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Preadmission Schooling Context Helps to Predict Examination Performance throughout Medical School

Neil Stringer[1], Michael Chan[2], Yaw Bimpeh[3] and Philip Chan[4]

Abstract

This study investigates the effects of socioeconomic status and schooling on the academic attainment of a cohort of students at a single medical school (N = 240). Partial least squares structural equation modelling was used to explore how students' cumulative summative assessment scores over four years of medical school were affected by: attainment in secondary school examinations (GCSEs and A-levels); the Income Deprivation Affecting Children Index (IDACI) rank associated with students' home postcodes; and the percentage of A-level students achieving 3 A-levels at AAB or higher in two or more facilitating subjects at students' A-level institutions. The effects were consistent across time; the final linear regression model used students' cumulative scores (the basis of the medical school's UK Foundation Programme submission) as the dependent variable. The final model fit was quite poor (R^2= .184, n = 178). IDACI Rank was non-significant and excluded from the final model. Both GCSE (.340, p <.001) and A-level (.204, p < .005) scores were associated with increasing Cumulative Score; School Performance was associated with decreasing Cumulative Score (-.159, p < .05). This study confirmed the predictive validity of prior academic attainment and found the same inverse relationship between schooling and medical course performance as previous studies. The study found no evidence that socioeconomic background affects course performance; however, students admitted to medicine from poorly-performing schools achieve higher academic attainment on the course than students admitted from better-performing schools with the same grades. Schooling could be taken into account for admissions purposes.

[1] AQA Education's Centre for Education Research & Practice (CERP, AQA Education, Stag Hill House, Guildford, Surrey, GU2 7XJ / tel: 01483 556023 / email: nstringer@aqa.org.uk)

[2] Barts and The London School of Medicine and Dentistry

[3] AQA Education's Centre for Education Research & Practice

[4] The Medical School, The University of Sheffield

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Introduction

Medical education in the UK takes many various forms. The most common model is a five to six year undergraduate course, with most entrants coming from secondary education within one to two years of their high school exit examinations (A-levels). Competition for places on undergraduate medicine courses is strong and the entry requirements are high; necessarily so, as the course of study is demanding. A degree in Medicine is unusual amongst degree courses in that it leads directly into a career; one that is prestigious, typically lifelong, highly mobile, and financially rewarding. Its vocational nature also means that being academic is not sufficient to become a successful practitioner, as there are non-academic qualities that are important for success (e.g. see Lievens, Ones, & Dilchert, 2009). Furthermore, legitimate educational and healthcare benefits can derive from the student and professional body reflecting the population from which it is drawn (Komaromy, Grumbach, & Drake, 1996; Lakhan, 2003; Saha, Guiton, Wimmers, & Wilkerson, 2008; Tiffin, Dowell, & McLachlan, 2012; Whitla et al., 2003). There are, therefore, various reasons why it is imperative that selection for medical school is especially thorough and fair.

For all medical courses, offers are made on the basis of a single centralised application through the Universities and Colleges Admissions Service (UCAS). At the time of application, most applicants are still in secondary education and have not yet taken their final A-level examinations. Therefore, academic achievement is assessed by grades achieved in national public exams (General Certificate of Secondary Education, GCSE) in year 11, two years before the end of secondary education, and also by predicted grades in the forthcoming A-level exams. Medicine is amongst a highly competitive and selective group of courses that often require applicants to take an aptitude test (most schools use the UK Clinical Aptitude test, UKCAT) and attend a formal interview, with predicted A-level grades and the aptitude test score typically being a gateway to interview. If the interview is successful, typically a candidate is offered a place on the medical course on the condition that they achieve certain, usually extremely high, A-level grades.

Selection on the basis of A-level results has strong predictive validity for performance at university (Bekhradnia & Thompson, 2002; Higher Education Funding Council for England, 2003, 2014), in medical school specifically (McManus, Richards, Winder, & Sproston, 1998), and in subsequent medical careers (McManus, Smithers, Partridge, Keeling, & Fleming, 2003). Aptitude tests, generally, predict performance at university no better than A-levels or equivalents, whilst using both measures in combination tends to offer little or no advantage over using one (Choppin & Orr, 1976; Choppin et al., 1972; Choppin, Orr, Kurle, Fara, & James, 1973; Kirkup, Wheater, Morrison, Durbin, & Pomati, 2010; McDonald, Newton, Whetton, & Benefield, 2000; Stage, 2003). A recent large-scale study of the validity of the UKCAT for predicting performance at medical school has reinforced this finding in the context of medicine. The study, referred to by the authors as the UKCAT-12, found that the aptitude test provided little additional predictive power beyond school achievement (McManus, Dewberry, Nicholson, & Dowell, 2013). Although aptitude test scores are reported on finer scales than examinations, and thus promise greater discrimination between applicants, this granularity provides little or no further valid discrimination.

