COMMUNITY COLLEGE STUDENT SUCCESS WITHIN HEALTHCARE-RELATED ASSOCIATE DEGREE PROGRAMS

by

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Abstract

The purpose of this study is to identify student characteristics and academic program factors, which influence the student's ability to persist through degree completion within healthcare-related, associate degree programs within four urban, community colleges. To achieve this outcome, the Bean and Metzner (1985) model of non-traditional student attrition was adapted to analyze academic and demographic variables which may lead to degree completion within healthcare programs of study. Records of 3,237 students from four urban, community colleges, with healthcare-related programs of study and prerequisites of English, anatomy and physiology, and mathematics, were analyzed to determine predictors leading to program completion. The study employed a quantitative, *ex post facto* design using descriptive statistics, correlation, and logistic regression models to analyze the sample of 552 students. Out of the twelve independent variables for the six programs of study (diagnostic medical sonography, echocardiology technology, invasive cardiovascular technology, nursing, radiologic sciences, and respiratory care programs), cumulative and program grade point averages were found to be significant predictors of program completion. Recommendations included adding shorter certificate options within the programs of study, consider reducing the length of associate degree programs, assessing licensure success and length of programs in the healthcare sector, applying similar studies in university or rural settings, assessment of financial aid and completion in healthcare programs, and establishing pre-advising opportunities to determine the best program fit for students within the healthcare sector, thus increasing the student's ability to persist to program completion or graduation.

Dedication

This dissertation would not have been possible without the support and encouragement of my family, colleagues, and dear friends. To my husband, Damien, I thank you for inspiring me to continue through my goal of a doctorate, and for all of your support in helping to raise our wonderful boys into incredible young gentlemen. To my parents, grandparents, and mother and father in-law, thank you for the encouragement to continue on with my education, and the guidance you have provided over the years. To my colleagues, thank you for listening, talking through the many facets of student persistence, and the in-depth discussions regarding success of our students in community colleges. Last, to my dear friends, especially Rani and Chris, thank you for your ongoing friendship, encouragement, and support.

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Table of Contents

List of Tables

List of Figures

CHAPTER 1. INTRODUCTION

Introduction to the Problem

In order to meet the challenge of President Obama to produce 5 million students completing degrees and certificates by 2020 (Obama, 2009), administrators within colleges and universities are seeking new and innovative ways to increase student persistence and completion rates in order to meet the workforce demands, create employment opportunities, and meet this challenge, according to Ewell (2011), Heller (2009), and O'Banion (2010). According to the United States Department of Labor (2012), the healthcare and social assistance areas are expected to increase by 5.6 million jobs from 2010 through 2020, with nursing increasing by 712,000 jobs, and home health aides by 706,000 jobs nationally. Employment in healthcare-related fields is expected to increase due to technology advances in patient care, indicating additional treatments, the aging population, and the emphasis on preventative care (United States Department of Labor, 2009a). With community colleges across the United States producing more than 50% of new nurses and other healthcare workers (National Commission on Community Colleges, 2008), factors and characteristics leading to increased student retention and completion must be analyzed to meet these workforce demands, to retain students through program completion, and to create new effective models of persistence.

Additionally, Bahr (2013) notes two themes dominating postsecondary education on a national level to include increasing college retention and persistence to degree attainment, and the improvement of performance of postsecondary institutions in regards

to degree completion. Retention and persistence focus on the characteristics, or factors which may cause students not to graduate, and the latter considers the institutional factors, which consider the aggregate related to degree completion (Bahr, 2013). Tinto (2012) notes that not all students plan to receive a degree or certificate, but many intend to transfer or are simply seeking enrichment courses, particularly in two-year colleges. These institutions serve a broad range of interests, and many serve a large number of students, and tend to have lower retention and graduation rates. With community colleges being primarily "open access," institutions are challenged to meet their core missions of upward transfer, workforce development, and community education due to the diversity of goals among the students and, the various pathways of success as "the community college is the primary door through which non-traditional, underrepresented, low-income, and first generations students enter postsecondary education" (Bahr, 2013, p. 139). Furthermore, student persistence becomes more complex because of discontinuous enrollment of students as they temporarily suspend attending college (Tinto, 2012).

Tinto (1993) suggested that students leave programs for various reasons such as personal concerns, financial problems or academic difficulties. Students in healthcare-related programs encounter similar challenges. Studies of healthcare students have identified personal problems (Boyd & McHendry, 2010), lack of social and academic integration (Tinto, 2012; Pascarella & Terenzini, 1995), financial difficulties (Braxton, 2008), and lack of preparedness for higher education as factors leading to student departure from the programs of study (Boyd & McHendry, 2010; Hamshire, Willgoss, & Wibberley, 2013). The identification of factors affecting student retention and

persistence is essential in order to analyze the student characteristics, which increase persistence within associate degree healthcare-related programs. A significant amount of research exists on nursing retention and completion with more than 3,666 journal articles, and 6,195 books, based on a library database search. In contrast, there are only 106 journal articles on medical laboratory technician positions, and 75 journal articles on diagnostic medical sonography, for example.

This study looked at characteristics which contributed to the attrition of students in associate healthcare-related degree programs in the areas of diagnostic medical sonography, echocardiology technology, invasive cardiovascular technology, nursing, radiologic sciences, and respiratory care programs. The study sought to determine which student characteristics and academic program factors contributed to predicting program completion of associate degrees within healthcare-related fields of study. The study identified student factors and characteristics, which may contribute to increased persistence and retention of individuals within associate degree, healthcare-related programs.

Background, Context, and Theoretical Framework

Understanding the background of the student population within the community college systems and overall purpose of the institutions is essential to the relevance of this study. Boggs (2010) describes American community colleges as being similar to the nation which created them as "They offer an open door to opportunity to all who would come, are innovative and agile in meeting economic and workplace needs, and provide value and service to individuals and communities" (p. 1).

Establishment and Purpose of Community Colleges

The community college system of today has changed dramatically since the time of its inception in the early 20th century. With 1,655 community colleges within the United States educating more than 8 million students, or 47% of the student population (Boggs, 2010; United States Department of Education, 2009), the landscape of the community college system has changed dramatically within the last 100 years. The growth is attributed to the increased number of colleges, expanded student enrollment, and meeting industry needs of the local communities. The colleges are also challenged with the reduction of federal and state funding sources for the institutions, and mandated accountability measures. Students elect to attend community colleges for a variety of reasons, such as enrichment courses, enhanced training, or for transfer, and the colleges continue to expand in order to serve the local communities, and consider the reasons related why students enter a community college (Gilroy, 2001).

At the inception of the community college systems, public or private two year colleges were termed "junior colleges" until 1960, when the term "community college" was established to represent the diversity of the college offerings in order to meet community needs (Pederson, 2000; Gilroy, 2001). The literature on the establishment and historical evolution of community college systems is actually limited, as more focus has been placed on the university systems. This key issue is discussed in Pederson's dissertation, *The Origins and Development of the Early Junior College*, (2000) as the author acknowledges the establishment of the first junior college Joliet Junior College (Boggs, 2010; Gilroy, 2001), and the progressiveness of the local community and those to follow. Boggs (2010) describes the establishment of the colleges as a social movement to

provide access to higher education for students who would not otherwise have the opportunity to attend college due to socioeconomic and accessibility issues.

In 1907, Senator Anthony Caminetti sponsored legislation in the state of California allowing high schools to provide two years of post-graduation education (Gilroy, 2001). Funding at the state level began in 1907, according to Vaughan (1982) and Gilroy (2001), as California was the first state to authorize legislation for a local junior college. Cost of attending a public junior college was difficult for students from underprivileged families, as scholarships or work study programs were not available to students. Administratively, the junior college's organizational structure varied from state to state, but in 1921, California adopted legislation establishing independent junior college districts. The district plan, according to Pederson (2000), allowed junior colleges to operate as "independent institutions under elected boards within a set taxing district" (p.108). After 1930, the shift toward occupational technical education became a large component of the community college curriculum, particularly with legislation such as the Government Issued Bill (G. I. Bill), and the 1947 President's Commission on Higher Education for American Democracy (or Truman Commission), according to Boggs (2010). Furthermore, Pederson (2000) notes the growth in property assessments in states such as California and Texas allowing communities to receive tax revenue to hire faculty, and equip science laboratories, in addition to support of the k-12 systems. This began a precedent for other states to pass similar laws regarding funding of colleges. Furthermore, as cited by Vaughan (1982), the state of California astutely allowed for local control, and "equated the first two years of junior college work with the first two

years of university work…and endorsed the concept of having public institutions of higher education available locally" (p. 14).

According to Gilroy (2001), the community colleges were "legitimized in a 1947 report, *Higher Education for American Democracy*, which called for the establishment of a network of public community colleges that would charge little or no tuition, serve as cultural centers, be comprehensive in their program offerings, and serve the area in which they were located" (p. 22). This report from the Truman Commission transformed higher education to allow individuals true access to pursue higher education by expanding to every state and addressing the educational needs of returning veterans, the baby boomers, and the growing need for a skilled workforce due to the changing economy (Bean and Metzner, 1985; Boggs, 2010). According to Bean and Metzner (1985), the passing of the G.I. Bill in 1944 also allowed for greater access to higher education, in addition to National Defense Education Act of 1958, and the Higher Education Act of 1965, which encouraged college attendance to promote the general welfare of the nation. Basic Education Opportunity Grants and Pell Grants provided various state financial aid programs to offer resources for non-traditional students. Furthermore, the Carnegie Commission on Higher Education endorsed the concept of lifelong learning and universal access to higher education, and in 1992 the American Association of Junior College members voted to adopt the name American Association of Community Colleges (Gilroy, 2001), as the title better represented how colleges provide access to higher education for the most diverse student body in history (Boggs, 2010). However, as the number of non-traditional students increases within community colleges, a higher rate of attrition

continues to occur as compared to traditional students (Astin, 1993; Bean and Metzner, 1985; Tinto, 2012).

Bean and Metzner (1985) note specific economic factors that have influenced higher enrollment levels of non-traditional students within community colleges. One area of focus includes the decline of blue-collar jobs impacting the labor force as individuals must select either a lower paying job in the service sector or higher paying jobs requiring specialized training in the technical, business, or professional service areas. Furthermore, the authors note the increase of women in the work place, the increased participation in educational programs of study, and the social acceptance of life-long learning, thus increasing enrollments of older, part-time, and commuting students.

According to the United States Department of Education (2009). *Community College Facts at a Glance, w*ithin the 1,665 community colleges across the nation, 47% (or 411,633 degrees conferred) of all students in public institutions were enrolled in a community college with 15% of those enrolled attaining their associates degree within three years, and 6% earning a certificate. During this period, of the degrees awarded, 73% were white, 10.9% were black, 9.3% Hispanic, 5% Asian or Pacific Islander, and 1.2% were American Indian, with 63% being female, and 37% being male. Also, the document cites that the higher a student's socioeconomic status, the more likely they are to transfer to a 4-year institution as 35% of the higher socioeconomic status students transferred, compared to 21% of the middle, and 7% of the lower economically disadvantaged students.

Accountability Trends

As stated previously, President Obama called upon community colleges to increase the number of graduates or program completers by 50%, or 5 million students, over a ten year period (Obama, 2009). According to Boggs (2010), the student completion and transfer rates must improve in order to meet this challenge. Students struggle through remediation coursework, financial aid issues, or poor institutional support and practices (Boggs, 2010; Tinto, 2012). The Lumina Foundation for Education launched Achieving the Dream: Community Colleges Count (ATD) initiative in 2004 to "emphasize the use of data and the creation of a 'culture of evidence' at the colleges to inform decision-making, and to measure progress against a specific set of student success metrics" (p. 3) in order to increase the number of Americans with degrees and credentials to 60% by the year 2025 (Lumina Foundation, 2009). The efforts, according to the strategic plan, are to assist student to be prepared academically, socially and financially, increase completion rates, and to increase institutional productivity to serve a larger number of students. Additionally, the Bill and Melinda Gates foundation are seeking new initiatives to enhance the number of postsecondary degrees or certificates as it is evident that success in today's workplace requires stronger math skills. To this end, workplaces are demanding higher levels of critical thinking, problem solving, and the ability to shift from one task to another, with stronger math, language, technology, and soft skills (Boggs, 2010).

Additionally, in reviewing accountability measures on a national level, when considering the Integrated Postsecondary Education Data System (IPEDS), which measures the graduation rates, the system is based on first time students who enroll in the

fall terms of an academic year (IPEDS, 2013), negating the spring enrollments, which is problematic for larger, urban institutions when attempting to report the correct number of completers (Tinto 2012). The data also only considers students that complete degrees in two-year institutions within a three year time period, and four-year institutions within a six year time period (IPEDS, 2013); thus, excluding a large number of part-time students enrolled within the institutions (Tinto, 2012). To this end, according to Tinto (2012), the data captures less than one third of the estimated student enrollments due to the fact that students may drop out and then return, or may complete their degree on a part-time basis, taking longer than the three-year time period under the IPEDS assessment model.

Many states are beginning to tie funding of retention and completion initiatives to community colleges and universities to incentivize the institutions toward student retention and success. For example, states such as Ohio and Washington have implemented momentum point models as a portion of funding for the public college systems (Jobs for the Future, 2012). Additional state legislatures are beginning to follow this direction as well. The Texas Higher Education Coordinating Board (2011) has mandated that Texas must award an additional 46,000 credentials by 2015. With community colleges being critical entry points to postsecondary education for diverse student populations, and to meet this challenge, the current funding model of student enrollment, contact hours, and general revenue funds are evolving to a *Momentum Point Model* developed by the Community College Research Center at Columbia University (Leinbach & Jenkins, 2008), where part of the funding will be based on student success or milestone completion. The model measures performance and provides incentives to colleges to enhance academic readiness, and increase progress of the students by embedding milestones and points for

completing developmental education, first year of college level math or English, completing 15 or 30 credit hours, earning a degree or certificate, and transferring to a four-year institution (Texas Higher Education Coordinating Board, 2011). The Texas Higher Education Coordinating Board (2011) believes that "the Momentum Points Model will enhance the existing accountability system for Texas' community and technical colleges" (p. 5), and encourage institutions to adopt practices focusing on student retention and completion.

Theoretical Framework

Historically, the earlier studies on student retention focused on involvement and considered student outcomes, including retention, within the first year of college (Astin, 1975; Pascarella and Terenzini, 1983; Tinto, 2006). Tinto (1975) developed a longitudinal process of attrition grounded in the social and academic systems of the academy as the individual student experienced these systems, in regards to their goals and institutional commitments, which may lead to persistence toward degree attainment or the decision to drop out. The model considered student demographics and pre-college experiences such as grade point average, academic and social attainment, and commitments, which directly relate to the individuals persistence in college within a traditional environment (Tinto, 1975). Since the study was conducted during a period when a large percentage of the students were high school graduates either living at home or on campus, the research focused on a more traditional university students, rather than commuter students, and focused on the "concept of integration and the patterns of interaction between the student and other members of the institution" (Tinto, 2006, pg. 3); however, according to Braxton, "Tinto's interactionalist theory, nevertheless, enjoys

near paradigmatic stature in the study of college student departure" (p. 2). Bean and Metzner (1985) expanded on Tinto's concept of academic integration as, "non-traditional students are more affected by the external environment than by the social integration variables affecting traditional student attrition" (p. 485). The Bean and Metzner Model of Non-traditional Student Attrition assessed the community college students in the area of retention and persistence and considered their unique characteristics. Community college transfer students generally do as well as incumbent university students in terms of grade point average and degree attainment, but not enough of the community college students are transferring to four year institutions (Boggs, 2010). According to Boggs (2010), educators must address the student success barriers in order to meet the challenges going forward, and states, "If we are to meet the 10-year challenge issued by President Obama and make good on the commitment to increase the numbers of student completers, educators must build on and expand programs and practices that reduce student barriers" (p. 4).

This study will utilize the Bean and Metzner Model of Non-traditional Student Attrition, which was published in 1985, and identified the need to research attrition of older students, who commuted to the college, and established a theoretical model to guide attrition research specifically in community college settings. The model established linkages, which were derived from traditional student attrition models and other behavioral theories, and extensive review of the literature on non-traditional students (Bean & Metzner, 1985). The authors defined non-traditional students as one that does not live in a college residence, is an older student being 24 or older, and is enrolled part-time, or any combination of these. The conceptual model indicates that dropout decisions

are based on four sets of variables. These variables include: students with poor academic performance are expected to drop out at higher rates than higher performing students; psychological outcomes and academic variables, which influence a student's intent to leave, are included; background and defining variables of high school performance and educational goals are expected to affect attrition; last, environmental variables are expected to impact the dropout decision of students. The three defining variables are age, enrollment status, and residence.

