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Exploring The Relationship Between Preadmission Factors And Dental School Student Success

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EXPLORING THE RELATIONSHIP BETWEEN PREADMISSION FACTORS AND
DENTAL SCHOOL STUDENT SUCCESS

BY

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Submitted in Partial Fulfillment
of the Requirements for the Degree
Doctor of Education
Higher Education in Leadership, Management and Policy
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SETON HALL UNIVERSITY
COLLEGE OF EDUCATION AND HUMAN SERVICES
OFFICE OF GRADUATE STUDIES

APPROVAL FOR SUCCESSFUL DEFENSE

Doctoral Candidate, **Nadege Dady**, has successfully defended and made the required modifications to the text of the doctoral dissertation for the **Ed.D.** during this **Spring Semester 2015**.

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ABSTRACT

Exploring the Relationship between Preadmission Factors and Dental School Student
Success

by

Nadege Dady, MS.Ed.

This quantitative study assessed the preadmission factor relationship to success at a graduate dental school. Preadmission factors are used nationally to assess student ability. There are concerns about the reliability of these factors in measuring URM student ability. 1,275 records were collected and assessed for those admitted between the years 1998-2009. Multiple linear regression analysis was conducted to assess the relationship of the pre admission variables to the continuous variable Dental School GPA. Logistic regression analysis was conducted to assess the relationship of the pre admission variables to the dichotomous categorical variables of Licensure Obtainment and Degree Awarded Status. Based on the findings, recommendations were made for bolstering the factors that contribute to a student's success in dental school.

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Dedication

This book is dedicated to my late grandfather, Mr. Claude Cyrille, a well-known educator in Haiti, W.I. who played a significant role in the lives of many. His protective spirit has been with me for as long as I can remember. I am thankful for his guidance, support, and unconditional love even in spirit.

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Chapter I

INTRODUCTION

There is a need for more Underrepresented Minority (URM) health care professionals in the United States. The Association of American Medical Colleges (AAMC, 2008) defined the term *underrepresented minorities* as racial and ethnic populations that are underrepresented in the health professions relative to their numbers in the general population. Specifically, the racial ethnic populations considered to be underrepresented in healthcare are: African Americans, Hispanics/Latinos, Native Americans, and Native Hawaiian/Pacific Islanders (AAMC, 2008). The disproportion of the number of available URM providers and the number of patients of these races or ethnicities in the general population have negative health care implications (Saha & Shipman, 2008). This imbalance in the URM provider and patient ratio increases the level of health disparities in our country because URM providers are most likely to serve and practice in underserved areas, and they play important roles in closing the gap on health disparities (AAMC, 2008). In clinical practice settings this ratio has been reported as a dentist to population ratio of: 1:1,452 (White); 1:6,140 (Blacks); 1:5,425 (Hispanics); and 1:10,072 (Native Americans) (The Sullivan Commission, 2004). Health disparities are costly for the American taxpayer and have broad long-term financial implications for the U.S. government (McGee & Keller, 2007; Villarejo, Barlow, Kogan, Veazey, Sweeney, 2008). Exacerbating this issue is the

fact that URM students are not applying and/or being accepted to Health Professional Schools (HPS) at the same rates as other racial ethnic groups (AAMC, 2008).

In the United States the preadmission factors for pursuing a career in medicine or dentistry are defined by the health professional schools of each career track. Preadmission factors include: (a) pre-requisite undergraduate college science courses, (b) a preadmission standardized test (*MCAT for medicine* and *DAT for dentistry*), and (c) the overall cumulative Undergraduate Grade Point Average (UGPA) (American Dental Association). Once admitted to a dental school the outcome factors include: (d) DAT (Preadmission standardized test), (e) Dental School GPA (DS GPA), and (f) Dental licensure exam (National Boards Dental Examination) (American Dental Association).

For the URM students who pursue careers in the health professions and eventually succeed, their resilience and determination characterize an ability to persist in the face of both academic and financial challenges. Currently, URM students do not perform at the same competitive levels in biomedical science fields as do other racial/ethnic groups (Alexander, Chen, Grumbach, 2009), yet they are most likely to persist in pre-health courses despite these challenges, and they are less deterred than White students when they receive lower grades (Alexander et al., 2009). Therefore, the present study examines the relationships between preadmission factors that are required for entry into dental school, academic performance in dental school, and successful graduation for all admitted into a particular dental school between the years 1998-2009. Additional analyses were conducted to evaluate if any specific outcomes were significant across racial or ethnic groups. The results can offer policy makers a better evaluation of the predictors for academic performance and successful graduation, as well as highlight specific considerations for the URM student population. Furthermore, this information

can help administrators to develop programs to attract URM students into biomedical science fields.

The U.S. government is concerned about the underrepresentation of minorities in the healthcare system because of its long-term overall impact on our society. It is projected that by the year 2050, 50% of the U.S. population will consist of people who are of minority racial or ethnic backgrounds (U.S. Census Bureau, 2006). The lack of sufficient URM representation in the health professions has tremendous implications for our society's ability to provide care for the underserved, especially since URM students are most likely to serve in medically underserved areas (The Sullivan Commission, 2004). Medically underserved areas, also known as areas with a shortage of access to healthcare facilities or healthcare professionals, tend to be located in the inner city and contain large populations of minorities (The Sullivan Commission, 2004). In the absence of access to care and the providers who can provide that care, health disparities emerge, compromising the overall quality of our health care system. As an example, an international comparative study conducted in the year 2000 on international healthcare spending levels (Anderson, Reinhardt, Hussey, Petrosyan 2008) found that although the U.S. health care system is the most expensive in the world (i.e., health care costs more per person than in any other nation), persons in the US tended to utilize health care services less than other countries. That same year the World Health Organization (WHO, 2000) ranked the US 37 out of 191 in overall performance on health outcomes, and 72 in overall level of health. By the year 2008 not much had improved, as The Commonwealth Report (2008) revealed that, although the U.S. government spent an exorbitant amount of money on the health care system, the system ranked last in providing quality health care, in comparison to all other developed countries.

The U.S. government is concerned about the underrepresentation of minorities in health professional schools because there are not enough students pursuing health fields to replace those who are dying and/or retiring. In the year 2001, the American Dental Association (ADA) found the racial and ethnic makeup of students who graduated from a US dental school to be: 63% White, 25% Asian, 6% Black, and 5% Hispanic. Early on, researchers such as Seymour and Hewitt (1997) discussed the issue of minority underrepresentation in biomedical science fields as having more to do with the unsuccessful demonstration of the URM student's capacity to persist than anything else. As such, in the years following this research, pipeline and outreach programs were developed and implemented across the country to inspire students to pursue careers in medicine and/or dentistry; many with a focus on URM students. Despite the effort to reverse the trend of underrepresentation, the American Council on Graduate Medical Education (ACGME, 1998) reported that the racial and ethnic makeup of this country's health professional schools remained homogenous. Table 1 (AAMC, 2009) provides data on the trends in medical school application, acceptance, and graduation rates for Black, White, and Asian students.

Table 1

*Acceptance Rate of Black, White and Asian Student Applicants
To Medical School (2002-2007)*

	<u>Applied</u>			<u>Accepted</u>			<u>Acceptance rate</u>		
	Black	White	Asian	Black	White	Asian	Black	White	Asian
2002	2,983	21,648	6,594	1,340	11,769	3,554	.449	.544	.534
2003	3,064	22,658	6,956	1,274	11,983	3,614	.416	.529	.519
2004	3,178	23,629	7,589	1,350	12,251	3,632	.425	.518	.478
2005	3,164	24,583	8,212	1,293	12,350	3,890	.408	.502	.474
2006	3,216	25,268	8,341	1,325	12,496	3,839	.412	.495	.460
2007	3,471	26,916	9,225	1,334	12,594	4,118	.384	.468	.446

Table 1 (AAMC, 2009) shows the noticeable and undeniable differences between the rate at which Black students are accepted into medical school in comparison to the rate at which White and Asian students are accepted. It is also important to notice that White and Asian students have consistently been accepted at higher rates over time as compared to Blacks.

When URM students do pursue careers in the health professions they are motivated by a desire to change people's lives and to work in underserved communities. In a survey conducted by the United Health Foundation (UHF, 2012), 497 minority students enrolled in higher education institutions were polled to gain a better understanding of their motivations for deciding to pursue health-related careers. The survey found that 46% of the URM students were motivated by a desire to change people's lives and cited it as the primary reason they were pursuing a health related career as compared to other motivations, such as money or job security (UHF, 2012). Data from the UHF report (2012) also indicated that 9 out of 10 students wanted to serve a community with a similar racial or ethnic background that was similar to their own. The Sullivan Commission (2004), Solomon, Williams, and Sinkford (2001) presented similar findings, but from practicing physicians. The Sullivan Commission reported that 62% of Black patients are seen by Black dentists, and only 10.5% of Black patients are seen by White dentists. This is important information because a diverse health care workforce leads to: (a) more culturally appropriate care, and (b) increased access to care for patients of minority race/ethnicity (Basco, Cull, O'Connor, Shipman 2010). Additionally, care is improved, at least from the patient's standpoint, when patients and physicians are of the same race/ethnicity (Basco et al., 2010).

The literature and data presented in the introduction and problem statement explored the importance of having URM students attend HPSs and later become health care providers. The

focus now shifts towards an examination of the challenges URM students encounter while pursuing HPS degrees.

Though URM students experience academic challenges in biomedical science fields, resiliency and determination characterize their ability to persist beyond those challenges. In 2009, Dr. Charles Alexander et al. conducted a study to evaluate URM student performance in pre-health science college gateway courses. The data from 15,000 college students who were enrolled in six California colleges during the 1999-2001 academic years and who were taking pre-health (“gateway”) college courses were collected and assessed. Students were compared across ethnic groups in course performance, as well as in their abilities to complete four gateway courses. The results found that URM students, on average, received significantly lower grades in gateway courses than did White students. In all courses, Black and Latino students were less likely to achieve a grade of A or B than White students, even though factors of prior academic performance were accounted for (Alexander et al, 2009). Also, the results indicated that these same Black and Latino students were just as likely as White students to persist and complete their gateway courses. Therefore, although URM students experienced academic challenges, they persisted in their pre-health courses despite these challenges (Alexander et al., 2009) and proved to be less deterred than White students when low grades in their initial gateway classes were received.

Assessing URM performance for the first 2 years of health professional school, which are traditionally the toughest academically, might prove valuable for policy makers. In the year 2001, Edelin and Ugbolue evaluated the performance of 39 URM students during their first 2 years at Boston University School of Medicine (BUSM). Students were admitted between the years of 1992-1999 through an early selection program. The focus of the study was to evaluate

their abilities to navigate the first two years of medical school, the hardest academic years, despite low performance on preadmission standardized examinations, such as the Scholastic Aptitude Test (SAT) and the MCAT. The total mean score for the 39 students on the SAT was 955, and on the MCAT exam it was 18.18. This placed the 39 students at the 55th percentile on the SAT for all URM high school students. On the MCAT, 18.18 meant that the 39 students performed lower than the national mean of 24 for all URM students who matriculated into medical school. Despite this lower than-national average performance on preadmission criteria, the results following the first 2 years at BUSM were that 74% of the 39 were promoted from year 1 to year 2 on time, and 92.6% were promoted from year 2 to year 3 on time. Following the completion of the didactic curriculum, students in medical school are required to take Step 1 of the United States Medical Licensing Examination (USMLE); a three-step examination to obtain licensure. Nearly 85% of the 39 students passed the USMLE Step 1 on the first attempt, and more than 92% who took the USMLE Step 1 passed. Approximately 94% of the 39 progressed on time from year 2 to year 3, 90% completed year 1 without academic difficulty, and 92% completed year 2 without academic difficulty.

The academic challenges that URM students face while pursuing a health profession degree are exacerbated by the high cost of attendance. According to a United Health Foundation (UHF, 2012) survey of 497 minority students enrolled in higher education institutions, 98% cited the lack of available funding as a significant barrier to their career aspirations in healthcare. To discover just how much of a hindrance financial indebtedness was to the URM HPS students, the AAMC conducted research on the rate of student indebtedness while pursuing either a dental (DDS) or medical school (MD) degree (see Table 2).

