

## Exploring Preadmission Criteria as Predictors for Dental Hygiene Licensure Examinations Pass Rates

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### Introduction

Dental hygiene programs use a variety of admissions criteria in their admissions selection processes. Program admissions review committees identify students capable of successfully completing the dental hygiene program and passing licensure examinations. Admissions committees are often tasked with determining which variables are most likely to impact student success in academic programs. Research specific to dental hygiene admissions is inconsistent and the validity of the criteria used for admissions has not been established.

### Grade Point Average (GPA)

Previous academic achievement is a factor used in many allied health programs for admissions. A number of accredited dental hygiene programs consider high school grades in the admissions process. Twenty percent use high school science GPA, 9% use non-science GPA, 9% use overall high school GPA and 12% reported "other" for assessing high school grades. College grades are also considered in dental hygiene admissions.<sup>1</sup> Seventy percent of accredited programs use college science GPA, 45% use non-science GPA, 70% use overall college GPA and 26% reported "other" for assessing college grades.<sup>1</sup> DeAngelis noted positive associations between entering GPA and scores for the National Board Dental Hygiene Examination (NBDHE).<sup>2</sup> Bauchmoyer et al validated these findings.<sup>3</sup> Austin found college GPA was weakly correlated to NBDHE scores.<sup>4</sup> Alzahrani et al found GPA was not a statistically significant variable when associated with successful outcomes on the NBDHE.<sup>5</sup> Dental hygiene studies relate conflicting findings as to whether or not GPA is a positive predictor

### Abstract

**Purpose:** Research specific to dental hygiene can provide programs guidance to implement the best admissions practices. This study sought to first identify all admissions variables currently being utilized by dental hygiene programs. Secondly, this study looked for associations between these variables and program pass rates on national and regional clinical board examinations.

**Methods:** An online survey was sent by email to 309 dental hygiene chairs/program directors. The survey was comprised of 18 questions to collect program demographic information, program admissions requirements, and program pass rates on both the National Board Dental Hygiene Examination (NBDHE) and regional clinical board examinations.

**Results:** One hundred and thirty-nine respondents participated in the survey for a response rate of 45%. Twenty-nine admissions variables were found and correlated to program clinic pass rates (n=131) and program NBDHE pass rates (n=133). The 2 admissions variables most often used by dental hygiene programs are overall college grade point average (GPA) at 67.6% and college science GPA at 61.2%. Multiple regression analysis detected no statistically significant variables as positive indicators for licensure examination pass rates.

**Conclusion:** Currently there are no defined variables associated with clinical and national licensure pass rates. Further research is needed to identify variables that are associated with clinical and national licensure pass rates.

**Keywords:** admissions criteria, dental hygiene, program admissions, performance indicators

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of NBDHE success. Furthermore, there is currently no dental hygiene research to validate GPA as a predictor of success on clinic licensure board examinations.

### Standardized Testing

Along with GPA, standardized testing is used in dental hygiene admissions. Thirty-one percent of accredited dental hygiene programs use the American College Test (ACT), 18% use the Scholastic Achievement Test (SAT) and 46% reported "other"

for test score assessment.<sup>6</sup> Edenfield and Hansen noted linkages between ACT and SAT with success on the NBDHE.<sup>6</sup> The reading comprehension component of the ACT has shown potential in predicting NBDHE scores.<sup>4</sup> Several nursing studies found the SAT and ACT to predict licensure examination scores for nursing students.<sup>7,8</sup> The predictive ability found in these studies could translate to dental hygiene clinic licensure examination success but has yet to be determined.

A standardized test formally used for admissions to dental hygiene programs was called the Dental Hygiene Aptitude Test (DHAT). The DHAT originated in 1956 and was used as a pre-admission examination for dental hygiene.<sup>9</sup> The intent of this exam was to measure numerical ability, science knowledge, verbal knowledge, and capability of reading and comprehending scientific information.<sup>10</sup> The DHAT was shown to be a positive predictor for the NBDHE according to a study done by Longenbecker and Wood.<sup>11</sup> In addition, this study compared predictive capability of both the DHAT and the ACT indicating the DHAT as the "most valid single predictor of NBDHE scores."<sup>11</sup> To the authors' knowledge, there have been no studies related to the DHAT in more than 25 years and none that validate this test as a predictor for clinical licensure examination success.

