Dental school admissions in Ireland: can current selection criteria predict success?

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Introduction: Entry into university education in Ireland, including dental school, is based solely on academic performance in the Leaving Certificate Examination, held at the end of formal school education. The aim of this investigation was to examine the suitability of this process for the selection of dental students in Ireland.

Materials and methods: Information for all dental students who entered the dental degree programme immediately following completion of the Leaving Certificate Examination at the National University of Ireland, Cork, during the years 1997–1999 was retrieved. Information was collected relating to gender, the number of times the student had attempted the Leaving Certificate Examination, their performance in this examination, the total number of marks awarded to each student at the end of the First and Final Dental Examinations, and their performance in individual modules.

Results: Whilst there was a significant relationship between performance in the Leaving Certificate Examination and the First Dental Examination (correlation coefficient $r = 0.22, P < 0.05$), this relationship could only explain 12% of the variation within the performance of students in this examination. There was no relationship between performance in the Leaving Certificate and the Final Dental Examination (correlation coefficient $r = 0.09, P > 0.05$). There was a significant correlation between performance in the Leaving Certificate Examination and performance in seven of the 55 programme modules, all of which were preclinical modules, and of which five were related to basic sciences.

Conclusions: Based on the limitations of this study, the current selection process for dental students in Ireland seems to be of limited value.

Key words: dental education; admissions; dental student; selection; performance; quality.

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Introduction

The challenge to modern universities and educational institutions, including dental schools, is to select students who are most likely to succeed, satisfactorily complete the educational programme, and to make a positive contribution to their profession and the public they serve (1). In many countries in the world, entry into dental school is highly competitive, with more applicants than training places available (2, 3). Selection processes should be evidence-based and legally defensible (1, 4, 5). A myriad of studies in the literature have considered the suitability of various methods for selecting university students in dentistry, medicine and other disciplines. Currently available methods of selecting aspirant dental students include:

• Consideration of previous academic performance, either school or college grades.
• Assessments of cognitive ability- so-called ‘intelligence testing’ or ‘aptitude testing’. In addition to testing knowledge that is demonstrable in school or college examinations, students are asked to demonstrate additional skills such as problem-solving, based on knowledge pertinent to their proposed course of study (e.g. this could relate to biology for dental and medical students).
• Assessments of non-cognitive ability. These assessments examine skills and attributes such as the ability to communicate, to empathise, and sense of professionalism, amongst others.

In certain European countries such as Ireland, dental students are selected on the basis of their previous academic performance alone. In other countries such as the UK, dental students are selected on the basis of their previous academic performance as well as their performance at a structured interview (3). The latter provides an opportunity to assess cognitive and non-cognitive abilities, and an association has been demonstrated between performance at this interview and performance in dental school (3). Some dental schools in Sweden now include an assessment of manual dexterity as part of their selection process (6).
Unsurprisingly, positive correlations have been noted between student performance in these manual dexterity assessments and subsequent dental school performance (6). In North America, applicants are assessed on the basis of their previous academic performance and their cognitive abilities demonstrated by, amongst others, spatial and perceptual aptitude testing (7).

There is disagreement in the literature regarding the suitability of basing selection processes on previous academic performance of aspirant students. McManus et al. (1, 4) have found positive association between performances of medical students in their A-level (Advanced Level) Examination and medical school. In contrast, similar examination of medical school admissions in the 1980s found no correlation between performance at A-level examinations and medical school (8). In a recent review of US dental school admissions, Ranney et al. found a correlation between dental school performance and previous academic performance (5). However, this paper also found evidence to support the use of assessments of perceptual and manual abilities in the selection of students (5). Investigations of dental school admissions in the UK in the 1970s found both positive (9, 10) and negative (11) correlations between performance at A-level examinations and performance at dental school. In Ireland, where the vast majority of University students are selected on the basis of their previous academic performance, selection of students for business (12) and teacher-training programmes (13) have found limited correlation between previous academic performance and subsequent performance at university.

In Ireland, entry to most University programmes, including dental school, is based on the performance of aspirant students in the Irish Leaving Certificate Examination, which is a state examination held each June (14). Aspirant students apply centrally for admission to university courses to the Central Applications Office (CAO), 4 months before sitting the Leaving Certificate Examination (2). Under the Irish Universities Act (1997), each University has the ability to set their own entrance/selection criteria (14), and the CAO selects University students based on their performance in the Leaving Certificate Examination on behalf of the Universities. To gain entry to University courses in Ireland, students are required to take the Leaving Certificate Examination in a minimum of six subjects, and to achieve passing grades in English, Irish, Mathematics and a Modern Continental Language such as French or German. Most subjects are available at two levels of difficulty, ‘higher’ and ‘ordinary’. Grades are awarded to each student based on their examination results. The CAO processes these results, and each student is awarded a number of ‘points’ based on grades achieved and level of difficulty (14). The maximum number of points awardable is 600. There are two dental schools in Ireland, and for the last 10 years, a minimum of 515 points has been required to gain entry. Should a student be dissatisfied with their results or unable to enter the programme of study they desired, they may repeat the Leaving Certificate Examination the following June.

