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EVALUATING STUDENT SUCCESS ON THE NATIONAL BOARD DENTAL HYGIENE
EXAMINATION AT A MIDWEST UNIVERSITY

by

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B.S., Southern Illinois University, 2010
M.S. Ed., Southern Illinois University, 2016

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 2024

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CAPSTONE REPORT APPROVAL

EVALUATING STUDENT SUCCESS ON THE NATIONAL BOARD DENTAL HYGIENE
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Stacey McKinney

A Capstone Report Submitted in Partial

Fulfillments of the Requirements

for the Degree of

Doctor of Education

in the field of Educational Administration

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March 25, 2024

AN ABSTRACT OF THE CAPSTONE REPORT OF

Stacey McKinney, for the Doctor of Education degree in Educational Administration, presented on March 25, 2024, at Southern Illinois University Carbondale.

TITLE: EVALUATING STUDENT SUCCESS ON THE NATIONAL BOARD DENTAL HYGIENE EXAMINATION AT A MIDWEST UNIVERSITY

MAJOR PROFESSOR: Dr. Saran Donahoo

The purpose of the study is to determine if preparatory measures, including the HESI exit examination and an on-campus board review course, helped increase first time pass rates on the NBDHE at a Midwest University. I compared national pass rates and school pass rates and observed school pass rates have been consistently below the national average for seven years. I utilized four cohorts of graduating students. One group was not provided with any preparatory measures, two groups were provided with the HESI examination only, and one group was provided with the HESI examination and an on-campus board review.

Student's HESI scores and pass rate on the NBDHE were evaluated to distinguish if there was any correlation between the two. The findings of the study identified the HESI to be a good predictor of success while it is uncertain if the on-campus board review course was beneficial for student success. The Midwest University should continually look for ways to improve pass rates on students first attempt of the NBDHE and provide preparatory measures to ensure student success. Based on the findings of this project, research should continue in the dental hygiene field with comparison of preparatory measures and NBDHE pass rates among other baccalaureate dental hygiene programs.

ACKNOWLEDGMENTS

While getting closer to the end of my writing, this blank page became more realistic. I wanted to follow proper format and fill out this page when I first started, but quickly realized it needed to be saved for the end. I knew when I was finally able to type it, I have accomplished my goal. I understood when I made the choice to continue my education it would be time consuming, sometimes tedious, full of happy and stressful moments, and there were things I would have to sacrifice, but I always knew there would be an end in sight, and it would all be worth it.

There were a number of individuals who have led me to where I am today, and pushed me to the finish line. I am thankful for you. I would first like to acknowledge my dissertation committee Chair, Dr. Saran Donahoo. Her encouragement and support throughout the process has been constant. Dr. Donahoo has provided reassurance for me through numerous hours on zoom, in office and in person lunch dates when I was not sure if I could finish. Your leadership and expertise never went unnoticed.

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To my family, friends and colleagues. Thank you for inspiring me to continue to better myself when I thought I could not do it anymore. I appreciate the pep talks, laughs, and simple smiles, especially on the long days of teaching all day followed by class. I am grateful for each one of you.

DEDICATION

This dissertation is dedicated to my family. Matthew, thank you for believing in me. When I told you I wanted to pursue my doctorate, you nodded, smiled and said “okay” as if it was no big deal. You had more confidence in me than I did myself. Thank you for taking care of me and our children and leading our family in grace during this demanding phase in our lives. Your constant support will never go unnoticed.

To my children, Bryer and Graeme. Thank you for giving me the motivation to do better for myself and our family! You have made me stronger, a better human and more fulfilled than I could ever imagine. I pray you two always know the sky is the limit. I love you!

Also, to my dad and mom. They supported my sister and myself throughout college and beyond and made sure we knew education was important. I am so grateful. While my mom is not able to physically celebrate with us, I know she could not be more proud. This one is for you, *momma!*

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CHAPTER I

INTRODUCTION

Through the evolution of the dental profession, dental hygienists have a broad role to provide preventive services in order to help maintain good oral health. This includes treating diseases that impact the teeth and gums, provide oral cancer screening, educate patients on preventive care and good oral hygiene practices, and more complicated procedures such as administering anesthesia (Coursera, 2022; U.S. Bureau of Labor Statistics [BLS], 2022).

The dental hygiene field is a profession that requires licensure to practice (American Dental Hygienists' Association, n.d.). Holding and maintaining a license to practice is a means to protect the health of patients, the public, and ensure critical standards of practice to protect the dental industry (DiFoggio, n.d.). Before attaining a license, individuals must receive training and successfully pass all required courses from a two- or four-year institution that holds accreditation from the Commission on Dental Accreditation (CODA). They must also successfully pass the written National Board of Dental Hygiene Examinations (NBDHE) and regional clinical exam with a minimum passing grade of 75% on each exam (Joint Commission on National Dental Accreditation, 2023). Table 1 represents the national percentage of students who graduated from accredited dental hygiene programs and successfully passed the written National Board Examination and clinical State/Regional board.

Table 1

National Student Success Rates on Clinical and Written Examinations from Accredited Institutions on the First Attempt

Year	Number of Students	Written National Board Outcomes (% passed)	Clinical Regional Board Outcomes- CRDTS exam only (% passed)
2013	7,016	95.2%	N/A
2014	7,357	95.2%	88.9%
2015	7,227	95.6%	87.71%
2016	7,397	94.9%	89.5%
2017	7,262	93.8%	92.77%
2018	7,360	94.3%	93.61%
2019	7,316	92.2%	93.76%
2020	6,938	90.3%	87.75%
2021	7,478	86.7%	92.57%

Note. Adapted from Joint Commission on National Dental Examinations and CRDTS annual report to program directors from 2014-2021. Clinical Regional Board Outcomes adapted from Central Regional Dental Testing Services, Inc., 2014-2021.

The table depicts a trending decrease in written national board outcomes since 2013, as opposed to the wavering passage rates of the clinical exam provided by CRDTS every year.

The number of students who have completed dental hygiene programs from 2013 to 2019 has remained constant with an average of 7,275 students graduating each year. The number of graduates declined in 2020 followed by a recovery in 2021 to near pre-pandemic levels, according to the Commission on Dental Accreditation's survey of enrollment (Commission on Dental Accreditation, 2021). Additionally, the number of graduates passing the regional clinical exam has remained constant, although the number of students successfully passing the written

NBDHE has continued to drop over the past four years. Given the continuous need for new dental hygienists, it is essential dental hygiene programs graduate students who can successfully pass both exams and enter the workforce after graduation.

Problem Statement

Southern Illinois University Carbondale (SIU) dental hygiene student passage rates on the NBDHE on the first attempt have lagged behind nationwide test scores from the years 2016-2022. See Table 2. I will conduct research to determine equitable measure to increase board scores.

Table 2

Comparison of National and SIUC NBHDE Passage Rates

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
National NBDHE pass rates (% passed)	95.2%	95.2%	95.6%	94.9%	93.8%	94.3%	92.2%	90.3%	86.7%	86.1%
SIUC NBDHE pass rates (% passed)	93%	97.3%	100%	84.8%	78.9%	76.7%	68.9%	63.6%	80%	80.9%

Note. Adapted from Joint Commission on National Dental Examinations and NBDHE Profile Report for 2013-2022. SIUC NBDHE pass rates adapted from Joint Commission on National Dental Accreditation, 2013 – 2022.

Being unsuccessful on the examination delays entry into the profession is costly for students, creates an emotional hardship, and reflects poorly on the school and program. The data shows an average of 14.9% deficiency in passage on the NBDHE from SIU dental hygiene students as compared to the national trend since 2016. Further research is needed to determine if board preparation programs are a reliable predictor of success on the first attempt of the NBDHE.

Background of Employment Opportunity for Dental Hygienists

In 2021, there were an estimated 214,700 employed hygienists in the United States (U.S. Bureau of Labor Statistics [BLS], 2023). The BLS projects that employment of dental hygienists will grow 9% annually from 2021 to 2031, faster than the average for all occupations (BLS, 2022). Nationally, the U.S. BLS also projects that there will be approximately 16,300 openings for hygienists on an annual basis due to job retirement or transferring to different occupations, increase in natural teeth retention when compared to previous generations, and states allowing hygienists to work at the top of their training, putting hygienists in significant demand (BLS, 2022).

Since 2015, the number of students initially enrolled in the first year of the dental hygiene sequence has remained somewhat constant with an average of 8,300 students and a deviation of 100 students, except for year 2020-21. The data also shows that among the 327 programs, an average of 1,000 students start dental hygiene programs but do not complete them (see Table 3).

