Associations Among Predental Credentials and Measures of Dental School Achievement

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Abstract: The purpose of this study was to investigate the associations among several dental school admission criteria and several measures of dental school achievement. Data were collected for 2000–07 University of Iowa dentistry graduates, including five specific preadmission credentials and five specific measures of dental school achievement for each student. Pearson product moment correlations or Mann-Whitney U statistics were computed for the association of each of the ten variables with the nine others. The strongest correlation observed was between predental science grade point average (GPA) and overall predental GPA. Dental Admission Test (DAT) Academic Average was very strongly correlated with DAT Total Science, and both of these were each moderately correlated with DAT Perceptual Ability, predental science GPA, and overall predental GPA. Among the measures of dental school achievement, the strongest association was observed between National Board Dental Examination (NBDE) scores and dental school GPA. These were also moderately correlated with final clinical grade. All of the measures of dental school achievement were slightly stronger for candidates who passed the Central Regional Dental Testing Service (CRDTS) examination than for those who failed that exam. Of the predental credentials considered, predental science GPA and overall predental GPA were the best predictors of dental school GPA. DAT Academic Average was the best predictor of NBDE scores. Although DAT Perceptual Ability was the best predictor of clinical competency at the time of graduation, these two variables were only weakly correlated. DAT Perceptual Ability scores and overall predental GPA were slightly higher for candidates who passed the CRDTS examination than for those who failed that exam.

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A body of scientific research has shown that general cognitive ability predicts a broad spectrum of important life outcomes, behaviors, and performances, including academic achievement, health-related behaviors, social outcomes, job performance, and creativity.[1] But substantial controversy still exists about ability determinants of individual differences in performance during and subsequent to skill acquisition.[2] It has been argued by some that academic tasks are fundamentally different from practical or real-world tasks, in that academic tasks tend to be well defined, have only a single correct answer, and be self-contained.[3] Others have held that the nature and determinants of academic performance are similar, although not fully identical, to the nature and determinants of job performance.[4]

Predental college grades and scores on the Dental Admission Test (DAT) are among the criteria used by dental school admissions committees to select candidates out of an extremely competitive applicant pool. Each of the various selection criteria is considered to measure a unique construct, but all are believed to be indicators of a candidate's potential for success in dental school and as a dental professional; thus, some overlap between the unique constructs is to be expected. Only one study has previously examined associations among overall predental grade point average (GPA), predental science GPA, and component DAT scores.[5]

A few reports have described the correlations among various measures of dental school achievement,[6,7] as well as those between measures of dental school achievement and performance on dental licensure examinations.[8-12] In addition, numerous authors have investigated the relationships between admission criteria and dental school performance.[6,7,13-29] In a 2005 review of the literature, Ranney et al. summarized that predental GPA and DAT scores provide

dental schools in the United States and Canada with defensible methods for selecting students.[30]

The purpose of our study was to investigate the associations among several admission criteria, among several measures of dental school achievement, and between admission criteria and measures of dental school achievement for 2000–07 graduates of the University of Iowa College of Dentistry.

Methods

Data were collected for 2000–07 University of Iowa dentistry graduates, including five specific preadmission credentials and five specific measures of dental school achievement for each student.

Preadmission Credentials

In addition to overall predental college GPA and predental college science GPA, preadmission credentials analyzed included the Academic Average score, Perceptual Ability Test score, and Total Science score from the Dental Admission Test (DAT).

The DAT is conducted by the American Dental Association (ADA) and has been in operation on a national basis since 1950. The testing program is designed to measure general academic ability, comprehension of scientific information, and perceptual ability. All U.S. dental schools require candidates for admission to participate in the dental admission testing program. There are four individual tests contained in the DAT battery: I. Survey of the Natural Sciences (Biology, General Chemistry, and Organic Chemistry); II. Perceptual Ability; III. Reading Comprehension; and IV. Quantitative Reasoning. The entire program requires just over one half-day for administration.[31]

On the DAT, eight standard test scores are reported: Quantitative Reasoning, Reading Comprehension, Biology, General Chemistry, Organic Chemistry, Total Science (combining Biology, General Chemistry, and Organic Chemistry), Perceptual Ability, and Academic Average (the average of the standard scores on the Quantitative Reasoning, Reading Comprehension, Biology, and General and Organic Chemistry tests). The results are reported in terms of standard scores rather than raw scores or percentile equivalents. The current standard score scale has been used since October 1988. Scores range from 1 to 30. The standard score of 17 typically signifies average performance on a national basis.[32]

Measures of Dental School Achievement

In addition to overall dental school GPA, dental school achievement measures analyzed in this study included scores on Part I and Part II of the National Board Dental Examination (NBDE), final grade in the course 114:188 Clinical Competencies in Comprehensive Care, and pass/fail status on the student's first attempt at the Central Regional Dental Testing Service (CRDTS) licensure examination.