In consideration of the issues highlighted by the studies mentioned above, and in the absence of previous investigation of dental school admissions in Ireland, the aim of this investigation was to examine the suitability of the Irish Leaving Certificate Examination as a predictor of student performance in dental school. An a priori hypothesis for this investigation was that there would be an association between the performance of dental students during their Leaving Certificate Examination and their subsequent performance at dental school.

Materials and methods

For this investigation, information for all dental students who entered the primary dental degree programme at the National University of Ireland, Cork during the years 1997, 1998 and 1999. This information was retrieved by the Registrar’s Office, National University of Ireland, Cork, Ireland. All information was communicated to the authors in a coded format, and it was not possible to identify any students from the records examined.

The majority of students in the primary dental degree programme in Cork enter the programme via the CAO, as described previously. The University also accepts a small number of students via ‘non-traditional’ routes such as mature/graduate-entry and overseas students. For the purposes of this investigation, information relating to the ‘non-traditional’ entry students was excluded.

Following elimination of these students, there were a total of 95 students, who had entered the dental programme based on their academic performance in the Leaving Certificate Examination. The numbers of points for each student were recorded, as were the total number of marks awarded to each student in the First and Final Dental Examinations. These examinations were selected for this study as the first year is the year traditionally associated with students either failing or leaving the course, and the final year is when students graduate. At the National University of
Ireland, Cork, the First Dental Examination includes examination of theoretical knowledge in Anatomy, Physiology and Biochemistry. The Final Dental Examination includes examination of theoretical knowledge and clinical skills in Restorative Dentistry, Dental Surgery and Oral Health & Development (Paediatric Dentistry, Orthodontics and Dental Public Health).

Information was also retrieved in relation to performance within individual modules, the gender of the student, and if they had repeated the Leaving Certificate Examination. The data was analysed using SPSS for Windows (Version 11). Scatter plots, Pearson's correlation coefficient and regression were used to examine the relationship between the explanatory variables (gender, points obtained in the Leaving Certificate Examination and whether or not a student had repeated the Leaving Certificate Examination) and the response variables (overall mark for first year dental examinations, overall mark for final year dental examinations, marks in individual modules). Data for points obtained in the Leaving Certificate Examination was positively skewed so the non-parametric Mann–Whitney U test was used to compare the median of points for different groups (males and females, students who repeated the Leaving Certificate Examination or not). A significance level of 5% was used for all hypothesis tests.

Results

Information relating to 95 students was available. Of these 95 students, six changed University course, failed or dropped out. Information relating to the number of points awarded in the Leaving Certificate Examination was available for 92 students, whilst information relating to gender was available for 93 students.

Points awarded to dental students ranged from 515 to 600 with a median value of 535 points. Fifty-five per cent of dental students (n = 51) were female, and 45% (n = 42) were male. There was no significant difference between the points awarded to males or females (medians of 540 and 535, respectively) in their Leaving Certificate Examination. Thirty-two per cent (n = 30) of the students repeated the Leaving Certificate at least once. Males were more likely to repeat the Leaving Certificate (41% of males compared with 26% of females).

The overall mark for a particular year was calculated as a weighted average of the marks awarded for individual modules. For the purposes of this study, only marks awarded for the first sitting of the examination were considered, i.e. results of repeated examinations were not considered. Table 1 summarises the overall mark in year 1 and year 5 by gender and whether or not the student repeated the Leaving Certificate Examination. There was no significant difference between the overall mark awarded in the First and Final Dental Examinations for males and females. Neither was there a significant difference between overall mark in the First or Final Dental Examination when the number of sittings of the Leaving Certificate Examination was considered.

Relationship between points in the Leaving Certificate Examination and overall mark the First Dental Examination

Figure 1 demonstrates the relationship between points achieved and overall mark in the First Dental Examination. There was a tendency for the overall mark in the First Dental Examination to increase as points achieved in the Leaving Certificate Examination increased. There were exceptions to this: for example, two students had overall marks <40% but high points (585 and 590) and one student obtained the highest examination mark in first year but had low points (520). Pearson's correlation coefficient (r), which measures the strength of the linear relationship between points and overall mark, was 0.22. This value was statistically significantly different from zero (P < 0.05). A regression model was fitted to the data. Because of the presence of outliers, a curve fitted the data better than a linear model. It was concluded from this model that points achieved in the Leaving Certificate Examination were a statistically significant predictor of overall mark (P < 0.05). However, the model only explains 12% of the variation in overall mark in the First Dental Examination.