Selection into medicine by academic achievement alone is common in many countries, but it is modified in the UK by the widening access agenda. Since the introduction of higher education tuition fees in 2006, all publicly funded universities and colleges in England must have an access agreement approved by the Office for Fair Access (OFFA) in order to be able to charge tuition fees above the basic level (Department for Education & Skills, 2003). OFFA's role is to promote and safeguard fair access to higher education for lower income and other under-represented groups. Access arrangements set out universities' tuition fee limits and the access measures they intend to put in place with regard to financial support for students and outreach work. Additionally, the Higher Education Funding Council for England (HEFCE) requires institutions to report annually their progress on widening participation. Admissions arrangements are outside the remit of OFFA; however, in response to the Schwartz Report (Admissions to Higher Education Steering Group, 2004), Supporting Professionalism in Admissions (SPA)—a central source of expertise on admissions for universities and colleges—was established. The use of contextual data in admissions has increased since the Schwarz Report and SPA has published recently research that highlights the variation in the type of information used as well as how and at what stage of admissions it is used (Bridger, Shaw, & Moore, 2012; Moore, Mountford-Zimdars, & Wiggans, 2013).

Scores in both school exams and aptitude tests are influenced by social background and school quality (Jencks & Crouse, 1982; McDonald et al., 2000; West & Gibbs, 2004; Whetton, McDonald, & Newton, 2001). Aptitude tests, despite their name, are typically no more able to identify applicants with untapped potential than are A-levels (Kirkup et al., 2010; Stringer, 2008). Although there is some evidence that using the UKCAT in admissions widens participation—some under-represented sociodemographic groups are less disadvantaged when applying to institutions that use it as a threshold or factor in selection when compared with institutions that use it only for decisions about borderline cases—the mechanism for the effect is unclear and the particular use of the UKCAT could simply signify broader differences in the use of admissions data (Tiffin et al., 2012).

Comparison of similarly able applicants from very different socioeconomic backgrounds on the basis of examination results may tend to favour more advantaged applicants over less advantaged ones. Research has shown that school quality is negatively associated with achievement in medical schools when prior attainment is controlled for (McManus et al., 2013). As regards universities in general, the picture is less clear. Reports by the Higher Education Funding Council for England (HEFCE) suggested an overall negative effect of school performance; however, closer analysis showed that the effects were somewhat inconsistent, varying according to sex and the level of A-level achievement (Higher Education Funding Council for England, 2003, 2014). The most recent research by HEFCE suggested a more nuanced relationship between school performance measures and student attainment. They found that there is a relationship between a student's level of attainment at A-level relative to the average of the school and his or her potential for success at degree level, but that degree outcomes are not affected by the average performance of the school that a student attended per se (Higher Education Funding Council for England, 2014).

This finding is not necessarily inconsistent with that of UKCAT-12. In the case of high-achieving students, such as those admitted to medical school, the question is probably about not whether they are below or above average in their school but instead the extent to which they are above average. With attainment relatively constant at near ceiling level, the variation between students in terms of the average performance of their schools will be approximately the same as the variation in their positions relative to the average performance of their schools. A possible implication of this is that, when the body of students has homogeneous school attainment, what may appear to be an effect of school performance could be an effect of attainment relative to average performance at the school; for bodies of students with heterogeneous attainment, the two effects would likely disentangle.

HEFCE (2014) reported effects of school type on attainment in higher education. Typically, in the UK there is a distinction between the public, state-funded sector and the independent, self-funded sector. The independent sector, being generally academically selective and better-resourced than the public sector, is seen as being particularly focused on high academic achievement. Students whose Key Stage 5 (A-level or equivalent) school was independent tended to have the lowest higher education achievement, except among students with the highest A-level achievement. Importantly, the differences in higher education achievement between students with the same A-level achievement were not explained by A-level subject differences between state and independent school students. Furthermore, students who had remained in the state school sector for the whole of their secondary school education tended to do better in their degree studies than those with the same prior educational attainment who attended an independent school for all or part of their secondary education. Interestingly, students who attended a selective state school tended to have slightly lower higher education achievement than their non-selective state school counterparts.

