to the use of students' home postcodes rather than term-time postcodes, and the fact that the IMD is generated separately for each of the UK administrations, students from outside of England were excluded from analyses.

Data analysis

Given that the final year of the medical programme at the UoL is a placement year which students either pass or fail, the average attainment of students in year 4 was selected as the main outcome variable that was included in analyses. Differences were also explored in entry-level

attainment (UCAS tariff points) based on students' contextual background characteristics (socioeconomic deprivation, residence in low-participation neighbourhood, school type, school performance, sex and ethnicity). Statistical significance of associations between the independent and outcome variables was assessed using conventional hypothesis testing for categorical (χ^2) and continuous (independent t test) comparisons.

Univariate linear regression was conducted to describe the association between contextual background characteristics (socioeconomic deprivation, residence in low-participation neighbourhood, school type, school performance, sex, ethnicity and UCAS tariff points) and academic performance (as a percentage) of medical students at year 4. As differences in degree performance have been observed between men and women in a number of studies,[19] univariate linear regression was also conducted to explore the extent to which trends between contextual background characteristics and attainment varied between men and women.

Multivariable linear regression modelling was conducted to identify which factors were independently associated with academic performance at year 4. No entry criteria were specified for selection of factors to go into the model, as all were judged a priori to be important for inclusion. All independent variables (socioeconomic deprivation, residence in low-participation neighbourhood, school type, school performance, sex, ethnicity and UCAS tariff points) were selected into the model using forced entry. Possible interactions were investigated between: school type × sex; school type × school performance; school type × sex × school performance, where sufficient numbers allowed analysis.[45]

All analyses were undertaken using SPSS (V.21).

RESULTS

There was no evidence of statistical collinearity between the explanatory factors used in the analysis (all associations were non-significant p>0.05).

Students were predominantly white (78.5%) though there was a high proportion of Asian students (13.1%) compared with other ethnic minorities. Almost two-thirds of the students were women (65.61%). Table 2 presents a descriptive summary of the associations between each of the contextual background characteristics and academic performance.

Significant differences were observed in the UCAS tariff points of students where prior attainment had been obtained from different school types. Students from schools denominated under the category 'state other' entered university with the lowest UCAS tariff points (M=335.17; SD=48.30), but achieved the highest final attainment at university (M=74.73, SD=1.93) along with students from comprehensive schools (M=74.25, SD=2.43) (p=0.05). Students from independent schools attained the lowest averages at university (M=73.56, SD=2.46).

Only 18% of the student population came from the most deprived quintile of IMD. These students were admitted into university with the lowest entry grades (M=335.35 SD=69.89), and achieved slightly lower final grades at university, though these differences were not statistically significant (p>0.05). Similarly, only 8% of students came from neighbourhoods with the lowest HE participation (highest quintile of POLAR 3), and this indicator did not predict significant differences in performance at entry level or by final year at university.

Differences in UCAS tariff points between men and women were not significant. However, at university, men performed slightly, but significantly less well (M=73.76, SD=2.66) than women (M=74.33, SD=2.30). Finally, with regard to ethnicity, though there were no significant differences in students' UCAS tariff points by the fourth year at university, significant differences were observed in the attainment of different ethnic groups. These differences varied from those identified at entry level. This was particularly noticeable in the attainment of Chinese students. Specifically, they achieved the lowest averages at university compared with students from other ethnicities (M=71.80, SD=3.0) despite entering university with the second highest grades out of all the ethnic groups (M=351.67, SD=13.37).

Table 3 summarises the results of univariate linear regression, depicting associations between contextual background factors in relation to average attainment at fourth year. A significant positive association was found between UCAS tariff points (school grades) and fourth year performance. For every unit increase in UCAS tariff points, a 0.18% increase in final year average performance was observed (B=0.01, p<0.001). Students from ethnic minorities were more likely to achieve lower averages than white students, though these differences were only statistically significant for Chinese (M=71.80, SD=3.0) (B=−2.61, p<0.001) and Asian students (M=72.97, SD=2.51) (B=−1.44, p<0.001).

