

An analysis of an admissions system: can performance in the first year of the dental course be predicted?

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The admissions process must be scrupulously fair and select the most suitable students. Data on applicants to the Manchester Dental School for the 1996/97 academic year were analysed. The aims of this project were to: describe the applicants using information from the UCAS (university entrance) form; to relate information from the UCAS form to interview performance and A-level results; and to evaluate whether these factors can predict performance during the first year of the course.

Between 1984 and 1997 there were wide fluctuations in numbers of applications for United Kingdom Dental Schools. At Manchester in 1992 there were around 600 applications for the 65 places on the dental course first year; in 1997 this number doubled (fig. 1). Reasons for the reduction in the early 1990s may have included fear of the effect of the AIDS virus coinciding with a negative image of the profession — particularly associated with the problems of NHS payment. The great increase in applications may reflect the wish of many candidates to enter a respectable profession with secure job prospects and may have been responsible for similar high levels of application to law, medicine and veterinary science.¹

Inevitably large numbers of applications affect admissions procedures. Not only are there more applications to process, in itself a time-consuming activity but, since at least half of the applicants more than fulfil the minimum entry requirements, fair selection is difficult. Many admission's officers feel dentistry not only requires candidates of high academic potential but that other, less academic, students would make good dentists — students who are caring, good com-

municators, good at time management and with good manual dexterity. Drummond and Duguid showed student dropout from all UK dental schools to be an increasing problem.² Good selection procedures should aim to reduce this.

Increasingly, admissions tutors base their selection on data provided on the UCAS (University and Colleges Admissions Service) form which provides a representation of the prospective student's ability through GCSE (General Certificate of Secondary Education — usually taken at age 16 in between 6–10 subjects) and projected A-level (Advanced level — usually taken aged 17/18 in three spe-

cialised subjects) grades, head teachers' reports and the personal statement, validated by interview.³

The admissions process has to be seen to be fair and, when each place is oversubscribed, it becomes difficult not to select purely on academic grounds. Average grades now required from candidates for the majority of dental schools are ABB at the first sitting of A-level; 5 years ago it was BCC.

At Manchester, in 1994, the method of teaching in the first 2 years of the course changed to problem-based learning (PBL).⁴ Concurrently, the admissions process was changed. Previously only selected candidates were invited for interview — where the UCAS form did not appear clear, and mature and overseas candidates. From 1995, all suitable candidates were invited for a structured interview. The objective was not only to attempt to attract the best candidates, but also those who would be able to cope with the PBL course which requires students to become active learners, participating in seminar groups, responsible for their own educational agenda, rather than more passive recipients of didactic instruction. Students must be able to work in groups with a high degree of self motivation.

In brief

- This paper gives the reader some insight into the admissions process. This will help GDPs who are often asked to advise prospective applicants
- Pupils present for admission to dental schools from a wide variety of schools; they have different life experiences and take different types of examinations. The effects of different GCSE examination type on A-level performance and of the type of school on subjects offered means that admissions tutors will have a better understanding of some of the background problems affecting admissions
- The analysis of A-level subjects offered in relation to Year 1 results will influence admissions policy especially with respect to A-level biology

Aims

The aims of this project were:

- To describe the applicants using information from the UCAS form
- To relate information from the UCAS form to interview performance and A-level results
- To evaluate whether these factors can predict student performance during the first year of the course.

Material and methods

UCAS forms and interview information were used for 356 candidates applying in 1995 for 1996 entry who had selected Manchester CF (confirmed firm) or CI (confirmed intention) with UCAS. These

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candidates were selected from among the 1497 original applicants, of whom 650 were interviewed. After interview, 418 offers were made to candidates who scored well at interview and fulfilled the minimum entrance requirements.

The structured interviews were devised so that candidates received marks for six criteria: professional attitude, communication skill, team and leadership experience, non-academic interests, evidence of manual dexterity, and awareness of the need for Hepatitis B immunisation. Each interview was conducted by three staff (two interviewers and a chairman) who came from all disciplines in the school — both pre-clinical and clinical — and usually included a member of the admissions working party. Staff were expected to attend for a half-day of interview training so there was a clear understanding of questions which could be asked and of marking criteria.

