ACT SCORE AND SUB SCORE AS PREDICTORS OF PASS/FAIL ON THE
CREDENTIALING EXAM FOR REGISTERED DIETITIAN NUTRITIONIST

by

Jeanna Haggard MS, RD, LD

Liberty University

A Dissertation Presented in Partial Fulfillment

Of the Requirements for the Degree

Doctor of Philosophy

Liberty University

2022

ACT SCORE AND SUB SCORE AS PREDICTORS OF PASS/FAIL ON THE
CREDENTIALING EXAM FOR REGISTERED DIETITIAN NUTRITIONIST

Jeanna Haggard MS, RD, LD

A Dissertation Presented in Partial Fulfillment

Of the Requirements for the Degree

PhD Higher Education Administration

Liberty University, Lynchburg, VA

2022

APPROVED BY:

Rebecca Lunde Ed.D., Committee Chair

Michelle J. Barthlow EdD., Committee Member

ABSTRACT

The profession of nutrition and dietetics is currently experiencing a significant change in the educational process with the conversion to a competency based graduate program for the process of licensure and ability to practice in the profession. In addition, the overall pass rate has declined nationwide, thus creating the need for accurate academic predictors for passing. For many health science programs, standardized exams continue to be an effective predictor of passing licensure exams. With many of the institutions of higher education dropping the requirement for test scores as part of the admission process, this is a consideration for many programs in student selection. This study used logistical regression to examine the predictive ability of the ACT in small private institution of passing or not passing the dietetic nutritionists licensure exam. Instruments included the standardized ACT preadmission exam for college admission and the credentialing exam administered by the Commission for Dietetic Registration which is the licensure exam for acknowledging professional practice status. ACT composite and sub scores are effective predictors of passing or not passing the CDR exam and should be considered in the admission process for accredited undergraduate programs.

Keywords: licensure exam, pass rate, dietetic undergraduate program, test flexible, academic success.

Table of Contents

List of Tables

List of Figures

List of Abbreviations

Commission on Dietetic Registration (CDR)

National Council Licensure Examination for Registered Nurses (NCLEX)

Future Education Model (FEM)

American College of Testing (ACT)

Scholastic Aptitude Test (SAT)

Graduate Record Examination (GRE)

Accreditation Council for Education in Nutrition and Dietetic (ACEND)

CHAPTER ONE: INTRODUCTION

Overview

The purpose of this multivariate quantitative correlational study is to determine if ACT scores and ACT sub scores are effective predictors of the pass rate on the credentialing exam for registered dietetic nutritionist. Chapter one provides background information on the history of the credentialing process in the profession of dietetics and the historical parameters utilized in the success rate of passing the credentialing exam. The problem statement examines the significant change in the profession, the movement towards the future education model, and the shift this creates in the admission variables to predict success on the dietetic nutritionist credentialing exam. This section also reviews the similarities in predictors of professional licensure pass rate of dietetics with other health science professions, and the depth that the ACT score plays in prediction of licensure pass rates. The significance of the topic is discussed including the benefits this study could provide to the undergraduate admission policies and maintenance of accredited standards for undergraduate dietetics programs. Chapter one concludes with research questions and a list of key terms with definitions.

Background

US Bureau of labor statists project larger than normal growth for the profession of dietetics (US Bureau Labor Statistics, 2020). This is no surprise when obesity rates are approaching 56% for some demographics and overweight adults at 71% of the total population (Center for Disease Control, 2020). Obesity rates and chronic diseases associated with obesity are making impacts in areas never considered thirty years ago. For the first time in history, children are not expected to outlive their parents, and obesity is now considered a national security threat, since obesity is the number one reason for rejection in military enrollment among

young men 18-25 (Sbraccia & Finer, 2019). Obesity and the cost of treatment is projected to be one of the greatest factors impacting the economy in 21st century (Rajbhandari-Thapa et al, 2020; Specchia et al., 2014). Registered dietitian nutritionists are the nutrition professional trained as a resource and change agent to improve individual and community health. Our declining health status in combination with the aging population of currently registered dietitian nutritionist (Nyland & Lafferty, 2012; Spiker, Reinhardts, Bruening, 2020) we need to be assured institutions of higher education are successfully graduating new generations of dietitian nutritionists who can be vital resources to our nations' health status.

To assure the availability of trained professionals to the general public, the profession of nutrition and dietetics has maintained a strong focus of upholding quality educational practices and policies for professional credentialing since the formation of the American Dietetic Association in 1917, now known as the Academy of Nutrition and Dietetics. The primary reason for the focus on educational standards and professional credentialing has been public protection and welfare (Stein & Rops 2017). Administering incorrect nutrition information can be detrimental to the health and welfare of a population or individual. The Commission for Dietetic Registration, CDR, was formed in 1969 to oversee the process and requirement for credentialing, which distinguishes and identifies persons qualified to administer nutrition information in a variety of settings including: hospitals, outpatient clinics, and community health.   For over 50 years, the credentialing process has basically remained the same with the following four requirements: 1) completion of an undergraduate bachelor's degree from an accredited dietetics program, 2) a verification statement from an undergraduate program director, 3) a one year post graduate supervised practicum, and 4) a passing score on the credentialing exam written and administered by Commission on Dietetic Registration. Historically, the postgraduate one-year

supervised practicum has been an extremely competitive process with a low acceptance rate of undergraduates who had met the first two requirements of the credentialing process (Moore, 1995). This application process was conducted via a national application process referred to as Dietetic Internship Central Application Service, DICAS. Due to the competitive nature of placements and the complicated process of DICAS, undergraduate courses where incorporated into the curriculum with the focus of completing the DICAS application. Without the supervised practicum, obtaining a licensure for employment was not an option. Much of the research associated with "success" as a dietetic student has been on variables associated with acceptance into the supervised practicum. The accepted or not accepted status post-graduation was the biggest obstacle, and the most significant controller of the number of practicing dietitians available to the public. Thus, most of the research on variables associated with pass/ not pass on the credentialing exam, final step in the credentialing process, has also been post-graduate, similar to the variables associated with acceptance into the competitive practicum. Carruth and Sneed (1990) surveyed practicum directors asking for the most likely variables affecting selection. Results indicated undergraduate GPA, undergraduate science GPA, work experience, and content of faculty recommendation letters where the strongest variables predicting placement. Sneed and Carruth (1991) followed up with an additional survey to practicums offering a combination of practicum and master's degree. All variables were the same as the survey in 1990 with the addition of GRE revealed as the top indicator of student success on the dietitian credentialing exam. From here, all research linked to the success rate of a dietetic students finishing the final step in the credentialing process was focused on post-graduate variables. Haubrick and Ross (2015), Tabata (2005), and Williams-Hooker (2013) all reviewed variables such as undergraduate GPA, work experience, and undergraduate science

GPA, and found the strongest correlation with passing the credentialing exam was GRE scores. Bradley and Conner (1993) and Farkas, Gregoire, and Hartney (2010) found the strongest correlation was verbal scores on the GRE, and Leonbery (2017) found a higher pass rate with students with a master's degree versus only an undergraduate degree.

Overall, the undergraduate admission variables associated with success on the credentialing exam is an under researched topic. Pope and Gines (1986) were the last researchers to look specifically at the connection between an undergraduate admission variable, ACT scores, and success on passing the credentialing exam. Pope and Gines found a positive correlation between ACT scores and successfully passing the credentialing exam. English (1995) investigated the connection between variables from the sophomore undergraduate year and predictors of acceptance into a post graduate practicum but did not look at ACT scores as a potential variable.

Other health science professions have researched both undergraduate and graduate variables associated with successful pass rate on licensure exams. ACT (Elkins, 2013; Grossbach & Kunchel, 2011), ACT sub scores (Austin, 2011), undergraduate GPA (Wolden, Hill, & Voorhees, 2020), and specific required undergraduate core course grades (Bearden, Robinson, & Deis, 2002; Bauchmoyer et al., 2004) have all been associated with positive correlations with successful pass rates. In addition to the ACT, the use of standardized profession-specific preadmission tests are utilized in pharmacy (Muratov et al., 2017; Chisholm-Burns et al., 2014), dental school (Stewart, Bates, & Smith, 2005; Curtis et al., 2007), physical therapy programs (Sloas, Keith, & Whitehead, 2013; Riddle et al., 2009; Vendrely, 2007), and medical school (Saguil, A et al. 2015) to predict student success on licensure exam. There are no undergraduate pre-admission tests developed for dietetic programs nor is there a significant

amount of literature on undergraduate admission criteria associated with successful passing of the dietitian nutritionist credentialing exam.

Not only have standardized test scores been positively correlated with pass rate on profession specific credentialing exams, but in particular, the verbal and reading scores a have the strongest correlation. The sub score on English and reading has been found to be positively correlated with increased pass rate for the nursing NCLEX-RN exam, (Harding, 2010; Gilmore, 2008; & Higgins, 2005), dietetic technicians (Bode, Gail, & Gates, 2001), and the National Board Dental Hygiene Examination (Austin, 2011). As well scores on the Nelson-Denny reading test have been positively correlated with an increased pass rate on medical board exams (Linsenmeyer & Ridpath, 2019).

Problem Statement

The profession of dietetics has been a credentialed profession since 1917. The basic credentialing process has remained unchanged which included an undergraduate degree and post graduate internship typically completed outside of the undergraduate institution. However, there have been significant changes to the professional requirements and steps in the credentialing process over the last two years. Specifically, with the addition of two requirements: 1) a graduate degree, and 2) incorporation of the Future Education Model which is a seamless process from freshman undergraduate admission through awarded licensure at one higher educational institution. This significant change eliminates the step of post graduate admission to an external internship location. Overall, this shifts the admission variables and predictors of student success from post-graduate variables to undergraduate variables.

Currently, the ability for predicting student's expectation and ability to pass the credentialing licensure exam has been linked to post graduate internship application

demographics and academic data. There is lack of research in best practices for undergraduate admission criteria to predict pass rate on the dietetic nutritionist credentialing exam. Knowing this data would assist in identifying students at risk and assure that institutes of higher education are able to successfully and consistently graduate practitioners to be change agents in our nation's health status.

Content of accredited undergraduate curriculum, and the required hours to be completed in a supervised practicum are determined by Accreditation Council for Education in Nutrition and Dietetics, ACEND (Accreditation Council for Education in Nutrition and Dietetics, 2020), and credentialing exam content is determined by CDR via practice audits conducted every five years (Griswold et al, 2015). Historically, admission requirements to the undergraduate degree, such as ACT scores, have not had been considered as variables related to the final step of achieving professional practicing privileges (passing of the credentialing exam), due to the fact, the majority of the focus has been on the post-graduate national application process. Thus, most correlational studies and predicators of successful pass rates on the credentialing exam have been associated with post graduate criteria including GRE scores (Williams-Hooker & Stock, 2013), undergraduate GPA (Haubrick & Ross, 2015), faculty letters of recommendation, and work experience (Farkas et al., 2010; Pinto & Toro, 2016).

In 2013, a final report was distributed from a joint meeting between Academy of Nutrition and Dietetics, ACEND, CDR, Council for Future Practice, and Nutrition and Dietetics Educators and Preceptors Group, which outlined significant changes to the process and requirements of credentialing (Commission of Dietetic Registration, 2013). This report outlined two main changes to the credentialing process including the addition of the graduate degree requirement, and the creation of the Future Education Model. The Future Education Model

requires programs to omit the post- graduate supervised practicum and integrate those hours into the undergraduate and graduate course work. The purpose is to ensure students will have a greater ability to qualify for the registered dietetic nutritionist exam.   The Future Education Model would provide a seamless process from undergraduate admission to the end goal of credentialing at one institution with no post-graduate transfer. There is a lack of research identifying specifically undergraduate admissions criteria that would be the best predictors of pass/fail on the dietetic nutritionist credentialing exam considering the last research was in the 1980's (Pope & Gines, 1986). Knowing the association between ACT scores and pass rate on dietetic credentialing exam could provide beneficial knowledge on college admission practices for institutions of higher education, as well as potentially identifying students at risk early in the curriculum. This significant change in the credentialing process eliminates the post graduate DICAS application process and shifts the admission and prediction criteria for student success from post-graduate variables to undergraduate admission variables. Therefore, the problem is the literature lacks best practices for undergraduate dietetic admissions which will identify students most likely to pass the licensure exam or those likely to not pass and need academic assistance early in the curriculum.

Purpose Statement

The purpose of this quantitative predictive correlational study is to determine the most effective undergraduate admission data to predict pass or not pass status on the credentialing exam for traditional undergraduate dietetic students pursing licensure by taking the dietetic nutritionist registration. This would help determine best practices for undergraduate Future Education Programs in dietetics for admission policies as well as identifying students at risk upon admission if accepted into the program.   Use of ACT sub scores including English, math,

science, and reading will be used as predictor variables and the pass/not pass on the credentialing

exam for dietetic nutritionist registration as criterion variable. The ACT is considered the

standard in assessing college readiness and is designed to test achievement in readiness for

postsecondary education skills. The CDR licensure exam is administered by the CDR which is

an independent organization and passing of this exam determines ability of an individual to

practice in the field of dietetics.

Significance of the Study

This significance of this study is the contribution the results can make within the dietetic

profession and dietetic educators regarding the knowledge of the best predictors of passing the

dietetic credentialing exam. There is a significant lack of research regarding undergraduate

predictors for success on the dietetic nutritionist credentialing exam. Current knowledge and

research have focused on graduate predictors of exam success. This is now more important to

the field of literature with the movement towards the Future Education Model. Accredited

institutions with this curriculum design will need to review undergraduate admission policies

within their programs and be aware of undergraduate students who may need assistance

academically and thus graduate predictors will not be available. This study also is significant to

the field educational field of dietetics because the national overall pass rate on the dietetic exam

dropped from 87% in 2016 to 54% in 2020. In addition to the low pass rate, the number of

students taking the exam a second time increased from 696 in 2016 to 1,183 in 2020 indicating

the requirement to take more than once to achieving passing score (Commission Dietetic

Registration, n.d.).

The effectiveness of the use of standardized tests in admission policies have been

disputed over the last twenty years revealing mixed results. Many studies particularly in the area

of health sciences have reported accurate use of standardized tests to predict academic success including, GRE (Benham & Hawley, 2015) standardized critical thinking exams (Meiners & Rush 2017), standardized pre-entrance exams (Allen & Diaz, 2013; De Ball, et al., 2002) as well as using standardized test to assess readiness to move through an undergraduate curriculum (Hunscker & Chitwood, 2019). Use of standardized tests to predict academic success has also been criticized for actually predicting demographic data of the student more than academic potential (Geiser, 2020), as well as decreasing diversity within an institutions or program (Cahn, 2015; Saboe & Terrizzi, 2019). It is important to have a better understanding of ACT scores as they relate to a dietetic curriculum, and pass rate on the credentialing exam since many institutions of higher education are opting to go test optional with admission polices (Futura, 2017). Many health science programs continue to require an ACT minimum score even though the institution does not require as part of the undergraduate admissions process. Many health science degrees such as pharmacy and nursing have program specific standardized pre-admission tests, however, this does not exist for nutrition and dietetics. Future Education Models will need to decide if there will be minimum ACT requirements, and if this data is a useful predictor of successful passing of the credentialing exam. There are also changes with ACT reporting including the ACT super scoring system which allows students to combine individual sub scores to report an overall combined score (Cruce & Mattern, 2020). This change increases the need to know if sub scores can be a better predictor of pass rate on dietetic credentialing exam than overall score. Not only would it be beneficial to know the role ACT scores might play in predicting the success for a student completing all requirements for credentialing including passing the licensure exam, but this information could also be important to identify at risk students early in their college career. The ability to identify students at risk can be beneficial for

both the profession of dietetics by increasing the availability of nutritional professionals to the public, but also improves institutions of higher education retention rates, and decreases risk of student debt with no gainful employment (Capstick, et al., 2019). Brady et al. (2012) describe undergraduate dietetic students who have competed the first 2 steps of the credentialing process, and then unable to obtain a supervised practicum as a loss of human capital and a source of both public and private financial concerns. Knowing if ACT scores at the time of undergraduate admission could prevent this situation for many students.

Lastly, undergraduate programs moving towards the Future Education Model will be admitting students into a seamless process with no best practices for admission criteria or identifiers for those at risk. Undergraduate accreditation depends on upholding an 85 percent pass rate of their graduates. Knowing this information would be valuable to accredited program directors to avoid potential drop-in pass rate and accreditation.

Research Question(s)

RQ1: How accurately can passing the CDR credentialing exam for registered dietician nutritionist be predicted from a linear combination of ACT overall score and ACT sub scores?

Definitions

1. *Accreditation Council for Education in Nutrition and Dietetics (ACEND)* - ACEND is the accreditation agency for educational programs preparing students for careers as registered dietitians nutritionist or nutrition and dietetics technicians, registered (ACEND, 2020).

2. *Commission on Dietetic Registration (CDR)-* CDR is an organization that oversees the registration and credentialing process of registered dietitian nutritionist (Commission for Dietetic Registration, 2020).