Women students attained slightly, but significantly, higher averages (M=74.33, SD=2.31) at university than their men counterparts (M=73.76, SD=2.66) (B=−0.57, p<0.01). A significant association between school type and final year performance at university was also identified. Specifically, attendance at comprehensive schools was associated with higher university achievement compared to attendance at independent schools (B=−0.82, p<0.001). There was no significant difference in attainment between students who came from neighbourhoods with differing levels of participation in HE (POLAR 3), or between those students who attended schools with low/high levels of performance.

Univariate linear regressions revealed significant statistical differences between men and women in associations between school type, ethnicity, UCAS Tariff Points and fourth year performance (table 4). UCAS Tariff Points were more strongly associated with fourth year achievement for men (B=0.02, p<0.001) than women (B=0.02, p<0.01). With regard to school type, compared

Table 1 Description of outcome (educational performance) and predictor (contextual factors) variables

Variables	Description
Outcome variables	
Year 4 performance	Students complete final examinations in year 4 of the medical programme (year 5 is a practical year where students undertake 8 clinical rotations).
Predictor variables	
UCAS Tariff Points	UCAS Tariff Points are a system used for allocating points to post-GCSE qualifications in the UK (eg, for A-levels, A=120, B=100, C=80, etc). These were calculated from students' three highest qualifications and used as a measure of prior achievement for entry to higher education (HE).
School type	The type of school students attended for their A-levels were organised into five categories including: independent schools, state grammar schools, state comprehensives, sixth form colleges and a category labelled state other (includes voluntary aided schools, voluntary controlled schools, technical colleges and adults colleges)
School performance	School performance data were used to contextualise prior attainment, represented by the overall percentage of students gaining 5A*-E or more at A-levels or their equivalent. Based on this, a binary classification was also created where 'high' performing schools, represented those schools where 82.5% of students and above achieved 5A*-E or more at A-level or their equivalent. 'Low' performing schools were those where less than 82.5% of students achieved 5A*-E or more at A-level or their equivalent. These thresholds were assigned based on the national averages reported in Department for Education (DfE) performance tables†.
'Neighbourhood' domicile: higher education participation rate (POLAR 3)	POLAR 3 data were matched to the Census Area Statistics (CAS) wards to illustrate the typical HE participation rate within which students were domiciled. POLAR 3 data is reported as five quintiles ordered from '1' (lowest participation -<20%) to '5' (highest participation >60%). A binary classification was created to compare performance of students residing in areas of lowest participation (1 and 2) to others (3,4 and 5). Quintiles 1 and 2 are those areas, which attract additional widening participation funding for each student domiciled within them‡.
Multiple deprivation	The Index of Multiple Deprivation (IMD) (2010) was used to identify the multiple facets of total deprivation. Students' postcodes were matched to Lower Layer Super Output Areas (LSOAs), which contain an average of 1500 households. These were then used to append IMD scores provided that students had a valid English home postcode. There are 32 482 LSOAs in England. IMD ranks LSOA with 1 as most deprived and 32 482 as least deprived. For the analyses, ranks were divided into quintiles, where quintile 1 includes the most deprived LSOA and quintile 5 includes the least deprived.§
Sex/ethnicity	Sex was self-reported by students during the university application process. Ethnicity was also self-reported by students, and based on this, categorised as one of the following: White, Asian, Black, Chinese, Mixed and Other

†DfE link http://www.education.gov.uk/schools/performance/.
‡HEFCE POLAR 3 link: http://www.hefce.ac.uk/media/hefce/content/pubs/2013/201328/HEFCE_2013_28.pdf.
§IMD link: https://www.gov.uk/government/publications/english-indices-of-deprivation-2010.

to comprehensive school students, men from independent schools were more likely to achieve lower averages (M=73.76, SD=2.66) (B=−1.36, p<0.01). Though women students from independent schools, on average, had lower attainment than comprehensive school students, unlike with men, attendance at independent schools for women did not predict significant differences in attainment at university (M=73.98, SD=2.31) (B=−0.44, p=0.206). Additionally, men from sixth form colleges, and not women, were more likely to achieve lower averages than comprehensive school students, though this association only approached significance (M=73.27, SD=2.82) (B=1.02, p=0.069). Second, with regard to ethnicity, students who classified themselves as Asian were significantly more likely to achieve lower averages at fourth year of university, where men performed slightly less well (M=72.01, SD=3.03) (B=−2.11, p<0.001) than women (M=73.60, SD=2.37) (B=−0.95, p<0.01). By contrast, women and not men of Chinese ethnicity were significantly more likely to achieve lower averages than students who classified themselves as white (M=71.20, SD=3.13) (B=−3.35, p<0.001).