NBDE. The purpose of the NBDE is to assist state boards in determining qualifications of dentists who seek licensure to practice dentistry. The examination assesses the ability to understand important information from basic biomedical and dental sciences and also the ability to apply such information in a problem-solving context. Although written examinations may be developed at the local level, most licensing boards use the NBDE (Parts I and II) as a major portion of their written examination requirement.

The NBDE is organized into two parts. Part I is usually taken after two years of dental school; it consists of four examinations on the basic biomedical sciences (Anatomic Sciences, Biochemistry-Physiology, Microbiology-Pathology, and Dental Anatomy and Occlusion). Part II is usually taken during the last year of dental school; it consists of a comprehensive, one-and-a-half-day examination covering the clinical dental sciences (Operative Dentistry, Pharmacology, Endodontics, Periodontics, Oral and Maxillofacial Surgery/Pain Control, Prosthodontics, Orthodontics/Pediatric Dentistry, Oral Diagnosis, and Patient Management).

Generally, National Board results are reported in standard scores of 49 to 99. A score of below 75 is considered a failure and does not earn National Board credit. For Part I, one score is reported for each of the four examinations, plus an additional Part I Average Score.[33] For Part II, a single comprehensive score is reported.[34] (Beginning in January 2007, Part I was restructured to be interdisciplinary in nature and more clinically relevant. Items from the traditional basic and dental science disciplines are now intermingled in Part I, and clinically relevant items are included in the form of testlets.[35] During the years considered in this study, all students took the examination in the earlier format.)

Clinical Competencies in Comprehensive Care. The course 114:188 Clinical Competencies in Comprehensive Care carries more semester credit

hours than any other single course in the entire dental curriculum at the University of Iowa College of Dentistry. The course grade is based on evaluation by all clinical instructors who have supervised the student in the comprehensive care (Family Dentistry) clinic during the final thirty weeks of dental school. It is believed that the grade earned in 114:188 represents the clinical faculty's most accurate assessment of the student's clinical competency at the time of graduation.

The CRDTS Examination. Prior to 2001, the CRDTS examination consisted of two parts, the Restorative Clinical Examination and the Periodontal Clinical Examination. Scoring for the examination was principally "conjunctive," in that a separate total score was reported for each part, and a failure of one part of the examination necessitated a retake of only that part within an eighteen-month period. From 2001 through 2005, the CRDTS exam was scored using a compensatory scoring system that yielded one overall score. Candidates who failed the exam now had to retake the entire exam rather than retaking only the part(s) they failed as in the past. Beginning with the 2005–06 examination cycle, the Central Regional Dental Testing Service, Inc. adopted the ADLEX format developed by the American Board of Dental Examiners, Inc. (ADEX) as the CRDTS examination. The examination now consists of five separate parts—I) computer-based examination; II) manikin-based endodontics examination; III) manikin-based fixed prosthodontics examination; IV) patient-based periodontal examination; and V) patient-based restorative examination—and utilizes a conjunctive scoring routine; that is, candidates who are unsuccessful with any part of the examination must retake only the part(s) they failed. The CRDTS offers the ADLEX examination in two formats: the Traditional Format (in which the examination is administered in its entirety over the course of three days), and the Integrated Format (in which the examination is administered in segments over the course of eight months to eligible dental students during their senior year in dental school). All University of Iowa dental students in the graduating Classes of 2006 and 2007 who took the CRDTS-ADLEX examination took it in the Integrated Format.

Mean value, standard deviation, range, and number of students were tabulated for five preadmission credentials (DAT Academic Average score, DAT Perceptual Ability Test score, DAT Total Science score, predental science GPA, and overall predental GPA) and five measures of dental school achievement

(NBDE Part I average score, NBDE Part II score, overall dental school GPA, final 114:188 clinical grade, and pass/fail of the CRDTS examination on the first attempt) for each graduation year from 2000 through 2007. Pearson product moment correlations (r) were computed for the association of each preadmission credential with each of the other preadmission credentials, of each measure of dental school achievement with each of the other measures of dental school achievement, and of each preadmission credential with each measure of dental school achievement. Utilizing the Wilcoxon-Mann-Whitney two-sample rank-sum test, measures of dental school achievement and preadmission credentials were compared between the group of candidates who passed the CRDTS examination (on the first attempt) and those who failed the examination.