3. *Dietetic Practice Audit* (*DPD*)- DPD is an audit conducted every five years by the Commission on Dietetic Registration in which surveys are sent to recently credentialed dietitians (last three years) and they are asked to report duties they are currently performing in their job. This list of job duties are ranked from most common to least common. This audit is then used to determine content of the credentialing exam (Griswold 2015).

4. *Nation Council Licensure Examination (NCLEX-RN)-* NCLEX is the national exam with the purpose to determine if it is safe for a nursing student to begin practice.

5. *Verification Statement-* A verification statement is a signed statement that documents an individual has completed the requirements of nutrition and education program accredited by ACEND (Academy of Nutrition and Dietetics, 2020).

CHAPTER TWO: LITERATURE REVIEW

Overview

Chapter two provides a background on predictors of academic success in dietetic education. For this study academic success is defined as passing the credentialing exam for registered dietitian nutritionists. This chapter explores both academic and non-academic variables. Academic variables reviewed include standardized tests, academic performance, GPA, and profession specific preadmission exams. Nonacademic variables reviewed include self-efficiency, learning styles, and student interest. Considering the lack of research specific to best predictors of passing the credentialing exam for dietitian nutritionist, predictors of successfully passing licensure exam in other health science and health care professions are reviewed due to the fact most health science programs required licensure exam post-graduation. The theoretical framework is described and how the study relates to the theory.

Theoretical Framework

Tinto's Theory of Student Drop Out

In 1975 Vincent Tinto set a goal to better describe the details and characteristics of why a college student dropped out of college. He sought to "explain, not simply to describe the processes that bring individuals to leave institutions of higher education" (Tinto, 1975). Tinto's theory of drop out criticized former research in the area due to the fact previous work failed to distinguish academic failure from voluntary withdrawal. His theory was rooted in work done by Durkheim's theory of suicide, which stated individuals prone to suicide are insufficiently integrated into the fabric of society. Tinto's final theory stated that students decide to drop out of college related to two main interacting factors that include a student's commitment to education, and a student's commitment to a specific institution. Tinto further explained that two main

factors, a student's educational state at the time of college admission, and second the dynamics that occur academically during the time at an institution. These dynamics are related to how a student is accepted into both the academic and social community within the educational institution. Tinto's theory has been researched extensively by higher educational institutions to help with student retention (Kerby, 2015, Barry & Okun, 2011, Aiken, DeBin, Hjorth-Jensen, & Caballero, 2020). His theory was specific to traditional on campus four year degree university settings. His theory was expanded and it was noted in the community college setting, the classroom is likely the intersection of the academic and social integration, and the role of the faculty was vital (Tinto 1997). Research was built from Tinto's work to better understand this intersection of academic and social interaction in the community college environment (Mechur et al., 2010, Stuart, Rios-Aguilar, & Deil-Amen, 2014, Townsend & Wilson, 2009) , and in different populations such as non-traditional or students of racial or ethnic minorities (Davidson & Wilson, 2013). Tinto himself acknowledged that actual gains in best practices for student retention did not make significant gains and acknowledged that faculty interaction was one of the most important factors in the academic integration (Tinto, 2006). Further expansion of this theory suggests that institutions should view more from the lens of the student and realize, "students do not seek to be retain, and they seek to persist" (Tinto, 2017). This further explains the academic integration needed in Tinto's theory, and suggests that goals drive motivation and motivation drives persistence in this model. Persistence is subject to a students' level of self-efficacy, sense of belonging and perception of the curriculum. Tinto further suggests not only do students need academic support, but support that is directly connected to individual courses or program goals and within the correct context.

Tinto's theory of student drop out directly relates to a better understanding of the appropriate predictors of student academic success in a dietetics program. Academic success will directly influence a student's ability to complete a degree and intervention early in a student's college career could ultimately impact self-efficacy and academic ability to pass the credentialing exam for dietetic nutritionist. Understanding the correct identifiers of a student at risk for not passing the licensure exam at admission would allow dietetic programs at higher education institutions to provide the academic help needed within the context of passing the licensure exam. As well, this early intervention could increase the chance the student will not only be successful within their college career, but also be successful with the admission goal of becoming a practicing professional dietitian nutritionist. If ACT is a significant predictor of pass rate on the RD exam, dietetic programs can be proactive and not only be aware that the student needs additional resources, but the resources can be tailored to know best practices and what is most effective in better assisting the student for the academic experience designed to prepare them for the passing the licensure exam. Understanding predictors of pass rate at admission sets the opportunity to provide the student with the needed academic integration for persistence which Tinto's theory states. This theory is appropriate for this research because acknowledging through Tinto's theory that we must be aware of factors that could be obstacles to both academic and social integration for higher risk population such as racial monitories and first generation students. Increasing diversity in dietetic practitioners and to become aware of potential social justice issues that could be affecting patients in their care is a priority of the profession (Brady, 2020, & Olivares, 2015). Early intervention and accurate admission predictors would be beneficial to this initiative by the profession.

Related Literature

History of Academic Research in Dietetics

Following the work by Pope and Grines (1986), much of the research related to academic success in the field of dietetic education has been focused on post graduate predictors. Academic success has been mainly defined as ability of a student with a four year degree in dietetics to successfully obtain a spot in a post graduate professional internship. Significant amount of work was completed surveying internship directors to determine best practices for obtaining an internship spot, and what are directors of these programs use as predictors and variables for their selection process. Traditional internship directors were looking for undergraduate GPA particularly in the science and nutrition courses, recommendation letters, and work experience (Carruth & Sneed, 1990), and directors of combined graduate degree and internships were focused on GRE scores as the most valuable criteria for selecting students (Sneed & Carruth, 1991). A main focus for faculty advisors of undergraduate students became focusing on assisting the student on best methods for increasing their chances of placement in an internship. This became one of the most important factors for an undergraduate program and percent of graduates who received internship placement was a determining factor of program quality during accreditation visits (Moore, 1995 & White & Beto, 2013). Despite the effort by undergraduate programs with advising, the profession came under significant criticism due to the lack of available internship spots across the country (Hooker et al., 2012). In 1995, 49% of academically successful graduates did not enter the profession of dietetics due to unsuccessful internship matching or placement (English, 1995). For programs to maintain accreditation, the majority of the research in academic success in dietetics focused on internship placement and less on ability to pass the credentialing exam. Thus, most of the research focusing on licensure

pass rate was post graduate. Academic advisors used data predicting a student's ability to obtain post graduate internship to advise if the student should continue in a dietetic undergraduate program or potentially seek an alternative major. The decision was not based on the student's ability to graduate or to pass the licensure exam. Now there is a shift in dietetic education to a competency-based model which will educate the student in a more holistic manner from undergraduate admission to licensure exam, and the infamous difficult placement in an internship will be gone. This means undergraduate dietetic programs need to look at undergraduate admission criteria which address student success in terms of program completion, undergraduate GPA, and pass rate on licensure exam. Many of the other health science programs provide this model for comparison including pharmacy, physical therapy, nursing, dental, and medical school. Ultimately, a successful program needs to include academic success at the undergraduate level, and a passing score on the credentialing exam for registered dietitian nutritionists. Without the passing score, work in the profession cannot occur and without successful undergraduate academic performance, students do not have access to take the credentialing exam.

History of the ACT

Various types of examinations have existed since the founding of Ivy League schools such as Harvard and Yale. These exams have served various functions such as admission selection to universities, assessing risk of high risk students to remedial courses, granting credit prior to enrollment, measuring knowledge gained during college years, and selection of major (Veysey, 1980). Most of the early admission exams were administered privately by each college or university which the student was seeking admission. This was a standard part of the admission process which required extensive faculty labor and hours to conduct. Each university

had specific qualities and educational assets required to be successful at that particular

institution. Certainly it must be acknowledged that students applying to universities at this time

were typically from elite families seeking knowledge in philosophy, religion, and languages

(Nettles, 2019). Seeking specific majors or area of study was not a common for students when

considering secondary degrees until the Morrill Act of 1862 and 1890 (Duemer, 2007). Thus,

students seeking a source of higher education was a very small percent of the total population,

thus the purpose of the examinations were focused on this targeted population (Barken, 2010).

The number of intuitions of higher education consistently grew in the United States since

the Revolutionary war and specifically, following the Emancipation Proclamation in 1870 there

was a consistent growth in Historically Black Colleges and Universities (Albritton, 2012).

Following the Morrill Act, further growth was seen in admissions of students seeking specific

education for careers and not just the study of religion and philosophy. Due to this growth, in

1901 the College Board administered the first standardized, non-institutional specific, college

entrance exam. Black universities were not included in this movement of standardized testing

for college admission. This first standardized exam required written essays in English, French,

German, Latin, Greek, mathematics, chemistry, and physics (Linn, 2001). Subjects on the exams

were considered college preparatory curriculum type subjects (Nettles, 2019). In 1918,

Columbia University used the Thorndike Test for Mental Alertness which was an intelligence

test to start examining a student's aptitude and ability (Wechsler, 2017). The SAT was

developed in 1926 and was developed to measure student quality. The SAT was an aptitude test

measuring verbal and mathematical abilities and was designed to show ability aside from each

student's high school curriculum or preparation, and thought today to be a method for correcting

grade inflation and identifying potential in low performing students (Zwick, 2004). The SAT was

the standard exam for college admissions until 1959 when the ACT was developed by the American College Testing Company. The ACT was considered to test achievement on high school work and the SAT measured aptitude (Zwick 2019). More standardized exams were created such as Medical College Admissions Test (MCAT), The Law School Admissions Test (LSAT), and the Graduate Record Examinations (GRE) exam to test student's post graduate knowledge (West-Faulcom, 2010).

Background of Test Optional Admission Standards

Many colleges and universities have made the decision to go "test optional" or "test flexible" regarding the requirement of a standardized exam score as part of the admission requirements. Test optional policies remove the requirement for admission for all students whereas text flexible only students who meet specific requirement can apply without submission of a standardized exam score either the ACT or SAT. This text optional admission policy is a movement to deemphasize the use of standardized exam as part of the admission process. The COVID-19 crisis and the decreased access high school students had to testing sites created a situation for many institutions of higher education to adopt the test optional policy out of necessity (Camara, 2020). Many of the alternative admission criteria for test flexible institutions include high school GPA, extracurricular activities and service (Syverson, 2007). An official comment from Boston College summarizes a common thought process with the test optional movements: "Prospective students and applicants must decide for themselves whether or not to include standardized test scores with their application for admission to Boston University. When making this decision, students should consider the totality of their academic record, their contribution both in and out of the classroom and to their communities, and whether they feel

confident that the same of the experiences fully reflect their academic ability and potential"

(Grappo, 2020).

Prevention of bias in standardized exams

Many critics of the ACT and SAT indicate both assess socioeconomic status and ethic/

racial background more than ability and college readiness. One of the main reasons many

universities have decided to go with the test optional movement and drop the requirement as part

of the admission process has been the criticism that the SAT and ACT are bias towards ethic and

lower socioeconomic groups due to previous questions regarding boating and regatta which was

considered a culturally advantaged question (Popham, 2006). Despite active changes to be

culturally sensitive on the standardized exam questions, many criticize the use of standardized

exams due to the fact performance on the exams continues to vary by ethnic or racial, or

socioeconomic status (Sackett et al, 2012). Questions on the standardized exams are pretested

for measurement equivalence, and any item noted to exhibit "differential item functioning "(DIF)

is eliminated from the operational exam. However there is still evidence of subgroups such as

African American and students of low socioeconomic status test different, and it is recommended

for test companies to continue to examine this situation (Santelices & Wilson, 2010).

Mattern, Shaw, and Korbin (2011) draw attention to the fact that particular sub group

performance on exams does not indicate bias considering the same sub groups tend to have lower

high school GPA illustrating that a large educational differences exist in the subgroups and not

necessarily due to exam bias. Shu, Kuncel, and Sackett (2017), found that SAT scores were still

valid and predicted college grades independent of socioeconomic status. In an American Indian

population of college students, Shu, Kunchel, and Sackett (2017) reported SAT scores were

effective predictors of college success independent of socioeconomic status. Gibson (2016)

determined in students of color enrolled in STEM majors, ACT and AP credits where stronger predictors of college GPA than high school GPA and core high school GPA including science and math was a significantly stronger predictor of college GPA than cumulative GPA.

Increase diversity of student body

A second common reason for universities to go test optional or test flexible is to increase the diversity rate within the institution. Many intuitions of higher education report an increase in both the number of total applications as well as an increase in applications from minority students (Epstein, 2009). Even though test optimal policies increases minority applications, there is lack of evidence that the number of enrolled minority students actually increases (De Windt, 2020, Mattern & Allen, 2016; Mattern, Shaw, & Kobrin, 2011). Saboe and Terrizzi (2019) found no change in diversity of enrolled students after reviewing over 1600 college and universities with test optional admission criteria. Authors also reported a consistent increase in admissions in the short term but revealed a delayed lag in admissions after the initial change in requirements of tests in the admission process. Not only have institutions not seen a dramatic increase in enrollment of ethic or lower socio-economic status students, there is a suggestion that many universities have selected test optional to reflect greater selectivity and present a lower acceptance rate. If a student has a higher SAT or ACT they are more likely to submit the score even if not required which in turn can make the average SAT or ACT of the institution much higher than if scores were required of all applicants (Rubin & Canche, 2019).

The Graduate Record Examination (GRE) is the graduate standardized exam used for graduate school admission. As with the ACT and SAT, removal of the GRE by many universities and colleges has had the same reasoning of increasing diversity in the student body. The same results were found with graduate school as with undergraduate enrollment. Cahn

(2015) found only 30% of universities require the GRE and schools which did not require the test report increased applications from students who would normally not apply, but no actual change in diversity of the enrolled students.

Assessing College Readiness

With the test optional or test flexible trend, many institutions of higher education are starting to rethink the best practices for admission and determining a student's college readiness. However, assessing and defining college readiness without creating a bias can be an extremely difficult (Hartman 2017). Kuh, Kinzie, Buckely, Bridges, & Hayek (2006) define college readiness as "Student success defined as academic achievement, engagement in educationally purposeful activities, satisfaction, acquisition of desired knowledge, skills and competencies, persistence, attainment of educational outcomes, and post college performance". High schools are monitoring for the best method for preparing K-12 and assuring college readiness (Mokher & Leeds, 2019; Woods et al., 2018). For postsecondary institutions, 53% accept 100% of student applications, and this situation creates a concern for the poor graduation rates and increased need for remedial college courses. It is estimated 20%-50% of students meeting admission requirements are placed in remedial math or developmental math courses illustrating admission gaps (Conley 2009). This is a concern considering college enrollment has steadily increased over the last 50 years, yet college graduation rates have remained considerably low (Bailey & Dynarski, 2011).

Admission criteria

Most institutions of higher education especially four-year institutions are focusing heavily on predictors of academic success for retention reasons and enrollment goals (Allensworth & Clark (2020, Westrick et al., 2015). For health care majors, predictors of

academic success are even more vital considering the impact this could have on pass rates of licensure exams, and thus accreditation status for programs (Alhadlaq et al 2015; Davis, Groom, Friesner, 2018; & Hamaideh, Hamdan-Mansour, 2014). Aptitude achievement tests in many health sciences programs are effective at predicting academic success (Alhadlaq et al., 2015; Alwan et al., 2013 & Monroe& Kunemn, 2021).   Data used to predict a college ready student who will be successful varies within health care programs. Loftin, Reyes, Harline, & Rice (2020) report factors that influence nursing program success and NCLEX-RN pass rate are the most important decisions made within a nursing program, and these factors should be one of the more heavily influenced data to make admission decisions. Many nursing programs focus academic success on retention especially associate degree programs located with community college environments (Jeffrey, Harris, and Sherman, 2019 & Newton & Moore, 2009), and a strong focus on passing of the NCLEX for indicator of program quality (Dreher, Glasgow, & Schreier, 2019). In addition, nursing programs have had success going back to the original admission testing situation (prior to ACT and SAT development) in which faculty develop exams testing student's ability (Jeffery, Harris, & Sherman, 2019), preadmission science grades and GPA (Wambuguh, Eckfield, & Van Hofwegen 2016), and standardized exam scores (Capponi & Barber, 2020). Nursing programs not only focus on best practices for admission to assess student success in course work and NCLEX performance, but also knowing factors associated with career readiness to prevent the high rate (17.6%) of burn out in the first year of employment which contributes significantly to the overall nursing shortage (Potter, Hussey, & Ojeda, 2021). Czehanski, Hoerst, and Kurz (2018) improved pass rates on the NCLEX-RN from 64% to 94% which is a 45% improvement in pass rate by focusing on admission criteria. Work on determining the best predictive factors of attrition is considered one of the best methods for

supplying qualified nurses to the workforce (Gartell et al, 2020). Banua (2017) reported academic performance prior to admission was one of the most significant indicators of program success and NCLEX-RN success and strongly suggests all programs have a top priority in reviewing and adhering to strong admission criteria for student selection.