Table 2 Descriptive breakdown of characteristics of study sample for students

Indicator variable		Indicator of student performance			
		UCAS Tariff Points		Year 4 average	
Variable	N (%)	Mean	SD	Mean	SD
School type					
Independent	110 (20.88)	342.43	27.29	73.56	2.46
Grammar	115 (21.82)	342.11	32.95	73.92	2.58
Comprehensive	163 (30.93)	347.30	18.88	74.25	2.43
Sixth form	105 (19.92)	346.73	23.25	74.31	2.46
State (other)	34 (6.45)	335.17	48.30	74.73	1.93
		p<0.01		p=0.052	
School performance					
High	426 (89.31)	346.82	42.85	74.22	2.52
Low	51 (10.69)	338.05	22.81	73.96	2.20
		p=0.040		p=0.404	
Deprivation*					
1	88 (17.81)	335.24	69.89	73.82	2.57
2	74 (14.98)	339.71	70.45	74.38	1.99
3	76 (15.38)	345.21	69.83	73.93	2.27
4	112 (22.670	342.94	70.03	74.17	2.42
5	144 (29.15)	343.57	70.27	74.24	2.63
		p=0.253		p=0.542	
POLAR 3†					
1	44 (7.72)	335.35	69.81	73.62	3.00
2	65 (11.40)	348.52	70.29	73.92	2.07
3	109 (19.12)	341.37	70.28	74.37	2.64
4	145 (25.44)	343.10	69.89	74.02	2.41
5	207 (36.32)	341.09	70.13	74.27	2.34
		p=0.260		p=0.351	
Sex					
Males	196 (34.39)	339.90	69.90	73.76	2.66
Females	375 (65.61)	343.18	70.19	74.33	2.30
		p=0.227		p=0.012	
Ethnicity					
White	448 (78.46)	341.25	31.35	74.41	2.33
Asian	75 (13.13)	344.66	28.97	72.97	2.52
Black	5 (0.88)	325.00	30.00	74.40	2.34
Chinese	13 (2.28)	351.67	13.37	71.80	3.00
Mixed	23 (4.03)	343.48	25.34	74.07	2.27
Other	7 (1.23)	353.33	10.33	73.42	3.30
		p=0.873		p<0.001	

*Deprivation defined by quintiles of Index of Multiple Deprivation (1=Most deprived to 5=Least deprived).
†Neighbourhood higher education participation (1=Lowest participation to 5=Highest participation).
Item Missingness (N): School Type 44; School Performance 94; IMD 77; UCAS Tariff Points 21.

Multivariable linear regression was carried out including all the following variables: UCAS Tariff Points, ethnicity, sex, school type, school performance, deprivation, neighbourhood participation and fourth year performance (table 5). When all these variables were included in the model, UCAS Tariff Points (school grades) and ethnicity were found to be independently associated with fourth year performance. UCAS Tariff Points (school grades) (B=0.01, p<0.001) remained significantly positively associated with fourth year performance. Ethnicity remained a significant predictor of final attainment. Specifically, on average, Chinese and Asian students achieved 3.01% (B=−3.01, p=0.001) and 1.41% (B=−1.41, p<0.001) less than white students, respectively. Though school type differences remained, where independent school students were more likely to achieve lower averages compared to students from other school types, this association was no longer statistically significant when all the variables were incorporated into the model. Similarly, though men performed slightly less well than women, the association between sex and academic achievement approached significance but was not statistically significant (B=−0.49, p=0.068). However, the overall model explains only 12% of the variation in the final grade suggesting that other factors, including chance, must also play a role. None of the interactions that were investigated achieved statistical significance (p>0.05).