Results

Descriptive statistics for the five preadmission credentials are shown in Table 1. All five of these parameters were fairly consistent, demonstrating a slight trend of increasing with time over the eight years reported. Annual mean DAT Academic Average score ranged from 17.76 (Class of 2003) to 19.00 (Class of 2006), with an overall mean of 18.34 for all eight years. Annual mean DAT Perceptual Ability score ranged from 16.24 (Class of 2003) to 17.96 (Class of 2006), with an overall mean of 17.16 for all eight years. Annual mean DAT Total Science score ranged from 17.51 (Class of 2003) to 18.79 (Class of 2006), with an overall mean of 18.13 for all eight years. Annual mean predental science GPA ranged from 3.22 (Class of 2001) to 3.51 (Class of 2007), with an overall mean of 3.37 for all eight years. Annual mean overall predental GPA ranged from 3.32 (Class of 2001) to 3.59 (Class of 2007), with an overall mean of 3.46 for all eight years.

Correlations between the preadmission credentials are shown in Table 2. There was a very strong correlation between DAT Academic Average score and DAT Total Science score (r=0.899). The DAT Perceptual Ability score showed a moderate degree of correlation with the DAT Academic Average score (r=0.504) and with the DAT Total Science score (r=0.470). A very strong correlation was observed between predental science GPA and overall predental GPA (r=0.936). Predental science GPA and overall predental GPA were moderately correlated with the DAT Academic Average score (r=0.472 and 0.440)

Table 1. Predental credentials of 2000–07 graduates of the University of Iowa College of Dentistry (mean ±standard deviation [range])

	DAT Academic Average	DAT Perceptual Ability	DAT Total Science	Predental Science GPA	Overall Predental GPA
Class of 2000	17.91 ±1.70 [14–21] n=67	16.88 ±2.60 [12–24] n=67	17.79 ±1.85 [14–22] n=67	3.27 ±0.44 [2.49–4.00] n=67	3.38 ±0.37 [2.62–4.01] n=67
Class of 2001	17.77 ±1.75 [14–23] n=71	16.28 ±2.56 [12–26] n=71	17.70 ±1.78 [14–22] n=71	3.22 ±0.37 [2.25–3.89] n=69	3.32 ±0.32 [2.35–3.92] n=70
Class of 2002	17.94 ±1.99 [13–25] n=64	17.22 ±2.53 [11–29] n=64	17.77 ±2.22 [13–25] n=64	3.27 ±0.44 [2.30–4.00] n=68	3.39 ±0.37 [2.41–4.00] n=71
Class of 2003	17.76 ±2.10 [14–24] n=70	16.24 ±2.77 [10–22] n=70	17.51 ±2.34 [13–24] n=70	3.32 ±0.42 [2.42–4.12] n=72	3.43 ±0.34 [2.51–4.09] n=72
Class of 2004	18.73 ±2.25 [14–25] n=73	17.71 ±2.62 [11–24] n=73	18.40 ±2.41 [14–24] n=73	3.39 ±0.40 [2.40–4.09] n=72	3.47 ±0.32 [2.67–4.00] n=73
Class of 2005	18.96 ±2.10 [15–25] n=73	17.89 ±2.64 [14–26] n=73	18.52 ±2.02 [15–26] n=73	3.42 ±0.43 [2.34–4.06] n=73	3.53 ±0.34 [2.82–4.00] n=73
Class of 2006	19.00 ±2.09 [14–25] n=73	17.96 ±2.71 [12–25] n=73	18.79 ±2.29 [14–27] n=73	3.50 ±0.40 [2.68–4.20] n=73	3.58 ±0.32 [2.68–4.13] n=73
Class of 2007	18.51 ±1.95 [15–24] n=75	16.99 ±2.05 [13–24] n=75	18.44 ±2.17 [14–24] n=75	3.51 ±0.32 [2.61–4.05] n=75	3.59 ±0.27 [2.86–4.02] n=75
All Classes	18.34 ±2.05 [13–25] n=566	17.16 ±2.63 [10–29] n=566	18.13 ±2.18 [13–27] n=566	3.37 ±0.41 [2.25–4.20] n=569	3.46 ±0.34 [2.35–4.13] n=574

Table 2. Correlation between various predental credentials (Pearson correlation coefficient, *r*)

	DAT Academic Average	DAT Perceptual Ability	DAT Total Science	Predental Science GPA	Overall Predental GPA
DAT Academic Average	1.00				
DAT Perceptual Ability	0.504	1.00			
DAT Total Science	0.899	0.470	1.00		
Predental Science GPA	0.472	0.288	0.430	1.00	
Overall Predental GPA	0.440	0.252	0.400	0.936	1.00

Note: All correlation coefficients are significantly different from zero (p<.05).

and with the DAT Total Science score (r=0.430 and 0.400), and weakly correlated with the DAT Perceptual Ability score (r=0.288 and 0.252). All correlation coefficients were significantly different from zero (p<.05).