Pharmacy programs also frequently utilize in-house exams which are institution specific (Note, 2021), undergraduate GPA (Spivey, Chisholm-Burns, & Johnson, 2019), standardized preadmission testing using the Pharmacy College Admission Test, PCAT (Muratov et al 2017), prior biology degrees (McCall, Allen, & Fike, 2006), science GPA (Nuciforo, Litvinsky, & Rheault, 2014), and utilization of a two-step process involving undergraduate performance and second clinical performance (Wilcox & Lawson, 2018). Luce (2011) reported both GRE scores and undergraduate GPA as effective predictors of academic success in physician assistant programs and recommended to narrow the percentiles for scores to assure program quality. The majority of the criteria for selecting successful dietetic students has revolved around selection process of the graduate internship, and somewhat lacking in recent research and a lack of undergraduate admission predictors (Moore, 1995). Even though the health care programs are focused on passing of licensure exams, overall academic performance is also vital to the students' professional career.

Predictors of Academic Performance

ACT and SAT

If the test optional movement is here to stay, the next consideration would be the role of the standardized test in current admission process at institution of higher education. Universities must still have a process and student criteria for applications and acceptance. Especially for programs that traditionally require a higher ACT, and to improve overall graduation rates. Does

the ACT and SAT have functional role in the admission process and can both exams serve as predictors of student performance? ACT has established a set of criteria or framework to outline college readiness from over 50 years of data (Camara et al., 2015). The evidence is compelling on the predictive ability of the ACT and SAT at the undergraduate and the GRE is predictive of graduate level work. Hiss and Franks (2014) found students who choose to not submit test scores as part of the admission process, had lower freshman grade point average, lower cumulative grade point average, and were less likely to major in STEM related field. It must be assumed from this report students who do not submit scores have lower scores than those willing and eager to share and submit test scores. Wainer (2009) reported similar results in students who selected to not submit scores, now referred to a "non-submitter". Students who selected to not submit test scores (non-submitters), performed a standard deviation lower in GPA during the freshman year than those who did submit scores. In addition, the non-submitters had ACT scores which were significantly lower than those who did submit scores. Suggesting a higher standardized test scores is associated with higher freshman GPA and both college readiness and college success.

It is certainly well documented that high school GPA can be a strong predictor of college GPA (Warner, 2019). However, high school GPA does not tell the entire story with potential college success for a student. Sayer (2010) reported that students with equal high school GPA (4.0) but an ACT of 10 has less than a 30% change of achieving a B or higher in college courses, but the same high school GPA with an ACT of 30 would have 95% probability of achieving a B grade. Allensworth and Clark (2020) examined the predictability of the high school GPA and ACT across various types of high schools. Results showed that ACT is not a good predictor across various types of high schools and high school GPA was a more consistent predictor of

college graduation and college GPA across various high school settings.   The authors stressed

that students with the same ACT and same high school GPA have different college graduation

rates, and different GPA based on high school attended, stressing the impact of the type of high

school as a predictor more than GPA or ACT. The authors further suggest that a student working

to improve high school GPA is a better strategy for college success than excessive work on

improving ACT scores.

Sub scores versus composite scores

Sub-scores of ACT and SAT have been successful in predicting college success.

Bettinger, Evans, and Pope (2013) found a strong connection between the English and math

subs-scores when reviewing data from over 25,000 students enrolled in public institutions within

the same state. The authors found that when English and math where controlled, the composite

ACT score could not predict college success measure by either GPA or retention rates. The

authors suggest that there could be a possibility that reading, and science scores predict the

measurement and strength of a high school curriculum as well as, suggests an indicator of level

of college preparation. When the authors controlled for the composite score, the math and

English scores significantly predicted first year GPA and second year GPA. A one-point

increase in math-English scores was associated with a 0.66 increase in first year GPA and 0.60

increase in second year GPA. In addition, first- and second-year GPA, were significant

predictors of retention for four years. A one-point increase in math-science score resulted in a

1.3 percent point reduction in probably of dropping out in the first year and 2.6% reduction in the

probably of dropping out in the second year. The authors also looked at individual institutions

and admission practices and retention rate. Authors concluded that if the highest-ranking

universities utilized math and English sub-scores as admission criteria instead of composite

scores, they would experience and 7% decrease in dropout rate while lower ranked institutions would experience a 7% increase in dropout rate. This is suggesting that math and science sub-scores are better predictors of many of the more difficult programs of study, and thus math and English sub-scores would help indicate student more likely to be successful in more demanding programs.

There is also the potential for ACT to be a predictor of success in specific college courses. Welborn, Lester, and Parnell (2015) found a significant correlation with using the English and math sub-scores to indicate at risk students in statistics and principles of management courses. Sub-scores were found to be the better predictor of course success including final semester grades. Authors suggest that it is likely that college students will struggle with specific courses, and not consistently all courses thus using sub scores can indicate when students are at risk rather than the use of overall composite scores. Harris and King (2016) also reported that at a community college, students were 12% more likely to be successful in a commuter science course with every point increase on the ACT science sub score, and with every point increase in composite score resulted an 18% increase of successful course grade.

The other potential factor that could change the admission landscape and should be considered in the admission criteria in the health science field, is the ability of students to complete retakes of the subject sections, and to achieve the composite super score from retaking including subjects (Cruce & Mattern, 2020). Ranunzel and Mattern (2020) found individual retakes and super-score composite results are still a significantly strong predictor of first year GPA as the traditional ACT score.

Retention and graduation

Certainly, degree completion is mandatory step for a health science student since a bachelor degree is typically a requirement to sit for a licensure exam. Information that predicts degree completion could affect programs pass rate. Stewart, Lim, and Kim (2015) found a statistically significant correlation between ACT scores and increased persistence of students beyond the sophomore year for over 3,000 students at a public institution of higher education. They also found a significant correlation between first year GPA, persistence, and retention as well as a strong correlation between high school GPA, first year GPA and ACT. Authors suggest ACT score and first year college GPA, are the strongest predictors for graduation and college success. Authors noted that their results were completely consistent with similar research conducted over 20 years prior (Pedrini and Pedrini, 1977) which concluded that ACT scores were a significantly strong predictor for college success.   Authors suggested that standardized exams have been a consistent benchmark for assessing college readiness and predicting college success, and thus should be considered in the admission process. It is interesting the same topics were researched with similar conclusions yet test optional method is becoming mainstream in the admission process. Westrick, Le, Robbins, Radunzel, and Schmidt (2015) found a strong correlation in over 189,000 students reviewed with both high school GPA and ACT in predicting academic performance during freshman year and a successful freshman year was a strong predictor of completion of degree.

Predictors of Success on Licensure Exams

ACT and SAT Scores

The last published research examining the use of ACT as a predictor of passing the credentialing exam for registered dietitian nutritionists was in 1986. Pope and Gines (1986)

reviewed five academic variables in an undergraduate coordinated dietetic program and the correlation with success on the licensure exam. Coordinated programs are important to review considering these programs are as close in curriculum design as the new Future Education Model. Pope and Gines reviewed forty-eight graduates of an undergraduate coordinated program working in the field of dietetics. One of the strongest predictors of passing the exam was ACT scores. Not only was ACT score and sub scores strongly associated with passing the licensure exam, but also significantly associated with third- and fourth-year GPA, salary increases, and success in obtaining advanced degree licensures. Researchers concluded, "Each program must have clear definition of the successful dietitian and instruments used to assess graduates must be based on that definition" (Pope & Gines, p. 1022).

Many students with Bachelor of Nutrition degrees who are not fortunate to be placed in a post graduate internship, are eligible to take the registered dietetic technician exam which is administered by the Commission for Dietetic Registration (Rhea & Bettles, 2012). This is the same credentialing agency who credentials registered and licensed dietitian nutritionist. Registered Dietetic Technicians, (DTRs) where typically associate degree students with significant clinical hours, however students with a bachelor's degree in nutrition were permitted to take the registration exam without clinical hours. This was considered a possible career path for unplaced students (White & Beto, 2013). Bode, Gail, and Gates (2001) found a significant positive correlation between a student's ACT score, and all domains of the DTR licensure exam including management and clinical. ACT sub scores in math and English were also positively correlated with passing the licensure exam as well as overall student GPA. It should be noted this study has a sample population completing a two-year associate degree and thus there could be other factors related to passing dietetic licensure exam which requires a bachelor level

education. Pope and Gines (1986) and Bode, Gail, and Gates (2001) are the only available

research specific to undergraduate work, ACT scores and passing dietetic licensure exams.

Correlation between ACT and pass rate has been studied in several allied health

programs. Ballinger (1976) was one of the first studies published researching predictors of

passing a health care licensure exam and researched ACT scores and pass rate on respiratory

therapy exams. Ballinger concluded ACT and ACT English sub scores were able to predict not

only if a respiratory student would pass the licensure exam, but as ACT scores increased as did

the licensure scores. Ballinger, as Pope and Gines (1986) also found a significant correlation

between ACT scores and professional competency ranking assessed by employer. ACT has also

been reviewed in dental hygiene programs as an admission criterion to best assess those students

capable of passing the National Dental Hygiene Board Exam (NDHB). ACT English sub score

has been reported as one of the strongest predictors of passing the National Dental Hygiene

Board Exam. Rudy, Singleton, Lewis, and Quick (2017) reported a positive correlation between

ACT cumulative score and both higher rates of successfully passing the National Dental Hygiene

Board Exam, and higher ACT score are positively associated with higher exam score. Similar

results were reported by Austin (2011) however reading portion of the ACT had the strongest

predictors of the NDHB score. Students who failed the NDHB typically have ACT scores below

the national average, and recommended ACT scores be part of the admission criteria required by

dental hygiene programs (Kissell, Moore, & Carr, 2008).

Preadmission criteria is studied frequently in the nursing curriculum and many health

sciences programs due to the high demand for competitive clinical spots, and the lack of

available clinical faculty. There is a demand to academia to produce more qualified candidates

for the professional health care field, yet institutions of higher education need strong predictors

of success in both retention and licensure exam to make best use of the clinical spots and for

accreditation (Davis, Groom, & Friesner, 2018). Especially with the nursing profession to assure

there will be an adequate number of graduates to meet the high number of nurses needed every

year in the United States to handle health needs of the aging population (Yousafzai & Jamil,

2019). Both attrition and pass rates are vital to heath science programs for maintaining

accreditation (Al-Alawi, Oliver, & Donaldson 2020). Cognitive and non-cognitive factors are

assessed in nursing education to ensure the best selection process is in place when admitting

students to nursing programs (Quinn, Smolinski, & Peters, 2018). Non-cognitive factors are

typically assessed in personal interviews which results lack predictive validity due to potential

bias in the nature of personal interviews (Timer & Clauson 2011). Cognitive predicators

continue to be considered the better standard considering the fast pace of the curriculum and

work environment expected for nursing graduates (Zamanzadeh et al., 2020). ACT scores are

considered effective cognitive predictors of a nursing student passing the NCLEX exam.

Trofino (2013) found ACT math sub score a significant predictor of NCLEX-RN pass rate and

for each point increase in the math sub score a nursing student was 2.36 times more likely to pass

the NCLEX-RN exam. There was no effect from reading sub score or composite scores.

Grossbach and Kunchel (2011) found ACT and SAT were strong predictors of passing the

NCLEX-RN as well as the all sub scales on the SAT, and all sub scores on the ACT. ACT sub

score of social science and SAT verbal were the strongest predictors.

　　　　ACT scores have been criticized for reporting socio- economic status rather than

academic preparedness (Bai, Chi, & Qian, 2014, Saboe & Terrizzi, 2019, Stewart, 2015).

Meyers and Karpinski (2018) did a retrospective study of 1,176 nursing students in 29 states and

pass rate on NCLEX-RN. Authors pursued this study due to the inconclusive argument in

nursing that ACT scores were better at "measuring a knowledge or product of socio-economic status" (Meyers & Karpinski p. 239). The authors wanted to know if ACT scores represented socio- economic when predicting NCLEX-RN success. Students of higher socio- economic status scored, on average, one point higher on the ACT than students of lower socio- economic status. However, when only students of lower socio- economic status (Pell grant eligible) where compared and socio- economic was controlled, ACT was still as significant predictor of NCLEX-RN success. Authors also summarized that Pell grant eligibility (low socio- economic) only affect the NCLEX-RN outcome through ACT scores and the authors fully support the use of ACT scores to predict at risk students and outcome of NCLEX-RN.

Physical therapy programs require post graduate work therefore much of the research regarding passing of the National Physical Therapy Examination has been post graduate markers such as GRE. However, Galleher, Rundquist, Barker, & Chang (2011) examined undergraduate academic variables including undergraduate GPA and non-cognitive factors such as coping skills and stress. Only SAT scores had a significant effect on predicting passing the National Physical Therapy Examination. Similar to dietetics education, the authors acknowledge the lack of research connecting admission criteria and prediction ability on successfully passing licensure examination. Hobson, Miller, Downs, & Vairo, (2020) found similar results with passing of the board exam for athletic training. Authors examined numerous factors including both demographic and academic however only Math and reading SAT scores produced the greatest accuracy at predicting passing.

GRE Scores

Many health-related programs are concerned that admission criteria is accurate in the selection process to best determine students who will be successful in the respective programs.

For many health care programs requiring graduate work, GRE and undergraduate GPA remain most likely to predict student success and continue to be the standard used in the admission process (Benham & Hawley 2015). Much of the work on determining success on the credentialing exam for registered dietitian nutritionists has been post graduate. Dietetic internship are considered post graduate level work thus GRE is a requirement for admission especially dietetic internships with a master's degrees integrated within the clinical experience. Several studies have reported the GRE a strong predictor of passing the credentialing exam for registered dietitian nutritionists. Williams-Hooker (2013) reported a positive correlation between GRE scores and the dietetic credentialing exam score when student had a mean GPA of 3.44. Leonberg (2017) reported a connection between GRE scores and higher first-time pass rates on the dietetic credentialing exam, higher scores on the credentialing exam, and higher placement rates in post graduate internships. Farkas, Gregoire, Lafferty, & Hartney (2010) found undergraduate non-nutrition professional GPA and quantitative and verbal GRE percentiles as the strongest predictors of the student's final GPA, but quantitative GRE percentile and undergraduate science course GPA the best predictor of passing the credentialing exam for registered dietitian nutritionists.

Bradley and Conner (1993) suggest use of the total GRE score is misleading and inappropriate to use in predicting passing credentialing exam for registered dietitian nutritionists. They found a significant correlation between verbal and quantitative and pass rate on the CDR exam. Instead of minimum GRE total score they recommend setting minimum requirements in the admission process for verbal, quantitative, and analytical. Of the sub scores, Bradley and Conner (1993) reported verbal the strongest predictor of exam success. Even further, researchers suggest GRE scores have significant impact on the evidence of competent practitioners. Clark,

Cole, and Funderburk (2018) confirmed the lack of research and thus the lack of evidence-based

admission selection criteria for graduate and dietetic internship combined programs. Researchers

also confirm the increased need to understand the role of standardized exams in particular the

GRE in predicting dietetic student success considering the requirement of a master's degree by

2024. This study did not find GRE scores as predictors of student success, but did report time

between taking the GRE and start of graduate programs was more common in student who were

labeled as non-completers of the program and recommend adding this criteria as a method for

identifying potentially at risk students.

In the field of physical therapy, Coleman-Salgado & Barakatt (2018) found the strongest

correlation with passing the National Physical Therapy licensure examination was the GRE with

equal correlation between all three sub scores of the GRE and the status of passing. Researchers

recommend including GRE as part of the admission process to improve a physical therapy

program pass rate. Bayliss, Thomas, and Eifert-Magine (2017) reported similar results with

verbal and quantitative GRE scores as well as professional GPA as strong predictors of first-time

pass rate on National Physical Therapy Licensure examination. Wolden, Hill, and Voorhees

(2020) suggest GRE scores remain an integral part of physical therapy program admission

criteria specifically with the purpose to positively affect pass rates on National Physical Therapy

Licensure Examination. Huhn and Schott (2017), found the strongest prediction model for a

strong pass rate to be a combination of GRE, Health Science Reasoning Test (HSRT),

undergraduate GPA, and first year doctorate GPA. Physician assistant programs also require the

GRE as part of the admission process and require passing of a licensure exam postgraduate.

GRE scores in particular the quantitative score was a strong predictor of passing the PANCE for

physician assistant students (Loar, McQueen, & Maher, 2020). Baggs, Barnett, and McCallough

(2015) reported GRE was found to be a stand-alone, significant predictor for speech language programs and recommended to use this in combination with clinical performance, speech-hearing GPA and Physical science grades for predicting pass/fail on the licensure exam.

Nelson Denny Reading Test

Easley (2016) and Sloas, Keith, and Whitehead (2013) reported the Nelson Denny Reading Test as a predictor of first-time pass rate on physical therapy assistance national exam. Researchers also examined ACT, TEAS, and HESI which were also predictors, but only the Nelson Denny was a predictor of specifically first attempt pass rate. Linsenmeyer and Ridpath (2019) reported a strong correlation between results on the Nelson-Denny Ready Test and results on the verbal reasoning section of the MCAT.

