Analyzing the Predictability of National Board Dental Hygiene Examination Success

by

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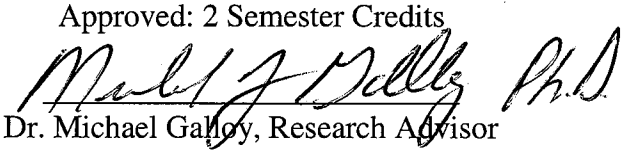

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ABSTRACT

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The purpose of this study was to research significance of correlation between pre-admission requirements, academic performance and the success of the National Board Dental Hygiene Examination (NBDHE). This study complied data from 189 Milwaukee Area Technical College graduates and 120 Waukesha County Technical College graduates from 1999 through 2004.

The data consisting of cumulative grade point average (C-GPA), program GPA, individual course grades, NBDHE scores and Asset test scores was entered into an excel spreadsheet graduation year. The data were analyzed using the Statistical Package for Social Sciences (SPSS), Pearson's r correlations, and regression analysis with a predetermined significance level of .05.

The results indicate that there is a significant correlation between multiple academic indicators studied and the NBDHE score, except for the Asset math test score. Based on these results, educators are advised to incorporate critical thinking into their courses and assess students at a higher cognitive level. It is also advised that students complete remediation for weak subject areas prior to taking the NBDHE.

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CHAPTER ONE *Introduction*

Dental hygienists are licensed oral health professionals who focus on preventing and treating oral health diseases. In addition to treating patients directly, dental hygienists also work as educators, researchers, administrators, sales and marketing representatives, editors and consultants. A clinical dental hygienist may work in a variety of health care settings, such as dental offices, schools, hospitals, correctional institutions or nursing homes (ADHA website 2004).

In order to obtain a license to practice dental hygiene, they must graduate from an accredited dental hygiene education program and pass written and clinical exams (ADHA website 2004). The written examination required by almost all states for licensure in dental hygiene is the National Board Dental Hygiene Examination (NBDHE). A passing score for this exam is 75 or higher. The NBDHE is prepared by the Joint commission on National Dental Examination which is a fifteen member commission that includes representatives of dental schools, dental practices, state examining boards, dental hygienists and the public. The purpose of the NBDHE is to assist state boards in determining qualifications of dental hygienists who seek licensures to practice dental hygiene. The examination assesses the ability to understand important information from basic biomedical, dental and dental hygiene sciences and also the ability to apply such information in a problem-solving context (NBDHE Candidate Guide 2004).

The NBDHE is a comprehensive examination consisting of approximately 350 multiple choice test items. There are two separate sections in the exam of which the performance outcome is combined to make one composite score. The first section

is 200 multiple-choice questions addressing the scientific basis for practice of dental hygiene, the provision of clinical services and finally, community health. The second section includes 150 case-based items that refer to between twelve and fifteen dental hygiene patient cases (NBDHE Candidate Guide 2004).

This format of the NBDHE is relatively new. It was introduced with a pilot test in 1998. The change in format is primarily in the second section of the exam. This section now consists of multiple-choice questions that pertain to case-based studies using intraoral pictures, radiographs patient histories, dental charts, and photographs. In the previous version, the second section was very similar to the first section in that it was composed of a series of comprehensive stand alone multiple choice questions designed to test a comprehension level of knowledge. The goal of the restructured NBDHE was to test candidates at a higher-order reasoning and problem-solving level in an effort to strengthen the tests validity as a measure for determining qualifications of individuals to practice dental hygiene (Francis 1999). In a study done by Bonnie Francis on the validity of the restructured NBDHE, she reports that

> 84.3 percent of the students surveyed believed that the case-related items appeared to evaluate different skills and abilities than the stand-alone items. The most frequent response was that it focused on the patient and simulated actual dental hygiene situations more than the traditional examination. This supports the claim that the new exam is more realistic and gives the final score overall meaning as it simulates actual activities of the practicing hygienist (1999 ¶ 6).

Accredited dental hygiene programs use the student results on the NBDHE as an outcome assessment tool. The ultimate goal of all dental hygiene programs is that students pass the NBDHE. When all of the requirements of the state in which a person wishes to practice dental hygiene are successfully completed, he/she can apply for licensure and then begin to practice and serve the community. Dental hygiene schools have been praised for their NBDHE results and they have closed due to reports of poor results. Onondaga Community College in Syracuse, New York has been discussing the option of closing the dental hygiene program because "of 236 schools nationwide, OCC last year ranked 229th for the number of students who passed the National Dental Hygiene Board Examination. It's a ranking that Sydow has called deplorable" (Buczek, 2003 ¶ 3). And in another newspaper article headlined, "Program for hygienists truly sparkles," the article boasts that the program has had only four or five failures on the national board level in its 29 year history. LSU program is a bachelor program and through tough admission standards accepts 32 students each year. The article also recognizes the reason for the program's success as "because of the rigorous requirements, the program has an exemplary record of students passing national certification exams" (Times-Picayune, 2001 ¶ 10).

