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The Working in Health Access Programme (WHAP): impact on school leaving exam results and applications to Medicine.

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Abstract

Introduction

Pupils from backgrounds with socio-economic deprivation are less likely to apply to study medicine than those from more affluent backgrounds. It is unclear whether those who might have the potential to be doctors can be identified at a time when they can be exposed to awareness raising activities to enhance their likelihood of success.

Methods

Sixty nine schools from all parts of Scotland with below average participation rates in Higher Education took part. More than 2000 pupils sat tests of cognitive ability (Mill Hill Vocabulary Scale and Raven's Progressive Matrices) as well as non-cognitive tests assessing characteristics that could influence success as a doctor.

Results

The results of the cognitive tests correlated closely with Standard Grade Examinations (sat in Year 11) and less so with Highers (sat in Year 12). The numbers applying to and being admitted to Medicine rose 80% and 300% respectively over the duration of the project. Those receiving an offer differed in personality from those who didn't.

Discussion

Widening Participation activities of the type used in our project successfully increased applications and offers for Medicine. The value of psychometric tests in the context of Widening Participation requires further research.

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Introduction

There is a well established relationship between educational achievement and socio-economic status (SES).(1,2) It has even been suggested that knowing about a child's socio-economic background allows relatively accurate predictions of their likely future academic attainment.(3) In particular applications to, and acceptances for, professional courses such as medicine reflect a class-based bias favouring middle class candidates.(4) However, this is not a recent phenomenon and efforts to address the balance have been made.(5) Entry to study medicine in the UK is highly selective and competitive. Even now there are relatively fewer applicants to university courses as a whole and particularly medicine and dentistry from the lower socio-economic groups 4 – 7 and more applicants from group 1. UCAS data demonstrates that this trend is also apparent in those accepting their offers It appears that those from higher socio-economic groups have a greater likelihood of success than those from lower socio-economic groups (6). Recognition of this has led many universities to embark on projects aimed at encouraging applications from under-represented groups. The principle underpinning these projects is that 'the social profile of NHS staff (should) more closely reflect the social composition of the wider society from which it is drawn and to whom it provides services, thus providing a better experience for patients and their carers,'(5). In addition there is the fear that able individuals from more deprived backgrounds are being denied the opportunity of studying medicine. However, it would appear that they have made little impact on the social profile of medical students.

If suitable applicants could be identified in advance, then they could be encouraged towards appropriate subject choice. Cognitive tests should improve the identification of those with appropriate intellectual skills but for some professions within the health service, certain non-cognitive traits are considered to enhance the likelihood of success and being able to determine these in pupils prior to deciding on their career choice, should improve the outcome. Such measures were evaluated in the WHAP project.

An approach that has been used in an attempt to identify potential ability in those who might not otherwise consider medicine, is to devise measures to supplement traditional school examination results Addition of psychometric assessments that are not so heavily dependent on educational background as school leaving exams may help facilitate admission to medicine of applicants from poorly represented groups.(7) and in recent years, a number of specific tests have been devised to supplement performance in public examinations and improve the fairness of the admissions process



for University particularly for competitive courses. An example of this is the UKCAT used in 25 UK Medical Schools that consists of a battery of tests of cognitive ability. If used to define a threshold for interview or admission rather than in borderline candidates alone, then it may advantage some from lower socio-economic groups (8). However, it is sat at the time of application to medical school, too late to influence subject choices in potential applicants of the future.

We aimed to evaluate psychometric assessment completed at the age of 15 when subject choices are being made and, also raise applications from under-represented groups by exposing them to awareness raising activities in the Working in Health Access Programme (WHAP). The application of psychometric tests to pupils from schools with below average participation rates in Higher Education was combined with intensive activities aimed at increasing the interest of the school pupils and also their knowledge of careers in Medicine. It was anticipated that this would result in an increase in the number of applications. The standard psychometric tools used to assess cognitive skills were the Mill Hill Vocabulary scale (MHV) and Raven's Progressive Matrices (RPM) test, which assesses linguistic knowledge and ability and non-verbal cognitive ability respectively.(9-13) .