Although previous research suggested that students from higher social classes and from medical families tended to fail more exams at medical school (Royal Commission on Medical Education 1965-8, 1969), more recent studies have found that medical school performance does not appear to be greatly affected by socioeconomic status per se, once educational attainment has been accounted for (McManus et al., 2013; McManus & Richards, 1986). If medical school performance is not affected by socioeconomic status, it does not mean that, across the spectrum of ability within the general student population, socioeconomic status does not influence attainment; rather that, once a student has reached the required level of attainment to enter medical school, his or her success there is not related to socioeconomic status. High-achieving medical students from low socioeconomic backgrounds are likely to be unrepresentative because, having gained a place at medical school, they are already successful. It is possible that unmeasured protective factors, located at the individual, family, or cultural level, have made these particular students resilient to socioeconomic deprivation (Siraj-Blatchford et al., 2011). The fact that social disadvantage may not have held them back does not mean that it does not hold back others: those with similar backgrounds, whose achievement might have been comparable had they benefited from higher socioeconomic status or similar protective factors. What these findings might mean, though, is that, had applicants who have narrowly missed the grades required for admission to medical school been admitted, those of lower socioeconomic status would not have performed differently to more advantaged students with the same grades. In fact, research by HEFCE suggests that, overall, university students from disadvantaged areas tend to do less well in higher education than those with the same prior educational attainment from more advantaged areas (Higher Education Funding Council for England, 2014). This undermines the argument for making allowances for socioeconomic status per se; to be justified in doing this, one would require evidence of disadvantaged students outperforming more advantaged students with the same prior attainment.

There is an argument for, and evidence to support, considering applicants' school achievement within the educational context in which it occurred when making admissions decisions. Previous studies suggest that school quality is more important than socioeconomic factors per se. The aim of such consideration is not to prefer less-advantaged applicants over more-advantaged ones, but to avoid missing able applicants whose earlier education has been under-resourced. There is effectively a sliding scale of consideration that may be given to educational context, ranging from: (a) none, which underestimates the potential of students from the least advantaged backgrounds; through (b) enough to allow them to be considered on equal terms with more advantaged students; to (c) too much, which would overestimate their potential for success. Whilst any endeavour that could be seen as social engineering will be contentious—as this is not the purpose or responsibility of universities generally or medical schools specifically—more valid measurement of applicants' potential to succeed at university ought to be uncontroversial.

The following analyses examine the influence on performance at medical school of: students' prior academic attainment; students' socioeconomic status; and the performance of the schools at which students sat their A-levels.

Methods

The analysis used data from admissions records and of students' educational attainment over the whole course for a full year cohort (N = 240) of Sheffield Medical School students who were due to graduate in 2013. The admissions data included students' home postcodes at the time of application and the details of the school or college at which they sat their A-levels. Using this information, the Income Deprivation Affecting Children Index (IDACI) ranks for the home postcode (see below for more details) and the percentage of A-level students at their school or college achieving 3 A-levels at AAB or higher, of which at least 2 are in facilitating subjects[i], were obtained. These measures are somewhat approximate for these students because they are based on the most recent government data (2010 for IDACI, 2012 for school performance tables), whereas the students would have applied from these addresses and schools/colleges around 2009.

Data for the performance of the schools at which students sat GCSE exams—although in most cases it was the same school at which the student sat A-levels—was incomplete, as was the record of their UKCAT scores. These variables were excluded on the grounds that including them would reduce the sample size unacceptably. A better measure of school attainment would be based on a more complete record of the schools attended. The evidence (cited above) suggests that prediction of performance in medical school may not be improved greatly when using the UKCAT in conjunction with A-level scores.

Students were excluded where they had: 1) entered medical school as graduates, because their school exam results were not the basis of their admission; or 2) were international students, because data would be unavailable for contextual variables and, typically, GCSEs and A-levels. In the path analysis and linear regressions, casewise deletion was used to exclude students with partial records.

The independent variables included in the analyses were:

A-level Score — A-level grades were scored from A = 5 to E = 1 (Ungraded [U] = 0; these students' A-levels predate grade A*, which was introduced from 2010). The mean of each student's total score was multiplied by three to produce a scale equivalent to three A-levels: 0 (3 Us) to 15 (3 As).