Health Education System Inc. (HESI)

The Health Education System Inc. has been used successfully as admission criteria and predictor of pass rate on the NCLEX (Johnson et al. 2016, Kaddoura et al., 2017). It is utilized as a method for measuring a nursing student applicant's ability in reading comprehension, vocabulary, general knowledge, and mathematics. Pullen (2017) found that students who required taking the HESI more than one time to achieve admission criteria score or those who scored low on vocabulary and general knowledge were more likely to fail the NCLEX exam. Results from this study was utilized to set admission score minimums on the HESI to improve program pass rates on the NCLEX. The level of critical thinking has also been associated with affecting pass rates on the NCLEX (Romeo, 2010). Kaddoura, Van Dyke, and Yan (2017) found a positive correlation between HESI critical thinking scores and success on the NCLEX-RN. Researchers recommend scores from the critical thinking section of the HESI to be utilized as both admission criteria to predict nursing school success, but also to be administered at the end

of nursing school programs to predict readiness for NCLEX-RN. Havrilla, Zbegner, and Joyce (2018) found a significant correlation between first time HESI exam scores and GPA with successfully passing the NCLEX-RN. The HESI was also strong predictor of passing the NCLEX-RN in a large sample of minority students (Flower et al, 2021). Scores of 950 or higher were considered good indicators of passing the NCLEX-RN exam. Robert (2018) found a significant correlation between passing the NCLEX-RN and program completing and entry HESI scores.

Profession Specific Standardized Exams

Pharmacy College Admission Test (PCAT) has been found to be a strong predictor of pass rate on the North American Pharmacist Licensure Examination (NAPLEX) especially when combined with pre-pharmacy admission GPA (Chislholm-Burns et al 2014 & McCall, MacLaughlin, Fike, & Ruiz 2007). Accredited pharmacy programs are required to admission the Pharmacy Curriculum Outcomes Assessment (PCOA) during the last year of pharmacy school. Shah, Peng, and Sifert (2029) reported the PCOA scores in combination with PCAT scores to me a strong predicator of passing the NAPLEX. In addition to pass rate, PCOA scores have been associated with increased likely hood of a pharmacy student requiring remediation courses (Palmer, et al, 2020) and increased need for remediation is strong associated with poor performance on the NAPLEX. Maddenn, Etzler, Schweiger, and Hershey (2012) also reported a significant correlation between a students's need for remediation for deficient course grades and lower pass rates on the NAPLEX. Pharmacy programs are now required to implement remediation programs within their curriculum (Harmon, Gonzales, & Fenn, (2021). Chisholm-Burns et al. 2017, found a significant correlation with Pre-NAPLEX scores, an exam designed to assess readiness to take the NAPLEX, and passing the NAPLEX. Dental schools report

effective use of Dental Aptitude Test (DAT) as predictor of pass rate on dental licensure exam (DeBall, et al., 2002 & Ranney, Wilson, and Bennett, 2005) and the Medical College Admission Test (MCAT) (Saguil et al. 2015) have been successful at predicting success in medical school programs and pass rates on the medical board examinations.

With physician assistant programs, the use of the Physician Assistant Clinical Knowledge Rating and Assessment Tool (PACKRAT) has been utilized to assess a student's readiness to take the Physician Assistant National Certification Exam (PANCE).   PACKRAT scores have shown to be strong midpoint of the curriculum predictors of passing the PANCE (Higgins, et al. 2010). This significant correlation on PACKRAT scores has been shown to vary significantly across program type suggesting program quality could play a more significant role in PANCE pass rate (Honda, et al, 2019). Scores on two pharmacy specific exams the HRDKA and the PCAT were found to be strong predictors of pass rate on the NAPLEX (Shah, Peng, & Seifert, 2020) and scores on the standardized practice exam for occupational therapy are strong predictors of pass rate on the National Board of Certified Occupational Therapy (NBCOT) exam (Avi-Itzhak, 2015). Scores have been effective at not only predicting pass rate but also first-time pass rates. Avi-Itzhak (2015) suggests use of profession specific standardized pre-tests as effective predictors and suggest more health science programs utilize this tool.

Academic Performance and Effect on Pass Rate

Several studies have examined the ability of high school GPA and undergraduate GPA to predict pass rates on dietetic nutritionist licensure exam. Erlandson et al. (2013) reported correlation between undergraduate sciences GPA and overall GPA and passing of the national registration examination for dietitians. Farkas, Gregoire, and Hartney (2010) reported undergraduate science GPA as the strongest academic performance predictor of passing the RD

exam, whereas Haubrick & Ross (2015) reported overall undergraduate GPA was a strong predictor of passing.

Overall GPA has been shown to be an accurate predictor for success on the NCLEX-RN (Matthew & Aktan, 2018, Meiners & Rush, 2017, Yin & Burger, 2003), National Physical Therapy Exam (Vendrely, 2007), physical therapy assistants exam (Desmarais, Woble-Valenski, & Oestmann, 2011), National Board for Cerrifaion Occupation Therapy (NBCOT) exam (Kurowski-Burt, et al., 2020 & . Zadnik, Lawson, Delany, Parente, Archer, 2017)CAATE licensure exam for athletic training (Cripps et al., 2018), and North American Pharmacist Licensure Examination (NAPLEX) (Allen & Diaz, 2013). Stewart, Bates, and Smith (2005) looked specifically at class rank to define academic performance and found a correlation when dental school students were ranked in quartiles by their academic standing defined as GPA. Students ranked in the top quarter had the highest probability of passing the dental exam. Researchers conclude academic performance in dental school has an impact on ability to pass the professional licensure exam.

DeWald, Gutmann, and Solomon (2004) found final GPA in dental school to be the strongest predictor and first year GPA to be a weak predictor of student's dental board exam score. Curtis, Lind, Plesh, and Finzen (2007) found traditional admission criteria for dental school weak for predicting first year dental student's GPA and graduating GPA yet first year GPA was the strongest predictor of graduating GPA. Riddle, Utzman, Jewell, Pearson, and Kong (2009) reported a student with academic difficulty was a predictor for not passing the physical therapy national licensure exam. Academic difficulty definition was defined as either a student who was placed on academic probation due to poor academic performance or having failed a physical therapy core course.

Kume, Reddin, and Horbacewicz (2019) found a strong ability of early academic performance (GPA in first year) to predict of passing the NPTE exam and recommend early remediation for student based on this connection between academic performance and pass rate on licensure exam. Novalis, Cyranowski, and Dolhi (2017) reported GPA at the professional level of occupational therapy school and absence of academic difficulty were strong predictors of passing the NBCOT.

Many studies have examined undergraduate science GPA versus course specific grades with mixed results. Undergraduate science course GPA was not found to be an effective predictor for NCLEX-RN pass rate (Higgins 2005), physical therapy licensure exam (Kume, Reddin, & Horbacewicz, 2019), nor the National Board Dental Hygiene Exam (Bauchmoyer et al., 2004), but was a significant predictor for North American Pharmacist Licensure Examination (NAPLEX) (Allen & Diaz, 2013 & Buraphadecha, Chinwong, & Thiankhanitihun, 2018). Specific course grades have also shown to be effective predictor for pass rates in various health science programs. Andreeff (2014) found grades in pathophysiology and biochemistry were significant predictors for passing the PANCE and after controlling for age, gender and admission GPA, PANCE scores were higher with every point increase in pathophysiology and biochemistry grades. Butina, Wyant, Remer, and Cardom (2017) found GPA in foundational physician assistant required core courses was the strongest predictor of PANCE success, and researchers suggest remediation in these core foundational courses with the intent to improve PANCE. Brown, et al. (2013) found similar results with a strong correlation between physician assistant required core courses GPA a strong predictor of PANCE pass, but undergraduate GPA had no significant correlation. Core nursing course grades have also been correlated with higher pass

rates on the NCLEX_RN (Pike et al. 2019) including senior medical-surgical course (Daley et al., 2003).

Non-academics Predictors

It would be inappropriate to discuss student success without acknowledging that there could be nonacademic factors that have an influence on student attrition, licensure pass rate, and overall GPA. Non-cognitive factors are of particular interest in science based programs (Willems et al., 2018). Self-efficacy and emotional intelligence is considered to be significant factor in higher education and incorporated into many early courses attempting to intervene with student success and retention (Shenaar-Golan et al., 2020). Jones-Schenk and Harper, (2014) found emotional intelligence to be a strong correlation with success in nursing programs and recommend consideration of emotional intelligence in the admission process for nursing programs. Codier and Odell (2014) also found a strong correlation with emotional intelligence and specifically the student's score for experiential emotional intelligence and nursing grade point average. Sparkman, Maulding, and Roberts (2011) examined the effect of emotional intelligence on students' academic success in college. Authors reported emotional intelligence specifically social reasonability and empathy were effective predictors similar to high school GPA and ACT scores.

Pinto and Cruz (2016) examined the effect of stress and self –efficacy on dietetic licensure exam results but reported only self-efficacy was significantly correlated with passing the credentialing exam for dietetic nutritionist. The sample was only 48 participants and information were via survey. Self-efficacy is added to several nursing program's required curriculum (Fiske, 2017) and has been shown to have a significant impact on passing of the NCLEX exam (Silvestri 2013). There continues to be a lack of research in the area but still

recommended to be considered in admission criteria for nursing programs (Jones-Schenk & Harper 2013), and recent work has been conducted to develop a valid instrument for measuring self-efficacy in nursing students (Bulfone et al., 2019). Self-efficacy has also been reported to affect medical students' grades in specific surgical anatomy courses (Burgoon, Meece, & Granger, 2012). Popovich, Katz, Iramaneerat, and Smith (2007) found self-efficacy important in the curriculum of pharmacy students and reported self-efficacy was also associated with students writing skills. In addition, researchers concluded high self-efficacy score increased discussion opportunities in courses such as medical ethics and improved the quality of the course. Ware (2019) found that there was a significant predictive value of the Myers-Briggs with first time pass rate on the NAPLEX. Author recommend considering personality types and the effect this might have on passing difficult licensure exams in pharmacy students.

Stress is another non-academic factor that in today's higher education environment should not be ignored regarding potential effect on retention and college success (Karaman et al., 2016). Spivey et al. (2020) reported perceived stress had a significant impact on academic performance of first year pharmacy students and Singh et al (2018) reported similar results in nursing students. However, Khan and Shamama-Tus-Sabah (2020) reported student reported stress had a negative impact on mental health yet a positive impact on academic performance, indicating stress in some students may be a motivator.

In addition to non-cognitive factors such as emotional intelligence and self-efficacy, there are numerous other factors that could affect student success that should be acknowledged. Learning styles have been found to impact NCLEX pass rate (Lown & Hawkins 2017) and level of empathy, citizenship, and ethics are considered in pharmacy admission criteria (Latif 2005). Nye, Butt, Bradburn, and Prasad (2018) using a sample of 1449 students documented that

measuring a student's interest in their program can predict a student's academic performance at the undergraduate level beyond their high school GPA and ACT scores.

Health science programs are also considering the effect quality life can have on student success. Spivey, Stallworth, Olivier, and Chisholm-Burns (2020) studied the impact of perceived quality of life reported by students and the effect on academic performance. Quality of life was determined by factors including: physical functioning, personal or emotional problems, energy level, social functioning, physical pain, and general physical health. The authors reported a significant correlation between higher quality of life and academic performance. Higher reported quality of life was associated with higher academic performance. McFadden (2016) reported similar results with nursing students who had a perceived higher physical health status also had stronger academic performance.

Many programs have also considered obtaining non cognitive factors through personal interviews to better obtain admission data such as interpersonal skills, communication, and knowledge of a profession (Ingrassia, 2016) yet agree there are logistical problems with validity and feasibility of conducting numerous personal interviews (Timer & Clauson 2011). Non cognitive skills assess during personal interviews are valued in the nursing program due to the fact characteristics such as ethics, empathy, and morality cannot be taught in a during a nursing curriculum thus should be screened as part of the admission criteria to predict not only student success, but success as a professional practicing nurse. It is also noted many of the non-cognitive factors could ultimately affect patient safety and effectiveness of care and patient improvement.

Summary

Knowing best practices for assessing admission criteria for health science programs is vital to assure successful completion to enter the work force including passing of a licensure exam. For many of the health science fields, there is a high demand and consistent problem of a shortage of graduates entering the workforce. Admission criteria can extend beyond retention, completion, and passing of exams, to also impact career readiness and prevention of early career burnout. Academic success can be difficult to assess and standardized exams which have been utilized for decades are shown to be effective and strongly criticized at the same time by many institutions. In the field of dietetics, passing of the credentialing exam for registered dietitian nutritionists is important academic milestone. This continues to be a controlling step in a students' ability to work in the profession. Understanding the best predictors of academic success and ability to pass a licensure exam are important for the profession considering the movement toward the Future Education Model. Standardized test including ACT and GRE continue to be effective predictors for many health science programs for predicting pass rate. Understanding best predictor will allow for early intervention and possibly increasing students' self-efficiency and ultimately their persistence towards a degree and licensure as this is grounded in Tinto's theory of student drop out.

CHAPTER THREE: METHODS

Overview

The purpose of this quantitative predictive correlational study is to determine the ability of high school ACT scores to predict pass versus fail on the commission for dietetic registration nutritionist exam for licensure. High school ACT sores will be the independent predictor variable and pass versus fail status on the licensure exam will be the dependent criterion variable. The population is college students enrolled in a private Christian university and the participants will be all dietetic majors over a set period of time who also took the licensure exam. Data will be collected via retrospective archival data from admission records.

Design

The purpose of this study is to determine the effectiveness of high school ACT scores to predict if a nutrition student will pass or not pass the national certification exam for registered dietitian nutritionist. A quantitative predicative correlational design will be utilized with the goal to examine relationships between the independent variable and the dependent variable. The main focus of correlational studies is to determine relationships between data and understand complex or abstract concepts (Tuckman & Harper, 2012). Lodico, Spauldling, and Voegtle (2010) stated, "Relationship studies seek to determine whether a relationship exists between two or more variables, whereas the purpose of predictive studies is to identify one or more variables that predict the result of participants on another variable" (p. 209). In prediction studies, the researcher is interested in knowing the correlations between variables, but in prediction studies the goal is to identify if the predictor variable can predict changes or outcomes in another variable (criterion) measure at a later point in time (Lodico, Spaulding, & Voegtle, 2010).

Since this will be a prediction study utilizing logistics regression, the independent variables will be referred to as the predictor variables and the dependent variable will be referred to as the criterion variable. The variables in this study are not influenced by the study itself nor by the researcher and thus, there is no control group and no treatment on the subjects in this study. This is appropriate for this study considering there will be no intervention conducted on the students to see if there would be an effect on passing the licensure exam, only observational with data collection. As well, there is no pre and posttest and collection of data does not occur over time as with longitudinal. The predictor variable must be collected prior to the criterion variable. Without this sequence, there is no ability for the independent or predictor variable to predict the criterion variable or the dependent variable.

The predictor variables are composite ACT scores and sub scores including English and math sub scores from the national standardized ACT college entrance exam administered by the American College of Testing. The criterion variable will be the results of the Commission for Dietetic Registration (CDR) licensure exam which is the exam designated by the Academy of Nutrition and Dietetics to determine a candidate's knowledge in practice (Griswold, Sauer, & Leibovitz, 2016). Passing of this exam designates the awarding of both registration as a Registered Dietitian Nutritionists and allows the candidate to apply for a practicing license within their state they would be employed. Passing of this exam is determined as the final stage in the professional track toward licensure. The dichotomous criterion variable will be pass / fail on this exam.

Predictive correlational designs are common with using standardized test scores to predict some type of academic success including college GPA, retention, and passing licensure exams (Westrick et al. 2015). Correlational and predictive studies are typically collected from

one group of participants and data is collected on all variables on a single group of participants. Typically scores or results from each variable is collected or obtained for each individual. Data from predictive studies typically span time thus staying in contact with participants over time is typically required (Lodico, Spaulding, & Voegtle 2010). An ACT score will be collected from each participant as well as knowledge of pass versus fail on the CDR exam. Time span will not be an issue since CDR maintains records of all applicants who take the CDR licensure exam regardless of year.

Utilizing a retrospective data collection or methodology is appropriate and common in many health care professions examining the connection between not only student program success (Chisholm-Burns et al., 2014; Leonberg, 2017) but, specifically ACT scores and pass rates on the licensure exam for registered dietitian nutritionist (Pope & Gines, 1986), registered dietitian assistants (Bode & Gates, 2001), dental hygienists (Austin, 2011), and respiratory therapists (Parrott-Robbins, 2010). Retrospective studies examining the ability of the GRE (Farkas et al., 2010; Haubrick & Ross, 2015; Williams-Hooker, 2013) and grade point average (Pinto, Torro, & Cruz, 2016) to predict passing of the dietetic licensure exam have been conducted. Many of the similar studies do not have a control group, and do not manipulate variables to assess outcomes on licensure exam since this would have an ethical component to this type of design. This design is appropriate considering the use of the ACT composite scores and sub scores will be used to optimize their ability as a predictors, and not to show casual relationships between the quantitative predictor variables, nor causation, and the dichotomous variables (Gall, Gall, & Borg, 2007). Curtis, Comiskey, and Dempsey (2016); encouraged the use of correlational design in health science research and emphasize the practical use of correlational design specifically for decision making purposes.

The main disadvantage of a correlational design, specifically predictive study, is the lack of causation, only predictive ability. Causation is not needed only ability of a variable to predict and assist with decision making. Data interpretation of a predictive study will only be conclusion of a criterion (ACT scores) variable's ability to predict pass/not pass on the CDR exam. Again, appropriate if using for admission policies and to decrease risk to a situation or academic performance (Curtis, Comiskey, & Dempsey 2016).