It has also been suggested that non-cognitive traits may also be important in a future medical career.(14,15) The NACE (*Narcissism, Aloofness, Confidence, Empathy*) test, specifically developed to assess personal qualities thought to be of relevance to medical professionals was included in the test battery.(16-18) The initial findings reported by Lumsden et al, (17) examined the relationship between socio-economic status (SES), performance in school examinations (Standard Grades at the Credit level (SGCL taken in Year 11 of schooling in Scotland)) and the PQA. The results of these examinations were strongly dependent on social class although results of the psychometric tests used (MHV and RPM) were affected to a lesser extent. Tests of non-cognitive attributes were not affected by social class. In a separate study where results of psychometric assessment that also included the NACE, were compared with exam results in Medical School, a relationship between these traits and professionalism was noted (19).

Similar assessments are being used in the UKCAT, although the non-cognitive component is still being used only as a research tool. So far it has been determined that for the cognitive component there is bias in favour of those from independent and grammar schools although it could be used as an appropriate proxy of A levels.(20) Thus its role in increasing diversity is becoming clearer although it is heavily dependent on the relationship of the UCKAT with the totality of the admission's process.



This paper will describe the impact of the WHAP project on the change in number of pupils applying to study Medicine in Scottish Universities as well as the psychometric profile of those applying comparing those who succeeded with those who did not.

Methods

These have been described in detail elsewhere.(1) Briefly 69 schools throughout Scotland, which had below average participation rates in Higher Education (HE) were identified by the local authorities. Links were made with the five Scottish medical schools, local health professionals, pupils, parents, teachers and others involved in widening participation activities. Visits to health care settings and universities with ‘hands on’ activities were organised by staff and medical students, who also visited the schools. All events were evaluated and demographic data on the participants collected. At the start of the project pupils were in S3 (Year 10 of education). According to their schools, those selected had the potential of gaining five Standard Grades at Credit Level (Grades 1-3) containing at least one science subject, which is deemed the minimum required to continue study with the aim of entering HE although the final decision regarding conditions for admission is made by the Universities after consideration of the Higher Examinations that are sat 1 year later at the end of Year 12.

These pupils sat the battery of psychometric tests in the 1st term of Year 10 covering both cognitive (Raven’s Progressive Matrices (RPM) and the Mill Hill Vocabulary scale (MHV)) and non-cognitive traits. The latter was assessed using the NACE test that measures the four components, Narcissism, Aloofness, Confidence and Empathy which can be combined into an overall score for Involvement (C+E) versus Detachment (A+N) labelled ECAN. They then took part in the programme of activities. The participants were followed up and those applying to and gaining offers for Medicine determined. In addition, the relationship between Scottish Highers (sat at the end of Year 12) and the results of the psychometric tests was determined, as well as the personality characteristics of those who did apply to study medicine.

Statistical Analysis

The data were analysed using a one-way analysis of variance (ANOVA). Where the result was significant *post hoc* comparisons between groups were conducted using



Dunnett's T3 and Tukey's HSD.(21) In addition, to test for the presence of relationships between measures of social class and test scores, Spearman's rank order correlations were computed.(22)

Results

Two thousand, four hundred and twenty two pupils took part in the project. Of these, 2,244 completed the RPM, 2221 completed the MHV and 2204 completed the NACE test. Attrition occurred between SG and Higher examinations as was expected since the age for the end of compulsory education was reached by most pupils in Year 11 and Scottish Higher examinations are sat one year later in Year 12.

Table 1: Attrition between phases by socio-economic classification

ACORN	At time of Standard Grades (Year 11)		At time of Scottish Highers (Year 12)	
	n	%	n	%
<i>Wealthy</i>	550	26.60	396	29.18
<i>Urban</i>	146	7.06	103	7.59
<i>Comfortable</i>	476	23.02	335	24.69
<i>Moderate</i>	219	10.59	137	10.10
<i>Struggling</i>	677	32.74	386	28.45
Total	2068	100.00	1357	100.00
RGS				
<i>1 professional</i>	391	19.35	287	21.73
<i>2 Intermediate</i>	381	18.85	277	20.97
<i>3 Skilled NM</i>	250	12.37	162	12.26
<i>4 Skilled M</i>	589	29.14	354	26.80
<i>5 Partly skilled</i>	137	6.78	91	6.89
<i>Unskilled</i>	14	0.69	4	0.30
<i>Other</i>	259	12.82	146	11.05
Total	2021	100.00	1321	100.00

There was greater relative loss of those from the lower socio-economic groups leading to an increased proportional representation from higher socio-economic groups in the study sample.

