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## Predictors For Student Success On The National Board Dental Hygiene Examination (NBDHE)

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PREDICTORS FOR STUDENT SUCCESS ON THE NATIONAL BOARD DENTAL  
HYGIENE EXAMINATION (NBDHE)

by

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B.S., Southern Illinois University, 1989  
M.S.Ed., Southern Illinois University, 2004

A Capstone Report  
Submitted in Partial Fulfillment of the Requirements for the  
Doctor of Education

School of Education  
in the Graduate School  
Southern Illinois University Carbondale  
May 2023

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**CAPSTONE REPORT APPROVAL**

PREDICTORS FOR STUDENT SUCCESS ON THE NATIONAL BOARD DENTAL  
HYGIENE EXAMINATION (NBDHE)

by

Jennifer S. Sherry

A Capstone Report Submitted in Partial

Fulfillment of the Requirements

for the Degree of

Doctor of Education

in the field of Educational Administration

Approved by:

Dr. William Bradley Colwell, Chair

Dr. Gary Kelly

Dr. Christine McIntyre

Dr. Grant Miller

Dr. George Vineyard

Graduate School  
Southern Illinois University Carbondale  
April 6, 2023

## **AN ABSTRACT OF THE CAPSTONE REPORT OF**

Jennifer S. Sherry, for the Doctor of Education degree in Educational Administration, presented on April 6, 2023, at Southern Illinois University Carbondale.

**TITLE: PREDICTORS FOR STUDENT SUCCESS ON THE NATIONAL BOARD DENTAL HYGIENE EXAMINATION (NBDHE)**

**MAJOR PROFESSOR: Dr. William Bradley Colwell**

The primary focus of this research was to determine if any link exists to pre-entry grade point average (GPA), science-based didactic dental hygiene course GPA, and graduation GPA and success on the National Board of Dental Examinations, Inc. (NBDHE).

Results were gathered through NBDHE score reports from Southern Illinois University Carbondale's (SIUC) dental hygiene program as well as GPA and course grades from the SIUC Registrar's office for graduates from the Class of 2012-2022. Pre-entry GPA, graduation GPA, and individual science-based didactic dental hygiene courses were evaluated by using the course grades "A, B, or C" as "pass" and "D or F" as "fail" based on the curriculum requirements of the SIUC dental hygiene program.

## ACKNOWLEDGMENTS

I would like to take this opportunity to thank my Lord and Savior, Jesus Christ for the strength, perseverance, and abilities He has given me throughout this monumental journey. He provided the will and survival skills for this process that proved to be testing at times.

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A very sincere thank you to my committee chair, Dr. Brad Colwell who spent countless hours with me reviewing and revising my paper---who never gave up on me throughout the process. Your words of guidance, support, and expertise in this process were invaluable and I will never forget your kindness and encouragement. In addition, I would like to thank my committee members, Dr. Gary Kelly, Dr. Christine McIntyre, Dr. Grant Miller, and a huge thanks to Dr. George Vineyard who “came to my rescue” with statistical expertise and assistance. I appreciate each comment and critique my committee members offered to ensure my paper was completed with integrity and usefulness to the SIUC dental hygiene program.

## **DEDICATION**

I would like to dedicate my paper and the entire process to my grandparents, James and Blanche Reid who provided financial support, guidance, and dedication to my undergraduate studies. As retired educators, they always worked hard to provide for their family, and it filtered down to all three of their grandchildren. I did not know until my grandmother passed away that my grandparents financially supported all three of us to attend college and graduate with our bachelor's degree. My cousin and I went to Southern Illinois University Carbondale (SIUC) and my brother, Jamie attended Eastern Illinois University (EIU). All three of us have enjoyed life and have success in personal and professional endeavors. They would be so proud of all of us because we have worked hard and are "good humans" ---just like they were all their lives. I catch myself often saying something that grandma would have said in her classroom and how she showed "tough love" to all her students along their journey. Many students loved her for teaching them life lessons and holding them accountable during the process.

In addition, I would like to dedicate this to all my professional mentors and students that I have been blessed to work with for almost 23 years in the SIUC dental hygiene program. You have enriched my life more than you know and pushed me to be a better educator, mentor, and friend to many throughout the dental hygiene profession. My "cup runneth over" with so much gratitude and joy for persevering through this very difficult but rewarding process. Thanks to anyone along the way who has helped keep my path straight and focused on becoming a better person and educator.

## **PREFACE**

The purpose of this study is to discover why the disparity exists and what changes should be made to improve NBDHE scores. Specifically, this study would examine factors such as student pre-entry grade point average (GPA), grades in science-based didactic dental hygiene courses (Oral Pathology, Microbiology, Oral Anatomy, Head and Neck Anatomy, and Dental Radiology I and II), and graduation GPA at the end of the dental hygiene curriculum and how those variables influence student scores on the NBDHE in SIUC's dental hygiene program.



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## **CHAPTER 1**

### **INTRODUCTION**

According to the National Institute of Dental and Craniofacial Research (NIDCR), the prevalence of periodontal (gum) disease continues to be an important public health issue in the United States as two in five adults were affected by some form of this type of disease (National Institute of Dental and Craniofacial Research, 2021). Untreated oral disease has a significant impact on one's well-being and productivity. Specifically, over \$45 billion (about \$140 per person in the US) was lost in productivity in the United States each year because of untreated oral disease (Centers for Disease Control and Prevention, 2021). Further, in 2008, over 34 million K-12 school hours were lost in the United States because of unplanned urgent oral health care (Centers for Disease Control and Prevention, 2021). In turn, a lack of productivity and absences from school can affect a person's overall health.

Plaque-induced gingivitis is the most common form of periodontal disease, which is the second most common oral disease after dental caries or cavities, affecting more than 75% of the population worldwide (Idrees, Azzeghaiby, Hammad, & Kujan, 2014, p. 1373). Fortunately, many patients' gum diseases can be treated and reversed if detected early and they follow an individualized treatment plan. Dental hygienists play a key role in early detection and are the first line of defense against these destructive oral conditions, namely, their primary responsibility is to assess and perform periodontal treatment. If left untreated, most gum diseases could turn more severe and develop into irreversible periodontal disease.

Given the wide scope of services provided in the dental profession, it is vital to understand the roles of each dental professional in their specific scope of practice. Every member of the oral health care team has certain areas of specialized training that create a synergistic

approach to comprehensive oral health care. There are three primary oral health care providers that a traditional patient sees within an office setting: a dentist, dental assistant, and dental hygienist.

- A dentist is a professional who can diagnose and treat problems with patients' teeth, gums, and related parts of the mouth. They provide advice and instruction on maintenance of the teeth and gums and on dietary choices that affect oral health. Some of their duties include restoring cavities and repairing teeth; monitoring whitening procedures; administering local or general anesthesia; taking and diagnosing radiographs (x-rays); writing prescriptions; fabricating models for crowns, bridges, and other appliances; performing laser therapy and providing oral health education (U.S. Bureau of Labor Statistics, 2022).
- Dental assistants usually work collaboratively with the dentist and use the suction to maintain a dry mouth, provide set-up and cleaning of treatment rooms, assist the dental hygienist, take impressions or molds of teeth, take radiographs (x-rays), order supplies, and monitor nitrous oxide (depending on the state practice act) (American Dental Association, 2022).
- A dental hygienist removes hard and soft material from tooth structures, takes and interprets radiographs (x-rays), places sealants, administers local anesthesia and monitors nitrous oxide (depending on the state practice act), provides oral hygiene education, gathers information for a dental hygiene diagnosis, and applies fluoride.
- The American Dental Hygienists' Association (ADHA) stated "there are more than 150,000 registered dental hygienists in the United States." (American Dental

Hygienists' Association, 2022, p.1). About 98 percent of the nation's dental hygienists are female.

Just like other health professionals, dental hygienists must be trained before entering the profession. Specifically, they must earn an associate or bachelor's degree in dental hygiene. In the United States, there are over 400 training/degree programs in dental hygiene: 330 associate or bachelor's degree programs, 60 degree completion programs (see definitions), and 18 master's degree programs (ADHA, n.d.). Of the 330 associate's/bachelor's degree programs, 12 are in Illinois (American Dental Education Association, 2022), and Southern Illinois University Carbondale (SIUC) is the lone bachelor's degree program in the state.

Dental hygienists must be licensed in the state where they are employed. According to the Illinois Joint Commission on Administrative Rules, Administrative Code, Section 1220.200, Application for Licensure, a dental hygienist must file a license application through the state (Illinois Joint Commission on Administrative Rules, 2022). Illinois' administrative rules for obtaining dental hygiene licensure include:

- Certification of successful completion of at least two academic years of credit from an approved dental hygiene program recognized by the Commission on Dental Accreditation of the American Dental Association;
- Proof of passing both the National Board of Dental Hygiene Examination as well as the clinical examination for the state of Illinois;
- Mandated reporter training (every six years);
- Current Basic Life Support certification through the American Red Cross, American Heart Association or American Safety and Health Institute; and paying the licensing fee to obtain an Illinois dental hygiene license.

The dental hygiene licensure application for Illinois is completed online. The period to receive a dental hygiene license is about three to four weeks. Simultaneously, the clinical and the National Board of Dental Hygiene Examination (NBDHE) examination is scheduled during the spring semester of any given year for each cohort of students.

Students must also show proficiency in the content and the practice of dental hygiene. Specifically, every student must pass both a clinical exam (depending on licensure requirements for the individual region or state) and a computerized exam (NBDHE) before they receive a license as a dental hygienist. First, the clinical examination is the Central Regional Dental Testing Service (CRDTS) exam and is offered on the campus of SIUC. It is comprised of two parts: Objective Structured Clinical Examination (OSCE) and patient treatment. The candidate would take the OSCE, which is administered on-site during the clinical examination. This 16-question, multiple-choice exam is recognized for licensure in over 40 states (Central Regional Dental Testing Service, 2022). The second clinical component is patient treatment. Historically performed on live patients, in 2020, the state of Illinois amended the Dental Practice Act to recognize either the patient-based or simulated (mannequin) patient dental hygiene examination to ease constraints of locating exam patients during COVID-19 (Illinois General Assembly, 2022). A combined score of 75 or higher is required to pass the two-part clinical exam. Over the last decade, SIUC candidates have had a successful pass rate for the clinical exam – earning 100% as the median test score. Table 1 would display the pass rates for the clinical examinations for students in the dental hygiene program at SIUC.

**Table 1. Mean Pass Rates (%): Clinical Examination SIUC Dental Hygiene Program\***

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
<b>Mean Pass Rate (%)</b>	100	93.2	100	96	86.2	90.6	100	100	100	100	100

\*All students did not take the CRDTS exam during all reported years, but they took other clinical examinations as described below. The mean scores for all clinical examinations were averaged together to report a total mean score.