For professionalism, candidates were expected to have undertaken work experience showing an inquisitive interest in what they had observed, with some knowledge of dental or scientific topics. Their communication skills were assessed taking note of ability to answer questions clearly, eye contact and general demeanour during the interview — suitability for PBL was considered at this stage, and also during assessment of their team/leadership experience. This focussed not only on their experience of such activities (team sports, Duke of Edinburgh's etc), but also on their attitude to team activity and whether they had noticed that a team was in action when they visited the dentist for work experience.

It was accepted that an interview cannot assess manual dexterity but candidates were asked about their experiences and whether they had considered their ability to coordinate hand/eye or perform intricate activity. A wide range of answers to this criteria were accepted (computer skills, sports eg tennis, sewing and even cake decorating) — attitude rather than ability was what was sought. Non-academic interests were used as a means of assessment, partly to give candidates a

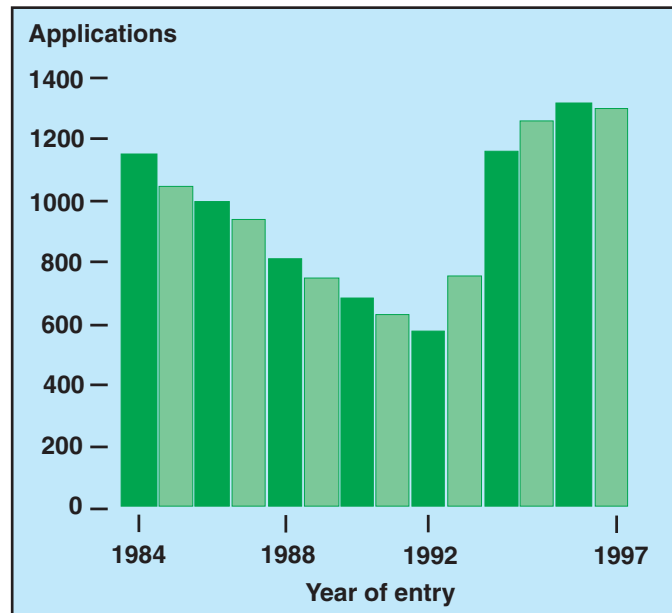


Fig. 1 Applications to the Dental School, University of Manchester, 1984-1997

chance to talk about something which interested them, but also to identify students who had a broad-based attitude to life generally, who would add colour to the student body.

Each individual was scored for professionalism, communication skills, manual skill, leadership/team experience and non-academic interest (ranging from 1 (little evidence) to 4 (excellent) for each — maximum 20). An average score was obtained using the average of total marks for all skills from three interviewers (minimum overall average of those offered a place 15, range 12-20). Students who scored less than 15 average were not usually offered a place.

Information from the 356 UCAS forms, A-level results and marks for interviews were entered onto a database and analysed using the SPSS statistical package.⁵ Statistical analysis included the Mann Whitney *U* test, *t*-test and *p*² test; backward logistic regression modelling allowed the determination of factors predicting failure in Year 1 of the course.

When the A-level results were announced, 117 of the CF and CI candidates had achieved their requested grades so fulfilled the entry requirements and had to be admitted. They subsequently

entered the first year of the course; their performance was followed and examination results for Semesters I and II included in the analysis.

Results

Information from UCAS form

General information: Of the 356 forms processed, 157 (44%) were from male candidates and 199 (56%) from females. The majority (325) were UK applicants with 7 from the EU and 21 from overseas. The number of applicants (146; 41%) from independent, grammar, and grant maintained schools and tutorial colleges (private sector) was similar to the number from the state sector (163; 45%) — comprehensive schools, sixth form, tertiary, FE and community colleges. Other candidates were graduates or educated abroad.

Most candidates took the advice given in the UCAS handbook 'that no more than five choices of the possible six should be used for either medicine or dentistry';³ 298 (84%) applied for five dental schools, 25 (7%) applied for four and 24 for six. The most commonly chosen alternative to dentistry was biological sciences; 56 (16%) applicants made it their selection; pharmacy was selected by

28 (8%) applicants; other courses included optometry (13; 4%), psychology (5; 1.4%), chemistry 3 and medicine 2.