Research Question

RQ1: How accurately can passing the CDR credentialing exam for registered dietician nutritionist be predicted from a linear combination of ACT overall score and ACT sub scores?

Hypothesis

$H_0 1$: There will be no significant predictive relationship between the criterion variable, first time pass or not pass on the Commission of Dietetic Registrations credentialing exam, and the linear combination of predictor variables (ACT composite and ACT sub scores for undergraduate dietetic students enrolled at higher education institutions with ACEND accredited Future Education Models.

Population and Participants

Participants of this study was obtained by convenience sampling at a small private Christian institution of higher education in Ohio with an ACEND accredited undergraduate dietetics program offering a Bachelor of Science in nutrition. Convenience sampling is common in studies within the health sciences and dietetics research due to proximity to hospitals, accredited programs, and community health centers (Farks et al., 2010). Participants will be selected between the years 2000 through 2020. Participants graduating prior to 2000 was not be included in the study considering the Commission for Dietetic Registration changed to a

computerized testing format after 2000. Paper versus computerized test format could become a variable and affect results.

Students in the study are between the age of 18-25 and considered traditional undergraduate college students living in residential on campus dorms. Demographic data will include gender and race. The average size of the accredited program is approximately 100 students from freshman to senior status with three full time faculty and one full time clinical or practicum coordinator. The target sample size for this study was 155 students which there are full admission records including ACT scores submitted at the time of their general application to the university. Female participants are n= 00 and male participants are n=00. All students obtained a bachelor's degree within 5 consecutive years of starting the program. This sample size exceeds the required minimum (10) when assuming a medium effect size. Warner (2013) suggests a minimum N that is at least 10 times k which is the number of independent variables.

Setting

The institution of higher education in which the data was be collected was founded in 1880 and the institution has housed an accredited nutrition and dietetics program since 1980. The university is a traditional liberal arts institution requiring standard general education courses and has on campus learning and career resources available to all students. The campus is in a small village with under 5,000 population, and most of the student body is recruited from states within the Midwest region of the United States. The accredited program has been assessed every seven years as part of standard accreditation process from ACEND. The program has consistently been without deficiencies, and without the need for remediation or follow up at each accreditation visit. Pass rate on the CDR exam has remained consistently at or above the required 85% of graduates since the 1980 initial accreditation.

Instrumentation

There is not a specific valid or reliable instrument needed to collect data since data will be recording of student records from the institution's admission and registrar's office. Data will be assumed unadulterated in any way and accurate for the student. It will be assumed the student submitted correct and honest information at the time of their general admission application to the institution. The exam scores used in this study will include ACT scores and results of the licensure exam administered by the CDR. Both exams are considered valid, standardized and administered and maintained via private organizations with no affiliation with an organization.

American College Testing, ACT Exam

The ACT exam has the main purpose to assess college readiness of high school students and to measure skills that are most important for success in postsecondary education (ACT, 2021). The ACT exam is clearly focused on measuring academic progress and achievement in high school work and not aptitude. ACT makes clear the test is intended to measure educational achievement and to clearly recognize the test results are not a matter of nature ability but a marker of achievement from hard work (ACT Technical Manual, 2021).   The ACT is divided into four main categories including English, mathematics, reading, and science with an optional writing section. The ACT is a norm-referenced exam which averages the four subcategory scores (which range from 1-36) to create a composite score. ACT also provides benchmarks for predicting college success of high school student entering college (ACT Test scores Higher Education, 2021). The benchmarks provide information on the student's ability or chance of earning either a B (50%) or earning a C (75%) or better in college courses. ACT scores have been used frequently in studies predicting pass rates on licensure exams in the health care field (Austin, 2011, Bode, Gail, & Gates, 2001, Grossbach & Kunchel, 2011, Myers & Karpinski,

2018, Pope & Gines, 1986, Rudy et al., 2017, & Trofino, 2013). Reliability of the ACT is shown using Cronbach's alpha levels of 0.93 for English, 0.92 for mathematics, 0.92, 0.87 for reading, 0.85 for science, and 0.97 for composite scores (ACT Technical Manual, 2021).

Commission on Dietetic Registration Licensure Exam

The Commission for Dietetic Registration (CDR) credentialing exam is designed to be the factor that determines the granting or not granting of a practicing license to allow a person to practice dietetics, and has been used frequently in research (Bradely & Cooper, 1993, Leonberg, 2017, & Williams & Hooker, 2013). Passing of the CDR exam also gives the right to sign as registered dietitian (RD) and a licensed dietitian (LD). Passing of this exam allows a person with a registration and license to perform nutritional assessment, interpret laboratory data, and to prescribe therapeutic diets.

The CDR exam has a development process that begins with a practice audit, which is a survey of recently graduated working dietitians conducted every five years, and inquires what job duties a typical dietitian performs in the job environment at the entry level. The goal of the practice audit in the test development process is to determine quantitative measures including frequency, level of involvement, and variety of activities an entry level practitioner would be expected to be proficient at the time of hire (CDR, 2021).   The practice audit develops the examination specification and drives the exam development. New items or questions are developed using topic experts from the practice audit and then new items questions are reviewed prior to adding to the exam. The exam in divided into four domains including principles of dietetics (25%), nutrition care for individuals and groups (40%), management (21%), and food service systems (14%). The exam is administered through Pearson VUE and in computer format. The exam is in multiple choice format and administered in a 2.5hr -time frame. A candidate

must answer 125 questions of which 100 are scored and 25 are pretest sample questions which must be answered but are not scored (CDR examination development, 2021).

Procedures

After review by IRB, and permission granted from the institution of higher education in which the students were enrolled, data will be collected.   See Appendix X for IRB approval. Data will be collected via the registrar's office for time transcript was completed and graduation date, major declared, and the admissions office will be utilized to college ACT scores in student records. Identity of the student will be protected. Data will be gathered in cooperation of the researcher and the registrar. Data and names of participants will remain secured in either the registrar's office or the office of the researcher and locked. After a complete list of students with the predictor variables of ACT composite score and sub scores are recorded, the researcher entered the name of the student into the Commission of Dietetic Registration website for licensure search (Commission of Dietetic Registration, 2020).   If the student passed the CDR exam they will be listed as "licensed and registered practitioner". Any names that do not appear on the CDR website as a licensed professional, will be sent to the institutions alumni office to determine a married name if female. For those in which a married name is available, they will be searched by married name in the CDR website. Any married names or male names which do not appear on the CDR website as holding a license, will be attempted to be contacted to ask: 1) their pass status on the CDR exam, 2) did they opt to not take the exam, 3) did they move on to a different career, or 4) did not receive practicum post-graduation therefore were unable to take exam. Only names of those in which it can be confirmed they passed or are not licensed due to not passing the exam will be included in the study. Student will be omitted from the study if they did not finish the undergraduate program within six years or if there is more than ten years

between high school graduate and the start of the undergraduate program considering there could be unknown variables in either of these situations affecting passing of the credential exam other than ACT scores (Miessen, Meijer, & Tendeiro, 2016).

Data Analysis

Data will be analyzed using logistical regression which is an appropriate method for assessing the predictive ability of a variable (Ztolzenberg, 2004). For most correlational studies when only a relationship between the variable is needed a Pearson r or a product movement coefficient is calculated. Pearson r provides the researcher with knowing if there is a significant relationship between variables and if it is a positive or negative relationship. Since in predictor type correlations studies the data for the criterion variable is dichotomous, a regression analysis must be utilized for data analysis (Warner, 2013). Typically, a logistic regression will provide the researcher with predictor equation to determine the ability of the independent variable to predict the criterion or outcome variable. Binary logistic regression is the appropriate statistical analysis for many reasons. First, the fact regression models are appropriate when the criterion variables are dichotomous with categorical, and the researcher is attempting to assess both the presence of a relationship and the strength of the relationship between several predictor variables and the criterion variable (Gall, Gall, & Borg, 2007). Logistic regression is appropriate when the relationship between the predictor variables and criterion or outcome variables are nonlinear, and an odds ratio is needed that will not go below 0 and not above 1 (Warner, 2013). Specifically, logistic regression is appropriate when group n between the two categorical criterion variables could be significantly different. It is likely there will be a higher number of participants in the pass group than the non-pass group. Binary logistic regression is more appropriate for assessing statistically significant variations when there is a small number in one of the criterion variables.

In this study the dichotomous criterion variable will be coded 0=passing the CDR and 1= not passing the CDR exam. The actual numerical value of the ACT composite score and sub score will be utilized in the statistical analysis. The following assumption tests are utilized. Scores of the criterial variable, passing versus not passing are statistically independent, criterion variables are dichotomous, and only relevant predictors are included in the study and participants are included in only one of the criterion variables. It is impossible to be included in both passing and not passing the exam. Data will be screened for extreme outliers using a box plot and visual examination of the frequencies in each criterion variable will be examined to determine if there are extreme differences in each group variable (pass versus not pass).

Students who pass the CDR exam will be utilized as the reference group and student who do not pass will be compared to the reference group which is coded 0= pass. SPSS will be used to calculate $R2$ from a logistic regression model equation containing the predictor variables and criterion variables to determine the strength of the relationship between the variables in an odds ratio. The equation will be run for each predictor variables to determine which predictor has statistically significance ($p < .05$) or ($p < .01$) ability and strength at predicting passing on the dietetic nutritionist licensure exam. The null hypothesis will be rejected at the 95% confidence level with a $\alpha = .05$.

CHAPTER FOUR: FINDINGS

Overview

Chapter Four reviews the overall descriptive statistics, reviews assumptions, and provides statical data on the significance level of the various independent variables. Binary logistic regression is the statical methods utilized and the significance level for each of the variables in the predictor models is provided.

Research Question

RQ1: How accurately can passing the CDR credentialing exam for registered dietician nutritionist be predicted from a linear combination of ACT overall score and ACT sub scores?

Null Hypothesis

$H_0 1$: There will be no significant predictive relationship between the criterion variable, first time pass or not pass on the Commission of Dietetic Registrations credentialing exam, and the linear combination of predictor variables (ACT composite and ACT sub scores for undergraduate dietetic students enrolled at higher education institutions with ACEND accredited Future Education Models.

Descriptive Statistics

Ninety-one students who were graduates of the undergraduate nutrition and dietetics program and completed at least one attempt at the CDR licensure examination were included in the study. The study included both traditional independent students living in residential dorms (n=82) and non-traditional commuting students (n= 9). All subjects in the study completed the undergraduate program within five consecutive years of starting their first course at the university. The dependent dichotomous variable was either pass or fail the CDR examination and the independent variables were composite ACT score, reading sub score, English sub score, math

sub score, and science sub score. The mean scores for both composite ACT, sub scores, and

undergraduate GPA are provided in Table 1.

Table 1
Mean Composite ACT Scores, Sub Scores, and GPA

	M	SD
Composite ACT	24.091	3.073
English	25.034	4.448
Math	23.965	3.276
Reading	24.826	4.152
Science	23.256	2.938
Undergraduate GPA	3.504	.301

Data Screening

The range of data was reviewed to assure no significant or inappropriate outliers for the

variables including the composite scores, all sub scores, and coding of passing CDR. No outliers

were noted, and all data was within an expected range eliminating outliers due to error of

entering appropriate data. The range with minimum and maximum exam scores are provided in

Table 2.   Data was also reviewed for valid and missing cases. Of the ninety-one students

included in the study, $n=91$ had complete data including composite scores and only $n=2$ were

missing data (sub scores). Students passing the exam was $n= 79$ and not passing was $n= 12$.

Table 2
Minimum and Maximum Exam Scores

	Minimum	Maximum
Composite ACT	16	32
English	13	35
Math	16	32
Reading	16	33
Science	14	29

Results

Assumption Tests

The data was also reviewed for normality using a Kolmogorov-Smirnov test and scatter

plots. The data had normal distribution but was slightly positively skewed for English,

composite, math, and science. This could be expected considering the population is college

accepted students with expected college preparation. Results for normality are provided in Table

3. Scatter plots for each exam can be seen in Figure 1-6 located in Appendix A.

The assumption of linearity of the continuous variables with respect to the logit of the

dependent variable was assessed via the Box-Tidwell procedure. A Bonferroni correction was

applied using all 10 terms in the model resulting in statically significance accepted when

$p < .005$ (Tabachnick & Fidell, 2014). Based on this assessment, all continuous independent

variables were found to be linearly related to the logit of the dependent variable. Outliers were

identified using case wide diagnostic which showed two standard residuals with a value of 2.084

and 2.213 standard deviations which were kept in the analysis.

Table 3
Kolmogorov-Smirnov

	Statistic	df	Sig.
Composite ACT	.095	89	.046
English	.096	89	.041
Math	.119	89	.003
Reading	.060	89	.200
Science	.131	89	.001

Hypothesis

A binary logistic regression was performed to test the model strength of composite ACT

scores, and all sub scores including English, science, math, and reading in predicting passing the

CDR credentialing exam for registered dietitian nutritionist. The null hypothesis was rejected

since the logistic regression model was statistically significant, χ^2 (5) = 26.273, p <.001) with a

confidence interval of 95%. Results of the binary logistic regression can be seen in Table 4.

Table 4
Logistic Regression Predicting Likelihood of Passing CDR Exam based on ACT Composite Score and Sub Scores.

	B	SE	Wald	*df*	*p*	Odds Ratio	95% CI for Odds Ratio	
							Lower	Upper
Composite ACT	.375	.383	.962	1	.327	1.455	.688	3.080
English	.242	.204	1.405	1	.327	1.455	.854	1.899
Math	.270	.194	1.927	1	.165	1.310	.895	1.917
Reading	-.037	.145	.066	1	.798	.963	.725	1.281
Science	.018	.178	.010	1	.920	1.018	.718	1.443

The model explained 49.2% (Nagelkerke R^2) of the variance in passing of the CDR exam

and correctly classified 88.4% of the dependent variable in the passing the CDR exam group.

Sensitivity was 96%, specificity was 36.4% positive predictive value was 91.4% and negative

predictive value was 57.14%. Of the five predictor variables, none were individually significant

as shown in Table 2. Increasing composite ACT score was associated with increasing likelihood

of passing the CDR exam. In addition, composite ACT score (p< .001) and undergraduate GPA

(p<.003) were both statistically significant at as individual predictors of passing the CDR exam.

CHAPTER FIVE: CONCLUSIONS

Overview

Chapter Five describes how findings from this study align with previous work completed in the health science professions. This section also includes the worth of the study in relation to the field of dietetics and the potential improvement in study outcomes if findings are utilized in admission criteria to identify at risk students.

Discussion

The overall purpose of this study was to determine best practices for admission criteria for undergraduate dietetics curriculum for predicting passing of the CDR registration exam. The research question was proposed if ACT composite scores and sub scores could act as a predictor model for passing the licensure exam. The model in this study was significant as well as individual ACT composite scores. These finding are in alignment with the last completed study for registered dietitians by Pope and Gines (1986) and registered dietetic technicians by Bode, Gail, and Gates in 2001.   In the 36 years since the original study by Pope and Gines there has been no follow up nor any significant contribution to the literature on use of ACT scores as part of best practices for accredited dietetic programs in predicting passing the CDR exam. Knowledge of ACT as a predictor of student success on licensure exams is not new to many other health care professions and these findings are also in alignment with several other health science fields including respiratory therapist (Ballinger, 1976), dental hygiene (Austin, 2011; & Rudy, et al 2017), nursing (Grossbach & Kunchel, 2011; & Meyer & Karpinkski, 2018). Considering ACT scores are effective predictors of passing the CDR exam, this should be discussed and considered within the profession and accredited programs.

Individual sub scores were not significant to predict passing the CDR exam which could

be attributed to the fact sub scores could measure strength of high school curriculum if areas such as science and math and not measure college readiness to learn (Bettinger, Evans, & Pope, 2013). In addition, undergraduate GPA was a significant individual predictor of passing the CDR exam. This is consistent with other licensure required programs such pharmacy (Spivey, Chislholm-Burns, & Johnson, 2019), physician assistant programs (Luce, 2011), and nursing (Wambuguh, Eckfield, & VanHofwegen, 2016).

Potentially the lack of research regarding ACT and predictive ability of passing the CDR exam could be related to the historical pathways for dietetic licensure. This pathway has historically been undergraduate degree plus acceptance and completion of a yearlong approved internship. The emphasis within the profession regarding research on student success in pass rate which was placed on undergraduate performance indicators considering the low placement rate and competitive nature of internship openings. Current literature on undergraduate performance indicators have been the primary focus of CDR pass rates. The strong focus on the undergraduate performance indictors in predicting placement in a potential internship have been vital since internship placement has been the deciding factor of a student's ability to continue within the profession and allow for the possibility to sit for the CDR licensure exam.