This study will analyze allied health programs of study at four community colleges using a modified version of the Bean and Metzner (1985) academic portion of the Conceptual Model of Non-traditional Student Attrition, which have pre-requisites of English 1301, Anatomy and Physiology I (BIOL 2401) or Applied Human Anatomy and Physiology I (SCIT 1407), and Math 1314 or Math 1414, and will be analyzing diagnostic medical sonography, echocardiology technology, invasive cardiovascular technology, nursing, radiologic sciences, and respiratory care. The demographic variables will be age, gender, and financial aid, and the independent academic variables will include program cumulative grade point average, degree selection, developmental coursework, cumulative grade point average, advising and the total number of credit hours completed. The dichotomous dependent variable will be program completion or non-completion in healthcare-related associate degree programs.

Statement of the Problem

As higher education seeks to increase associate degree completion, in addition to other types of certificates or degrees, further research related to student retention and completion in associate degree, healthcare-related programs is essential as community

colleges produce more than 50% of the healthcare workers across the United States (National Commission on Community Colleges, 2008). Furthermore, employment in healthcare occupations is expected to be one of the highest growth sectors at 34.5% through 2020 (United States Department of Labor, 2009b), and 91% of the healthcare market will be in nursing, allied health, and support care areas, which will account for an estimated 3.4 million jobs or 27% of all healthcare occupations, according to Carnevale and Smith (2013). However, the growth rate of positions in healthcare may be below the forecasted increase in percentage as the Bureau of Labor Statistics data is based on employers responses to questions about the number of individuals performing the specific duties, and respondents are not asked to distinguish between licensed or certified personnel from those without specific credentials (Institute of Medical Staff, 1984).

Educational leaders within community college systems are seeking strategic and systemic solutions to meet accountability measures and state mandates to serve stakeholders, including employers, students, and the community. There is limited research in the area of student persistence in healthcare-related associate degree programs, but a large amount of research available in the areas of university persistence initiatives, first year experiences in university settings, nursing programs or other healthcare specific programs in retention and completion, and studies related to general advising and completion within academic systems. Pascarella and Terenzini (199) noted that all types of community college research will be needed in order to contribute to greater understanding of this diverse student population. This study will fill a void in regards to factors and characteristics which lead to degree completion of students

enrolled in healthcare-related, associate degree programs within four, urban community college settings.

Purpose of the Study

The purpose of this study is to identify student characteristics and academic program factors, which influence the student's ability to persist through degree completion within healthcare-related, associate degree programs within an urban, highly complex, community college system.

Research Questions

The research questions are as follows:

What are the factors within Associate in Applied Sciences Degree (AAS), which predict the likelihood of degree completion within associate degree healthcare-related programs (Diagnostic Medical Sonography, Echocardiology Technology, Invasive Cardio Vascular Technology, Nursing, Radiologic Sciences, and Respiratory Care programs)?

Sub question 1:

What is the unique contribution of gender in predicting the likelihood of persistence to degree completion?

$H_0 1$: There is no statistically significant predictive contribution based on gender in predicting persistence to degree completion.

Sub question 2:

What is the unique contribution of age in predicting the likelihood of persistence to degree completion?

$H_0$2: There is no statistically significant predictive contribution based on age in predicting persistence to degree completion.

Sub question 3:

What is the unique contribution of program cumulative grade point average in predicting the likelihood of persistence to degree completion?

$H_0$3: There is no difference statistically significant predictive contribution based on program cumulative grade point average in predicting persistence to degree completion.

Sub question 4:

What are the unique contributions of the type of degree (Associate in Applied Sciences Degree (AAS) in Diagnostic Medical Sonography, Echocardiology Technology, Invasive Cardiovascular Technology, Nursing, Radiologic Sciences, and Respiratory Care programs) in predicting the likelihood of persistence to degree completion?

$H_0$4: There is no statistically significant predictive contribution based on the type of degree in predicting persistence to degree completion.

Sub question 5:

What is the unique contribution of developmental course requirements in predicting the likelihood of persistence to degree completion?

$H_0$5: There is no difference statistically significant predictive contribution based on developmental coursework in predicting persistence to degree completion.

Sub question 6:

What is the unique contribution of student's course grades in English 1301 in predicting the likelihood of persistence to degree completion?

$H_0$6: There is no difference statistically significant predictive contribution in student's course grades in of English 1301 in predicting persistence to degree completion.

Sub question 7:

What is the unique contribution of student's course grades in Anatomy and Physiology I (BIOL 2401) or Applied Human Anatomy and Physiology I (SCIT 1407) in predicting the likelihood of persistence to degree completion?

$H_0$7: There is no difference statistically significant predictive contribution in student's course grades in Anatomy and Physiology I (BIOL 2401) or Applied Human Anatomy and Physiology I (SCIT 1407) in predicting persistence to degree completion.

Sub question 8:

What is the unique contribution of student's course grades in 1314 in predicting the likelihood of persistence to degree completion?

$H_0$6: There is no difference statistically significant predictive contribution in student's course grades in Math 1314 in predicting persistence to degree completion.

Sub question 9:

What is the unique contribution of students receiving financial aid in predicting the likelihood of persistence to degree completion?

$H_0$9: There is no difference statistically significant predictive contribution based on students receiving financial aid in predicting persistence to degree completion.

Sub question 10:

What is the unique contribution of students receiving specialized healthcare program advising in predicting the likelihood of persistence to degree completion?

$H_0$10: There is no difference statistically significant predictive contribution based students receiving specialized healthcare program advising in predicting persistence to degree completion.

Sub question 11:

What is the unique contribution of total credit hours in predicting the likelihood of persistence to degree completion?

$H_0$11: There is no difference statistically significant predictive contribution based total credit hours in predicting persistence to degree completion.

Sub question 12:

What is the unique contribution of cumulative grade point average in predicting the likelihood of persistence to degree completion?

$H_0$12: There is no difference statistically significant predictive contribution based on cumulative grade point average in predicting persistence to degree completion.

Rationale, Relevance, and Significance

As higher education seeks to increase associate degree completion, in addition to other types of certificates or degrees, further research related to student retention and completion characteristics and academic program factors leading to student persistence in associate degree, healthcare-related programs is essential as community colleges produce more than 50% of the healthcare workers across the United States (National Commission on Community Colleges, 2008). These key academic and student characteristics will

assist institutions of higher education with predictors of student retention and success, according to Fike and Fike (2008), within allied health associate degree programs, and enable community colleges to use the data to improve student retention and completion within healthcare-related programs.

The majority of retention studies have been within university environments, or are specific to nursing retention within the healthcare sector (Papes and Lopez, 2007; Shelton, 2012). This study will analyze allied health programs of study at four community colleges using the Bean and Metzner (1985) academic portion of the Conceptual Model of Non-traditional Student Attrition, which have pre-requisites of English 1301, Anatomy and Physiology I (BIOL 2401) or Applied Human Anatomy and Physiology I (SCIT 1407), and Math 1314 and Math 1414, and will be analyzing diagnostic medical sonography, echocardiology technology, invasive cardiovascular technology, nursing, radiologic sciences, and respiratory care.

Nature of the Study

These key student characteristics will assist institutions of higher education with predictors of student retention and success within healthcare related associate degree programs, and enable community colleges to use the data to improve student retention and completion. Tinto (2012) notes that student attributes are largely beyond the control of the institution, but institutional conditions in which students are placed may lead to greater results in the area of institutional actions. Use of such data may be applied to improve student retention within allied health programs, and to analyze and evaluate student persistence and improvement, thus enhancing institutional processes and academic program practices within healthcare-related fields of study.

Definition of Terms

Allied Health – a large cluster of health-related professions that fulfill necessary roles in the healthcare system (Gupta, 1991).

Associate of applied science degree program – a degree which prepares students for specific career/technical skills, with listed requirements for each major in the Associate in Applied Sciences Degree (AAS) as clearly shown in curriculum patterns within catalogs, and is a terminal 2-year undergraduate degree between 60 to 72 credit hours.

Attrition – "the rate at which students terminate college without completing a degree" (Tinto, 2012, p. 128). For this study, attrition refers to the change from the number of students accepted into the program to the number actually completing.

Cumulative grade point average - Grade points earned for each course are determined by multiplying the number of points for each grade by the number of credit hours the course carries. Cumulative grade point average is based upon all courses completed in colleges in which the student received a performance grade of A-F. Grades are based upon a 4.0 system: A = 4.0, B = 3.0, C = 2.0, D = 1.0 and F = 0.0.

Demographic data – information related to gender, age at the time of program entry, and major of study.

Developmental courses – coursework required for remedial and developmental educations courses in the areas of reading, writing, and mathematics. An "E" grade is given upon course completion, and is not computed in the program or cumulative grade point averages.

Healthcare Program Advising – A specialized and intensive advising area to assist students with healthcare program selection based on their skills and interests.

Health-related program – a program of study in an Associates of Applied Science major in the areas diagnostic medical sonography, echocardiology technology, invasive cardiovascular technology, nursing, radiologic sciences, and respiratory care.

Retention – refers to "the rate at which an institution retains and graduates students who enter the institution" (Tinto, 2012, p. 127).

Persistence – refers to "the rate at which students who begin higher education at a given point in time continue in higher education and eventually complete their degree, regardless of where they do so" (Tinto, 2012, p. 127).

Prerequisite course work – for the purpose of this study, required courses prior to program entry will be defined as English 1301, Anatomy and Physiology I (BIOL 2401) or Applied Human Anatomy and Physiology I (SCIT 1407), and Math 1314.

Program completer (graduate) – a student who was accepted into a healthcare-related program with prerequisites of English 1301, Anatomy and Physiology I (BIOL 2401) or Applied Human Anatomy and Physiology I (SCIT 1407), and Math 1314, and successfully completed all required courses to graduate with an Associate in Applied Sciences Degree (AAS) in Diagnostic Medical Sonography, Invasive Cardiovascular Technology, Echocardiology Technology, Nursing, Radiologic Sciences, and Respiratory Care.

Assumptions, Limitations, and Delimitations

Assumptions

Two assumptions within this research study are that data collected on all students is considered accurate, since the data set was derived from a central Datatel system in an automated format, and that the grades assigned to students are based on the evaluation criteria within each course syllabus.

Delimitations and Limitations

There are a number of issues which may limit the general application of this study to different student populations within healthcare-related associate degree programs. Primarily, this study evaluated the predictors of success of non-traditional students enrolled in four, urban community colleges, rather than surveying all students in Associate in Applied Sciences Degrees (AAS) in Diagnostic Medical Sonography, Invasive Cardiovascular Technology, Echocardiology Technology, Nursing, Radiologic Sciences, and Respiratory Care across the United States. Other delimitation and limitations are as follows:

1. This study delimited to the population of students who were enrolled in health-related programs in four public, urban colleges with prerequisites of English 1301, Anatomy and Physiology I (BIOL 2401) or Applied Human Anatomy and Physiology I (SCIT 1407), and Math 1314 or Math 1414.
2. This study does not recognize students who have declared a major in the area of study, and have not been accepted to the healthcare-related program.
3. This study does not control for additional tutoring or counseling during the student's program of study.

4. This study does not differentiate between full-time and part-time students.
5. This study is limited by the fact that variables such as gender and age were self-reported.
6. The study does not address variations in grading scales and grade inflation.
7. This study does not address variations in teaching modalities or instructional styles by various professors.
8. This study does not address variation in faculty teaching experience or turnover rates.
9. This study does not differentiate between entrance requirements for the various programs of study.
10. This study may reflect my personal biases due to my professional work experience in the healthcare sector within a community college setting, but all precautions have been taken to mitigate this issue.

Organization of the Remainder of the Study

Chapter 1 provides an introduction to the study, which includes an introduction to the problem, background, context, theoretical framework, and includes the importance of the study with research questions, hypotheses, delimitation and limitations, assumption, definition of terms, and rationale. Chapter 2 includes a comprehensive review of the literature related to student persistence and completion. Chapter 3 examines the primary research question and sub-questions and includes a detailed analysis of the methodology, procedures, and data analysis conducted. Chapter 4 presents the results of the study, analyses, and narrative explanations for the primary research question and sub-questions. Last, Chapter 5 provides a summary of the findings, conclusions, and recommendation.

CHAPTER 2. LITERATURE REVIEW

Introduction to the Literature Review

Recommendations from the Education Secretary Margaret Spellings' Commission on the future of higher education spurred much debate, and required higher education leaders to adopt more proactive approaches in regards to accountability and institutional effectiveness (Ewell, 2011; Boggs, 2009). With a higher demand for skilled workers, state legislatures, accrediting organizations, employers, and other stakeholders are seeking answers on what students can do, what they are learning, and how is learning being assessed from a quality perspective (Kuh, 2001). These accountability measures are seeking to increase student success in order to provide a stronger skilled workforce by increasing degree attainment for students (Kuh, 2001; Kuh, Kinzie, Schuh, & Whitt, 2005). Furthermore, according to Carnevale, Smith, and Strohl (n.d.), healthcare is one of the fastest growing industries in the United States, and those with post-secondary education typically earn 74% more than workers with a high school diploma. The administrators within colleges and universities are seeking ways to increase student persistence and completion in order to meet these initiatives, according to Ewell (2011), Heller (2009), and O'Banion (2010). Additionally, the overarching research indicates that the time and energy students expend on purposeful, education activities is the greatest predictor of their learning and personal development (Astin, 1993; Pascarella & Terenzini, 2005; Wolf-Wendel, Ward & Kinzie, 2009). Within healthcare-related programs, clinical experiences allow for such learning and personal development in

regards to working with patients, and applying theoretical concepts in a clinical environment.

In considering educational outcomes related to retention and persistence within higher education, Tinto (1993) explores the relationship between student involvement(s) relating to learning in correlation to persistence. As stated previously, key areas that impact student persistence include socio-economic status (Tinto, 2006; Wolniak, Mayhew & Engberg, 2012), successful academics prior to college (Braxton, Bray, & Berger, 2000; Reason, 2009), financial aid (Tinto, 2006; Wolniak, Mayhew, & Engberg, 2012), institutional characteristics (Ewell, 2011), academic and social integration (Tinto, 2006; Pascarella & Terenzini, 1995), and college grades (Wolniak, Mayhew, & Engberg, 2012). The majority of these studies have been within university environments or are specific to nursing retention within the healthcare sector (Papes & Lopez, 2007; Shelton, 2012).

One study of students in healthcare-related associate degrees was conducted by Allana Hamilton (2011) within a community college setting to identify factors related to persistence of students at Northeast State Community College in Tennessee. The findings indicated a significant difference in persistence within the programs of study, and a strong relationship between course grades and persistence to graduation, and the number of math and science courses completed, but was limited to one college; additionally, other community college studies are centered around overall student retention and completion in general studies rather than healthcare-related programs. An additional study conducted by Nilia Madan (2012) evaluated predictors of student success in medical laboratory associate degree programs utilizing factors of reading and

math placement scores, cumulative GPA, science GPA, first semester lab course GPA, and demographic data to predict program completion. The study found a significant relationship between cumulative, science, and program grade point averages, and college math placement scores as being predictors of students more likely to complete their degree within two years. Furthermore, the findings were consistent with the academic portion of the Bean and Metzner Conceptual Model of Non-traditional Student Attrition (1985).

Completion and retention of students in community colleges across the country is a significant problem (National Commission on Community Colleges, 2008). Nine out of ten community college students seek a certificate, associate degree or to transfer to a university, but only 36% achieve a degree within 6 years, according to Schuetz (2005) and Crawford and Jervis (2011). Furthermore, Schuetz (2005) notes the problems with attrition as it essentially depletes the skilled workers and educated workforce of the future, which will require higher level skills for jobs in the future (Carnevale, Smith, & Strohl, n. d.). As students enter community colleges, issues with the lack of basic educational skills, particularly in math, according to the Carnegie Foundation (2010), ill-defined programs of study, and the inability of students to navigate the application process are barriers to completion (Crawford & Jervis, 2011; Laurance & VanNahmen, 2011); whereas, Elena (2011) notes higher completion and success rates within technical education programs because of the structured degree requirements within the programs of study. As retention and completion rates are evaluated to determine success for students, a balance must be maintained regarding access, institutional services, and student success

initiatives leading to completion to ensure equitable outcomes, and to remain true to the mission of the community college system, as reflected by Bragg and Durham (2012).