Table 2

AAMC Trends in Student Indebtedness per Academic Year (2000-2007)

School	Debt per Academic Year							
	2000	2001	2002	2003	2004	2005	2006	2007
Dental Branch (DDS)	\$72,625	\$72,385	\$70,732	\$77,156	\$88,924	\$96,260	\$130,982	\$114,128
Dental Hygiene	13,866	13,294	14,644	16,880	18,801	30,798		
Dental Post Grad	55,971	85,223	46,951	35,147	46,375	58,686		
Graduate School of Biomedical Sciences	34,953	33,085	28,809	28,150	36,933	37,892		
School of Health Information Sciences			11,034		23,804	34,900		
Medical School (MD)	68,057	73,975	74,723	78,989	83,635	112,163	122,364	11,834
School of Nursing - Undergraduate	14,079	15,429	14,419	14,002	16,210	28,886		
School of Nursing - Graduate	28,729	31,799	29,914	33,164	34,374	29,491		
School of Public Health	25,152	24,643	28,044	28,557	27,522	40,030		

Table 2 (AAMC, 2008) shows that tuition has risen steadily since the year 2000. This has resulted in 75.5 % of graduates amassing debt of at least \$100,000, and 87.6% of graduating medical students carrying outstanding loans. Moreover, the average indebtedness of graduating medical students increased in 2007 by 6.9% over the previous year. What may or may not be known to the general public is that many state schools are required to generate 70% or more of their operating budgets from tuition, grants, clinical services, and charitable donations. Dental schools have responded to this pressure by increasing tuition and fees (Walker, Duley, Beach, Deem, Pileggi, Samet, Segura, Williams 2008), which has contributed to the rise in student indebtedness by the date of graduation. A byproduct of this increased tuition has been that students from higher-income families have increased their enrollment at dental schools, while

those from lower-income minorities have decreased their enrollment (Bailit, Beazoglou, Formicola, Tedesco, Brown, Weaver, 2006; Chmar, Harlow, Weaver, Valachovic 2007). In fact, from 1998 to 2006, the number of students who enrolled at U.S. dental schools with parental incomes of \$100,000 or greater increased from 35.1 % to 44.2 %, while the number of students with parental incomes less than \$50,000 declined from 32.4 % to 25.8 %. In summary, as tuition and fees increase, so, too, do the factors that discourage talented URM students from pursuing dental careers, such as indebtedness (Bailit & Beazoglou, 2003; Bailit et al., 2006).

Purpose of this Study

The purpose of this study is to assess the extent to which preadmission factors predict success in dental school.

Research Questions

The research questions guiding this study are as follows:

1. To what extent do preadmission factors (specifically UGPA and DAT score) predict the student's academic performance during the first 2 years of dental school (DS GPA)?
2. To what extent do preadmission factors (specifically UGPA and DAT score) predict a student's ability to successfully obtain a license to practice dentistry (licensure obtainment)?
3. To what extent do preadmission factors (specifically UGPA and DAT score) predict a student's ability to successfully obtain a graduate diploma in dentistry (degree awarded status)?
4. Are there any racial/ethnic differences in these three outcomes?

Utilizing multiple and logistic regression analysis methods, the goal is to discover the relationships between the following variables: (a) the DAT (Preadmission standardized test), (b) the undergraduate grade point average (UGPA), (c) the dental school GPA (DS GPA), (d) licensure obtainment (National Boards Part II performance) and, (e) degree awarded status from a dental school located in the Northeast.

Significance of the Study

This study is significant because of the undeniable impact that the shortage of URM students in biomedical science fields has on the quality of the American healthcare system. Policy implications demand a critical account of how the shortage of URM students in biomedical science fields, who then become URM health professionals, undermines the ability of society to effectively address health care disparities. The important connection between the quality of our healthcare system and the shortage of URM students in biomedical science fields is that URM students are the students most likely to practice in underserved areas and play important roles in closing the gap on health disparities (The Sullivan Commission, 2004). Health disparities exist in the United States because our health care system is the most expensive in the world (World Health Organization, 2000), in that it costs more per person than in any other nation, while also being utilized by the broader population the least. A shortage of URM health professionals leads to greater health disparities, is costly to the American taxpayer (World Health Organization, 2000), and compromises the overall quality of our country's financial stability (World Health Organization, 2000).

In summary, this study is important to resolving the issue of increasing URM student representation at HPSs in the US because it could provide a different perspective on the relationships preadmission factors have to success and the participation of the URM student in biomedical science fields. The broader implications for our society involve the need to: (a) live up to the promise of equal access to educational opportunities, and (b) support this country's healthcare goals of meeting the needs of all its citizens. Admissions policies may need to acknowledge the unintentional barriers that scare URM students into believing that they cannot pursue a career in healthcare.

The chapters that follow are organized in a logical progression that builds upon the knowledge that was presented in this chapter. This introductory chapter provided the context of the issue of URM student shortages in biomedical science fields and how this impacts our American healthcare system. Chapter II describes the theories on graduate level specialty training and the literature that has assessed the impact of pre admission factors on graduate level student success. Chapter III presents the methodology that was used to obtain the answers to the research questions that guided this study and formed the basis for assessing the predictive value of preadmission factors for success.

Chapter II

LITERATURE REVIEW

Organization of the Literature Review

The body of research that has addressed the impact of preadmission factors on student success, or the achievement of professional licensure and graduation at the graduate level, is rich when analyzed across disciplines. Prior research measuring the relationship between preadmission factors and student success at the graduate level across various fields of higher education is presented, while other factors discovered that also contribute to student success are discussed. Specifically, the purpose of this literature review is to: (a) review the theoretical frameworks that have been used to understand graduate-level specialty training, (b) identify the preadmission factors found to predict graduate level student success, (c) summarize other factors found to impact graduate student success, and (d) propose the appropriate theoretical framework for assessing relationships between preadmission factors and student success in dentistry. It is worth noting that, although the focus of the study is the success of dentistry students, the review goes beyond the field of medicine, due to limited research in this area.

Defining Preadmission Factors

Preadmission factors, defined broadly, are the scores or grades used to evaluate the academic and personal readiness of a prospective student to enter graduate-level specialty training (Alnasir & Jaradat, 2011; Al-Rukban, Munshi, Abdulghani, Hoqail, 2010). This practice

is consistent across higher education disciplines and is quantified through a well-defined minimum and maximum level of achievement. Achieving at a high level in preadmission factor scores is considered an excellent predictor of the likelihood for student success in their educational program. Although the specific factors and test scores utilized to predict future performance are defined by the field of study one decides to pursue, the common factors between programs are as follows: (a) performance in pre admission course work, (b) the grade point average (GPA) achieved in undergraduate study, and (c) a discipline specific standardized test score. One example of a graduate level standardized test score is the Graduate Record Examination (GRE). Most graduate level standardized tests assess student knowledge in various key subjects that have been deemed necessary for academic progression in higher education. Those subjects include math, reading comprehension, vocabulary, and critical thinking skills. For students entering health science fields of study such as nursing, pharmacy, medicine, and dentistry, additional standardized tests are incorporated to assess student competence in the subjects of biology, chemistry, anatomy, and physiology (Explore Health Careers, Health Care Careers).

Defining Graduate Student Success

A graduate school is a school that awards an advanced academic degree such as a master's or doctoral degree, with the general requirement that students must have earned a previous undergraduate (bachelor's) degree. Another level of graduate school education is the professional school. The professional school is a graduate school-level institution, the purpose of which is to prepare students for a specific career field. Examples of professional schools offering specialized advanced degrees include social work, education, computer sciences, medicine, business, dentistry, engineering, ministry, and law, among many others. The literature

suggests that the ability to graduate and obtain professional licensure is key to successfully completing professional training. The ability to obtain professional licensure is measured by (a) degree completion (Duncan-Hewitt, 1996; Hardigan, Lai, Arneson, Robeson 2001), (b) graduate level GPA (Lobb & Wilkin, 2003), and (c) the passing of licensure exams (Bloom, Karp, Cohen 1998; Holt, Bleckmann, Zitzmann, 2006). Graduate licensure examinations are typically referred to as *candidacy*, *special*, or *general* examinations (Bloom et al., 1998), and they are specifically designed to test the student and to ensure that he or she has achieved an expert level of understanding of their discipline. Within the field of dentistry that licensure examination is the National Boards Dental Examination Part II. In the fields of nursing, pharmacy, and medicine the general exams are respectively, as follows: (a) The National Council Licensure Examination for Registered Nurses (NCLEX-RN) (Whitley & Chadwick, 1986), (b) the North American Pharmacist Licensure Examination (NAPLEX) (Broedel-Zaugg, Buring, Shankar, Soltis, Stamatakis, Zaiken, Bradberry, 2008; McCall, MacLaughlin, Fike, & Ruiz, (2007), and (c) the United States Medical Licensing Examination (USMLE Steps 1-3) (Vancouver, Reinhart, Solomon, Haf, 1990).

As descriptions for pre admission factors and graduate student success have been presented, what follows is a review of the literature on the graduate level training experience and the research studies that have identified relationships between pre- admission factors and student success within graduate level study.

Literature Review

Theories on Graduate Level Specialty Training

To obtain a graduate degree one must acquire specialization in a particular discipline of interest (Petrie, 1976). Within the context of the present study, examples of disciplines include engineering, nursing, pharmacy, and medicine. Specialization requires a narrow focus on developing the necessary skill level (Petrie, 1976) to become an expert in that discipline. Expertise is derived from substantial training, which is nontransferable (Glaser, Chi, Farr, 1988; Johnston, 2003) and utilizes higher order principles to solve problems with more accuracy (Johnston, 2003). In order for excellence to occur, the demonstration of acquired expertise is seen as a necessary requirement within the discipline of study (Marginson and Van der Wende, 2007). To gain a broader perspective of how graduate level training is structured the relevant theories are reviewed. This discussion includes an analysis of the theories assessing the nature of graduate level training; general system, experiential, student development, belonging uncertainty, human capital, and resource theories.

General Systems Theory and System Psychology

General systems theory (GST) can be used to explain the behavior of complex, organized systems like graduate level specialty training program. GST is a worldview that adopts a “systems thinking” (Ruben & Kim, 1975) approach to analyzing systems with complex interacting elements. Those elements include inputs, outputs, boundaries, an environment, and feedback loops (Bertalanffy, 1968). With regard to higher education, systems theory can serve as a bridge to the interdisciplinary areas of study within a system. An example of this would be the Rutgers School of Biomedical Sciences serving as the complex umbrella system that

incorporates the interdisciplinary areas of the School of Nursing, School of Health Related Professions, The School of Dental Medicine, and New Jersey Medical School within it. Systems psychology, therefore, is the branch of GST that is primarily concerned with human behaviors (Plas, 1986) and the characteristics of the people interacting with that system (i.e., individual motivational needs, rewards, expectations, and attributes) that contribute to making it effective or not (Behrmann, 1984).

Experiential Learning Theory

Experiential learning theory (ELT) is based on the works of 20th century scholars (John Dewey, Kurt Lewin, Jean Piaget, William James, Carl Jung, Paulo Freire, and Carl Rogers) who described experience as central to human learning and the development process (Kolb & Kolb, 2005), and who found that the way individuals learn tends to shape the course of their personal development. In fact, the needs for autonomy and self-efficacy make up critical components of the general theories on achievement motivation (Deci & Ryan, 1985).

The ELT developmental model (Kolb, 1984) includes three formal stages of development that lead to self-efficacy: (a) acquisition, (b) specialization, and (c) integration as they are interwoven into the fabric of graduate level curricula and training. Procedurally, students first acquire the foundational knowledge of their chosen discipline and retain it for application to studies and examinations. Next, students are guided towards developing their specialization through rigorous preparation, evaluation, and application. Last, completion of training requires that the successful integration of learned skills be demonstrated in real world practice settings, such as clinical laboratories or internships. It is important to note, however, that ELT is influenced by personality type, educational specialization, and career choice, (Kolb & Kolb,

2005), as well as culture (Yamazaki, 2003; Yamazaki, Murphy, Puerta 2002). The evaluation of a student's ability to engage in experiential learning can be better understood through student development theory and belonging uncertainty theory.

Student Development Theory

Student development theory is applicable to the graduate level training environment because it argues for a strong relationship between student development and co-curricular involvement (Astin, 1985). The term *co-curricular* refers to the activities, programs and learning experiences that complement what students are learning in school (The Hidden Curriculum, 2014). These activities are generally defined by their separation from the classroom, although they are considered an extension of the learning process. Examples of such activities include: involvement in the student newspaper, volunteerism, medical missions, debate competitions, and science fairs. The main aspects of student development theory are that co-curricular involvement is dependent upon: (a) the student's "inputs", such as demographics, background, and previous experiences; (b) the student's "environment", which is the higher education institution; and (c) the student "outcomes", such as their characteristics, knowledge, attitudes, beliefs, and values. Additionally, student development theorists (Astin, 1985) have found that a student's level of co-curricular involvement is linked to their educational outcomes, as well as the success of the higher education institution. In order to understand exactly how co-curricular involvement impacts learner outcomes we are guided through the lens of the five basic components of co-curricular involvement. First, when students are involved in activities outside the classroom that do not have academic credit an investment of both psychosocial and physical energy is required. It sends a strong message that the student is very interested in this activity,

and the activity may also reinforce his or her career goals. Second, involvement is continuous, but the amount of energy invested varies from student to student. Third, involvement can be both qualitative and quantitative. Fourth, what a student gains from being involved is directly proportional to the extent to which he or she is involved (in both aspects of quality and quantity). Finally, academic performance is positively correlated with student involvement. The application in real life experiences is evident in the following activities. The management of the student newspaper is supported through in-kind resources from the institution, such as the use of office space or technology, but the activity is conducted mainly by the students. The benefit to the student is the experience that is gained if one is interested in journalism or writing as a future career. In health science professions, such as nursing, medicine, and dentistry, the equivalent co-curricular activity is involvement in community service programs. The typical community service program incorporates a volunteer health service to a community in the vicinity of the training institution. This activity serves two purposes: the first is to connect the student to his or her immediate future career as a care provider, and the second is to gain some level of satisfaction from the learned experience. In summary, the more students are involved in co-curricular activities the more connected they feel to their career choice and the more motivated they are to continue their academic progress within the curriculum (Astin, 1985).