It is important for dental hygiene programs to graduate candidates who can meet the state requirements and enter the workforce. The educational programs help society meet its needs by providing educated professionals who can serve the population and by providing work opportunities for people.

Because the courses in dental hygiene programs are sequential, it is essential that each one of the students, who begin the sequence, must also finish it. Should a

student fail a course during the program, it isn't possible to fill that position by someone else in the future. Therefore, it is important that programs admit students who are have the capability for success and are committed to completing the program. Otherwise, if some students fail, those positions are lost in addition to the potential for fulfilling the community needs for dental hygiene professionals. Another potential loss is to the student who has made an investment of both time and money and did not fulfill his/her expectations of gaining a career or a job as a dental hygienist. In an effort to be fiscally responsible as well as efficiently serve the needs of the community, admission requirements are necessary for any dental hygiene program.

What are the admission requirements for dental hygiene programs? There is no nationwide standard for admission into dental hygiene programs. Admission requirements vary from state to state and from program to program. There is a significant difference between associate degree program admission standards and bachelor degree program admissions. Research has examined several variables designed to find a predictor of academic and NBDHE success. If a student is successful on the NBDHE then it can be said that the dental hygiene education program was successful in preparing the student academically for the written requirements of state licensure. As stated in an abstract by Schutte and Smith (2002, ¶ 1), "student successes on the National Board Dental Hygiene Examination (NBDHE) have become a key indicator of the quality and effectiveness of dental hygiene curricula."

In an attempt to find a variable to predict success in the NBDHE and thereby aid admission committees with the selection of students, several variables have been

studied. According to Schutte and Smith (2002), these variables include: scores on the American College Test (ACT), the Scholastic Aptitude Test (SAT), the Dental Hygiene Candidate Aptitude Test (DHCAT), the mock board dental hygiene examination, high school grade-point average (GPA), college sciences GPA, cumulative GPA, dental hygiene curriculum GPA. Demographic variables include age, and marital status. Studies have even been done to examine nontraditional variables. However, the end results are mixed. Schutte and Smith's study examined correlations between ACT scores, high school GPA, college sciences GPA, first–year dental hygiene GPA, age and dental assisting experience. Their study reports that the ability of traditional variables to predict success on NBDHE is weak and that further research is needed (2002).

College programs are feeling pressure from administrations to increase retention, diversify program participants and increase graduation rates while at the same time maintaining a high level of employed graduates. With such pressure from administration, finding a baseline admission requirement for dental hygiene programs is even more important.

Statement of the Problem

The goal of dental hygiene education is to prepare students for the practice of dental hygiene. The practice of dental hygiene requires that a graduate of an accredited dental hygiene program pass the National Board Dental Hygiene Exam (NBDHE) with a score of 75 or greater. Dental hygiene programs use their students' ability to successfully pass the NBDHE as an outcome assessment goal. This study will determine if there is a relationship between pre-admission requirements,

academic performance and NBDHE score. The majority of studies that have been done are limited to investigating only one school's data and few studies have been done after the change in the exam's format in 1998 or with 2-year programs. This study will use data from two different associate degree programs in the same state and will focus on the years after the NBDHE format change. By comparing more than one school's data, the results will be transferable and will help in determining if traditional predictors are valid.

Purpose of the Study

For an institution, the predictability of successfully passing the National Board exam is useful in establishing admission requirements, program goals and curriculum content. If a variable is found to positively correlate with the success of the exam, then educational programs could use that information to adjust their program admission requirements and help ensure applicant success. Or an institution may use the results to help monitor students and initiate remediation. Another potential implication this research could have would be if curriculum content could be adjusted in accordance with findings to help the program meet its goals. If the students aren't successful in the program or they fail the licensure requirements, it is an economic waste for both the student and the public. Because tuition is subsidized by taxpayers' money, they too are losers. The public also loses in terms of reduced or limited dental hygiene professionals available to serve the community oral health needs.

Questions

This study will address the following questions:

1. Is there a correlation between an individual course, the Cumulative grade point average (C-GPA) and the National Board Dental Hygiene (NBDHE) exam?
2. Is there a relationship between 1st year didactic courses grade point average (Y1-GPA) and the score of the NBDHE?
3. Is there a relationship between second year courses grade point average (Y2-GPA) and the score of the NBDHE?
4. Is there a relationship between the three science courses grade point average (S-GPA) and the score of NBDHE or the C-GPA?
5. Using data from another technical college is there a relationship between NBDHE, C-GPA and pre-program admission tests scores?

Significance of the Study

This study should help associate degree dental hygiene programs meet their outcomes assessment goal for graduates being able to successfully pass the NBDHE. The trend in dental hygiene education has been a dramatic increase in the number of 2-year programs at community colleges, and a decrease in the number of baccalaureate programs. "Many educators believe that the dental hygiene curriculum is so full that most dental hygiene programs require more than 2 years to complete an associate's degree and that 4-year dental hygiene programs have significant strength because of their breadth and depth in courses. As a result, there seems to be increased interest in trying to achieve some level of national consensus in identifying appropriate curriculum content for associate and bachelor's degree programs" (Heine, 2004 p. 30).