Theoretical Framework

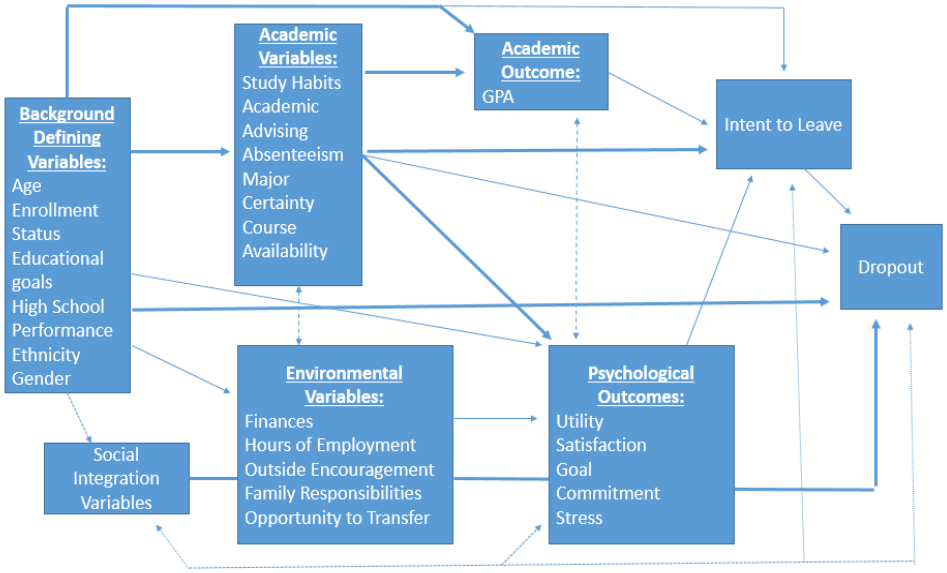
This study focuses on non-traditional students and factors, which influence persistence to degree completion by applying the Bean and Metzner's (1985) model related to healthcare associate degree programs across four public colleges, which is not present within current research. This study will explore whether the persistence factors can be defined and predicted to increase completion within healthcare-related, associate degree programs, and may provide findings or insight to assist colleges in determining factors of completion leading to greater retention of non-traditional healthcare students.

Bean and Metzner (1985) sought to define non-traditional, undergraduate students, and to develop a conceptual model of the attrition process of older, part-time, commuter students. The researchers noted that non-traditional students are more affected by external environments than by the social integration variables (Spady, 1970; Tinto, 1975; Pascarella & Terenzini, 1983), which typically impact the traditional students in regards to attrition. The Bean and Metzner (1985) conceptual model has been effective in guiding attrition research of non-traditional students within institutions of higher education, and notes the likelihood of non-traditional students completing a degree is less than that of traditional students, and is grounded in the attrition theories of Spady (1970), Tinto (1975), and Pascarella and Terenzini (1983). According to Bean and Metzner (1985), non-traditional students tend to be more driven by academic variables, rather than social integration as in traditional students. Additionally, the Bean and Metzner (1985) model defines a dropout as a "Student who enrolls at an institution one semester, but does

not enroll the next semester and has not completed his or her formally declared program of study" (p. 489).

The "Figure 1. Conceptual Model of Non-traditional Undergraduate Student Attrition" by Bean and Metzner (1985) includes background variables related to the student's interaction with the institution, that dropping out is a longitudinal process, and identifies specific academic variables expected to impact the attrition decision. As indicated in Figure 1, the model utilizes four sets of variables including academic variables (study skills and habits, academic advising, absenteeism, major certainty, and course availability), background variables (educational goals, high school academic performance, ethnicity, and gender) and defining variables (age, enrollment status, and residence), environmental variables (finances, hours of employment, outside encouragement, family responsibilities, and opportunity for transfer), academic outcomes (grade point average), and psychological outcomes (utility, satisfaction, goal commitment, and stress). It is noted that the background variable of parental education level was not included because previous research indicated there is not a significant difference between student attrition and educational attainment of parents (Bean and Metzner, 1985).

Figure 1. Bean and Metzner's (1985) Conceptual Model of Non-traditional Undergraduate Student Attrition.



Key: Direct Effects
Direct Effects presumed most
Compensatory interaction effects
Possible Effects

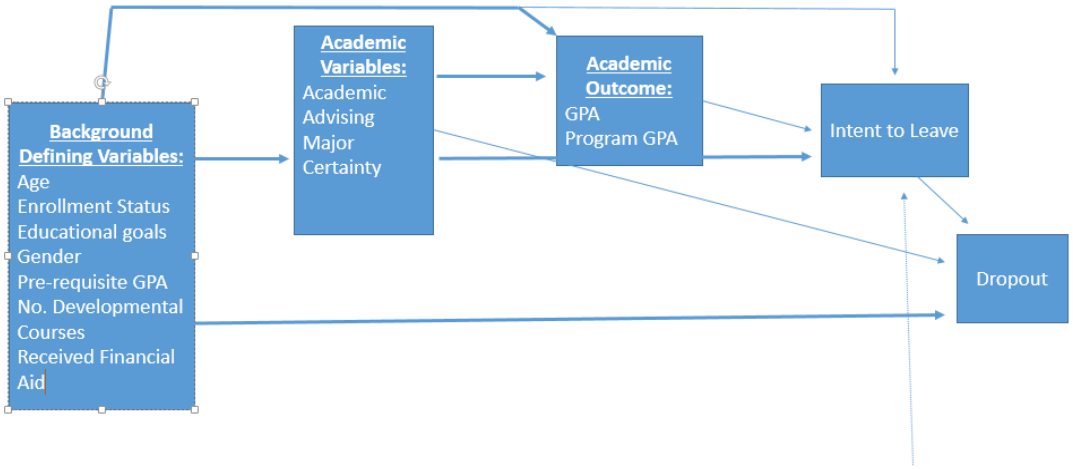
From "A Conceptual Model of Non-traditional Undergraduate Student Attrition," by J. P. Bean, and B. S. Metzner, 1985, Review of Educational Research, 55, p. 491. Copyright 1985 by the American Educational Research Association. Reprinted with permission of the publisher.

Bean and Metzner (1985) considered non-traditional students as those that were part-time, non-residential, not in need of the social environment of the institution, over the age of 24, and primarily interested in degrees or certificates offered within the colleges or any combination of these factors. As various definitions have been derived related to non-traditional students, for the purposes of this study, non-traditional students are commuter students, over the age of 24, and are interested in specific healthcare-related, associate degree programs. Bean and Metzner (1985) found that non-traditional students interact with the institution through academic variables, such as advising and major certainty; therefore, these variables are included within the study and are expected

to have a direct correlation with grade point averages within the healthcare program pre-requisite courses, program courses, and overall program grades (Spady, 1970, Tinto, 1975; and Hamilton, 2011). The research in this study addressed selected academic and background variables in regards to determining predictors of persistence in healthcare-related associate degrees.

Figure 2 shows a modified Bean and Metzner model utilized as this study's framework. In outlining this study, the researcher used age, gender, and financial aid as demographic variables. The academic variables of program cumulative grade point average, degree selection (or major certainty), developmental course work requirements, course grades in BIOL 2401 or SCIT 1407, Math 1314 or Math 1414, program grade point average, advising, and total number of credit hours completed as independent variables. The dependent variable for the study was program completion or non-completion of a healthcare-related associate degree program. Figure 2 shows the modified framework used for this study from the Bean and Metzner (1985) *Model of Non-traditional Student Attrition*.

Figure 2. Bean and Metzner (1985) Adapted Model of Non-traditional Student Attrition.



Key: Direct Effects
Direct Effects presumed most important

Figure 2: Framework of the study adapted from the Bean & Metzner Conceptual Model of Non-traditional Student Attrition. (Bean & Metzner, 1985, p. 491.). Copyright 1985 by the American Educational Research Association. Adapted with permission of the publisher.

Review of the Research Literature and Methodological Literature

While this study specifically examines persistence factors within healthcare-related associate degree programs in an urban setting, a review of the relevant literature provides explanations and supporting theories related to the factors of persistence, which lead to degree retention and completion. However, students entering community colleges may not intend to receive a degree or certificate, but may be simply taking courses for personal enrichment, job training, or to meet general educational requirements to transfer to a university setting (Choy, 2002; Summers, 2003; Tinto, 2012). Furthermore, community college students may temporarily "stopout" or "stayout" of college due to work, family, or financial circumstances (Horn, 1998; Schatzel, Callahan, Scott, & Davis, 2011). Schatzel, Callahan, Scott, and Davis (2011) conducted a study to target non-

traditional students that intended to return to college noting the intention to re-enroll is increased when students have previous educational attainment, value education, and its importance in society. Of the students intending to "stayout" of college, the students were more likely to have children and cited family responsibilities as the major reason to not return to college within the five segments of family ties, married and comfortable, financially strapped singles, "progressors," and time bound (Schatzel, Callahan, Scott, & Davis, 2011).

Choy (2002) defines the traditional undergraduate student as:

> One who earns a high school diploma, enrolls full time immediately after finishing high school, depends on parents for financial support, and either does not work during the school year or works part time – is the exception rather than the rule. (p. 1).

During the Fall of 2010, an estimated 11 million undergraduate students were attending institutions full time, while 7 million (or 39%) attended part time; of the part time students, two thirds attended 2-year institutions, which is 64% of the total student body (United States Department of Education, 2012). The term non-traditional student is not a precise term; however, a student's age and enrollment status are typically included within the common definition (Bean and Metzner, 1985). Choy (2002) described non-traditional students on a continuum based on several characteristics present, which include delays in enrollment, attending part time for at least part of the academic year, working more than 35 hours a week, financially independent for financial aid purposes, have dependents, are single parents, and not holding a high school diploma.

Bean and Metzner (1985) also consider students who commute to campus as being non-traditional, which is a significant characteristic for 2-year, public, urban community colleges. In 1999-2000, 73% of all undergraduates had one or more of these characteristics with 51% being financially independent, 48% attending part time, and 46% having delays in enrollment (Choy, 2002). To this end, Choy (2002) states, "The 'traditional' student is not typical. Fully three-quarters of all postsecondary students in 1999-2000 had at least one non-traditional characteristic. The most highly non-traditional students, defined as (those with four or more non-traditional characteristics) were concentrated in public 2-year institutions, with two-thirds enrolled in this type of institution" (p. 19). With 64% of the total student body of 2-year institutions working at least part time in 2012, the majority of these institutions are comprised of non-traditional students today (United States Department of Education, 2012).

Review of Research Regarding Student Retention

As community colleges continue to change in order to adapt to the needs of business, industry, government, and the local community, colleges are charged with vocational training and education, workforce development, corporate or customized course offerings, transfer courses, remedial courses, and other programs and services (Kasper, 2003). Over the past decades, scholars have considered ways to evaluate the persistence and completion of students within 2-year and 4-year institutions and provided extensive research regarding student success. Typically, researchers explore student persistence by identifying predictors through modeling of studies. This literature review will address the conceptual framework and theoretical models of student attrition from a

historical perspective to current studies, which evaluate, analyze and identify predictors of persistence impacting student decisions to remain in college.

The Editor, George Simpson, in Durkheim (1951) refers to *Le Suicide* as "a milestone in social science and an indispensable part in understanding the work of the man who founded and firmly established academic sociology in France, and influenced many others outside of France" (p. 9), and is noted for aligning with sociological, statistical, philosophical, and psychological disciplines. Furthermore, Durkheim's suicide research, according to the Editor George Simpson, is touted as "the prototype of systematic, rigorous and unrelenting attack on the subject with the data, techniques, and accumulated knowledge available at any given period…is among the very first modern examples of consistent and organized use of statistical method in social investigation" (p. 9). This approach was effective in realigning the statistical study to answer the specific research question in order to create a theoretical framework and organize studies from a logical standpoint.

Durkheim's (1951) research sought to establish suicide as a social construct, rather than an individual phenomenon, as tendencies toward suicide increased as individuals were unable to integrate into their surrounding social systems, or egoistic suicide, which resulted from the lack of integration of the individual into society. Durkheim (1951) also found that the more an individual utilized their own resources to prevent suicide, the greater the suicide rate within the society. Altruistic suicide was defined within the study, and exists where the individual's life is governed by custom and habit in regards to allegiance to higher commandments related to religious or political allegiances (Durkheim, 1951). Both altruistic and egoistic forms of suicide relate to how

individuals inadequately or over-adequately integrate into society. As the individual reaches a threshold, and is unable to cope with new circumstances, such as divorce, conditions for anomic suicide may be increased to a maximum. To this end, Durkheim (1951) categorizes suicide as egoistic, altruistic, and anomic to establish behavior patterns related to social phenomena such as family, religion, political and economic circumstance, and the individuals inability to integrate within the systems.

Spady (1970) expanded on Durkheim's theory by applying the concept to students integrating socially into academic systems, and their ability to persist or drop out, analogous with the concept of suicide. Spady's (1970) model of college attrition evaluated five independent variables of grade performance, intellectual development, friendship support, normative congruence, and social integration in regards to the dependent variable of the decision to drop out related to satisfaction and institutional commitment, as intervening variables. In 1971, Spady conducted a longitudinal study of 683 undergraduate university students in order to "operationalize" the variables, and analyze the relationships in order to understand the attrition process. The outcome of the study was to include a structural relation with friendship support, and to revise the relationships within the model.

Astin (1984) defines student involvement as "the amount of physical and psychological energy that the student devotes to the academic experience" (p. 518). This theory of student involvement is based on a previous longitudinal study of college dropouts (Astin, 1975) to identify factors within the educational environment impacting student persistence to completion. Each effect was viewed in terms of student involvement or non-involvement based on positive and negative factors contributing to

success, or the dropping out of students, based on the individuals level of involvement (Astin, 1984). With the examination of 200,000 students, and 80 different outcomes focusing on student involvement, Astin (1984) considered variables of residency, honors programs, undergraduate research participation, fraternity and sororities' participation, academic involvement, student-faculty interaction, athletics, and student government activities as contributing to student's level of involvement. The study found attendance had a positive correlation on student involvement, and "nearly all forms of student involvement are associated with greater than average changes in entering freshman characteristics" (p. 524); furthermore, additional findings indicated that faculty should pay close attention to students showing passive traits, rather than the more assertive students, in order to navigate greater involvement of the students within the system, thus leading to retention and persistence. Involvement is a condition for student success (Tinto, 1993, 2001) within traditional institutions; the more students are involved within the first year, the more they will persist to graduation (Milem & Berger, 1997; Tinto, 2006; Wolniak et al., 2012).

According to Astin's theory of involvement (1984), highly engaged students expend a considerable amount of energy studying, spending time on campus, participating in student organizations, and interacting with faculty and peer groups within the college system. Most first-year experiences in higher education are uninvolving, expectations for learning are low, as well as time spent on task (Astin, 1984; Tinto, 2006, 2012). Un-involved students neglect studies, do not participate in organizations or extracurricular activities, and are reluctant to contact faculty members or student peers of the college (Astin, 1984; Tinto, 2006). Astin asserts that student persistence or effort is

associated with their involvement within such a college system, and non-involvement creates student departure from the college (Kuh, 2009; Pascarella & Terenzini, 2005; Tinto, 1975, 1993, 2001). Astin (1984) states, "It is not so much what the individual thinks or feels, but what the individual does, how he or she behaves, that defines and identified involvement" (p. 298).

Astin (1999) further posits the involvement theory by describing five impacted areas of involvement as being the investment of physical and psychological energy (Milem & Berger, 1997; Richmond, 1986) in various objects (student experiences, exams, etc.), occurring along a continuum with different levels of student involvement, holding quantitative (number of hours spent studying) and qualitative (comprehension of assignments or readings) features, personal development associated with quality and quantity of student involvement in programs, and the effectiveness of educational policy to increase student involvement. Similar to Tinto (1975), Astin considers the theory of involvement as a process of integration into the academic system.

With the theory of student involvement, the link between subject matter, resources, and individualization approaches lies in a curriculum to achieve the intended results, and elicits sufficient student effort and investment of energy, according to Astin (1999). Students are placed in active learning environments, and the professors are encouraged to focus on the actions of the students, rather than on course content, teaching techniques, and other resources (Astin, 1999). The key concept regarding Astin's (1984) theory of student involvement relates to the concept that highly engaged students expend considerable energy, and also acknowledges the contributions of the educational environment (Wolf-Wendel, Ward, & Kinzie, 2009). More recently, according to Wolf-

Wendel, Ward, and Kinzie (2009), the concept of involvement has contributed to educational research and practice by emphasizing academic and extracurricular activities, and by focusing on the individual to become more involved within the system of higher education.