Table 3

First-Year Enrollment Compared to Graduates of Dental Hygiene Programs in the U.S. per CODA

Year	Number of students initially enrolled in DH programs	Number of students who completed DH programs	Number of students not completing DH programs
2013	8,258	7,277	↓ 981
2014	8,287	7,298	↓ 989
2015	8,472	7,323	↓ 1,149
2016	8,279	7,385	↓ 894
2017	8,370	7,294	↓ 1,076
2018	8,265	7,377	↓ 888
2019	8,288	7,311	↓ 977
2020	8,322	7,002	↓ 1,320
2021	7,745	N/A	N/A

Note. Data taken from Commission on Dental Accreditation, 2021

As shown above, only 7,002 students completed an associate or baccalaureate dental hygiene program in 2020. While 90.3% were successful on the NBDHE, 9.7% have not passed the written examination, and it is unknown if those students were successful or not on the clinical examination, leaving them without a license to practice (Commission on Dental Accreditation, 2021). This depicts an annual deficit of more than 8,500 hygiene positions needing to be filled.

Testing Requirements

The written NBDHE consists of 350 multiple-choice questions that assess students in their ability to understand information from the biomedical, clinical, and/or dental sciences subjects and apply the information in a problem-solving context (National Board Dental Hygiene

Examination, 2022). The Joint Commission on National Dental Examinations (JCNDE) requires a minimum score of 75% and provides the students with a “pass/fail” grade. Two factors that affect the candidate’s score are (1) the number of correct answers selected by the candidate and (2) the conversion scale for the examination form (Joint Commission on National Dental Examinations, 2022).

The consequences of failing the NBDHE are shocking and extensive for the student, both emotionally and financially. Students who are unsuccessful lose money in examination fees and time required to re-take the test (Nordquist et al., 2017). They also experience a loss of potential income as a result of being ineligible for licensure. Nordquist, Mitchell, Overman, Van Ness and Gadbury-Amyot (2017) pointed out that dental hygiene program reputations are defined, in part, by student pass/fail rates on licensure exams. One of the Commission’s standards discusses institutional effectiveness. Having a poor class-wide pass rate could have a negative impact on a program’s accreditation status and influence future enrollment (Atemafac, 2014; Nordquist et al., 2017). Conversely, having high first-time pass rates can be viewed as an indicator of success.

Clinical examinations are designed to provide a reliable assessment of a student’s clinical skills. There are five regional testing agencies who provide testing for students and all criteria vary slightly, although they all provide reliable assessment of a student’s clinical skills. Consistent among all five exams and the written examination, the student must successfully pass with a minimum competency of 75%. The one significant difference is that some examinations include a written or electronic patient-based component. Students have the option to choose which clinical board examination they want to take based on the state they choose to practice in (National, Regional and State Dental Hygiene Certification Exams, 2022).

Given the national workforce demand for hygienists, preparation programs are

fundamental in maintaining a competitive success rate on the national examination. According to the 2020-21 Survey of Allied Dental Education Program, in 2020-21, dental hygiene programs had a maximum capacity of 9,005 students, and national enrollment was noted at 7,745 students (Commission on Dental Accreditation, 2021). In comparison to the national 327 programs, SIU accommodates a maximum capacity of 36 students per cohort. Only 30 students graduated in 2021. Like SIU, not all programs are operating at full enrollment, which could be due to educational facilities clustering in areas where there are already enough providers and the market in those areas is saturated (Valachovic, 2009). Additionally, operating at full capacity may not be related to low number of applicants, but a low number of qualified applicants.

The dental hygiene program at SIUC compares pass rates from the national level to our local level. From 2015 to 2022, there has been a significant downward trend in pass rates on the written national exam. After a 100% pass rate in 2015, SIUC has had an average annual pass rate of 76% as compared to a national average pass rate of 91% (Commission on Dental Accreditation, 2021). Additionally, 2020 graduates pass rates showed to be significantly (27.1%) behind the national average (90.7). Further preparation for the NBDHE is necessary to improve the first-time pass rates on the written exam.

A review of the literature supports the most common strategy used by dental hygiene programs to prepare students for the NBDHE, using an institutional written mock board examination in the final year (Nordquist et al., 2017). Focusing solely on preparation methods employed at SIU, students prepare for the written examination throughout the entirety of the program although more strict preparation should begin months in advance. There are a variety of board preparation courses students can attend to hear content speakers provide a comprehensive review of material covered on the NBDHE, as well as emphasis placed on computer and question

format (Dental Hygiene Seminars, 2023). Board review books also provide multiple choice questions and rationales to help students understand fundamental concepts (Darby, 2011). Additionally, podcasts and videos allow the student to listen to a speaker on demand (StudentRDH, 2023). The goal of these review programs is to provide resources for students with different learning styles to prepare and successfully complete the written national exam on the first attempt.

At SIU, the program recommends that students attend DHS Seminar virtually or in-person. This review course has a pass rate of 99% and has been in business for 32 years (Dental Hygiene Seminars, 2023). They provide in-person reviews at four separate locations in the Midwest and students can access the materials online via their website. Students are also recommended StudentRDH as a supplemental resource but are not required to purchase any supplemental board review materials.

Purpose Statement

Given the demand for dental hygienists, it is important educational institutions prepare students to be successful on the board examinations on their first attempt. The purpose of this project is to improve student preparation and readiness for the NBDHE by implementing the dental hygiene HESI exit examination and on-campus board review course in the final semester of the course sequence. Since little to no research examines the reliability of predicting success using the HESI exit exam or on-campus board review course in dental hygiene, I am interested in learning if these preparation efforts are beneficial for student success and outcomes on the examination.

Research Questions

This study seeks to answer the following research questions:

RQ1: Is there a difference on the NBDHE passage rate between students who do not have any preparatory tests measures and those who complete the HESI exit exam?

RQ2: Is there a difference on the NBDHE passage rate between students who complete the HESI exit exam and those who complete the HESI exit exam and on-campus board review program?

Research Design

To answer the research questions, I will use a quantitative approach to help determine if implementation of an exit exam or on-campus board review course is beneficial to student success on the NBDHE. For this quantitative study, I selected comparative analysis as it is a side-by-side analysis that compares two or more factors to identify similarities and differences (Dovetail Editorial Team, 2023). Additionally, comparative analysis can provide deep insight into the processes of a program or organization to continually improve products, services or results (Dovetail editorial team, 2023).

The aim of this study is to identify similarities and differences between the board preparation methods for four groups of students so deficiencies and strengths can be identified. This study compares four groups of students at SIUC who did and did not participate in a HESI exam and/or on-campus board review program prior to completing the NBHDE.

Positionality

As an educator with over eight years of experience, my passion is to ensure successful students' outcomes on the NBHDE post-graduation. I serve as an Assistant Professor and Program Director at a four-year institution. My goal is to determine if requiring students to take an on-campus board review course including the HESI practice examination will prove to be an adequate predictor of success on the NBDHE.

Having taught multiple classes in the program, my most recent course is a mandatory on-campus board review course offered in the final semester. This new course is a review of didactic material taught in prior semesters and designed to prepare students for the clinical and written examination through daily multiple-choice questions, weekly quizzes and case studies, and monthly online timed tests.

I have observed students over the past several years successfully complete the clinical board examination on their first attempt, although they are unsuccessful on the written NBDHE after one or multiple attempts. Following a recent site visit (November 2021) from CODA, it was determined the program is graduating students but one-fourth to one-third cannot successfully pass their written board exam. The results of this study will identify if changes are needed at the four-year institution. This includes requiring students to take an on-campus board review course and proctored HESI exit examination their final semester.

Significance of the Study

This study seeks to determine if completing a proctored HESI exam or HESI exam and an on-campus board review course in the final semester of the curriculum sequence has any impact on first time pass rates on the NBDHE. Additionally, if requiring them will improve student success and success of the program. This study is significant to students as successful completion will help them attain a job immediately after graduation as well as the University in decreasing the time to degree. Students have a multitude of programs to choose from, so it is vital that the SIUC DH program – the only baccalaureate degree program in Illinois – can showcase student success rates and provide qualified hygienists immediately after graduation.

Currently, with the decline in pass rates on the NBDHE, it is worrisome for the survival of the program, but also challenging for the demanding workforce. As an accredited program, we

must respond to the commission on the success of graduates on national board examinations as outlined by Standard 1-1. For example, if poor pass rates continue, the programs status can change from “approval without reporting requirements” to “approval with reporting requirements.” This indicates the program is deficient in one or more areas and must demonstrate compliance within two years’ time. Being Illinois’ only baccalaureate degree in dental hygiene, it is important we lead the way and provide students who are successful on their written and clinical board examination on the first attempt.

Definitions

For the purpose of this study, I defined the terms as follows:

- *American Dental Association (ADA)*: the professional association of dentists dedicated to serving both the public and the profession of dentistry (About the ADA, 2022).
- *American Dental Education Association (ADEA)*: The Voice of Dental Education. The mission is to lead institutions and individuals in the dental education community to address contemporary issues influencing education, research and the delivery of oral health care for the overall health and safety of the public. (About ADEA, n.d.)
- *American Dental Hygienists’ Association (ADHA)*: The largest national organization representing the professional interests of more than 226,000 registered dental hygienists across the country (About ADHA, 2022).
- *Baccalaureate (bachelor’s) degree*: An undergraduate degree awarded by colleges after traditionally studying for three to seven years, depending upon the institution of higher learning and the academic discipline of study (Mischler, 1983).
- *Commission on Dental Accreditation (CODA)*: The Commission on Dental Accreditation accredits dental and dental-related education programs including advanced dental

education programs and allied dental education programs in the United States (The Commission on Dental Accreditation Accredits Dental, Advanced Dental and Allied Dental Education Programs, 2023).