Table 3 Linear regression between contextual variables and fourth year performance

Variable	x̄	SD	B	95% CI	Sig
School type					
State comprehensive (reference)	74.25	2.43			
Sixth form college	74.31	2.46	−0.07	−0.64 to 0.50	0.814
State other	74.72	1.92	0.35	−0.53 to 1.24	0.435
State grammar	73.92	2.58	−0.45	−1.01 to 0.11	0.112
Independent school	73.56	2.46	−0.82	−1.38 to 0.25	<0.001
Ethnicity					
White (reference)	74.41	2.33			
Black	74.40	2.34	−0.012	−2.12 to 2.09	0.991
Asian	72.97	2.51	−1.44	−2.03 to 0.861	<0.001
Chinese	71.80	3.00	−2.61	−4.70 to 1.31	<0.001
Other	73.92	2.50	−0.50	−1.38 to 0.387	0.271
Sex					
Female (reference)	74.33	2.31			
Male	73.76	2.66	−0.57	−0.99 to 0.15	<0.01
Continuous variables					
School performance*			0.005	−0.16 to 0.01	0.404
Socioeconomic status (Index of Multiple Deprivation; percentile†)			0.004	−0.003 to 0.011	0.280
UCAS Tariff Points			0.01	0.01 to 0.02	<0.001
Polar 3‡			0.06	−0.05 to 0.27	0.185
Model parameters (for UCAS Tariff Points)					
B0	69.38				
R	0.18				
R^2	0.03				

*School performance-based on the percentage of students achieving 3 A-levels or equivalent.
†Defined by percentiles of Index of Multiple Deprivation (1=Most deprived to =100 Least deprived).
‡ Neighbourhood higher education participation (1=Lowest Participation to 5=Highest Participation).

Table 4 Linear regression between contextual variables and fourth year performance divided by sex

	Males					Females				
Variable	x̄	SD	B	95% CI	Sig	x̄	SD	B	95% CI	Sig
School type										
State comprehensive (ref)	74.07	2.31				74.37	2.51			
Sixth form college	73.27	2.82	−1.02	−2.12 to 0.08	0.069	74.74	2.17	0.31	−0.35 to 0.97	0.357
State other	74.54	1.41	0.26	−1.79 to 2.30	0.806	74.77	2.06	0.34	−0.61 to 1.30	0.481
State grammar	73.91	3.04	−0.38	−1.44 to 0.69	0.485	73.93	2.38	−0.50	−1.14 to 0.14	0.127
Independent school	73.76	2.66	−1.36	−2.33 to 0.38	0.007	73.98	2.31	−0.44	−1.13 to 0.25	0.206
Ethnicity										
White (ref)	74.12	2.43				74.56	2.27			
Black	73.89	3.14	−0.23	−3.84 to 3.37	0.898	74.74	1.89	0.18	−2.39 to 2.75	0.890
Asian	72.01	3.03	−2.11	−3.13 to 1.10	<0.001	73.60	2.37	−0.95	−1.66 to 0.24	<0.01
Chinese	72.50	2.96	−1.62	−3.73 to 0.485	0.130	71.20	3.13	−3.35	−5.05 to 1.66	<0.001
Other	74.48	2.66	0.36	−1.48 to 2.18	0.700	73.71	2.35	−0.85	−1.83 to 0.132	0.090
Continuous variables										
School performance*			0.03	−0.04 to 0.09	0.381			0.001	−0.03 to 0.3	0.961
Socioecomomic status (Index of Multiple Deprivation; percentile†)			0.002	−0.01 to 0.02	0.804			0.01	−0.003 to 0.01	0.173
Polar 3‡			0.15	−0.14 to 0.45	0.309			0.07	−0.12 to 0.25	0.491
UCAS Tariff Points			0.02	0.005 to 0.03	<0.001			0.01	0.003 to 0.02	<0.01

*School performance-based on the percentage of students achieving 3 A-levels or equivalent.
†Defined by percentiles of Index of Multiple Deprivation (1=Most deprived to =100 Least deprived).
‡Neighbourhood higher education participation (1=Lowest Participation to 5=Highest Participation).