The Higher examination results were converted to the Universities and Colleges Admissions Service (UCAS) tariff score by allocating points for each grade achieved with a greater number being allocated for higher grades. Since this can be done for all types of school leaving examinations it facilitates comparison between different types of qualifications.(23) The means for the number of Highers awarded differs significantly by RGS ($F [6,1418] = 13.216, p < 0.01$), as do the resultant tariff scores ($F [6,1418] = 14.538, p < 0.01$).

The following tables report correlations between a number of variables relating to socio-economic status (as measured by the RGS and ACORN) (24-6), academic ability (as measured by results of examinations in Year 11 and Year 12), cognitive (Raven's Matrices and Mill Hill) and non-cognitive tests (NACE).



In relation to the two tables, Table 2 refers to the sample drawn at Year 11, while Table 3 refers those who progressed to Year 12. In general, only those with the academic ability to achieve Higher qualifications (expected for entry to higher education) will progress.

Table 2: Correlations between socio-economic status; academic attainment and cognitive and psychometric tests at time of Standard Grades.

<u>Year 11</u>	SG‡	ECAN§	Raven's Matrices	Mill Hill	RGS	ACORN
SGCL†	0.269** (2022)	0.113** (1942)	0.346** (1971)	0.301** (1957)	-0.212** (1784)	-0.224** (1826)
SG‡		-0.009 (1942)	-0.011 (1971)	-0.103** (1957)	-0.031 (1784)	0.065** (1826)
ECAN§			0.061** (2186)	0.048* (2166)	-0.033 (1956)	0.009 (2005)
Raven's Matrices				0.193** (2210)	-0.137** (1997)	-0.089** (2044)
Mill Hill					-0.110** (1974)	-0.144** (2021)
RGS						0.221** (1870)

** indicates $p < 0.01$; †SGCL: Standard Grade at Credit Level; ‡SG: Standard Grade; §ECAN: Involvement versus Detachment score [NACE test] (N)

The associations between attainment as measured by tariff score, and both RPM and MHV decrease in comparison with the association between these tests and Standard Grades sat 1 year earlier and although some of the individual correlations are statistically significant they remain weak (indeed some indicate almost no association) and must be interpreted with caution. The number of Standard Grades at Credit Level (this corresponds to a pass at Grade A-C) correlated strongly with the total number of Highers awarded ($r = 0.618$, $p < 0.001$).

Table 3: Correlations between socio-economic status; academic attainment and cognitive and psychometric tests at time of Scottish Highers.

<u>Year 12</u>	Tariff score	ECAN	Raven's Matrices	Mill Hill	RGS	ACORN
Highers	0.972** (1615)	0.001 (1550)	0.318** (1571)	0.258** (1556)	-0.220** (1425)	-0.228** (1463)
Tariff score		0.005 (1550)	0.332** (1571)	0.285** (1556)	-0.225** (1425)	-0.237** (1463)
ECAN§			0.005 (1539)	0.008 (1524)	-0.029 (1391)	0.005 (1431)
Raven's Matrices				0.138** (1549)	-0.118** (1412)	-0.095** (1450)
Mill Hill					-0.095** (1450)	-0.114** (1436)
RGS						0.172** (1337)

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** indicates $p < 0.01$; †ECAN: Involvement versus Detachment score [NACE test] (N)

There is a reduction in the strength of the associations between the cognitive tests and the 2 sets of school leaving examinations suggesting that these psychometric tests would appear to be less discriminating in relation to social class at higher levels of ability or attainment level. In addition, using the Fisher r to z transformation¹, the difference between the two samples (Year 11 (Standard grade examination) and Year 12 (Higher examinations) in relation to the correlation between ECAN (the non-cognitive assessment tool) and Raven' Matrices is significant at better than 10%, and perhaps suggests that ECAN does not seem to be affected by either social class or cognitive ability even when higher attainment is concerned.

The number of pupils applying to Medicine from the WHAP schools increased by 38% between 2003, before the project commenced, and 2006, following the completion of the first 2 years of the project, although the number of offers increased by only 33% (Table 4).