GCSE results: Analysis of GCSE results showed that 44% of candidates presented with nine subjects passed at one attempt; 33% had gained ten at one attempt, and 9% of candidates succeeded in either eight or eleven subjects. Half the applicants (48%) achieved at least five A grades and almost one quarter (23%), two or more A*.

Almost equal numbers presented with Dual Award (combined science — two examinations covering all the science subjects) as with separate individual sciences (physics, chemistry and biology taken individually) but dual award science candidates were almost 20% more likely ($P < 0.003$) to have gained an A or A* (78%) compared to those who had studied separate GCSE science subjects (chemistry 63%; biology 60%; mathematics 56%; physics 51%).

Personal statement:

(i) *Dental work experience:* Details from the candidates' personal statements showed 174 (50%) candidates had spent between 1 and 2 weeks observing a local dentist and 50 (15%) assisted a dentist regularly. One-third of applicants were considered to have had no, or very little, work experience. Comparison of groups with different work experience (not sufficient or adequate) showed no significant differences in GCSE results.

(ii) *Choice of dental career:* Forty-four (12%) applicants suggested their career choice was influenced by a relative in the profession; 47 (13%) described personal experience of dental treatment affecting their choice (orthodontics 36, other 11).

(iii) *Team and leadership experience:* Many candidates (187; 52%) were active members of youth clubs; 200 (56%) had undertaken some charity work. Just less than half (162; 45%) declared themselves to be school prefects/captains and almost one quarter had undertaken the Duke of Edinburgh's Award Scheme.

(iv) *Evidence of manual dexterity:* Most

applicants provided some evidence of manual dexterity (228; 64%). More than one-third (137; 38%) played a musical instrument, 44 were involved in art/drawing, 37 sculpturing/model making, 33 sewing/knitting and 111 cited some other manual skills — of these 96 gave IT as their activity.

(v) *Other extra-curricular activities:* These usually included sporting activities and going out with friends/socialising. Other favoured activities included travel (122; 34%), reading — scientific material (29; 8%) and more general reading (74; 20%). Foreign languages were reportedly spoken by 65 applicants (18%) and 104 (29%) described regularly undertaking part-time paid employment.

(vi) *Type of school:* Schools attended by candidates were classified into the two groups detailed above (state and private sectors) for comparison. It was clear that the state sector group opted for the dual award (combined) GCSE science examinations with 69% (112) of candidates presenting this style of examination. In the private sector the majority presented with single science subjects; 88% (128) of private sector pupils took single award chemistry.

There was no significant difference between the educational groups' GCSE performance except for mathematics (which was presented by all candidates): 66% of private sector pupils obtained A or A* compared with 47% of pupils from the state sector ($P < 0.001$).

Applicants from the private sector were more likely to have undertaken the Duke of Edinburgh award, have experienced group work, clubs or youth enterprise or to be a school captain/prefect. But no differences could be detected between the groups for dental or charity work experience.

A-level results

Results for A level examinations show that candidates appeared to have performed better in mathematics (25% achieved 'A' and 62% achieved 'A' or 'B') and biology (22% achieved 'A' and 62% achieved 'A' or 'B') than in chemistry

(16% achieved 'A' and 50% achieved 'A' or 'B') or physics (11% achieved 'A' and 35% achieved 'A' or 'B').

The predictions (obtained from the UCAS form) were most reliable for mathematics (62% achieved their predicted or higher grades) and worst for physics — only 39% achieved their predicted or higher grades (Table 1). Grade A was scored as '5' and E scored as '1'; observed and predicted grades were compared using the paired *T*-test. Projected grades were statistically significantly higher than actual ($P < 0.01$) and therefore predicted grades could not be used as 'proxy' for actual A-level grades.

When considering those with GCSE A or A* for individual science subjects, only 21% achieved A level 'A' for chemistry, 26% for physics, 31% for mathematics and 41% for biology. When considering those who achieved A or A* for GCSE dual award, at A-level, 9% achieved A in physics, 14% in chemistry, 21% in biology and 22% in mathematics. This suggests that GCSE results are not good indicators of A level results and that performance of GCSE single science candidates is better at A-level than dual award candidates (especially in biology and physics).