- *Dental hygiene care (DH)*: The science and practice of the prevention of oral diseases; the integrated preventive and treatment services administered for a patient by a dental hygienist (Boyd et al., 2020).
- *Health Education Systems, Inc. (HESI)*: Exam used by Dental Hygiene Programs to help evaluate students' academic readiness utilizing standardized test and assessing understanding of key concepts through application-level licensure or certification exam-style questions. (Sathar, 2023)
- *Licensure*: a regulatory condition that verifies certification; often necessary for practicing an occupation, profession, or trade within an outlined area such as a state or country (ADHA, 2018)
- *National Board Dental Hygiene Examination (NBDHE)*: A written examination required by state licensing agencies for those who are seeking to be a licensed dental hygienist in the United States (About the NBDHE, 2022).
- *Registered Dental Hygienist (RDH)*: A licensed oral health professional who focuses on the maintenance of oral health and the prevention of oral disease (Boyd et al., 2020).

Overview of the Study

In this study, I observe the value added of a HESI examination and an on-campus board review program prior to sitting for the NBDHE. I collected data from the past four years of graduating students from SIUC to compare NBDHE first time pass rates.

Chapter II includes a review of the literature related to the dental hygiene profession. The

review of literature includes the history of dentistry and dental hygiene, job duties of a dental hygienists, education necessary to become licensed, HESI and board review courses, and national and local pass rates on the NBDHE. Chapter III provides the methodology used to collect the data. Chapter IV included a description of the findings of the study. In Chapter V, I provide a summary of the findings, implications, and a conclusion.

CHAPTER II

LITERATURE REVIEW

Introduction

This review of literature explores the historical background of the dental hygiene profession and research specific to the passage of the national board examination. It discusses hygienists' scope of practice, the requirements needed to complete a dental hygiene program, the licensure application process including board examinations, national and local pass rates and predictors of success for the national board examination. This chapter provides a compilation of information designed to highlight if additional resources, such as an additional class or simulated exam, are useful in predicting success on the national examination on the student's first attempt. Although documentation is available, limited research exists to support or refute if these additional resources are beneficial in a dental hygiene program.

The Southern Illinois University Carbondale Library databases were used to access Google Scholar, PubMed, EBSCO Databases and Web of Science. Search terms included: dental hygiene, education, dental hygiene examination, national board dental hygiene examination, Commission on Dental Accreditation, predictors of success, HESI and pass rates. These searches compiled various peer-reviewed research findings and were appraised for content relativity. Additionally, the staff at the American Dental Association was contacted for data purposes, although they were unable to provide any additional statistics.

Dental Hygienist Defined

“Dental hygienists are licensed oral health professionals who focus on preventing and treating oral diseases to protect teeth and gums, and also to protect patients' total health” (American Dental Hygienists' Association, n.d.). They are preventive oral health professionals

who provide educational, clinical, and therapeutic services to the public (American Dental Hygienists' Association, 2019). In addition, hygienists collaborate with other oral healthcare providers and healthcare professional to assist individuals in seeking other health services as needed. As the advanced practice for dental hygiene emerges, it is imperative that educational qualifications of dental hygienists are sufficient to enable them to safely provide the scope of services and care necessary and to effectively participate as an interprofessional team member (Vanderbilt et al., 2013).

Since its inception, the profession of dental hygiene was created to provide preventive oral care and oral health education (Reitz & Jadeja, 2004). The roles and responsibilities have since evolved over the years. Today, the profession builds upon this foundation while expanding its scope to include the promotion of health and wellness as oral health is integral to overall health (Pieren & Bowen, 2019).

Dental Hygiene History

The growth of the profession since its inception in 1913 has allowed hygienists to be able to perform more duties. These expanded duties help meet the increasing demand for preventive oral services, including one of the Surgeon General's goals of "producing health." as stated in his 2000's report. Additionally, the ability for hygienists to provide services without the direct supervision of a dentist provides access to safe, effective oral health services for patients and collaborative interprofessional partnerships and coalitions for oral health care. Table 4 shows the development of the profession from its inception in 1913 and beyond (American Dental Hygiene Association, 2013).

Table 4*Development of the Dental Hygiene Profession: A Timeline*

Year	Advancements in the profession
1913	Dr. Fones' assistant, Irene Newman, is the first dental hygienist
1920	Dental hygienists are employed outside of a public-school setting
1923	The American Dental Hygienists' Association is organized
1935	ADHA and ADA recommends high school graduation as one of the requirements for licensure
1952	Minimum education standards for education are set and accreditation process for dental hygiene programs begins
1990	Dental hygienist are allowed to administer local anesthetic
2000	U.S. Department of Health and Human Services publishes Oral Health in America: A Report of the Surgeon General

Note, Taken from Wilkins' Clinical Practice of the Dental Hygienist.

The origin of the dental hygienist role can be traced back to the oral hygiene movement in the nineteenth century. Initially termed 'dental nurses', dental hygienists received on the job training to provide prophylactic care as dentists were focused on restorative work (Haaland, 1999). In 1913, Dr. Alfred C. Fones, the founder of dental hygiene, felt the term 'dental hygienists' would create an association with the prevention, rather than treatment of oral disease (Boyd et al., 2020; Reitz & Jadeja, 2004). Dr. Fones presented the profession to medical practices by emphasizing the necessity of preventive oral health care and the role of the hygienist including education, assessment, and treatment (Nathe, 2001). Faced with opposition, Dr. Fones discussed the new profession of dental hygiene with dentists across the country (Nathe, 2017). Preventive dental science was a new concept, and many did not have experience working alongside a hygienist. Consequently, many laws were enacted that prohibited dental hygienists' scope of practice and prevented them from working without a supervising dentist.

Irene Newman, the first dental hygienist and Dr. Fone's assistant, was trained to demonstrate the value of education through prevention measures to reduce caries among children (Boyd et al., 2020). Additionally, she was the first president of an organized dental hygiene society, the American Dental Hygienists Association (ADHA).

Initially, dental hygienists were employed through the public-school system to emphasize the importance of oral care to children in New Haven, Connecticut. In 1920s, the trend was moved to hygienists working in private practice offices throughout the United States (Boyd et al., 2020; Haaland, 1999; Hakes, 2022). In the 1930s, the ADHA alongside the American Dental Association (ADA) recommended a minimum of a high school diploma. The University of Michigan began to offer the first baccalaureate degree in dental hygiene (American Dental Hygiene Association, 2013). Students also had to complete a two-year course of study to attain licensure as compared to the previously recommended one-year program (Boyd et al., 2020).

Approximately twenty years later, in the 1950's, all states granted licensure for dental hygienists, minimum education standards were set, and the accreditation process for dental hygiene programs began (American Dental Hygiene Association, 2013; Boyd et al., 2020). This is also the time when the written National Board of Dental Hygiene Examination was implemented as well as the first clinical Regional Board Examination. Advancement in education continued and the first dental hygiene master's degree program began at Columbia University in New York. This set the trend for many master-level dental hygiene programs for the future (Boyd et al., 2020).

Hygienists practiced for 50 years with moderate changes to assigned duties and licensure requirements. In certain states, hygienists were allowed to provide a defined set of restorative services, local anesthesia, and even unsupervised oral care to special populations in alternative

settings (Boyd et al., 2020).

In the 2000's, the U.S. Department of Health and Human Services published the Surgeon General's Report highlighting the significance of oral health to general health. His charge was to "define, describe, and evaluate the interaction between oral health and health and well-being [quality of life], through the life span in the context of changes in society" (U.S. Department of Health and Human Services, 2000, p. #5). The primary focus was on prevention and "producing health", rather than "restoring health." This report forced many states to implement policies that would allow hygienists in some settings to initiate dental hygiene care without the specific authorization of a dentist.

Education

Admission and prerequisite requirements for entry-level programs vary from institution to institution but typically include high school diploma or GED, high school courses in mathematics, chemistry, biology and English, a minimum high school GPA of 2.0, college entrance test scores, and up to 40 credit hours of prerequisite college coursework in chemistry, English, speech, psychology and sociology (American Dental Education Association, n.d.). An institution and program application must be filled out, and some may require students to observe a dental hygienist for a few hours to gain an understanding of the occupation.

There are three dental hygiene program types recognized and accredited by the Commission on Dental Accreditation (CODA). This includes entry-level, degree completion and graduate. Additionally, there are three entry-level programs: associate degree, baccalaureate degree and post-baccalaureate (American Dental Education Association, n.d.). Entry-level programs are for students who do not have any prior dental hygiene education. These programs are taught at vocational institutions, community colleges or four-year institutions, where the

student graduates with an associate or bachelor's degree in dental hygiene.

Students completing an entry-level associate degree program are awarded an associate degree upon completion and complete an average of 84 credit hours (American Dental Education Association, n.d.). The program typically takes three years to complete and prepares dental hygiene students with knowledge and experience to practice in the field (*Types of Dental Hygiene Degrees Available to You*, 2021).