Tinto (1975) expanded on Durkheim (1951) and Spady (1970) theories by applying the concepts to a linear student attrition model. Similar to Durkheim's theory of integration, Tinto evaluated a longitudinal process in which the student's background, commitment to the institution, and interaction with peers and faculty were impacted by social and academic integration into the college as predictors of attrition. The model considered the transition from the stages of separation (disassociation from the student's previous community), transition, and incorporation (full integration or acceptance of the institution) of first year university students (Tinto, 1975, 1987, and 1993).

Vincent Tinto's model of student departure is among the most widely discussed persistence models in higher education (Milem & Berger, 1997; Summers, 2003). With student departure rates of 56% prior to a student's second year in college, research indicates that students leave colleges and universities for various reasons including academics, transitional or adjustment issues, goal uncertainty, lack of persistence or student involvement, and inadequate finances (Braxton, Milem, & Sullivan, 2000; Morrow & Ackermann, 2012; Tinto, 2001; Wolniak, Mayhew, & Engberg, 2012). Tinto's (1975) research in student persistence identified that the student's integration or transition into the academic and social environment of a college or university was a strong contributor to successful degree completion (Wolniak et al., 2012). Tinto's 1975 book, *Leaving College*, was the first to detail a longitudinal model to connect the

environment (academic and social systems of higher education institutions) with individuals who shaped the systems and student retention over time (Tinto 1975, 1993, 2006).

In order for students to persist within the academy, a process of integration into the social systems of the institution is essential to navigate the stages of separation, transition, and incorporation (Milem & Berger, 1997; Tinto, 1993). In considering educational outcomes related to retention and persistence within higher education, Tinto (1993) explored the relationship between student involvement(s) relating to learning in correlation to persistence. His "interactionalist" model of student departure describes ways in which the students' social interests and academic life are experienced within college environments in order to persist through degree attainment (Milem & Berger, 1997). Key areas where students are more likely to persist include socio-economic status (Tinto, 2006; Wolniak et al., 2012), successful academics prior to college (Braxton, Bray et al., 2000; Reason, 2009), financial aid (Tinto, 2006; Wolniak et al., 2012), institutional characteristics and choice (Braxton, Bray, & Berger, 2000), academic and social integration (Tinto, 2006), and college grades (Wolniak, Mayhew, & Engberg, 2012).

Social and academic involvement is a critical component of the first year for students in order to successfully navigate through the stages of separation, transition and incorporation (Brier, Hirschy, & Braxton, 2008; Tinto, 1975), which social and academic integration are positively correlated with student persistence (Wolniak et al., 2012; Milem & Berger, 1997; Tinto, 2006). Students are within the system of the university or college, and begin to interact within the system by encountering new values, norms, behaviors, or attitudes in order to explore new experiences and adopt particular norms of

the system, and begin to reject norms or their past systems of their family and friends (Tinto 1993; Milem & Berger, 1997).

As students begin to separate or disassociate from their past communities and attempt to connect to the new college system's norms, the first stage of separation occurs as students become involved within the new academic and social life of the academy (Tinto, 1993). The transition phase occurs after students have successfully completed the separation phase; however, it was previously argued that students had to completely break away from their past communities, more recent studies (Elkins, Braxton, & James, 2000) indicate that the "likelihood of successful passage through separation stage is enhanced by students receiving support from members of their past communities" (p. 365). As described by Milem and Berger (1997), in the transition phase, students have separated from the past norms, but have not yet adopted the norms or behaviors of the new collegiate system. The final phase of incorporation occurs once the norms of the college are adopted. Tinto (1993) asserts that in order for students to successfully integrate into the system, they must reach the incorporation phase of the academic and social life of the college in order to persist to degree attainment, and be retained within the collegiate system. According to Tinto (2006), involvement, or recently termed engagement, is what matters most within the first year of college in order for students to persist.

In 1983, Pascarella, Duby, and Iverson sought to determine if Tinto's (1975) *Theoretical Model of College Withdrawals* could be generalized to a non-residential, urban, commuter university setting, or to establish which dimensions of the model worked within a non-residential setting. The second purpose of the study was to extend

the model by including "intention" of the student to leave or stay within the university, thus building on the work of Bean (1981) related to the importance that intention (intent of students to leave or stay) had on the direct effect of persistence. The researchers found Tinto's concept of academic integration was consistent with the theory within the model (Pacarella, Duby, & Iverson, 1983) and noted:

> Regardless of the type of post-secondary institution attended, it seems evident that persistence is predicated to a significant extent on the individual's attaining sufficient levels of structural integration (the extrinsic reward of grades), and normative integration (the intrinsic reward of intellectual development) in the institution's academic system (p. 96).

However, regarding commuter institutions, the influence of social integration on persistence is inconsistent with the model and research related to residential institutions (Pascarella, et. al., 1983). Furthermore, Pascarella et al. (1983) expanded further on Tinto's model related to precollege variables of gender and academic aptitude as having significant impact on student persistence. The application of Tinto's model on commuter university institutions is critical to the existing research to include precollege variables as an indicator of student persistence to graduation.

Building on Astin's (1984) theory of student involvement, with a focus on psychological and behavioral dimensions related to effort, Kuh's theory of student engagement included time, quality of effort (Tinto, 1993; Braxton, Milem et al., 2000; Cox, McIntosh, Reason, & Terenzini, 2011), the premise that students learn from engagement within the college setting (Pike & Kau, 2005), and what they actually do (Kau, 2003). In an attempt to define student engagement, Kuh (2003, 2009) describes

this theory as representing “the time and effort students devote to activities that are empirically linked to desired outcomes of college, and what institutions do to induce students to participate in these activities" (p. 683). Simply stated by Kuh (2003), “The more students study a subject, the more they learn about it. Likewise, the more students practice and get feedback on their writing, analyzing, or problem solving, the more adept they become” (p. 25). Also, student engagement is positively linked to gains in general abilities and critical thinking skills, grades, and persistence rates (Pike and Kuh, 2005).

During the 1990’s, student engagement, or involvement initiatives, began to consider how institutions of higher learning allocated resources, arranged curriculum, considered opportunities for learning, and made available student support services to encourage students to participate within the collegiate environment in support of persistence and retention leading to degree attainment (Kuh 2003, 2009; Wolf-Wendel, Ward, & Kinzie, 2009). During this period, student engagement also began to be measured as a function of educational quality, and a critical area, which the college could directly influence through institutional policies and practices (Kuh, 2009).

Institutional Engagement

Pike and Kuh (2005) considered institutions with similar characteristics and missions, noting the substantially different engagement levels, and types in order to create a typology independent of the Carnegie classifications in order to better align student engagement with institutional characteristics (Astin, 1984). The study confirmed the National Survey of Student Engagement (NSSE) reports in that institutions differ in how students are engaged, and there were no findings that institutions are uniformly significant in all measures of engagement (Pike & Kuh, 2005), but identified seven types

of engaging institutions, as an alternative to the Carnegie classification (McCormick, Pike, Kuh, & Chen, 2009) with characteristics of diversity, homogeneous and interpersonally cohesive, intellectually stimulating, interpersonally supportive, high-tech and low-touch, academically challenging and supportive, and collaborative.

In an effort to incorporate student engagement data, assess student learning outcomes, and measure the effectiveness of student engagement to meet the call for accountability (Kuh, 2009; Kuh et al., 2005), systematic approaches to assess student learning were established utilizing the Voluntary System of Accountability, a joint effort by the Association of Public and Land-Grant Universities (APLU), and American Association of State Colleges and Universities (AASCU), as cited by Kuh (2009) and McPherson and Shulenburger (2010), the National Survey of Student Engagement (2008), and encouragement by the Council of Independent Colleges to establish instruments to assess student learning (Kuh, 2009). These meaningful, institutional practices helped to establish additional instruments such as the Community College Survey of Student Engagement (CCSSE), the Law School Survey of Student Engagement, the Community College Faculty Survey of Student Engagement, and Beginning College Survey of Student Engagement for four-year schools, and the Survey of Entering Student Engagement for Community Colleges (Kuh, 2009).

Pascarella and Terenzini (1998) note that their study conducted between 1968 through 1988 of the 2,600 studies of first year college students allowed the researchers to draw conclusions of effective practices such as a "small institutional size, a strong faculty emphasis on teaching and student development, a student body that attends college full time and resides on-campus, a common general education

emphasis or shared intellectual experience in the curriculum, and frequent interaction in- and outside the classroom between students and faculty and between students and their peers" (p. 151) As stated previously, what students do and the time and energy devoted to purposeful educational activities is the best predictor of their persistence to learning, personal development, retention and completion (Astin, 1993; Pascarella & Terenzini; Wolf-Wendel, Ward, & Kinzie, 2009).

Review of Methodological Issues

From the seminal research on retention (Tinto, 1975), it was determined that students needed to disconnect from their past cultural systems and norms in order to integrate and become involved within the higher education environment, and also affirms the role of student involvement related to educational outcomes (Berger & Milem, 1999). Recent studies indicate that some students need to stay connected to their past communities, such as church and family, in order to persist to degree attainment (Tinto, 2006; Banyard & Cantor, 2004). Tinto (1993) also considered the academic and social life of students related to acceptance or norms within the system, and included behavior and perception by students as they integrate into the system, according to Milem and Berger (1997). However, empirical research testing the model, according to Berger & Milem (1999), focuses on the student perceptions of academic and social integration, rather than measuring the actual behavior (Wolf-Wendel, Ward, & Kinzie, 2009). Braxton, Sullivan, and Johnson (1997) suggested that additional "helper" theories or perspectives should be used within research to identify sources of the academic or social integration, and to improve the validity of the model.

Astin's theory of involvement also considered the level of persistence from a behavioral perspective in regards to what the individual does in order to engage within the college environment. To this end, involvement theory contributed to the field by emphasizing immersion of students into academics and extracurricular activities, and the level of such involvement (Wolf-Wendel, Ward, & Kinzie, 2009). Berger and Milem (1999) note the use of behavioral measures including perceptual measures within the social and academic variable of other researchers (Pascarella & Terenzini, 1983; Pascarella & Chapman, 1983; Nora & Rendon, 1990). Understanding of such variables is essential to student involvement because students are more likely to feel a sense of loyalty to their institutions of study if effective and meaningful involvement of activities and learning is encouraged at the institution (Kuh et al., 2005).

Berger (1997) noted the intention to persist within a community college was strongly correlated to institutional practices, and a sense of community, while researchers have approached integration studies in various ways including classroom discussions, teaching practices, and orientations (Wolniak et al., 2012). However, the first experience for college students, particularly within the community college (Talbert, 2012), is critical for retention and completion within the institution. Leaders of institutions may engage in a number of practices in order to align student success initiatives with policies and procedures or funding practices of the college in order to support the learning and retention initiatives of the organization (Astin, 1984; Cox, McIntosh, Reason, & Terenzini, 2009; Pike & Kuh, 2005).

From a policy and procedure standpoint, practices such as requiring a student success course in the first term (Cho & Karp, 2013), prohibiting late registration, creating

learning communities (Cox, McIntosh, Reason, & Terenzini, 2009) such as English for Healthcare Communication courses or Pharmaceutical Math, establishing health professions clubs or organizations (Wolf-Wendel, Ward, & Kinzie, 2009) to enhance student involvement, creating retention committees involving numerous institutional stakeholders (faculty, staff, and administrators) to identify issues preventing students from persisting (Bosco, 2012), and participating in surveys Community College Survey of Student Engagement (CCSSE) will support retention practices within academic settings. Talbert (2012) noted strategic approaches by college administrations to include establishing tracking systems to identify high risk students and assess student retention, expand marketing and advertising to promote programs, align English as a second language to programs of study and college-level coursework, and ensure course planning, design, delivery, and assessment of learning outcomes as meaningful outcomes for students and faculty. Also, encouraging students to apply for financial aid, as filing of the Free Application for Federal Student Aid (FASFA) increases persistence and retention of students within community colleges (McKinney & Novak, 2013).

Furthermore, to meet the goals of retention and completion of healthcare students within a community college, the establishment of an intrusive advising (O'Banion, 2012) center and mentoring program can be strategically deployed to provide information regarding the variety of programs for the more than 200 healthcare occupations (U. S. Department of Labor, 2012) and, extensive program pre-requisites in order to provide information to meet the needs of the student's long-term career goals, thus increasing the likelihood student persistence. Students entering an advising center may be assigned an advisor to communicate progress with each semester in order to receive guidance,

understand tutoring resources, and to work with students regarding their active involvement within the learning process to encourage persistence and completion student persistence (Wolniak et al., 2012; Milem & Berger, 1997; Tinto, 2006).

Review of Healthcare-related Research

The application of student retention practices is critical within healthcare-related programs of study because of the high demand for the skilled workforce, and the limitations on the number of students that can be accepted into programs due to clinical rotation requirements and limited quality faculty (Allen, Keough & Armstrong, 2013). The selection process is considered an essential component as a retention strategy in order to retain students through degree completion. Herrera (2013) conducted a study on a baccalaureate nursing program to evaluate predictors of success including prerequisite courses, scores earned on the entrance exams, number of prerequisite courses taken at four-year verses two-year colleges, race, ethnicity, and gender. Newton and Moore (2009) noted that pre-requisite grades with a grade point average of less than 2.5 are correlated to have a weak scholastic aptitude, and science courses, such as anatomy and physiology are the most predictive of success within nursing programs (Elkins, 2013). Furthermore, Herrera (2013) found that there was no statistical significance in program completion between students taking prerequisite courses at a community college verses a four year university.

Summers (2003) stressed academic factors as being essential for predictors of attrition. With this in mind, numerous healthcare studies related to specific programs are available, which evaluated predictors of success for certain academic variables. Walker et al. (2011) found that nursing students across nine programs (898 students) had highly

predictive variables of attrition related to grades within the anatomy and physiology coursework.

Studies surrounding educational programs or concerns within the allied health arena emerged in the 1980's as the Institute of Medicine Staff (1989) considered issues related to supply and demand of the top ten healthcare worker shortage areas: clinical laboratory technicians, dental hygienists, dietitians, emergency medical technicians, medical records technicians, occupational and physical therapists, radiologic technicians, respiratory therapists, and speech-language pathologists. The committee's intent was to note significant trends influencing supply of healthcare workers, being most often, the lack of the number of graduates, program offerings, and faculty shortages (Institute of Medicine Staff, 1989). However, several researchers (Gupta, 1991; Ross, 1996; Kudlas, 2006), note the impact of retention on the entire healthcare field because if a student leaves a healthcare-related program, a void is created which cannot be filled until the program completes another admissions cycle. To this end, it is essential for programs to select individuals more likely to complete the area of study. Admissions criteria may consider past performance as a predictor of student success in the areas of GPA in specific pre-requisite courses or overall averages, letters of reference, interviews, and entrance exams (Kudlas, 2006).

Diagnostic Medical Sonography

Studies related to medical sonography student retention and completions are very limited. One dissertation study was located specific to the program retention and attrition for diagnostic medical sonography; furthermore, limited findings on web searches indicate a need for additional research on diagnostic medical sonography retention within

community colleges. Students are admitted into sonography programs based on the accreditation criteria established by the American Registry of Diagnostic Medical Sonographers (ARDMS). In a qualitative research study conducted by Ross (1996) on attrition of 15 non-traditional students within an ultrasound study (which is a portion of medical sonography programs), the researcher considered key areas of attrition related to demographics, financial support, faculty support, family support, clinical training support, and socialization. Within the study, only 13% of non-traditional students reported contact with classmates outside of the class for social or academic purposes; the majority indicated family obligations (38.5%), part-time work (53.8%), and location of the student's home (7.7%) prevented additional social interaction. When evaluating the reason for attrition, 60% of the respondents indicated problems at the clinical training site, personal reasons were listed as 26.6%, and 13.3% attrition occurred due to lack of financial support (Ross, 1996).

Keys (2006) conducted a study to analyze the relationship of student satisfaction and program retention of students graduating from a technical college to determine if the instrument was predictive of retention within five program areas, including medical diagnostic sonography. The analysis concluded that an inter-correlation between student satisfaction and retention was inconclusive, and found that a cluster of student satisfaction parameters were un-predictive of student success, and thus the Noel-Levitz Student Satisfaction Inventory could not be validated, and will not be included within this study.