Belonging Uncertainty Theory

Student learning outcomes projected through educational learning and student development theories are impacted by student background (i.e., socioeconomic status, URM, cultural norms, etc), which in turn impacts his/her overall experiences. This co-dependence is explored by belonging uncertainty theory. Social belonging, or the ability to see oneself as

socially connected, is understood to be a basic human need (Baumeister & Leary, 1995; MacDonald & Leary, 2005). Researchers have (Bolger, Zuckerman, Kessler 2000; Spiegel, Kraemer, Bloom, Gottheil, 1989) presented the argument that favorable outcomes on the mental and physical well-being of the student can be predicted by how socially connected people feel. Within the context of academic achievement, at-risk students who participated in co-curricular activities and felt socially integrated with their friends demonstrated less school dropout (Mahoney & Cairns, 1997). Students who have trusting relationships with teachers or mentors were reported as better able to take advantage of critical feedback and other opportunities to learn (Brown & Campione, 1998; Caprara, Barbaranelli, Pastorelli, Bandura, Zimbardo, 2000; Cohen & Steele, 2002). Therefore, if social belonging is a critical component of academic achievement, URM student groups may be at a disadvantage because they are observing educational settings, particularly at the graduate level, where members of their group are numerically under-represented (Census Bureau, 2006) encounter overt and subtle forms of prejudice (Dovidio & Gaertner, 2000; Greenwald & Banaji, 1995; Harber, 1998; Uhlmann & Cohen, 2005) and receive lower grades (Grodsky & Pager, 2001; Steele, 1997). In summary, belonging uncertainty theory would suggest that an internalized hypothesis that “people like me do not belong here” (Bolger et. al, 2000; Spiegel et. al, 1989) exists, and that this further complicates the ability to form trusting relationships that are the essential components of success. The next section is an exploration of theories that describe how the educational environment is systematized to either support or hinder student development in the face of personal challenges.

Human Capital Theory

The theory of human capital (HCT) was defined as the stock of competencies, knowledge, and social and personal attributes embodied in the ability to perform and produce economic value through educational and job skills training (Simkovic, 2013). Further, investing in the development of a stock of competencies through the attainment of a graduate education expands and extends knowledge, which leads to raised productivity, higher earning, and improved health (Weisbrod, 1962). Described in simpler terms, the more a person contributes time and energy to attaining a graduate education, the higher his or her earning capacity. In analyzing the benefit of attaining a higher education such as a health professional degree in medicine or dentistry, fields for which the earning capacity is considered very high, HCT can be used to support the argument that once students decide to commit they persist in their pursuit of an HPS degree because they understand that it translates into increased earnings and the ability to contribute to their respective communities. This is in spite of any academic difficulties they may face in the pursuit of the successful completion of their degree (Alexander et al., 2009). Although the theory works as an effective descriptor of persistence, the continued rising cost of student indebtedness threatens to undermine its long-term applicability.

Resource Theory

Resource theory argues that if adequate resources are brought together in one place, student learning and development will occur (Astin, 1999). Within the academic setting, resources are defined as the wide range of ingredients that are believed to enhance student learning. Examples include physical facilities (laboratories, libraries, and audiovisual aids), human resources (well-trained faculty members, counselors, and support personnel), and fiscal

resources (financial aid, endowments, and extramural research funds). Many higher education administrators believe that the acquisition of resources, such as the faculty to student ratio is their most important resource (Astin, 1999). Many administrators believe that the lower the faculty to student ratio, the greater the chances of learning and development to occur and that by increasing the proportion of high-quality professors, they will strengthen the educational environment (Astin, 1999). Resource theory also suggests that high-achieving students are a resource in that the recruitment and retention of large numbers of high achieving students is perceived as an enhancement to the learning environment for all students. Although the restrictive components of this approach to the acquisition of resources are numerous, the focus of the present study is how this impacts student development. First, the recruitment of high quality professors within the academic setting is mainly associated with the known scholarly productivity and national visibility of the professor. There is little emphasis on the ability to work effectively with students from all backgrounds or the ability to teach effectively; two of the core components of successful student and institutional outcomes. Second, the concentration on recruiting large numbers of higher achieving students may inadvertently reverse efforts to diversify the student body and lock out students that come from educationally disadvantaged and lower income backgrounds (Zusman, 2005), particularly since higher academic achievement is strongly correlated with majority groups (Alexander et al., 2009; Johnson & Rosevear, 1977).

Student success refers to the successful completion of, and graduation from, a graduate-level specialty program. The following section bridges the gap between the theoretical and the practical, as it pertains to the specialties of engineering, nursing, pharmacy, and medicine.

The Impact of Pre Admission Factors on Graduate Level Student Success

The literature exploring pre admission factor relationship to graduate level student success degree completion and the obtainment of professional licensure is discussed in this section. Specifically the following preadmission tests are described: the Graduate Record Examination (GRE), the Pharmacy College Admission Test (PCAT), the Medical College Admission Test (MCAT), and the Dental Admission Test (DAT).

The GRE is the standardized test most commonly used to determine the scholastic aptitude of students applying to graduate school, and it consists of 93 scored items with five choices per item. For the present study the GRE was used for admission to the schools of engineering as well as nursing. The Educational Testing Service (ETS) is the organization that produces the GRE (Graduate Records Examination Board, 2003) exam. ETS described the focus of the exam as a measure of the test taker's ability to solve problems, synthesize information, and reason the complex relationships between pieces of information; all of which are relevant to graduate studies (Graduate Records Examination Board, 2003). Specifically, the test was designed to assess three specific abilities: verbal (GRE-V), quantitative (GRE-Q), and analytical (GRE-A). The literature that has assessed the relationship of the GRE to graduate school performance spans over 40 years (Fenster, Markus, Wiedemann, Brackett, Fernandez, 2001; Madus & Walsh, 1965; Omizo & Michael, 1979; Powers, 2004; Rhodes, Bullough, Fulton, 1994), and the results from these studies recognize that the GRE does predict certain facets of success in graduate school. The literature also points to a variance with respect to the test's ability to predict positive graduate school outcomes, showing that, on average, GRE scores accounted for less than 10% of the variation when compared to other criteria (e.g., cumulative

graduate GPA, 1st-year graduate GPA) (Fenster et. al, 2001; Madus & Walsh, 1965; Omizo & Michael, 1979; Powers, 2004; Rhodes et. al, 1994). Nonetheless, research has supported the continued use of the GRE in forensic psychology (Fenster et al., 2001; Norcross, Haynch, Terranova, 1996), nursing (Ainslie, 1975) and veterinary medicine (Powers, 2004).

The Pharmacy College Admission Test (PCAT) is endorsed by the American Association of Colleges of Pharmacy (AACCP) as the preferred admissions test for entrance to pharmacy school (www.PACTweb.info). The purpose of the PCAT is to help identify qualified applicants to pharmacy colleges. It measures general academic ability in the areas of writing and verbal and reading comprehension, as well as general scientific knowledge in the areas of biology, chemistry, and quantitative ability (www.PACTweb.info). The design and content of the PCAT are determined by the types of abilities, aptitudes, and skills deemed essential by colleges of pharmacy. Periodic reviews of the test content are conducted with deans, faculty, and administrators from schools of pharmacy to ensure that test items reflect the most current standards of what is important to examine for students in the field.

The Medical College Admission Test (MCAT) is a standardized, multiple-choice examination designed to assess the preparedness of applicants for medical school. Its purpose is to test the skills and knowledge that medical educators and physicians have identified as key prerequisites for success in medical school and the practice of medicine. Examinees are tested in the areas of problem solving, critical thinking, and knowledge of science concepts and principles that are considered prerequisite to the study of medicine (<https://www.aamc.org/>). Scores are reported in physical sciences, verbal reasoning, and biological sciences. Medical schools in the US and Canada require the submission of MCAT exam scores, but do not accept MCAT exam scores that are more than 3 years old.

The DAT is a multiple-choice standardized exam taken by applicants to dental school in the United States and Canada. The DAT is conducted by the ADA and has been administered since 1950. It is designed to measure general academic ability, comprehension of scientific information, and perceptual ability. Administered by the ADA, the test is comprised of four sections: the natural sciences (90 minutes), perceptual ability (PAT) (60 minutes), reading comprehension (60 minutes), and quantitative reasoning (45 minutes). The first section is divided into questions about biology (40 questions), general chemistry (30 questions), and organic chemistry (30 questions). The second section is divided into six different problem sets designed to test perceptual ability, specifically in the areas of three-dimensional manipulation and spatial reasoning. The third section of the DAT is composed of three academic essays, each of which is followed by questions about the content of the passage. The final section tests basic mathematics skills, with emphasis placed on algebra, critical thinking, fractions, roots, and trigonometric identities.

The following sections summarize the literature regarding how preadmission factors impact graduate student success in the disciplines of engineering, nursing, pharmacy, and medicine.

Engineering

A study by Holt et al. (2006) examined the ability of performance on the Graduate Record Examination (GRE) to predict the success of students attending the Graduate School of Engineering and Management at the Air Force Institute of Technology was conducted. The Air Force Institute of Technology is the only master's level engineering management program accredited by the Accreditation Board for Engineering and Technology (ABET), and it awards

both master's and doctoral degrees in 14 areas of study, provides graduate education, research, and consultation to improve operations within the U.S. Department of Defense.

The focus of this study (Holt et al., 2006) was to measure the extent to which the verbal, quantitative, and analytical tests of the GRE predicted success, including cumulative GPA and thesis grade, while other variables that explained certain variances in graduate school success were controlled. The academic records of all the students graduating with a Master of Science degree from the engineering management program at the Air Force Institute of Technology during the period of 1995 to 2004 ($n = 221$) were considered. With regard to the GPA, both the cumulative GPA and first-year GPA, were considered a part of the assessment. The thesis grade represented students' demonstrated analytical, creative, practical, and research abilities. Professional licensure was also measured, and it was used to represent the attainment of professional success. Hierarchical multiple regression was used to test the incremental predictive validity of GRE scores. Each of the control variables (age, gender, undergraduate GPA, and time between undergraduate and graduate programs) was added to the regression model to test for level of prediction for each of the outcomes (i.e., first year GPA, cumulative GPA, and thesis grade), then GRE-Q and GRE-V scores were added to the equations to ascertain any increase in explained variance. Finally, the GRE-A score was added in the third step, by itself, because most schools do not consider this score as candidates are evaluated.

The results demonstrated that a student's GRE-V score was the best preadmission predictor of first-year performance and cumulative GPA performance. Specifically, the data showed that GRE-V was positively correlated with the end of the first year GPA ($.37, p < .01$) and cumulative GPA ($.34, p < .01$). These results are consistent with the Graduate Record Examination Board's (2003) findings that the correlation between the GRE-V score and first-

year grades for engineering graduate students to be $r=.27$ and smaller relationships between the GRE-Q and these students' grades ($r = .22$). On the other hand, none of the GRE scores was effective in predicting performance in research. Of these, the student's undergraduate GPA (i.e., mean values were .38, significant for each model) and time between the degree programs (i.e., mean values were .35, significant for first-year and cumulative GPAs appeared to be the strongest indicators of program success.

In summary, the GRE-V score was the most predictive of student performance (Holt et al., 2006). On the other hand, the fact that the GRE-A scores did little to predict analytical ability might be cause for concern, as analytical ability is a critical aspect of performance and the most important professional decision making aspect of an engineering manager.

Nursing

Regarding the field of graduate level nursing, Crosby, Iyer, Clayton, and Downing (2003) conducted a study to determine the most important prerequisites and preadmission characteristics of students applying to Advanced Practice Nursing (APN) programs. The two types of graduate nursing programs that were examined as part of this study are Nurse Practitioner programs (NPs) and Certified Registered Nurse Anesthetists programs (CRNAs). They are the two nursing specialties most dependent on clinical nursing skills, and they have specific prerequisite requirements for admission, such as the completion of basic nursing education, a baccalaureate degree, registered nurse (RN) licensure, and a minimum of 1 year experience as an RN in an acute critical care area (Elnitsky, Cato, Nichols, 1999). The purpose of the study was to identify the competencies and characteristics needed to be successful in NP/CRNA programs. Part I of the study consisted of focus groups that consisted of APN program faculty (16 participant sample) members who were asked to share their views on the characteristics that shape the

successful NP/CRNA student. The responses were organized into the following categories: 20 personal characteristics, 14 professional characteristics, 9 clinical skills, and 12 kinds of clinical experiences. Part II consisted of mailing a survey to program and admissions directors of NP/CRNA programs in the US.