Entry-level baccalaureate degree programs are four years in length and require an average of 120 credit hours for completion, combining the requirements of an associate degree with a bachelor's degree curriculum (*University of Bridgeport News*, 2021). The curriculum at this level provides students with the opportunity to minor in other areas leading to a more versatile career. Students are also required to intern at various professional settings, increasing the ability to hone their skills.

Entry-level post-baccalaureate degree programs are for individuals who have obtained a baccalaureate degree in something other than dental hygiene from an accredited institution and wish to earn a subsequent degree in dental hygiene (American Dental Education Association, n.d.). Focus of this degree is to deepen the knowledge, skills, and value of the profession of dental hygiene.

Licensed dental hygienists who have completed their entry level associate degree program and want to continue their education by earning a bachelor's degree in dental hygiene can enroll in a degree completion program. Students can either enroll full- or part-time and complete courses on-campus or online. By earning a bachelor's degree, there are more career opportunities within the dental hygiene field including education, administration, and sales (American Dental Education Association, n.d.).

The last program type, graduate-level dental hygiene education, is for hygienists who have obtained a baccalaureate degree in dental hygiene and wish to earn a master's degree. A master's degree opens the career path, specifically in dental hygiene education. Graduate programs prepare students for careers related to education, administration, research, curricula focused on research methods, health education, and legal issues in dental hygiene (American Dental Education Association, n.d.). Typically, there is no clinical component involved in graduate-level dental hygiene education. See table 5.

Table 5

Dental hygiene programs based on level of degree

Program Type	Criteria	Degree Awarded
Entry Level:		
Associate Degree	Associate Degree: <ul style="list-style-type: none"> • 84 credit hours • 2-year program 	Associate degree
Baccalaureate Degree	Baccalaureate Degree <ul style="list-style-type: none"> • 120 credit hours • 4-year program 	Baccalaureate Degree
Post-Baccalaureate Degree	Post-Baccalaureate: <ul style="list-style-type: none"> • Already awarded a baccalaureate degree in other profession 	Baccalaureate Degree
Degree Completion	Licensed dental hygienist who have a certificate or associate degree	Baccalaureate Degree
Graduate	Licensed dental hygienist who have obtained a baccalaureate degree in dental hygiene	Master's Degree

In the United States, there are 327 entry-level dental hygiene programs; 280 offering an associate degree and 57 awarding students with a baccalaureate degree in dental hygiene (DeRosa Hays, Moglia & Willis, 2021; American Dental Hygienists' Association, 2023). Specific to Illinois, there are 12 associate degree programs, half residing in the Chicagoland area, and the

remaining 5 scattered throughout the state (American Dental Hygienists' Association, 2023). SIU Carbondale is the only Illinois institution to offer a bachelor's degree in dental hygiene. Additionally, in the state of Illinois, SIUC is the only institution to offer a degree completion program for those who have already received licensure and want to continue toward their bachelor's degree.

Licensure Process

In order to become a licensed hygienist in the United States, students must successfully complete the following: pre-requisite and core curriculum courses offered by an accredited dental hygiene program, a written examination, and a clinical examination. The National Board of Dental Hygiene Examination (NBDHE), administered by the JCNDE, is a standardized written test required for licensure in all 50 states (Joint Commission on National Dental Examinations, 2022). It contains 350 multiple choice questions including discipline-based and case-based questions used to assess student's ability in obtaining important information from the biomedical and clinical sciences and apply the information in a problem-solving context (NBDHE Practice Test, 2022). Students are required to take the eight-hour exam at a proctored testing center (Joint Commission on National Dental Examinations, 2022).

The distributed testing components include: 61 questions related to scientific basis for the dental hygiene practice, 115 questions relating to provisions of dental hygiene practice and 24 questions related to community health and research principles. See table 6.

Table 6

Detailed test specifications for the NBDHE

Scientific-Based (61 questions)	Provisions of Dental Hygiene (115 questions)	Community Health/Research Principles (24 questions)
------------------------------------	---	---

-
- | | | |
|---|--|--|
| <ul style="list-style-type: none"> • Anatomic Sciences (14) • Physiology (4) • Biochemistry and Nutrition (6) • Microbiology (9) • Pathology (13) • Pharmacology (15) | <ul style="list-style-type: none"> • Assessing patient characteristics (20) • Obtaining and interpreting Radiographs (13) • Planning and managing dental hygiene care (34) • Performing periodontal procedures (20) • Using preventive agents (9) • Provide supportive treatment (7) • Professional responsibility (12) | <ul style="list-style-type: none"> • Promoting health and preventive disease (6) • Participating in community programs (9) • Analyzing scientific literature, and understating statistics (9) |
|---|--|--|
-

Note, Taken from the 2021 Technical Report National Board Dental Hygiene Examination (NBDHE)

The remaining 150 questions are case-based questions related to patient care focusing on patients with special considerations, including geriatric, periodontally complex, special needs or medically compromised. Students are provided with patient histories, dental charts, radiographs and clinical photographs. Multiple choice questions include assessing patient characteristics, interpreting radiographs, planning dental hygiene care, performing periodontal procedures, using preventive agents and providing supportive treatment services (Joint Commission on National Dental Examinations, 2022).

Scoring on the NBHDE ranges from 49 to 99, with a minimum passing score of 75 (Joint Commission on National Dental Examinations, 2022). Those who pass the exam will receive a score report stating they passed only. Those who fail will receive a numerical score for each major area of the exam. This will aid the student in determining what content material needs to be further reviewed (Joint Commission on National Dental Examinations, 2022). Exam standards are reviewed and updated on a periodic basis by subject content experts to provide content that is up to date and reflective of safe practices and skills utilized by a licensed clinician. Student results are computer based and scores are converted to scale scores, which adjust to any minor differences in difficulty across exam forms (Joint Commission on National Dental Examinations,

2022). Additionally, experimental questions are asked on the exam to determine if they are appropriate to use as a scored question for future exams. The unscored experimental questions appear on the test as the exact same as scored questions. Score reports are typically made available three to four weeks after completing the exam (Joint Commission on National Dental Examinations, 2022).

Clinical examinations, administered by three different agencies, are not offered at the national level (Voge, 2022). The Commission on Dental Competency Assessments, Western Regional Examining Board and Council of Interstate Testing Agencies (CDCA-WREB-CITA) were merged as one agency in August of 2022 to provide a uniform licensed examination for dental hygiene professions (CDCA WREB CITA, 2023). Central Regional Dental Testing Services (CRDTS) and Southern Regional Testing Agency (SRTA) also provide reliable clinical testing for dental hygiene students (Voge, 2022). Students choose which exam to take based on the region where they plan to obtain a license after graduation. The purpose of the clinical examination is to assess student's professional knowledge, skills, ability and judgement in applying clinical procedures that are provided in the practice of dental hygiene (Central Regional Dental Testing Service, Inc, 2022). Students in the dental hygiene program at SIUC receive a significant amount of clinical practice and pass rates have proven to not be an issue.

In addition to a written and clinical exam, some states require a jurisprudence exam to be taken prior to receiving licensure. This exam contains questions related to state dental laws, rules and interpretive statements and guidelines (Washington State Department of Health, n.d.). The goal of the exam is to allow applicants to familiarize themselves with the boards regulations and understand where to look when searching for answers related to practicing dental hygiene (Montana Board of Dentistry, 2022).

Success on each exam the first time around is crucial. Students can increase opportunities to enter the workforce directly after graduation and start earning competitive wages. Schools with high first-attempt pass rates also prove to be more enticing for incoming students. The examinations are expensive (estimated \$550 for the written, \$1,400 for the clinical, and \$100 for jurisprudence), time consuming, and mentally exhausting (Hatten, 2021). If unsuccessful on any of the exams, students may often feel financially strained, isolated, and lack confidence that they may never be able to pass.

If candidates are unsuccessful on the written NBDHE, they must wait a minimum of 90 days and submit full payment again before retesting (Heinrich-Null, 2018). Under the JCNDE's 5 Years/5 Attempts Eligibility Rule, candidates must pass the exam within: a) five years of their first attempt or b) five examination attempts, whichever comes first. (Joint Commission on National Dental Examinations, 2018). If failure results on the clinical exam, some agencies allow students to retest at the same location at no cost, while others require full payment and re-registration at another testing location.

Pass rates

The American Dental Association, Health Policy Institute, states the number of first-time candidates from accredited programs attempting to take the NBHDE increased by 9% from 6,882 in 2012 to 7,478 in 2021. While there was a lull in 2020 due to testing centers being closed due to COVID-19, there was a significant increase of students testing in 2021. (Commission on Dental Accreditation, 2021).

As shown in table 7, national failure rates on the national written board exam remained below 10% from 2013 to 2020, with an average of 6% of students failing on the first attempt. In 2021, there was a 4% increase in the national failure rates. SIU has wavered on first attempt pass

rates since 2013. In 2019, the school failure rate increased by almost 8%. This was also when SIUC dropped the ACT/SAT for admissions criteria. In spring 2020, the pandemic occurred causing programs to teach remotely. “It is plausible that the elevated failure rates are the result of candidates being further removed from their academic studies and corresponding clinical experiences at the same of their test administration and performing less well on the examination as a result”. (Joint Commission on National Dental Examinations, 2022).