From 2012 through 2015, SIUC students took either the North East Regional Board of Dental Examinations (NERB) or the Southern Regional Testing Agency (SRTA) clinical examinations. During this time, the SIUC mean pass rate on these exams was 97.3%. Beginning in 2016, the CRDTS exam replaced the NERB and SRTA as the primary clinical examination at SIUC. When evaluating a 10-year window (2012 through 2022), SIUC's mean pass rate on clinical exams was 96.9%. Only patient-based clinical exams were administered from 2012 to 2019 and then patient-based or simulated (mannequin) were administered from 2020 to 2022. The national mean pass rate for the CRDTS exam from 2016 to 2021 was 91.22% (Central Regional Dental Testing Service, 2022). Data for 2022 is not completed yet.

The National Board of Dental Hygiene Examination (NBDHE) is the second component of the dental hygiene licensure process. The NBDHE assesses the qualifications and problem-solving skills for dental hygiene licensure. The content of this 350-question computerized exam is comprised of two sections -- discipline-based (200 items) and case-based (150 items) -- and administered through Pearson VUE testing centers across the United States and Canada. Dental hygiene graduates are encouraged to study using course materials and/or approved official board review course content. The application is online, and testing is scheduled based on availability (after April 1<sup>st</sup> of any year) at the preferred testing site. Figure 1 shows the breakdown of sessions



for the all-day computerized examination (Joint Commission on National Dental Examinations, 2022). Dental hygiene students who are in an accredited program or have graduated from an accredited program may sit for the exam.

#### ADMINISTRATION SCHEDULE

The following table provides the administration schedule for the NBDHE. The total administration time is nine hours, including the tutorial, scheduled break, and a survey.

NATIONAL BOARD DENTAL HYGIENE EXAMINATION	
Optional Tutorial	15 minutes
<b>Session One: Discipline-based Items (100 items)</b>	<b>3 hours 30 minutes</b>
Optional 15-minute Scheduled Break after the 100th question	<b>plus optional</b>
<b>Session One: Discipline-based Items (100 items)</b>	<b>15-minute scheduled break</b>
Optional Scheduled Break	30 minutes
<b>Session Two: 7-8 Patient Cases (approximately 75 items)</b>	<b>4 hours plus optional</b>
Optional 15-minute Scheduled Break	<b>15-minute scheduled break</b>
<b>Session Two: 7-8 Patient Cases (approximately 75 items)</b>	
Optional Post-examination Survey	15 minutes
<b>Total Time</b>	<b>9 hours</b>

**Figure 1. National Board Dental Hygiene Examination (NBDHE) Session Content (Joint Commission on National Dental Examinations, 2022)**

Once dental hygiene students complete the NBDHE, the results would arrive via email or be posted on their account through the American Dental Association. Like the clinical pass rate, 75% or higher is considered a passing content score, which is subsequently reported to the candidate's dental hygiene program. In 2012, the Joint Commission on National Dental Hygiene Examination migrated to the pass/fail reporting of scores (Joint Commission on National Dental Examinations, 2022). The program would only receive a "pass" or "fail" designation for each candidate, but they receive either a "pass" or "fail" designation along with an explanation of topics they scored poorly on. This information assists a "failing" student to remediate prior to retesting, but, unfortunately, the testing agency does not provide information to the program to help build topic areas or reinforce learning.

In 2020, the SIUC dental hygiene program instituted a dental hygiene Health Education Systems, Inc., or HESI exam through Elsevier as a mock board examination for senior dental hygiene students. HESI is administered online through Elsevier's Evolve system. Students have unlimited attempts for the HESI Practice Exam and HESI Case-Based Exam. The HESI Exam must be passed with a 75%. If the student does not pass the HESI Exam with a 75% after one attempt, students must wait until after graduation to register for the NBDHE to allow more time to prepare for the exam.

Table 2 shows the national pass rates in comparison to the SIUC pass rates for the NBDHE computerized exam. All figures below in Table 2 indicate the overall pass rates at SIUC and national pass rates for all NBDHE attempts, not just first attempt pass rates. Moving forward beyond Table 2, the NBDHE pass rates will be reflecting first attempt pass rates.

**Table 2: SIUC Pass Rates (%) and National Pass Rates (%) on the NBDHE (2012-2022)**

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
<b>SIUC Pass Rates on NBDHE (%)</b>	96.3	93.1	97.1	100	84	78.8	76.7	68.9	84.3	96.3	95.2*
<b>National Pass Rates on NBDHE (%)</b>	96	95.5	95.5	95.7	95	93.9	94.3	92.2	90.7	96	N/A**

\*In 2022, 95.2% reflects the pass rates as of 3/12/23 \*\*The national pass rate is not known at this time because the report is not sent to the program until April/May 2023; Yellow shaded column showed when the Joint Commission on National Dental Hygiene Examinations migrated to pass/fail scoring on the NBDHE; Columns that were shaded in gray and in italics show the following changes with the NBDHE or assessments at SIUC: SIUC dropped the ACT/SAT for admission criteria (2019); Testing format of the NBDHE with three distinct categories of scoring (2020); HESI exam was used as a mock board exam for senior dental hygiene students at SIUC (beginning with the Class of 2021)

The overall student pass rates on the NBDHE for 2020-2022 can be calculated based on what is reported to SIUC. When reviewing these data, SIUC was equal to the national mean score in 2012 (SIUC was 96.3%, and the national was 96%). SIUC showed a steep decline beginning in 2016. That year, the NBDHE pass rate was 95%, while SIUC's pass rate was 84%-- a double-digit decline of 11%. In 2017, the mean pass rate for SIUC's students decreased an additional 5 percent to 78.8% and in 2018, decreased by another 2 percent. SIUC's worst year for pass rates was in 2019 when the mean pass rate plummeted to 68%, which represented an approximate 23 percent gap between SIUC and the national average. In 2020, SIUC's mean pass rates started to reverse their negative slide (+15%), and the gap between the national average and SIUC's average was narrowed to 6.4%. The next year (2021), SIUC showed an additional 6% improvement--its highest percentage since 2015.

Starting in 2020, NBDHE scoring was modified due to COVID-19. It was condensed to only reflect three distinct categories -- Scientific Basis for Dental Hygiene Practice (61 items), Provision of Clinical Dental Hygiene Services (115 items), and Community Health/Research Principles (24 items) -- instead of specific topic areas such as Radiology or Pathology. These scores were reported as a d-value score, which was based on data from current students/recent graduates who attempted their first examination during the most recent 12-month period (Joint Commission on National Dental Examinations, 2022).

### **Problem Statement**

In the last ten years, SIUC's dental hygiene students have experienced a significant decline (30%) in NBDHE pass rates. Further, during a 6-year span, there was a wide disparity between national and SIUC's pass rates on this exam, with a gap ranging from 6 to 23 percent.

Interestingly, this downward trend was preceded by a year in which SIUC's pass rate exceeded the national pass rate.

### **Purpose Statement**

The purpose of this study is to discover why the disparity exists and what changes should be made to improve NBDHE scores. Specifically, this study would examine factors such as student pre-entry grade point average (GPA), grades in science-based didactic dental hygiene courses (Oral Pathology, Microbiology, Oral Anatomy, Head and Neck Anatomy, and Dental Radiology I and II), and graduation GPA at the end of the dental hygiene curriculum and how those variables influence student scores on the NBDHE in SIUC's dental hygiene program.

### **Research Question**

**RQ 1.** How does student grade point average in the following areas affect pass rates on the NBDHE examination in SIUC's dental hygiene program over a ten-year span (2012-22):

1. Pre-entry into the dental hygiene program (including Microbiology);
2. SIUC's science-based, didactic dental hygiene courses; and
3. Conclusion of the dental hygiene curriculum?

### **Background**

Student success begins at the admission process and concludes with obtaining licensure to practice dental hygiene. Dental hygiene programs strive to produce high pass rates to maintain full accreditation status and graduate well-educated, competent professionals. Students' academic success is based on focused didactic and performance-based preparation and a passing NBDHE score along with a clinical (patient or mannequin) examination. The NBDHE is particularly imperative in a dental hygiene student's scholastic career since they would not obtain professional licensure if they cannot earn a passing score (Pearson Vue, 2022).

A review of the literature shows the various relationships between a student's grades and standardized tests to successful passage of the NBDHE. First, multiple studies concluded that GPA does affect student success on the NBDHE (Alzahrani, Thomson, & Bauman, 2007; Downey, Collins, & Browning, 2002; Ward, Downey, Thompson & Collins, 2010). Moreover, pre-entry standardized testing, such as the American College Test (ACT) or the Scholastic Achievement Test (SAT), provide faculty ways to assess students' success (but SIUC no longer requires these examinations). Another group of long-standing, standardized tests specific to dental hygiene students -- the Dental Hygiene Aptitude Test (DHAT) or Admission Test for Dental Hygiene (ATDH) -- may show a positive correlation to student success.

These predictors result in dental hygiene students maintaining a prominent level of comprehension skills, successful performance with critical-thinking exercises, and devising in-depth treatment plans for patients.

### **Information about the SIUC's Dental Hygiene Program**

SIUC's dental hygiene program typically has a maximum of 36 students entering the professional sequence in the fall of the second year. Students must complete coursework with a grade of "C" or above to enter the dental hygiene program's professional sequence. Students are accepted into the professional sequence based on high school GPA (non-weighted and use up to three decimal places in the selection process) and class rank; college GPA; the number of completed prerequisite courses; and ACT (American College Testing) scores /SAT (Scholastic Aptitude Test) scores (these may be used to break a tie in the selection process).

Below are the admission requirements for the first year and second-year dental hygiene students.

- **First-year (freshman) dental hygiene students:** Students can be admitted directly from high school. Prerequisites are met at SIUC. Students' professional sequence begins the second or sophomore year.
- **Second-year (sophomore) dental hygiene students:** Students can either take prerequisites for the program from another college or university or take the prerequisites at SIUC. Regardless, 32 hours of prerequisites must be completed before entering the second or sophomore year.

### **Positionality**

I have been a dental hygiene educator at SIUC for 22 years and have a personal desire for student success. As an associate professor, I teach many science-based didactic and lab courses throughout the curriculum. These courses and topic areas are used to scaffold students' learning and are paramount in building critical-thinking skills and case-based learning within the NBDHE.

### **Research Design**

This study would be conducted using quantitative research methods. SIUC's dental hygiene students' NBDHE scores from a ten-year period (2012-2022) would be evaluated. Further, existing numerical data (frequencies and percentages) would be utilized to evaluate student pre-entry GPA, dental hygiene science-based didactic course GPA, and graduation GPA to discover if these scores can predict success on the NBDHE. A "cluster population" was utilized since the researcher would be using students' data from where she is currently employed.

### **Significance of Study**

This study's significance is to determine the effects of distinct types of GPA results on the NBDHE exam results of SIUC's dental hygiene students. As a program, faculty could discuss strategies to either increase the admission GPA for the program and/or begin utilizing written or in-person interviews to discover students' strengths and weaknesses prior to being admitted into the dental hygiene program. In addition, faculty and academic advisors can collaborate to improve student selection and increase student success within SIUC's dental hygiene program. Thirdly, admissions criteria for the program should be investigated so students would represent many diverse backgrounds and socioeconomic groups. Finally, the program's faculty should discuss how the HESI exam was a predictor of success on the NBDHE and if instituting this process earlier in the curriculum sequence could help to gauge student's progress.