Comparison of the groups with different work experience showed no significant differences in A-level results ($P > 0.05$).

A-level results in the private school sector were higher than in the state sector, however, the difference was greatest and statistically significant only for mathematics (31% with A in the private sector against 15% in the state sector, $P < 0.01$).

Relationship between information from UCAS form and interview performance

(1) *Type of school:* There was no difference in overall interview score or score for communication skills between applicants from the two educational sectors ($P > 0.05$).

(2) *Work experience:* There were no differences in overall interview score, or score for professionalism between interviewees

who had undertaken sufficient work experience and those who had not ($P > 0.05$).

(3) *Personal statement:* School captains/prefects had better communication skills and applicants who had undertaken the Duke of Edinburgh's award scheme or those with group work experience had better overall score at interview ($P < 0.01$).

Performance during Year 1 of the dental course

Of the 117 students who were admitted to the course, 45 (39%) failed Semester 1 and 37 (32%) Semester 2. Of those who failed Semester 1, 27 (60%) also failed Semester 2. Figures 2 and 3 show the relationship between A-level study of chemistry and biology and the results of Semesters 1 and 2 examinations. Students who had not studied biology to A-level were more likely to fail Year 1 examinations than students who had not studied either mathematics or physics to A-level. There were only eight students without A-level chemistry (they entered with equivalent qualifications); however they were more likely to fail.

The following factors were considered from the UCAS form and related to Year 1 results: gender, work experience, type of school, school captain/prefect, Duke of Edinburgh's award. The only significant difference was found for gender — female students were less likely to fail in the second semester ($P = 0.04$).

The relationship between the interview results and performance during Year 1 was examined — students with a high score for leadership experience were less likely to fail in Semester 2 ($P = 0.03$).

Backward logistic regression modelling was used to determine which factors could predict failure in Year 1 examinations. When modelling results for Semester 2, the results for Semester 1 were included in the model.

The only significant predictor of performance in Semester 1 was whether students has taken biology at A-level: those students who had studied biology were less likely to fail (odds ratio (OR) 0.29, 95% confidence interval (CI) 0.11–0.73).

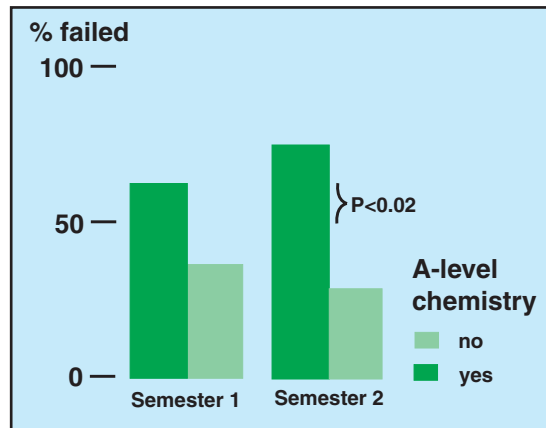


Fig. 2 Failure rate among Year 1 students with and without A-level chemistry

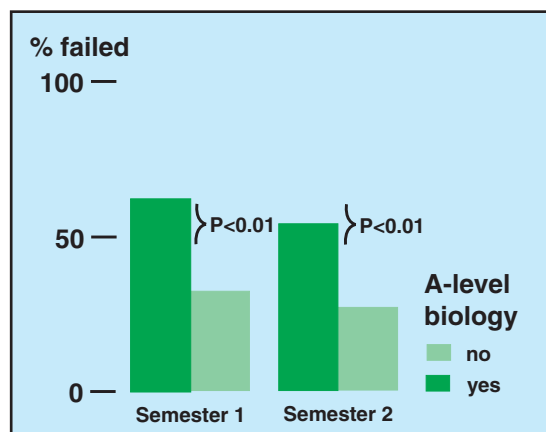


Fig. 3 Failure rate among Year 1 students with and without A-level biology

The sensitivity of the model was 87.5%, specificity 33.3%.