The purpose of the DHAT is similar to what dental schools use for admissions. The Dental Admission Test (DAT) provides an assessment of academic aptitude and understanding of scientific knowledge. In addition, it provides an assessment of perceptual ability.<sup>12</sup> In a study conducted by Park et al, clinical performance on operative procedures was associated with the biology component of the DAT for students at the Harvard School of Dental Medicine.<sup>13</sup> Bergman et al reported that the reading comprehension component of the DAT was statistically significant when associated to the NBDE part I.<sup>14</sup> DeBall et al found similar associations between the DAT reading comprehension component and NBDE anatomic science scores.<sup>15</sup> For comprehensive examinations, the quantitative reasoning and total science portions of the DAT were positive predictors of performance.<sup>16</sup> These studies suggest that the DAT is associated with performance on the NBDE possibly demonstrating the predictive validity of the use of standardized testing to foresee candidates' ability to pass licensure examinations during pre-admission selection.

Other standardized tests such as the Allied Health Professions Admission Test (AHPAT) show an ability to predict allied health in-course GPA as well as national certification exams.<sup>7,17,18</sup> The Health Science

Reasoning Test (HSRT) is used to assess critical thinking skills as part of the admissions process. Scores on the HSRT correlate with both candidate rank and scores on the Pharmacy College Admission Test (PCAT).<sup>19,20</sup> Another pre-admission test to assess critical thinking skills is the California Critical Thinking Skills Test (CCTST). This test has been positively linked to allied health program success as well as clinical judgment.<sup>21</sup> Initial dental hygiene clinical performance has been positively linked to the CCTST. Additionally, the CCTST is a predictor of NBDHE scores.<sup>22,23</sup> Studies have identified the Test of Essential Academic Skills (TEAS) as a predictive tool for nursing program success.<sup>24,25</sup> Schultz et al found the Health Occupations Basic Entrance Test (HOBET) a better predictor of academic student success in allied health programs compared to the ACT.<sup>26</sup> The TEAS and HOBET show predictive ability for several allied health programs, yet only the ACT, SAT, DHAT and CCTST have been linked to dental hygiene academic success. The ACT, AHPAT, CCTST, DHAT, HOBET, HSRT, PCAT, SAT and the TEAS have not been validated as predictors of clinical licensure examination success. Furthermore, the AHPAT, HSRT, TEAS and HOBET assessments have yet to be validated for their ability to predict scores on the NBDHE.

### **Non-cognitive Variables**

Dental hygiene programs also use non-cognitive variables for admissions requirements such as manual dexterity or psychomotor skills testing. Three percent of accredited dental hygiene programs utilize manual dexterity tests.<sup>1</sup> Researchers have explored the Perceptual Abilities Test (PAT) or Part II of the DAT for usefulness in measuring motor skills.<sup>27</sup> In a study by Holmes et al, students who passed the clinical board examination demonstrated higher PAT scores than the students who failed the clinical board examination.<sup>28</sup> Psychomotor tests predict dental student course grades for Oral Anatomy and Operative Dentistry.<sup>29</sup> Tweezers dexterity aptitude has been studied as a predictor of dental student success. In a study by Lundergan et al, the use of tweezers dexterity tests to augment the predictive capability of the PAT is uncertain.<sup>30</sup> The Purdue Pegboard Test is used to evaluate motor dexterity among medical students. Students pursuing a surgical field did not have greater dexterity scores than the students pursuing a non-surgical field.<sup>31</sup> The research is unclear as to the usefulness of assessing motor skill as a predictor for academic and clinical performance. These dexterity tests along with the Crawford Small Parts Dexterity Test, California Performance Test and Perception and Control Test have yet to be correlated with dental hygiene licensure examinations.

Letters of recommendation are used by 26% of accredited dental hygiene programs.<sup>1</sup> There is currently no dental hygiene literature available to validate the use of letters of recommendation in admissions. Pre-admission interviews are used by 35% of accredited dental hygiene programs.<sup>1</sup> Evans and Dirks determined that interview scores were significantly related to laboratory grades.<sup>32</sup> Interview scores have still not been correlated to NBDHE and clinical licensure exam scores.

Previous dental office experience is required as part of the dental hygiene admissions process by 46% of accredited dental hygiene programs.<sup>1</sup> Previous dental experience, specifically dental assisting, was positively correlated to dental hygiene clinic performance and clinic GPA in a study done by DeAngelis and Goral.<sup>33</sup> Park et al reported that dental students with prior assisting experience are more apt to obtain higher scores in pre-clinical courses.<sup>34</sup> The requirement of dental office experience for admissions has not been confirmed as a predictor for NBDHE or regional clinical licensure examination success.