However, over the course of the next two years, during which activities were organised to enhance the chance of success (e.g. interview practice), applications increased by a total of 80% while offers to pupils from WHAP schools increased 3 fold. This was not due to an increase in the number of Scottish applicants as a whole since the numbers remained constant (data from UCAS; not shown).

Table 4: Applications to Scottish Medical Schools from WHAP schools (Source UCAS 2008)

	Applications	Offers
2003	42	12
2006	58	16
2008	76	36

There was no significant difference in mean tariff scores between those who were accepted and those who were not, suggesting that tariff score was only one element in achieving 'success'. There was no difference in the results of the cognitive tests (MHV and RPM). However, those who were successful in their application for medicine scored significantly higher on narcissism in the NACE instrument, a trait generally considered unlikely to enhance success in interview ($t [32] = 2.805, p < 0.01$ (Table 5).

1 <http://faculty.vassar.edu/lowry/rdiff.html>

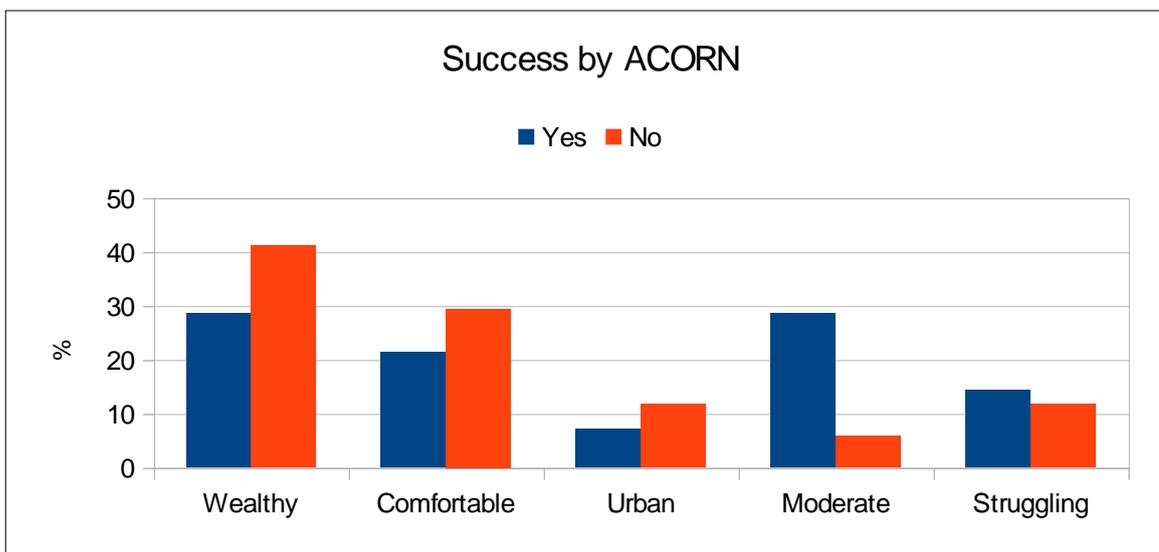


Table 5: Mean scores by 'success' for psychometric and examination performance

<i>Tariff</i>	Mean	Std. Dev.	Min.	Max	N
Yes	348.8	12.4	324	360	15
No	337.9	22.7	288	360	19
<i>NACE</i>					
Yes	132.5	11.4	117	149	15
No	141.6	14.1	111	163	19
<i>Raven's Matrices</i>					
Yes	51.3	3.7	45	57	15
No	52.0	3.9	45	59	20
<i>Mill Hill</i>					
Yes	28.7	8.7	10	41	15
No	30.5	6.5	14	41	20

Moreover, the profile of 'success' by ACORN classification differed from that of the profile of all those receiving offers to study Medicine. The figure below shows the category of those accepted versus those rejected and the group accepted have a more comprehensive profile than might have been expected but reflects the profile of the WHAP cohort as a whole.

Figure 1: 'Success' rate in gaining an offer at Scottish medical schools by ACORN classification



Within the WHAN sample there were another 182 pupils who achieved at least the minimum tariff score of those who were successful in obtaining a place at medical school, suggesting that there is still a pool of untapped talent available.