Assumptions of the Study

The following assumptions were made:

1. The data received from the college data base is accurate
2. The course curriculum is similar from year to year
3. The grading system is similar between the colleges
4. The instructors are qualified and the colleges are providing an adequate learning environment

Definition of Terms

1. Student: any individual enrolled in the dental hygiene programs at the Milwaukee Area Technical College or Waukesha Community Technical College
2. Student program success: As determined by grade point and program graduation
3. Cumulative Grade Point Average (C-GPA): computed by dividing the number of grade points earned by the total number of credits attempted. (*Milwaukee Area Technical College 2004-05 Catalog*, 42.)
4. Dental Hygiene Program Grade Point Average (P-GPA): Only Dental Hygiene Program courses are used to compute P-GPA
5. Asset Scores – During the admissions process Asset tests are taken to measure students' skill and knowledge level in an area. Score levels are predetermined as high enough skill level to succeed in a particular course or program. Asset is the name of the test used to generate the scores.
6. Milwaukee Area Technical College (MATC) – community/technical college currently serving Milwaukee County and surrounding south eastern Wisconsin communities.
7. Waukesha Community Technical College (WCTC) – community/technical college currently serve Waukesha County and surrounding communities in south eastern Wisconsin.

8. Dental Hygienist: "is an individual who practices dental hygiene. Dental hygiene is the performance of educational, preventatives or therapeutic dental serves" (http://www.drl.wi.gov)
9. Licensure: Licensure is the strongest form of regulation in accordance within state law; licensed individuals are (the) only persons who meet the minimum qualifications necessary to practice in their profession. Licensure is a means of protecting the public from unqualified individuals and unsafe practice in addition to initial graduation and testing." (http://www.adha.org/careerinfo/dir_licensure.htm.)
10. NBDHE – National Board Dental Hygiene Examination, a national examination excepted by 53 states or provinces as the written requirement for dental hygiene license

Limitations of the Study

1. The collection of data is limited to what is available in the schools data base
2. The data considered will be for graduates between the years 1999 and 2004
3. When comparing data collected for the 2 associate degree programs, no adjustment will be made for the fact that the programs matriculate students at different times. Both schools matriculate students in the fall and one school also enrolls students in winter. Consequently, at one school a student may have to wait a semester before repeating a course or there may be a summer schedule difference, or just the difference between seasons may affect how a student prepares for a course.

4. There will be incomplete data when a student has dropped out of the program before completion
5. A students ability to drop and retake a course will increase their overall GPA
6. The number of variables available to study between the 2 colleges.

CHAPTER 2 Review of Literature

Before the 1998 Format Change

The NBDHE was established in 1962 and with that began a long history of research to determine if there was a variable that would predict success for completion of a dental hygiene program or passing the NBDHE. Throughout that history, many variables have been reviewed but few have been found to be consistently reliable predictors of success. The majority of the research was done prior to the NBDHE format modification in 1998. This research was conducted in a variety of accredited dental hygiene programs, with varying degree types and admission requirements.

Admission into dental hygiene programs had requirements even before the NBDHE was established. As early as 1956, the first aptitude test for dental hygienists was available. (http://www.marquette.edu/chs/dehy/History.html) Currently the majority of colleges have some admission requirements such as pre-requisite courses, GPA range, standardized test scores such as ACT or SAT and/or dental hygiene aptitude tests.

From 1962 through1968, Rowe and Collins studied graduates from the University of Detroit certificate program to determine if there was a variable that correlated with success on the NBDHE. Cumulative GPA and NBDHE were arbitrarily designated as the criteria for success in this study. The results showed strong correlations between high school science averages, previous college averages, and high school GPA with the Total GPA. The results of the dental hygiene program GPA proved to be more predictable than National Board scores. There were five

variables which proved to be the most predictive: high school GPA, (HS Avg.) high school science average (HS Science Avg.), Dental Hygiene Aptitude Test-- Total Academic Score (DHAT –Total), Dental Hygiene Aptitude Test—Science (DHAT-Science) and Dental Hygiene Aptitude Test—General Information (DHAT—General). Of the five variables identified as the most predictive, none of the variables was consistently predictive every year. The variables predictability fluctuated from year to year. However, because of the fact that the same five variables strongly correlated with success from 1962 – 1968, it was recommended that they be weighted heavily as admission criteria (Rowe and Collins, 1972).

The results of this study are now fairly outdated and may no longer be significant due to the fact that for the majority of programs, college courses are required prior to entrance into dental hygiene programs. Having the foresight to anticipate this change in practice, the study reported, "HS Avg. may prove to be continually less significant in the future as more students enter the dental hygiene program with a college background" (Rowe, et al., 1972, p.55).

Another factor making the study outdated is that the dental hygiene aptitude test that was used in this study is no longer used. The current dental hygiene aptitude test is Psychological Service Bureau, Inc. Health Occupations Aptitude Test (PSBHOAT).