Although manual dexterity exams, letters of recommendation and interviews are variables used by dental hygiene programs for admissions decisions, there is no dental hygiene literature available to relate these variables to NBDHE and clinic licensure exam scores. This study sought to identify all variables that are currently used by U.S. dental hygiene programs and to explore possible associations between these variables and program pass rates on national and regional clinical licensure board examinations.

## Methods and Materials

This quantitative study is both exploratory and descriptive in design. This study was approved by the University of Bridgeport Institutional Review Board. The instrument used for data gathering was a survey developed by the researchers and administered via email. The survey was comprised of 18 questions to collect program demographic information, program admissions requirements, and program pass rates on both the NBDHE and regional clinical board examinations. Readability and validity were determined through a pilot survey reviewed by 5 dental hygiene faculty at various academic institutions. The faculty reported any problems and questions needing clarification to the researchers.

Email addresses for dental hygiene program directors were obtained from the American Dental Hygienists' Association website and 309 directors/chairs from the U.S. were invited to participate. The

email invitation provided directors with a cover letter and a link to the electronic survey hosted by SurveyMonkey. A second request for participation was emailed to program directors 11 days later and the survey was closed 4 days after the second request. Program director email addresses were not linked to survey responses. Survey responses were reviewed for completeness.

Data was entered into SAS version 9.2 (SAS Institute Inc.). Descriptive statistics using measures of central tendency were used as well as inferential statistics using multiple regression analysis. An alpha level of 0.05 was used for statistical testing. Multiple regression analysis was used to look for relationships between the independent variables (dental hygiene admissions criteria) and the dependent variables (NBDHE pass rates/clinical pass rates). For the purposes of this study, NBDHE pass rates are defined as the percentage of candidates per program that pass the NBDHE on the first attempt. Likewise, clinical pass rates are defined as the percentage of candidates per program that pass the clinical licensure board examination on the first attempt.

## Results

Of the 309 programs invited to participate, 139 programs chose to participate for a response rate of 45%. Because some of the respondents did not answer each question, the sample size when exploring clinic pass rates was  $n=131$  and for national pass rates was  $n=133$ .

### Admissions Variables Currently Utilized

There are many different combinations of GPA variables used for dental hygiene program admissions. Additionally, several types of standardized test assessments were reported as well as numerous non-cognitive variables. The percentages of participating programs that utilize each of the variables can be reviewed in Table I. The type of manual dexterity test utilized by the dental hygiene programs include the California Performance Test, Crawford Small Parts Dexterity Test, Johnson O'Connor Tweezer Dexterity Test, Perception and Control Test, Purdue Manual Dexterity, and a peg board and symbol digit test. The CCTST was reported by 1 participant. This variable was a linear combination of other variables in the model so is not shown in the data set. Additionally, the Wonderlic assessment was reported, however, clinical and national pass rate data was not provided.

### Clinical Pass Rates

Participating programs provided the percentage of

Table I: Variable Used by Dental Hygiene Programs for Admissions Decisions

Variable	Mean
Overall College GPA	67.6%
College Science GPA	61.2%
American College Test	30.2%
Pe-Admission Interview	29.5%
Previous Dental Experience	28.1%
Essay	23.7%
Scholastic Aptitude Test	20.9%
Letters of Recommendation	18.7%
High School Science GPA	16.5%
Prerequisite GPA	15.1%
Overall High School GPA	14.4%
Community Service	13.7%
Health Occupations Basic Entrance Test	11.5%
Personal Statement	11.5%
Health Occupations Aptitude Exam/Psychological Services Bureau	7.9%
Compass	6.5%
Test of Essential Academic Skills	6.5%
Accuplacer	5.8%
Spatial Ability	4.3%
General Education Requirements	3.6%
Manual Dexterity Tests	3.6%
Personality Assessment	3.6%
Allied Health Professions Admissions Test	2.2%
National League for Nursing Preadmission Examination	2.2%
Asset	1.4%
Health Science Reasoning Test	1.4%
Texas Assessment	1.4%
Wonderlic	1.4%
California Critical Thinking Skills Test	0.7%

their eligible candidates that passed the clinical licensure examination on the first attempt. The mean for program clinical pass rates was 91.8%. Multiple regression analysis found no statistically significant independent variables ( $p < 0.05$ ). Table II shows the results of multiple regression analysis for clinical pass rates for each of the admissions criteria provided by dental hygiene programs.