Table 7

Failure rate (%) on the NBDHE on the first attempt (2012-2022)

NBDHE	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
National Fail Rate	4.8%	4.8%	4.4%	5.1%	6.2%	5.7%	7.8%	9.3%	13.3%	13.9%
School Fail Rate	7%	2.7%	0%	15.2%	21.2%	23.3%	31.1%	36.4%	20%	19.1%

Note, Adapted from Joint Commission on National Dental Examinations and NBDHE Profile Report for 2013-2022.

Southern Illinois University Carbondale’s failure rates from 2015 to 2020 have increasingly progressed. For example, in 2015, the class had a 100% pass rate on the first attempt, as compared to 2020, where 36.4% of students were unsuccessful. In 2021, the failure rates decreased by 16%, although that is still significantly higher (6.7%) than the national average of 13.3. This is also when the HESI examination was used as a mock board examination for senior dental hygiene students to determine their level of preparedness prior to taking the NBHDE.

Grading on the NBDHE is analyzed through each content topic, and a standard deviation score is returned to each institution on an annual basis. The exam is criterion referenced and not norm referenced. Specifically, examination results and the pass/fail standard are determined by

specific criteria, not by the process of “grading on a curve” (Joint Commission on National Dental Examinations, 2022). Additionally, the Joint Commission on National Dental Examinations has several versions of the exam to minimize dishonesty.

Predictors of Success

Predicting success on the examination is a difficult process. The process starts with selecting students from a pool of qualified applicants who will most likely succeed and begin in the workforce immediately after graduation (Alzahrani et al., 2007). Historically, numerous variables with admissions have been used to predict success including American College Testing (ACT) Scholarship Aptitude Test (SAT), and high school grade point average (GPA). Although, validity of standardized test scores are a measure of college readiness and success on a national exam post-graduation is questionable (Allensworth & Clark, 2020).

Various studies have tried to provide data for admission related decisions and have faced challenges due to variability in sample size, student characteristics, outcome variables and period of evaluation. Studies on noncognitive variables such as experience in the dental field, personality test and admissions interviews have produced mixed results (Alzahrani et al., 2007). Cognitive studies have attempted to identify variables that are related to academic success including grade point averages, science grades, and scores on standardized testing (Alzahrani et al., 2007; Bauchmoyer et al., 2004). These studies have also produced mixed results in determining correlation between variables and academic success (Alzahrani et al., 2007). The admissions process may benefit from a student's grade in a prerequisite course, but the grade in a particular dental hygiene course is not determined until after admission.

Once accepted into the dental hygiene sequence, students in the hygiene program must maintain a minimum of a 75% passing rate for didactic and clinic courses. If a student maintains

a 'C' average throughout the dental hygiene sequence, they are more likely to be unsuccessful on the NBDHE. In 2000, Edenfield and Hanson (2000) examined the relationship between dental hygiene course grades, a mock board dental hygiene examination and the NBDHE. They concluded that final course grades showed a strong probability of success or failure in subsequent classes and were a major influencer on the NBDHE (Edenfield & Hansen, 2000). Research has been conducted on predicting success on the NBDHE, including single program studies and studies that include multiple programs though there are minimal studies indicating mock examinations as a predictor of success on the NBDHE.

HESI

According to Elsevier (2023a), "HESI dental hygiene practice tests familiarize you with standardized tests and assess your understanding of key concepts through application-level licensure or certification exam-style questions" (p. 1). The purpose of this mock testing is to identify if students are adequately prepared by attaining enough knowledge and problem-solving skills to sit for the eight-hour exam. "Self-study practice quizzes and exams give you unlimited opportunities to test your comprehension and include both comprehensive and content-specific assessments with detailed rationales included for each question" (Elsevier, 2023a). When students enroll in the HESI dental hygiene practice tests, they are given unlimited attempts to answer questions in the scientific based, provisions of dental hygiene and community health/research principles categories, similar to the NBDHE. Students have access to three different sets of questions, with rationales for each question.

The primary purpose of including the HESI as a mock exam is to help student acclimate to the experience of taking a board, specifically computer based. It also allows students to self assess their level of preparation, motivates students to study, and helps faculty identify students

who are at risk of failing the national exam (Dadian et al., 2002).

The Health Education Systems, Inc. (HESI), designed by Elsevier Student Life, is a standard for admissions used in several health-related fields (Sathar, 2023). It is used to prepare health profession students for the national board examination in their specific health profession upon graduation. The dental hygiene HESI exam consists of two different versions, the dental hygiene practice test and dental hygiene case-based practice test. The dental hygiene practice tests consist of 200 questions and is divided into three topics: scientific basis, provisions, and community, similar to the NBDHE. The dental hygiene case-based practice test is 150 questions from 10 different cases. Students at SIUC are required to register for the practice exams in addition to a proctored exit examination. The exit exam consists of 200 questions in the same topics previously listed: scientific based, provisions and community. As an additional resource, faculty can also incorporate Elsevier Adaptive Quizzing (Elsevier, 2023b). “The highly effective, formative evaluation tool strengthens students’ knowledge and confidence with high-quality practice questions. Through personalized quizzing, students and instructors can identify weak topic areas and develop simple strategies to improve their results” (Elsevier, 2023b, p. 1). The adaptive quizzing provides questions for students to gain exposure to additional topics and allow for a deeper understanding of subject matter. The faculty receives a detailed report to track student progress and identify students who need remediation.

Students in the dental hygiene program at SIUC have completed the HESI exit exam from 2021 to 2023. They are required to take the proctored exam in February-March and if they are successful with a score of 651, or equivalent of 75%, they are allowed to sit for the NBDHE prior to graduation. If students receive a score of 650 or lower, they must wait until after graduating in May to take the NBDHE. This extra time is to allow the student to better prepare to

take the exam, so they are successful on the first attempt. Table 8 shows the comparison of passage on the HESI into the NBDHE.

Table 8

HESI exit exam as predictor of success on NBDHE

HESI Exit Exam	2021	2022	2023
Pass rate on HESI	51.7%	80.6%	60.7%
Pass rate on NBDHE	80%	80.9%	75%

Note. This is for SIUC dental hygiene students, not a national representation.

Although there are no studies identifying the HESI as a predictor for success in dental hygiene specifically, there are studies relating the exam to be highly predictive of students' success on the licensing exam in nursing (Lauchner et al., 1999). Lauchner et al. (1999) noted the accuracy of prediction on the proctored exams was 99.49%. An additional study conducted by Newman et al. nine years later in the field of nursing, again found the exam to be highly predictive, specifically when proctored (Newman et al., 2000). Used as a remedial tool by dental hygiene schools, the HESI predicts the likelihood that low-scoring students will be unsuccessful on the licensing exam on the first attempt. To find out what kinds of techniques and remediation programs are successful for at-risk students, more studies should be conducted.

Summary

The field of dental hygiene has grown exponentially since its inception in 1913. “When it comes to oral health, prevention is always better than cure” (Benco Dental, 2022, p. 1). With a demand for the profession, educational institutions must set high educational standards and produce student who can start in the workforce immediately after graduation. While implementing a mock examination proves to be beneficial in other healthcare fields, there is little

to no research on its predictability of success in the field of dental hygiene. By requiring students to take a mock examination prior to the NBHDE, faculty will be able to identify students who are at risk. Requiring additional time for preparation prior to testing will allow the student to be further prepared and successful on their first attempt of the written examination.

CHAPTER III

METHODOLOGY

Introduction

The purpose of this project is to improve student preparation and readiness for the NBDHE by implementing the dental hygiene HESI exit examination and an on-campus board review course the final semester of the course sequence. The evaluation of this data will determine if the HESI exit examination is a good predictor of success and if an on-campus board review course in the final semester helped to improve students' passage on the NBDHE. With the continued demand for hygienists, it is important to ensure student readiness upon completion of a dental hygiene program.

Chapter III provides a review of the study's research methodology. The first part of the chapter reviews the research questions, followed by the explanation of the chosen research design. Next, I will discuss data analysis based on the four study groups followed by the chapter summary. This chapter will conclude with a brief description of Chapters IV and V.

Research Questions

This project has two main research questions that seek to determine how students prepare for their final examination before licensure. Specifically, if a HESI exit examination or a HESI exit examination and on-campus board review course in the final semester of the course sequence helps with student preparedness and readiness prior to taking the national written examination.

Research Question 1: Is there a difference on the NBDHE passage rate between students who do not have any preparatory tests measures and those who complete the HESI exit exam?

Research Question 2: Is there a difference on the NBDHE passage rate between students who

complete the HESI exit exam and those who complete the HESI exit exam and on-campus board review program?