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**TABLE 1. Summary of the overall mark awarded in the First and Final Dental Examinations considered by gender and number of sittings of the Leaving Certificate Examination**

<table>
<thead>
<tr>
<th></th>
<th>Males</th>
<th>Females</th>
<th>Repeat Leaving Certificate</th>
<th>Did not repeat Leaving Certificate</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Dental Examination, Median mark (minimum, maximum)</td>
<td>58 (37, 70)</td>
<td>56 (23, 70)</td>
<td>56 (30, 70)</td>
<td>58 (23, 70)</td>
</tr>
<tr>
<td>Final Dental Examination, Median mark (minimum, maximum)</td>
<td>60 (53, 69)</td>
<td>61 (54, 70)</td>
<td>59 (53, 69)</td>
<td>61 (54, 70)</td>
</tr>
</tbody>
</table>
gender or the number of repeat sittings of the Leaving Certificate Examination did not improve the percentage of variation explained, nor are these statistically significant predictors of overall mark.

**Relationship between points in the Leaving Certificate Examination and overall mark for the Final Dental Examination**

There was no relationship between points achieved in the Leaving Certificate and the overall mark achieved in the Final Dental Examination. This is illustrated in Fig. 2, where there is no obvious pattern between points achieved in the Leaving Certificate Examination and marks achieved in the Final Dental Examination. The correlation coefficient was found to be close to zero ($r = 0.09$).

**Discussion**

There is inconsistency amongst published investigations regarding the most suitable indicator of performance in university programmes, including dental school. Studies by McManus et al. found a positive correlation between the performance of aspirant UK medical students in their A-level examinations and their subsequent performance in medical school (1, 4). This group advanced the argument that this predictive value of previous academic performance could be explained by three arguments: achievement, ability and motivation (1). The ‘achievement argument’ is based on the fact that successful A-level students will
have achieved a very good grounding in subjects relevant to medicine, such as biology and chemistry. The ‘ability’ argument claims that successful performance in A-levels is a reflection of the intelligence of the student, which will have a positive effect on their university performance. The final argument, that of ‘motivation’ suggests that students who are motivated to achieve the necessary A-level grades will also be sufficiently motivated to succeed in medical school. However, in contrast to medical degree programmes, the association between previous academic performance and subsequent performance at university in non-medical programmes is not clear. In Ireland, similar investigations into the performance of students in university programmes in business (12) and teacher-training (13) have found that these are not always related to previous academic performance. An examination of entrants to pharmacy school programmes in the USA (15) has demonstrated that performance in the pharmacy programme may not be predicted by the previous academic performance of the applicant. The reasons for the difference in the predictive values of previous academic performance between medical and other programmes may be a reflection a self-selecting bias. The minimum grades required for entry to medical school are greater than those required for most other programmes, including those mentioned above (i.e. pharmacy, business and teacher-training) (1). Based on the arguments of McManus et al. (1), medical school applicants will be of higher achievement, greater ability and more motivated than applicants to other programmes, and are effectively, more likely to succeed. In terms of admission to dentistry, evidence to support the relevance of specific predictive factors is often conflicting. The principal difference between success in dental programmes and other (non-dental) programmes is that success in dental programmes is dependent on academic as well as clinical (e.g. psychomotor skills and manual dexterity) success.