Considering the growth of the test flexible admission policy in the higher education environment and the absence of a replacement testing option, knowledge of the ACT is still needed. This test flexible option will likely not affect other health care professions considering most health care professions utilize effective profession specific admission test, such as medical school (MCAT) , pharmacy (PCAT), dental (DAT), and physician assistant (PA-CAT). Dietetic does not have a profession specific entrance exam. At this point, the ACT is still widely available to high school students and in many states is required prior to graduation or for college

credit plus courses. The ACT can be a simple and cost-effective way to predict students at risk for not passing and make a dramatic influence on their professional path as well as gainful employment status. The ACT has strong evidence of predicting first year GPA, college success, and thus strong undergraduate GPA in dietetics is a predictor of success on the CDR exam (Erlandson et al., 2013 & Farkas, Gregorie, & Hartney, 2010). Even if ACT is not utilized as a a predictor of passing CDR exam, it can be a predictor of students at risk for lower GPA early in the program. GPA in this study was a significant predictor of passing the CDR licensure exam and this is consistent with other professions including the NCLEX-RN (Matthew & Aktan, 2018, Meiners & Rush, 2017, Yin & Burger, 2003), National Physical Therapy Exam (Vendrely, 2007), physical therapy assistants exam (Desmarais, Woble-Valenski, & Oestmann, 2011), National Board for Cerrifaion Occupation Therapy (NBCOT) exam (Kurowski-Burt, et al., 2020 & . Zadnik, Lawson, Delany, Parente, Archer, 2017) CAATE licensure exam for athletic training (Cripps et al., 2018), and North American Pharmacist Licensure Examination (NAPLEX) (Allen & Diaz, 2013).

With the growth of the future education model and the loss of the traditional post graduate internship at many institutions in combination with a significant decline in the pass rate of the CDR exam, there needs to be a focus on predictors of student success. Results from 2021 indicate with 3,444 total CDR licensure exams taken only 48.1% passed. Of these 3,444 exams taken, 1,762 were first time attempts with a 66% pass rate on first time attempt and of the 3,444 exams, 1,682 are repeating due to prior attempt failure.   From 1999-2016 the range of pass rates were 80-91%. Since 2016, range for passing has been 66-74% with evidence of a steady decline in pass rate to the current 66% first time attempt and total passing of 48%. When pass rates are broken down by type of licensure pathway, lowest rates of passing are from a traditional dietetic

internship (65%) and highest pass rates from established future education models (82%). Traditional dietetic internship programs are the programs which have focused on undergraduate and post graduate performance indicators as predicators of passing the CDR exam and not early admission factors such as ACT. Again, it is important to note most of these new future education programs are seamless from undergraduate admission through graduate school and first attempt on CDR exam. Certainty, there are a multitude of factors contributing to this difference, however it is important to note undergraduate admission variables are important in this pathway since there is no graduation and admission to a different location or institution for completion.

The majority if health science programs research best practices for admission with a focus on variables that increase likely hood of passing a licensure exam. Most health sciences programs need to maintain a particular pass rate for accreditation. In addition to this standard, most health science programs employ clinical teaching faculty and have the primary purpose of supervising and teaching students in the field which is typically referred to as "clinicals". In most programs these clinical openings for students are limited due to various factors including the cost of clinical faculty, limited space at health care institutions, and certainly in today's environment COVID restrictions. Part of the admission requirement is to reserve theses clinical spots for student most likely to succeed on licensure exams. In dietetics, clinical faculty typically are not part of the accredited program in the higher education environment and instead are preceptors who are working professionals (non-university faculty) willing to take a student for observation and potentially hands on experience. Acknowledgement of this overall system and lack of university-trained faculty overseeing a pass/fail situation for students in dietetic further shows the need for some type of indication of academic and professional performance from the student. ACT scores at admission could be utilized as an indicator for students who

potentially need additional testing, case studies, etc prior to experience with a preceptor which could improve that experience and better prepare a student for the CDR exam.

Implications

Last published study on predictors of specifically undergraduate admission criteria for passing the CDR exam was 1986. Overall, predictors have been based on post graduate criteria thus there has been a lack of data assisting accredited undergraduate programs of best practices for identifying students that could be at risk of not passing the licensure exam. Undergraduate admission data would be useful for accredited programs to identify those students who might need addition academic intervention to improve their chances of passing the licensure exam early in their undergraduate study. Considering dietetics is like other health care professions in that passing of a licensure exam is the ultimate determining factor of entering the profession and job placement and thus determining a student's gainful employment status. Job openings for students lacking licensure status and only a bachelor's degree are limited as well as the salary for these positions are typically not stainable. Thus, academic programs should be equipped with all the knowledge possible to know best practices at admission that both increase the likely hood of passing the licensure exam as well as possible indicator of the risk of not passing. Considering the significant change in our profession with the adoption the Future Education Model, which is the seamless model of admission as a freshman through graduate degree and clinicals at one institutions of higher education, undergraduate admission data would be useful for programs. There is a predicted shortage of registered dietitians due to the rise in chronic disease states such as diabetes and heart disease as well as the large number of dietitians approaching retirement age. Knowing best practices for admission of incoming freshmen to accredited programs is

beneficial for both the student seeking a professional degree and to health care institutions needing a large employment pool to hire those professionals.

The ACT has been criticized for various factors including biases, decreasing diversity, and testing strength of high school curriculum versus potential. Due to this criticism, there is a strong movement in the United States for institutions of higher education to adopt test optional admission policies. This could be a concern for health care professions considering at this time there is no other test available to make predictions of passing licensure exams. Several programs such as pharmacy, physician assist, and nursing have adopted profession specific exams that are required regardless if the home institutions have adopted test optional admission policies. Currently the ability of ACT to predict pass rate on CDR exam is valuable information considering dietetics does not have a profession specific exam, and in general significantly lacks research for predictive factors of passing licensure exam.

Limitations

This study is limited mainly due to the fact the population was from one institutions of higher education. The population was limited to a private faith-based environment. It is difficult to imply findings to other academic environment obviously due to other factors that could have affected outcome on the CDR exam including class size, faculty to student ratio, and other general education requirements. The accredited program at this institution requires a significant amount of experiential learning which is partially required in courses and offered on a volunteer basis. This variable was not controlled and could have impacted pass rate on the CDR exam.

Recommendations for Future Research

1. Repeat study with a larger sample size and a combination of participants from both private and public institutions of higher education.

2. Study the effect of including a tutoring program and early academic intervention as a predictor variable for students with a lower ACT upon admission.

3. Create a study that includes level of clinical experience and experiential experience during the undergraduate level as a predictor of passing or failing the CDR exam.

REFERENCES

Accredited Programs. (n.d.). *Accreditation Council for Education in Nutrition and Dietetics*.

https://www.eatrightpro.org/acend/accredited-programs/about-accredited-programs

Aiken, J, DeBin, R., Hjorth-Jensen, M., Caballero, M. (2020). Predicting time to graduation at a large

enrollment American University. PlosOne, 15(11), https://doi.org/10.1371/journal.pone.0242334

Albritton, T. (2012). Education our own: The historical legacy of HBCU's and their relevance of

educating a new generation of leaders. *The Urban Review*, 44(3), 311-331.

Alhadlaq, A., Alshammari, O., Alsager, S, Founda, K., & Mohamed, A. (2015). Ability of admissions

criteria to predict early academic performance among students of health Science College at King

Saud University. *Journal of Dental Education*, 79(6), 665-670.

Allen, R. E., & Diaz, C. (2013). Use of preadmission criteria and performance in the doctor of pharmacy

program to predict success on the North American pharmacist's licensure examination. *American

Journal of Pharmaceutical Education*, 77(9), 193. https://doi.org/10.5688/ajpe779193

Allensworth, E. & Clark, K. (2020). High school GPA and ACT scores as predictors of college

completion: examining assumptions about consistency across high schools. *Educational

Researcher,* April.

Alwan, I., Kushi, M., Tamim, H., Magaoub, M., & Elzubeir, M. (2013). Health sciences and medical

college preadmission criteria and predication of in course academic performance: a longitudinal

cohort study. *Advances in Health Science Education*, 18, 427-438.

Andreeff, R. (2014). Predictors of student success on physician assistant national certifying examination.

Journal of Physician Assistant Education, 25(3), 36-39.

Austin, L. (2011). Predicting national dental hygiene board examination success based on specific

admission factors. *The Journal of Dental Hygiene*, 85(4).

Avi-Itzhak, T. (2015). Ability of national board for certification in occupational therapy practice test to estimate the probability of first time pass status on the national certification exam. *The American Journal of Occupational Therapy,* 9(2).http://dx.doi.org/10.5014/ajot2015.015024

Bai, C. & Qian, X. (2014). Do college entrance examination scores predict undergraduate GPA? A tale of two universities. *China Economic Review*, 30, 672-647.

Bailey, M. & Dynarski, S. (2011). Gains and gaps: Changing inequality in US college entry and completion. *National Bureau of Economic Research*. Retrieved from http://www.nber.org/papers/w17633.

Barken, S. (2010). A brief history of education in the United States. *Sociology: Understanding and Changing the Social World*. Minneapolis, MN. University of Minnesota Libraries.

Barry, C. & Okun, M. Application of investment theory to predicting maintenance of the intent to stay among freshman. *Journal of College Student Retention*, 13(1), 87-107.

Bauchmoyer, S., Carr, M., Clutter, J., & Hoberty, P. (2004). Predicting academic and national board dental hygiene examination performance based on academic factors. *Journal of Dental Hygiene,* 78(1), 39–45.

Baylis, J., Thomas, R., Eifert-Magine, M. (2017). Pilot study: What measure predict first time pass rate on national physical therapy examination? Internet *Journal of Allied Health Sciences and Practice,* 15(4), https://nsuworks.nova.edu/ijahsp

Bearden, E., Robinson, K., & Deis, M. (2002). A statistical analysis of dental hygiene students" grades in online and on-campus courses and performance on the national board dental hygiene. *Journal Dental Hygiene*, 76(3), 213–217.

Benham, B., & Hawley, D. (2015). The effectiveness of tools used to evaluate successful critical decision making skills for applicants to healthcare graduate educational programs: A systematic

review. *JBI Database of Systematic Reviews and Implementation Reports*, 13(4), 231–275.

https://doi.org/10.11124/jbisrir-2015-2322

Bettinger, E., Evans, B., & Pope, D. (2015). Improving college performance and retention the easy way: unpacking the ACT exam. *American Economic Journal: Economic Policy*, 5(2), 26-52.

Bode, S. K., & Gates, G. E. (2001). Correlates of success on the registered dietetic technician credentialing examination. *Journal of the American Dietetic Association*, 101(12), 1473–1474. https://doi.org/10.1016/s0002-8223(01)00356-x

Brady, J. (2020). Social justice and dietetic education: are we preparing practitioners to lead? *Canadian Journal Diet Practice* Res, 81, 120-126.

Bradley, R. L., & Deaton Conner, W. (1993). Selected admission and academic correlates of the scores on the national registration examination for dietitians. *Journal of the American Dietetic Association,* 93(8), 912–913. https://doi.org/10.1016/0002-8223(93)91534-w

Brady, J., Hoang, A., Tzianetas, R., Buccino, J., Glynn, K., & Gingras, J. (2012). Unsuccessful dietetic internship applicants: A descriptive survey. *Canadian Journal of Dietetic Practice and Research,* 73(2), e248–e252. https://doi.org/10.3148/73.2.2012.e248

Brown, G., Imel, B., Nelson, A., Hale, L., Jansen, N. (2013). Correlations between PANCE performance, physician assistant programs grade point average, and selection criteria. *Journal of Physician Assistant Education*, 24(1), 42-44.

Buraphadecha, S., Chinwong, D., & Thiankhanitihun, K. (2018). Identifying predictors of pharmacy license examination using grade point average. *Pharmacy Education,* 18(1), 143-148.

Bulfone, G., Vellone, E., Maurici, M., Macale, L., & Alvaro, R. (2019). Academic self-efficacy in bachelor level nursing students: development and validation of a new instrument. *Journal of Advanced Nursing*, 76, 398-408.

Butina, M., Wyant, A., Remer, R., Cardom, R. (2017). Early predictors of students at risk of poor PANCE performance. *Journal of Physician Assistant Education, 28(1), 45-48.*

Cahn, P. (44). Do health profession graduate programs increase diversity by not requiring the GRE examination for admission? *Journal of Allied Health*, (1), 51–56.

Capstick, M., Harrell-Williams, L. M., Cockrum, C. D., & West, S. L. (2019). Exploring the effectiveness of academic coaching for academically at-risk college students. *Innovative Higher Education*, 44(3), 219–231. https://doi.org/10.1007/s10755-019-9459-1

Camara, W. (2020). Never let a crisis go to waste: Large scale assessment and the response to COVID-19. *Educational Measurement: Issues and Practice,* 39(3), 10-18.

Carruth, B., & Sneed, J. (1990). Selection criteria for dietetic internship admission: what do internship directors consider most important. *Journal of the American Dietetic Association*, 90, 999. https://doi.org/1001

Camar, W., O'Conner, R., Mattern, K., & Hanson, M. (2015). Beyond Academics: A Holistic Framework for Enhancing Education and Workplace Success. Iowa City, IA; ACT.

Center for Disease Control. (n.d.). National Health and Nutrition Examination Survey. Center for Disease Control, CDC. https://wwwn.cdc.gov/nchs/nhanes/Default.aspx

Chisholm-Burns, M. A., Spivey, C. A., McDonough, S., Phelps, S., & Byrd, D. (2014). Evaluation of student factors associated with pre-naplex scores. *American Journal of Pharmaceutical Education*, 78(10), 181. https://doi.org/10.5688/ajpe7810181

Clark, H., Cole, R., & Funderburk, L. (2018). US Military dietetic internship and graduate program: Retrospective analysis of selection criteria and student success. s, *Journal of Academy of Nutrition and Dietetics* 118(60, 1057-1064.

Clinedinst, M., Koranteng, A., Nocola, T. (2015). State of college admission. Arlington, VA: National Association of College Admissions Counselors.

Codier, E. & Odell, E. (2014). Measured emotional intelligence ability and grade point average in nursing students. *Nurse Education Today*, 34, 608-612.

Cruce, T. & Mattern, K. (2020). The impact of super score on the distribution of ACT scores. *ACT Research & Policy Issue Brief*. March 2020.

Coleman-Salgado, B. & Barakatt, E.(2018). Identifying demographic and preadmission factor predictor of success on the National Physical Therapy Licensure Examination for graduates of a public physical therapist educational program. *Journal of Physical Therapy Education*, 32(1), 8-16.

Commission Dietetic Registration. (n.d.). Registration Examination for Dietitians Group Performance Statistics October 1987-December 2019.
https://www.cdrnet.org/vault/2459/web/files/RDPerformanceGroup.pdf

Commission on Dietetic Registration. (2013). Final Report of the Joint Meeting of the Council for Education in Nutrition and Dietetics Commission on Dietetic Registration Council for Future Practice Education Committee Nutrition and Dietetics Educators and Preceptors DPG. Commission Dietetic Registration.
https://www.cdrnet.org/pub/file.cfm?item_type=xm_file&id=11703

Conley, D. (2010). *College and Career Ready: Helping all students beyond high school*. San Francisco; Jossey Bass.

Cripps, A., Stiltner, S., Walters, E., Fullenkamp, A., & Laurent, M. (2018). Predictors of success on the board of certification exam. *Journal of Sports Medicine and Allied Health* Sciences: 4(1).
https://scholarworks.bgsu.edu/jsmahs/vol4/iss1/1

Cruse, T., & Mattern, K. (2020). The impact of Super scoring on the distribution of ACT scores. *ACT Research and Policy Issue Brief*.

Curtis, D. A., Lind, S. L., Plesh, O., & Finzen, F. C. (2007). Correlation of admissions criteria with academic performance in dental students. Journal of Dental Education, 71(10), 1314

Curtis, E., Comiskey, C., & Dempsey, O. (2016). Importance and use of correlations research. Nurse Research, 23(6), doi: https://doi.org/10.7748/nr.2016.e13821321. https://doi.org/10.1002/j.0022-0337.2007.71.10.tb04395.x

Daley, L, Kirkpatrick, B., Frazier, S., Chung, M., & Moser, D. (2003). Predictors of NCLEX-RN success in baccalaureate nursing programs as a foundation for remediation. *Journal of Nursing Education, 4*2(9), 390-398.

Davidson, C. & Wilson, K. (2013). Reassessing Tinto's concepts of social and academic integrations in student retention. *Journal of College Student Retention*, 15(3), 329-346.

Davis, D., Groom, A., & Friesner, D. (2018). Predictors of academic success in health professions programs. *Journal of Higher Education Theory and Practice*, 18(6), 22-42.

De Ball, S., Sullivan, K., Horine, J., Duncan, W. K., & Replogle, W. (2002). The relationship of performance on the dental admission test and performance on part i of the national board dental examinations. *Journal of Dental Education*, 66(4), 478–484. https://doi.org/10.1002/j.0022-0337.2002.66.4.tb03526.x

Desmarais, L., (2011). Factors influencing physical therapist assistant licensure examination success. *Journal of Physical Therapy Education*, 25(2), 36-41.

Duemer, L. (2007). The agricultural education origins of the Morrill Land Grant Act of 1862. *America Educational History Journal*, 34(1), 135-146.