### **Definition of Terms**

**BSDH:** Bachelor of Science in Dental Hygiene. This is a four-year degree that includes prerequisites and core courses in the dental hygiene curriculum. (Acronym Finder, 2022)

**NBDHE:** The NBDHE or National Board of Dental Hygiene Examinations, Inc. is "a comprehensive examination consisting of 350 multiple-choice items covering functions that a dental hygienist is expected to be able to perform. Only functions that can be delegated to a dental hygienist in many states are included in the examination." (Pearson Vue, 2022)

**ACT:** ACT or American College Testing "is a mission-driven, nonprofit organization dedicated to helping people achieve education and workplace success." (American College Testing, 2022)

**SAT:** SAT or Scholastic Aptitude Test “is a multiple-choice entrance exam used by most colleges and universities to make admissions decisions about high school student’s readiness.” (Princeton Review, 2022)

**DHAT (now called ATDH):** This stands for Admission Test for Dental Hygiene and “is an admission test for anyone interested in pursuing a career in dental hygiene. The ATDH should be taken before entering a dental hygiene education program in the United States.” (American Dental Association, 2022)

**University Core:** “The University Core Curriculum shapes the structure of general education at SIUC.” (Southern Illinois University Carbondale, 2022)

**Prerequisites:** Courses that must be taken prior to either beginning the dental hygiene program or within the program’s curriculum.

**Degree Completion:** “A degree completion program is an academic program specifically designed for students who have started, but not finished, a four-year undergraduate degree. By accepting some or all the credits that a student has already earned from their previous education, degree completion programs offer students a faster and often less expensive alternative to starting over an undergraduate education from scratch.” (Stobierski, 2019)

**Capstone Option:** “The Capstone Option is for the student who has earned or would soon earn an Associate in Applied Science (AAS) degree, Associate in Engineering Sciences (AES) degree, or equivalent certification and whose SIUC’s major is one that participates in the option. The Capstone Option advantage allows students to complete an abbreviated University Core Curriculum (UCC) requirement of 30 credit hours rather than 39 credit hours.” (Southern Illinois University Carbondale, 2022)



**Dental Hygienist Observation Form:** Students interested in SIUC's dental hygiene program must complete at least two observation hours of a practicing dental hygienist and sign a designated form for the student to mail to the program. (Southern Illinois University Carbondale, 2022)

**OSCE:** OSCE, or Objective Structured Clinical Examination, is a measurement of diagnosis, treatment planning, and clinical decision-making of licensure candidates. (Central Regional Dental Testing Service, 2022)

### **Limitations and Delimitations**

The limitations of this study are the items the researcher cannot control. One item is that curricular changes and/or modifications must go through an extensive approval process, which is often difficult to navigate in a timely manner. Over the last ten years, the SIUC dental hygiene program has experienced some moderate turnover and faculty retirements. Faculty that have retired or left SIUC taught many of the integral science-based didactic courses in our program that have major content within the NBDHE.

Another limitation is the researcher discovered missing data from the SIUC Registrar for GPA pre-entry, and some students' Microbiology and Pathology course grades. The reason behind the missing pre-entry GPA is that some students may transfer, and this was not part of the search for the SIUC Registrar's Office. Microbiology is a course that can be taken as a pre-entry transfer course or taken at SIUC. The Microbiology course could have been assigned a different course number and it was not present in the data sets. Thirdly, the Pathology course was assigned a different course number early in the year range, so it was not included in the original data set. The researcher was able to gather some missing data from other program historical records. Negative effects from COVID-19 may have affected students' learning due to migrating from an

in-person clinic, lab, and didactic model to a more online platform via Zoom instruction may have reduced learning capacity for the hands-on profession of dental hygiene.

The researcher does not control the students accepted into the dental hygiene program because that duty has been delegated to the academic advisor. The dental hygiene program uses a certain protocol and “ranking” of potential students that are characterized by the academic advisor, program director, and the school director of the School of Health Sciences at SIUC.

The following protocol is used to “rank” potential students for the dental hygiene program:

1. For acceptance as a freshman, year 1, the academic advisor reviews an applicant’s high school GPA.
2. For acceptance as a sophomore, year 2, which is our biggest selection class, a student needs to have the pre-requisite courses and they are listed below. If you wish to take pre-requisite courses at a community college, the academic advisor needs the name of the college and state it is located, so they can provide the transfer equivalency courses: (Note: a 2.75 or higher GPA was required to be a successful applicant)
  1. ENGL 101
  2. ENGL 102
  3. MATH 101 or 108
  4. Speech/ CMST 101
  5. Intro to PSYC 102 or SOC 108
  6. Chemistry 106
  7. Microbiology 201

8. Intro to Nutrition HND 101
9. Anatomy AH 241---A&P 1 and 2 (if from a community college)
10. Medical Terminology 105

3. The academic advisor assigned points for letter grades in those courses (A=2, B=1, C=0). Students received one-half point for every pre-requisite course they have scheduled for the spring (during the selection period).

Points were added to the points for students' GPA, to give them a total point value, then students are ranked, and highest points are offered a spot in the program. If there was a tie between students, preference goes to the student who either applied first or high school science and/or math grades were assessed.

4. A student must apply to SIUC: <http://admissions.siu.edu/apply/> When applying to the university, they would be able to apply to the dental hygiene program during the online application process to the university. We start taking applications every July 15<sup>th</sup> and the deadline is February 1<sup>st</sup>. Students should submit their fall transcripts to SIUC with the fall grades posted, and then submit a spring schedule to the dental hygiene program to receive points for any of the pre-requisite courses they are registered for. Again, when students apply to the university, they can apply to the dental hygiene program during the online application process for the university. If you have not yet applied to SIUC, now is the time to do so. Just a reminder, if students are in any of the classes evaluated for selection during the spring prior to the fall of applying to the program, they would want to include a copy of their spring

semester classes with an application, so that we can award one-half points for each class they are enrolled in during the spring that are evaluated for selection in the fall.

Another item that could affect course grades is the SIUC Registrar only keeps a primary record of the last grade in a course. The protocol was changed as of Summer 2013 and only the most recent grade will be calculated in the overall GPA and count toward the student's hours earned (Southern Illinois University Carbondale Office of the Registrar, 2023). For example, if a student fails a course and must repeat it the following year, new course grade(s) replace the original course grade. A significant difference would occur within the current data sets in comparison to what is reported in the previous data sets. In addition, the researcher is unsure about the pre-entry GPA and if it is referring to a high school or college GPA.

Delimitations of this study are boundaries the researcher has determined.

1. The researcher would only evaluate the mean NBDHE scores in the United States in comparison to SIUC's dental hygiene program.
2. The researcher would investigate SIUC's NBDHE pass rates from 2012-2022, when reporting was changed due to COVID. Specifically, the NBDHE has decreased the amount of data they share as far as specific types of questions that students scored incorrectly. A broad topic area or heading was provided, and the testing agency gave the dental hygiene program the standard deviation for each topic and how close the program's standard deviation is to the mean score for the dental hygiene programs throughout the country. In addition, if the student is unsuccessful on the NBDHE, they would receive a scoring sheet that explains areas of weakness on the exam so they would know how to remediate or prepare for retaking the exam.

3. The researcher teaches many didactic and science-based courses used for student preparation for the NBDHE.
4. The researcher discloses that passing grades for the dental hygiene program is an “A, B, or C.” A “D or F” is considered a failing grade and the course(s) would have to be repeated if the student reapplies and is accepted back into the dental hygiene program.

From the findings in this study, the following inferences were made:

- Students who master course content are at a higher percentage of pass rates, hence, less likely to fail the NBDHE
- The SIUC dental hygiene program does an excellent job selecting students for the program
- In the past, the pre-entry GPA requirement was 3.0, but the SIUC dental hygiene program decreased it to 2.75 about the time the program experienced a decrease in board scores

### **Overview of the Study**

Chapter 2 includes a literature review that relates the different varieties within student variables and how they may influence success on the NBDHE for SIUC’s dental hygiene program. In addition, in Chapter 3, the methods of this study would be explored as well as specific information on the research question, study design, and data collection and analysis. Chapter 4 would present the research and report findings by theme. Each theme would be elaborated on in detail to draw conclusions. Chapter 5 would summarize the findings, discover future implications, and conclude the study.

## **CHAPTER 2**

### **LITERATURE REVIEW**

The purpose of this literature review is to explore how the student academic experience may influence students' success on the National Board of Dental Examination (NBDHE). Specifically, it would review different variables, then would discuss how each variable impacts the NBDHE. Since the literature regarding dental hygiene programs and NBDHE results is sparse, the researcher expanded the scope to include similar undergraduate programs and how students' academic and non-academic variables impacted their ability to pass a national board examination. Some dental hygiene programs require ACT or SAT testing for pre-entry into the program in addition to other requirements set by their institution. In turn, evaluation of student learning outcomes provides insight for planning and implementing current curricular practices. The following information helps demonstrate the importance of refining common practices within the dental hygiene curriculum.

For this literature review, twenty-three peer-reviewed articles and one master's thesis were retrieved online using Google Scholar. More specific search engines within Google Scholar were used such as PubMed, Wiley Online Library, Sage Pub Journals, Springer, and website information from the American Dental Hygienists' Association. The following search categories-- 'student success,' 'National Board Dental Hygiene Examination,' and 'dental hygiene education'-- were successful in the retrieval of pertinent information. The dental hygiene education topic was maintained, but some other healthcare professions were evaluated and compared for this specific literature review.

**Socioeconomic Status, Cultural Diversity, Transfer Students, and Student Success**

Variables that influence university academic success can start as early as elementary school, including the impact of a student's socioeconomic status (SES), cultural diversity, and transfer status. A student's SES may influence their success within a dental hygiene program. According to a 2008 article by Aikens and Barbarin, many areas throughout the country have students with low SES, which can affect the quality of the K-12 educational experience or access to modern technology. Secondarily, the American Psychological Association's research in 2022 indicated that school conditions played a vital role in how a child learned and retained information. The lack of access to learning materials, classroom and/or practical learning experiences, or tutoring programs may hamper the ability of students to have a positive learning environment (Bradley, Corwyn, McAdoo, & Garcia Coll, 2001; Orr, 2003). The National Center for Education Statistics (2014) mentioned that decreased academic success rates and achievement for lower SES children may continue in science, technology, engineering, and mathematics fields for many years post-secondary graduation and can cause students to have higher collegiate dropout rates than students from higher-income families.