### NBDHE Pass Rates

Participating programs provided the percentage of their eligible candidates that passed the NBDHE on the first attempt. The mean for national board pass

Table II: Multiple Regression Analysis for Clinical Pass Rates

Admissions Variable	Estimate	tValue	Pr> t
Intercept	89.5%	24.76	<0.0001
Essay	-6.8%	-1.81	0.074
Health Occupations Aptitude Exam (Psychological Services Bureau)	-10.6%	-1.75	0.084
Preadmission Interview	6.0%	1.68	0.096
Manual Dexterity Tests	-15.2%	-1.34	0.183
Previous Dental Office Experience	-3.8%	-1.19	0.236
National League for Nursing Preadmission Examination	9.1%	1.16	0.249
Prerequisite GPA	-3.8%	-1.01	0.314
Allied Health Professions Admission Test	8.5%	1.01	0.316
Test of Essential Academic Skills	4.6%	0.94	0.35
College Science GPA	2.4%	0.89	0.376
Spatial Ability	12.4%	0.86	0.389
Personal Statement	4.2%	0.86	0.392
High School Science GPA	3.1%	0.79	0.429
American College Test	2.3%	0.68	0.495
Health Science Reasoning Test	5.3%	0.55	0.581
Asset	-5.4%	-0.5	0.615
Compass	2.5%	0.47	0.643
Scholastic Aptitude Test	1.4%	0.38	0.701
Accuplacer	-1.9%	-0.36	0.717
Personality Assessment	3.5%	0.19	0.852
General Education Requirements	1.3%	0.17	0.868
Community Service	0.8%	0.16	0.875
Texas Assessment	-1.0%	-0.1	0.919
Letters of Recommendation	0.4%	0.09	0.931
Overall College GPA	-0.3%	-0.08	0.933
Health Occupations Basic Entrance Test	-0.3%	-0.07	0.944
Overall High School Science GPA	0.0%	0	0.997

rates was 96.8%. The independent variables were correlated to NBDHE pass rates using multiple regression analysis. Of these variables analyzed, none emerged as statistically significant criteria. Table III shows the results of multiple regression analysis for NBDHE pass rates for each of the admissions criteria provided by dental hygiene programs.

## Discussion

The first objective of this study was to identify all variables currently utilized by dental hygiene programs. The admissions variables identified in this study and the corresponding mean for these factors is displayed in Table I. Some of these variables collected are not made available as a response choice in the yearly American Dental Association's Survey of Dental Hygiene Education Programs. This fact may account for selection of "other" categories in the survey.<sup>1</sup>

The second objective of this study was to explore possible associations between the identified admissions variables and pass rates on licensure examinations. The 3 categories of independent variables that were explored in this study are GPA, standardized testing and non-cognitive variables used in program admissions. Pre-requisite GPA was reported by 15.1% of participating programs and general education requirements were reported by 3.6%. These GPA admission factors, in addition to overall college, college science, overall high school and high school science averages, were not identified in this study as statistically significant variables. This data supports the study done by Alzahrani et al reporting that there is no statistically significant relationship between incoming GPA and NBDHE success.<sup>5</sup>

Standardized tests were explored as potential preadmission predictors for licensure examination success. The sample size used for analysis of the ACT (30.2%) for this study was comparable to the percentages reported in the Survey of Dental Hygiene Education Programs (31%).<sup>1</sup> The ACT did not emerge as a statistically significant variable. This data fails to corroborate findings of Edenfield and Hansen, which noted linkages between the ACT and the NBDHE.<sup>6</sup>

As for non-cognitive variables, less than 2% of participating programs reported using manual dexterity tests for admissions. This small sample size is consistent with the Survey of Dental Hygiene Education Programs where 3% of accredited dental hygiene programs reported using this criterion.<sup>1</sup> The analysis of this variable showed no relationship to pass rates. The use of letters of recommendation was not statistically significant as related to licensure examination pass rates. As there are no other dental hygiene studies to validate these findings, additional research in this area must be considered. Although Evans and Dirks found a positive relationship between laboratory grades and interview scores, those findings did not translate to this national study.<sup>32</sup> While interviews were not found to be statistically significant in this study, the use of a