Echocardiology, and Invasive Cardiovascular Technology

Echocardiology yielded three articles mentioning the program of study, but not directly analyzing student retention and completion from a quantitative standpoint. For example, Abel (2005) considered common success factors for the successful adoption of internet-supported learning through "motivation, leadership, measurements and expectations, student and faculty support, and delivery format" (p. 3). Aabakken and Bach-Gansmo (2000) evaluated problem-based learning-oriented curriculum, rather than block-oriented curriculum structures, within the echocardiology area; however, student attrition and retention was not considered within the scope of the study. Furthermore, Schmidt (2006) conducted a study to explore the interest of men enrolling in a predominantly female profession, with occupational characteristics that consist of a broad mix of patient care/technology skills. The researcher considered the gender aspects of women interested in a technical field, and men entering a field, which is considered "high touch". Studies related to Invasive Cardiovascular Technology related to student retention and completion are not currently present in the literature, as well. To this end, it is evident that additional studies surrounding student retention and completion within echocardiology technician, and invasive cardiovascular technology programs are needed, and will be included within the fields of study.

Nursing

A significant amount of research exists surrounding nursing profession, specifically due to the national shortage of nurses, and attempts to increase retention efforts within colleges and universities (Newton & Moore, 2009). Studies specific to student retention and predictors of success within community college settings will be described within in this portion of the literature review. For example, Sayles, Shelton, and Powell (2003), found composite

scores on the pre-RN entrance exams were useful in predicting success on the licensure examination post program. Seago, Keane, Chen, Spetz, and Grumbach (2012) evaluated 738 nurses in California with an average GPA of 2.56, median age of 31, and predominantly female, married population with children; whereas, Walker et al. (2011) found predictive variables of attrition related to grades within the anatomy and physiology coursework. Seago et al. (2012) "tested a model that specifies four general constructs as predictors of student success in nursing education--dispositional factors, career value factors, situational factors, and institutional factors" (p. 489). The researcher's logistical regression found program graduation was predicted by higher grade point averages in pre-nursing and science courses, with 91% graduated, with all but 16 students not graduating on time within six semesters including summer, or two calendar years.

In a dissertation study conducted by Akin (2008), the researcher evaluated 85 students' motivation profile scores, and the grade point averages as predictors of student success, and found grade point average as being a strong predictor of success as supported in the literature. De Lima, London and Manieri (2011) conducted a retrospective study comparing academic records with student demographics related to those students either passing or not passing the National Council Licensure Examination for Registered Nurses (NCLEX-RN). The independent variables included cumulative grade point average, nursing prerequisite grade point averages, preadmission examination scores for the Health Education Systems, Inc. (HESI) exam, clinical nursing course grades, and graduating GPA of 38 graduates out of 199 students. Demographic data included age, gender, and ethnicity. The results revealed that women had a slighter higher

pass rate of 54% compared with 42% of men. The significant predictors ($p \leq .05$) included terminal grades in mental health courses, and scores on the HESI exam. Variables of cumulative GPA, clinical course grades, and graduating GPA were not found to be significant; however, the sample size was small and limited to one specific school.

Rogers (2009) dissertation examined the preadmission academic criteria as a predictor of program completion and successful completion of the NCLEX-RN licensure exam of 294 students within a state university associate degree program. The logistical regression model indicated preadmission academic variables that were most predictive as science and reading scores on the entrance exams as a predictor of passing the licensure examination, but not program completion. Specific science course grades, and health-related course work were also predictors of success. In regards to traditional (n = 116) verses non-traditional (n = 175) students, the non-traditional students were more likely to succeed within the study; however, the researcher defined a traditional student as one entering the program within one year of completing high school. Cumulative GPA and prerequisite GPA failed to significantly predict NCLEX-RN success and program completion.

Radiologic Sciences

According to the Institute of Medicine Staff (1989), the BLS analysts "evaluate job opportunities in many different areas radiology encompasses including sonography, fluoroscopy, mammography, computerized tomography, magnetic resonance imaging (MRI), and radiation therapy" (p. 135). This study noted the shift from hospital jobs to out-patient services based on utilization reviews and costs that were considered by the administration (Institute of Medicine Staff, 1989). Radiology research studies related to student retention and completion within

radiologic sciences are more prevalent than programs such as respiratory care, medical diagnostic sonography, echocardiology, and invasive cardiovascular technology programs.

Kolenovic, Linderman and Karp (2012) evaluated radiology technician students within the Accelerated Study in Associate Programs (ASAP) and found that participation in the programs impacted retention, credit accrual, transfer and degree attainment significantly out of the 1,024 students, and was 12 percentage points higher within the first year, and by 24 percentage points. Thus, the acceleration of programs to complete in a quicker time period is essential in regards to establishing structured technical programs within healthcare-related programs. The programs within this research study are also in a structured format, and students complete healthcare related associate degree programs within a cohort. In regards to waiting lists for radiology and respiratory care programs, Schumacher (2011), found a decrease in the persistence rates, but a higher overall average of retention and persistence to program completion for the programs.

Respiratory Care programs

Similar to echocardiology and invasive cardiovascular technology, limited studies exist related to respiratory care student retention and completion within healthcare-related associate degree programs in community colleges. Previously, the Institute of Medicine Staff (1989) projected an increase in demand of respiratory therapists to 95% by the year 2000 due to the "admission of older, sicker patients who require more intensive care" (p. 142). Furthermore, technological advances in ventilator care, such as neonatal and cardiac care will be critical factors in specializations of hospital services in the respiratory care area, in addition to applying their skills in the area of electrocardiography, or EKG, and cardiopulmonary areas (Institute of Medicine, 1989). More recently, Barnes, Gale, Kacmarek and Kageler (2010), evaluated the competencies needed by respiratory therapist graduates in 2015 and beyond. The researchers noted the dramatic changes within the United States to reduce costs and improve quality of care

through evidence-based protocols following acceptable standards of practice. The education needed by respiratory therapists includes additional skills in pulmonary function technology, sleep studies, and invasive diagnostic procedures.

Ari (2009) conducted a study to evaluate the relationship between student retention and respiratory care therapy program resources. Of the 36 respondents to the survey (63% response rate), Ari (2009) found statistical significance between resources and student retention specifically in the areas of personal and program financial resources as the strongest predictor of student retention. Specifically related to student retention and completion within respiratory therapy, Kudlas (2006) examined the admissions criteria of two year programs and the extent to which practices affect retention rates within the programs. The independent variables within the study included "high-school GPA, college GPA, selective GPA, reference letters, reference checks, writing sample or goal statement, standardized test scores, non-cognitive test scores, criminal background checks, drug testing, departmental observation, and personal interview. The dependent variable was the retention rate of each radiography program" (Kudlas, 2006, p. 163). Of the 327 programs representing 5,191 graduates and 1,252 withdrawals, retention rates were significant higher ($p < .05$) in programs utilizing competitive admissions criteria. Furthermore, selective grade point average and reference letters were significant in predicting increased retention rates within the programs. Overall, programs with a competitive admissions requirement were more likely to have higher retention rates within the programs (Kudlas, 2006).

Synthesis of Research Findings

The vast literature related to attrition indicates the importance of academic factors in examining student attrition and completion within healthcare areas. Furthermore, a significant amount of congruency exists between the various healthcare program areas

and research related to student attrition, and the independent variables considered as predictors of student success. The following Table 1 shows an overview of the research examined within this study regarding student characteristics, which may predict a student's ability to persist to program completion within the healthcare programs of study.

Table 1

Studies of Student Attrition

Study	Site(s)	Programs of Study	Sample Size	Student Status: Traditional or Non-traditional	Independent Variable Reviewed
Akin (2008)	1 college	Nursing	85	Non-traditional	Motivation profile scores, age, gender, and grade point averages
Ari (2009)	57 universities	Respiratory Therapy	36	Traditional and Non-traditional	Program resources related to financial, personnel and clinical.
De Lima, London and Manieri (2011)	1 college	Nursing	38	Non-traditional	Cumulative grade point average, age, gender, ethnicity, nursing prerequisite grade point averages, HESI examination scores, clinical nursing course grades, and graduating GPA
Elkins (2013)	1 university	Nursing	187	Traditional	Prerequisite GPA, ACT scores, course grades in anatomy and physiology, and HESI exam scores
Hamilton, 2011	1 college	Dental Assisting, Cardiovascular Technology, Emergency Medical Technology, Medical Laboratory Technology, Nursing, and Surgical Technology	761	Non-traditional	Gender, ethnicity, first generation student, age, major, developmental courses, course grades (A&P, Microbiology, Statistics, English I), number of math and science credit hours, and course grades in clinical sections

Table 1. Studies of Student Attrition (continued)

Study	Site(s)	Programs of Study	Sample Size	Student Status: Traditional or Non-traditional	Independent Variable Reviewed
Herrera, 2013	1 university	Nursing	620	Traditional	Prerequisite courses, HESI exam scores, number of prerequisite courses taken, race, ethnicity, and gender
Kolenovic, Linderman and Karp (2013)	1 university	Radiology Technician	1,024	Traditional and Non-traditional	Race, ethnicity, age, income, enrollment terms, full-time or part-time status, course GPA, cumulative GPA, and credits earned
Kudlas (2006)	327 colleges	Radiography Technician	6,443	Traditional and Non-traditional	Program type, number of student to matriculate, reasons for departure, and admissions criteria.
Madan, 2012	1 college	Medical Laboratory Technology	158	Non-traditional	College placement Test Math and Reading scores, cumulative GPA, science GPA, professional GPA, age, language, gender, and ethnicity.
Newton and Moore (2009)	1 university	Nursing	107	Traditional and Non-traditional	Pre-requisite GPA (biology, anatomy and physiology, chemistry, biochemistry, psychology, composition I and II) and math, science, reading and English entrance exams.

Table 1. Studies of Student Attrition (continued)

Study	Site(s)	Programs of Study	Sample Size	Student Status: Traditional or Non-traditional	Independent Variable Reviewed
Rogers (2009)	1 university	Nursing	294	Traditional and Non-traditional	Program, NCLEX-RN scores, TEA scores, ACT scores, Cumulative GPA at admission, Prerequisite GPA (biology, chemistry, and algebra), support course credit hours prior to admission, general education GPA (English, sociology, and political science), race, class, and gender, healthcare support courses (psychology and diet therapy), science support course (anatomy and physiology, and microbiology), LPN experience, High School GPA
Ross (1996)	1 college	Diagnostic Medical Sonography	15	Non-traditional	Demographics, financial support, faculty support, family support, clinical training support, and socialization.
Seago, Keane, Chen, Spetz, and Grumbach (2012)	12 colleges	Nursing	738	Non-traditional	Science GPA, pre-nursing GPA, Ethnicity, gender, family support, days missed for work, financial support, confidence, career values, US born, marital status, children, parent's college level, and overall GPA.

Table 1. Studies of Student Attrition (continued)

Study	Site(s)	Programs of Study	Sample Size	Student Status: Traditional or Non-traditional	Independent Variable Reviewed
Sayles, Shelton, and Powell (2003)	1 college	Nursing	86	Non-traditional	Date of birth, gender, ethnicity, marital status, ACT, GED, GPA (courses toward the degree and overall), grades in nursing courses and the number of repeated nursing courses, Pre-Nursing examination.
Walker et al. (2011)	3 universities and 9 colleges	Nursing	898	Traditional and Non-traditional	Reading comprehension scores, math composite score, anatomy and physiology grades, family and peer support, and hours worked.

Baird (1990) describes community college students as "older, attend part-time more often, do not reside on campus, have lower aspirations, have lower high schools grades, have more modest financial resources, are employed for more hours, have more family responsibilities, have relatively little interaction with other students outside the classroom, and are not strongly involved in campus activities when compared to students at four-year institutions" (p. 1). With an extensive amount of research related to student characteristics and attrition (Summers, 2003), this study will focus on the following characteristics of allied health programs in a community college setting.

Demographics

A research study conducted by Craig and Ward (2008) indicated that students delaying entry into college have higher attrition rates; however, age and gender were not found to be related to GPA, nor was it a predictor of student persistence to remain in college. Additionally, students delaying entry to college are more likely to be male, and of lower socioeconomic status (Tinto, 1993). Within the healthcare-related studies, the areas of student characteristics evaluated demographic factors such as age (Akin, 2008; De Lima, London, & Manieri, 2011; Hamilton, 2011; Kolenovic, Linderman & Karp, 2013; Madan, 2012) and gender (Akin, 2008; De Lima, London & Manieri, 2011; Hamilton, 2011; Herrera, 2013; Kolenovic, Linderman, & Karp, 2013; Madan, 2012; Seago, et. al., 2012). Age and gender will be evaluated within this study.

Major Certainty

Bean and Metzner (1985) found that non-traditional students interact with the institution through academic variables, such as advising and major certainty. However, students enrolled in technical programs requiring stronger mathematics ability resulted in

lower grade point averages, but had moderate significance in persisting to graduation, according to Craig and Ward (2008). Hirshy, Bremer, and Castellano (2011) noted students seeking a career and technical degree have different characteristics than those individuals seeking academic majors, and select their career and technical program of study at the beginning of the program, as the curriculum is typically prescriptive. An evaluation of cumulative grade point averages and completion within the various healthcare programs of study will be evaluated as academic characteristics within each major.

Tinto's Student Integration Model, according to Cabrera, Castaneda, Nora, and Hengstler (1992), asserts "the match between an individual's characteristics and those of the institution shape two underlying individual commitments: a commitment to completing college (goal commitment) and a commitment to his or her respective institution (institutional commitment)" (p. 143). Few studies exist evaluating multiple healthcare program areas. Hamilton (2011) evaluated six programs and found there was not a difference between the students program of study and their ability to persist to graduation; however, the study was conducted at one institution. With limited research available on multiple healthcare programs of study and several colleges, this factor will be included within this study.

Grade Point Averages in Pre-requisite Courses, Overall Courses, and Programs of Study

Academic variables have shown to be significant predictors of student attrition or persistence (Summers, 2003). As noted by Craig and Ward (2008), "grade point average can serve as an indirect measure of other variables that impact performance" (p.507),

with the number of credits earned as being linked to student persistence. Kudlas (2006) included the independent variables of college GPA and selective course GPA, in addition to other admissions criteria related to radiology programs, and found that mathematics and science grades were predictors of academic performance within respiratory therapy programs. Furthermore, Salvatori (2001) noted overall grade point average as "the best predictor in all of the health professions; however, the relationship between pre-admission GPA and clinical performance is less clear" (p. 159). With the competitive nature of health professions programs, which typically includes cognitive abilities such as GPA, grade point averages will be evaluated within this study to determine predictors related to pre-requisite courses, cumulative and program grades.

Number of Developmental Courses

More than half of students entering community college systems are placed into developmental education classes based on entrance exams within reading, writing, and mathematics, but little evidence exists indicating that student learning outcomes are achieved through remediation (Hughes and Scott-Clayton, 2011). Hamilton (2011) included the number of developmental or remedial courses taken by healthcare students, which was 56.2% of the sample, and found that persistence and students taking one or more developmental course were not significantly related. However, Bettinger and Long (2005) noted positive results of developmental math regarding attaining mathematics credits, and the increased likelihood of transfer for community college students, but found no significance related to program completion. The student's ability to persist through the healthcare programs based on completion of developmental courses will be assessed as a potential predictor of completion.

Received Financial Aid

Seago, Keane, Chen, Spetz, and Grumbach (2012) evaluated the receipt of financial aid as an intervention to increase persistence to graduation, and cited students as receiving adequate financial support. According to the United States Department of Education (2009) the higher a student's socioeconomic status, the more likely they are to transfer to a 4-year (35% of the students) compared to 21% of the middle, and 7% of the lesser economically disadvantaged students. Ari (2009) found statistical significance between financial resources and student retention specifically in the area of personal resources as the strongest predictor of student retention, and Ross (1996) noted financial difficulty as an area strong impacting student attrition, and students within career and technical programs are more likely to receive financial aid than those in academic programs of study (Hirshy, Bremer, and Castellano, 2011). To this end, receipt of financial aid will be analyzed to determine if it is a predictor of student success and completion within healthcare-related programs.