Cultural diversity among faculty and students in dental hygiene programs adds a positive direction to the educational experience. In a 2019 article by Jenkins and Boyd, multicultural faculty and students cultivate meaningful relationships, which would only enhance the students' learning experience. In addition, Jenkins and Boyd (2019) discussed that most international students who were attending dental hygiene programs in the United States lacked an understanding of written and verbal English. Second, international students faced challenges with cultural adaptation; feelings of discrimination, anxiety, stress; and a decreased connection with other students and faculty within the program. Dental hygiene faculty should focus on barriers international students encounter when they are initially accepted into their programs. For

example, students may not be familiar with multiple-choice questions or completing evaluations on a computerized system. Further, in this same article by Jenkins and Boyd (2019), international students were not accustomed to the perceived “lack of formality” within the classroom setting. If this takes place, international students see that programs are willing to embrace differences between groups of people and teach in an engaging way. Jenkins and Boyd concluded their research study by determining that cultural diversity and cultural competence may be multifaceted because the “melting pot” of the United States is evolving and changing very rapidly. An article by Welch and Ayers (2021) reported that dental hygiene students should learn different approaches to communicating with individuals who are different from themselves. This takes practice and time to build these valuable skillsets, and a diverse dental hygiene faculty population may encourage diversity within their student population. Cultural competence of health care providers is a vital connection between the provider and care of their patients (Lehman, Fenza, & Hollinger-Smith, 2020).

Students can also transfer from a community college to a university setting to obtain a bachelor’s degree in dental hygiene. In a 2017 article by Rudy et al., students who transfer from a community college have a lower graduation rate than students who begin and continue their education in a university setting. In addition, they mentioned that students have immediate barriers and were not prepared for the major change in surroundings, nor ready for the major time commitment with studying and other program responsibilities. A highlight from an article by Tucker (2018) stated this may be due to “transfer shock” because at the university level some courses may be structured differently. Further, Tucker stated some students are living away from home for the first time and this can be a large adjustment.



## **Pre-Entry Requirements (Standardized Tests, College Pre-Requisites, Pre-Interviews) and Student Success**

Many universities evaluate pre-entry standardized requirements, such as the ACT and/or SAT, prior to acceptance into dental hygiene programs. In research by Sanderson and Lorentzen (2015), dental hygiene programs used overall college GPA, college science GPA, and ACT as admission criteria. However, they found these variables were not statistically significant in creating a passing score on the NBDHE. In the same article by Sanderson and Lorentzen (2015), they discovered that a certain score must be attained on standardized exams, and this adds value to predicting success on the NBDHE. In an earlier study, Bauchmoyer, et.al reported that adding entrance GPA to SAT results predicted success on the NBDHE (2004). Moreover, Austin (2011) determined the reading subsection on the ACT can drive success on the NBDHE along with microbiology lecture grades. Austin added that overall reading comprehension was particularly important in processing the content on the NBDHE, and the microbiology component was dispersed throughout the exam. Finally, Rudy et al. (2017) stressed that if scores are high on the ACT, students have improved scores on the NBDHE; however, some dental hygiene programs are no longer utilizing the standardized exam(s) as a program entrance requirement.

More specifically, universities may utilize a program specific examination to determine entry into the program, such as the Dental Hygiene Aptitude Test (DHAT). An article published in 1984 by Longenbecker and Wood stated that in 1956 the American Dental Hygienists' Association developed the DHAT to create a mechanism to measure a student's potential success within a dental hygiene program. This finding was verified when Tucker (2018) discovered the DHAT had a strong correlation in predicting student success in dental hygiene education

programs. Additionally, the study by Longenbecker and Wood (1984) found the DHAT was more consistent than a general ACT assessment test in predicting success on the NBDHE.

Often dental hygiene programs utilize college pre-requisites and pre-interviews as program admission criteria. In a study conducted by Liang, DeWald, and Solomon (2018), courses that proved to be strong predictors in NBDHE success were oral anatomy, histology, oral pathology, and radiology. In further reviewing the role of pre-requisite coursework, Chow and Milos (2018, p. 185) “reviewed 30 university credits -- including required courses such as English, biology, general and organic chemistry, psychology, statistics, and sociology -- and found the pre-requisite grades were weak predictors of academic performance in the dental hygiene program, with the strongest correlation being cumulative pre-requisite GPA.” Data collected from a survey created by Sanderson and Lorentzen (2015) found that dental hygiene programs did not show a positive correlation between these types of pre-requisite courses and the skillsets of potential dental hygiene students. Additionally, in Sanderson and Lorentzen’s study, there was not a positive correlation between interviews and success in the dental hygiene program or on the NBDHE. In contrast, a study by Alzahrani, Thomson, and Bauman (2007) indicated that entry interviews correlated with success in the dental hygiene program, but dental hygiene faculty would not see the correlation until students migrate through courses within the curriculum. Two articles, one by Mercer and Puddey (2011) and one by Mercer, Abbott, and Puddey (2013) supported Alzahrani, Thomson, and Bauman’s findings that interviews were positively correlated with latter years in the dental hygiene program and led to more emphasis on clinical applications with patients.

**Evaluating Learning and Delivery of the Dental Hygiene Curriculum (GPA, Science-Based Courses, Critical-Thinking Exercises, Distance Education) and Student Success**

After reviewing the impact of standardized tests and pre-interviews, it is necessary to study the overall and entering GPA of dental hygiene students for evaluation of the dental hygiene program and NBDHE success. In separate 2017 studies, both Leiken and Rudy et al. noted that overall college GPA and science GPA are the strongest positive predictors of student success. In contrast, research by Alzahrani, Thomson, and Bauman (2007) mentioned that GPA was not significant when compared to successful results on the NBDHE. To echo this non-significance, Austin (2011) stated that college cumulative GPA or high school GPA was not strongly correlated to NBDHE scores.

According to Leiken (2017), if a student had a declining GPA when transferring from a community college to a university, this increased the chance of having an unsuccessful result on the NBDHE. Further, Leiken added that students who have a degree from another higher education institution were more likely to have higher overall GPA than students who did not have a degree. Tucker (2018) also mentioned that transfer students who possess a proficient level of motivation and excellent problem-based learning skills would more likely experience academic success.

The dental hygiene curriculum is a driving force for student success within any dental hygiene program (Alzahrani, Thomson, & Bauman, 2007). Course delivery may change, but certain standards and content must be covered within any associate's or bachelor's dental hygiene program. Partido and Stafford (2018) discussed the evaluation of curriculum delivery and how important it was in gauging student success.

Evaluation of curriculum delivery may be performed through critical-thinking exercises, synchronous learning, learning styles assessment, lecture, and performance-based learning.

Critical-thinking exercises are beneficial when attempting to answer case-based questions or case study scenarios. This specific question format has been added to the NBDHE in the last several years and has made the exam greater in length (Tucker, 2018). Dental hygiene programs may want to consider screening for critical-thinking skills to assess entry-level skills (Williams et al., 2006). Partido and Soto (2018) stated in an article that when evaluating science-based courses, many activities can be incorporated to build critical-thinking skills. Students also use critical-thinking skills to compare, contrast, analyze, and reflect on different patient scenarios. Partido and Soto (2018) also noted that students often encountered patient complexities in medical/dental histories due to chronic diseases and extensive medication needs. Sanderson and Lorentzen (2015) added that building relationships with others in the program would add learning capacity in a critical-thinking mindset. For example, students can work in teams to solve complex case studies and develop more treatment planning skills and improve patient care.

Science-based courses such as oral pathology, oral anatomy, histology, and oral radiology can predict success in student outcomes. In 2017, Liang, DeWald, and Solomon concluded that these specific courses encouraged critical-thinking exercises to solve scenarios in case-based questions. Rote memory techniques in these courses did not prove to be as successful because they do not assist the student when reading case studies and attempting to solve complex problems. Oral radiology and oral pathology are entirely new topics for students, and they must utilize many critical-thinking skills in science-based courses. Research by Liang, DeWald, and Solomon (2017) discussed the importance of positive performance in the oral radiology course required for all dental hygiene students. They concluded there was a positive correlation between performance in an oral radiology course and overall scoring on the NBDHE. Some limitations are noted within this article because there were no accounts for student study habits or time

preparing for classes. A 2004 article by Bauchmoyer et al. determined that students who take science-related courses at more than one institution could have negative effects on NBDHE outcomes or courses in general.

Other critical-thinking skills tests predict success programmatically and on licensure examinations. Objective Structured Clinical Examinations (OSCE) gauge student's performance and pre-clinical GPA. In 2017, Terry et al. stated that many programs use OSCE for topics such as local anesthesia training or clinical competency. The OSCE may be utilized for tracking students' performance and to see if any students are at-risk of failing courses or having an unsuccessful attempt on the NBDHE. In 2018, Partido and Soto discussed that dental hygiene didactic (lecture) courses could use critical-thinking skills and lecture-type presentations to teach dental hygiene content. Faculty members who solely use lecture-based classrooms do little to build the skills necessary to solve case studies. They suggest if students work together to solve complex case studies, development of superior skills in treatment planning and improving patient care was more likely to occur.

Dental hygiene programs have distance education learning options. An article by Olmstead (2010) mentioned distance education included synchronous learning and was successful in dental hygiene education while improving learning outcomes. This specific type of distance education encourages several modes of interaction between faculty and students such as videos, chat rooms, and group breakout rooms using an online platform. Second, Olmstead gauged that students who maintain this type of learning prefer more structure in scheduling courses. The level of learning should be a broad experience for students and should parallel with the Commission on Dental Accreditation (CODA) standards. Thirdly, Olmstead stated students were lost due to attrition and equally distributed between distance education platforms and on-

campus classroom learning. Fourthly, Olmsted mentioned distance learning did not negatively affect the student's grade point average (2010).

Other allied health students (such as nursing, physician assistants, and dental or dental hygiene students) have similar learning styles and personal traits. As recognized in an article by Terry et al. (2017), allied health students must have good ethical reasoning standards, communication, interpersonal skills, interprofessional collaboration, and exceptional skill of comprehension of course material. Secondly, Terry et al. stated that in a classroom or lab setting, formative and/or summative evaluations were used as critical ways to assess students' learning and performance. Terry et al. noted that in some instances, essay questions were chosen by faculty to gauge knowledge and these types of questions were not successful for summative evaluation (2017).

### **Dental Hygiene Faculty Mentorship, Preparation, Teaching Modalities, and Student Success**

The key to student success is to enhance motivation techniques, engage in positive experiences with faculty and other students, and to learn using different critical teaching strategies. Social and intellectual capabilities were critical in students' study habits and how well students adapt to the dental hygiene program. Any differences within the success of students may depend on faculty preparedness, curriculum, and course structure.

Research by Tucker (2018) determined faculty interaction and quality faculty mentorship and feedback are effective ways to assist students with supplemental learning techniques. Students have improved academic performance when faculty are engaged and committed to academic success and encouraged involvement in student organizations. According to Tucker, the development of students' self-confidence and interpersonal relationships helped guide them

for higher achievement in long-term problem-solving within patient care (2018). A study by Leiken (2017) determined that students who were positively mentored by faculty members and program directors had strong predictors for success. In addition, Leiken stated that students who have an initial positive professional relationship with the dental hygiene program director have more overall success throughout the program. If students encounter unexpected hardships or challenges, they are more likely to seek support and guidance from a faculty or program director (2017).