Descriptive statistics for the five measures of dental school achievement are tabulated in Table 3.

Annual mean National Board Part I scores ranged from 84.0 (Class of 2000) to 87.3 (Class of 2005), with an overall mean of 86.4 for all eight years. Annual mean National Board Part II scores ranged from 82.7 (Class of 2001) to 86.7 (Class of 2006), with an overall mean of 83.9 for all eight years. Annual mean four-year dental school grade point averages ranged

from 3.15 (Class of 2001) to 3.34 (Class of 2002), with an overall mean of 3.25 for all eight years. Annual mean 114:188 final clinical grade ranged from 2.87 (Class of 2000) to 3.14 (Class of 2006), with an overall mean of 3.02 for all eight years. CRDTS pass/fail rates ranged from 78.3%/21.7% (2006) to 94.3%/5.7% (2002).

Correlations among four measures of dental school achievement are shown in Table 4. There was a strong correlation between scores on National Board Parts I and II (r=0.789). Four-year dental school GPA was strongly correlated with scores on National Board Part I (r=0.757) and Part II (r=0.696). Final clinical grade for course 114:188 Clinical Competencies in Comprehensive Care showed a moderate correlation with four-year dental school GPA (r=0.588), and a weaker correlation with scores on National Board Part I (r=0.339) and Part II (r=0.348). All

Table 3. Measures of dental school achievement of 2000–07 graduates of the University of Iowa College of Dentistry (mean ±standard deviation [range])

	NBDE I	NBDE II	Dental School GPA	Final Clinical Grade	CRDTS Pass/Fail
Class of 2000	84.0 ±4.4 [76–93] n=67	83.1 ±4.5 [75–93] n=67	3.19 ±0.39 [2.26–4.00] n=67	2.87 ±0.73 [D+(1.33)–A(4.00)] n=67	91.2%/8.8% n=57
Class of 2001	85.4 ±4.6 [76–97] n=71	82.7 ±4.8 [70–94] n=71	3.15 ±0.44 [2.15–3.98] n=71	2.96 ±0.77 [D(1.00)–A+(4.33)] n=71	90.9%/9.1% n=66
Class of 2002	87.1 ±4.6 [77–99] n=71	83.4 ±4.8 [75–99] n=71	3.34 ±0.42 [2.39–4.00] n=71	3.09 ±0.73 [D(1.00)–A(4.00)] n=71	94.3%/5.7% n=53
Class of 2003	86.5 ±4.9 [77–97] n=72	84.1 ±4.7 [75–95] n=72	3.22 ±0.41 [2.40–3.96] n=72	2.93 ±0.80 [D(1.00)–A+(4.33)] n=72	93.8%/6.2% n=65
Class of 2004	86.9 ±4.6 [77–97] n=73	84.3 ±4.0 [74–93] n=72	3.27 ±0.35 [2.06–4.00] n=73	3.05 ±0.64 [C-(1.67)–A+(4.33)] n=73	92.2%/7.8% n=64
Class of 2005	87.3 ±4.7 [78–98] n=73	83.8 ±4.2 [73–92] n=73	3.22 ±0.37 [2.54–3.99] n=73	3.01 ±0.70 [C-(1.67)–A(4.00)] n=72	84.5%/15.5% n=71
Class of 2006	87.1 ±5.5 [69–99] n=73	86.7 ±4.9 [77–97] n=71	3.29 ±0.36 [2.52–4.00] n=73	3.14 ±0.65 [C-(1.67)–A+(4.33)] n=73	78.3%/21.7% n=69
Class of 2007	86.3 ±4.1 [80–97] n=74	83.0 ±3.5 [74–93] n=74	3.31 ±0.34 [2.52–3.97] n=75	3.09 ±0.65 [D(1.00)–A(4.00)] n=75	79.2%/20.8% n=72
All Classes	86.4 ±4.8 [69–99] n=574	83.9 ±4.6 [70–99] n=571	3.25 ±0.39 [2.06–4.00] n=575	3.02 ±0.71 [D(1.00)–A+(4.33)] n=574	87.6%/12.4% n=517

Table 4. Correlation among various measures of dental school achievement (Pearson correlation coefficient, r)

	NBDE I	NBDE II	Dental School GPA	Final Clinical Grade
NBDE I	1.00			
NBDE II	0.789	1.00		
Dental School GPA	0.757	0.696	1.00	
Final Clinical Grade	0.339	0.348	0.588	1.00

Note: All correlation coefficients are significantly different from zero (p<.05).

correlation coefficients were significantly different from zero (p<.05).