Comparative Analysis

In this quantitative research approach, comparative analysis is utilized. It is the act of describing and explaining similarities and differences of conditions with a view to discovering something about one or all things being compared (Drobnic, 2014). In educational research, it can help provide programs focus on meaningful data that supports completing research in a particular way, or in the contrary, fostering growth by changing approaches (Dovetail Editorial Team, 2023). Comparative cases are more useful for studying changes over time and enable a more effective isolation of reason for differences and changes (Bridgman & Cummings, 2023)

One reason for carrying out a comparative analysis is to examine whether a condition which is given in one society is influential or not (Pickvance, 2001). While comparative analysis does not have boundaries, it should include the following two conditions. First, data must come from two or more cases. In this project, cases meaning cohorts of students. Second, there must be an attempt to explain rather than only describe (Pickvance, 2001). For my project, comparative research will determine if preparation test measures have any impact on student success on the first attempt at the NBDHE including the HESI exam and on-campus board review program. Additionally, I will hypothesize if academic performance over the course of the program has any impact on student success.

Population and Sample Selection

Within quantitative research design, subject and population is used to provide a basis where data is applied from one group to another (McMillan & Schumacher, 2001). The population includes a group of individuals, objects, or events that mold into specific criteria that

generalize results (McMillan & Schumacher, 2001).

The population for this study consisted of dental hygiene students at a Midwestern University from the classes of 2020 – 2023. The four group samples totaled 112 graduating dental hygiene students. I obtained data through the Evolve Elsevier portal and NBDHE profile reports specifically provided to dental hygiene program directors. I securely placed the data on my computer as an excel document, utilizing a 16-character password for access.

Data Collection

Data is collected from dental hygiene students at a Midwestern University from the classes of 2020 – 2023. The students are grouped and analyzed based on their NBDHE preparation: (group A – class of 2020) did not receive any preparation materials prior to taking the exam; (group B – class of 2021) received HESI exit exam only; (group C – class of 2022) received HESI exit exam only; and (group D – class of 2023) received the HESI exit exam and an on-campus board review course. For groups B, C and D, the students received all materials before the final semester in course sequence.

Prior to registering for the HESI examination, all students provided written consent to participate in the exam. Additionally, when applying to take the NBDHE, all students provided consent to share exam scores with their individual dental hygiene school. The Institutional Review Board deemed the project exempt after completing the necessary application.

Students from groups B, C, and D registered for the HESI practice tests, including the practice test and case-based practice test, and exit exam through the Evolve Elsevier portal. Students were able to access the HESI practice test after payment was received, and could attempt the practice exams as many times as desired. Students are required to complete version 1 (V1) of the HESI practice test and case-based practice test in September-October and version 2

(V2) in December-January. Additionally, a proctored exit exam is taken in March. When students attempt either of the exams, the practice test or case-based practice test, a score is recorded and saved to the portal. As the instructor, I have access to the portal and can track each attempt to check progression.

After taking the proctored exit exam in March, students receive a score and a detailed report identifying proficient and weak areas. If they score above 650, equivalent to 75%, they are allowed to sit for the NBDHE prior to graduation. If that score is not met, those students have to wait until after graduation to register for the NBDHE to allow for additional study time. After graduation, students are allowed to register without further approval from the program.

Following completion of the NBDHE, scores are reported to the student and program director within three to four weeks. These reports either state “pass” (75 or higher) or “fail” (74 or below). Student names from each cohort will be typed into an excel document, along with their HESI exit exam score and NBDHE pass/fail score. I compared to determine if preparatory test measures have any impact on student success on the first attempt of the NBDHE.

Data Analysis

To analyze the data, I examined test scores from the classes of 2020-2023. A secured excel file contains each students' first and last name with their HESI exit exam score (ranging from 0-1001) and their first attempt on the NBDHE, recorded as a “pass” or “fail.” If a student passes the exam, the report will state “pass,” no percentage attached. If a student fails the exam, they are provided with their overall score and score in each content area (Joint Commission on National Dental Examinations, 2023). The dental hygiene program only receives a report stating “fail.” Tables in Chapter III provide more detailed information about results and how the HESI exit exam and on-campus board review course may have influenced outcomes for students.

Summary

In Chapter III, I provided the purpose of the study, the research questions and the design including a quantitative comparative analysis. I specifically discussed the data collection and analysis. In Chapters IV and V, I will provide data comparing the students' scores from groups A through D and hypothesize if academic performance over the course of the program has any impact on student success.

CHAPTER IV

RESULTS AND DISCUSSION

Introduction

The purpose of this study is to determine if implementation of the HESI exit exam and on-campus board review course helped to increase first time pass rates on the NBDHE for students at a Midwest University. This chapter provides pass rates on the NBDHE from four cohorts of students attending the same University from 2020 to 2023, while acknowledging three of the four groups had different preparation methods. Results from the clinical exam were not pursued with this research as the students have proven to be successful on that exam for at least the past four years receiving a 100% pass rate. The evaluation of this data will determine if any additional preparation methods provided increased passage on the NBDHE.

I completed a comparative statistical analysis to determine if different preparation methods from four cohorts of students impacted first time pass rates on the NBDHE. Since 2016, the Midwest University students have lagged behind the national pass rates by an average of 14% annually. Although the Midwestern University student pass rates have gradually increased since 2019, there is still a shortfall as compared to the national trends.

Structure of HESI reporting

The HESI examination is provided to the students in the final year of the course sequencing. Students in group B, C and D are given access to the HESI exam in September – October. They are required to complete version 1 (V1) in September-October and version 2 (V2) in December-January through the Evolve portal. The proctored exit exam must be completed in March. In order to take the NBHDE prior to graduation, students have to successfully receive a 650, with a conversion score of 75% or higher on the exit exam. Those students receiving less

than a 650 on the exit exam are required to wait until after graduation to register for the NBDHE. This is monitored as a faculty member must approve the application in the NBDHE hub prior to the student registering at a testing location.

Students receive their score on the V1 and V2 immediately after submission. The student receives a score for each of the following categories: scientific based, provisions, community and case-based. Before taking the exams, students are informed that their grades should average between 50% to 60% on V1. Their grade for V2, taken two to three months later, should go up by at least 5% in each category. Table 9 below demonstrates the mean score for each cohort and category.

Table 9

Mean score on V1 and V2 of HESI for groups B, C, and D.

	Group B N = 30	Group C N = 21	Group D N = 28
V1 Scientific Based	53.80%	43.46%	65.36%
V2 Scientific Based	64.04%	61.48%	59.43%
V1 Provisions	54.20%	56.86%	53.60%
V2 Provisions	65.77%	65.43%	55.32%
V1 Community	51.97%	54.81%	61.18%
V2 Community	70.91%	73.86%	70.12%
V1 Case-based	54.84%	58.90%	59.25%
V2 Case-based	N/A	59.48%	57.14%

Note: Adapted from Elsevier faculty portal. Group B did not have saved grades for V2 case-based.

In groups B and C, the average scientific based, provisions, and community scores increased by at least 5%. Group D had almost a 6% decrease in the scientific based category, a minimal increase in the provisions category, and an average increase in the community category. In groups C and D, the case-based grades stayed consistent with a decrease of 2% for group D.

Students complete the 200 question exit exam in March. They receive a results report immediately after testing stating their name, HESI score, conversion score, date and duration of time. See Table 10 for example.

Table 10

HESI exit exam results report provided to the student

Student Name	
Date	3/1/2023
HESI Score	838
Conversion Score	89.76
Duration of Exam	94 minutes and 33 seconds

Note: Adapted from Elsevier exit summary report to the student.

Each category is part of the exit exam with the exception of case-based questions. Additionally, students only have access to this exam one time, for a limited time, unlike V1 and V2 where they can repeat the exam multiple times. Furthermore, faculty do not have access to these questions unlike the V1 and V2 where the faculty has full access.

The exit exam results report also divides the results into specialty topics including: scientific based, clinical provisions and health/research principles. Each specialty topic includes the subject area, the students specific HESI score, deviation from acceptable, deviation from recommended and number of questions answered correctly. The student is able to see their results over each subject area content. Table 11 shows an example of a detailed exit exam results report students may receive.

Table 11

Detailed example of HESI exit exam results report provided to the student

Category	Subject area	HESI score	Deviation from acceptable	Deviation from recommended	Number of questions answered correctly
Scientific based	Physiology	757	107	57	1 of 2
Clinical provisions	Assessing patient characteristics	1023	373	323	3 of 3
Health/research principles	Preventing disease within groups	671	21	-29	4 of 6

Note: Adapted from Elsevier exit summary report to the student.

If the HESI score is a 650 or above, the student is proficient on that topic and can dedicate study time to a specific subject or topic that they are not as proficient in. If the HESI score is below a 650, the student will know to remediate on that subject content.

The final pages of the HESI exit exam results report provides a detailed report of the question number missed and subtopic included. For example, if the student missed question 22, it would state the specialty topic as scientific based and the subtopic as microbiology/immunology – lactobacilli. The student would then know exactly what content area to focus on when reviewing microbiology/immunology.

As the instructor of record and program director, I am provided a class summary report after each cohort completes the HESI exit exam. This report provides statistics regarding the number of students, number of scored and non-scored test times, mean HESI score, mean HESI conversions score and a range of scores as shown in table 12.