In a 2010 article, Olmstead concluded dental hygiene curriculum should be continually assessed to ensure an improved learning environment for students. Olmstead added that teaching assignments can change, and a learning curve may initially exist for faculty members. If new course preparation is mandatory, mentorship by other faculty members within the dental hygiene program will help smooth the transition (2010).

Terry et al. (2017) discovered that oftentimes dental hygiene programs have their students create a portfolio to highlight their educational experiences. Unfortunately, this type of assessment tool did not prove to be successful in predicting or demonstrating student success. Terry concluded that portfolios map out student accomplishments and performance but did not encourage maximum performance within the program or beyond their professional career (2017).

For clinical hours and experiences, students can learn from interprofessional education (IPE) opportunities such as collaborating with physician assistant, nursing, and other student professional groups. According to a 2017 article by Furgeson, Inglehart, and Habil, IPE (such as rubrics and reflection papers) was considered “best practice” for dental hygiene programs and assessed student readiness for learning outcomes. Many programs acknowledged they should

participate in IPE activities, but some faculty were resistant to change. In addition, Furgeson, et al. mentioned that IPE should be recognized in accreditation standards for dental hygiene due to the scope of practice changes within the profession. For example, many states have instituted advanced dental hygiene practitioners, other advanced degree options, and/or additional training for dental hygienists, which would enhance longevity within the profession and broaden the scope of practice.

Dental hygiene programs may choose to utilize course outcomes instead of mock board results to gauge student's success. Nordquist et al. (2017) determined that board preparation courses were effective to decrease student stress levels and to increase their motivation to study. In addition, these courses assess student's knowledge prior to taking the NBDHE. Second, programs have a board review course incorporated into the dental hygiene curriculum to review content areas and to discover and/or reinforce weaker areas within the curriculum. Third, programs design and administer a mock board examination to test knowledge and gauge learning prior to the "real" exam. Nordquist et al., concluded that program directors mentioned that student success and outcomes were based on willingness to prepare within the clinical and didactic courses. Finally, Nordquist et al. confirmed the importance for students to begin reviewing and studying early for the NBDHE (2017).

After program completion, Thiele (2017) determined that building educational opportunities for dental hygienists to enhance patient care minimally include working in collaborative teams, providing information for risk assessment and moving into the age of technology. Thiele further discovered that many new educational models have been developed to address access to care issues. Specifically, in 2015, the American Dental Hygienists' Association mentioned the dental hygiene profession was moving from individualized care to population-



based care for patients in public health settings or low access areas. This evolving mindset of care may help other professionals collaborate with dental hygienists and enrich comprehensive treatment options.

### **Conclusion**

A literature review showed that a positive learning environment for students and a focus on inclusivity would create opportunities for dental hygiene students. Incorporating more emphasis on science-based courses helps to synthesize difficult topics and gives students more fulfilling pathways of learning. The research showed mixed results when evaluating the effectiveness of GPA and student success on the NBDHE. In comparison to other healthcare professions, many types of assessments were used to precipitate learning. Chapter 3 provides specific information regarding the methods used in this study.

## **CHAPTER 3**

### **METHODOLOGY**

The primary focus of this study is to discover why the disparity exists within the SIUC dental hygiene program's National Board Dental Hygiene Examination (NBDHE) scores and what changes should occur to improve exam scores. Specifically, this study would examine factors -- such as student pre-entry grade point average (GPA); GPA in science-based didactic dental hygiene courses; and graduating GPA at the end of the dental hygiene curriculum -- and how each correlate to student scores on the NBDHE in SIUC's dental hygiene program.

This chapter would provide information on research design, methodology, data collection, and data analysis as it relates to this study. The chapter would conclude with a brief description of Chapters 4 and 5.

This study is designed to answer the following research question:

**RQ 1.** How does student grade point average in the following areas affect pass rates on the NBDHE examination in SIUC's dental hygiene program over a ten-year span (2012-22):

1. Pre-entry into the dental hygiene program (including Microbiology);
2. SIUC's science-based, didactic dental hygiene courses; and
3. Conclusion of the dental hygiene curriculum?

#### **Research Design**

Most often, one of three distinct types of methodology is utilized when researchers conduct studies (Creswell & Plano Clark, 2011). Qualitative, quantitative, and mixed methods (which is a combination of quantitative and qualitative). The researcher has selected quantitative methods for this specific study. The rationale for selecting the quantitative design and reason(s)

for not utilizing a qualitative design is provided below.

### **Qualitative**

According to McDavid, Huse, and Hawthorn (2019), a qualitative research design is based on gathering words, documents, text, or other non-numerical representations of data, including direct observations or similar themes within research. Qualitative research is not concerned with numerical identity, but with a deep understanding of a given problem. The objective of qualitative methodology is to “produce in-depth and illustrative information in order to understand the various dimensions of the problem under analysis.” (Queiros, Faria, & Almeida, 2017, p. 370). A qualitative research design was not utilized in this study because other text documents were not used, and more numerical data sets (GPA’s and NBDHE scores) were available. Observations were not conducive to this type of study. In addition, conducting surveys of former students would be difficult due to inaccurate contact information such as emails, addresses, and name changes.

### **Quantitative**

Quantitative research focuses on a stringent and controlled design to examine phenomena using a precise measurement that generates numerical data (Polit & Beck, 2012; Rutberg & Bouikidis, 2018). Specifically, this scientific model is grounded in detached observation, data collection and analysis, and the acceptance or rejection of a formed hypothesis (Melkert & Vos, 2010). Here, phenomena can be controlled by manipulating variables or controlling variables in a particular setting. Three primary ways to analyze quantitative data are descriptive, correlational, and experimental research designs (Charles, 1988).

These types of designs are quite common in business and education professions. Normally, the researcher wishes to construct internal correlations or comparisons within

variables or subgroups that are chosen (for example, gender, age, or rank in class) and how these subgroups compare to measured outcomes (McDavid, Huse, & Hawthorn, 2019). Positive and negative correlations can be traced in three ways; (1) one variable increases, the other variable increases; (2) one variable increases, the other variable decreases (inverse relationship), and (3) one variable decreases, the other variable decreases (Schober, Boer, & Schwarte, 2018).

A quality research design is paramount to ensure accuracy in assessment and evaluating cause-and-effect relationships between dependent and independent variables. A quantitative research design was selected in the present study because of the existing numerical data sets and the interest in evaluating if any correlation exists between any of the given variables presented above. Using secondary data to discover correlations within data sets may provide useful information to guide the dental hygiene faculty as well as the administration of SIUC's School of Health Sciences (SHeS) and the College of Health and Human Sciences (CHHS) to improve student success.

A key concern with quantitative data collection is that outliers can occur. This happens when one or more of the observations in a data set is inconsistent with the other observations, in other words, it does not "fit in" with the other observations. Gofen and Weimer (2020) suggested identifying recognizable outliers and ways to determine how they exist. Any researcher must state outliers and report on data analysis procedures during any research project.

### **Methodology**

Correlational research methods determine if relationships exist between two or more variables (can be negative or positive; strong or weak relationships). Cause and effects are not shown, and the null hypothesis indicates what the researcher wants to discover. A primary goal is

to accept or reject the hypothesis and determine the degree of the relationship. A correlational coefficient is commonly used in this type of design (Charles, 1988).

In this study, the researcher would use correlational methods to discover if various aspects of GPA affect student success on the NBDHE. Correlation is a relationship between variables that can be measured in a mathematical way via the correlation coefficient ( $r$  which is a number between  $-1$  and  $+1$ ). The value displays the direction and strength of association using a positive or negative sign. The value of  $r$  indicates the strength of the association or relationship; if the value moves closer to  $+1$  or  $-1$ , the relationship is stronger and movement to  $0$  indicates a weaker relationship (Nathe, 2017). The one main limitation to correlational studies is that “correlation does not mean causation.” Researchers must use caution when drawing conclusions from correlation coefficients (Janse et al, 2021).

Applied to this research, the researcher would examine factors such as student pre-entry GPA; GPA in science-based didactic dental hygiene courses (Oral Pathology, Microbiology, Oral Anatomy, Head and Neck Anatomy, and Dental Radiology I and II); and graduating GPA at the end of the dental hygiene curriculum -- and how each correlate to student scores on the NBDHE in SIUC’s dental hygiene program.

### **Population**

The population of a research study is a group of individuals, objects, or events, that mold into specific criteria that generalize results (McMillan & Schumacher, 2001). In this study, the population consists of students in SIUC’s dental hygiene program that sat for the NBDHE at a Pearson Vue (a national testing center) and graduated between 2012 to 2022. The researcher would not utilize a sample for this project since all students meeting these criteria would be studied.

## **Data Collection**

### **Pre-Collection Treatment of the Data**

Prior to data collection, the researcher reviewed how scores on the NBDHE were calculated. Between 2012-2019, data were reported to the school as a raw score and a standard deviation on each content area. From 2020-present, the NBDHE did not report content area data, only a “pass” (75 or higher) or “fail” (74 or below) score for each SIUC dental hygiene student. If a student fails the examination, they receive data about their performance in each of the topic areas covered on the examination. This assists in student remediation and preparation for retesting in the future (Joint Commission on National Dental Examinations, 2022).

Once students sign the application to sit for the NBDHE, this provides expressed consent to share exam scores with individual dental hygiene schools. In addition, NBDHE pass rates and any other associated data were attached to the students’ secure PIN (DENTPIN) through the Commission on Dental Accreditation (CODA) website. Students do not have an option to release or “opt out” of sending the NBDHE pass rates to the SIUC dental hygiene program. The NBDHE data assessment is provided to CODA by Pearson Vue. Once CODA checks the validity and reliability of test results, scores are forwarded to the student’s program director of the individual college or university where they graduated.

### **Institutional Review Board**

Normally, with secondary data, Institutional Review Board (IRB) review is not necessary. Since personal identifiable data are being shared with the researcher, SIUC IRB approval is necessary using Form A, B1, and E. Permission was granted (Appendix A) by the Interim Director of the SIUC’s Registrar Office to attain SIUC dental hygiene graduates’ GPA information from existing SIUC transcripts as well as the SIUC dental hygiene program director

(Appendix B) to access NBDHE data. A copy of Appendix A was sent to Dr. Brad Colwell to ensure all identifiable data is handled properly and not published in any way. All approval letters from the SIUC Registrar and SIUC dental hygiene program director to access data were sent to the IRB along with submitting Form A, B1, and E for initial review. An approval from the IRB has now been secured (Appendix C).