Table 5 compares the four measures of dental school achievement between candidates who passed the CRDTS examination and those who failed (on the candidate's first attempt). All four measures (NBDE I, NBDE II, dental school GPA, and final clinical grade) were higher for the group who passed the examination than for those who failed. The median [quartiles (25th percentile and 75th percentile) reported in brackets] NBDE I score for candidates who passed/failed the CRDTS exam respectively are 86 [83, 90] and 84 [81, 88.5]. Median [quartiles] NBDE II scores were 84 [81, 87] and 82 [78.25, 85]. Median [quartiles] dental school GPAs were 3.30 [3.05, 3.57] and 3.11 [2.87, 3.35]. Median [quartiles] final clinical grades were 3.00 (B) [2.67 (B-), 3.67 (A-)] and 3.00 (B) [2.00 (C), 3.00 (B)]. All differences were significant at the p<0.05 level.

Table 6 shows the correlation between preadmission credentials and measures of dental school achievement. Scores on National Board Parts I and II were moderately correlated with DAT Academic Average score ($r=0.610$ and 0.524), DAT Total Science score ($r=0.582$ and 0.469), predental science GPA ($r=0.527$ and 0.460), and overall predental GPA ($r=0.497$ and 0.433) and weakly correlated with the DAT Perceptual Ability score ($r=0.363$ and 0.344). A somewhat similar trend was observed for four-year dental school GPA, which was moderately correlated with DAT Academic Average score ($r=0.494$), DAT Total Science score ($r=0.449$), predental science GPA ($r=0.537$), and overall predental GPA ($r=0.529$) and weakly correlated with the DAT Perceptual Ability score ($r=0.370$). Final clinical grade for course 114:188 showed a weak correlation with DAT Perceptual Ability score ($r=0.259$), DAT Academic Average score ($r=0.204$), predental science GPA ($r=0.277$),

Table 5. Comparison of various measures of dental school achievement between candidates who passed the CRDTS examination and those who failed (on the candidate's first attempt)

		Measures of Dental School Achievement			
		NBDE I	NBDE II	Dental School GPA	Final Clinical Grade
Candidates Who Passed CRDTS Exam	Median value [quartiles] n	86 [83, 90] n=453	84 [81, 87] n=452	3.30 [3.05, 3.57] n=453	3.00 (B) [2.67 (B-), 3.67 (A-)] n=453
Candidates Who Failed CRDTS Exam	Median value [quartiles] n	84 [81, 88.5] n=63	82 [78.25, 85] n=62	3.11 [2.87, 3.35] n=64	3.00 (B) [2.00 (C), 3.00 (B)] n=64
	Mann-Whitney U statistic	17328.5	17685.5	18575.5	18483.5
	p value (two-tail, normal approximation, corrected for ties)	0.006	0.001	<0.001	<0.001

Note: All differences significant (p<.05) between candidates who passed and candidates who failed the CRDTS exam.

Table 6. Correlation between predental credentials and measures of dental school achievement (Pearson correlation coefficient, *r*)

		Predental Credentials				
		DAT Academic Average	DAT Perceptual Ability	DAT Total Science	Predental Science GPA	Overall Predental GPA
Measures of Dental School Achievement	NBDE I	0.610	0.363	0.582	0.527	0.497
	NBDE II	0.524	0.344	0.469	0.460	0.433
	Dental School GPA	0.494	0.370	0.449	0.537	0.529
	Final Clinical Grade	0.204	0.259	0.152	0.277	0.276

Note: All correlation coefficients are significantly different from zero (p<.05).

and overall predental GPA (r=0.276) and a negligible correlation with DAT Total Science score (r=0.152). All correlation coefficients were significantly different from zero (p<.05).

Table 7 compares the preadmission credentials between candidates who passed the CRDTS examination and those who failed (on the candidate's first attempt). Of the five preadmission credentials (DAT Academic Average, DAT Perceptual Ability, DAT Total Science, predental science GPA, and overall predental GPA), only DAT Perceptual Ability score and overall predental GPA were higher for the group who passed the examination than for those who failed. The median [quartiles] DAT Perceptual Ability scores for candidates who passed/failed the CRDTS exam respectively are 17 [15, 19] and 16 [14, 18]. Median [quartiles] overall predental GPAs were 3.53 [3.25, 3.77] and 3.39 [3.18, 3.69]. Differences between the CRDTS pass/fail groups were not significant (p<0.05) for DAT Academic Average, DAT Total Science, or predental science GPA.