Analysis of the results in Part I were based on a 73% response rate. The applicants most likely to succeed in an NP/CRNA program were described as having been admitted with a baccalaureate degree from a National League of Nursing accredited program, having a grade point average of 3.0 or higher, having taken the Graduate Record Examination (GRE), having work experience (typically of 1 year or less), having in-state licensure, having taken additional prerequisite courses, having references, and having completed an interview and a statement of goals. For Part II, a total of 48 surveys were completed for a 33% response rate. The trends discovered in the data were that most programs (86%) required a minimum GPA of a 3.0 (64%). GRE scores were required by 62% of the programs, with acceptable scores ranging from 400 to 550, and most programs requiring a score of 500 (40%). Ninety percent of the respondents indicated that they had other specific criteria, such as a bachelor's degree in nursing (83%), recommendations (83%), and an interview (59%). In the personal characteristics category the qualities that scored as *most important* (90%) included ethical, critical thinker, responsible, and demonstrates good judgment. In the professional characteristics category; 50% of the qualities scoring as *very important* were the a) clinically competent and, b) advocates for patients qualities. The other qualities (50%) that were found to be *somewhat important* were a) awareness of professional issues, and b) translates theory into practice. In the clinical skills category; 44% of the qualities rated as *very important* included a) effective interpersonal communication, and b) synthesizes information from various sources. The remaining qualities

(66%) found to be *somewhat important*, included a) experience in acute area of specialty, and b) manages acute episodes of care.

In summary, these results suggest that the candidate most likely to succeed at an NP/CRNA program, besides having met the appropriate academic standards (GRE, BA degree, etc), was also ethical, trust-worthy, responsible, utilized good personal judgment, demonstrated clinical competency, advocated on behalf of patients, and desired the expanded role of the APN.

Pharmacy

The pre-professional curriculum required to pursue a Doctorate in Pharmacy (PharmD) degree includes at least 2 years of university or college course work (Boyce and Lawson, 2009) and encompasses basic sciences courses (general and organic chemistry, biological sciences with a focus on human processes and diseases, mathematics, informatics, communication technologies, and physical sciences), and additional course work in the humanities, social sciences, and communications (Accreditation Council for Pharmacy Education, Standard 17.1). Lobb & Wilkin (2003) reported that the factors most closely associated with success in pursuit of a PharmD degree and/or licensure include undergraduate performance; motivation; community service orientation; and abilities in communications, critical thinking, empathy, chemical sciences, biological sciences, and mathematics. The chemical sciences are an integral part of the development of knowledge in pharmaceuticals, compounding, and the actions of drugs, while mathematic ability is important for drug dosing and pharmacokinetic calculations (Duncan-Hewitt, 1996).

In a study conducted by McCall, MacLaughlin, Fike, and Ruiz, (2007) the pre-pharmacy variables that predict graduate performance on the North American Pharmacist Licensure

Examination (NAPLEX) were identified. The results indicated that for PharmD programs participating in the Pharmacy College Application Service (PHARM CAS): (a) Grades in organic chemistry are associated with first-year success (McCall et al., 2007), b) advanced course work in chemistry and taking organic chemistry at a 4-year institution were associated with higher PCAT chemistry subtest scores (McCall et al., 2007). Success on the NAPLEX was most associated with the PCAT chemistry score, while having a Baccalaureate or Master's degree did not correlate with success on the NAPLEX (McCall et al., 2007). First-year and overall pharmacy GPA each correlated with pre-professional mathematics GPA and PCAT Quantitative (PCAT-Q) or mathematics scores in some but not all studies. Advanced course work in mathematics correlated with higher PCAT-Q scores, while performance on the NAPLEX also correlated with the PCAT-Q but not with advanced mathematics courses prior to entering the professional program (McCall et al., 2007). 2) *Communication ability*, which is assessed via the PCAT verbal subtests of structured interviews, writing samples, and verbal standardized multiple-choice tests correlates with academic performance and performance on the NAPLEX (McCall et al., 2007). Success in PharmD programs overall is also correlated with communication ability and the PCAT reading subtest score in particular correlated with cumulative pharmacy program GPA (Duncan-Hewitt, 1996; Hardigan et al., 2001), 3) *Critical thinking ability* assessed through the various tests at the time of admission (California Critical Thinking Skills Test, California Critical Thinking Disposition Inventory) correlates with the overall PharmD GPA, the first through third year GPA, the GPA in advanced pharmacy practice experiences (APPEs), and scores on the NAPLEX (Kidd & Latiff, 2003) (McCall et al., 2007). 4) *Ethics & Moral reasoning ability*, assessed at the time of admission despite difficulties in

evaluating it, found that pharmacy students and practitioners scored lower on moral reasoning tests than medical and dental students.

Medicine

Various researchers (Vancouver, Reinhart, Solomon, & Haf, 1990; Dawson, Iwamoto, Ross, Nungester, Swanson, Volle, 1994) have reported undergraduate (UGPA + MCAT) scores to be valid predictors of performance on the United States Medical Licensing Examination (USMLE 1), the first step of a three-step examination for medical licensure in the United States. In a study conducted by Vancouver, et al. (1990), a sample of 579 medical students who were attending medical school between the years of 1979-80 and 1983-84 was analyzed. Utilizing multiple regression analysis, Vancouver et al., (1990) examined the Medical College Admissions test (MCAT) scores and GPA of undergraduate science courses (S-GPAs) for predictive validity and differential prediction of USMLE Part I scores.

The results indicated that using the SGPA and a composite MCAT score that included biology, chemistry, physics, science knowledge, and reading subtests was valid and predictive of both majority and minority students, although differences existed in the mean of both performance factors between the two groups. When examining predictors of clinical performance were examined, several researchers (Hampton, Collins, Perry, Meydrech, Wisner, Morrison, 1996; Ripkey, Case, Swanson, 1997; Whalen & Moses, 1990) reported that clerkship timing impacted performance on the USMLE and final grades, in that significant improvement in USMLE subject examination scores (obstetrics & gynecology) and final grades (pediatrics, surgery and obstetrics & gynecology clerkships) were reported as the academic year progressed.

Other Factors Impacting Graduate Level Student Success

Apart from the aforementioned preadmission factors, other factors have been found to be important in predicting graduate student success. The following is a description of how gender, race, finance, and critical thinking/analytical ability, and ethics/moral reasoning were found to impact graduate level training.

Gender

Perceived climate in engineering programs may be a co-factor with gender as students' feelings of belongingness is found to either be a detriment or an enabler to their retention in those programs. In fact, the term "chilly climate" was used to describe educational practices and environments that treat men and women differently (Sandler, Silverberg, Hall, 1996) and thus had an adverse impact on the retention rate for women (Marra, Rodgers, Shen, Bogue, 2012). In the year 2004, Zhang, Anderson, Ohland, and Thorndyke analyzed student success in the field of engineering. Out of the eight universities participating in that study, the graduation rate for males was higher than for females at three of those universities, while the graduation rate was higher for females at only one of the eight. Overall the study found that although gender played a role in graduation outcomes, it was not necessarily impactful in a consistently positive or negative way.

Race

In a study that examined the field of medicine, Vancouver et al. (1990) completed a retrospective analysis of existing records from the Association of American Medical Colleges (AAMC), and they used multiple regression methods to investigate racial and ethnic differences

on the USMLE Part I examination, provided that all students participating in the study had similar MCAT scores, UGPAs, and other pre admission factors. Significant differences in performance based on race/ethnicity, with White students scoring the highest, followed by Asian/Pacific Islanders, Hispanics, and Blacks. When the differences in academic background were controlled for it greatly reduced Part I differences among most racial and ethnic groups, and the results were consistent for 3 consecutive years. In another study spanning 30 years Veloski, Callahan, Xu, Hojat, and Nash, (2000) found the variables of race, gender, and MCAT scores to be consistently more predictive of performance on the USMLE licensing exam than undergraduate GPA (UGPA). Meanwhile research conducted by Cooper, Roter, Johnson, Ford, Steinwachs, Powe (2003) and Saha, Arbelaez and Cooper (2003) found UGPA to be the most significant predictor of academic performance in the first year of medical school (M1) and the second year (M2) for both majority and minority students, while the MCAT score was found to be a significant predictor of M1 performance for majority students only. With regard to the effect of clerkship timing on URM student performance, Reteguiz, Davidow, Miller, and Johanson (2002) reported that academic performance improved with time and varied among the racial-ethnic groups. All groups achieved higher scores in USMLE examinations scheduled later in the year, but the scores of African American and Hispanic students, in particular, increased to a greater degree than other students.

Finances

Due to data limitations the role of finance was not directly assessed in this study. A full description of this limitation is presented in Chapter III. The important role that finance plays is recognized, nonetheless, with regard to its relationship to participation rates for URM students in

dental school. Essentially, finances are important because within the health profession fields of medicine and dentistry increased tuition rates have impacted URM students disproportionately. Research (Bailit et. al., 2006; Chmar et al., 2007) has found that the enrolment of students from higher income families has increased as tuition costs rise, while the number of students coming from lower income minority families has decreased. A recent study by the United Health Foundation (UHF, 2012) collected data from a survey of 497 minority students enrolled in higher education institutions and reported that about 98% of the respondents cited the lack of available funding as a significant barrier to their career aspirations in healthcare. As reported by the Association of American Medical Colleges (AAMC, 2008), tuition has been on such a steady increase that nearly 75.5 % of graduates are carrying debts of at least \$100,000. Access to graduate health professional schools is impacted by finances in that the number of students with parental incomes of \$100,000 or greater who matriculated at health professional schools between the years of 1998-2006 increased from 35.1% to 44.2 %, while the number of students with parental incomes of less than \$50,000 showed a steady decline from 32.4 % to 25.8 % during those same years (Bailit et al., 2006; Chmar et al., 2007). The cost of tuition at dental schools across the county has risen steadily since the year 2000, and it has resulted in 75.5% of dental students and 87.6% of medical students carrying outstanding loans of at least \$100,000 by the time of graduation (author, year??). By comparison, the average debt of graduating medical students increased in 2007 by 6.9% in just 1 year.

Critical Thinking, Analytical Ability, Ethics, and Moral Reasoning

The impacts of critical thinking and analytical ability on student success are growing, however this is another area where this study is limited. This limitation was discussed in

Chapter III. Within the nursing profession, as well as pharmacy, the ability to think critically and to demonstrate the ability to analyze and make decisions that are both ethical and moral has been found to be an essential part of training. In a study conducted by Crosby et al. (2003), the qualities of ethical decision making, critical thinking ability, responsibility, and good judgment were found to be among the most important (90%) personal characteristics that APNs should possess. In the literature on pharmacy, ethics and moral reasoning were among the top 5 most important attributes needed for admission (McCall et al., 2007). It is so important that ethics and moral reasoning are included in admissions factors because pharmacy students were found to perform lower than medical and dental students on ethical reasoning scales (McCall et al., 2007). The argument in support of this change to pharmacy admissions policies is that pharmacy students are exposed to ethical dilemmas throughout their educational curricula; that is, during on-campus courses, introductory pharmacy practice experiences, professional organization activities, and pharmacy work experiences (Lobb et al., 2006).

Summary of the Literature

There is no question that preadmission factors are an important aspect of the higher educational pathway that contributes to certain levels of success. In pharmacy, student success on the NAPLEX was best predicted by the PCAT chemistry score (Chisholm, Carter, Ames, Morison, 1995; McCall et al., 2007; Ried & McKenzie, 2004). In the field of medicine, MCAT score, as well as other variables such as race and gender, were consistently more valuable than UGPA as predictors of student performance on the USMLE licensing exam (Veloski et al., 2000). The UGPA was identified as the most significant predictor of cumulative GPA in the first and second years of medical school for both majority and minority students (Cooper & Roter

2003; Saha et al., 2003). Nonetheless, the relationship between preadmission factors and URM student success in graduate schools does not seem to be as strong as it is for majority racial/ethnic groups (Fredericks & Mundy 1976; Gough & Hall 1975; Ingersoll & Graves 1965; Korman, Stubblefield, Martin, 1968; Reid & Blain 1977).

Limitations of Prior Research

The scope of the research exploring the relationship between preadmission factors and student success within the field of dentistry is limited. Specifically, prior research has two limitations, which suggests an urgent need for the present study. The prior research is limited in its ability to specifically demonstrate preadmission factor relationship to success in dental school. In particular, it is not very clear as to whether, and if so how, preadmission variables relate to successful graduation from dental school, and if there are any differences across racial ethnic groups. Previous studies have focused primarily on the correlation of preadmission factors to clinical clerkship performance in medical school (Cooper & Roter 2003; Downie., 1994; Flowers , 1996; Saha et al., 2003; Leger, 1997), therefore, in the present study, the examination of the relationship between preadmission factors and successful graduation, as measured by licensure obtainment and degree awarded status, provides important information for policy makers and recruitment specialists in dentistry.

Proposed Study

This study assessed the relationships between preadmission factors that are required for entry into dental school, academic progress in dental school (DS GPA), and successful graduation (licensure obtainment and degree awarded status) for students admitted to dental

school between the years of 1998-2009. Part of the analysis examined the role that race played on outcomes. Data from an accredited dental school in the northeast was collected and evaluated in order to answer the following research questions:

1. To what extent do preadmission factors (specifically UGPA and DAT score) predict the student's academic performance during the first 2 years of dental school (DS GPA)?
2. To what extent do preadmission factors (specifically UGPA and DAT score) predict a student's ability to successfully obtain a license to practice dentistry (licensure obtainment)?
3. To what extent do preadmission factors (specifically UGPA and DAT score) predict a student's ability to successfully obtain a graduate diploma in dentistry (degree awarded status)?
4. Are there any racial/ethnic differences in these three outcomes?