Alternative ways of scoring A-level grades were considered. A sum of the grade score would have differentiated between students with 3 A-levels and those with 4 or more; however, the number of A-levels taken may vary by school policy and introducing such noise could detract from the predictive value of A-level grades. A score including only the best 3 grades would also treat students with 3 and 4 A-levels similarly but would mean discarding data.

Students with alternative qualifications did not receive an A-level score and would therefore not be included in the statistical models. The uncertainty in equating their qualifications with A-level grades outweighed the benefit of including a relatively small number of additional students. Moreover, those taking the International

Baccalaureate qualification would be excluded anyway because their school performance measure (see below), based on A-level grades and subjects, would be missing or misleading.

GCSE Score — GCSE grades were scored from A* = 8 to G = 1 (Ungraded = 0) and each student's mean grade score was calculated. An alternative approach would have been to sum the value of each student's GCSE grades. However, for high ability students, the number of GCSEs taken at secondary school is likely to vary as much according to school policy and timetabling as it does according to the ability of the student; therefore, a total GCSE score might not be a reliable indicator of academic ability.

School Performance: the percentage of A-level students at the student's school or college achieving 3 A-levels at AAB or higher, of which at least 2 are in facilitating subjects — This is one of a number of school performance measures reported in the official Department for Education School and College Performance Tables (Department for Education, 2012). It was considered particularly suitable as a measure of school quality for medical school applicants because most successful undergraduate applicants will have a minimum of three A-levels at AAB including two science subjects (which are facilitating subjects). More broadly, it is indicative of the success of a school in preparing students for the most competitive university courses.

Several students did not receive a School Performance score because they attended schools (typically independent) that offer the International Baccalaureate instead of A-levels, thus the appropriate data were missing or misleading. These students would therefore not be included in the statistical models.

IDACI Rank — This is a ranking based on the percentage of children aged 0–15 in each lower super output area (LSOA) living in families that are income deprived. LSOAs are small, fixed geographic areas encompassing a population of approximately 1,000 people. An income deprived family is defined as one in receipt of income support, income-based jobseeker's allowance or pension credit, or not in receipt of these benefits but in receipt of Child Tax Credit with an equivalised income (excluding housing benefits) below 60% of the national median before housing costs. The LSOA with a rank of 1 is the most deprived and that with a rank of 32,482 is the least deprived (Department for Communities and Local Government, 2011).

The dependent variables were:

Year 1, 2, 3, and 4 summative end-of-year exam scores — Each year's score is calculated as the sum of a student's results in the summative end-of-year exams, expressed as a percentage.

Cumulative Score — This score is calculated as the sum of a student's results in the summative end of year exams in years 1 to 4, expressed as percentages in each year. Therefore, the highest possible score was 400 and, in theory, the lowest possible was 0, although it is unlikely that a student would have progressed through 4 years with a score of much lower than 4 × 50% = 200. This score is used to rank students within their cohort and, in turn, this ranking is used nationally to apply for Foundation posts, which start after graduation.

Statistical Analyses

To gain insight into how the baseline variables, A-level Score, GCSE Score, School Performance, and IDACI Rank, relate to one another and affect students' performance in each of the first four years of medical school, unrestricted partial least squares structural equation modelling (PLS-SEM) was conducted using SmartPLS (Ringle, Wende, & Becker, 2015). PLS-SEM does not assume that the data are normally distributed and therefore relies on a nonparametric bootstrap procedure (Davison & Hinkley, 1997; Efron & Tibshirani, 1993) to test the significance of the estimated path coefficients. Subsamples are created using observations randomly drawn from the original set of data (with replacement) and used to estimate the PLS path model; the process is repeated until a large number of random subsamples—typically about 5,000 (Ringle et al., 2015)—has been created. The parameter estimates, estimated from the subsamples, are used to derive standard errors for the estimates.

The exploratory path analysis suggested that the effects of A-level Score, GCSE Score, and School Performance are broadly consistent across the first four years of medical school; therefore, the sum of those scores—the basis of the medical school's UK Foundation Programme submission—was used in a simplified linear regression model. In the interests of parsimony, backward elimination was used to calculate the model. This procedure produced two models: the initial model based on the forced entry of all independent variables and the final model based on the removal of variables where their removal did not significantly diminish model fit.