Table III: Multiple Regression Analysis for NBDHE Pass Rates

Admissions Variable	Estimate	tValue	Pr> t
Intercept	96.30%	56.39	<.001
Accuplacer	-4.73%	-1.88	0.063
National League for Nursing Preadmission Examination	-4.65%	-1.25	0.214
Prerequisite GPA	2.01%	1.15	0.255
Compass	2.70%	1.05	0.296
Essay	1.71%	0.96	0.337
College Science GPA	1.19%	0.96	0.341
Health Occupations Aptitude Exam (Psychological Services Bureau)	-2.61%	-0.91	0.366
Preadmission Interview	1.41%	0.84	0.402
Letters of Recommendation	-1.53%	-0.69	0.493
American College Test	-0.96%	-0.61	0.541
Overall College GPA	-0.90%	-0.60	0.548
Personal Statement	1.31%	0.56	0.577
Overall High School Science GPA	0.85%	0.44	0.663
Health Science Reasoning Test	1.89%	0.42	0.677
Spatial Ability	2.57%	0.38	0.705
Community Service	-0.86%	-0.37	0.715
Scholastic Aptitude Test	0.55%	0.31	0.759
Asset	-1.23%	-0.24	0.808
Texas Assessment	1.13%	0.24	0.814
Personality Assessment	-1.71%	-0.19	0.848
High School Science GPA	-0.33%	-0.18	0.856
Manual Dexterity Test	0.89%	0.17	0.868
Allied Health Professions Admission Test	-0.49%	-0.12	0.902
General Education Requirements	-0.38%	-0.10	0.918
Health Occupations Basic Entrance Test	-0.20%	-0.10	0.921
Previous Dental Experience	-0.08%	-0.05	0.960
Test of Essential Academic Skills	0.00%	0.00	0.999

standardized interview for admissions needs to be investigated. Research supports the use of a standardized or structured interview for medical admission selection criteria.<sup>35,36</sup>

Another non-cognitive variable is the use of previ-

ous dental experience. DeAngelis and Goral showed a positive correlation between previous dental assisting experience and dental hygiene clinic performance, as well as clinic GPA.<sup>33</sup> This study did not validate those findings possibly due to the low response rate of this category by participating programs. The Survey of Dental Hygiene Education Programs established that 46% of accredited dental hygiene programs use previous dental experience as an admissions criterion.<sup>1</sup> In this study, only 28.1% of participating programs reported using previous dental office experience. It is possible that many of the non-participating programs utilize this admissions factor thereby affecting the response rate for this particular variable.

The data collected from the survey revealed a multifaceted approach to requirements for dental hygiene program admissions. Programs reported using a variety of combinations of GPA as well as numerous standardized test assessments and a number of non-cognitive variables. The current study found none of these variables to be positively correlated to program pass rates on the NBDHE. Additionally, none of the admissions criteria were statistically significant for predicting program pass rates on clinical licensure board exams.

The dental hygiene profession requires the same motor skills needed in dentistry. The profession could contemplate using an admissions exam similar to the DAT. Historically, there existed a DHAT available for dental hygiene admissions. Dental hygiene studies have inferred that the DHAT has greater predictive power over the ACT and SAT to determine NBDHE success as well as dental hygiene clinical and didactic grades.<sup>9-11</sup> The authors suggest consideration of the development of an admissions test specific to dental hygiene.

Data collected from this national dental hygiene survey showed a lack of standardization for admissions criteria required by dental hygiene programs. The question to be raised is do the multi-dimensional, varying criteria being utilized for dental hygiene program admissions lend itself to the inability to establish valid predictors of dental hygiene success? Additional research correlating combinations of these variables could lead to finding an evidence-based strategy for the admissions selection process. Further research to confirm a basic dental hygiene admissions platform is still warranted.

Moreover, the authors propose that the theoretical implications of this study include consideration to a different view on admissions procedures. The literature review shows conflicting results on best admissions practices. This study failed to identify

any statistically significant preadmission predictors for success on dental hygiene licensure examinations. Theoretically, candidates with certain attributes along with expert faculty instruction could yield successful outcomes. Consideration must be given to the possibility that a student's basic aptitude for learning clinical skills may not be a necessary factor during the admissions selection process. However, further investigation to discover measures that can assess clinical ability prior to admittance may be warranted.

While admissions and demographic data were collected in this study, future studies should narrow the investigation to specific categories of admissions variables. A limitation of this study is that self-reported data has the potential to be skewed and biased by participants. Another limitation of this study is that it is uncertain as to what types of variables the non-participating dental hygiene programs are currently using. It is conceivable that an undiscovered admissions factor exists that can be positively linked to program licensure examination pass rates. Further research to investigate the multiple combinations of GPA, standardized test assessments and non-cognitive variables for admissions is suggested. As this study investigated program pass rates, it is also recommended that research be initiated that explores the relationship of these variables to individual scores.

## Conclusion

This study explored factors used in dental hygiene admissions that can be further investigated to determine their validity and reliability. In addition, this study demonstrates the need for the development of new dental hygiene program admissions standards. This study suggests that a foundation for reliable, valid and evidence-based dental hygiene program admissions standards still needs to be developed.

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