### My Study

Since IRB approval has been secured, the SIUC Registrar's Office would electronically transmit the requested GPA data via Excel spreadsheet to the researcher. All data sets used were considered existing data and no surveys were performed in this study. A coding system list was used on Microsoft Excel, and the researcher assigned a number to each student. Once this was accomplished, the researcher took all necessary steps to de-identify the data, including securing the Microsoft Excel file on a separate One Drive file on the researcher's office computer (which is a private, locked office). Further, the researcher would be the only one with access to the code list and gathered data, which would be kept in a secure location on a separate One Drive file. Upon completion of the study, the code list would be kept for three years and then destroyed from the One Drive file. In this study, the nationally reported data are reported as nationwide mean and does not identify individual student scores. Individual student pass rates and their graduation year are reported only to the student and their home institution (ie., program director). The NBDHE score results are saved on SIUC's database that only dental hygiene faculty have access (S Drive).

### Data Analysis

Statistical processes and testing are critical in analyzing numerical data, and this study utilized correlations to evaluate numerical data from certain categories of GPA and the scores

from the NBDHE. A statistician was secured and assisted with the computation of specific correlations. Microsoft Excel was used by the researcher to organize, graph, and analyze the NBDHE pass rates from each cohort between 2012 and 2022.

First, the researcher and statistician met on Zoom and discussed what to assess and which items were independent and dependent variables. Independent variables are manipulated by researchers and often considered to directly affect the dependent variable. Dependent variables are defined as a variable being tested and measured in any experiment and are dependent on the independent variable (McLeod, 2019). The relationships between variables would be evaluated prior to organizing data. Independent variables for this study were pre-entry GPA; SIUC's dental hygiene GPA in science-based didactic dental hygiene courses (Oral Pathology, Microbiology, Oral Anatomy, Head and Neck Anatomy, and Dental Radiology I and II); graduation GPA at the end of the dental hygiene curriculum. A dependent variable was the dental hygiene student pass rates from the NBDHE. SAS version 9 was used by the statistician to calculate the means within various groups (proc means) and frequency distributions (proc frequency), and this can be used for Chi-Square analysis. Proc means is the command that runs the MEANS procedure, and it provides data summaries for calculating descriptive statistics for variables across observations and within groups of variables.

### **Chapter Overview**

In Chapter 3, this study's methods were explored as well as specific information on the research question, study design, and data collection and analysis. Chapter 4 will present the research and report findings using frequencies, percentages, means, and Chi-Square analysis. Each set of data is elaborated on in detail to draw conclusions. Chapter 5 would summarize the findings, discover future implications, and conclude the study.



## CHAPTER 4

### PRESENTATION OF RESEARCH

The purpose of this study was to discover why the disparity exists and what changes should be made to improve NBDHE scores. Specifically, this study examined factors -- such as student pre-entry grade point average (GPA), grades in science-based didactic dental hygiene courses (Oral Pathology, Microbiology, Oral Anatomy, Head and Neck Anatomy, and Dental Radiology I and II), and graduating GPA at the end of the dental hygiene curriculum -- and how those factors influenced student scores on the NBDHE in SIUC's dental hygiene program. Pre-entry GPA is considered a 2.75 or higher.

In this study, the researcher used correlational methods to discover if various aspects of GPA affect student success on the NBDHE. Using secondary data to determine correlations within data sets should provide useful information to guide the dental hygiene faculty as well as the administration of SIUC's School of Health Sciences (SHeS) and the College of Health and Human Sciences (CHHS) to improve student academic success. For this study, it was critical to determine if GPA had a correlation to science-based dental hygiene course grades and, in turn, for dental hygiene students to pass the NBDHE. This study utilized quantitative data to calculate comparisons to individual didactic courses throughout the dental hygiene program. Secondary to a quantitative research design, a non-experimental or correlational design was used in this study.

In the last ten years, SIUC's dental hygiene students have experienced a significant decline (30%) in NBDHE pass rates. Further, during a 6-year span, there was a wide disparity between national and SIUC's pass rates on this exam, with a gap ranging from 6 to 23 percent.

Interestingly, this downward trend was preceded by a year in which SIUC's pass rate exceeded the national pass rate.

Based upon these data, this study was designed to answer the following research question:

**RQ 1.** How does student grade point average in the following areas affect pass rates on the NBDHE examination in SIUC's dental hygiene program over a ten-year span (2012-22):

1. Pre-entry into the dental hygiene program (including Microbiology);
2. SIUC's science-based, didactic dental hygiene courses; and
3. Conclusion of the dental hygiene curriculum?

The study's population includes 334 dental hygiene graduates from SIUC's dental hygiene program that graduated in 2012-2022. No students were excluded from the study, but data were missing for three data sets: select pre-dental hygiene GPA from 2012 to 2022 graduates, select Oral Pathology course grades (all graduates in 2013 and 2017, respectively), as well as select Microbiology course grades from 2012-2022. All other dental hygiene didactic courses (Oral Anatomy, Radiology I/II, Head and Neck Anatomy) had complete data sets. The NBDHE pass/fail rates were complete data sets for all SIUC dental hygiene students graduating in 2012-2022. In all tables moving forward, the NBDHE pass rates are reflecting first attempt pass rates and not overall pass rates.

Table 3 shows the total breakout of NBDHE first attempt pass rates by graduation year. The column labeled "0" is for graduates who failed the first attempt of the NBDHE, and the column labeled "1" is for graduates who passed the NBDHE on the first attempt. Within the "fail" and "pass" columns are the number or percent of "fail" or "pass" using the total number of students (N=334). The far-right column labeled "all" depicts the total of dental hygiene students who took the NBDHE separated by graduation year. The range of failures on the NBDHE is

from one to 11 students with a mean failure rate of 4.72 students for the 10-year period (2012 to 2022). The largest decline in failure rates is in 2020 with 11 failures out of 33 students --- or 33.3% who took the NBDHE failed the exam on the first attempt. Ranges for pass rates are the lowest in 2022 at 17 students to the highest pass rate in 2014 at 34 students.

**Table 3. Total Breakout of NBDHE First Attempt Pass Rates by Graduation Year**

	<b>0 (Fail)</b>	<b>1 (Pass)</b>	<b>All</b>
	<b>N (%)</b>	<b>N (%)</b>	<b>N</b>
<b>Graduation Year</b>			
2012	1 (3.6%)	27 (96.4%)	28
2013	1 (3.33%)	29 (96.7%)	30
2014	1 (2.9%)	34 (97.1%)	35
2015	1 (3.3%)	29 (96.7%)	30
2016	5 (15.2%)	28 (84.8%)	33
2017	7 (21.2%)	26 (78.8%)	33
2018	7 (21.9%)	25 (78.1%)	32
2019	8 (27.6%)	21 (72.4%)	29
2020	11 (33.3%)	22 (66.7%)	33
2021	6 (20%)	24 (80%)	30
2022	4 (19%)	17 (81%)	21
<b>TOTAL</b>	<b>52</b>	<b>282</b>	<b>334</b>

Table 4 displays the pre-entry and graduation GPA by NBDHE pass rates using the MEANS procedure. The MEANS procedure provides data summaries for calculating descriptive statistics for variables across observations and within groups of variables. The far-left column is the NBDHE first attempt pass rates, where “0” indicates “fail” and “1” indicates “pass”. The “N Obs” column is the actual number of students who failed or passed the NBDHE on the first attempt. The “Variable” column is the pre-entry GPA and graduating GPA divided into results of “fail” and “pass.” Missing data is shown (76 of 334 students or 22.7%) in the category of pre-

entry GPA for “fail” and “pass” students. A slight increase in the mean graduating GPA for both students who failed and passed the NBDHE is displayed below. Standard deviations for both pre-entry GPA and graduating GPA for students who pass or fail the NBDHE indicate either a weak or very weak association (ranging from 0.25-0.41 standard deviation). The mean GPA for pre-entry and graduating GPA and the standard deviation of the pre-entry and graduating mean GPA is provided in Table 4.

**Table 4. Pre-Entry and Graduating GPA by NBDHE Pass Rates Using the MEANS Procedure**

<b>NBDHE First Attempt Pass Rates</b>	<b>N Obs</b>	<b>Variable</b>	<b>N</b>	<b>Mean</b>	<b>Std Dev</b>
<b>0 (Fail)</b>	52	Pre-Entry GPA	13	3.15	0.37
		Graduating GPA	52	3.45	0.25
<b>1 (Pass)</b>	282	Pre-Entry GPA	63	3.27	0.41
		Graduating GPA	282	3.65	0.27

Table 5 presents the NBDHE first attempt pass rate compared to the pass rate for Microbiology, which students take before starting the dental hygiene program curriculum. In the far-left column, the “0” is for graduates who failed the first attempt of the NBDHE, and the column below labeled “1” is for graduates who passed the NBDHE on the first attempt. The designation of “Microbiology Fail” at the top of the second column explains which students failed Microbiology and the top of the third column displays “Microbiology Pass” and students who passed Microbiology. Also included in the “fail” and “pass” columns are total “N” (%). “Fail” is defined as a course grade of “D or F” and “Pass” is defined as a course grade of “A, B, or C.” The frequency of missing data is 75 students (or 22%), so a total of 259 graduates’ Microbiology grades and NBDHE scores are calculated. When comparing Microbiology pass rates to the NBDHE first attempt pass rates, 14.7% who passed Microbiology failed the NBDHE on the first attempt. In turn, 78.7% of students who passed Microbiology passed the NBDHE on

the first attempt. If students pass Microbiology, this is a good indicator of success on the NBDHE. In addition to frequencies and percentages, Chi-square, degree of freedom, and probability are displayed as it relates to Table 5.

**Table 5. NBDHE First Pass Attempt by Microbiology Course Pass Rate\***

<b>NBDHE First Attempt Pass Rates</b>	<b>Microbiology Fail N (%)</b>	<b>Microbiology Pass N (%)</b>	<b>Total</b>
<b>0 (Fail)</b>	3 (1.2%)	38 (14.7%)	41
<b>1 (Pass)</b>	14 (5.4%)	204 (78.7%)	218
<b>TOTAL</b>	<b>17</b>	<b>242</b>	<b>259</b>

\*No relationship is found between the Microbiology course and the NBDHE with a Chi-Square of .045, 1 degree of freedom, and p value=.831

Table 6 unveils the NBDHE first attempt pass rate in comparison to the pass rate for Oral Anatomy. In the far-left column labeled “NBDHE First Attempt Pass Rates”, the row labeled “0 (Fail)” is for graduates who failed the first attempt of the NBDHE, and the row labeled “1 (Pass)” is for graduates who passed the NBDHE on the first attempt. The designation of “pass” are the students who passed Oral Anatomy. A “pass” is defined as a grade of “A, B, or C.” The sample size is 334 students and of the sample, 282 that passed Oral Anatomy also passed the NBDHE on the first attempt. In addition, the “Oral Anatomy Fail” column has 0% for course failures because no students failed this course with a “D or F” from 2012-2022. Frequencies and percentages are used as it relates to Table 6. No Chi-Square is available due to the lack of students failing the Oral Anatomy course.