Results

Descriptive Statistics

Table 1 shows the descriptive statistics for each of the variables used in the analyses. It is notable that the performance measures all appear to show restricted ranges, high means, and small standard deviations, which may affect the strength of the correlations between them in later analyses. A-level Score ranges from the equivalent of three grade Cs to three grade As, with a mean equivalent to three high Bs; similarly, GCSE Score ranges from the equivalent of high grade Cs to straight A*s with a mean equivalent to a low grade A. The minimum Cumulative Score confirms that any student in the final year of the medical course is likely to average at least fifty per cent of the marks in total, although Year 1 and Year 2 scores tend to range from lower than this.

Table 1 goes here

Path Analysis

The path diagram is shown in Figure 1; the line thicknesses represent the relative strengths of the standardised effects between variables. The path coefficients and estimated standard errors, based on 5,000 bootstrapped samples, are reported in Table 2.

Figure 1 goes here

Table 2 goes here

Both A-level Score and GCSE Score have reliable positive effects on each of the first four years of medical school, with the exception of A-level Score in Year 3. The particularly restricted range, high mean, and low standard deviation of Year 3 scores (Table 1) suggest that weak discrimination between students may explain this exception. School Performance has a reliable negative effect on performance in Years 2 and 4 of medical school and is on the cusp of significance in Year 1; again the exception—most likely for the same reasons as before—is Year 3, which does not approach statistical significance.

There is also a reliable relationship between School Performance and GCSE Score. This requires cautious interpretation, as the School Performance measure relates to the school attended for A-levels. For many students this will have been the same school attended for GCSE but a direct relationship ought not to be assumed. IDACI Rank has no significant direct effect on performance in any year of medical school, although having a higher rank (lower deprivation) is associated with having a higher GCSE Score.

Regression Analyses Using Cumulative Score

Using forced entry, the original four predictor variables, GCSE Score, A-level Score, School Performance, and IDACI Rank, were entered into an initial model. Backward elimination, using significance of change in F >= .100 as the criterion to remove independent variables, resulted in the removal of IDACI Rank from the final model (Table 3).

The path analysis indicated a relationship between each of the contextual measures, IDACI Rank and School Performance, and GCSE Score, so the possible occurrence of multicollinearity was explored. In Table 3, tolerance indicates the proportion of variance in the predictor that cannot be accounted for by the other predictors: very small values indicate that a predictor is redundant. The variance inflation factor (VIF) is (1 / tolerance). As a rule of thumb, tolerance values less than .10 / VIF values greater than 10 may merit further investigation. In this case, the degree of multicollinearity is acceptable.

Table 3 goes here

The final model fit was quite poor (R Square = .184, n = 178). This is, perhaps, to be expected for a cohort with such a restricted range of scores on the independent variables. The effects of range restriction were explored and are reported in an endnote.[ii]

The standardised beta coefficients show that both GCSE (.340, p <.001) and A-level (.204, p < .005) scores were associated with increasing final year scores, whilst School Performance was associated with decreasing final year scores (-.159, p < .05). This means that a change of one standard deviation in GCSE Score results in a change of 8.28 units (2.07%), or 0.34 standard deviations, in Cumulative Score; a change of one standard deviation in A-level Score results in a change of 4.98 units (1.25%), or 0.20 standard deviations, in Cumulative

Score; and a change of one standard deviation in School Performance results in an opposite change of 3.88 units (0.97%), or 0.16 standard deviations, in Cumulative Score. To put this in context, the range of GCSE Scores, A-level Scores, and School Performance scores observed in the data would produce changes in Cumulative Score of 44.73, 34.52, and 17.47, respectively: up to 96.73 (24.18%), or 0.70 standard deviations, in total. Thus, the student with the highest prior achievement from the lowest-performing school would be expected to outperform the student with the lowest prior achievement from the highest-performing school by three quarters of the range of the Cumulative Scores observed (129.87).

Discussion

The current study found that prior attainment at both GCSE and A-level were associated positively with performance in medical school, whilst the overall performance of the schools in which A-level achievement occurred was inversely related to performance; social deprivation per se was not associated with medical school performance. These findings are consistent with the findings of larger studies, in particular the recent UKCAT-12 (McManus et al., 2013). Whilst that study used first year results, the current study used results in the summative end of year exams in years 1–4. It is noteworthy that the relationships demonstrated in the first year of medical school remain present throughout. McManus et al. concluded:

> That the effect found by HESA is now found in medical students suggests that there is a strong argument for using the contextual measure of average A-level attainment at a secondary school in making admission decisions. (p. 22)