Elkins, N. (2015). Predictors of retention and passing the national council licensure examination for

    registered nurses. *Open Journal of Nursing*, 05(03), 218–225.

    https://doi.org/10.4236/ojn.2015.53026

English, C. (1995). Academic measures available in sophomore year can predict application and

    admission to dietetic supervised practice programs. *Journal of the American Dietetic*

    Association, 95(8), 904–907. https://doi.org/10.1016/s0002-8223(95)00249-9

Epstein, J. (2009). Behind the SAT optional movement: Context and contrvesry. Journal of College

    Admission, 204, 8-19.

Erlandson, B., Wagner, M., Yeong, R., Brunt, A., & Winters, L. (2013). *Topics in Clinical Nutrition,*

    28(3), 262-273.

Farkas, E., Gregoire, M., Lafferty, L., & Hartney, C. (2010). What predicts success in a dietetic

    internship/ms degree program and on the dietetic registration exam? *Journal of the American*

    Dietetic Association, 110(9), A65. https://doi.org/10.1016/j.jada.2010.06.243

Furuta, J. (2017). Rationalization and student/school personhood in U.S. college admissions: The rise of

    test-optional policies, 1987 to 2015. *Sociology of Education*, 90(3), 236–254.

    https://doi.org/10.1177/0038040717713583

Gall, M. D., Gall, J. P., & Borg, W. R. (2007). *Educational research* (8th ed.). Pearson/allyn & Bacon.

Geiser, S. (2020). SAT/ACT scores, high school GPA, and the problem of omitted variable bias: Why

    the US taskforce's finding are spurious. *Berkley Research & Occasional Paper Series*, CSHE:1.

Gipson, J.(2016). Predicting academic success for student of color writing STEM majors. *The Journal*

    for Multicultural Education, 10(2), 124-134.

Gillmore, M. (2008). Predictors of success in associate degree nursing programs. *Teaching and*

    Learning in Nursing, 3(4), 121–124.

Grapo, R. (2020). College admission and COVID-19. An evolving landscape. *The Foreign Service Journal,* June, 2020.

Griswold, K., Rogers, D., Sauer, K. L., Kellogg Leibovitz, P., & Finn, J. R. (2016). Entry-level dietetics practice today: Results from the 2015 commission on dietetic registration entry-level dietetics practice audit. *Journal of the Academy of Nutrition and Dietetics*, 116(10), 1632–1684. https://doi.org/10.1016/j.jand.2016.08.003

Grossbach, A., & Kuncel, N. R. (2011). The predictive validity of nursing admission measures for performance on the national council licensure examination: A meta-analysis. *Journal of Professional Nursing*, 27(2), 124–128. https://doi.org/10.1016/j.profnurs.2010.09.010

Hamaideh, S. & Hamdan-Mansour, A. (2014). Psychological, cognitive, and personal variables that predict college academic achievement among health science students. *Nurse Education Today,* 34, 703-708.

Harding, M. (2010). Predictability associated with exit examinations: A literature review. *Journal of Nursing Education,* 49(9), 493–497. https://doi.org/10.3928/01484834-20100730-01

Harmon, K., Gonzales, A., & Fenn, N. (2021). Remediation and reassessment methods in pharmacy education: systemic review. *Currents in Pharmacy Teaching and Learning*, 13, 81-90.

Hartman, J. (2017). P-16 Partnership to improve student's postsecondary mathematics achievement. *NASSP Bulletin*, 101(1), 36-49.

Haubrick, K., & Ross, M. (2015). Predictors of success on the registration examination for dietitians. *Journal of the Academy of Nutrition and Dietetics*, 115(9), A47. https://doi.org/10.1016/j.jand.2015.06.163

Havrilla, E., Zgegner, D., Joyce, V.(2018). Exploring predictor of NCLEX-RN success: One school's search for excellence. *Journal of Nursing Education*, 57(9), 554-56.

Higgins, B. (2005). Strategies for lowering attrition rates and raising NCLEX-RN® pass rates. *Journal of Nursing Education*, 44(12), 541–547. https://doi.org/10.3928/01484834-20051201-03

Higgins, R., Moser, S., Dereczyk, A., Canales, R., Stewart, G., Schierholtz, C., Ruback, T., McDaniel, J., Rhee, J., & Arbuckle, S.(2010). Admission variables as predictors of PANCE physician assistant programs: A comparison study across universities. *Journal of Physician Assistant Education,* 21(1), 10-17.

Harris, R. & King, S. (2016). Use of standardized test scores to predict success in a computer applications course. *Community College Journal of Research and Practice*, 40(1), 75-78.

Higdem, J., Kostal, J., Kuncel, N., & Sackett, P., Shen, W., Beatty, A., Kiger, T. (2016). The role of socioeconomic status in SAT-freshman grade relationships across gender and racial subgroups. *Educational Measurement: Issues and Practice,* 35(1), 21-28.

Hiss, W., & Franks, V. (2014). Defining promise: Optional standardized testing policies in American college and university admission. Arlington, VA: National Association for College Admission.

Hobson, Z., Miller, S., Symons, D., & Vairo, L. (2020). Accuracy of undergraduate athletic training student performance factor for determining board of certification exam first time pass outcomes. *Athletic Training Education Journal*, 15(3), 213-223.

Honda, T., Barry,C., Buchs, S., Garbas, B., Hibbard, S., McLellan, A., Riethle, T., & Swanchak, L.(2019). Consideration around predicting physician assistant national certifying exam scores from PACKRAT: A multiprogramming study. *The Journal of Physician Assistant Education,* 30(2), 86-92.

Hooker, R., Williams, J., Papneja, J., Sen, N., & Hogan, P. (2011). Dietetics Supply and Demand: 2010-2020. *Journal of Academy of Nutrition and Dietetics*, 112(3), 75-91.

Hunsicker, & Chitwood, T. (2018). High-Stakes testing in nursing education: A review of *Literature*. *Nurse Educator,* 43(4), 183–186.

Hyman, J. (2017). ACT for all: The effect of mandatory college entrance exam on postsecondary attainment and choice. *Association for Education Finance and Policy*. Doi: 10.1162/EDFP_a_00206

Inayat, I. & Jami, B. (2019). Relationship between admission criteria and academic performance: A correlational study in nursing students. *Pak Journal Medical Science*, 35(3), 853-861.

Jeffery, P, Harris, R., & Sherman, J. (2019). Quality improvement: A practical nursing program's admission test. *Nurse Education Today*, 73, 65-70.

Jones-Schenk, J. & Harper, M. (2014). Emotional intelligence: An admission criterion alternative to cumulative grade point average for pre-licensure students. *Nurse Education Today*, 34(4), 413-420.

Johnson, T., Sanderson, B., Wang, C., & Parker, F. (2016). Factors associated with first time NCLEX-RN success: A descriptive research study. *Journal of Nursing Education*, 56(9), 542-545

Kerby, M. (2015). Toward a new predictive model of student retention in higher education: An application of classical sociological theory. *Journal of College Student Retention*, 17(2), 138-161.

Kaddoura, M., Flint, E., Van Dyke, O., Yang, Q., & Chiang, L. (2017). Academic and demographic predictors of NCLEX-RN pass rates in first and second degree accelerated BSN programs. *Journal of Professional Nursing*, 33(3), 229-240.

Kaddoura, M., Van dyke, O., & Yang, Q. (2017). Correlation between critical thinking skills and national council licensure examination for registered nurses success in accelerated bachelor nursing students. *Teaching and Learning in Nursing*, 12(10, 3-7.

Karaman, M., Lerma, E., Vela, J., & Watson, J. (2016). Predictors of academic stress among college students. *Journal of College Counseling*, 22, 41-52.

Khan, S. & Shamama-Tus-Sabah, S. (2020). Perceived stress and its association with positive mental health and academic performance of university students. *Pak Armed Forces Medical Journal,* 70(5), 1391-1395.

Kume, J., Reddin, V., & Horbacewicz, J. (2019). Predictors of physical therapy academic and NPTE licensure performance. *Health Profession Education*, 5, 185-193.

Kuh, G., Kinzie, J., Buckley, J., Bridges, B., Hayek, J. (2006). What matters to student success: A review of the literature commission report for the national symposium on postsecondary student success: Spearheading a dialog on student success.

Kurowski-Burt, A., Woods, S., Daily, S., Lilly, C., Scaife, B., & Davis, D. (2020). Predicting student success on the National Board for Certification in Occupational Therapy. *American Journal of Occupational Therapy*, 74, 23-33.

Latif, D. (2005). Including the assessment of nontraditional factors in pharmacy school admissions. *Pharmaceutical Education*, 39, 721-726.

Leonberg, B. (2017). Internship match and entry level exam performance of undergraduate versus graduate level didactic students. *Journal of the Academy of Nutrition and Dietetics*, 117(9), A12. https://doi.org/10.1016/j.jand.2017.06.322

Linn, R. (2001). A century of standardized testing: Controversies and pendulum swings. *Educational Assessment,* 7(1), 29-38.

Linsenmeyer, M., & Ridpath, L. (2019). Nelson-Denny reading test scores as a predictor of student success in osteopathic medical education. *The Journal of the American Osteopathic Association,* 119(3), 189. https://doi.org/10.7556/jaoa.2019.030

Lodico, M., Spaulding, D., & Voegtle, K. (2010). Methods in Educational Research from Theory to
Practice. Jossey-Bass.

Lolar, S., McQuenn, J., Maher, S. (2020). Correlation between physician assistant students' performance
score of history taking and physical exam documentation and scores of graduate record
examination, clinical year grade point average, and score of physician assistant national
certifying exam in the United States. *Journal of education Evaluation Health Professions.*
https://doi.org/10.3352/jeehp.2020.17.16

Lown, S. & Hawkins, L. Learning style as a predictor of first time NCLEX-RN success. *Nurse
Educator,* 42(4), 181-185.

Luce, D. (2011). Screening applicant for risk of poor academic performance: a novel scoring system
using preadmission grade point averages and graduate record examination scores. *The Journal of
Physician Assistant Education*, 22(3), 15-22.

Madden, M., Etzler, F., Schweiger, T., & Bell, H.(2012). The impact of pharmacy students remediation
status on NAPLEX first-time pass rates. *American Journal of pharmaceutical Education,* 76(10),
1-8.

Mattern, K. & Allen, J. (2016). More information, more informed decisions: Why test-optional policies
do NOT benefit institutions or students. *ACT Insights in Education and Work.*

Mattern, K., Shaw, E., & Korbin, J. (2011). An alternative presentation of incremental validity:
Discrepant SAT and HSGPA performance. *Educational and Psychological Measurement,* 71(4),
638-662.

Mokher, C's & Leeds, D.(2019). Can a college readiness intervention impact longer-term college
success? Evidence from Florida statewide initiative. *The Journal of Higher Education,* 90(4),
585-619.,

Matthew, L. & Aktan, N. (2018). Factors associated with NCLEX-RN success of gradate from an undergraduate nursing program. *Journal of Nursing Practice Application and Reviews of Research, 8*(2), 50-59.

McCall, K., Allen, D., & Fike, D. (2006). Predictors of academic success in a doctor of pharmacy program. *American Journal of Pharmaceutical Education*, 70(5), 1-15.

McFadden, D. (2016). Health and academic success: A look at challenges of first generation community college students. *Journal of the American Association of Nurse Practitioners,* 28, 227-232.

Mechur Karp, M., Hughes, K., & O'Gara, L. (2010). An exploration of Tinto's integration framework for community college students. *Journal of College Student Retention*, 12(1), 69-86.

Meiners, K., & Rush, D. (2017). Clinical performance and admission variables as predictors of passage on the national physical therapy examination. *Journal of Allied Health,* 46(3).

Meyers, T. & Karpinski, A. (2018). The relationship between socioeconomic status (SES) and NCLEX-RN: Comparing SES indicators in medicated logistic regression. *Nursing Education Perspectives,* 39(4), 238-240.

Moore, K. (1995). Criteria for acceptance to pre-professional dietetics programs vs desired qualities of professionals. *Journal of the American Dietetic Association*, 95(1), 77–81. https://doi.org/10.1016/s0002-8223(95)00017-8

Muratov, E., Lewis, M., Fourches, D., Tropsha, A., & Cox, W. C. (2017). Computer-assisted decision support for student admissions based on their predicted academic performance. *American Journal of Pharmaceutical Education*, 81(3), 46. https://doi.org/10.5688/ajpe81346

Nayar, N. (2015). How are states reporting on college and career readiness? *College and Career Readiness and success Center at American Institutes for research.*

Newton, S., & Moore, G. (2009). Use of Aptitude to understand bachelor of scince in nursing student attrition and readiness for the national council licensure examination –registered nurse. *Journal of Professional Nursing*, 25(5), 273-238.

Novalis, S., Cyranowski, J, & Dolhi, C. (2017). Passing the NBCOT examination: Preadmission, academic, and fieldwork factors. *The Open Journal of Occupational Therapy*, 5(4), 1-20.

Nye, C., Butt, S., Bradburn, J., & Prasad, J.(2018). Interests as predictors of performance: An omitted and underappreciated variable. *Journal of Vocational Behavior*, 108, 178-189.

Nyland, N., & Lafferty, L. (2012). Implications of the dietetics workforce demand study. *Journal of the Academy of Nutrition and Dietetics*, 112(3), S92–S94. https://doi.org/10.1016/j.jand.2011.12.013

Olivares, L.(2015). Retaining Hispanic dietetic undergraduate students through mentoring and professional development. *Journal of the Academy of Nutrition and Dietetics*, 115(5), S10-S15.

Palmer, E., Esposito, E., Shin, M., Raake, S., Malcom, D., & Daugherty, K. (2020). Impact of intersession course remediation on NAPLEX/PCOA scores in an accelerated doctor of pharmacy program. *American Journal of Pharmaceutical Education*, 84(9), 1233-1239.

Pedrini, B. & Pedrini, D. (1977). The usefulness of ACT scores in predicting achievement and attrition among disadvantage and regular freshmen: A survey and study. https://files.eric.ed.gov/fulltext/ED128429.pdf

Pike, A., Luckewich, J., Wells, J., Kirkland, M., & Manuel, M. (2019). Identifying indicators of national council licensure examination for registered nurses (NCLEX-RN) success in nursing graduate in Newfoundland & Labrador. *International Journal of Nursing Education Scholarship.* Doi;10.1515/ijnes-2018-0060

Pinto, E., Toro, B., & Cruz, J. (2016). Factors that may influence success in the registered dietitian

exam. *Journal of the Academy of Nutrition and Dietetics*, 116(9), A80.

https://doi.org/10.1016/j.jand.2016.06.283

Pope, J., & Gines, D. (1986). Correlates of success of graduates of a coordinated undergraduate

program. *Journal of the American Dietetics Association*, 86, 1022–1027.

Popham, W. (2006). Branded by a test. *Educational Leadership*.

Powers, D. (2004). Validity of Graduate Record Examination (GRE) General Test scores for admission

to college of Veterinary Medicine. *Journal of Applied Psychology*, 89, 208-219.

Pullen, R. (2017). A prescription for NCLEX-RN success. *Nursing,* 47(6).

Quinn, B., Smolinski, M., Peters, A. (2018). Strategies to improve NCLEX-RN success: A review.

Teaching and Learning in Nursing, 13, 18-26.

Radunzel, J. & Mattern, K. (2020). A case Study: ACT section retest scores and super-scores are

predictive of first term grades. *ACT Research & Policy Technical Brief*, May 2020.

Rajbhandari-Thapa, J., Zhang, D., MacLeod, K. E., & Thapa, K. (2020). Impact of Medicaid expansion

on insurance coverage rates among adult populations with low income and by obesity status.

Obesity, 28(7), 1219–1223. https://doi.org/10.1002/oby.22793

Rubin, P. & Canche, M.(2019). Test flexible admissions policies and student enrollment demographics:

examining a public research university. *The Review of Higher Education,* 42(4), 1337-1371.

Rhea, M & Bettles, C. (2012). Four futures for dietetic workforce supply and demand: 2012-2022.

Journal of the Academy of Nutrition and Dietetics. doi: 10.1016/j.jand.2011.12.007.

Riddle, D. L., Utzman, R. R., Jewell, D. V., Pearson, S., & Kong, X. (2009). Academic difficulty and

program-level variables predict performance on the national physical therapy examination for

licensure: A population-based cohort study. *Physical Therapy*, 89(11), 1182–1191.

https://doi.org/10.2522/ptj.20080400

Romeo, E. (2010). The predictive ability of critical thinking, nursing GPA, and SAT scores on first time NCLEX-RN performance. *Nursing Education Perspective,* 34(4), 248-253.

Saboe, M., & Terrizzi, S. (2019). Sat optional policies: Do they influence graduate quality, selectivity or diversity? *Economics Letters*, 174, 13–17. https://doi.org/10.1016/j.econlet.2018.10.017

Saguil, A., Dong, T., Gingerich, R. J., Swygert, K., LaRochelle, J. S., Artino, A. R., Cruess, D. F., & Durning, S. J. (2015). Does the MCAT predict medical school and pgy-1 performance? *Military Medicine*, 180(suppl_4), 4–11. https://doi.org/10.7205/milmed-d-14-00550

Santelices, M. & Wilson, M. Unfair Treatment? The case of Freedle the SAT, and the standardization approach to differential item functioning. *Harvard Educational Review*, 80(1), 106-134.