In Semester 2 those who had gained high (> 3) interview scores (averaged from three interviewers) for leadership experience were less likely to fail (OR 0.27, 95% CI 0.09–0.80) as well as those who had taken biology (OR 0.24, 95% CI 0.06–0.89) and physics (OR 0.21, 95% CI 0.06–0.77) at A-level. Those who failed in Semester 1 were more likely to fail again in Semester 2 (OR 8.92, 95% CI 3.25–24.50). The sensitivity of the model was 91.3%, specificity 64.9%.

Discussion

Auditing admissions to medical schools, McManus and Richards stated: 'the greatest advantage of selection based primarily on A-level grades is its lack of bias by irrele-

vant social factors'.⁶ They also suggest that since A- and O-level are poor predictors of final university grades, the interview makes some correction for admission systems originally based only on A-level results. It has been shown in this paper, which follows a single cohort, and by other workers during longer periods,^{7,8} that there is not a clear correlation between predicted and achieved grades and that reliability varies between subjects.

Delap found that UCAS referees tended to over-estimate on average by 1 point (half a grade), especially at the bottom of the scale.⁹ In this study, predictions for mathematics were most reliable and those for physics least (Table 1); candidates predicted lower grades in all subjects were more likely to achieve or surpass them. Delap found chemistry less optimistically forecast than maths/physics.

Table 1 Percentage of candidates who achieved or surpassed the predicted A-level grades from UCAS forms, and difference between the observed and predicted grade

Predicted grades	% of candidates who achieved or surpassed the predicted grade			
	Chemistry	Physics	Biology	Mathematics
A	43.0	31.6	53.2	52.2
AB, BA or B	53.6	33.3	57.4	59.7
BC, CB or C	57.9	46.7	60.0	74.4
Overall	52.2	38.8	54.7	61.5

Delap also found that independent and selective schools were likely to be more accurate (49%) than FE establishments. Other variables were examining boards (in one of the two boards with the highest grades only 20% of predictions were pessimistic), gender (predictions were more optimistic for males than for females) and age (less optimistic for 19-year-olds than for those of 17/18 years).

The aim of the selection process must be to find students who are best suited to the type of teaching and who will succeed on the course. Sheetz showed that in the USA, (where dental students all have completed a first degree), the main attrition occurred in the first two years¹⁰ — this agrees with the findings of Drummond and Duguid.² In the USA, candidates take a dental aptitude test; Sheetz showed a positive correlation between the test results and drop-out rates.

Researching the structured interview Powis *et al.*¹¹ and Chapman¹² found no differences in interview numerical scores between those who completed the course and those who dropped-out but, those with negative written comments were more likely to drop-out. In this present study it appears that those with high interview scores, with better leadership experience, perform better at the end of Year 1. Since the course is PBL, and the interview is geared toward communication skills, this may indicate that the selection process is effective. As this cohort of students is to be followed through the course, this finding will be watched with interest. It will be particularly interesting to observe whether factors relating to and predicting success vary at different stages of the course.

The importance of biology to the course is borne out by the first year results. Montague and Odds found that critical subjects for medicine at A-level were biology and chemistry.¹³ Success in chemistry was related to the whole course whereas biology grades were only related to the pre-clinical years. Green, Peters and Webster did not find chemistry grades were associated with undergraduate performance but, students with A or B in biology were less likely to have problems on the course.¹⁴ The importance of biology for the dentistry course is at present undergoing review and, although in most dental schools it has not been a mandatory subject, this may be set to change; certainly at Manchester students are recommended to take biology.

Conclusions

This paper has analysed UCAS forms and interviews of 356 applicants and tracked 117 entrants through to the end of the first year of the course. Mean GCSE grades presented by candidates have become apparent and differences between single and dual award science highlighted. Effects of the type of school on subject choice and personal statement on the UCAS form have become evident although it was observed there was no difference in overall interview scores between the two groups.

Admissions tutors are keen to ensure there is no bias in any admissions process. This research allows a clearer understanding of the admissions process and, as results for Years 1 and 2 and subsequent clinical years emerge, may show other factors to be important. Already differences between the two types of GCSE science

and the importance of A-level Biology are informing the admissions decision-making process. The positive relationship between interview scores and success in Seminar 2 justifies the expensive and time-consuming interviewing process.

It is vital that the admissions process not only admits students who are well suited to the course but also that the process is fair. If the process is better understood it is easier to make informed decisions.

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