Discussion

Preadmission Credentials

The five preadmission credentials examined in this study remained fairly consistent through the years for 2000–07 graduates of the University of Iowa College of Dentistry, and these measures were reflective of national trends during that period. Annual mean DAT Academic Average scores of University of Iowa students ranged from 17.76 (Class of 2003) to 19.00 (Class of 2006), while the national average ranged from 17.9 (1997 enrollees) to 18.8 (2001, 2002 enrollees). Annual mean DAT Perceptual Ability scores of University of Iowa students ranged from 16.24 (Class of 2003) to 17.96 (Class of 2006), while the national average ranged from 16.9 (1997 enrollees) to 18.1 (2001, 2002 enrollees). Annual mean DAT Total Science scores of University of Iowa students ranged from 17.51 (Class of 2003) to 18.79 (Class of 2006), while the national average ranged from 17.6 (1997 enrollees) to 18.5 (2002 enrollees). Annual mean predental science GPAs of University of Iowa students ranged from 3.22 (Class of 2001) to 3.50 (Class of 2006), while the national average ranged from 3.22 (1997 enrollees) to 3.32 (2002 enrollees). Annual mean overall predental GPAs of University of Iowa students ranged from 3.32 (Class of 2001) to 3.58 (Class of 2006), while the national average ranged from 3.31 (1997 enrollees) to 3.42 (2001, 2002, 2004 enrollees).[36,37]

While there have been many studies examining the association between admission criteria and dental school performance, there is not as much in

Table 7. Comparison of predental credentials between candidates who passed the CRDTS examination and those who failed (on the candidate's first attempt)

		Predental Credentials				
		DAT Academic Average	DAT Perceptual Ability	DAT Total Science	Predental Science GPA	Overall Predental GPA
Candidates Who Passed CRDTS Exam	Median value [quartiles] n	18 [17, 19.75] n=446	17 [15, 19] n=446	18 [17, 19] n=446	3.42 [3.10, 3.74] n=447	3.53 [3.25, 3.77] n=452
Candidates Who Failed CRDTS Exam	Median value [quartiles] n	18 [17, 20] n=63	16 [14, 18] n=63	18 [16, 19] n=63	3.32 [2.96, 3.63] n=64	3.39 [3.18, 3.69] n=64
	Mann-Whitney U statistic	15440.5	16868	15675	16389.5	16729
	p value (two-tail, normal approximation, corrected for ties)	0.203†	0.010*	0.137†	0.059†	0.042*

*Differences significant (p<.05) between candidates who passed and candidates who failed the CRDTS exam.
†Differences not significant (p<.05) between candidates who passed and candidates who failed the CRDTS exam.

the literature concerning correlation of one preadmission credential with other preadmission credentials. In a study of all students admitted to the University of California, San Francisco School of Dentistry in 1996, 1997, and 1998 (Classes of 2000, 2001, and 2002), Gansky et al. reported a very strong association between predental science GPA and overall predental GPA (Spearman correlation co-efficient, r_s=0.90).[5] This is consistent with the correlation we observed between predental science GPA and overall predental GPA (r=0.936). An association between these two measures is not surprising, since the course grades contributing to predental science GPA are also considered in the computation of the overall predental GPA.

Gansky et al. also found DAT Perceptual Ability scores to have a moderate correlation with overall DAT scores (r_s=0.35), DAT scores to be weakly associated with predental science GPA and overall predental GPA (r_s=0.22 and 0.21, respectively), and DAT Perceptual Ability scores to have a very weak negative correlation with predental science GPA and overall predental GPA (r_s=-0.11 and -0.14, respectively).[5] These are not as strong as the associations we report for the same measures in our study.

Measures of Dental School Achievement

Scores on NBDE Parts I and II, four-year dental school GPA, and final grade for the clinical course 114:188 remained fairly consistent through the years for 2000–07 graduates of the University of Iowa College of Dentistry. The CRDTS pass-fail outcome (on the candidate's first attempt) ranged from 6 percent to 9 percent for the years 2000 through 2004, but the failure rate increased sharply in the last three years, with 15 percent failing in 2005, 22 percent in 2006, and 21 percent in 2007. The increased failure rate on the CRDTS examination is likely attributable, at least in part, to substantial changes in the format and scoring of the examination.

Several previous studies have investigated the possible association between various measures of dental school achievement, including overall dental school grade point average, performance in preclinical courses and clinical courses, scores on NBDE Parts I and II, and performance on clinical licensure examinations.