Academic Advising

Coates (1984) presented a theoretical model of an Allied Health Career Center to assist in matching students to healthcare occupations based on specialized disciplines, student potential, and adults considering career changes. Within healthcare-related programs, students are limited based on clinical rotations, for the purpose of ensuring high quality patient care safety and practices (Coates, 1984); furthermore, programs may vary based on the competencies required by students based on the program areas. According to Coates (1984), "Generally the allied health professions attract individuals

who possess a specific personality type. They have chosen the field of medicine as a general area to satisfy their need to work with and help people" (p. 2). In order to invest in a centralized career center focused on healthcare, Coates (1984) recommends that institutions have at least six to eight healthcare educational programs, a commitment to comprehensive career advising, internal support by administration, and a director with a balanced healthcare background, including counseling. One suggestion of Kolenovic, Linderman and Karp (2012) based on their research study, is to establish intrusive academic and social support systems, which may greater impact student retention and completion in a positive manner.

Critique of Previous Research

Considering Tinto's (1975) model focused on traditional students within a university setting, the application of the model to non-traditional students within commuter settings found that commitment to the institution was defined largely by interactions with the environment, rather than the social systems of the academic institutions (Pascarella, et. al., 1983). Furthermore, researchers have noted the lack of attention to environmental factors impacting student retention (Braxton, 2008), which may reside outside of the academic system within Tinto's (1975) theoretical approach (Bean & Metzner, 1985). Cabrera, Stempen and Hansen (1992) note, "A major gap in Tinto's theory and allied research is the role of external factors in shaping perceptions, commitments and preferences" (p. 144).

In regards to the *Student Attrition Model*, Bean and Metzner (1985) state the importance of the internal environment for residential students, but a greater emphasis is placed on variables such as financial assistance, outside encouragement, hours worked,

family obligations, and opportunities for transfer as non-traditional students are connected to academic performance and environmental variables as indicators of the student's intent to leave the institution. Cabrera, Stempen, and Hansen (1992) suggest that additional variables must be included in order to fully understand student departure, and empirical testing results have been mixed regarding patterns among academic integration, social integration, institutional and goal commitments. Whereas, Hurtado and Carter (1997) note ambiguity in the area of social integration concept, both Bean and Metzner (1985) and Tinto (1975) models consider student departure as occurring on a continuum, over time, and that precollege characteristics impact the student's ability to integrate into the institution and persistence (Cabrera, Nora, et. al., 1992).

In a review of the literature related to healthcare programs, a combination of reasons exist which may contribute to attrition within the programs of study. Many of the studies related to healthcare are descriptive in nature, rather than predictive (Coates, 1984; Ross, 1996). However, these studies cite potential reasons for attrition issues within the programs. In research conducted by Astin (1975), Gupta (1991), and Ross (1996) financial difficulties, academic failure, and dissatisfaction with program requirements, family obligations were indicated. Studies related to gender (Gupta 1991; Renn and Reason, 2012; Ross, 1996; Sawyer, 2011) show that men have a higher attrition rate than women within healthcare-related professions and higher education. Seago et al. (2012) research related to nursing retention lacked consistency among the various interventions across the participating colleges, but found conclusive results related to pre-nursing and science course GPAs as a predictor of student success. Graduation rates among the participating schools varied (holding predictors constant), which indicates

environment as a predictors of student success. Furthermore, situational variables such as employment, family and social support, and cost were not significant predictors of success.

Chapter 2 Summary

Student departure is viewed on a continuum as a linear process seeking to determine predictors of success in order to assist individuals to succeed through to program completion within community college settings. The work of Spady (1970), Tinto (1975), and Bean and Metzner (1985) in evaluating student characteristics and factors of success as applied to healthcare programs, much work still needs to be done in the area of research related to student persistence, particularly in the healthcare sector. However, it is evident that studies in healthcare associate degree program regarding persistence are limited within the broad range of student retention related studies. In order to assist with meeting the challenge of President Obama for the United States to once again become the leader in the number of college graduates by 2020, this study will fill a void related to academic variables, which predict student characteristics of success within community college settings. Community college leaders will need to seek new and innovative ways to serve students in a period of declining financial resources, retiring faculty and leaders, reliance on adjunct faculty, deteriorating facilities, and accountability requirements by accrediting bodies O'Banion (2012). These transformational changes, according to O'Banion citing the *21st Century Commission on the Future of the Community College*: *The American Dream Is at Risk*, will require courageous leaders to transform and "disturb the universe" of the 110-year old history of the community college systems.

CHAPTER 3. METHODOLOGY

Introduction to Chapter 3

This study will utilize *ex post facto*, non-experimental data from academic year's fall of 2005 through summer of 2011 of students completing associate degrees in healthcare-related programs within a community college setting. According to Lodico, Spaulding, and Voegtle (2010), non-experimental research is used to "describe preexisting groups or to determine whether a relationship exists between variables" (p. 24). The independent variables considered will include student characteristics (gender and age at the time of program entry), and academic program factors (developmental course work, pre-requisite course work, number of credit hours completed, healthcare program advising, and financial aid), which potentially impact student persistence within associate degree healthcare-related programs. Only associate degree healthcare-related programs with pre-requisites of English 1301, Anatomy and Physiology I (BIOL 2401) or Applied Human Anatomy and Physiology I (SCIT 1407), and Math 1314 or Math 1414 were used to maintain consistency of program prerequisites. Analysis of the student characteristics and academic program factors were derived from the institutional data system, Datatel, and may help to gain further insight, and add to the understanding of what factors relate to student persistence and completion within healthcare-related, associate degree programs. Information regarding students visiting the healthcare

program advising center were collected and analyzed to determine if greater persistence exists within this academic program factor. Triangulation of the data regarding student demographics and academic program factors were analyzed in order to determine predictors of student persistence within healthcare-related associate degree programs.

Purpose of the Study

The purpose of this study was to identify predictors of student characteristics and academic program factors, which influence the student's ability to persist through degree completion within healthcare-related, associate degree programs within four urban community colleges. The independent variables which were examined as predictors of program completion or non-completion were gender, age, program of study, developmental coursework, receipt of healthcare advising, receipt of financial aid, prerequisite course grades, program grade point average, cumulative grade point average, and total number of credit courses completed.

Research Question and Hypotheses

The research question is as follows:

What are the factors within Associate in Applied Sciences Degree (AAS), which predict the likelihood of degree completion within healthcare-related programs (diagnostic medical sonography, echocardiology technology, invasive cardiovascular technology, nursing, radiologic sciences, and respiratory care programs)?

Sub question 1:

What is the unique contribution of gender in predicting the likelihood of persistence to degree completion?

$H_0$1: There is no statistically significant predictive contribution based on gender in predicting persistence to degree completion.

Sub question 2:

What is the unique contribution of age in predicting the likelihood of persistence to degree completion?

$H_0$2: There is no statistically significant predictive contribution based on age in predicting persistence to degree completion.

Sub question 3:

What is the unique contribution of program cumulative grade point average in predicting the likelihood of persistence to degree completion?

$H_0$3: There is no difference statistically significant predictive contribution based on program cumulative grade point average in predicting persistence to degree completion.

Sub question 4:

What are the unique contributions of the type of degree (Associate in Applied Sciences Degree (AAS) in Diagnostic Medical Sonography, Echocardiology Technology, Invasive Cardiovascular Technology, Nursing, Radiologic Sciences, and Respiratory Care programs) in predicting the likelihood of persistence to degree completion?

$H_0$4: There is no statistically significant predictive contribution based on the type of degree in predicting persistence to degree completion.

Sub question 5:

What is the unique contribution of developmental course requirements in predicting the likelihood of persistence to degree completion?

$H_0$5: There is no difference statistically significant predictive contribution based on developmental coursework in predicting persistence to degree completion.

Sub question 6:

What is the unique contribution of student's course grades in English 1301 in predicting the likelihood of persistence to degree completion?

$H_0$6: There is no difference statistically significant predictive contribution in student's course grades in of English 1301 in predicting persistence to degree completion.

Sub question 7:

What is the unique contribution of student's course grades in Anatomy and Physiology I (BIOL 2401) or Applied Human Anatomy and Physiology I (SCIT 1407) in predicting the likelihood of persistence to degree completion?

$H_0$7: There is no difference statistically significant predictive contribution in student's course grades in Anatomy and Physiology I (BIOL 2401) or Applied Human Anatomy and Physiology I (SCIT 1407) in predicting persistence to degree completion.

Sub question 8:

What is the unique contribution of student's course grades in Math 1314 in predicting the likelihood of persistence to degree completion?

$H_0$6: There is no difference statistically significant predictive contribution in student's course grades in Math 1314 in predicting persistence to degree completion.

Sub question 9:

What is the unique contribution of students receiving financial aid in predicting the likelihood of persistence to degree completion?

$H_0$9: There is no difference statistically significant predictive contribution based on students receiving financial aid in predicting persistence to degree completion.

Sub question 10:

What is the unique contribution of students receiving specialized healthcare program advising in predicting the likelihood of persistence to degree completion?

$H_0$10: There is no difference statistically significant predictive contribution based students receiving specialized healthcare program advising in predicting persistence to degree completion.

Sub question 11:

What is the unique contribution of total credit hours in predicting the likelihood of persistence to degree completion?

$H_0$11: There is no difference statistically significant predictive contribution based total credit hours in predicting persistence to degree completion.

Sub question 12:

What is the unique contribution of cumulative grade point average in predicting the likelihood of persistence to degree completion?

$H_0$12: There is no difference statistically significant predictive contribution based on program cumulative grade point average in predicting persistence to degree completion.

Research Design

A quantitative, *ex post facto*, non-experimental research design (Tabachnick & Fidell, 2007) was used to collect archived data on students in associate degree, credit, allied health programs from the academic time periods of fall 2005 through summer of 2011. *Ex post facto* design is a form of research using data from the past, which cannot be altered for the purposes of research as it has already occurred (McMillan & Schumacher, 2006). All data collection was extracted from the Datatel system, which is an integrated database used in the internal operations of all four colleges. Student characteristics collected included the student's gender, and age at the time of program entry; academic program data or characteristics evaluated and collected included the completion of developmental reading and math courses, course pre-requisite grade point averages (English 1301, Anatomy and Physiology I, BIOL 2401, or Applied Human Anatomy and Physiology I, SCIT 1407, and Math 1314 or Math 1414), number of credit hours completed, advising by the healthcare program advising, and receipt of financial aid, as independent variables. This study sought to determine predictors of student characteristics or factors which lead to program completion within associate degree healthcare-related programs by utilizing logistic regression statistical models comparing the dichotomous dependent variable (program completion or non-completion) to the independent variables. Evaluation of the predictions of program completion will either prove or disprove the stated hypotheses. When conducting quantitative research with a dichotomous dependent variable, logistic regression is the recommended method for predicting the likelihood of the outcome, according to Hosmer, Lemeshow, and Sturdivant (2013) and Peng, Lee, and Ingersoll (2002). Boslaugh (2013) notes logistic

regression models calculate the log odds ratio, and record these as regression coefficients (B), as a nonlinear relationship exists between the independent variables, and the dichotomous dependent variable (program completion). Furthermore, if a correlation exists between the variables, log odds will either increase or decrease to acknowledge the probability that program completion would occur. To produce the odds within the logistic regression coefficients, the number *e* (or 2.178) is increased to the power B. To this end, positive logs represent a positive relationship between the independent and dependent variables, and negative logs indicate an inverse relationship (Boslaugh, 2013).

Descriptive statistics will be conducted to analyze each of the independent variables (gender, age, program of study, developmental coursework, receipt of healthcare advising, receipt of financial aid, prerequisite course grades, program grade point average, cumulative grade point average, and total number of credit courses completed) in the area of frequency, percentage of completers verses non-completers, mean, and ranges of the variables. Program completion was the dependent variable for the twelve tests. Goodness-of-fit tests (Omnibus Test of Model Coefficients) will be used to develop the model in order to determine the most relevant prediction (Tabachnick & Fidell, 2007). Logistic regression was conducted on all twelve independent variables to establish if a predictive relationship exists to the dichotomous dependent variable, program completion (Peng & So, 2002). To this end, logistical regression was the selected method for this study, as the model allows for the prediction of a dichotomous dependent variable when the independent variables are categorical or continuous (Hosmer, Lemeshow, & Sturdivant, 2013; Tabachnick & Fidell, 2007, Boslaugh (2013). In the case of this study, the dependent variable of program completion was coded as "1"

for completed program, and "0" for those students that did not complete their program of study.

According to Hosmer, Lemeshow and Sturdivant (2013), when considering logistical regression the parameters of the model provide for meaningful estimates of effect on the independent variable. The logistic regression calculation provided by Hosmer, Lemeshow and Sturdivant (2013) is represented as:

$$\Pi(x) = \frac{e^{\beta o} + b1x}{1 + e^{\beta o} + b1x}$$

The transformation of $\Pi(x)$ is represented as:

$$g(x) = \ln\left[\frac{\Pi(x)}{1 - \Pi(x)}\right]$$

$$= \beta o + \beta_1 x$$

According to Hosmer, Lemeshow and Sturdivant (2013), "the importance of this transformation is the *g(x)* has many of the desirable properties of a linear regression model. The logit, *g(x)*, is linear in its parameters, may be continuous, and may range from - ∞ to +∞, depending on the range of *x*" (p. 7). Logistic regression allows for a dichotomous outcome variable given *x* as y=*y*= $\pi(x) + \varepsilon$, allowing for an outcome of either 0 or 1. Regression analysis with dichotomous outcomes allows the distribution to describe the errors, and is the distribution on which the analysis is based (Hosmer, Lemshow, & Sturdivant, 2013). With *y* being the dichotomous outcome indicating not completing a program (0) or program completion (1) with p being the probability of *y*

being 1, or p=prob(y=1), and xk estimating the parameter values, the maximum likelihood method equation is represented by:

$$\text{Logit}(p) = \log(p/1\text{-}p) = B0+B1 * xk.$$

According to Boslaugh (2013), the natural log (or base e) is used in logistic regression to convert probabilities to logits (Boslaugh, 2013). The natural log considered the relationship between the odds ratio and beta weights (Hosmer, Lemeshow, & Strudivant, 2012), and is represented as:

$$\text{Logit}(p) = \beta_0+ \beta_1X_1+B_2x_2\ldots+ \beta_nX_n+e$$

When evaluating this model for goodness-of-fit, a significance value of less than .05 indicates that the model is a poor fit for the variables being analyzed (Pallant, 2007).

The IBM SPSS Statistics version 22 (or SPSS) software was used to analyze the data, and logistical regression was used as the model as it is the appropriate statistical procedure as the dependent variable is dichotomous, and the independent, or predictor variables, are continuous or categorical (Hosmer, Lemeshow, & Sturdivant, 2013; Peng, Lee, & Ingersoll, 2002). The overall fit of the model was evaluated using the omnibus test of the model coefficients, which tests whether the entire model is a better fit than the null model with no coefficients (Boslaugh, 2013). The Hosmer-Lemeshow goodness-of-fit statistic was not used within this study because the SPSS software groups subjects into "deciles of risk…The problem is that the packages use different algorithms to select cut points that define the deciles" (Hosmer, Hosmer, Cessie, & Lemeshow, 1997, p. 966). Therefore, the Hosmer-Lemeshow goodness-of-fit statistic was not appropriate for this study because of the low number of subjects within several of the subcategories (grades in anatomy and physiology, completion of developmental coursework, grades in English

1301, receipt of financial aid, attended healthcare advising, and gender). To measure the model fit, the pseudo R^2 statistics Cox and Snell R^2 and Nagelkerke R^2 were used to evaluate the goodness-of-fit of the bivariate logic regression, and the chi-square statistic (Peng, Lee, & Ingersoll, 2002). Each of the independent variables was analyzed using this methodology to determine predictors of student success in the dichotomous variable of program completion. It is important to note that both the Cox and Snell R^2 and Nagelkerke R^2 are based on the log likelihood of the model in comparison to the null model, but the range of the Cox and Snell R^2 never reaches the maximum of 1.0, but the Nagelkerke's R^2 has included a correction, which typically results in a higher value, but both determine the amount of variance within a model (Boslaugh, 2013). According to the Institute for Digital Research and Education (2014) at the University of California, Los Angeles (2014), the Cox and Snell R^2 and Nagelkerke's R^2 are represented as:

$$R^2 = 1 - \left\{ \frac{L(M_{Intercept})}{L(M_{Full})} \right\}^{2/N}$$

The Nagelkerke's R Square equation is:

$$R^2 = \frac{1 - \left\{ \frac{L(M_{Intercept})}{L(M_{Full})} \right\}^{2/N}}{1 - L(M_{Intercept})^{2/N}}$$

Target Population

Ravid (2011) defines a population as "an entire group of persons or elements that have at least one characteristic in common" (p. 242). All four of the colleges selected for this study were all within an urban setting, public, open access, two year institutions,

which offered associate degree healthcare-related programs with prerequisites in English 1301, anatomy and physiology, and mathematics. With an open access model, students within the colleges may complete their first two years of a bachelor's program, seek associate degrees or certificates in high-demand careers, or complete enrichment classes for personal development (Summers, 2003). For purposes of this research plan, fictitious names have been assigned to the four colleges; these include "Brooklyn Community College," "Centerville Community College," "Our Lady of the Lakes Community College," and "Valley View Community College".