Discussion

The Working in Health Access Programme was successful in raising aspirations, with an increase in the number applying and being admitted to Medical School. Consequently the principles of the project in regard to awareness-raising and encouragement have been continued in 'REACH Scotland, the name given to the widening access project ongoing within Scotland (27). Initially, there was only a small increase in applications and offers which prompted increased effort by project staff to improve the quality of the applications to allow competitive entry against the wide body of applicants rather than into designated places to a local university as tends to happen with Access Courses. Initially, there was only a small increase in applications and offers which prompted increased effort by project staff to improve the quality of the applications. This is against a background of static numbers applying from Scotland as a whole. (Applications to Scottish Medical Schools by Scottish school leavers were 544 in 2005 and 563 in 2008). In our group of applicants, receiving an offer showed little social class bias but this may have been a reflection of the small numbers in this group although these observations are consistent with those made for earlier years. (6) However, overall, UCAS figures for all UK applicants show that in 2008 fewer from S.E. groups 4 – 7 applied to medicine and dentistry courses relative to their application rate to other UK university courses; the opposite being the case for S.E. groups 1 and 2. Also, these figures suggest that even when individuals from the lower S.E. groups do apply to medicine and dentistry courses their acceptance rate is significantly less than that for S.E. group 1.

Currently, selection to medical schools in the UK requires the highest academic attainment and those from the lower S.E. groups (4 – 7) tend to achieve lower tariff scores than those from S.E. groups 1 and 2.(6) This was also apparent in our study sample since fewer individuals from the lower S.E. groups, as assessed by RGS and ACORN, progress from Standard Grade examinations to take Scottish Highers. Those who did progress obtained a lesser number of Highers and a lower mean Tariff point score, which could explain (at least in part) the lower numbers applying to medical school However, the non-cognitive traits evaluated in the ECAN score did constitute a measure that had no association with socio-economic status as measured by the ACORN and RGS classification schema.

Assessment of social class is complex and many of the issues cannot be covered here. However, it is likely to be affected by other factors such as ethnicity, which in itself could be responsible for differences in application rate although in our case, a vast majority of the participants were Caucasian (97%). In addition the ACORN classification was set up to assess affluence for marketing



purposes rather than the reverse although it was found that the data correlate strongly when evaluated using the ACORN and the registrar general classification.

The initial failure to improve the number of lower SES candidates admitted to medical school was a cause for concern. One explanation was that applicants from the participating schools were less prepared in terms of completing their UCAS forms and in preparing their applications as a whole. Lack of work experience was overcome for these pupils by the awareness raising activities organised as part of the project. Once this became apparent the teams involved in the project worked at improving the quality of the applications which would appear to have been successful.

An initial hypothesis of our work was that if selection decisions were informed by measures of cognitive ability and non-cognitive qualities other than school leaving exams then this would improve the admission rates from the lower social classes (28, 29). Recently, studies assessing the value of the UKCAT in predicting performance in medical school showed variation from one school to another (30-32) and their role is still uncertain particularly as there are fears that psychometric testing may actually discriminate against those from lower social classes.(33) In our study, those from lower S.E groups (both those who sat Standard Grades and also those who went onto sit Highers) performed significantly worse than those from higher social groups in cognitive skills tests such as the RPM and MHV. However, for non-cognitive qualities, there was no significant difference in performance due to S.E. grouping as assessed using the NACE tool. Of the individuals in the WHAP study there are data from the small number who were eventually selected for medical school. It was found that the successful candidates had higher tariff point scores, but lower scores for 'desirable' personal qualities as determined by NACE. This was surprising in that it is generally assumed that empathic and extrovert individuals will perform well at interview. However, an alternative explanation is that the pupils in low achieving schools need to be able to focus on their studies while their peers maybe pursuing other activities and so a degree of narcissism could be an advantage. However, it is also possible that the result may have occurred simply by chance due to the small group size.

Conclusions:

1. Applicants from lower S.E. groups are less likely to apply for entry to medicine than to other university courses partly because there are less progressing into Years 12 and thus year 13 of school when advanced examinations are sat.
2. As a group, they get lower tariff point scores than those from the highest two S.E. groups.



3. Non-cognitive skills are not affected by social class overall although those achieving admission to medicine from schools with low participation rates in Higher education may differ from those who do not
4. A reduction in tariff point threshold, if appropriately advertised, might encourage more applications from those in the lower S.E. groups.

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