How might this be implemented? The use of contextual measures in university admissions varies, though a common use is as a “flag”. Thus, for example, if an applicant applies from a school that has particularly poor pupil attainment, or comes from a family with no experience of higher education, the flag will lead to special consideration of the application where it might otherwise have been rejected on the basis of the predicted A-level results. In some cases, flags may attract a lower-than-usual conditional offer for the applicant. Whilst this has the potential to address the disadvantage to applicants from the very worst schools, there is often a cut-off point meaning that special consideration is all or none, depending on which side of the cut-off an applicant falls. Stringer (2008) discusses a national system for ranking university applicants that would account for educational context across the full range of absolute achievement. Pupils' ranks would form the basis of universities' initial shortlisting process, allowing applicants from diverse socioeconomic backgrounds to compete fairly for university places. However, in the absence of finer-grained information than A-level grades, such as Uniform Mark Scale (UMS)[iii] scores or scaled raw marks, this system could produce perverse results if used to select applicants for a course that has extremely high minimum requirements, such as three A grades or better. Many of the applicants meeting that criterion would essentially be preferred on the basis of school performance, poorest school first. This ignores differences in ability and suitability between applicants with the same grades and possibly exaggerates the differences between applicants with slightly different grades.

Admissions policies also have the potential for far wider influence than simply determining which applicants are admitted to which course. The widespread adoption of a policy such as the one described above might create an interesting dilemma for very ambitious students and their supporters. Students considering competitive university courses, such as medicine, are motivated to attend schools with high performance at GCSE and particularly at A-level. However, if preference were given to such students applying from low-performing schools, this type of self-selection might be inhibited, with effects towards reducing inequality in school performance. Under these circumstances, rather than the more salient inequality that exists between schools, inequality might become hidden within schools, so that those students from families with the resources for private school fees, or relocating to areas nearest the best-performing state schools, would instead use those resources for private tuition. Thus, the admissions policy could prove self-defeating in a relatively short time.

For the purposes of admissions to medicine, contextual information might be used to select for interview those applicants who do not meet the normal criteria but who meet a lower set of criteria. Using as a measure of school quality the Department for Education's measure of the average points gained by each examination entry at a school, the UKCAT-12 study suggested that medical students who achieved ABB at A-level from a secondary school at the 1st percentile performed similarly in medical school to students with AAA at A-level from a secondary school at the 99th percentile (McManus et al., 2013). This seems a sound basis on which to suggest that, in addition to those applicants reaching the standard criteria, a number of applicants with predicted A-level outcomes as low as ABB be interviewed, with priority given to those who have attended the lowest-performing schools.

The range of school performances observed in the current study is wide: the percentage of A-level students achieving 3 A-levels at AAB or higher in two or more facilitating subjects ranged from 1 to 70 per cent. The distribution is positively skewed: 50 per cent of students came from schools where 20 per cent or fewer students achieved the A-level benchmark. Even so, there are few students from the very-worst-performing schools; the median value for schools in England in 2012 was 9 per cent[iv], which is less than half that for the schools attended by the cohort in this study. How many applicants might apply from the weakest schools with ABB is unknown, although the application to acceptance ratios for medicine averages approximately 11:1 (UCAS, 2012), which suggests there is unlikely to be a shortage of them.

Postgraduate students are also admitted into UK medical schools, either to the same courses as undergraduates, or to 4 year courses restricted to postgraduates only. The use of contextual schooling data in the postgraduate environment might be problematic. Most postgraduate applicants do not have quite as high attainment on A-levels as undergraduate applicants. Our conclusion, that high-achieving students from poorly achieving schools do better, might not apply to the postgraduate group, as they are not quite as high achieving. A separate study of the characteristics of their undergraduate degrees might yield informative data.

This study, although limited to a single year cohort in a single medical school, offers support for widening participation. In accordance with the findings of previous studies, it suggests that, once students reach the qualifying standard for entry into medicine, socioeconomic and educational disadvantages have no apparent persistent adverse effects on educational attainment throughout medical school. On the contrary, those students who manage to reach the qualifying standard for medical school despite—rather than because of—the quality of the school they attended will, if anything, tend to perform better in medical school than students from high-performing schools.