According to the Brooklyn Community College (2012) website, the student population at the time of this study was 12,786, with 41% males, and 59% females. The race of the students shows 18.8% African-American, 11.5% Asian, 39.3% white and .02% Native Hawaiian/Pacific Islander, and 30.2% not reported. Under ethnicity, 32% declare Hispanic/Latino origin, and 62% declare Non-Hispanic Latino origin. The student population consists of 79.9% part-time students, and 20.1% full time, or taking more than 12 credit hours in the fall and spring terms, with an average age of 28. Of the 12, 786 students, 23% have selected majors in the health sciences and medically related programs. According to the Centerville Community College (2012) website, the student population is 10,817, with 35% males, and 65% females. The ethnicity of the students' show 36% Hispanic, 32% African-American, 23% white, 5% Asian, and .5% Native American, and 4% in not reported or an international category. The student population consists of 67% part-time students, and 33% full time, or taking more than 12 credit hours in the fall and spring terms, with an average age of 28.

The Our Lady of the Lakes Community College (2011) website indicate the student population as being 12,074, with 43% males, and 57% females. The ethnicity of the students' show 29% Hispanic, 20% African-American, 32% white, 13% Asian/Pacific Islander, and .5% Native American, and 5.5% in not reported or an international category. The student population consists of 77% part-time students, and 23% full time, or taking more than 12 credit hours in the fall and spring terms, with an average age of 26. Last, the Valley View Community College (2012) website indicated the student population as being 9,065, with 42% males, and 58% females. The ethnicity of the students' show 49% Hispanic, 29% African-American, 15% white, 4% Asian/Pacific Islander, .4% American Indian, and 2.6% not reported or an international category. The student population consists of 75% part-time students, and 25% full time, or taking more than 12 credit hours in the fall and spring terms, with an average age of 25.

Participants of the study were drawn from those students accepted in the associate degree healthcare-related programs with pre-requisites of English 1301, Anatomy and Physiology I (BIOL 2401) or Applied Human Anatomy and Physiology I (SCIT 1407), and Math 1314 or Math 1414 from the colleges. The programs which were analyzed included students admitted to the programs between academic years 2005 through 2011 in the areas of diagnostic medical sonography (10 student accepted each year), echocardiology technology (10 student accepted each year), invasive cardiovascular technology (10 students per year), nursing (1,252 student accepted each year), radiologic technology (55 student accepted each year), and respiratory care (20 students accepted each year) for an estimated sample size of 1,900 over the six year period. In considering

twelve predictors of student success (gender, age at the time of program entry, cumulative GPA, completion of developmental courses in reading, writing, and math, pre-requisite course work GPA, number of credit hours completed, healthcare program advising, and financial aid award of PALE) with an effect size of .15 and desired statistical power level of .9 and probability level of .05, the sample size calculator or power analysis recommends a minimum of 152 student files; thus, the projected 1,900 student records provide a sufficient sample size for this study.

Sampling Method

Participants for this study will be drawn from students admitted to the diagnostic medical sonography, echocardiology technology, invasive cardiovascular technology, nursing, radiologic sciences, and respiratory care programs, which will include associate degrees with pre-requisites of English 1301, Anatomy and Physiology I (BIOL 2401) or Applied Human Anatomy and Physiology I (SCIT 1407), and Math 1314 or Math 1414 in urban, 2-year community colleges between academic years 2005 through 2011 to establish a homogeneous sample. These four colleges have a common course numbering system though the state's coordinating board.

Sample Size

Creswell (2008) defines a homogeneous sample as "the researcher purposefully samples individuals or sites based on membership in a subgroup that has defining characteristics" (p. 216); such as programs of study and prerequisite requirements. Because programs of study are typically two years, this study will consider six academic years of data, and examine the records of approximately 3,237 students. According to Creswell (2008), the selection of the largest possible sample will reduce the potential for

error that the sample will be different from the population. The 552 students included in the sample had all three prerequisite course grades documented on individual transcripts in College Algebra, Anatomy and Physiology, and English, which provided a full and accurate data set by removing 2,685 cases. This list wise deletion allowed for exclusion of missing data sets for the purpose of a more accurate regression analyses. The remaining associate degrees with varying pre-requisites or one year certificate programs, and students without pre-requisites documented were eliminated from the study to establish criterion for the sample. Of the 552 students, the sample consisted of 67 radiologic science students, 8 diagnostic medical sonography students, 14 echocardiology technician students, 8 invasive cardiovascular students, 34 respiratory care technicians, and 421 nursing students.

Tabachnick and Fidell (2001) note the importance of an adequate sample size due to the complexity on the chosen Type I and Type II error rates, number of independent variables, expected relationships, reliability of the measurement, and the frequency of the dependent variable. If we assume a normally distributed dependent variable, the minimum sample size for detecting medium size R^2 is calculated as 50 plus 8 times the number of independent variables, 50 + (8)(12) = 146. Additionally, the minimum samples size for detecting a medium-size beta is calculated as 104 plus the number of independent variables, or 116. To this end, a sample size of 552 meets both of these requirements (Spicer, 2009).

Setting

This research study was a records only study; therefore, there was not an actual setting in which the study was conducted. However, the data was collected from four

open access, public, community colleges in an urban setting. Data was extracted from the college's transcript systems in order to analyze persistence of students in healthcare-related associate degree programs.

Instrumentation

The Datatel system is used at all four of the community colleges within this research study. Queries were conducted within the system to provide the *ex post facto* data related to student retention and persistence within the healthcare-related programs of study, and data was exported to an excel document for distribution to the researcher. The study will use a logistic regression analysis model to determine the relationship and contribution of the predictor variables to the criterion, or dependent variable of program completion. According to Ravid (2011), logistic regression is "the process of using one variable to predict another when the two are correlated" (p. 129). Using IBM SPSS Statistics version 22 (or SPSS), a statistical package, the data will be analyzed to evaluate descriptive statistics, such as frequencies, correlation, goodness of fit, and logistic regression, which is a statistical technique employed to describe and test a hypotheses about particular relationships between a categorical outcome variable and one or more predictor variables (Peng, Lee, & Ingersoll, 2002). Microsoft Excel 2013 was used to organize the data for coding purposes, and then to upload the spreadsheet to the SPSS software system. To answer the research question, the researcher performed logistic regression analysis to evaluate the correlation that students developmental education, prerequisite courses, age, gender, program completion, and advising have in regards to predicting associate degree program completion. These dependent variables were coded dichotomously, e.g., yes (1) or no (0), thus the use of a logistic regression model with

continuous or categorical variables (Hosmer, Lemeshow, & Sturdivant, 2013; Peng, Lee, & Ingersoll, 2002). Descriptive statistics were also used to describe the independent variables related to program and cumulative grade point averages, and the student's likelihood to persist to degree completion.

Data Collection

The primary dataset was retrieved from the college's Datatel system, exported to an excel spreadsheet, and provided to the researcher by the Institutional Research Office. The data collection consisted of 22 columns and 3,237 rows of data of anonymous student records, from academic years 2005 through 2011. This large data set necessitated the need to identify the variables most needed to test the research question, as described by Hosmer and Lemeshow's (2000) definition of "overfitting" a model. To this end, students with all three letter grades in the prerequisite courses (English, anatomy and physiology, and mathematics) and analysis were collected to create the study's sample (N = 552). As stated previously, data collection was accomplished using the Datatel system, which is an integrated database used in the daily operations of the colleges, and Microsoft Excel 2013. Demographic and academic information were collected as the independent variables and copied into a centralized spreadsheet with columns titled as developmental coursework, English 1301 grade, A&P grade, received advising, completed program, cumulative GPA, program GPA, number of credit hours completed, received financial aid, gender, age at the time of program entry, and program of study. The researcher analyzed the data to determine all cells had complete data, and transformed the "yes" variable to "1," and "no" variables to "0" for analysis purposes. For example, the outcome variable of program completion was evaluated for each student record within the

sample to determine if the student completed the final clinical course assigned to each program. The following section and Table 2 describes each code and the categories with the corresponding coding methodology.

Operationalization of the Variables

The following definitions are essential to understand the variables utilized within the study to determine predictors of program completion:

Age – the student's age at the time of program completion will be coded as ranges with traditional students being ages 18 to 23, and non-traditional students coded as group 1 (ages 24 to 30), group 2 (ages 31 to 40), group 3 (ages 41 to 50), and group 4 ages (51 and over).

Associate of applied science degree program – a degree which prepares students for specific career/technical skills. The requirements for each major in the Associate in Applied Sciences Degree (AAS) are clearly shown in the curriculum patterns in this catalog located under Career and Technical Programs" and is a terminal 2-year undergraduate degree between 60 to 72 credit hours. Degrees selected for this study included radiologic science, diagnostic medical sonography, echocardiology technician, invasive cardiovascular, respiratory care technicians, and nursing. Data was coded as (1) radiologic sciences, (2) diagnostic medical sonography, (3) echocardiology technology, (4) invasive cardiovascular technology, (5) respiratory care, and (6) nursing. Program completers were coded as 1, and non-completers as 2.

Developmental courses – coursework required for remedial and developmental educations courses in the areas of reading, writing, and mathematics. An "E" grade may be given when an instructor wishes to indicate that you have made progress in a developmental studies course. An "E" grade is non-punitive and is not computed. Data was coded as 0 = No coursework and 1 = coursework.

Gender – will be indicated as male or female. Data was coded as 1=Female, and 0=Male.

Healthcare Program Advising Center – A specialized and intensive advising center to assist students with healthcare program selection based on their skills and interests. Attendance to the center was coded as 0 = No, and 1 = Yes.

Health-related program – a program of study in an Associates of Applied Science major in the areas diagnostic medical sonography, echocardiology technology, invasive cardiovascular technology, nursing, radiologic sciences, and respiratory care. Data was coded as (1)Nursing and (0) Non-nursing.

Number of credit courses completed – a complete count of the number of courses completed during the student's academic pursuit of a degree. Total number of courses were coded as Year 1 = 0-24 courses, Year 2 = 25 – 48 courses; Year 3 = 49 – 72 courses

Prerequisite course work – required courses prior to program entry such as English 1301, Anatomy and Physiology I (BIOL 2401) or Applied Human Anatomy and Physiology I (SCIT 1407), and Math 1314. Course grades are based upon a 4.0 system: A = 4.0, B = 3.0, C = 2.0, D = 1.0 and F = 0.0.

Program completer (graduate) – a student who was accepted into a healthcare-related program with prerequisites of English 1301, Anatomy and Physiology I (BIOL 2401) or Applied Human Anatomy and Physiology I (SCIT 1407), and Math 1314, and successfully completed all required courses to graduate with an Associate in Applied Sciences Degree (AAS) in Diagnostic Medical Sonography, Invasive Cardiovascular Technology, Echocardiology Technology, Nursing, Radiologic Sciences, and Respiratory Care. Program completers were coded as 1=Yes and 2=No.

Program grade point average - Grade points earned for each course within a healthcare-related program are determined by multiplying the number of points for each grade by the number of credit hours the course carries. GPA is based upon all courses completed in colleges in which the student received a performance grade of A-F. Grades are based upon a 4.0 system: A = 4.0, B = 3.0, C = 2.0, D = 1.0 and F = 0.0.

Cumulative grade point average - Grade points earned for each course taken at the college are determined by multiplying the number of points for each grade by the number of credit hours the course carries. GPA is based upon all courses completed in colleges in which the student received a performance grade of A-F. Grades are based upon a 4.0 system: A = 4.0, B = 3.0, C = 2.0, D = 1.0 and F = 0.0.

All data collection was accomplished using the Datatel system, and Excel 2013 to collect student information located in the healthcare program advising area to confirm attendance at the center. The Datatel system is an integrated online database used in the day-to-day operations of the colleges being studied. Information such as cumulative and course pre-requisite grade point averages, demographics, number of developmental and

science credit courses, and financial aid need will be evaluated and analyzed using descriptive statistics and logistic regression analysis models. A database of students visiting the healthcare program advising center was also utilized to analyze the relationship among the variable of advising and the contribution of each of the predictor variables to the criterion of completion.

The data set received from institutional research comprised of 3,237 students between the academic years 2005 through 2011. Students enrolled in the health professions courses prior to 2005 were removed from the data set, leaving 552 participants. Table 2 describes the coding methodology used during the course of this study.

Table 2

Variable Names and Values

Variable Name	Variable Description
Gender	1=Female; 0=Male
Age	18 – 23= Traditional student (Value 1) 24 – 30=Non-traditional student group (Value 2) 31 – 40= Non-traditional student group (Value 3) 41 – 50= Non-traditional student group (Value 4) 51 – and over = Non-traditional student group (Value 5)
Traditional student	0=No; 1=Yes (ages 18 – 23)
Student's major program of study	(1) Nursing (0) Non-Nursing
Remedial and Developmental Coursework	0=No; 1=Yes
Healthcare program advising	0=No; 1=Yes

Table 2. Variable Names and Values (continued)

Variable Name	Variable Description
Completed program	0=No; 1=Yes
Received financial aid	0=No; 1=Yes
Prerequisite grades in English	A = 4.0, B = 3.0, C = 2.0, D = 1.0 and F = 0.0
Prerequisite grades: College Algebra	A = 4.0, B = 3.0, C = 2.0, D = 1.0 and F = 0.0
Prerequisite grades in Anatomy & Physiology	A = 4.0, B = 3.0, C = 2.0, D = 1.0 and F = 0.0
Program grade point average	A = 4.0, B = 3.0, C = 2.0, D = 1.0 and F = 0.0
Cumulative grade point average	A = 4.0, B = 3.0, C = 2.0, D = 1.0 and F = 0.0
Total Number of Courses Completed	Year 1 = 1-24 courses, Year 2 = 25 – 48 courses; Year 3 = 49 – 72 courses

Data Analysis Procedures

After receiving the necessary approvals from the dissertation committee and institutional review boards on February 5, 2014, data was collected via excel spreadsheet on a portable USB (Universal Serial Bus) or "jump" drive. The data for this retrospective study was retrieved from the college's student information database system, Datatel, and exported to an excel spreadsheet via the Office of Institutional Research and Planning. The colleges utilize a 4.0 grading scale of A, B, C, D, or F letter grading, and program and cumulative grade point averages were coded using the 4.0 scale. Grades in pre-requisite courses of English, anatomy and physiology, and college algebra were coded utilizing the 4.0 scale, and completion of developmental course work in reading, writing,

and mathematics was noted as "1" for yes, and "0" for no. Program completion, receipt of financial aid, and advising was indicated as a 1 or 0 value as well. Gender was noted as male (0) or female (1), and age was computed from the birth date of students at the time of program entry.

The following information was requested for students accepted into Associate in Applied Sciences Degree (AAS) in Diagnostic Medical Sonography, Echocardiology Technology, Invasive Cardiovascular Technology, Nursing, Radiologic Sciences, and Respiratory Care programs between 2005-2011 including gender, age at the time of program entry, program of study, developmental course work, pre-requisite course work grades (English 1301, Anatomy and Physiology I, BIOL 2401, or Applied Human Anatomy and Physiology I, SCIT 1407, and Math 1314 or Math 1414), additional credit hours completed, healthcare program advising, course grade of the first and last class while in the program, total credit hours completed, and receipt of financial aid. Data was received via an excel spreadsheet, which was password protected, and saved electronically on a flash drive. Students with incomplete data sets were removed from the study.