Table 12

HESI exit exam summary results report provided to the instructor of record

Summary of findings			
Number of students	28	Mean HESI score	732
Number of scored test items	170	Mean HESI conversion score	79.70
Number of non-scored test items	30	Range of HESI scores	499-1141

Note: Adapted from Elsevier exit summary report to the instructor of record for group D.

The information in the above table allows the instructor to identify how the class as a whole is performing. The program shares this report with students so they can evaluate their individual score to the class average.

Below, table 13 displays the results report by providing a chart displaying the HESI scoring interval, performance level and number of students who completed the exit exam.

Table 13

HESI exit exam summary results report on class passage rates provided to the instructor of record

HESI examination scoring		
HESI scoring interval	Performance level	Number of students
700 or greater	Recommended performance	14
650 – 699	Acceptable performance	3
550 – 649	Below acceptable	9
Less than 550	Needs further preparation	2

Note: Adapted from Elsevier exit summary report to the instructor of record for group D. Elsevier reports 650 as acceptable performance, although our program identifies 650 as minimally acceptable.

This information correlates with the information in table 44 and provides a visual to quickly identify the number of proficient and deficient students.

Findings

I utilized the data gathered to answer the following research question:

Research Question 1: Is there a difference on the NBDHE passage rate between students who do not have any preparatory tests measures and those who complete the HESI exit exam?

The study consisted of 112 graduating dental hygiene students from a Midwest University from the classes of 2020-2023. Students were grouped and analyzed based on their NBDHE preparation: (group A – class of 2020) did not receive any preparation materials prior to taking the exam; (group B – class of 2021) received HESI exit exam only; (group C – class of 2022) received HESI exit exam only; and (group D – class of 2023) received the HESI exit exam and an on-campus board review course. Additionally, students from each cohort were given the opportunity to attend an off-site board review course as well as purchase additional board preparation materials.

Table 14 shows first-time failure rates among the four groups. There is a maximum of 36 students per cohort, with the average $N=28$. Group A did not receive any on-site preparation, and a low first-time pass rate was reflected. Group B was provided with the HESI practice and exit exams, and the first time pass rate increased by 13% as compared to group A. Group C, the smallest cohort, did significantly better on the first attempt of the HESI, which proved to be a good predictor of success on the NBDHE as 16 people passed the HESI and 17 passed the NBDHE on the first attempt. Group D was provided with the HESI and an on-site board review. Of the 28 students, 17 scored above a 650. When taking the NBDHE, 21 students successfully passed on their first attempt.

Table 14*First-time failure rate among four groups*

	Group A	Group B	Group C	Group D
Testing Method	No HESI	HESI only	HESI only	HESI & Board Review
	N = 33	N = 30	N = 21	N = 28
Students scoring above 650 on HESI		16 = 53%	16 = 76%	17 = 61%
Students scoring below 650 on HESI		14 = 46.7%	5 = 24%	11 = 39%
Student passage on NBDHE	22 = 67%	24 = 80%	17 = 81%	21 = 75%
Student failure on NBDHE	11 = 33%	6 = 20%	4 = 19%	7 = 26%

Note: Adapted from Joint Commission on National Dental Examinations annual report to program directors from 2020-2023.

In reviewing the three groups who completed the HESI, all those scoring above a 650 were successful on their NBDHE.

While this study does not look at student data prior to 2020, it is important to include the decreased national passing rate on the exam in comparison to the increased pass rates at the Midwest University. Table 15 shows the comparison of national and school pass rates on the NBDHE.

Table 15*National pass rate on NBDHE*

Year	2018	2019	2020	2021	2022
National rate	94.3%	92.2%	90.7%	86.7%	86.1%
School rate	76.7%	69%	65.6%	75.9%	81%

Note: Adapted from Joint Commission on National Dental Examinations and NBDHE Profile Report for 2018-2022. Year 2023 is not included as national pass rates have not been published.

School pass rates show that those in group A (class of 2020) receiving no preparatory measures had a pass rate of 65.6%. After implementation of the HESI exam with group B (class of 2021) the pass rate increased by 10.3% and again by 5.1% for those in group C (class of 2022).

Research Question 2: Is there a difference on the NBDHE passage rate between students who complete the HESI exit exam and those who complete the HESI exit exam and on-campus board review program?

Students in Group B, C, and D were all provided the HESI examination in the final year of the program. Group D was the only group to receive an on-campus board review course. This eight-week course was mandatory and delivered from January to March for two hours each week. Prior to the course, I surveyed students to determine what material they wanted to cover, as the course could not address all subjects in such a short amount of time. Based on the suggested topics, content experts attended the course and provided lectures. Students also received a 25-question multiple choice review over content reviewed that week and a 15-point case study. If time allowed, I would facilitate a discussion over the case study for the week and students could provide their rationale for their answers. In addition, students had to provide a study plan at the beginning of the eight week course and on week eight they were asked if they followed their original plan. The goal for the course was to keep students actively engaged in preparing for the NBDHE.

The total number of students who completed the HESI only was 51, and the total number of students who completed the HESI and board review course was 28. Table 16 displays students in group B, C and D along with the number of students who successfully passed the HESI with a 650 as well as those who successfully passed the NBDHE on the first attempt.

Table 16*First-time pass rate among three groups*

Testing method	Group B and C HESI only	Group D HESI & Board Review
	N = 51	N = 28
Students scoring above 650 on HESI	32 = 65%	16 = 61%
Student Passage on NBDHE	41 = 81%	21 = 75%

Note: Adapted from Joint Commission on National Dental Examinations and NBDHE Profile Report for 2018-2022. Additionally, HESI Dental Hygiene Exit summary report for 2021-2023.

Students who were provided the HESI only were more successful on the first attempt of the NBDHE as opposed to those who were provided the HESI and board review course. Group D had access to the same information as previous classes, although their performance was below Group B and C. Based on historical academic performance, group D does not test well and the results received are not indicative for future cohorts.

When comparing HESI scores to NBDHE passage in groups B and C, there was a 16% increase in student passage rate. For those in group D, there was a 14% increase in passage rate. This indicates those students who did not perform well on the HESI altered their study techniques to improve their outcomes. It is noteworthy that there was only a 4% difference in the number of students who scored above a 650 on the HESI between group B and C as compared to group D. Additionally, group D had two less students pass the NBDHE as compared to groups B and C.

Conclusion

This chapter showcased four different cohorts, the preparation methods they used prior to

taking the NBDHE, and their first time pass rate on the NBDHE. Dental hygiene programs have a plethora of resources to help students pass the national board examination. Students at the Midwest University were provided with the HESI and an on-campus board review course with the purpose to increase first time pass rates. The HESI was used as an additional resource as it provided students the opportunity to sit for an extended length of time and answer board-worthy multiple choice question. These questions are written to mimic the NBDHE and help students identify proficient and deficient content areas, while also proving to be a reliable predictor of success.

The board review course also helped to provide individualized study schedules, hold students accountable for their preparation, and deliver further clarification from subject experts while providing students with weekly multiple choice questions and case-based questions. In the following chapter, I will present limitations and delimitations, implications, and recommendations for dental hygiene programs when considering board preparation measures and improving student outcomes.

CHAPTER V

CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS

Given the workforce demand for the profession, preparation programs are fundamental in maintaining a high first attempt national examination passage rate and providing hygienists who are trained and ready for the workforce. The purpose of this study is to determine what preparatory measures dental hygiene programs can utilize to help increase first time pass rates on the NBDHE. Specifically, this study explored students who did not have any preparatory test measures, students who were offered the HESI examination, and students who were offered the HESI examination in combination with an on-campus board review program.

Conclusions

I have constructed the conclusions for this project according to the findings from four cohorts attending a dental hygiene program at a Midwest University.

Conclusion One

Programs have to rely heavily on faculty and student motivation to guide students toward measures for success. Our program utilized the HESI examination provided through Elsevier after first time pass rates continued to drop. The examinations proved to be reliable as a preparatory measure and predictor of success. All students who successfully passed the HESI exit exam with a 650 were also successful on the NBDHE on the first attempt.

Despite the fact that their examinations help to prepare students, there were several obstacles I noticed after working with the company for the past three years. I have utilized multiple representatives who have become increasingly unresponsive to faculty and student concerns. Registering students to take the examination is daunting as multiple repetitive steps must be completed with multiple representatives.

As the instructor of record, I can allow students to take the V1 and V2 an unlimited number of times so they can see the questions repeatedly. Unfortunately, the examinations are posted throughout the internet so the score obtained on the examination might not be reflective of the student's knowledge as their first attempt is not necessarily the first time seeing the questions. The information on the examinations rely on outdated data, and requests have been sent for Elsevier to update this information although there has been no follow through.

Students in my program tend to have a difficult time answering case-based questions. The case-based questions on V1 and V2 have proven to be effective but it would be beneficial if the exit exam had one to two cases so students could have more practice with these. I believe Elsevier has a great product, but after hearing student commentary, a decent amount of information on the exams is geared toward nursing students as opposed to hygiene. Elsevier seems to put a strong emphasis on their nursing preparation programs, but little focus is geared toward dental hygiene preparation programs as there are no studies completed on the HESI as a predictor of success for dental hygiene.