The third reason that this study may no longer be significant is that the format of the NBDHE significantly changed in 1998. Even though the results of this study have questionable significance, new questions can be derived for further research. Such as, since there was a relationship with high school science GPA, is there a

similar relationship between college science GPA and NBDHE scores or dental hygiene program GPA?

A study by Shannon (1989) researched predictable variables using data from multiple dental hygiene programs. This ambitious study compared data from three associate degree programs from 1983 – 1986. The study sought to find out if there as a variable useful in predicting dental hygiene GPA, determining if a academic variables could be used predict success on the NBDHE or if being married or single had an affect on passing the NBDHE. The study found no appreciable difference in DHPGPA between the three colleges. There were however, significant positive correlations between HS GPA and DHPGPA. This concurs with Rowe et al. study. The DHPGPA also correlated strongly with success on the NBDHE. This correlation also supports the findings of the Rowe et al. study from 20 years earlier. An interesting point to note from this study is that while HS GPA and College GPA were found to predict success in the dental hygiene program they were not significant predictors to success on the NBDHE. (Shannon).

In 1991, a retrospective study by Vitasek and Parker examined the correlation between ACT scores and scores on the NBDHE spanning 11 years (1974-1984) at the Baylor College of Dentistry. The results of this study indicated that the ACT was a weak to moderate predictor of success on the NBDHE. Of the 11 years studied, 5 of those years showed a significant t-ratio and those five years were towards the beginning of the cycle (1975, 1976, 1977, 1979, and 1981). An interesting point to note is that those 5 years the minimum sample ACT score was equal to or greater than the national median score of 16, indicating the student "pool" had a potential for

better than average college academic potential. (Vitasek & Parker 1991) Currently the Caruth School of Dental Hygiene at the Baylor College of Dentistry uses cumulative GPA, science GPA and an interview process as admission criteria for entrance into the program. (http://www.tambcd.edu/admissions/Hygiene_Admissions/hygiene_admissions.html, Retrieved July 21, 2004)

To date, a consistent academic predictor of success for the NBDHE has eluded researchers. Looking beyond traditional predictors, DeAngelis and Goral studied dental assisting experience as a predictor of dental hygiene program success from 1989 – 1993 at the University of Arkansas for the Medical Sciences, Department of Dental Hygiene. The study found that some correlations between clinical competence and dental assisting experience did exist. The performance of students with prior dental assisting experience was stronger in earlier course work and remained stronger throughout clinical program coursework than for students without the experience. However, there was no significant statistical trend in predicting NBDHE success. (DeAngelis et al. 1995)

This study doesn't identify any significant variables as predictors of success for the NBDHE or the dental hygiene program but it does help answer an alternative variable's relationship to the question. It can be said from the results of this study that prior dental assisting experience can enhance a student's clinical program abilities but will not determine overall program success or NBDHE success.

The relationships among dental hygiene GPA, a mock written exam and the NBDHE were examined in a study by Edenfield and Hansen (2000). This study found

that while an independent variable couldn't predict the NBDHE score, it could predict the potential for student success on the NBDHE. If a student's performance early in the program was in the top three quarters of the class, there was a 98% pass rate of the NBDHE. While on the other hand, if the student's performance was in the bottom quarter of the class early on in the program, a 62 % pass rate resulted. Prediction of success was slightly different for the relationship of the mock board dental hygiene exam score. If a student scored in the top three quarters on the mock exam there was a 78% pass rate on the NBDHE and if they scored in the bottom quarter there was a 54% pass rate. The diversity of population studied was representative of the population taking the NBDHE at the time. A significant finding and an interesting point to note about this study is that the probability of passing the NBDHE significantly greater for students in the top of the class. Only 2 out of 88 students in the top three quarters failed to pass the NBDHE, while 16 of 42 students in the bottom quarter failed to pass (Edenfield et al.). The results of the study suggest that the higher the students' academic abilities are the closer the relationship is to succeeding either in a dental hygiene program or on the NBDHE.

After 1998 Format Change

Downey, Collins and Browning (2002) did a study on the predictability of success in dental hygiene education which crossed the timeline for the NBDHE format change. Their study went from 1996-2000 and reviewed the reliability of admissions data in predicting student success in the dental hygiene program. The national trend for admission into dental hygiene programs are that 80% use incoming college GPA and 72% use incoming science GPA in the admission process (Downey

et al.). In the Department of Dental Hygiene at the Medical College of Georgia, a combined math/science GPA is used for the admission process. This study determined both a probability model to predict a student's graduating GPA at that institution and also a probability model to predict performance on the NBDHE (65.545 + (incoming GPA X 5.984). "Using this model, a dental hygiene student attending this institution with an I-GPA of 3.0 could be predicted to score 83 on the National Board" (Downey, et al. 2002, pg. 1272).

As the use of increased technology entered the academic picture so did more variables for studying the predictability of NBDHE and program success. One example involved the question, was the educational difference between taking an online course as opposed to an on-campus course significant in predicting performance on the NBDHE? The performance was measured by the grade a student received in the nutrition course and the nutrition-specific questions on the NBDHE. Online students did not perform better than students who took the face to face course (Bearden, Robinson, and Deis 2002). One could consider the value of this study somewhat limited due to the weight the NBDHE has on nutrition content. There are only six questions correlated to this content consequently; more study on equivalence of education compared to other courses offered online might be advisable.