Table 5 Multiple linear regression including all contextual variables and fourth year performance

Variable	x̄	SD	B	95% CI	Sig
School type					
State comprehensive (reference)	74.25	2.43			
Sixth form college	74.31	2.46	−0.12	−0.82 to 0.57	0.727
State other	74.72	1.92	0.67	−0.72 to 1.92	0.370
State grammar	73.92	2.58	−0.22	−0.98 to 0.54	0.566
Independent school	73.56	2.46	−0.29	−0.99 to 0.42	0.426
Ethnicity					
White (reference)	74.41	2.33			
Black	74.40	2.34	−2.51	−5.77 to 0.75	0.131
Asian	72.97	2.51	−1.41	−2.11 to 0.72	<0.001
Chinese	71.80	3.00	−3.01	−4.70 to 1.31	0.001
Other	73.92	2.50	−0.56	−1.58 to 0.47	0.288
Sex					
Female (reference)	74.33	2.31	−0.49	−1.02 to 0.04	0.068
Male	73.76	2.66			
Continuous variables					
School performance*			0.01	−0.010 to 0.02	0.486
Socioeconomic status (Index of Multiple Deprivation; percentile)			0.003	−0.01 to 0.01	0.458
Polar 3†			0.05	−0.15 to 0.24	0.634
UCAS Tariff Points			0.01	0.003 to 0.02	0.010
Model parameters					
B0	70.14				
R	0.35				
R^2	0.12				

*School performance-Based on the percentage of students achieving 3 A-levels or equivalent.
†Neighbourhood higher education participation (1=Lowest Participation to 5=Highest Participation).
‡Defined by percentiles of Index of Multiple Deprivation (1=Most deprived to =100 Least deprived).
IMD link: https://www.gov.uk/government/publications/english-indices-of-deprivation-2010.

DISCUSSION

While the use of contextual data in admissions is promoted and considered a powerful tool which medical schools can use to widen participation,[25] there is a paucity of research focusing specifically on medical students, and considering measures of disadvantage, alongside educational background characteristics to identify contextual effects on academic attainment.[27 31] The principal aim of this research was to explore these associations, as this has not previously been investigated using both area-based measures of disadvantage and school background information within a medical school environment.

Principal findings from results

A crucial part of this analysis explored the extent to which school grades in isolation are representative of 'true academic potential' by comparing group differences in attainment at school compared to university. Consistent with other studies, school grades (UCAS Tariff Points) were found to be a strong and significant predictor of academic performance.[11–14 46–51] Statistically significant associations were also observed between three of the contextual background characteristics and students' school grades, including school type, average school performance and ethnicity. Though school grades were the strongest predictor of university attainment, school type, ethnicity and sex also predicted statistically significant differences, albeit with some differences to those observed when students entered university.

Compared to students from comprehensive schools, students from independent schools achieved lower averages at fourth year, though this association was not significant after controlling for multiple effects.

This association was similar for men and women, but statistically significant only for men. Ethnic differences in academic attainment evidenced at entry level, differed from the associations observed between these variables by the fourth year of university. Overall, students who classified themselves as white were more likely to achieve a higher average at fourth year than students of other ethnicities, though they did not enter university with the highest grades. These associations also varied slightly between men and women. With regard to sex, there were no statistically significant differences in the entry grades of men and women. However, by fourth year at university, men students performed significantly less well than women students. Socioeconomic deprivation (IMD), and coming from neighbourhoods with low or high levels of participation in HE (POLAR 3), did not predict significant differences in final year performance.

How do these findings relate to the current evidence base?

The type of school students attended appears to have a consistent effect on degree performance.[17–19 52 53] Specifically, research suggests that for a given set of A-level results, the degree performance of students who attended state schools has been found to be higher compared to those who attended private schools, when other factors were held equal.[13 15 18 28 30] Unlike other studies,[17–19] students from independent schools did not enter the UoL with the highest grades. However, consistent with past research, once at university, students from independent schools achieved lower results than comprehensive school students, though these differences were not significant once all variables were incorporated into the model.[17–19 28] Despite the overlap between school type and school performance, and the fact that both have similar benefits in relation to school attainment, results relating to school performance are more difficult to reconcile with past research, given that findings have been more inconsistent.[10 18 19 24 53] That said, recent studies have found that, conditional on prior attainment, students from the worst-performing schools were likely to outperform those from the best-performing schools.[24 30 52 53]