In an investigation of students matriculating through the University of Texas Health Science Center at San Antonio (UTHSCSA) Dental School

between 1993 and 1996, Hermesch et al. found dental school GPA to be strongly correlated with scores on National Board Part I (r=0.74 for Early Acceptance students; r=0.60 for "standard admissions" students) and Part II (r=0.72 for Early Acceptance students; r=0.64 for "standard admissions" students).[6] In a study of 836 D.D.S. graduates of the Baltimore College of Dental Surgery/Dental School, University of Maryland, during the years 1994 through 2002, Ranney et al. reported a strong correlation of four-year dental school GPA with NBDE Part II scores (r=0.75; r_s=0.75).[38] These are consistent with our findings that four-year dental school GPA was strongly correlated with scores on National Board Part I (r=0.757) and Part II (r=0.696)

In a study of eighty-four students at the Harvard School of Dental Medicine who graduated during the period 2002–04, Park et al. found no significant correlation between NBDE Part I scores and clinical productivity or clinical performance.[7] In our study, we found a weak correlation (r=0.339) between the final clinical grade for course 114:188 Clinical Competencies in Comprehensive Care and scores on National Board Part I.

In our study, we also report that four measures of dental school achievement were higher for the group who passed the CRDTS examination than for those who failed. Previous reports in the literature are somewhat contradictory on the association between performance on regional licensure examinations and measures of dental school achievement. In a 1981 study of new graduates of two dental schools, Hangorsky found no correlation between their academic rank as fourth-year dental students and their performance on the North East Regional Board (NERB) clinical examination.[8] In a study of 202 students at the Columbia University School of Dental and Oral Surgery from 1994 to 1997, Formicola et al. found no correlation between student performance on in-school clinical examinations and NERB examinations.[9] In a study of 835 D.D.S. graduates of the Baltimore College of Dental Surgery/Dental School, University of Maryland from 1994 through 2002, Ranney et al. reported that "NERB examination results from one dental school failed to be a good measure for detecting the quality of those graduates as determined by the dental school's faculty."[11] However, in a study of 524 University of Florida College of Dentistry graduates from 1996 to 2003, Stewart et al. identified a strong correlation between academic rank in dental school and performance on the Florida dental licensure exam.[12]

Correlation Between Predental Credentials and Measures of Dental School Achievement

In our study, scores on the National Board Parts I and II were moderately correlated with DAT Academic Average scores (r=0.610 and 0.524), DAT Total Science scores (r=0.582 and 0.469), predental science GPA (r=0.527 and 0.460), and overall predental GPA (r=0.497 and 0.433). These are higher correlations than the national trends for 2000–04, which showed scores on the NBDE Parts I and II were less strongly correlated with the DAT Academic Average score (r ranged from 0.420 to 0.516 for Part I and from 0.305 to 0.365 for Part II), DAT Total Science score (r ranged from 0.394 to 0.478 and from 0.243 to 0.330), predental science GPA (r ranged from 0.271 to 0.380 and from 0.185 to 0.323), and overall predental GPA (r ranged from 0.262 to 0.357 and from 0.180 to 0.334).[26]

Other investigations of the predictive value of DAT scores on NBDE scores reported correlations in the same range. In a study of 114 students matriculating at the University of Mississippi School of Dentistry from 1992 through 1995, De Ball et al. reported that DAT scores were moderately correlated with subtest scores on the NBDE Part I (r ranged from 0.460 to 0.553). Multiple regression analyses revealed that DAT Perceptual Ability Test scores were not significant predictors of scores on the NBDE Part I.[21] In an investigation of students matriculating through the University of Florida College of Dentistry from 1990 through 1995 (the graduating classes of 1994 through 1999), Sandow et al. found predental science GPA to be moderately correlated with scores on the NBDE Part I (r=0.309), Part II (r=0.280), and overall dental school GPA (r=0.425). They found DAT Academic Average scores to have stronger correlations with scores on the NBDE Part I (r=0.507), Part II (r=0.433), and dental school GPA (r=0.317). DAT Perceptual Ability scores had a weaker correlation with scores on the NBDE Part I (r=0.263), Part II (r=0.304), and dental school GPA (r=0.198).[20] In a study of 244 students who matriculated at the Harvard School of Dental Medicine during the period of 1995–2002, Bergman et al. reported that DAT scores were relatively poor predictors of NBDE Part I subtest performance.[28] In an investigation of 225 students in the first three classes at the University of Nevada, Las Vegas, School of Dental Medicine, Kingsley et al. reported that certain DAT section scores were significantly correlated with the NBDE Part I (r ranged from 0.122 to 0.304) and with four-year dental school GPA (for the initial cohort class of seventy-four students, r ranged from 0.064 to 0.332).[29]