**Table 6. NBDHE First Pass Attempt by Oral Anatomy Course Pass Rate\***

<b>NBDHE First Attempt Pass Rates</b>	<b>Oral Anatomy Fail N (%)</b>	<b>Oral Anatomy Pass N (%)</b>	<b>Total</b>
<b>0 (Fail)</b>	0 (0%)	52 (15.57%)	52
<b>1 (Pass)</b>	0 (0%)	282 (84.43%)	282
<b>TOTAL</b>	<b>0</b>	<b>334</b>	<b>334</b>

\*No Chi-Square is available due to lack of students failing the Oral Anatomy course

Table 7 tabulates the NBDHE first attempt pass rate in comparison to the pass rate for Dental Radiology I. In the far-left column labeled “NBDHE First Attempt Pass Rates”, the row labeled “0 (Fail)” is for graduates who failed the first attempt of the NBDHE, and the row labeled “1 (Pass)” is for graduates who passed the NBDHE on the first attempt. The designation of “Dental Radiology I Fail” or “Dental Radiology I Pass” are the graduates that “passed” or “failed” this course in the curriculum. A “pass” is defined as a grade of “A, B, or C.” The sample size is 334 students, and of the total sample of students, 52 passed Dental Radiology I but failed the NBDHE on the first attempt. Of the 334 total students, 84.43% passed Dental Radiology I and passed the NBDHE on the first attempt. No Chi-Square is available due to the lack of students failing the Dental Radiology I course during a 10-year period. Frequencies and percentages are displayed as it relates to Table 7.

**Table 7. NBDHE First Pass Attempt by Dental Radiology I Course Pass Rate\***

<b>NBDHE First Attempt Pass Rates</b>	<b>Dental Radiology I Fail N (%)</b>	<b>Dental Radiology I Pass N (%)</b>	<b>Total</b>
<b>0 (Fail)</b>	0 (0%)	52 (15.57%)	52
<b>1 (Pass)</b>	0 (0%)	282 (84.43%)	282
<b>TOTAL</b>	<b>0</b>	<b>334</b>	<b>334</b>

\*No Chi-Square is available due to lack of students failing the Dental Radiology I course

Table 8 displays the NBDHE first attempt pass rate compared to the pass rate for Dental Radiology II. In the far-left column labeled “NBDHE First Attempt Pass Rates”, the row labeled “0 (Fail)” is for graduates who failed the first attempt of the NBDHE, and the row labeled “1 (Pass)” is for graduates who passed the NBDHE on the first attempt. The designation of “Dental Radiology II Fail” or “Dental Radiology II Pass” are the graduates that “passed” or “failed” this course in the curriculum. The “N (%)” is also shown with the pass and fail rates of this course. A “Dental Radiology II pass” was defined as a grade of “A, B, or C.” The sample size is 334 students, and it is evident the same pass rate (282 students) and failure rate (52 students) exist with the Dental Radiology I and II courses. A total of 84.43% of dental hygiene students passed both the Dental Radiology II course and the NBDHE on the first attempt. Frequencies and percentages are displayed as it relates to Table 8.

**Table 8. NBDHE First Pass Attempt by Dental Radiology II Course Pass Rate\***

<b>NBDHE First Attempt Pass Rates</b>	<b>Dental Radiology II Fail N (%)</b>	<b>Dental Radiology II Pass N (%)</b>	<b>Total</b>
<b>0 (Fail)</b>	0 (0%)	52 (15.57%)	52
<b>1 (Pass)</b>	0 (0%)	282 (84.43%)	282
<b>TOTAL</b>	<b>0</b>	<b>334</b>	<b>334</b>

\*No Chi-Square is available due to lack of students failing the Dental Radiology II course

Table 9 gauges the NBDHE first attempt pass rate in comparison to the pass rate for Head and Neck Anatomy. In the far-left column labeled “NBDHE First Attempt Pass Rates”, the row labeled “0 (Fail)” is for graduates who failed the first attempt of the NBDHE, and the row labeled “1 (Pass)” is for graduates who passed the NBDHE on the first attempt. The designation of “Head and Neck Anatomy Fail” or “Head and Neck Anatomy Pass” are the graduates that “failed” or “passed” this course in the curriculum. The “N (%)” is also shown with the course

pass and fail rates. A course “pass” is defined as a grade of “A, B, or C” and a course “fail” is defined as a grade of “D or F.” The sample size is 334 students, and the Head and Neck course pass rates are the same as the Dental Radiology I and II courses. Of the students who passed Head and Neck Anatomy, 15.57% failed the NBDHE but passed the course. In Table 9, 84.43% of students in 2012-2022 passed Head and Neck Anatomy as well as passed the NBDHE on the first attempt. All three courses (Dental Radiology I, Dental Radiology II, and Head and Neck Anatomy) are taught by the same professor, but Head and Neck Anatomy has not always been taught by this professor in earlier years. Frequencies and percentages are displayed as it relates to Table 9.

**Table 9. NBDHE First Pass Attempt by Head and Neck Anatomy Course Pass Rate**

<b>NBDHE First Attempt Pass Rates</b>	<b>Head and Neck Anatomy Fail N (%)</b>	<b>Head and Neck Anatomy Pass N (%)</b>	<b>Total</b>
<b>0 (Fail)</b>	0 (0%)	52 (15.57%)	52
<b>1 (Pass)</b>	0 (0%)	282 (84.43%)	282
<b>TOTAL</b>	<b>0</b>	<b>334</b>	<b>334</b>

\*No Chi-Square is available due to lack of students failing the Head and Neck Anatomy course

Table 10 shows the NBDHE first pass attempt in comparison to the pass rate for Oral Pathology. In the far-left column labeled “NBDHE First Attempt Pass Rates,” the row labeled “0 (Fail)” is for graduates who failed the first attempt of the NBDHE, and the row labeled “1 (Pass)” is for graduates who passed the NBDHE on the first attempt. The designation of “Oral Pathology Fail” or “Oral Pathology Pass” are the graduates that “passed” or “failed” this course. The “N (%)” is also shown with the pass and fail rates for this course. “Fail” was defined as a grade “D or F” and “pass” was defined as a grade “A, B, or C.” The frequency of missing data was 63 students (or 19%), so a total of 271 graduates’ grades and NBDHE scores were



calculated. Of the students who passed Oral Pathology, 44 of 271 (16.24%) failed the NBDHE on the first attempt. Many students who passed Oral Pathology (83.02%) also passed the NBDHE on the first attempt. Another important discovery is that two students who failed Oral Pathology did pass the NBDHE on the first attempt. In addition to frequencies and percentages, Chi-square, degree of freedom, and probability are displayed as it relates to Table 10.

**Table 10. NBDHE First Pass Attempt by Oral Pathology Course Pass Rate\***

<b>NBDHE First Attempt Pass Rates</b>	<b>Oral Pathology Fail</b>	<b>Oral Pathology Pass</b>	<b>Total</b>
<b>0 (Fail)</b>	0 (0%)	44 (16.24%)	44
<b>1 (Pass)</b>	2 (.738%)	225 (83.02%)	227
<b>TOTAL</b>	<b>2</b>	<b>269</b>	<b>271</b>

\*No relationship was found between the Oral Pathology course and the NBDHE First Attempt Pass Rates with a Chi-Square of .39, 1 degree of freedom, and p value=.532

## **Conclusion**

Many dental hygiene programs across the country struggle from time to time with student outcomes on the NBDHE. Evaluating dental hygiene didactic course outcomes, pre-entry GPA, graduating GPA, and determining if results on the NBDHE have any correlation to rates of student success or have any impact on these individual variables. In Chapter 5, the results will be summarized and explained in detail. Conclusions will be drawn as to strategies the SIUC dental hygiene program can utilize using this latest information to improve student outcomes and pass rates on the NBDHE.

## CHAPTER 5

### SUMMARY, CONCLUSION, AND RECOMMENDATIONS

The purpose of this study is to discover why the disparity exists and what changes should be made to improve NBDHE scores at Southern Illinois University Carbondale (SIUC) dental hygiene program. Specifically, this study examined factors -- such as student pre-entry grade point average (GPA), grades in science-based didactic dental hygiene courses (Oral Pathology, Microbiology, Oral Anatomy, Head and Neck Anatomy, and Dental Radiology I and II), and graduating GPA at the end of the dental hygiene curriculum -- and how these factors influenced student scores on the NBDHE in SIUC's dental hygiene program.

This chapter outlines the data analysis and determines the answer to the research question. In addition, this chapter develops conclusions discovered within the research, implications for the SIUC dental hygiene program to make improvements to guide successful outcomes on the NBDHE, and goals for future research.

The researcher collected data that answered the following research question:

**RQ 1.** How does student grade point average in the following areas affect pass rates on the NBDHE examination in SIUC's dental hygiene program over a ten-year span (2012-22):

1. Pre-entry into the dental hygiene program (including Microbiology);
2. SIUC's science-based, didactic dental hygiene courses; and
3. Conclusion of the dental hygiene curriculum?

#### Findings

**How Does Dental Hygiene Pre-Entry GPA Affect Pass Rates on the NBDHE in SIUC's Dental Hygiene Program?**

A likely explanation for the increased GPA is the number of pre-requisite courses that students take that are calculated into the pre-entry GPA, which may inflate scores. The standard deviation pre-entry GPA ranged from .37 (for failing) and .41 (for passing) the NBDHE. Since the failing and passing standard deviations are similar, this shows there is not significant difference. In addition, this study found no correlation that GPA affects student success on the NBDHE. In agreement with the study by Austin (2011), they found no correlation between college cumulative GPA, high school GPA, and success on the NBDHE.

Dental hygiene students who passed Microbiology also passed the NBDHE at 78.7%. Students who passed the course (38 students, or 14.7%) failed the NBDHE. Of the 17 students who failed Microbiology, 14 failed the course but passed the NBDHE. Three students failed both Microbiology and the NBDHE. This course has a lower percentage of pass rate on the NBDHE in comparison to some of the SIUC dental hygiene science-based courses. However, this is based on the data received from the SIUC Registrar. Data was missing from Microbiology and additionally, students may have retaken the course due to a failing grade and this would affect the pre-entry GPA due to current SIUC Registrar policy.

### **How Does SIUC Dental Hygiene GPA in Science-Based Didactic Courses Affect Pass Rates on the NBDHE in SIUC's Dental Hygiene Program?**

Contrary to Liang, DeWald, and Solomon's (2018) findings that oral anatomy, histology, oral pathology, and radiology predicted success on the NBDHE, this study's data showed that none of the science-based, didactic dental hygiene courses displayed any correlation to pass rates of the NBDHE. The SIUC dental hygiene science-based didactic courses are Oral Anatomy, Dental Radiology I and II, Head and Neck Anatomy, and Oral Pathology. Approximately 84 percent of all dental hygiene students who passed Oral Anatomy, Dental Radiology I and II, Oral

Pathology, and Head and Neck Anatomy, respectively, also passed the NBDHE (mean course/NBDHE pass rate is 83.24%).