The theories guiding this study included experiential learning theory, human capital theory, and belonging uncertainty theory. Experiential learning theory has tremendous applicability to the type of training that is provided at the graduate professional level. Experiential learning theory describes the attainment of specialization through the acquisition of an expertise skill level. The students, through sacrifice and effort, eventually arrive at the necessary knowledge and skill to become experts in their chosen discipline. The successful acquisition of that skill is evaluated with tests and examinations that must be passed if one is to graduate. The ELT developmental model (Kolb, 1984) includes educational stages of development that are present in graduate professional training: (a) acquisition, (b) specialization, and (c) integration, which are interwoven into the curricula. Due to the fact that ELT is

influenced by type of specialization and career choice (Kolb & Kolb, 2005), human capital theory (HCT) was the second theory guiding my study. HCT posits that a graduate education expands and extends knowledge, which leads to raised productivity and a higher earning capacity (Weisbrod, 1962). Belonging uncertainty theory (BUT) was the third theory chosen to guide my study because it recognizes that there may be psychological barriers that are faced by URM students in environments where they are not represented amongst their peers, mentors, or within the leadership, a distinction that is especially true of dental schools in the US (Bailit & Beazoglou, 2003; Bailit et al., 2006).

This study is significant because it examined dental school admissions practices. By identifying the extent to which preadmission factors predicted successful degree completion, important information is provided for policy makers looking to update their dental school admissions procedures in response to the changing American educational landscape. According to the U.S. Census Bureau (2006), the American population and its educational needs are growing more multiracial. As such, research is needed to help fill policy gaps with regard to preadmission assessment and to address persistent concerns about the diversification of the student body at American dental schools. This importance of this study is supported by the findings that suggest that a shortage of URM students in biomedical science fields that lead to the pursuit of dental degrees ultimately devastates the American healthcare system (Anderson et al., 2008) (The Sullivan Commission, 2004). A shortage of URM health professionals leads to greater health disparities, is costly to the American taxpayer (The Sullivan Commission, 2004) and compromises the financial stability of the US (World Health Organization, 2000). URM students play an important role in mitigating health disparities because, according to the United

Health Foundation (2012), they are the ones most likely to practice in underserved areas that have the greatest health disparities.

Chapter III

METHODOLOGY

Research Design

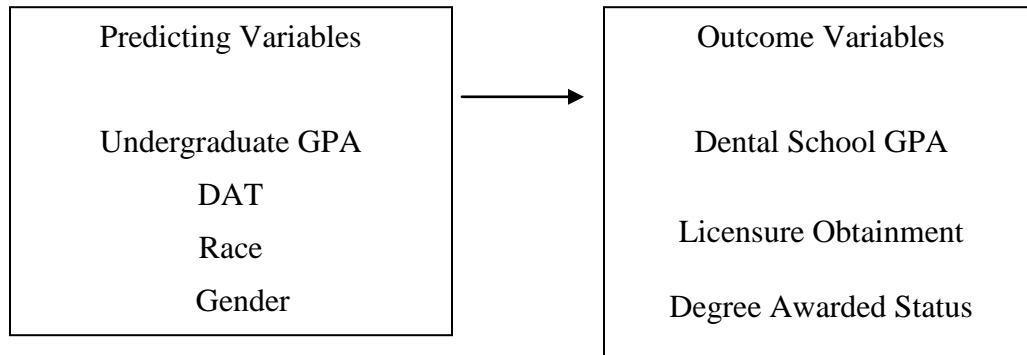
To restate the main purpose of this research, the goal is to assess the relationship of preadmission factors to success in dental school. Preadmission factors, defined broadly, are the collection of scores used to assess the academic and personal readiness of a prospective student to enter graduate level specialty training (Alnasir & Jaradat, 2011; Al-Rukban et al., 2010). In order to be considered for entry into dental school, an evaluation of preadmission factors must include the UGPA and the DAT (American Dental Education Association, 2008). Building upon the prior research and adjusting for its limitations, this study broadens the understanding of student achievement beyond performance in dental school to include successful graduation, as measured by licensure obtainment and degree awarded status. This chapter presents the research model, the research questions, the data source, sample size, research variables, research methods, and the statistical analysis that were used to answer the research questions.

Research Model

The conceptual framework for this study is based on experiential learning theory, human capital theory, and belonging uncertainty theory. Collectively these theories provided a rich context from which to better understand the pursuit of graduate-level specialty training.

Experiential learning explores the environment and how that environment supports the learning process of the student from novice to expert in that specialty (Kolb & Kolb, 2005). As such, students in graduate programs of dentistry are transitioning from novice to expert and are thereby confronted with issues pertaining to persistence, motivation achievement, autonomy, and skill building (Kolb & Kolb, 2005). With regard to human capital theory, students pursuing a dental degree are making financial investments in their future growth and economic potential, which in turn contributes to our society (Simkovic, 2013). Though not directly analyzed in this study due to limitations in the availability of sufficient data it is still recognized as a motivational factor in the sacrifices that are made to obtain a dental degree. These sacrifices appear in the willingness of students to assume the high costs required to acquire the skills necessary to become a dentist, and these sacrifices are perceived as a tradeoff for improved future earnings and an elevated standard of living. Belonging uncertainty theory provided the social psychological context from which to understand the role of belongingness as it relates to the level of exposure to other students and faculty from the same racial and /or ethnic groups. This theory has been applied to the experiences that URM students encountered on campuses of graduate specialty education (Dovidio & Gaertner, 2000; Grodsky & Pager, 2001; Greenwald & Banaji, 1995; Harber, 1998; Uhlmann & Cohen, 2005; Steele, 1997).

Figure 1: Preadmission effects on Graduation Status



Research Questions

This study addressed the following questions about students who were admitted into a dental school located in the northeast United States between the years of 1998-2009:

1. To what extent do preadmission factors (specifically UGPA and DAT score) predict the student's academic performance during the first 2 years of dental school (DS GPA)?
2. To what extent do preadmission factors (specifically UGPA and DAT score) predict a student's ability to successfully obtain a license to practice dentistry (licensure obtainment)?
3. To what extent do preadmission factors (specifically UGPA and DAT score) predict a student's ability to successfully obtain a graduate diploma in dentistry (degree awarded status)?
4. Are there any racial/ethnic differences in these three outcomes?

Hypothesis Statement

The study of the relationship between preadmission factors and successful graduation was based on the following three hypotheses:

Hypothesis 1. Preadmission factors are not directly predictive of academic performance in dental school.

Hypothesis 2. Preadmission factors are not directly predictive of successfully obtaining a license to practice dentistry (licensure obtainment).

Hypothesis 3. Preadmission factors are not directly predictive of successfully obtaining a graduate diploma in dentistry (degree awarded status).

Hypothesis 4. There are no differences across racial/ethnic groups in the statistical outcomes measuring performance in dental school, licensure obtainment, and degree award status.

Data Source

The source of the data for this study was a state dental school in the northeast United States that is located in an inner-city area. The mission of the dental school is to improve oral health and the quality of life through: (a) the education of oral health professionals and scientists, (b) the conduct of research, (c) the promotion of health and disease prevention, and (d) the delivery of oral health care to communities throughout the state and beyond. As the only dental school in the state, it is a major resource for both graduate dental education and postgraduate specialty education. Students are able to acquire the needed expertise—such as gaining valuable hands-on experience that also enhances their interpersonal skills and cultural competency--through faculty supervised patient care sessions in dental clinics and extramural sites.

The dental school is part of a larger university setting that serves an entire state, along with seven other health professions schools. The larger university also owns a teaching and safety-net hospital, a comprehensive cancer center, a statewide network of behavioral healthcare centers, and has affiliations with leading healthcare facilities, institutions of higher learning, as well as other agencies.

This particular dental school was selected for this study because of its large student population and the diversity of its student body. Multiple cohorts were used to form a large sample so that an in-depth longitudinal assessment of preadmission factors and their relationship to successful graduation could be made. Data for 1,275 dental students who were admitted to the dental school between 1998-2009 were analyzed. To obtain this data a formal request was made to the Institutional Review Board (IRB) of the University for Permission to access and evaluate the data available from the Registrar's Office of the university. Following approval by the IRB, of the research proposal, the data was downloaded to a USB drive.

Research Variables

Successfully graduating from dental school requires completion of a 4-year academic program and passing the dental licensure examination, known as the National Boards. As legislated by the Joint Commission on National Dental Examinations (JCNDE, 2015) the National Board Part II is the standardized test utilized to evaluate the preparedness of students for the practice of dentistry. The purpose of this examination is to assist state boards in determining who is qualified to obtain a license and practice dentistry. Under JCNDE regulations a student must receive a minimum passing grade of 75 % on the exam (Joint Commission on National Dental Examinations, 2015). The outcome variables that measured dental school

success in the present study are the cumulative dental school GPA, degree awarded status, and licensure obtainment. The following is a description of all the variables for this study.

Dependent Variables

- The dental school (DS) GPA is a continuous variable that is recorded for each student and represents their academic achievement while in dental school.
- Licensure obtainment (National Boards Part II performance) – is a dichotomous categorical variable reported as either Pass or Fail. Part II is taken in the senior year and certifies dental students for the obtainment of their licensure. The exam covers nine discipline areas: endodontics, operative dentistry, oral and maxillofacial surgery, oral diagnosis, orthodontics, pediatric dentistry, patient, management, periodontics, pharmacology, and prosthodontics.
- Degree awarded status is a dichotomous categorical variable that indicates whether a student was awarded their degree or not.

Independent Variables

- The UGPA is a continuous variable recorded for each student that represents their academic achievement at a college or university.
- The DAT is a continuous variable recorded for each student and represents their achievement on a multiple-choice standardized exam taken by applicants to dental school. The DAT is made up of the following four sections: (a) the natural sciences (i.e., biology, chemistry and organic chemistry, 90 minutes); (b) perceptual ability (three-

dimensional manipulation and spatial reasoning, 60 minutes); (c) reading comprehension (60 minutes); and (d) quantitative reasoning (basic math, algebra, critical thinking, fractions, roots, and trigonometric identities, 45 minutes).

Control Variables

The control variables stand between the independent and dependent variables and mediate the effects of the independent variable on the dependent variable. Researchers will often utilize statistical procedures such as the analysis of the covariance to measure the impact of control variables on the outcome. They may be demographic or personal variables (age or gender) that need to be controlled so that the true influence of the independent variable on the dependent can be determined. The following are the control variables for the present study:

- Race is the student's race or ethnicity. It is a dichotomous variable.
- Gender is whether the student is male or female. It is a dichotomous variable.

Statistical Analysis

The Research Questions

The first question asked: to what extent do preadmission factors (specifically UGPA and DAT score) predict dental school GPA? Previous research has established a relationship between preadmission factors and first and second year graduate school performance (Holt et al, 2006); therefore, assessing the impact of preadmission factors on the cumulative dental school GPA will advance the research in this area. The second question asked the extent to which preadmission factors (specifically UGPA and DAT score) predicted a student's ability to successfully obtain a license to practice dentistry. This is another area where the research was advanced through my

study, as the literature has generally observed the impact of preadmission factor onto the clerkship years, which is only the third year of medical school (Hampton et al., 1996; Ripkey et al., 1997; Whalen & Moses, 1990;). The next research question asked the extent to which preadmission factors (specifically UGPA and DAT score) predicted a student's ability to successfully obtain a graduate diploma in dentistry. The fourth and final research question sought to explore if any differences existed in the outcomes measured for dental school performance, licensure obtainment, and degree award status across the racial ethnic groups.

Design of the Study, Dealing with Missing Data

The sample in this study was students who were admitted to dental school between the years of 1998-2009. A total of 1,275 dental student cases were collected from the Registrar's Office of the University for analysis. An issue encountered while conducting the analysis was missing cases. Nonrandom missing cases did appear in the data collected. In an attempt to minimize the impact of missing cases on the outcome of the data analysis, the cases with missing information were deleted through case list wise exclusion in the SPSS software.

Descriptive Analysis

The goal of the present study was to assess the predictive ability of UGPA and DAT on successful academic performance in dental school as measured by cumulative DS GPA, licensure obtainment, and degree awarded status. The goal of the analysis was to measure the impact of the preadmission factor on the outcome variables, and then to relate that finding to implications for future policy and procedure. In Chapter IV a full discussion of the analysis is presented, including the strength of the relationships between variables. Multiple and linear regression analysis were the methods of data analysis.