Though socioeconomic differences in academic achievement have been identified in other studies,[7 29 46 54 55] they have not been explored using these specific measures in published academic research at other medical schools. It is possible that neither of the postcode measures of disadvantage (IMD or POLAR 3) predicted significant differences in academic achievement at medical school because less variation exists in the demographic backgrounds of students admitted to medical programmes compared with those of other programmes.[44 56] However, further research is needed to explore this, as previous studies exploring these effects have focused largely on students in classified degree programmes and used the NS-SEC as a measure of social class.[18 19 57 58] A number of these studies have identified significant socioeconomic differences in degree performance based on NS-SEC data.[18 28] However, various flaws have been identified with NS-SEC, which affect the accuracy and credibility of findings derived from studies that use this measure.[42 57–59] Critically, NS-SEC is derived from non-mandatory information that is self-declared by individuals on application to HE making this prone to manipulation and error.[56 57] Additionally, there is evidence that around 25% of students do not provide this information, and those who omit this, often fit into target widening participation (WP) populations.[57 58] For example, Hoare and Johnston identified significant socioeconomic differences in attainment between students on classified degree programmes based on NS-SEC data, but highlight the caveat that NS-SEC data was missing for 42% of students in their study.[18]

Sex and ethnic differences in educational attainment have been reported in various studies across different medical schools in the UK.[56 60–69] Though there were no significant differences in the entry grades of men and women, consistent with previous research, women achieved higher averages than men at university.[1 48 51 63 64] Interestingly, associations between variables, specifically UCAS Tariff Points, ethnicity, school type and academic achievement at university, differed between men and women. UCAS Tariff Points were a slightly stronger predictor of university achievement for men than women, even though there were no entry-level differences. Subgroup differences in school grades, and the extent to which these predict university performance, have been identified in other studies, and are associated with institutional and personal factors.[29 30 69–73] Ethnic differences in attainment have also been associated with these factors and appear to be widespread.[1 4 29 51 68 69 74] Though students who classify themselves as white have consistently been found to achieve higher degree outcomes than students recording other ethnicities, variations exist with regard to the particular ethnic groups that perform less well,.[1 4 51 67] In this study, despite entering with higher grades, students who classified themselves as Chinese and Asian performed less well than students from other ethnic groups. These associations varied depending on sex. Most notably, only women and not men who classified themselves as Chinese performed significantly worse than students who classified themselves as white. Though the extent to which these differences are generalisable is difficult to discern and requires further exploration, the literature indicates that these are not local or atypical problems.[1]

Implications of these findings

The present study raises a number of implications for policymakers and universities that are interested in using contextual background information to inform their decision-making processes and admissions policies. While medical schools have developed complex selection processes to select the individuals to whom offers are made, the ability to meet the academic offer is of crucial importance and represents a principal basis for selection.[11 14 24 75] This study corroborates previous research depicting limitations associated with school grades as indicators of future performance and 'true academic potential'.[1 11] Such evidence has previously been used to justify the implementation of contextual data alongside school grades, in university admissions processes.[18 34 52 76] This may be particularly beneficial in highly competitive programmes such as medicine, where a large proportion of applicants achieve top marks, making it especially difficult to select from among them.[27 44] However, the uses and importance of contextual information extend beyond the point of admissions.[25 57 58] By providing insight into the associations between contextual background characteristics and academic attainment, the current analysis also depicts how contextual information could help identify students that may require additional support once at university.

Additionally, the use of different types of contextual information in admissions processes is important to triangulate data and ensure that the identified individuals are truly from widening participation backgrounds.[25]

Though the use of contextual data in medical admissions processes is increasingly encouraged, there is no standardised or universal approach to the use of contextual data, and very limited guidance on best practice.[25–27 34 76] As such, there are various questions and practical issues surrounding the implementation of policies relating to school type/school-level performance, including questions of how to 'equate' between nations, how to treat applicants who have changed school, how to identify able applicants who obtained scholarships to attend a fee-paying school, and how to ensure that applicants report their educational establishment correctly/truthfully.[27 52 76] Firm empirical evidence is required to address these issues and guide institutional policy in respect of contextual data.[22 23 25 58 76]