Many dental hygiene programs and commercial continuing education courses offer a NBDHE review course in an effort to help prepare students for the exam. A study was done to determine if taking a review course had an impact on the predictability for success on the NBDHE. The study examined students who enrolled in a review course provided by a particular commercial company over a period of 6

years and compared those results to students who didn't take the course during the same time period. The study found the review course was not significant in predicting success on the NBDHE and it also found that the entering GPA did not predict NBDHE performance. However, there was support found for the Cumulative Dental Hygiene Program GPA (CDHPGPA) and the performance on the National Board examination (DeWald, Gutmann & Solomon 2004).

To date, Bauchmoyer, Carr, Clutter and Hoberty (2004) authored the most current study published which evaluates whether established predictors of success in the dental hygiene program and on the NBDHE remained viable given the new format of the NBDHE. Their study focused on the dental hygiene program at The Ohio State University (OSU) between 1998 and 2002. OSU offers a three-year professional program leading to the Bachelor of Science degree in dental hygiene. Admission into the program is selective and competitive. The admission committee uses entering GPA, and prerequisite sciences GPA in the admission process. The results of this study indicate that the current prerequisites used for admission into their dental hygiene program remain strong indicators of success in the program even with the change of format. This study also revealed the strongest single course predictor within the prerequisites GPA was biology. Another strong predictor of the Cumulative Dental Hygiene Program GPA (CDHYGPA) was human nutrition. The study supported previous studies findings indicating that the students CDHPGPA and the three sciences GPA were the greatest predictors of success for the NBDHE. The findings suggest that to be successful on the new NBDHE format the students may need to critically analyze and use information from a variety of courses to effectively

problem solve a variety of issues related to comprehensive patient care (Bauchmoyer, et al.).

CHAPTER III: *Methodology*

Introduction

The purpose of this study is to determine the relationship between different GPA's, admission test scores and the NBDHE from students graduating with an associate degree in dental hygiene. A strong correlation would be valuable in determining dental hygiene program entrance requirements or the predictability of success on the NBDHE. This study is a retrospective study examining the significance of correlation between courses grades, cumulative GPA's program, admission testing scores and the NBDHE. The data will be examined from two different colleges separately.

Milwaukee Area Technical College

For the first portion of the study, data gathered from 189 graduate dental hygiene students' who graduated from Milwaukee Area Technical College (MATC) between 1999 and 2004 was entered into an Excel spreadsheet. The students' identity was kept anonymous by randomizing each subject's data and grouping the data by graduating year. For example, since MATC matriculates every semester and has a graduating class every semester as well, the graduating class of 1999 includes students who graduated in December of 1998 and in spring of 1999. The GPAs were calculated using the 4.0 grading system. The three science courses used for the science GPA (S-GPA) consisted of the Anatomy and Physiology, Microbiology and Introduction to Biochemistry. The cumulative GPA (C-GPA) consisted of all of the college courses taken at MATC. The program GPA consisted of all of the college courses identified as part of the MATC dental hygiene program requirements. The

first year course GPA (Y1-GPA) consisted of all of the courses taken during the first year of the dental hygiene program with the exception of the clinical courses. The first year courses included: Oral Anatomy, Pathology, Dental Hygiene Theory 1, Radiography, Nutrition, Periodontology and Adaptive Clinical Skills. The second year GPA (Y2-GPA) was computed by using all of the courses taken during the second year of the program except the clinical courses. The Y2-GPA courses included: Dental Hygiene Theory 2, Dental Materials, Community Oral Health, Pharmacology, Dental Hygiene Theory 3 and Practice Administration. And finally many of the required dental hygiene courses in addition to the pre-requisite Anatomy and Physiology course GPA's were individually examined for correlation to the NBDHE and the Cumulative GPA.

With the help of Yan Wang from the Strategic Planning office at MATC, data was imported into the Statistical Package for the Social Sciences (SPSS) software package for analysis. The data was summarized using Pearson's r correlations and multiple stepwise regression analysis with a pre-determined level of significance at 0.05.

Waukesha County Technical College

For the second part of this study and with the assistance of the program director, Pam Brilowski, the data from 120 Waukesha County Technical College (WCTC) students' was collected entered into an excel spread sheet according to graduation years in a similar fashion. That data included cumulative GPA, NBDHE scores and Asset test scores for Math, Reading and Writing. However, out of 120 samples, only 80 subjects had Asset scores. The reason not all of the students had

Asset scores is because the school does not require the testing for transfer students with previous college experience. Another reason some of students didn't have Asses scores was because some students took a different entrance test.

Again with the help of Yan Wang, the data from WCTC was then analyzed using the SPSS software for correlation between NBDHE scores, cumulative GPA (C-GPA) and the Asset scores. Multiple stepwise regression analysis for NBDHE was also used for C-GPA and Asset Scores.