In North America, dental school aspirants normally complete an undergraduate degree in science or the arts prior to entering dental school. Sandow et al. (16) found that in a cohort of dental students in Florida that previous academic performance [Grade Point Average (GPA) in undergraduate science degrees] and interview performance were the most consistent predictors of subsequent performance in dental school (it should be remembered that interviews allow assessment of non-cognitive abilities in addition to cognitive abilities). This investigation considered Dental Admissions Test (DAT) score and Perceptual Motor Aptitude Test (PMAT) score (both cognitive assessments), yet these were not as consistent at predicting subsequent success as GPA (previous academic performance) and interview performance. In contrast, in a study of international dental student applicants to a US dental program in California (17) found that assessments of manual dexterity were significant predictors of academic performance and clinical competency. Gray et al. (7) have found that whilst assessments of cognitive abilities in the DAT may have a role in predicting performance in pre-clinical examinations, they are of no use in predicting clinical performance. In a recent investigation of the similar Canadian Dental Aptitude Test, Smithers et al. (18) concurred with the findings of Gray et al. (7). One investigation of performance in US dental hygiene programmes (19) found that previous GPA and performance in the Scholastic Aptitude Test (SAT – test of cognitive abilities) were predictors of performance. In Europe, studies from the UK in the 1970 have found both positive (9, 10) and negative (11) correlations between previous academic performance and subsequent performance in the dental school. The role of the structured interview in selecting dental students has attracted interest in recent years (3, 16, 18). A survey of UK dental students in one dental school in the late 1990s (3) found a positive correlation between performance at interview and performance in pre-clinical examinations. To revisit the investigations by Sandow et al. (16) and Smithers et al. (18) mentioned above, it would seem that performance in a structured interview is a predictor of performance, and may be more useful than assessment of previous academic performance, or tests of cognitive abilities such as the Perceptual Motor Aptitude Test or Canadian Dental Aptitude Test (18). Moreover, in relation to the previously mentioned investigation into the selection of students for teacher-training programmes in Ireland, whilst consideration of previous academic performance may be of little value, a positive correlation between performance at a selection interview and subsequent assessment of classroom teaching skills during teacher training has been demonstrated (13). To consider some ‘non-traditional’ selection processes, in Sweden, a positive correlation between success in clinical dental subjects and completion of manual dexterity assessments at time of interview has been demonstrated (6). In Flemish universities, positive correlations with subsequent performance university examinations was found in association with novel assessments of non-cognitive abilities, through the use of ‘situational selection tests’, for selection of medical and dental students in Flemish universities (1).
Perhaps, the confusion over the ‘best’ predictive factor(s) is best summed up in the following statement from a recent review of admissions procedures by Ranney et al. ‘…[while] the academic average is [the best] predictor [of performance]…dental educators who believe that evidence of manual dexterity or perceptual ability must be a part of the admissions decision can find enough evidence to justify doing so…’ (5) Does this suggest that it is possible to advance arguments to support each form of ‘traditional’ selection process?

This investigation has a number of limitations. These relate to the relatively small sample size and the educational profile of the cohort examined. This study considered only 95 students, who entered the dental programme in three subsequent years. This limitation was a result of the record keeping protocol in the University, a new system was introduced in 1997, and the period 1997–1999 was the only period for which complete information was available. In relation to the educational profile of the cohort, each of the subjects achieved over 515 points in the Leaving Certificate Examination, and could be considered ‘high achievers’, being in the top 10% of candidates sitting the examination. In a similar way to the previous work by McManus et al. (1) it can be difficult to discriminate between students who achieve such high grades. In relation to the exploratory analysis of the correlation between the number of points and performance in individual modules, no adjustment was made for multiple testing and the sample size varied for each module. Within this small sample, assessment and grading of students was relatively consistent.

This study has demonstrated that the criterion used for selecting dental students in Ireland, the Irish Leaving Certificate Examination, was poorly predictive of the performance of students in dental school, specifically in relation to clinical subjects. In Ireland, University education is primarily funded by the state; students themselves do not usually pay tuition/clinical fees. Therefore, there is a responsibility when selecting students to choose those who are best suited and are likely to succeed. This will avoid a subsequent loss of students due to failure/drop-out (3), and ensure high-quality skilled professionals to serve the public. Based on the limitations and results of this study, it would seem that the grades in the Irish Leaving Certificate Examination may be of limited value in predicting subsequent performance of students in dental school. As the dental degree awarded at the National University of Ireland, Cork is suitable for the purposes of registration as a dental practitioner with the Irish Dental Council and the United Kingdom’s General Dental Council, the Final Dental Examination is a de facto assessment of the suitability of the student to practice as a dentist in Ireland, the UK and Europe. Based on these results, and the review of the literature, is it therefore time to consider alternate, more suitable methods, perhaps assessing previous academic performance, cognitive and non-cognitive abilities, and manual dexterity when selecting dental students in Ireland?

Conclusion

In Ireland, students are selected for dental school solely based on their performance in their Leaving Certificate Examination. This investigation has found:

- A weak association between the number of points achieved by students in their Leaving Certificate Examination and their performance in the First Dental Examination (using points as an explanatory variable in a model explained about 12% of the variation in exam results).
- No association between the number of points achieved by students in their Leaving Certificate Examination and their performance in the Final Dental Examination.
- A correlation between the number of points achieved in their Leaving Certificate Examination and a small number of individual modules which were related to either basic sciences or assessments of pre-clinical theoretical knowledge.

Based on the limitations of this study, the selection process for dental students in Ireland appears to be of limited value. It is worth considering the suitability of alternate methods, perhaps assessing previous academic performance, cognitive and non-cognitive abilities, and manual dexterity, when selecting dental students in Ireland.

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