Multiple Regression Analysis

Multiple regression analysis is the assessment of relationships between multiple predicting variables and one continuous dependent variable (Allison, 1999). Multiple linear regression (MLR) was the multivariate statistical technique used in this study to examine the linear correlations between four independent variables (i.e, UGPA, USGPA, DAT, DAT Science) and one continuous dependent variable (DS GPA). The results are presented in tables followed by a discussion of the analysis and outcomes. The combination of the following statistical analysis statistics provides reasonable support for the decision to either retain or reject the null hypothesis (H_0). The first is the value for Beta. The Beta for each variable was presented indicating the relative strength of each predictor on a scale ranging from -1 to 1 (Pallant, 2010; Witte & Witte, 2007). The positive or negative symbol of Beta tells us the direction of a predictor's relationship, as in which factors increase the likelihood of a yes answer and which factors decrease it (Witte & Witte, 2007). Next, the standard error (σ) of the mean is a measure of the average amount by which sample means differ, just by chance, from the population mean (Witte & Witte, 2007). Lastly, an evaluation of the significance level for each predictor explains whether or not the independent variable made a unique statistically significant contribution to the outcome. Statistical significance is $p < .001$; $p < 0.01$; or $p < 0.05$, whereby a small p value tends to discredit the null hypothesis and to support the research hypothesis. The combination of all three diagnostics discussed provides strong support for making decisions about rejecting the null hypothesis or not (Witte & Witte, 2007).

Logistic Regression Analysis

Logistic regression analysis was utilized in the assessment of the dependent categorical variables. Within this study there are two dependent variables, licensure obtainment (Pass/Fail), as well as degree awarded status (Yes/No), which together were used to indicate successful graduation from dental school. Binary logistic regression analyses were conducted on the two outcomes to assess the relationships with independent variables. Odds ratios are reported to assess the measure of the association between the independent and dependent variables, as well as explain how well the set of independent variables predicts the categorical dependent variable (Pallant, 2010; Witte & Witte, 2007). The dichotomous variables of gender and race were included in the analyses. Race and gender were recoded into dummy variables. The dummy variables were assigned a value of either 0 or 1 to indicate the absence or presence of one or the other variables. Within the race/ethnicity variable categories, the category assessing “Two or More Races” did not contain enough cases to include in the analysis (2 or .18%), therefore it was removed, leaving White, Asian, and URM categories.

Limitations of this Study

This study was limited in four major areas. The first limitation is found in the nature of regression analysis because it cannot be used to discern cause and effect relationships. As an example the issues associated with a) the URM student academic achievement gap, and b) difficulties encountered at the K-12 levels are not possible to explore. The second limitation was in the availability of complete data sets. Specifically, complete data sets with all of the needed variables--financial aid need, socioeconomic status, and critical thinking skills--were unavailable. With regard to financial aid need and socioeconomic status the study site was

unable to provide the data for years 2002-2004. As such the data set would have been restricted to students who were admitted to dental school between the years 2001-2009 and also decreased the total n to 738. The third limitation was the limited data available regarding student participation in social groups, clubs and associations. Specifically, students volunteer to join clubs and associations, but they are not required to participate. Additionally, student participation in community service was solely managed by students through the student organizations. At the time data collection and reporting was not required of student organization leaders resulting in a data pool that was inconsistently reported and thus unreliable. This factor limited the ability to use belonging uncertainty theory in drawing conclusions from student participation in community service. The fourth limitation was the lack of sufficient data in the student cohort across racial ethnic groups. This produced a barrier in the ability to conduct meaningful analysis to compare across subgroups.

The sample for the present study consisted of 1,275 dental students who were admitted to dental school between the years 1998-2009. The study focused on this particular category of graduate professional students to present a comprehensive assessment of dental school student performance up to graduation and the obtainment of licensure across multiple cohorts.

Chapter IV

RESULTS

This chapter includes the narrative description, statistical analyses, and outcomes of the present study. The preadmission factors that are required for entry into dental school, student academic performance, and successful graduation were evaluated, and the role of race those relationships was examined.

Description of the Sample

Following the review and approval by the Institutional Review Board (IRB) of the university, the data for 1,275 students who were admitted to dental school between the years 1998-2009 was collected from the Registrar's Office. After missing cases were deleted, 1,100 cases were included in the data analyses.

Background Characteristics

Gender was self-reported ($n=1,100$) by the student as either male or female. Female students made up 53% of the sample, in comparison to male students who made up 47% of the sample. This distribution is consistent with national higher education trends that indicate that (a) higher percentages of women are pursuing a higher education (National Center for Education

Statistics, 2013), and (b) higher percentages of women are pursuing careers in dentistry (Weaver, 2003). In fact, the number of women enrolling in dental school has increased dramatically over the last 30 years. Currently, women make up 44% of the total enrollment at all U.S. dental schools (Weaver, personal communication, August, 2003) in comparison to 1970 when that number was only 1% (Scarbecz & Ross, 2002). This trend is explained by the profession (at least from a sociological perspective) remaining independent in terms of environmental structure. Essentially, the private-practice work environment afforded women the opportunity to integrate family and career. As the owner of a practice, a woman could set the rules, which many women found very attractive in terms of meeting their family needs (Niessen, 1992; Scarbecz & Ross, 2002).

Race/ethnicity of the student population ($n=1,098$) was a categorical variable. The category of *Other* was defined as two or more races, and it was excluded from the analysis. Therefore, the race/ethnicity categories in this study were: White (Caucasian), under represented minority (URM, includes: Black, Cuban, Hispanic - other, Hispanic or Latino, Mexican, Native American/Alaskan Native, Puerto Rican/Mainland or Puerto-Rican/ Commonwealth), and Asian (includes: Asian/Pacific Islander, Asian-Chinese, Asian-Indian, Asian-Korean, Asian-Pakistani). White students comprised the largest racial/ethnic group in the sample (58.6%), followed by Asian students (28.3%), and URM students (12.8%). This data is consistent with national higher education trends for the racial and ethnic make-up of students in college enrollment (National Center for Education Statistics, 2013), and enrollment at U.S. dental schools (American Dental Education Association, 2013).

Table 3 presents the undergraduate GPA (UGPA) and undergraduate science GPA (USPGA) scores across racial ethnic groups. There is some difference in the mean and standard deviation of scores across the racial/ethnic groups for UGPA and U Sci GPA.

Table 3

Undergraduate preadmission factors across racial ethnic groups

	UGPA Mean Score	UGPA Standard Deviation	U Sci GPA Mean Score	U Sci GPA Standard Deviation
White	3.45	.31	3.38	.36
URM	3.29	.32	3.19	.39
Asian	3.44	.28	3.38	.34

Preadmission Factor Relationship to Student Performance

Dental School GPA Descriptive Analysis

Table 4 presents the means and standard deviations for the UGPA, U Science GPA, DAT academic average, DAT science average, and dental school GPA for students assessed in the present study. The percentages for gender, and racial/ethnicity are presented as well.

Table 4

Descriptive of the sample for the analysis on DS GPA (total n=1,100)

	Mean/Percentage	Std. Deviation
DAT Aca Avg	18.7	2.16
DAT SCI	18.7	2.29
U Sci GPA	3.60	4.71
U GPA	3.45	.913
DS GPA	3.32	.502
WHITE	1.76	1.47
ASIAN	.28	.450
GENDERFem	.531	.499

Dental School GPA Regression Analysis

Multiple linear regression analysis was utilized to determine (a) the Beta value, which indicated the relative strength of each predictor, (b) the standard error (σ) of the mean, and (c) the statistical significance of each predictor. The outcomes are presented in Table 5.

Table 5

Dental School GPA, multiple linear regression analysis

	Std. Error	Beta	Sig.
U GPA	.054	.103	*
U Sci GPA	.003	.024	
DAT Acad Avg	.017	.120	
DAT SCI	.016	.068	
WHITE	.160	.313	
ASIAN	.482	.170	
GENDERFem	.032	.035	

Adjusted R square: .085

Significance: *** $p < .001$; ** $p < 0.01$; * $p < 0.05$

For Table 5 the beta value for UGPA was $b = .103$, which indicates a positive relationship to the dependent variable. UGPA was the only predictor found to make a uniquely significant contribution to the DS GPA. The other independent variables, U Science GPA, DAT academic average, DAT science score, race and gender were not found to be significant predictors of the DS GPA. Null hypotheses 1 (H_0) states that preadmission factors were not directly predictive of academic performance in dental school (DS GPA). This hypothesis is rejected as a significant relationship between the UGPA and the DS GPA was found; specifically, 1 point in UGPA was found to be associated with .103 increase in dental school GPA ($b = .103, p < .05$).

Preadmission Factor Relationship to Successful Graduation

The second research question explored the extent to which UGPA and DAT scores predicted a student's ability to successfully graduate from dental school. Successful graduation was measured in two steps; the first was an analysis of licensure obtainment, and the second was degree awarded status.

Licensure Obtainment Descriptive Analysis

Licensure obtainment is a dichotomous categorical variable that represented a student's performance on the National Boards Part II examination. A score of 75 is a passing grade on the NB Part II. The total number of observations for the Licensure Obtainment variable is 783, approximately 317 less than the total number of observations of the study sample which is 1,100. The numbers of missing cases are attributable to various factors. The first was due to the study site's conversion to an updated data management system called Banner in the year 2004. During the conversion years data had to be imported manually into the new system resulting in the loss of some data ($n = 245$), irrespective of the fact that those persons had already had their degrees awarded. The second is the student cohort that was admitted via the International Dentist Program (IDP, $n=72$); an advanced dental curriculum for students with an international dental degree. Students admitted into the IDP are admitted having already passed the Part II and are thus not required to retake it. That data was also not available at the time of data collection. Table 6 presents the descriptive analysis for licensure obtainment; the mean and corresponding standard deviations for the preadmission predictor variables, the licensure obtainment variable, as well as the percentage of male and female participants, and the racial and ethnic breakdowns of the students who passed the NB II exam on the first try and obtained their license ($n = 783$). Please note that the GPA variables (including DS GPA, UGPA and U Science GPA) were rescaled in 100 to facilitate the easier interpretation of the relationships with licensure obtainment.

Table 6

Descriptive of the sample for the analysis of Licensure Obtainment (n=783)

	Mean/Percentage	SD
DSGPA2 (in 100)	339	27.8
Acac Avg	18.9	1.86
DAT SCI	18.9	2.00
U Sci GPA2 (in 100)	337	36.3
U GPA2 (in 100)	344	29.9
LicensureOb	.932	.251
WHITE	1.85	1.46
ASIAN	.27	.442
GENDERFem	.521	.499

Note: Variables for DSGPA and UGPA are rescaled in 100 to facilitate easier interpretation of relationships with licensure obtainment

Table 7 presents the reported licensure obtainment across racial ethnic groups. The results supports previous research that found that URM student performance on test scores are generally below that of White students (Alexander et al., 2009; Edelin & Ugbolue 2001) and, within the present study, below that of Asian students. Despite this observed lower performance, previous research (Edelin & Ugbolue 2001) also reported that URM students tended to successfully navigate the first 2 years of the HPS-- considered by many to be the hardest-- irrespective of less competitive academic performance measures (Edelin & Ugbolue 2001). Further, previous research has suggested that performance in dental school is equal between the racial ethnic groups as the years in dental school progress (Hampton et al., 1996; Ripkey et al., 1997; Whalen & Moses, 1990). In summary, resiliency and determination characterized the URM students' abilities to persist beyond low scores (Alexander et al., 2009) and in fact, go on

to do well in their clinical years (Hampton et al., 1996; Ripkey et al., 1997; Whalen & Moses, 1990).

Table 7

Racial/ethnic group differences on Licensure Obtainment (n=783)

	<i>N</i>	% Licensure Obtainment
White	485	96%
URM	92	87%
Asian	205	90%

Licensure Obtainment Regression Analysis

Table 8 presents the outcomes for the second research question, which asked the extent to which the independent variables of UGPA and DAT score, amongst others, significantly predicted successful graduation as measured by licensure obtainment. In order to arrive at a better scale of interpretation, GPA variables (including DS GPA, UGPA and U Science GPA) were rescaled in 100 to better demonstrate the relationship with licensure obtainment. Knowing that licensure obtainment is a dichotomous categorical variable, in that the response is either PASS or FAIL, therefore a binary logistic regression analysis method was conducted. For logistic regression analysis the odds ratio (i.e, Exp B) is reported, to assess the relative effect of the predictor on the dependent variable, as well as the probability of the result and the standard error. Race/ethnicity was dummy coded, and was considered to be a true value represented as a

proxy or numeric stand-in for the regression model. The dummy variables were assigned a value of either 0 or 1, so as to indicate the absence or presence of one or the other variables. Within the race/ethnicity variable categories, the category of *Two or More Races* did not contain enough cases to include ($n=2$ or .18%), therefore it was removed leaving the White, Asian, and URM categories. Total observations and missing cases are reported and are then followed by a discussion.