### **How Does Graduating GPA Affect Pass Rates on the NBDHE in SIUC's Dental Hygiene Program?**

At graduation, there is a lower standard deviation than for pre-entry GPA. The standard deviation for graduating GPA who failed the NBDHE is .25 and pass is .27. Since the failing and passing standard deviations are similar, this shows there is not a significant difference. Strangely, data revealed that every SIUC student who took the NBDHE showed academic improvement in their coursework (via an increase in GPA) from pre-entry to the conclusion of the program. However, regardless of this GPA increase, students still earned a failing score on the NBDHE. Missing data, such as the "N" size, can affect the range in GPA for each student or cohorts of students.

### **Conclusion**

In this study, the researcher was unable to make a determination regarding program or course assessments and how these affected pass rates, primarily due to the large number of missing data sets. Consequently, this study showed no correlation between pre-entry GPA, science-based didactic dental hygiene courses, and graduation GPA when predicting success on the NBDHE.

As a researcher, I learned a valuable lesson about the role of reporting course grades. I was surprised when reviewing the results of the study because my preconceived ideas were that collective course grades (or GPA) actually gauged student success and showed mastery of course content. It appears that SIUC's grading policies impacted how the data were reported. Specifically, the grade improvement policy by the Office of the Registrar does not report a failed

course grade together with the new (repeated) passing course grade, thus skewing GPAs, and in the scheme of things, the better grade trumps the failing grade. Consequently, unless faculty maintain records of each course grade in the curriculum, complete grade information is not accessible to them. Moving forward, faculty should have access to all course grades to evaluate students' performance and the number of attempts it took to receive a passing grade. The grade improvement policy made me aware of the issues within such a policy and how grades and GPAs are not as helpful as once thought. In sum, academicians should tread cautiously when using GPA as a predictive marker of student academic growth since the current SIUC grade replacement results in data that are not a true representation of student course outcomes.

Then again, in 2020, SIUC modified its grading policy -- this time offering a Pass/Fail option due to COVID-19. Passing grades were represented as "A, B, C, or D", and failing or unsatisfactory was represented as "F". Subsequently, students could change their grading option to Pass/Fail at their discretion on their transcript after faculty posted course letter grades. Within the SIUC Dental Hygiene program, due to accreditation standards, the students were advised to keep letter grades because passing in dental hygiene courses is considered "C" or above. During COVID-19 restrictions, more students failed dental hygiene courses; however, the grade reporting did not show actual failing grades for these students. Once students retook the course, the new grade was entered, and the previous failing grade was not part of the GPA calculation. So that begs the question --- what does GPA mean and what is the true assessment of students? More time should be spent by the SIUC dental hygiene program to find answers to the previous questions and will definitely improve course outcomes and learning by students.

### **Recommendations for the SIUC Dental Hygiene Program**

#### ***Pre-Entry into the SIUC Dental Hygiene Program***

- In the future, to adequately assess accurate GPAs and how these align with student performance, the dental hygiene program should consider maintaining an internal spreadsheet of all dental hygiene courses as well as the grade attained for each student.
- Suggest incoming students take courses designed to build successful student traits and train for success within the dental hygiene program
  - An increase in the pre-entry GPA for SIUC dental hygiene students
  - Consider incorporating the Health Education Systems, Inc. (HESI) exam or some other type of entrance assessment exam to measure students' learning and gauge complex problem-solving and critical-thinking skills before entering the program
- Student Selection Process:
  - Annually assess the rubric used for the student selection process
  - Involve faculty in the student selection process. Presently, such a process is conducted solely by academic advisors
  - Develop a writing assessment prior to selection for the SIUC dental hygiene program
  - Include a pre-entry interview prior to selection for the SIUC dental hygiene program

***While Students Are in the SIUC Dental Hygiene Program***

- A structured remediation process to assist students struggling with course content, clinical application, and lab techniques
- Student Engagement:

- Keeping students involved in the dental hygiene program's activities to promote programmatic engagement and a sense of belonging (from freshman to senior year)
- Encourage more student team activities and more critical-thinking exercises within the curriculum to build test-taking skills to enhance NBDHE results

***Prior to Graduation from the SIUC Dental Hygiene Program***

- Board Review:
  - Continue to have students attend an off-site board review
  - Continue the board review course that is built within the current dental hygiene curriculum and construct challenging board exam-type questions and case studies to gauge learning by discovering deficiencies in learning content
- HESI Exam:
  - Continue to build the HESI exam into the board review course during the senior year and require a 75% or higher before approving the student to take the NBDHE and as a pre-condition to graduation
  - Tie the HESI exam to the board review course syllabus so students understand expectations at the very beginning
    - Share the HESI exam results with all dental hygiene faculty so they can begin to revamp courses for the following academic year and share results with students to help guide further review of topic areas

The SIUC dental hygiene program had two graduates who did not take the NBDHE which made the “N” size 28 students. Twenty-eight students took the HESI exam and 13 failed,

or 46.42%. Of the 13 students who failed the HESI exam, seven (53.85%) passed the NBDHE on the first attempt and six (46.15%) failed the NBDHE on the first attempt. There is a lower predictor of success during 2021 by the equal distribution of pass and fail rates displayed within the percentages. Table 11 results are represented in the table below.

**Table 11: SIUC Dental Hygiene Class of 2021 Failure Rates on HESI Exam and Failure Rates of NBDHE on First Attempt**

<b>Number of Students N</b>	<b>HESI Exam Failures N (%)</b>	<b>HESI Exam Failures and Students Who Failed NBDHE on First Attempt N (%)</b>
<b>28</b>	13 (46.42%)	6 (46.15%)

All SIUC dental hygiene students took the NBDHE in 2022, which created an “N” size of 21 students. Of the 21 students who took the HESI exam, five students (23.8%) failed the HESI exam. Of the five students who failed the HESI exam, four students (80%) failed the NBDHE on the first attempt and one (20%) passed the NBDHE on the first attempt. The HESI exam for the Class of 2022 was a strong predictor of success on the NBDHE because 80% of those who failed the NBDHE also failed the HESI exam. The researcher also noted the HESI exam failure rate improved by 22.6% from the Class of 2021 to the Class of 2022. Table 12 results are represented in the table below.

**Table 12: SIUC Dental Hygiene Class of 2022 Failure Rates on HESI Exam and Failure Rates of NBDHE on First Attempt**

<b>Number of Students N</b>	<b>HESI Exam Failures N (%)</b>	<b>HESI Exam Failures and Students Who Failed NBDHE on First Attempt N (%)</b>
<b>21</b>	5 (23.8%)	4 (80%)



### *Recommendations for Future Research*

- Determine the impact of transfer courses and the impact on NBDHE results
- Discover if SIUC dental hygiene students take some prerequisite courses such as Microbiology at other institutions and determine if this affects NBDHE results in a positive or negative way
- Compare other health programs to gauge student success on specific licensure exams in comparison to success on the NBDHE
- Evaluate which course content students fail on the NBDHE and how course grades align with student success on the NBDHE
- Perform qualitative surveys to current students and/or previous graduates about how they prepared for the NBDHE and how many hours they studied outside of class to prepare for this exam. What strategies did students use to study the course material? The SIUC dental hygiene program does have a current exit survey that could be used to assess seniors' preparation for NBDHE and compare that to student success in all aspects of learning

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## **APPENDICES**

## APPENDIX A

### Interim Director of SIUC Registrar Office Approval Letter



**REGISTRAR'S OFFICE**  
STUDENT SERVICES BUILDING  
SUITE 0251 – MAIL CODE 4701  
1263 LINCOLN DRIVE  
CARBONDALE, ILLINOIS 62901

618/453-2963  
618/453-2915 FAX

registrar.siu.edu

November 29, 2022

TO: Dr. Brad Colwell, Professor  
School of Education

FROM: Rachel Frazier  
Interim Director, Registrar

RE: Jennifer S. Sherry, Research

This memo requires Dr. Brad Colwell, Faculty Advisor (Co-PI) for Associate Professor, Jennifer S. Sherry, (PI), to take full responsibility for identified student information released by the SIS data team for research purposes.

Based on SIU Policy, [FERPA III.C.IV](#) the University can disclose personally identifiable information without prior consent of the student if the faculty member sponsoring the research guarantees no personally identifiable information will be published or released.

cc. Jennifer S. Sherry  
Matthew Herman

SIU.EDU

**APPENDIX B****SIUC Dental Hygiene Program Director Approval Letter**

To Whom It May Concern,

I am giving permission to Jennifer Sherry to use the SIUC Dental Hygiene program National Board of Dental Hygiene Examinations (NBDHE) results to successfully aid in completion of her dissertation. The results will be de-identified.

Thank you,

A handwritten signature in blue ink that reads "Stacey McKinney".

STACEY MCKINNEY, RDH, PHDH, MEd.  
Assistant Professor & Program Director

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## APPENDIX C

## SIUC IRB Approval Letter



INSTITUTIONAL REVIEW BOARD

siuhsc@siu.edu

OFFICE OF RESEARCH COMPLIANCE

618/453-4534

WOODY HALL - MAIL CODE 4344

FAX 618/453-4573

900 SOUTH NORMAL AVENUE

CARBONDALE, ILLINOIS 62901

To: Jennifer Sherry

From: M. Daniel Becque  
Chair, Institutional Review Board

Date: November 17, 2022

Title: *Predictors for Student Success on the National Board Dental Hygiene Examination*

Protocol Number: 22210

The SIUC Institutional Review Board has approved the above-referenced study. The study is determined to be exempt according to 45 CFR 46.104. This approval does not have an expiration date. However, this approval is valid only for as long as you are a student or employee of SIUC. Additionally, any future modifications to your protocol must be submitted to the IRB for review and approval before implementation.

The IRB requests updates on exempted studies every three years. Failure to file a project update report may lead to the premature closure of your protocol.

When your study is complete, please fill out and return a study close-out form. A study is considered complete when you are no longer enrolling new participants, collecting or analyzing data.

Best wishes for a successful study.

This institution has an Assurance on file with the USDHHS Office of Human Research Protection. The Assurance number is FWA00005334.

DB:eb

cc: Brad Colwell

## VITA

Graduate School  
Southern Illinois University

Jennifer S. Sherry

[jenlater@msn.com](mailto:jenlater@msn.com)

Southern Illinois University Carbondale  
Master of Science, Education, May 2004

Capstone Report Title:

Student Predictors for Student Success on the National Board Dental Hygiene Examination (NBDHE)

Major Professor: Dr. William Bradley Colwell

Publications:

Sherry, J.S. (2022, September). E-cigarettes and vaping: Educational strategies for the dental professional. *Dental Academy of Continuing Education (continuing education published course)*.

Sherry, J. S., McKinney, S. & Cataldo, J. (2021, August). The correlation between periodontal disease and systemic health in rural Southern Illinois [Abstract]. *The Journal of Dental Hygiene*, 95(4), 90-91.

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