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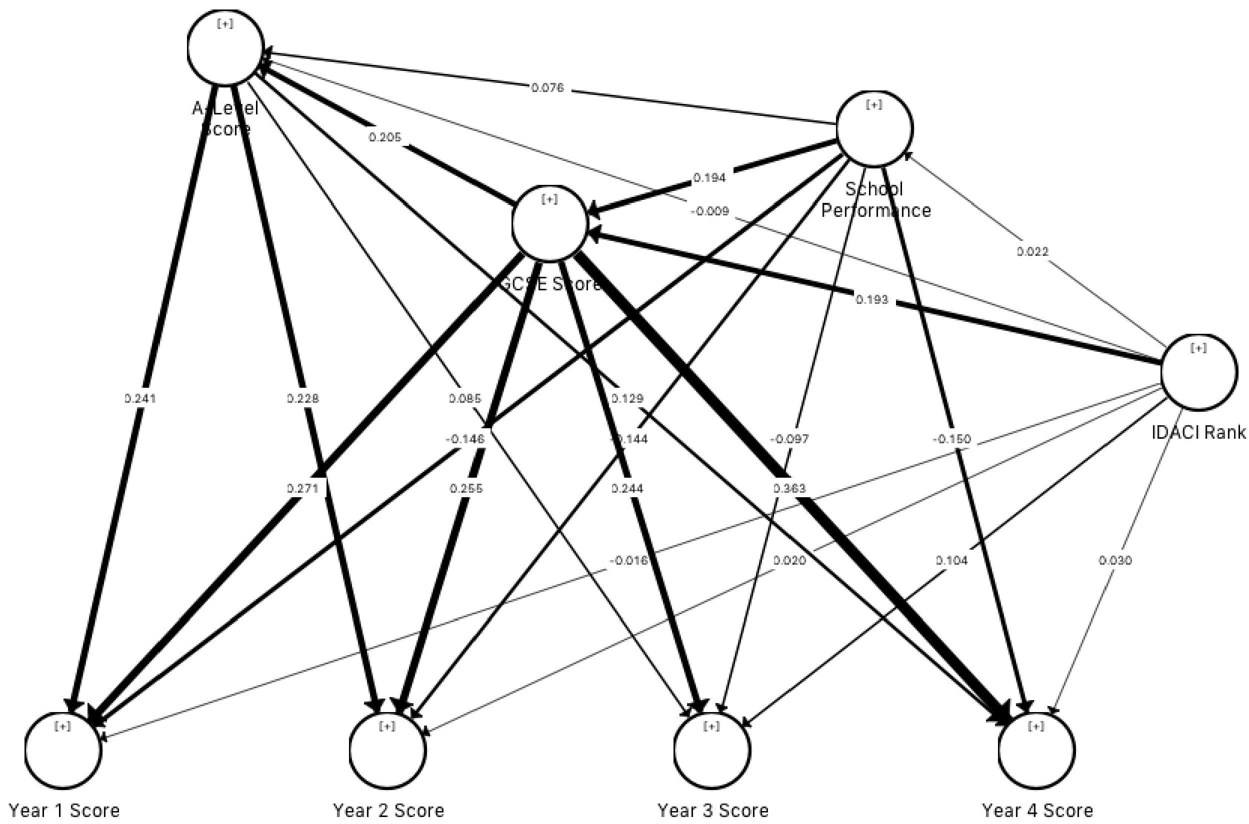

Figure 1. Path diagram showing the relationship between the variables A-level Score, GCSE Score, School Performance, and IDACI Rank and performance at the end of years one to four of medical school.

Table 1. Descriptive statistics for the independent and dependent variables.

	N	Minimum	Maximum	Mean	Std. Deviation
A-level Score	192	9.00	15.00	14.59	0.86
GCSE Score	198	5.80	8.00	7.38	0.41
School Performance	185	1.00	70.00	24.09	15.50
IDACI Rank	191	637	32,409	22,587	8,845
Year 1	201	34.90	84.97	65.69	8.01
Year 2	201	38.28	84.12	62.61	7.76
Year 3	201	53.85	90.49	75.29	6.64
Year 4	201	49.74	89.98	69.80	7.28
Cumulative Score	201	213.45	343.32	273.39	25.56
Valid N (casewise)	178				

Table 2. Path coefficients and estimated standard errors based on 5,000 bootstrapped samples.