Table 8

Licensure Obtainment, logistic regression analysis (n=783)

	<i>SE</i>	<i>p</i>	Odds Ratio
GENDER	.333		1.18
DAT Ac Avg	.201		1.47
DATSCI	.176		.850
U Sci GPA2 (in 100)	.011		1.01
U GPA2 (in 100)	.014		.984
DSGPA2 (in 100)	.008	***	1.05
white2	.445		1.22
ASIAN	.474		.614

Significance: *** $p < .001$; ** $p < 0.01$; * $p < 0.05$. Note: Variables for DSGPA and UGPA recorded in 100 to facilitate better scale of interpretation of GPA relationships to licensure obtainment

For Table 8, when assessing the odds ratio value for DSGPA (rescaled in 100) the numeric value was 1.05, which indicates that for every .01 increase in raw DSGPA, there was a corresponding 1.05 increase in the odds of obtaining a license (exponential of beta is 1.05, $p < .001$). Although the odds ratios for U Sci GPA, DAT, academic average, and Asian are also greater than 1, they were not statistically significant at the .05 level. Therefore, none of the other

independent variables were found to be significant predictors of the licensure obtainment. Null hypotheses 2 (H_0) stated that preadmission factors were not directly predictive of successful graduation as measured through licensure obtainment. Based on the outcome for Table 8, I was not able to reject the second null hypothesis (H_0), as the only significant predictor was DS GPA, which was not a pre admission factor.

Degree Awarded Descriptive Analysis

To review, the second research question asked the extent to which the independent variables UGPA and DAT score were able to predict the second measure of successful graduation, degree awarded status. Degree awarded status was a dichotomous categorical variable measured as YES or NO. Table 9 presents the descriptive analysis for degree awarded status, the mean and corresponding standard deviations for the preadmission predictor variables, the degree awarded status variable, as well as the percentage of males and females, and the racial and ethnic breakdowns of the students who obtained their degree ($n=1,026$). With degree awarded status it was necessary to rescale the GPA variables (including DS GPA, UGPA and U Science GPA) in 100 to arrive at a better scale of interpretation of the GPA variable relationship to degree awarded status. Table 10 presents the reported degrees awarded across racial ethnic groups. The total number of students who were not awarded a degree was seventy-four. Degree not awarded status was divided among students who were reported as: Deceased ($n=1$), Dismissed ($n=27$), on a Leave of Absence ($n=2$), Withdrawn ($n=28$), Suspended ($n=1$) and Still Pursuing a Degree ($n=15$).

Table 9

Descriptive of the sample for Degree Awarded YES analysis (n=1,100)

	Mean/Percentage	SD
DS GPA2 (in 100)	333	41.2
DAT Acac Avg	18.8	1.89
DAT SCI	18.8	2.04
U Sci GPA2 (in 100)	335	36.3
U GPA2 (in 100)	343	30.3
DegreeAwYES	.936	.243
WHITE	1.85	1.46
ASIAN	.26	.438
GENDERFem	.521	.499

Note: Variables for DSGPA and UGPA recorded in 100 to facilitate better scale of interpretation of GPA relationships to degree awarded status

Table 10

Racial/ethnic group differences on Degree Awarded = YES (n=1,100)

	N	% of Degree Awarded = YES
White	607	94%
URM	131	91%
Asian	286	92.5%

Degree Awarded Regression Analysis

Table 11 provides the outcomes for the second part of the second research question, which asks the extent to which the independent variables of UGPA and DAT score significantly predicted successful graduation, as measured by degree awarded status. Degree awarded status is a dichotomous categorical variable, in that the response is either YES or NO, therefore a

binary logistic regression analysis method was conducted. For logistic regression analysis the odds ratio (i.e, Exp (B) is reported along with the level of significance and standard error. The race/ethnicity variable was dummy coded and assigned a value of either 0 or 1, indicating the absence or presence of one or the other variables. Total observations and missing cases are reported and are then followed by a discussion.

Table 11

Degree Awarded Status (YES) logistic regression analysis (n=1,100)

	<i>SE</i>	<i>p</i>	Odds Ratio
GENDER	.396		.576
DAT AcAvg	.207		.779
DATSCI	.188		1.08
U Sci GPA2 (in 100)	.014		.997
U GPA2 (in 100)	.016		.988
DSGPA2 (in 100)	.007	***	1.06
white2	.639		.643
ASIAN	.673		.990

Significance: ***P<.001; **P<0.01; *P<0.05

Note: Variables for DSGPA and UGPA recorded in 100 to provide a better scale of interpretation of GPA relationships to degree awarded status

For Table 11, the odds ratio value for DSGPA (rescaled in 100) is 1.06 which indicates that for every .01 increase in raw DSGPA there was a 1.06 increase in the odds of obtaining a degree. The other independent variables were not found to make a significant contribution to degree awarded status. Null Hypotheses 3 (H_0) asserted that preadmission factors were not directly predictive of successful graduation as measured by degree awarded status. Based on the outcomes for Table 11, I was not able to reject the third null hypothesis (H_0) because the only significant predictor was the DS GPA, which is not a pre admission factor.

Racial/Ethnic Differences in the Three Outcomes

It is important to note that Table 3 shows variance across the racial/ethnic groups for the preadmission factors of UGPA and USciGPA; in that URM students had a lower reported mean in the categories of UGPA and USciGPA than did Whites and Asian students. A very different result occurred with the regression analysis, however. Within the regression analysis outcomes for Tables 5, 8 and 11 the findings indicate that there was no significant racial/ethnic gap in the three outcomes even, after controlling for all factors.

Summary

This section provides a summary of the relationship between preadmission factors and overall success. The results were that:

1. The UGPA plays a significant role in a high DS GPA, therefore null hypothesis 1 (H_0) was rejected because there was a direct, significant relationship between the UGPA and the DS GPA.
2. The DS GPA is significantly correlated to successfully completing dental school.

Based on the outcomes for Tables 8 and 11, null hypotheses (H_0) 2 and 3 were not able to be rejected because a significant relationship was found between the DSGPA, licensure obtainment, and degree attainment, however DS GPA was not a preadmission factor. The preadmission factors of UGPA, USGPA, DAT academic average, and DAT Science average were not found to be predictive of obtaining a diploma. An additional important outcome was that gender and race/ethnicity did not play significant roles in predicting successful graduation. The meaning of these findings and the relationship of the findings to the future of education, dental school

recruitment, and the overall implications of the findings for future policy and practice are presented and discussed in Chapter V.

Chapter V

CONCLUSIONS and IMPLICATIONS

This chapter presents a brief review of the conclusions and findings reported in Chapter IV and a discussion of the implications for policy and practice.

The impact of preadmission factors on student performance has been examined across disciplines, and the findings suggest that only certain preadmission factors correlate with performance (Chisholm et al., 1995; Cooper & Roter 2003; McCall et al., 2007; Ried & McKenzie, 2004; Saha et al., 2003; Veloski et al., 2000). The focus of the present study was to assess the relationship of certain preadmission factors to success at a graduate dental school. This research was conducted to fill the academic void in the literature regarding a direct relationship between preadmission factors and successfully obtaining a graduate diploma in dentistry. The core research questions guiding the analyses were: (a) To what extent do preadmission factors (specifically UGPA and DAT score) predict the student's academic performance during the first 2 years of dental school (DS GPA)? (b) To what extent do preadmission factors (specifically UGPA and DAT score) predict a student's ability to successfully obtain a license to practice dentistry (licensure obtainment)? (c) To what extent do preadmission factors (specifically UGPA and DAT score) predict a student's ability to successfully obtain a graduate diploma in dentistry (degree awarded status)?

The analysis of this study was conducted in three steps. An evaluation of the strength of relationships between the variables was observed while facilitating the opportunity to assess the predictive power of and strength of the independent variables to the dependent variable. The source for all the data was a dental school located in an inner city urban area in the northeast United States. The population included 1,275 students who were admitted into dental school between the years 1998-2009. Following approval by the Institutional Review Board (IRB), data was collected from the university's Registrar's Office. The conceptual model was selected to meet the needs of the three steps of the data analysis. The first step, or rather to answer the first research question, an exploration of pre admission factor relationship to performance in dental school was assessed. The second research question asked about the strength of preadmission factors to predict the ability to obtain a license to practice dentistry. The third research question asked about the strength of preadmission factors to predict the ability to obtain a graduate diploma in dentistry.

Conclusions

The narrative description provided valuable information about the student population involved in this study. Percentile distribution of how the class is constructed with respect to gender and race/ethnicity was provided. In general, White students comprised the largest racial/ethnic group of the student population followed by Asian students, and then URM students. This trend is consistent with national higher education trends regarding the racial ethnic makeup of students enrolled at health professional institutions across the country. The overall results support the following conclusions:

1. DS GPA is a significant predictor of successfully obtaining a diploma from dental school.
2. The DS GPA plays a role in successfully obtaining a license to practice dentistry.
3. UGPA is a significant predictor of successful academic performance in the first 2 years of dental school.
4. No particular racial ethnic group was found to be significantly correlated with any of the three outcomes (i.e., DSGPA, licensure obtainment and degree attainment).

Implications for Policy and Practice

The results suggest three very important conclusions. First, UGPA, a pre admission factor, is an important component of success in the first 2 years of dental school. Second, how well a student does in dental school (dental school performance) is predictive of obtaining licensure, as well as the diploma. Lastly, race/ethnicity was not found to be significantly correlated with successful graduation. The racial ethnic outcome is particularly meaningful for the URM student population, as it confirms that URM students have the ability to successfully complete the academic rigors of dental school. This is further explained by the experiential learning, human capital, and belonging uncertainty theories, which provided a richer context for understanding the overall URM dental student experience.

The results of this study have implications for the following areas: (a) encouraging enhanced UGPA performance through pipeline programs and its connection to persistence, and (b) promoting positive dental school performance (DS GPA), which correlates to success, through a structured educational environment that is also sensitive to the specific racial ethnic needs of URM students.

The UGPA, Pipeline Programs and Persistence

The outcomes presented in Chapter IV indicated the importance of the UGPA preadmission factor to academic success in dental school. The implications of this outcome for college practitioners is that the UGPA is important for the prospective dental student. The implications for students and parents are that enhanced attention must be paid to undergraduate-level preparation when a student identifies a desire to pursue a career in the health professions. For URM students, who tend to perform lower in their undergraduate education, it is an opportunity to put certain safeguards in place—such as extra support in the sciences through summer intensive programs or tutoring—that might help bolster their UGPAs. Additionally previous research has identified programs that have been found to be useful for promoting URM student UGPA in their undergraduate studies. Strayhorn (1999) reported that pre-admission pipeline programs reversed the URM student perceptions of healthcare as an unrealistic pursuit by providing access to science enrichment programs and/or exposure to minority mentors. These experiences positively correlated to increased levels of confidence about pursuing a career in health and greater rates of graduation from high school and admittance to medical schools. As an example, a study of 371 URMs (see Figure 2) who participated in a Medical Education Development Program (MEDP) at the University of North Carolina at Chapel Hill (UNCC) confirmed this analysis (AAMC, 1998).

Figure 2: Medical Education Development Program (MEDDP) at the University of North Carolina at Chapel Hill (UNCC) Academic Profiles of 371 Participants in the MEDDP UNCC 1980-1999

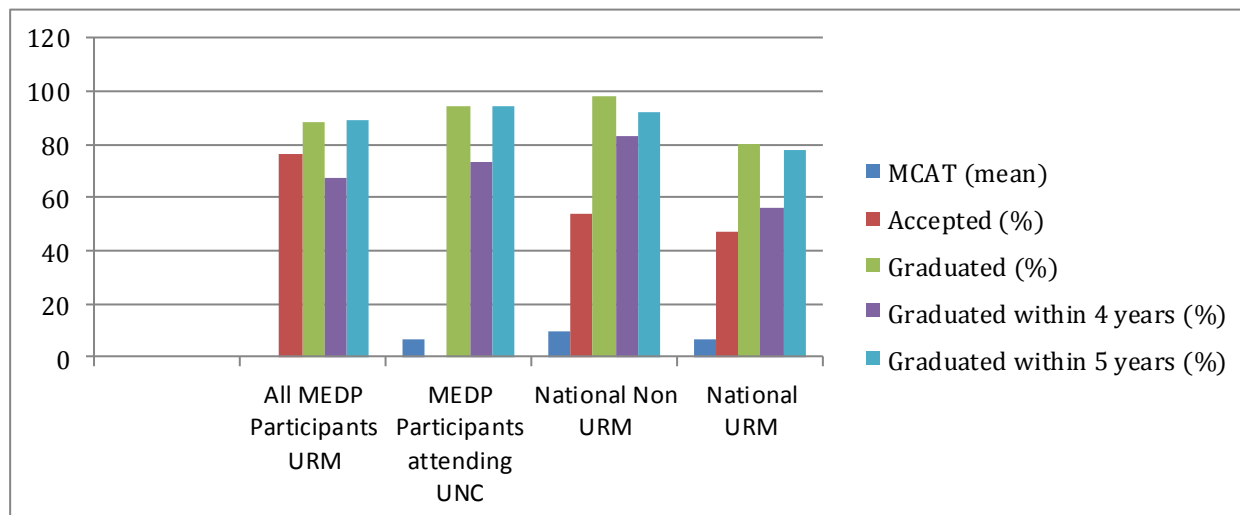


Figure 2 (AAMC, 1998) shows that the acceptance rate for URM participants in MEDDP was higher than those of both the national URM and the non-URM applicant pools. Compared to the national URM pool, MEDDP URM participants had higher 4 and 5-year graduation rates. Strayhorn (1999) indicated that a student's ranking within the MEDDP program was the strongest predictor of medical school academic performance. Therefore, participation in an MEDDP is a strong and positive predictor of application to medical school, acceptance, and timely graduation for URM.