CHAPTER FOUR Results

Milwaukee Area Technical College

This study sought to examine the relationship between multiple varieties of academic GPA's with the NBDHE results to determine if there was a variable which significantly correlated with the NBDHE and could predict the results of the exam. The first research question focused on there is a significant correlation between the student's GPA on individual dental hygiene academic courses, C-GPA and the NBDHE performance. Using Pearson's r Correlation the NBDHE results were compared to the cumulative GPA and many of the individual didactic courses required by the dental hygiene program. (The clinical courses were not used because the grades are computed based on skill accomplishments.) The results showed that there was a significant correlation between the NBDHE and the Cumulative GPA and each one of the didactic courses tested, with the weakest correlation occurring between English 201 and the NBDHE. The results from the correlation of MATC students' exam scores, course grades and C-GPA are summarized on table 1.

Table 1

Correlation between NBDHE and Course GPA's for MATC Students (N=189)

Course Title	*NBDHE*	*C- GPA*
C- GPA (cumulative grade point average)	.677(**)	1.000000
Dental Hygiene Theory 1	.608(**)	.688(**)
Dental Hygiene Theory 2	.270(**)	.354(**)
Dental Hygiene Theory 3	.280(**)	.279(**)

Table 1(Continued

Correlation between NBDHE and Course GPA's for MATC Students (N=189)

Course Title	*NBDHE*	*C- GPA*
Oral Anatomy	.591(**)	.736(**)
Dental Radiology	.489(**)	.621(**)
Nutrition	.215(**)	.565(**)
Periodontology	.574(**)	.663(**)
Adaptive Skills	.245(**)	.383(**)
Dental Materials	.535(**)	.657(**)
Community Oral Health	.464(**)	.572(**)
Pharmacology	.607(**)	.712(**)
Practice Administration	.328(**)	.435(**)
Systemic Oral Pathology	.607(**)	.765(**)
Anatomy and Physiology	.488(**)	.684(**)
Microbiology	.449(**)	.637(**)
Biochemistry	.259(**)	.516(**)
Eng-201 course grade	.253(*)	.470(**)

Note. NBDHE= National Board Dental Hygiene Examination

** Correlation is significant at the $p < 0.01$ level, 2-tailed. , * Correlation is significant at the $p < 0.05$ level, 2-tailed.

The next three questions in the study explored the correlation between NBDHE scores and C-GPA with program GPA (P-GPA), first year GPA (Y1-GPA)

and second year GPA (Y2-GPA) and the three science course GPA (S-GPA) for MATC graduates. The results of this correlation, as summarized on table 2, show that all of the variables had a significant correlation. This significant correlation between the variables suggests that the scores are predictive. A multiple stepwise regression analysis was done to determine which variable was significant to predicting the NBDHE score. The results, as shown in table 3, reveal that the Y1 and Y2 GPA's were significant while the S-GPA was not.

Table 2.

Pearson's R Correlations between NBDHE and Grouped GPA's (N=189)

Grouped GPA	*NBDHE*	*C-GPA*	*P-GPA*	*Y1 -GPA*	*Y2- GPA*	*S-GPA*
NBDHE	1	.677(**)	.679(**)	.658(**)	.660(**)	.422(**)
Cumulative GPA (C-GPA)	.677(**)	1	.979(**)	.867(**)	.799(**)	.674(**)
Program GPA (P-GPA)	.679(**)	.979(**)	1	.897(**)	.813(**)	.705(**)
First-year Dental Course GPA (Y1-GPA)	.658(**)	.867(**)	.897(**)	1	.770(**)	.555(**)
Second-year Dental Course GPA (Y2-GPA)	.660(**)	.799(**)	.813(**)	.770(**)	1	.528(**)
3 Science Course GPA (S-GPA)	.422(**)	.674(**)	.705(**)	.555(**)	.528(**)	1

Note. NBDHE= National Board Dental Hygiene Examination

** Correlation is significant at the $p < 0.01$ level (2-tailed).

Table 3.

Regression for MATC students on NBDHE with Grouped GPA's (N=189)

Coefficients (a)

Grouped GPA	*Unstandardized Coefficients*		*Standardized Coefficients*	*t*	*Sig.*
	B	SE	β		
(Constant)	50.074	2.796		17.912	.000
Y1-GPA	4.223	1.103	.351	3.829	.000
Y2-GPA	5.156	1.274	.363	4.047	.000
S-GPA	.250	.491	.036	.509	.611

Note .a Dependent Variable: National Board Dental Hygiene Exam (NBDHE)

MATC= Milwaukee Area Technical College; Y1-GPA = 1st year courses grade point average; Y2-GPA = 2 year courses grade point average; S-GPA = three science courses grade point average.

Waukesha County Technical College

Data from Waukesha County Technical College (WCTC) was collected and researched in an effort to vary the student data base. The answer to the fifth question concerning a relationship between NBDHE, C- GPA and Asset test scores for Math, Reading and Writing for graduates of the WCTC dental hygiene program, show a significant relationship with all variables. The analysis of data for WCTC graduates from 1999 – 2004 are summarized in table 4.