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
A-Level Score -> Year 1 Score	0.241	0.247	0.084	2.866	0.004
A-Level Score -> Year 2 Score	0.228	0.236	0.058	3.912	0.000
A-Level Score -> Year 3 Score	0.085	0.088	0.063	1.348	0.178
A-Level Score -> Year 4 Score	0.129	0.134	0.054	2.416	0.016
GCSE Score -> A-Level Score	0.205	0.216	0.119	1.728	0.084
GCSE Score -> Year 1 Score	0.271	0.264	0.079	3.443	0.001
GCSE Score -> Year 2 Score	0.255	0.251	0.075	3.406	0.001
GCSE Score -> Year 3 Score	0.244	0.247	0.078	3.141	0.002
GCSE Score -> Year 4 Score	0.363	0.362	0.065	5.584	0.000
IDACI Rank -> A-Level Score	-0.009	-0.015	0.081	0.113	0.910
IDACI Rank -> GCSE Score	0.193	0.190	0.083	2.322	0.020
IDACI Rank -> School Performance	0.022	0.023	0.076	0.295	0.768
IDACI Rank -> Year 1 Score	-0.016	-0.010	0.070	0.228	0.820
IDACI Rank -> Year 2 Score	0.020	0.024	0.066	0.294	0.769
IDACI Rank -> Year 3 Score	0.104	0.104	0.071	1.479	0.139
IDACI Rank -> Year 4 Score	0.030	0.033	0.068	0.444	0.657
School Performance -> A-Level Score	0.076	0.071	0.083	0.911	0.363
School Performance -> GCSE Score	0.194	0.194	0.067	2.891	0.004
School Performance -> Year 1 Score	-0.146	-0.140	0.074	1.960	0.050
School Performance -> Year 2 Score	-0.144	-0.142	0.070	2.064	0.039
School Performance -> Year 3 Score	-0.097	-0.098	0.079	1.227	0.220
School Performance -> Year 4 Score	-0.150	-0.149	0.073	2.045	0.041

Table 3. Linear Regression Model Coefficients[a] using Forced Entry (R Square = .185, n = 178) and Backward Elimination (R Square = .184, n = 178).

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B		Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF
Forced Entry	(Constant)	46.246	37.935		1.219	.224	-28.628	121.121		
	A-level Score	5.764	1.987	.205	2.901	.004	1.842	9.686	.947	1.056
	GCSE Score	19.883	4.363	.332	4.557	.000	11.271	28.496	.887	1.127
	IDACI Rank	.000	.000	.037	.530	.597	.000	.000	.961	1.041
	School Performance	-.252	.112	-.158	-2.255	.025	-.473	-.031	.955	1.047
Backward Elimination	(Constant)	45.486	37.829		1.202	.231	-29.178	120.149		
	A-level Score	5.754	1.983	.204	2.902	.004	1.841	9.668	.947	1.056
	GCSE Score	20.333	4.271	.340	4.760	.000	11.903	28.763	.922	1.084
	School Performance	-.253	.112	-.159	-2.269	.025	-.474	-.033	.955	1.047

a. Dependent Variable: Cumulative Score

[i] The facilitating subjects are biology, chemistry, English literature, geography, history, physics, modern and classical languages, maths and further maths (The Russell Group of Universities, 2015).

[ii] The restricted ranges of both A-level Score and GCSE Score are likely to have resulted in lower correlations between variables than would obtain using fuller ranges. There are methods for correcting correlations diminished by range restriction. One approach is to adjust for the difference in variance on these scores between the sample and the population. Who constitutes the population is debatable: all those who applied to the particular medical course; all those who applied to study medicine; all those who applied to study at university; or all those who took GCSEs / A-levels? The ranges will increase with each population on the list.

There are also obstacles to obtaining the distributions of the variables in each population. Without ready access to the data for unsuccessful applicants or to the national datasets necessary to calculate A-level Score and GCSE Score, a method was used for correcting the mean, standard deviation, and correlation coefficient for range restriction when the population variance is unknown (Alexander, Alliger, & Hanges, 1984). This method is based on an estimate of the extent or point of truncation. In this instance the difference between the uncorrected and corrected r values were negligible:

	Adjusted Mean	Adjusted SD	Unadjusted r (correlation with Cumulative Score)	Adjusted r (correlation with Cumulative Score)
A-level Score	11.598	0.866	0.284	0.286
GCSE Score	7.039	0.413	0.381	0.383

[iii] The Uniform Mark Scale (UMS) is used in unitised qualifications to transform the raw marks obtained on non-standardised assessments in different examination series (testing windows) on to a common scale for the purpose of aggregation. (http://www.aqa.org.uk/exams-administration/about-results/uniform-mark-scale)

[iv] Data obtained from http://www.education.gov.uk/schools/performance/2012/download_data.html