Limitations and directions for future research

The present study has various limitations that must be taken into consideration when interpreting findings. First, it is important to note that this study included only students who were successfully admitted and completed their medical degree. Hence, nothing is known about students who failed or dropped out, thereby restricting the extent to which findings are representative of all medical students. Additionally, in other studies, interactions have been documented between background characteristics, educational disadvantage and the likelihood of dropping out of medical school, which could be explored further.[51 69] Future research should consequently include these students, and explore when and why students fail and drop out of programmes. Such information is necessary to ensure that 'at risk' students are successfully identified and supported. A second limitation of this research is that both the IMD and POLAR 3 are based on aggregate data. Consequently, it should be noted that trends relating to both IMD and POLAR 3 do not necessarily relate to individuals themselves but rather to the areas in which they are based. An alternative approach to IMD/POLAR 3 could be to use NS-SEC. However, as explained previously, this has limitations, and for the majority of undergraduate admissions, NS-SEC is also not an individual measure, as this relates to parental occupation.[57 59] Hence, though postcode measures of disadvantage have weaknesses, there is less uncertainty attached to these measures, and it is unlikely that a student would manipulate their postcode, as they have the imperative that they actually want contact from UCAS or the university, which is where the postcodes are sourced. Another limitation of this kind of research is that it is not possible to control for everything that affects academic attainment. Some prominent factors which are likely to affect participation and performance include: personality, motivation, study skills, family history in HE,[44 64 65 68 71 73 74] parental occupation, particularly coming from medical families,[4 77] and intelligence.[78] Indeed, some variance also relates to chance and other factors that are unpredictable, including life events and illness.[10 12 79]

A further potential limitation of the current study is that information from personal statements and interview performance were not included in analyses even though students in the data cohort examined were selected on the basis of these measures as well as their academic attainment. Analyses focused on academic attainment, primarily, due to the weighting this has in the selection process.[25–27 49–51] Additionally, information from the personal statements of students in the cohort was highly limited, as these were marked simply as yes/no to interview. Hence, this did not provide enough information on which to correlate the quality of a statement with on-course performance. Data from traditional interviews was also not included in analyses, as previous studies have identified various limitations with these.[80–82] It would have been useful to incorporate data from multiple mini-interviews (MMIs), as these are said to offer improved reliability and validity over traditional interview approaches,[82] and students' UK Clinical Aptitude Test (UKCAT) scores which appear to be less sensitive to background effects compared with school grades.[79 83] However, UoL medical school has only recently changed its selection process to introduce the use of UKCAT, MMIs, and alter the use of personal statements. Hence, though the present study illustrates important differences between different groups of students at a medical school in the UK, future studies should explore how the use of additional criteria (eg, MMIs, UKCAT) in selection processes affect widening participation and predict differences between students based on their educational and sociodemographic backgrounds. Such studies should take more sophisticated approaches to modelling by using path analysis or other forms of causal modelling, and expand analysis to compare subgroups, and include other universities.

CONCLUSION

Though there is increasing interest in the use of contextual information within university admissions processes, there is a paradoxical lack of research exploring how these can be used at medical schools in the UK.[1 22 27 34 76] The current analyses provide insight into the associations between contextual background characteristics and academic attainment. In doing so, this illustrates how educational attainment at school is a good, albeit imperfect, predictor of academic attainment at a medical school. A recommendation from this analysis is that implementation of contextual data alongside school attainment during the admissions process could provide a more detailed and relevant assessment of candidates. Furthermore, this could also help to refine the targeting of students from disadvantaged backgrounds, and to identify those students who may require

additional support once at university.[25 27 29 76] That said, the patterns observed in the current study differed in some ways from previous research exploring associations between contextual background characteristics and academic attainment. These variations exemplify how patterns observed nationally may differ between HE institutions and programmes.[28–30] Further research is needed to explore these differences at individual medical schools, and guide institutional policy in respect of contextual data. This may be key in reducing inequalities perpetuated by current admissions systems, by promoting social mobility and decreasing the socioeconomic stratification of medical schools in the UK.

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