Another more current example of a pre-admission pipeline program is the Short Term Enrichment Program (STEP) of the University Of Pennsylvania School Of Dental Medicine (Wadenya & Lopez, 2008). STEP consists of presentations on the dental profession, laboratory and virtual classrooms, and biannual workshops for high-school participants and their parents. It incorporates local high schools and the involvement of parents who can impact their children's career decisions. The aspect of parental involvement is unique to this program and has been

supported by the research. Crawford, Schelzel, Fleming, and Harrison, (1975) found that parental support and participation in health career orientation programs were the two most influential factors in a student's decision to pursue a career in the health professions. Wadenya and Lopez (2008) reported that students in pre-dental programs or dental school have the highest percentage of parents who participated in STEP (96%), compared to students enrolled in other programs (44%). All of the students (100%) enrolled in pre-dental/dental programs had parents who discussed their college careers with them and engaged them in discussions about career goals. There was a positive correlation between parents who participated in the STEP program and those who tended to discuss careers with their children ($r=.5$). There was also a strong correlation between the discussions parents had with their children and the decisions made about careers ($r=.61$). Wadenya and Lopez (2008) argued that early recruitment to a STEP program demonstrated two major advantages for URM students. First, it provides young students with early exposure to minority role models in the community, a critical recruitment tool for first-generation, college-bound students who oftentimes do not have family members or friends as role models to emulate. Second, participating in preparatory programs augments both study and test-taking skills; factors that facilitate and enable them to be more competitive college applicants. Wadenya and Lopez (2008) reported that one particular enrichment program was so advantageous to a U.S. dental school that it resulted in an increased enrollment rate of about 325% (for URM students) in the course of 3 years.

Although proof of the efficacy of pipeline programs can be found in the literature, these programs are not funded on a consistent basis. Sustaining pipeline programs is critical to the successful recruitment and retention of URM students because they promote academic competency, interest in health careers, and they build self-esteem through exposure to medical/dental students

in the clinical setting, providing preparatory courses for taking the DATs, and enhancing students scientific knowledge.

The DSGPA and Performance in Dental School

For all students, including URM students, performance in dental school (DSGPA) is predictive of obtaining a diploma, as well as licensure from dental school. As such, important observations can be made with respect to the theories and practices that enhance performance in dental school.

Experiential learning theory (ELT) describes *the experience* as core to human learning and development (Kolb & Kolb, 2005). The ELT developmental model (Kolb & Kolb, 2005) of self-efficacy involves three steps: (a) acquisition, (b) specialization, and (c) integration. This model is parallel to the dental school curriculum and training as students must (a) acquire the foundational knowledge, (b) develop their specialization through rigorous preparation, evaluation, and application, and (c) integrate learned skills in the clinical practice setting. Additionally ELT involves ensuring that the learning environment supports the developmental process of transitioning the student from novice to expert (Kolb & Kolb, 2005).

In belonging uncertainty theory student learning and development outcomes or performance are impacted by social belonging, as it relates to feeling like you belong in the educational environment that you are in and correlates with higher achievement. Considering the arguments of this theory, the URM student experiences psychosocial challenges when attending racially homogenous educational settings (Census Bureau, 2006) due to confrontations with overt as well as subtle forms of prejudice (Dovidio & Gaertner, 2000; Greenwald & Banaji, 1995; Harber, 1998; Uhlmann & Cohen, 2005), and being assigned lower grades as a result of

that prejudice (Grodsky & Pager, 2001; Steele, 1997). Regardless, the URM student has managed to maneuver successfully despite having to navigate a learning environment that is unprepared to embrace the culturally diverse students they work hard to recruit (Dovidio & Gaertner, 2000; Greenwald & Banaji, 1995; Harber, 1998; Uhlmann & Cohen, 2005). Knowing that there is a national policy agenda to increase the number of URMs in health professional schools (AAMC, 2008; The National Academies, 2004; The Sullivan Commission, 2004), the implications of the findings of the present study for practice suggest a need to provide emotional and psychological support to URM students by providing access to mentors who can understand their socio-psychological needs. Although the literature reveals the importance of access to URM mentors, teachers, and administrators, faculty of color remain underrepresented among the total number of full-time faculty in higher education across the U S. (Turner, Gonzalez, Wood, 2008). Minority faculty have reported widespread disparities in the recruitment and promotion process, as well as disparities in exposure to career options, recruitment to training programs, poor retention efforts, and lack of mentorship, as hindrances to their success and professional satisfaction after recruitment (Price, Gozu, Kern, Powe, Wand, Golden, Cooper, 2005). In the context of academic achievement, students who demonstrate a sense of social integration by forming trusting relationships with teachers or mentors have demonstrated less school dropout (Mahoney & Cairns, 1997) and have been found to be better able to take advantage of critical feedback and other opportunities to learn (Brown & Campione, 1998; Caprara et al, 2000; Cohen & Steele, 2002). As presented by the American Dental Education Association (as cited in Swift, 2008), there are solutions for addressing these workforce challenges at both the student and faculty levels. The solutions require the re-prioritization of financial resources as well as coordination and compromise between multiple interested parties. Due to the complex nature of

these solutions, the recommendations must be implemented at the federal level in order to ensure a level of efficacy that goes beyond the rhetoric of diversity recruitment practices.

Gap in Preadmission Factors Across Racial Ethnic Groups Not Significant to Success Outcomes

To reiterate, the regression analysis outcomes presented in Tables 5, 8 and 11 indicated that there were no significant racial/ethnic gaps in the three outcomes of DS GPA, licensure obtainment, and degree obtainment, even after controlling for all factors. The literature demonstrates that URM students; (a) tend to successfully navigate the first 2 years of the HPS despite lower performance in preadmission scores (Alexander et al., 2009; Edelin & Ugbolue 2001); (b) performance in dental school equalizes between racial ethnic groups as the years in dental school progress (Hampton et al, 1996; Ripkey et al, 1997; Whalen & Moses, 1990); and (c) are characterized by resiliency and determination with respect to persistence (Alexander et al., 2009) and, in fact, do well in their clinical years at HPSs (Hampton et al, 1996; Ripkey et al, 1997; Whalen & Moses, 1990). What was observed in the present study was that other factors likely contributed to the URM students successes. The first is the structured learning environment as described in experiential learning theory. The structured learning environment allows the URM student, as well as all other students, to demonstrate competency through rigorous preparation, hands on application, and developed specialization, which leads to increased levels of self-efficacy and correlates to greater levels of confidence and commitment to chosen career path. Another critical contributing factor to success is explained by human capital theory. Human capital theory (Simkovic, 2012) would suggest that once a student commits to pursuing a dental degree they understand that persistence in obtaining that degree would translate

to increased earnings, improved personal health, and greater respect in their community. Despite any academic difficulties that are encountered, this makes the sacrifice and financial investment in pursuing the degree worth pursuing (Alexander et al., 2009). The implications of this outcome for dental admissions officers, parents, and policy makers are that, as indicated by the previous literature (Alexander et al., 2009; Edelin & Ugbolue 2001; Hampton et al, 1996; Ripkey et al, 1997; Whalen & Moses, 1990) as well as the results of this study, there is strong support for URM students to not only pursue a career in the health professions, but to also do well and succeed in their pursuit of a dental degree.

Implications for Future Research

Though the data was insufficient to conduct subgroup analyses across racial/ ethnic groups, it would be very important to conduct such an analysis in the future to explore the direct relationship that preadmission factors have to these outcomes across the different racial ethnic groups. The findings might help to better understand if or whether these factors matter the same or differently to certain ethnic groups. This would be a powerful way to further concentrate efforts in the area of better preparation or recruitment strategies. Another area for subgroup analysis is to repeat this study, but using a mixed-methods approach and using a sample from a Historically Black College and University (HBCU) setting. The purpose would be twofold. The first would be to conduct a qualitative analysis of the URM student's experience in pursuit of a dental degree at an HBCU, and then to compare that to that of a URM student in a non-HBCU setting. My suggestion is to incorporate the qualitative study format presented in the book, *How Minority Students Experience College: Implications for Planning and Policy* (Watson, 2002). The information from such research would better inform policy makers and administrators who are involved in progressing the discussion beyond recruitment practices. The second analysis

would be to compare performance data between the HBCU setting and the non-HBCU setting to assess the net effect of ELT and human capital theories on actual outcomes. The literature also arouses curiosity about the URM students' educational pathways and the types of academic challenges they experience in the pursuit of graduation from a dental school. We know from the literature that even though URM students receive lower grades on average in biomedical science courses (Alexander et al, 2009), they are just as likely to persist and complete their courses, while remaining less deterred and discouraged by the receipt of lower grades than their other racial and ethnic counterparts. Additional research (Edelin & Ugbolue, 2001) has further indicated that despite low performance on preadmission standardized examinations such as the DAT, they are able to successfully complete the first 2 years of HPS and tend to academically improve their performances in the clinical years (Hampton et al., 1996; Reteguiz et al., 2002; Ripkey et al., 1997; Whalen & Moses, 1990), also known as the third and fourth years. Future research could assess these persistence factors by conducting the following two assessments. The first is a review of how much time it takes a student to complete dental school. The dental school curriculum is completed in 4 years. If, as an example, a student completes his or her studies in 5 or 6 years rather than 4, it provides valuable data regarding a student's level of determination and his or her will to succeed. The second is a review of how many times a student takes the National Board Dental Written Examination (Part II). Currently, the Joint Commission on Dental Examiners allows students the opportunity to retake the examination if they fail it, with ninety-day intervals between each examination. An assessment of how many trials were necessary to achieve success on each examination is further evidence of a will to persist beyond challenges that are presented academically.

Finance

Due to insufficient data, the financial aid variable was not assessed in this study, but it is nonetheless recognized as an important factor in human capital theory and in the pursuit of a dental education (Nash & Brown, 2012). Therefore, finance is discussed in this section as a special consideration for future research. Human capital refers to any activity that entails a cost in the current period and raises productivity in the future. The type of human capital investment that is involved in the present study was the one associated with education and training; as individuals choosing a career are making important and costly investments in their future. A student pursuing a dental degree is also investing in their own potential, which will in turn contribute to society, their future growth, and economic potential (Simkovic, 2013). The cost associated with the acquisition of the skills necessary is high and is perceived as a trade-off for improved future earnings and an elevated standard of living. Health professional education is not only labor intensive, but very costly, and it has experienced decreased financial support at the state level. In 2010, the average debt burden carried by a dental student at the time of graduation was reported as \$200,000 and another 13% reported the debt to be \$300,000 (ADEA, 2012). The impact of this cost on URM students has devastated national efforts to increase the recruitment and retention of students to the profession. The U.S. Census Bureau (2006) reported a large disparity in family income across racial and ethnic groups in the United States. Black and Hispanic households earned less than either White non-Hispanic or Asian and Pacific Islander householders. The median income for Black and Hispanic families was reported as approximately \$35,000 in the year 2001, in comparison to White families who reported median incomes of \$57,000, and Asian/Pacific Islander families as \$60,000. In addition to disparities in household income there are also reported differences in wealth across racial ethnic groups. On

average, White families are wealthier than Black or Hispanic households, even after controlling for income and demographic variables (Choudhury, 2002). As a result, the lower-income URM student is more likely to face financial difficulties in the pursuit of a higher education. From 1998 to 2006, the number of students who enrolled at dental schools in the United States with parental incomes less than \$50,000 declined from 32.4% to 25.8 % in comparison to those with parental incomes of \$100,000 or greater, who saw an increase from 35.1% to 44.2%. It is highly recommended that the development of future policies and procedures are guided by the literature regarding the financial burdens that are placed on lower income URM students. As such, the American Dental Education Association (as cited in Swift, 2008) reported a critical need for the federal government to continue to support the Title VII Centers of Excellence (COE) and Health Careers Opportunity Programs (HCOP). These programs have a history of assisting institutions in developing diverse applicant pools by strengthening the academic performance of URM students and enhancing pipeline efforts to undergraduate and pre-college students. Currently these programs are underfunded as a result of several annual cuts to their budgets. It is recommended that congress restore their funding to the FY 2005 level in order to properly address the needs of the URM health care workforce shortage in the U.S. (Swift, 2008).

Overall Summary

In conclusion, this findings of this study underscore the important connection between the diminished quality of our healthcare system and the shortage of URM students in biomedical science fields. The shortage of URM health professionals has lead to greater health disparities, has been costly to the American taxpayer (The Sullivan Commission, 2004), and has compromised the overall financial stability of the US (World Health Organization, 2000). URM

students are the students most likely to practice in underserved areas and, as such, they play important roles in closing the gap in health disparities. They report being motivated by a desire to change people's lives and to serve underserved communities rather than other motivations such as money or job security (UHF, 2012). These recommendations are meaningful, especially as they relate to the future quality of our educational and American healthcare systems.

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