Hermesch et al. found predental GPA to have some correlation with dental school GPA (r=0.50 for Early Acceptance students; r=0.42 for "standard admissions" students), and scores on the National Board Part I (r=0.39 for Early Acceptance students; r=0.28 for "standard admissions" students) and Part II (r=0.48 for Early Acceptance students; r=0.29 for "standard admissions" students).[6] Kingsley et al. reported a weak correlation of predental science GPA and overall predental GPA with the NBDE Part I (r=0.227 and 0.222) and with four-year dental school GPA (r=0.217 and 0.224).[29]

In our study, the DAT Perceptual Ability score was observed to be the best predictor of the grade earned in 114:188, but the DAT Perceptual Ability score only accounted for less than 8 percent of the variation in the 114:188 grade (r=0.280). Similar findings have been previously reported by others. Park et al. reported that clinical performance on operative procedures was significantly associated with predental science GPA and DAT biology section score, but found no statistically significant predictors of clinical performance for major restorative or removable prosthodontic procedures. They concluded that it is possible that the overlap in skill sets required for success in the predental/preclinical and clinical areas is minimal.[7] In an investigation of students from the Temple University School of Dentistry graduating classes of 1998 to 2001, Gray and Deem found a significant correlation of the DAT Perceptual Ability score with grades in preclinical technique courses (r=0.496), but a weak correlation of either the DAT Academic Average score or overall predental GPA with grades in preclinical technique courses (r=0.188 and 0.173, respectively).[22] In another study regarding the same students, Gray et al. reported a weak to insignificant correlation of the DAT Academic Average scores and DAT Perceptual Ability Test scores with final grades in clinical courses (r=0.068 and 0.051, respectively).[23]

Conclusions

The highest correlation observed in this study was between predental science GPA and overall predental GPA. An association between these two measures is not surprising, since the course grades contributing to predental science GPA are also con-

sidered in the computation of the overall predental GPA. Of the other predental credentials considered in this study, the DAT Academic Average score was very strongly correlated with the DAT Total Science score, and both of these variables were each moderately correlated with the DAT Perceptual Ability score, predental science GPA, and overall predental GPA. This suggests that, while each of these five measures identifies a unique construct, there is likely overlap among those constructs, with the greatest overlap occurring between the constructs measured by the DAT Academic Average and Total Science scores.

Among the measures of dental school achievement, the strongest association was observed between NBDE scores and four-year dental school GPA. All three of these variables were also moderately correlated with the final grade in the clinical course 114:188. This suggests that there is likely overlap between the constructs measured by these variables, with greater overlap occurring between NBDE scores and four-year dental school GPA. All of the measures of dental school achievement were slightly stronger for candidates who passed the CRDTS examination than for those who failed that exam, suggesting that some overlap may occur between the construct identified by the CRDTS examination and the other four variables.

Of the predental credentials considered, predental science GPA and overall predental GPA were the best predictors of four-year dental school GPA. Again, it could be argued that the constructs identified by these measures overlap. The DAT Academic Average score was the best predictor of NBDE scores. Although the DAT Perceptual Ability score was the best predictor of clinical competency at the time of graduation (as measured by the grade earned in 114:188), these two variables were only weakly correlated. The DAT Perceptual Ability scores and overall predental GPA were slightly higher for candidates who passed the CRDTS examination than for those who failed that examination.

In summary, then, the results of this study suggest that students who demonstrate strength in one didactic or cognitive measure may be more likely to achieve high scores on other didactic or cognitive measures. Students who have done well on standardized, multiple-choice, fill-in-the-dot tests are likely to do well on subsequent standardized, multiple-choice, fill-in-the-dot tests. Students who earn a high grade point average in undergraduate school are likely to earn a high GPA in dental school. This is, in essence, the rationale used by dental school admissions committees when they rely heavily on GPA and DAT scores in making admission decisions. And it seems to work reasonably well if we only consider didactic and cognitive measures such as National Board Dental Examination scores and dental school GPA to be the ultimate measure of success in dental education. But while these are important benchmarks of dental school achievement, the admissions process should identify applicants who are likely to excel on other measures of dental school achievement as well. Moreover, the process should identify applicants who show promise of becoming successful oral health practitioners (and future dental faculty members[39]). As Chmar et al. note, "Dental schools . . . have the responsibility to administer a broadly considered and fair process that enables the selection of a diverse body of capable students, giving rise to competent graduates and practitioners who can best serve the profession, the public's health, and the public good."[40] However, even a valid admissions process that reliably selects the "right" students is not a guarantee that students will achieve their full potential in dental school. It is the duty of dental school faculty to design, implement, and perpetually refine relevant curricula in order to facilitate the development of capable students into complete, competent professionals. This is an extremely worthwhile area for continuing discussion, investigation, and innovation.

Acknowledgments

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