Sawyer, R. (2010). Usefulness of high School average and ACT scores in Making College Admission Decisions. (ACT Research Report Series 2010-2012). Iowa City; IA.

Sbraccia, P, P., & Finer, N. (Eds.). (2018). *Obesity.* Springer International Publishing.

https://doi.org/10.1007/978-3-319-47685-8

Shah, S., Peng, I., & Seifert, C. (2019). A model to predict NAPLEX outcome and identify students needing additional preparation. *Current in Pharmacy Teaching and Learning*, 11(8), 810-817.

Shenaar-Golan, V., Walter, O., Greenburg, Z., Zibenberg, A. (2020). Emotional intelligence in higher education: exploring its effects on academic self-efficacy and coping with stress. *College Student Journal*.

Shu, S., Kuncel, N., & Sackett, P. (2017). Predicting college performance of America Indians; A large sample examination of the SAT. *Educational Measurement: Issues and Practice,* 36(2), 24-33.

Singh, S., Singh, K.S., Manar, M., Kar, S., Gupta, A., Bajpai, P., & Sharam,N. (2018). Epidemiology of stress among nursing undergraduate students. *Indian Journal of Community Health, 30*(3), 233-238.

Siwen, S., Kuncel, N., & Sackett, P. (2017). Predicting college performance on American Indians: A large sample examination of the SAT. *Educational Measurement: Issues and Practice*, 36(2), 24-33.

Sloas, S., & Whitehead, M. (2013). Use of a pretest strategy for physical therapist assistance programs to predict success rate on the national physical therapy exam. *Journal of Allied Health,* 42(2), 79–83.

Sneed, J., & Carruth, B. (1991). Selection criteria for approved preprofessional practice programs: are they different from those for dietetic internships? *Journal of the American Dietetic Association,* 91(8), 950. https://doi.org/953

Sparkman, L., Mauding, W., & Roberts, J. (2012). Non-Cognitive predictors of student success in college, *College Student Journal*, 146(3), 642-652.

Specchia, M. L., Veneziano, M. A., Cadeddu, C., Ferriero, A. M., Mancuso, A., Ianuale, C., Parente, P., Capri, S., & Ricciardi, W. (2014). Economic impact of adult obesity on health systems: A systematic review. *The European Journal of Public Health*, 25(2), 255–262. https://doi.org/10.1093/eurpub/cku170

Spiker, M., Reinhardt, S,& Bruening, M (2020). Academy of Nutrition and Dietetics: Revised 2020 standards of Professional Performances for Registered Dietitian Nutritionist. *Journal of Academic of Nutrition and Dietetics*, 120(9), 1568-1568.

Spivey, C., Chishom-Burns, M., & Johnson, J. (2020). Factors associated with student pharmacist academic progression and performance on the national licensure examination, *American Journal of Pharmaceutical Education*, 84(2), 269-276.

Spivey, C., Havrda, D., Stallworth, S., Renfro, C., & Chisholm-Burns, M. (2020). Longitudinal examination of perceived stress and academic performance of first year student pharmacists. *Currents in Pharmacy Teaching and Learning*, 12, 1116-1122.

Spivey, C., Stallworth, S., Olivier, E., Chisholm-Burns, M. (2020). Examination of the relationship between health-related quality of life and academic performance among student pharmacists. *Current in Pharmacy Teaching and Learning*, 12, 1304-1310.

Stein, K., & Rops, M. (2017). The commission on dietetic registration: Ahead of the trends for a competent 21st century workforce. *Journal of the Academy of Nutrition and Dietetics*, 117(10), S45–S61.e7. https://doi.org/10.1016/j.jand.2017.08.016

Stewart, S., Lim, D., & Kim, J. (2015). Factors influencing college persistence for first-time students. *Journal of Developmental Education*, 38(3), 12-20.

Stewart, C. M., Bates, R. E., & Smith, G. E. (2005). Relationship between performance in dental school and performance on a dental licensure examination: An eight-year study. *Journal of Dental Education,* 69(8), 864–869. https://doi.org/10.1002/j.0022-0337.2005.69.8.tb03982.x

Stuart, G., Rios-Aguilar, C., & Deil-Amen, R. (2014). How much economic value does my credential have? Reformulating Tinto's model to study students' persistence in community colleges. *Community College Review, 42(*4), 327-341.

Timer, J., & Causon, M. (2011). The use of selective admission tools to predict student's success in an advanced standing baccalaureate nursing program. *Nurse Education Today*, 31(6), https://doi.org./10.1016/j.nedt.2010.10.015

Tinto, V. (1975). Dropout from higher educational: A theoretical synthesis of recent research. *Review of Education Research*, 45(1), 89-125.

Tinto, V. (1998). Classrooms as Communities. Exploring the educational character of student persistence. *Journal of Higher Education,* 68(6), 599-623.

Tinto, V., (2007). Research and practice of student retention: What next? *Journal of College Student Retention,* 8(10, 1-13.

Tinto, V., (2017). Through the eyes of students. *Journal of College Student Retention: Research, Theory, and Practice, 1*9(3), 254-269.

Tuckman, B. & Harper, B. (2012). *Conducting Educational Research*. Rowman & Littlefield.

Vendrely, A. (2007). An investigation of the relationships among academic performance, clinical performance, critical thinking, and success on the physical therapy licensure examination. *Journal Allied Health*, 36(2).

Wainer, H. What happens if the SAT is made optional?

Ware, K. (2019). Relationships between Myers-Briggs type indicators and NAPLEX performances. *American Journal of Pharmaceutical Education*, 83(10, 23-27.

Warner, R. M. (2013). *Applied statistics*. Sage Publications.

Warren, J. (2019). Exploring the relationship between high school course enrollment, achievement, and first semester GPA. *Journal of Educational Research and Practice*, 9(1), 386-399.

Wechsler, H. (2017). The qualified student: A History of Selective College Admission in America. New York, NY: Routledge

Welborne, C., Lester, D., & Parnell, J. (2015). Using ACT sub-scores to identify at risk students in business statics and principles of management courses. *Journal of Education for Business,* 90, 328-334.

West-Faulcom, K. (2010). More intelligent design: Testing measures of merit. *University of Pennsylvania Journal of Constitutional Law,* 13, 1235-1245.

Westrick, P., Le, H., Robbins,S., Radunzel, J., & Schmidt, F. (2015). College performance and retention: A meta-analysis of the predictive validities of ACT scores , high school grades, and SES. *Educational Assessment*, 20, 23-45.

White, J. & Betto, J. (2013). Strategies for addressing the internship shortage and lack of ethnic diversity in dietetics. *Journal of the Academy of Nutrition and Dietetics*, 113(6), 771-775.

Wiggins, N. (2012). Secretes of success for high NCLEX-RN pass rates for BSN nursing programs. *Administrative Issues Journal,* 2(3), 73-77.

Willams, J., Coertjens, L., Tambuyzer, B., & Donche, V. (2018). Identifying science students at risk in the first year of higher education: The incremental value of non-cognitive variable in predicting early academic achievement. *European Journal of Psychology Education*. Retrieved from: doi.org/10.1007/s10212-018-0399-4

Williams-Hooker, R., & Stock, M. (2013). Predictors of successful passing of the registered dietitian exam. *Journal of the Academy of Nutrition and Dietetics*, 113(9), A15. https://doi.org/10.1016/j.jand.2013.06.035

Wolden, M., Hill, B., & Voorhees, S. (2019). Predicting success for student physical therapists on the national physical therapy examination (npte): Systematic review and meta-analysis. *Physical Therapy*. https://doi.org/10.1093/ptj/pzz145

Woods, C., Park, T., Hu, S., & Jones, T. (2018). How high school coursework predicts introductory college level course success. *Community College Review,* 46(2), 176-196.

U.S. Bureau of Labor Statistics (2020). Occupational Outlook Handbook, retrieved from: https://www.bls.gov/ooh/healthcare/dietitians-and-nutritionists.htm

Zadnik, M., Sonia, L., Delany, J., Parente, F., Archer, K.(2017). Analysis of objective factors related to successful outcome on the national exam for occupational therapist. *Rehabilitation, Research, Policy, and Education*, 31(1).

Zamanzadeh, V., Ghahramanian, A., Valizadeh, L., Bagheriyeh, F., & Lynagh, M. (2020). *BMC Nursing*, 19, 1-17.

Ztolzengerg, R. (2004). Handbook of Data Analysis. Multiple Regression Analysis. doi: http://dx.doilorg/10.4135/9781848608184.n8

Zwick, R. (Ed.). (2004). Rethinking the SAT: The Future of Standardized Testing in University Admissions (1st ed.). Routledge. https://doi.org/10.4324/9780203463932

Zwick, R. (2019). Assessment in American Higher Education: The Role of Admission Tests. *ANNALS, AAPS*, May 2019.

APPENDIX A

Figure 1

Scatter plot English Sub Score

Normal Q-Q Plot of English score

Figure 2
Scatter Plot Composite Scores

Normal Q-Q Plot of composite
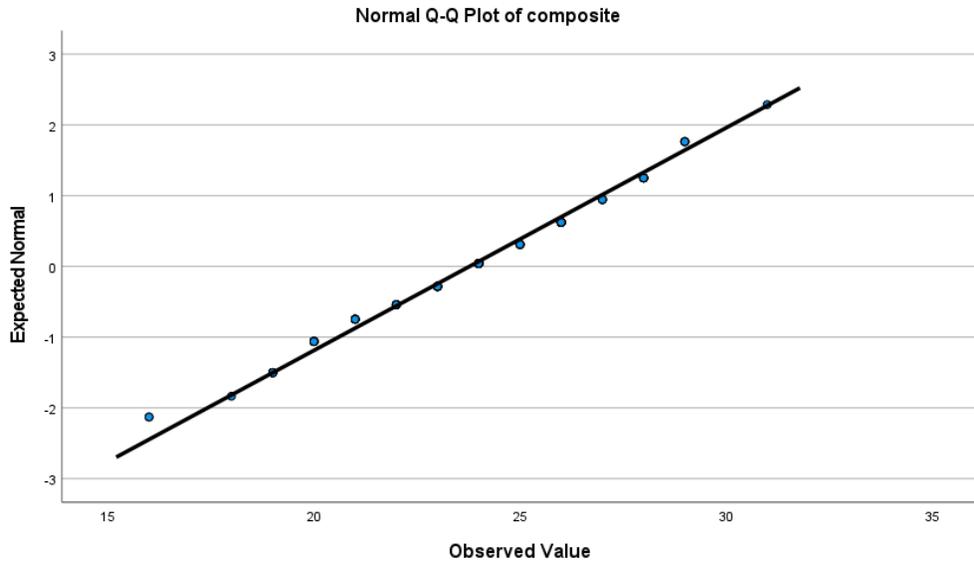
Figure 3

Scatter Plot Undergraduate GPA
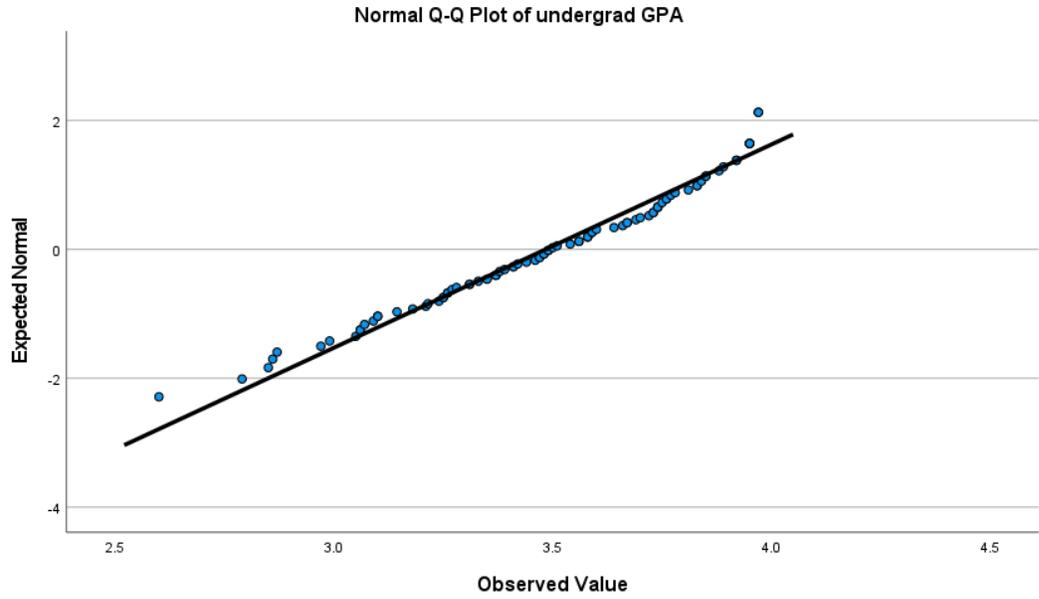
Figure 4

Scatter Plot Math Scores
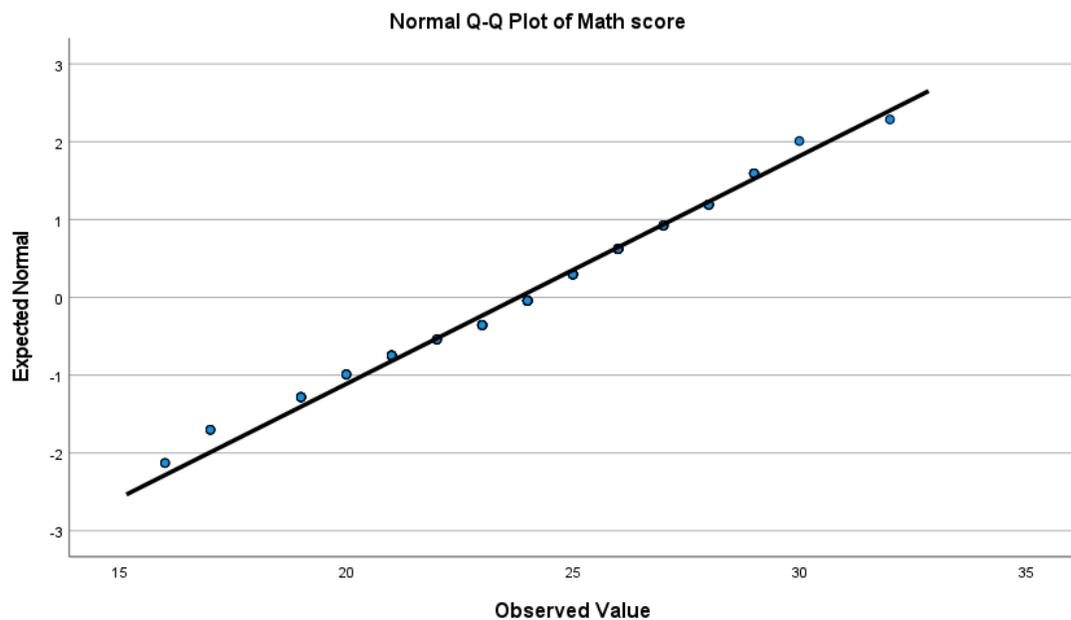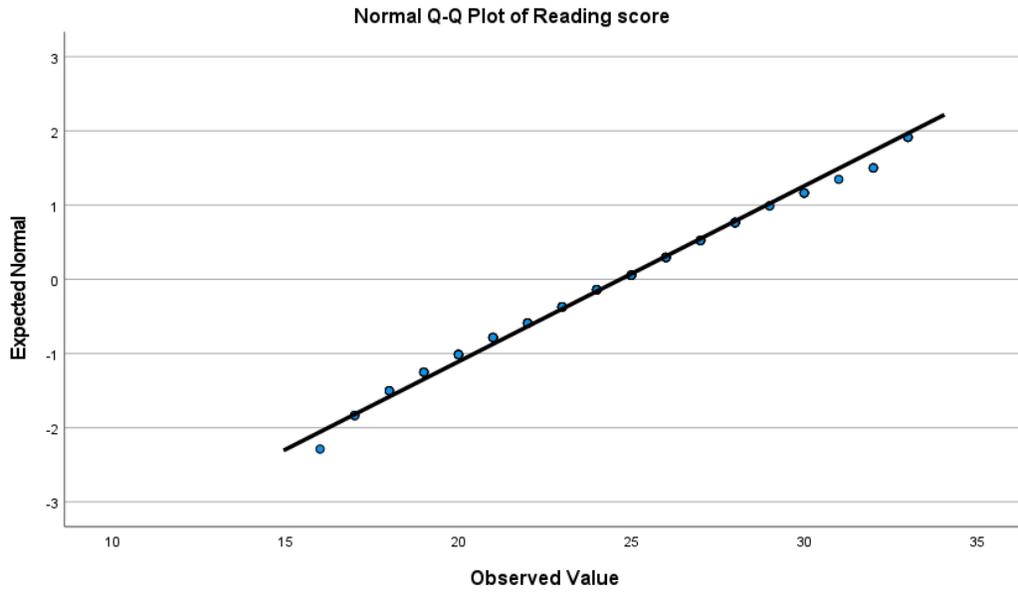
Figure 5

Scatter Plot Reading Scores

Normal Q-Q Plot of Reading score

Figure 6

Scatter Plot Science Scores

Normal Q-Q Plot of Science score