Table 4.

Correlations between NBDHE and WCTC Variables

Variable	*Sample Size*	*NBDHE*	*C- GPA*
National Board Dental Hygiene Exam (NBDHE)	120	1	.725(**)
Cumulative Grade Point Average (C-GPA)	120	.725(**)	1
Asset Math Score	80	.245(*)	.142
Asset Reading Score	80	.513(**)	.486(**)
Asset Writing	80	.522(**)	.487(**)

Note. WCTC=Waukesha County Technical College

**Correlation is significant at the $p < 0.01$ level, 2-tailed.

*Correlation is significant at the $p < 0.05$ level, 2-tailed.

A multiple stepwise regression analysis of the C-GPA scores and the Asset test scores for WCTC results show that there was a significant relationship between the C-GPA and the Reading and Writing scores but no significant correlation between the C-GPA and the math scores. (Table 5) A multiple stepwise regression analysis of the NBDHE scores and the Asset scores revealed the same results as the C-GPA regression analysis which is that the reading and writing scores were significant while the math scores were not. (Table 6)

Table 5.

Regression summary for C-GPA on Asset Scores for WCTC

Coefficients(a)

Scores	*Unstandardized Coefficients*		*Standardized Coefficients*	*t*	*Sig.*
	B	*SE*	β		
(Constant)	1.424	.359		3.965	.000
Asset Math	-.007	.005	-.151	-1.397	.167
Asset Reading	.025	.009	.346	2.817	.006
Asset Writing	.025	.009	.342	2.808	.006

Note. a Dependent Variable: Cumulative GPA

Table 6.

Regression summary for NDBHE on Asset Scores for WCTC

Coefficients(a)

Scores	*Unstandardized Coefficients*		*Standardized Coefficients*	*t*	*Sig.*
	B	*SE*	β		
(Constant)	44.506	6.314		7.049	.000
Asset Math	-.033	.092	-.039	-.363	.717
Asset Reading	.416	.155	.324	2.679	.009
Asset Writing	.449	.156	.344	2.876	.005

Note .a Dependent Variable: National Board Dental Hygiene Exam (NBDHE)

WCTC= Waukesha County Technical College

CHAPTER V: DISCUSSION

This study examined relationships between NBDHE and C-GPA and a variety of academic variables in order to find a predictor of success for the dental hygiene program and the NBDHE. The variables reviewed were: C-GPA, P-GPA, English 201, Anatomy and Physiology, Microbiology, Biochemistry, individual program courses, Y1-GPA, Y2-GPA, S-GPA and Asset test scores for math, reading and writing. The results indicate significant correlations but not a definitive GPA number with a NBDHE score. The differences between the C-GPA and the P-GPA were found to be insignificant, so only the C-GPA was used from then on.

Research Question 1

The first research question asked if there was a correlation between an individual required course, the C-GPA and the NBDHE. The results show all of the individual courses had a significant correlation to the NBDHE scores and to the C-GPA. These findings are somewhat different than the findings of studies done before the NBDHE format change. For example, in Shannon's (1989) study chemistry, microbiology, pharmacology, nutrition, and C-GPA were not significant predictors for passing the NBDHE and had questionable value as selection requirements for program entrance.

The findings are similar for studies done after the NBDHE format change. For example, the pre-requisite courses used as predictive variables for the Bauchmoyer et al. (2004) study which paralleled the courses used in this study were English, Microbiology, Anatomy, and Nutrition. The results from both studies showed that all the courses had a significant correlation with C-GPA's and NBDHE scores except

English. The Bauchmoyer et al. study did not show a significant correlation between English and either C-GPA or NBDHE and in this study, English had a correlation of significance at the .05 with the NBDHE and .01 with the C-GPA.

For the second part of this question, data from two colleges was compiled and the results showed significant correlations were found between the cumulative and program GPA and with the NBDHE exam for both colleges. The mean C-GPA was different for each college but the correlation between C-GPA and NBDHE for both colleges was significant. These findings are a little different from the findings of Shannon's research. In that study the C-GPA was not a significant predictor of passing the NBDHE but the P-GPA was a significant predictor. In Bauchmoyer et al., the P-GPA and the NBDHE had a significant positive correlation to each other.

Based on this data it can be concluded that there is a significant relationship between the individual courses, the C-GPA and the NBDHE. This significant correlation for all courses indicates the restructured format of the NBDHE is testing at a comprehensive level and assessing a full range of program content. If the exam was assessing only recall of factual material there would be a difference in significance of some courses with the NBDHE significance level as were the findings of Shannon.

Based on these conclusions it is recommended that this data be used to help students and educators understand the individual value of each course and the competencies of that course. If student demonstrates a weakness in a particular course then every effort must be made to improve those deficiencies before taking the NBDHE. Due to the increased assessment level of the NBDHE, educators need to be

striving to evaluate course competency performance at a higher cognitive level of understanding than recall or comprehension.