Conclusion Two

Structure and requirements should be changed for the on-campus board review course to hold students accountable. Since this was my first time teaching a course of this nature, I was unsure what would work best. I did not weigh the course and only required students to complete the HESI, multiple choice questions, case study questions and create a study schedule. If the student completed the work, they would receive full credit. The students grade in the board review course does not accurately reflect the student's knowledge in course content nor did it allow myself or the student to determine where they were proficient and deficient.

Not all student took the board review course or HESI exams seriously. All students

attended an off-campus preparatory review in addition to the on-campus review, but some reported they did not attend the review and explored the city instead. In addition, the exit exam should have more emphasis toward the overall grade for the course to hold students accountable for their preparation.

Conclusion Three

The program has a planned curriculum where students have to take courses in a specific sequence. After reviewing cohort results from the NBDHE profile report sent to program directors, I would review the programs curriculum map and course sequencing. Classes taught toward the end of the program should have reiteration from course content taught in the first or second semester. The faculty strive to do this, but more emphasis needs to be placed so this truly happens. Students are required to take periodontology, pathology and pharmacology in one semester. Two of the three course are back to back along with another course, so students are in lecture from 9-5 once a week expected to prepare and retain all of the content for those courses. Students have historically not tested well on pathology, pharmacology and periodontology on the NBDHE.

Students take nutrition as a prerequisite to the program and it is discussed in a few courses but there is no strong emphasis on nutrition after being enrolled in the dental hygiene course sequencing. They are also required to take microbiology prior to the program, and while this information is covered in other courses through the program, students may lack the basics to build on that material. The program currently offers periodontology over the course of two semesters but the courses are spaced a year apart so all information taught in the first course has to be retaught in the second course.

Limitations and Delimitations

Limitations:

1. The findings of this study may not be generalizable for all bachelor's degree dental hygiene programs in the United States.
2. The study did not evaluate content or sequencing of courses in the dental hygiene program.
3. Program faculty do not have control during the admissions process. All students are required to have a minimum of a 2.75, although there is a selection committee who provide points to students based on their application, including GPA, pre-requisite courses completed, and the grade received in each pre-requisite course. The committee then accepts the highest ranking 36 students.
4. There has been a significant turnover of faculty, either by retirement or taking other career paths. Some faculty who have left taught essential courses that are heavily covered on the NBDHE.
5. The exam is all speculation, hindering our practice and preparation programs as members of the American Dental Association write the examination, not the American Dental Hygienists Association.

Delimitations:

1. This study focused only on 2020-2023 graduating dental hygiene students from a Midwest University.
2. The study did not make an attempt to monitor or assess the influence of COVID. The only information we have on the impact of COVID is a shortened examination was provided by the ADA for one year to help address the backlog of candidates. Additionally, the class of 2021-2023 were taught online for some courses instead of the traditional in person lectures.

3. I observed students study habits, although I did not discuss with the student how I thought this affected their performance on the NBDHE.
4. I am responsible for teaching many didactic courses that are heavily covered on the NBDHE.
5. All faculty have input and follow the program curriculum map, although I do not attend other faculties courses so I am not certain on what they actually teach on a weekly basis.

Implications

As an instructor and program director I have used efforts to learn more about those who were unsuccessful on their first attempt. Table 17 gives an example of students who were unsuccessful from groups A-D using a pseudonym for their name and a suspected reason for failure. Although the table is not an exhaustive list of all students and suspected reasons for failure, it does provide insight.

Table 17

First time failure and suspected reason for failure

	Pseudonym	HESI Score	Suspected reason for failure
Group A	Iris	N/A	Average C student/off campus
	Gladiolus	N/A	Substance use
	Pansy	N/A	Family responsibilities/abuse
	Violet	N/A	Average C student/social
	Camellia	N/A	Repeat student/average C student
Group B	Orange	416	Average C student/off campus
	Yellow	552	Social
	Sage	436	Average C student/substance use

	Grey	390	Average C student/family responsibilities/off campus
	Maroon	631	Social
Group C	Wolf	595	Average C student/ESL
	Fox	528	Average C student/substance use
	Bull	490	Average C student/social
	Crocodile	650	Average C student
Group D	Kiwi	562	Repeat student/wedding
	Banana	499	Average C student/social
	Cherry	514	Average C student/work
	Watermelon	563	Average C student/wedding
	Pineapple	605	Repeat student

Note, this list includes those who scored below a 650 on their HESI exit exam and also failed the first attempt at the NBDHE. Students who failed the HESI but passed the NBDHE on the first attempt are not listed in this table. Additionally, the suspected reasons are based on my observations as their instructor. N/A students were not offered the HESI.

Several of the students above who were unsuccessful on their first attempt were average ‘C’ students. Although it is not true for all those students, some were not prepared for classes or group discussion, did not participate in extra study hours/tutoring, did not ask for additional help through the program, and were okay with minimally passing grades. Requirements for entry into the program have changed over the years with a minimum GPA being 2.75. With a multitude of dental hygiene programs being offered, specifically associate degree programs, the number and quality of applicants has decreased.

Some students were unsuccessful on their exams possibly due to having a strong social life. Some of these students would present to class with bar stamps on their hands, late for class, hung over, played on social media during class time and discussed their evening/weekend plans

rather than what projects and homework was due. Some of the students who attended an outside board review course in Chicago stated they showed up to receive the book and left so they could go out with friends and explore the city for the weekend. Through observation, those enrolled in the on-campus board review class (group D) and who were not participatory included five of the seven who were unsuccessful.

Additionally, some students had other obligations and priorities. Sage and fox would post on social media their substance use disorders. Watermelon and kiwi were planning weddings and had multiple friends' weddings to attend, pansy and grey had families to attend to and other responsibilities at home that made school less of a priority for them at that time. Camellia, kiwi and pineapple were unsuccessful on their first attempt on the NBDHE, and they were also unsuccessful on their first year of the program, requiring them to sit out a semester and repeat the failed courses. Faculty can provide redirection for students to help them stay abreast of their studies, but ultimately the student is responsible for how they spend their time in the program. Ultimately, despite the efforts to try and understand why each student was unsuccessful on their HESI exit exam and NBDHE, I cannot say the reasons provided above are all-inclusive.

Recommendations

Based on the findings of my project, future research should continue to evaluate and revise preparation programs for dental hygiene students prior to taking the NBDHE. One consideration to increase student success includes increasing the minimum GPA of 2.75 for entry into the program. This could provide a higher caliber of students to apply. Another programmatic change would be to implement study sessions, remediation strategies, or apply different teaching methodologies during didactic, clinical and lab courses to help students retain information. If the majority of the students who are failing the NBDHE on the first attempt are

average C students, we need to provide more resources and mandate students to attend a portion of the study sessions through the program so they can perform at a higher level.

The program should continue to utilize a mock examination such as the HESI and an on-campus review program in the final semester. An alternative to the HESI V1, V2 and exit exam should be considered as students have access to these questions via the internet, and their score may not be a true reflection of their knowledge. The program already utilizes an assessment examination for each cohort to complete every fall semester, but this could also serve as V1. Didactic faculty could then create questions for a V2 and exit exam for their respective courses. This would allow all faculty to be involved in the board preparation process. All faculty would also have access to student results and could make curricular changes to their course for better comprehension among future cohorts.

The on-campus board review course should be weighted with the HESI, or alternative assessment examination, worth a certain percentage of the overall grade so students take the course seriously. Students should also be required to pass the exit examination at a 75% or above in order to pass the course as this is standard practice in the School at the Midwest University.

Another recommendation is to identify if there is a component of the exam students historically perform poor in. The program could evaluate what programmatic changes have occurred, when in the course sequencing is content is covered, if there is repetition of the content, and what specific content are the students struggling with.

It would be advantageous to look at our course sequencing and compare it with other baccalaureate degree programs. The program has not had major curricular shifts for the past ten years and a change in the sequencing may provide better results on the NBDHE. Preparation measures and NBDHE results could be compared to another baccalaureate program to identify

what they utilize and how their students perform.

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APPENDIX**SIUC IRB Approval Letter**

INSTITUTIONAL REVIEW BOARD

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WOODY HALL - MAIL CODE 4344
900 SOUTH NORMAL AVENUE
CARBONDALE, ILLINOIS 62901618/453-4534
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To: Stacey McKinney

From: M. Daniel Becque
Chair, Institutional Review Board

Date: November 17, 2023

Title: *Evaluating Student Success on the National Board Dental Hygiene Examination at a Midwest University*

Protocol Number: 23199

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.

MDB:eb

cc: Saran Donahoo

VITA

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Stacey McKinney

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John Wood Community College Quincy, IL
Associate in Applied Science, May 2007

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Capstone Report Title:

Evaluating Student Success on the National Board Dental Hygiene Examination at a
Midwest University

Major Professor: Saran Donahoo, Ph.D.