Research Questions 2 and 3

The second and third research questions asked if there was a relationship between Y1-GPA and the NBDHE score or between Y2-GPA and NBDHE score. The data showed that both Y1 and Y2 GPA's were significantly correlated to the NBDHE scores. The grouping of Y1-GPA and Y2-GPA variable is very similar to the concept of early course average (ECA) and the interim course average (ICA) used by the Endenfield, et al. (2000) study. However different courses were grouped. The similar courses for Y1-GPA and ECA are periodontics, dental anatomy and pathology. The only course used by both Y2-GPA and ICA groupings was community oral health. Both studies did find a significant correlation between the groupings, however Shannon's study found greater significance indicated with the ECA.

The combination of first year dental hygiene courses as a potential predictable variable was also identified in a study by Schutte et al. (2002). In this study the first year grouping of courses was not strong in predicting success on the NBDHE. This study was published as an abstract and it is unknown as to which courses were included in the grouping or the format of the NBDHE scored.

Based on this data it can be concluded that each year of program courses is important to the student's predictability of success in the dental hygiene program as well as success on the NBDHE. It is recommended that if a student is weak in the first year of study, a remediation intervention be advised. Another recommendation is that

rather than waiting until the end of a program to begin a NBDHE review course, sequence a NBDHE review course in the third semester for first year courses.

Research Question 4

The fourth question in this study asked if there was a relationship between the S-GPA and the score of the NBDHE or the C-GPA. The results of this study show that the S-GPA is significant to the correlation of C-GPA and to the NBDHE score. But when a regression analysis was done on the NBDHE between the Y1-GPA, Y2-GPA and S-GPA, the S-GPA was not significant.

Based on these findings it can be concluded that the S-GPA by it self is not a strong predictor of success on the NBDHE. While an MATC student could take the majority of the required science courses during the first year of study most of the students have these courses completed before they enter the program. That is why the combination of the courses for the Y1-GPA didn't include those courses. Neither the Y1-GPA nor the Y2-GPA variables included the courses combined in the S-GPA.

These findings are very similar to the findings of Downey, et al. (2002) and Bauchmoyer et al. In those studies the three science pre-requisite courses had a positive correlation between the C-GPA and the NBDHE. And in the regression analysis summary of variables done by Bauchmoyer et al. the science courses were moderately weak predictors of the NBDHE.

These findings of this study differ from those of studies done prior to the NBDHE format change. In the Rowe et al. (1972) study the High School science GPA had a stronger correlation with the NBDHE Average than even the C-GPA. The

reason stated for this high correlation was, "the fact that the NB examination mainly tests knowledge of scientific facts" (Rowe et al. p. 52).

Based on these conclusions it is recommended that the colleges who use the S- GPA as a pre-admission program selection determinant may want to review the value of these criteria. While a sound base and understanding in science may be helpful to understanding program course curriculum, it is not as significant to predicting NBDHE results as it used to be. With the new NBDHE format a student who can problem solve and use critical thinking skills will have an advantage over a student who can only memorize facts.

Question 5

By using data from a second local technical college, the final question researched the relationship between the NBDHE, C-GPA and the Asset test scores for math, reading and writing. This question is a partial replication of the first question in the study. The C-GPA's, NBDHE scores and pre-admission Asset test scores used by WCTC were collected by graduation year. The results of this question found significant correlations between all of the variables except for the Asset math score.

The conclusions that can be drawn from these results are that the findings of C-GPA and NBDHE significant correlations can be replicated and therefore transferable to other schools. The Asset reading and writing tests scores used by WCTC do correlate to performance of C-GPA and NBDHE scores.

The recommendations that can be made from these correlations are that if WCTC continues to use the Asset test scores as a pre-admission test for their program, the math test may not be necessary. For WCTC, admitting students into

their dental hygiene program based on the Asset testing scores for reading and writing will correlate with students C-GPA. Adjustments to the score level acceptable for the program entrance may be needed according to the program performance of the students who have been accepted.

The recommendations from the correlation between the C-GPA and the NBDHE indicate that the academic performance in the dental hygiene program is closely related to the NBDHE performance. Therefore if a student passes courses at marginal levels, the predictability of passing the NBDHE will be only marginal. Or put another way, if a student demonstrates a strong academic performance in dental hygiene course work, the prediction can be made that the student will perform similarly on the NBDHE.

Dental hygiene program outcome goals are closely tied to the student's success on the NBDHE. The recommendation from these findings is that if a program is not meeting its outcome assessment goal of NBDHE success, a review should be done to determine if the C-GPA significantly correlates with the NBDHE scores. If the results are significant and a program is not meeting its outcome goals then possibly the program courses may not be assessing the student's comprehension at a high enough level resulting in an inflated C-GPA.

Recommendations

Further research and analysis could be done to find predictors of success for completing the dental hygiene program or the NBDHE by examining students who are admitted into the program yet fail, drop or withdraw. Other factors that could be studied are psychomotor skills, employment status, time management or

organizational skills and problem solving or critical thinking ability as they relate to dental hygiene program success.

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