Specific courses for developmental reading, writing, and math were identified within the common course number system with the state's coordinating board, and the college catalogs from academic years 2005 through 2011 as indicated as follows:

Table 3

Courses Evaluated for Developmental or Remediation Purposes

Course Name	Course Rubric Description
Developmental Reading	DREA 0100, 0200, 0090. 0091, and 0093
Developmental Math 0099	DMAT 0066, 0090. 0091, 0093, 0097, 0098, and
Developmental Writing	DWRI 0100, 0200, 0090. 0091, and 0093

Specific courses for prerequisites in anatomy and physiology, mathematics, and English were identified within the common course number system with the state's coordinating board, and the college catalogs from academic years 2005 through 2011 as indicated as follows:

Table 4

Courses Evaluated for Prerequisite Purposes

Course Name	Course Rubric Description
Human Anatomy and Physiology	BIOL 2401
Applied Human Anatomy & Physiology	SCIT 1407
English I	ENGL 1301
College Algebra	MATH 1313 or MATH 1414

Specific courses to designate acceptance into the programs, as coded by the state's coordinating board, and the college catalogs from academic years 2005 through 2011 as were as follows:

Table 5

Courses Evaluated for Prerequisite Purposes

Course Name Description	Course Rubric
Advanced Ultrasound Principles and Instruments	DMSO 2343
Cardiovascular Concepts	DSAE 2303
Catheterization Lab Fundamentals	CVTT 1313
Introduction to Nursing Professional, Nursing for Integrated Programs	RNSG 1423*
Nursing Pathophysiology	RNSG 1211*
Patient Care	RADR 1203*
Radiation Biology and Protection	RADR 2213*
Basic Radiographic Procedures	RADR 1411*
Applied Physics for Respiratory Care	RSPT 1227

*College catalogs vary one academic year to the next for the first class within the program of study.

Specific courses to designate completion of the programs, or clinical coursework, as coded by the state's coordinating board, and the college catalogs from academic years 2005 through 2011 as:

Table 6

Courses Evaluated for Clinical Completion Purposes

Course Name	Course Rubric Description
Practicum – Diagnostic Medical Sonography	DMSO 2367
Clinical – Diagnostic Medical Sonography – Sonographer and Ultrasound Technician	DSAE 2661

Table 6. Courses Evaluated for Clinical Completion Purposes (continued)

Course Name	Course Rubric Description
Clinical - Cardiovascular Technology	CVTT 2563
Clinical – Registered Nursing	RNSG 2560
Clinical – Registered Nursing	RNSG 2460
Clinical – Registered Nursing	RNSG 2461
Clinical – Registered Nursing	RNSG 2161
Clinical – Registered Nursing	RNSG 1461
Practicum – Radiologic Technology	RADR 2267
Practicum – Respiratory Care Therapy	RSPT 2166

*College catalogs vary one academic year to the next for the first class within the program of study.

Statistical analysis was conducted using the IBM SPSS Statistics for Windows, version 22. To ensure confidentiality of the student data, the identities of the students were coded numerically, and the dataset file was stored on a USB drive, which will remained in a locked filing cabinet, where only this researcher has access at all times. The data was analyzed through selected statistical techniques to address the primary research question:

> What are the factors within Associate in Applied Sciences Degree (AAS), which predict the likelihood of degree completion within associate degree healthcare-related programs (Diagnostic Medical Sonography, Echocardiology Technology, Invasive Cardio Vascular Technology, Nursing, Radiologic Sciences, and Respiratory Care programs)?

The sub questions related to the primary question were as follows:

Sub question 1:

What is the unique contribution of gender in predicting the likelihood of persistence to degree completion?

$H_0$1: There is no statistically significant predictive contribution based on gender in predicting persistence to degree completion.

Sub question 2:

What is the unique contribution of age in predicting the likelihood of persistence to degree completion?

$H_0$2: There is no statistically significant predictive contribution based on age in predicting persistence to degree completion.

Sub question 3:

What is the unique contribution of program cumulative grade point average in predicting the likelihood of persistence to degree completion?

$H_0$3: There is no difference statistically significant predictive contribution based on program cumulative grade point average in predicting persistence to degree completion.

Sub question 4:

What are the unique contributions of the type of degree (Associate in Applied Sciences Degree (AAS) in Diagnostic Medical Sonography, Echocardiology Technology, Invasive Cardiovascular Technology, Nursing, Radiologic Sciences, and Respiratory Care programs) in predicting the likelihood of persistence to degree completion?

$H_0$4: There is no statistically significant predictive contribution based on the type of degree in predicting persistence to degree completion.

Sub question 5:

What is the unique contribution of developmental course requirements in predicting the likelihood of persistence to degree completion?

$H_0$5: There is no difference statistically significant predictive contribution based on developmental coursework in predicting persistence to degree completion.

Sub question 6:

What is the unique contribution of student's course grades in English 1301 in predicting the likelihood of persistence to degree completion?

$H_0$6: There is no difference statistically significant predictive contribution in student's course grades in of English 1301 in predicting persistence to degree completion.

Sub question 7:

What is the unique contribution of student's course grades in Anatomy and Physiology I (BIOL 2401) or Applied Human Anatomy and Physiology I (SCIT 1407) in predicting the likelihood of persistence to degree completion?

$H_0$7: There is no difference statistically significant predictive contribution in student's course grades in Anatomy and Physiology I (BIOL 2401) or Applied Human Anatomy and Physiology I (SCIT 1407) in predicting persistence to degree completion.

Sub question 8:

What is the unique contribution of student's course grades in Math 1314 in predicting the likelihood of persistence to degree completion?

$H_0$8: There is no difference statistically significant predictive contribution in student's course grades in Math 1314 in predicting persistence to degree completion.

Sub question 9:

What is the unique contribution of students receiving financial aid in predicting the likelihood of persistence to degree completion?

$H_0$9: There is no difference statistically significant predictive contribution based on students receiving financial aid in predicting persistence to degree completion.

Sub question 10:

What is the unique contribution of students receiving specialized healthcare program advising in predicting the likelihood of persistence to degree completion?

$H_0$10: There is no difference statistically significant predictive contribution based students receiving specialized healthcare program advising in predicting persistence to degree completion.

Sub question 11:

What is the unique contribution of total credit hours in predicting the likelihood of persistence to degree completion?

$H_0$11: There is no difference statistically significant predictive contribution based total credit hours in predicting persistence to degree completion.

Sub question 12:

What is the unique contribution of cumulative grade point average in predicting the likelihood of persistence to degree completion?

$H_0$12: There is no difference statistically significant predictive contribution based on program cumulative grade point average in predicting persistence to degree completion.

Last, all statistical analysis were performed using IBM SPSS Statistics for Windows, version 22. The researcher performed descriptive statistics analysis in regards to frequencies and percentages of the sample for each of the demographic variables listing the mean, standard deviation, and range for continuous scaled variables with $p <$ .05. A correlation table was analyzed to determine the strength and direction of the linear relationship between the independent variables by analyzing the coefficient of determination to find the combination of predictor variables that account for a high proportion of the variation in program completion, or the outcome variable (Boslaugh, 2013). Goodness-of-fit tests (Omnibus Test of Model Coefficients, Cox and Smell R^2, and Nagelkerke R^2) were used to develop the model in order to determine the most relevant prediction (Tabachnick & Fidell, 2007).

Selected variables were evaluated for consideration to include in the logistic regression analysis to establish if a predictive relationship exists. Program completion, gender, receipt of financial aid, completion of developmental coursework, program grade

point average, cumulative grade point average, and total credit coursework were evaluated to determine their level of significance at $p < .05$ within the correlation and logistic regression models. Upon completion of the logistic regression, the Cox and Snell R^2 and the Nagelkerke R^2 were evaluated to access goodness-of-fit within the model; the chi-square was evaluated to determine if the independent variable is a predictor of program completion with a significance level of $p < .05$, and the odds ratio, or Exp(B), was analyzed regarding each predictor variable and the confidence interval for the adjusted odds ratio. This will determine the odds ratio for the independent variable being evaluated, and the likeliness of program completion based on gender, age, program of study, developmental coursework, received healthcare advising, receipt of financial aid, prerequisite course grades, program grade point average, cumulative grade point average, and total number of credit courses completed. According to Boslaugh (2013), "The neutral value for the odds ratio is 1; values higher than 1 indicate increased odds, values lower than 1, decreased odds" (p. 278).

The computation of correlation (Table 17), as recommended by Hosmer, Lemeshow and Sturdivant (2013) was conducted to further evaluate variables. Hosmer, Lemeshow and Sturdivant (2013) recommended analyzing correlations to evaluate variables to be included in an overall logistic regression. According to Boslaugh (2013), this analysis tests the direction and strength of the relationships among the independent variables via the correlation matrix (Table 17). In evaluating the variable comparisons, the correlation coefficients between .10 and .29 indicate a small association, between .30 and .49 indicate a medium association, and coefficients between .50 and 1.0 are indicators of a large association (Pallant, 2007).

Multicollinearity is a concern when working with more than one variable, as none of the predictor variables should correlate highly with another predictor as these variables tend to explain much of the same variance within the outcome, which may obscure the relationship of each predictor (Boslaugh, 2013). To prevent multicollinearity within the logistic regression model, the program of study variable was collapsed into nursing and non-nursing categories due to the large number of nursing students (419) with the remaining 133 students in other healthcare related programs. Hosmer and Lemeshow (1998) note that bivariate correlations values greater than .7 or less than .1 are indicators of multicollinearity. Additionally, for the purpose of this research study, all correlations fell below .7, and were therefore retained within the correlation matrix.

Limitations of the Research Design

Within this quantitative study, the methodology does not include surveys or interviews with participants to analyze reasons for not completing the healthcare-related programs of study. Students may leave institutions for various reasons such as personal problems (Boyd & McHendry, 2010), personal or family illnesses or concerns, financial aid status (Braxton, 2001), or academic difficulties (Tinto, 1993) or lack of preparedness for higher education (Boyd & McHendry, 2010; Hamshire, Willgoss, & Wibberley, 2013) or the rigor of the healthcare-related program's curriculum. Also, when using existing data, randomization is not required, and a control group cannot be established (Ravid, 2011). However, the cost saving and reduction in time to gather the data was a benefit within the course of completing the research study.

Internal Validity

High internal validity exists within a study when the researchers control the extraneous variables so only the obvious difference between the experimental and control group is the intervention, or independent variable (Ravid, 2011). This allows researchers to draw conclusions or inferences from the data about the sample to generalize it to the population (Creswell, 2008). Threats to internal validity for this *ex post facto* research include history, maturation, mortality, and selection of participants. History refers to events which occur while the study takes place that may affect the dependent variable, according to Ravid (2011). For example, an event occurring during the time of the study, which may impact the ability for a student to complete, such as receipt of financial aid or changes in instructors from one group of students to the next. Maturation refers to physical, intellectual, or mental changes experience by participants (Ravid, 2011), such as the students understanding of patient care and critical thinking decisions within the healthcare setting. Mortality, within the context of this study, refers to the loss of participants as incomplete data sets were withdrawn from the sample. Pretests were not included within the study, so testing and regression were not threats to the internal validity of the research. Also, instrumentation was not considered a threat to internal validity due to the use of archived data within the quantitative ex post facto research design.

Within the context of external validity related to history, this threat was reduced as each participant included within the study completed the same prerequisites of English 1301, College Algebra (Math 1314 or Math 1414), and Anatomy and Physicology (BIOL 2401 or SCIT 1407). This allowed for similar educational

requirements of the participants. The threat of maturation was minimized as the length of training within the programs of study was the same in regards to semester length across the four colleges, thus allowing participants to mature or change at a similar rate during the study. The two groups being studied (completers and non-completers) were not randomly assigned; therefore, the selection of participants could not be controlled, and mortality was not an issue within the study as complete data sets were utilized within the study. Furthermore, the dichotomous nature of the research variables and analysis in determining the characteristics between the variables indicated logistic regression as the appropriate design for the research study.

External Validity

Ravid (2011) describes external threats to validity as those which "limit the extent to which the results of the study can be generalized and applied to populations that are not participating in a study" (p. 11). This may also occur as researchers conclude incorrect inferences from the sample and attempt to apply the data to other settings or situations (Creswell, 2008). Since the study utilized *ex post facto* data, there was not a threat related to personal reactions or behaviors during interviews, perception of being observed, or the researcher's knowledge of the participants. There are similar studies related to student retention and completion within healthcare-related programs (Hamilton, 2011), but none that consider the impact of student retention and completion within healthcare-related associate degree programs across multiple institutions. Therefore, this study would need to be replicated in other urban settings in order to assess the repeatability of the study and generalization to the population.

Expected Findings

Studies on retention and persistence within single colleges found predictors of student success within various student characteristics and academic program factors. For example, a similar study conducted by Hamilton (2011) within a community college setting to identify factors related to persistence of students at Northeast State Community College in Tennessee indicated a significant difference in persistence within the programs of study, a strong relationship between course grades and persistence to graduation, and the number of math and science courses completed. It is expected to find similar results for the differences in programs of study, relationship of program cumulative grades and cumulative grade point averages, and developmental coursework requirements. Furthermore, Sawyers (2011) found that college grade point average was a strong predictor of graduation for all students, and that women were more likely to graduate then men, as also noted in Renn and Reason (2012). To this end, it is expected to find that women are more likely than men to persist to graduation, and cumulative grade point averages increase persistence to graduation. Story (2011) found that adult students require a greater connection with faculty and a supportive learning environment, so it is expected to not see a difference in older non-traditional students with those in the average age category type related to student persistence.

Tinto (1987) included psychological, societal, economic, organizational, and interaction factors, which was supported by previous findings of Metzner and Bean (1987). It is expected to find that financial aid eligibility will increase student persistence to degree attainment (Renn and Reason, 2012), in addition to intensive advising offered for healthcare-related programs.

Renn and Reason (2012) noted the empirical persistence research included preparation and commitment as categorical input predictors, in addition to, student demographic variables including race, sex and socioeconomic factors, noting the conundrum of these predictors and the impact on higher education in understanding the predictive power of such characteristics. Furthermore, race, gender, and socioeconomic status "have been found in numerous students to be reliable predictors of student persistence" (Renn & Reason, 2012, p. 189). Pascarella and Terenzini (2005) emphasized the importance of including student characteristics in studies of persistence to explore the effectiveness of interventions implemented within higher education environments, such as strategic or intensive advising areas. According to Tinto (2012), "Despite years of effort, institutions have yet to develop a coherent framework to guide their thinking about what actions matter most and how they should be organized and successfully implemented" (p. 5). To this end, the student characteristics and academic program factors will be evaluated to identify predictors associated with student success in community college healthcare-related associate degree programs in order to establish a framework of predictors of success.

Ethical Issues

According to Creswell (2008), "ethics should be a primary consideration rather than an afterthought. Researchers should reflect on ethical issues throughout the research process, from defining the problem to advancing research questions to collecting and analyzing data to writing the final report" (p. 13). With this concept in mind, the following position statement, conflict of interest assessment, and ethical concerns are noted within this research study.

Researcher's Position Statement

Prior to conducting this study, the researcher was employed in the healthcare program areas within a community college setting beginning in January of 2005 as a Program Administrator, an Associate Dean beginning in 2011, and as an Executive Director beginning in September of 2012. Since being employed within the healthcare sector, the researcher was not directly involved with the *ex post facto* data collected and did not extract program information from the college the researcher was directly affiliated with during these periods of employment. Therefore, the findings and researcher were less likely to be influenced by external factors related to the study of student persistence and completion within the healthcare sector.

Conflict of Interest Assessment

The researcher worked within a community college, healthcare program area during the time of this study. To this end, *ex post facto* data regarding student success factors was utilized from a period in which the researcher did not have organizational access to students within the study (2005 – 2011). To prevent bias within the study, student identification numbers were removed and numerically coded for analysis purposes. Furthermore, additional compensation was not derived during the course of completing this research study, and data was provided through the designated individuals within the institutional review board, and not from program coordinators overseeing students within the community colleges. However, without the researcher's previous experience within community college settings, the conceptual framework related to non-traditional students may not have evolved in considering student persistent factors across multiple colleges.

Researcher's Position

Currently, the researcher's position within a community college setting is overseeing an advising area, which assists students in selecting the best healthcare program based on their interests and capabilities, and to work with employer partners to assist with job placement opportunities as of September of 2012. To this end, the researcher was interested in determining what factors or characteristics that lead to student retention and completion within the healthcare area, or which barriers impede the student's ability to persist. In order to avoid any particular bias in this area, the data set analyzed included students prior to the fall of 2011, at which time the researcher was employed in an area which did not offer associate degree healthcare-related programs, and would prevent such bias during the time of the study. Furthermore, participants were coded to protect the confidentiality of the students and to provide an additional layer of anonymity during the study.

Ethical Issues in the Study

The college institutional review board was provided with a research plan prior to conducting the study. Since the data consisted of preexisting information, and the researcher agreed that all data would be coded by removing the student identification numbers in order to protect the privacy and anonymity of the participants, the research study was approved by the institutions review board and the research office. Data was provided via a flash drive by a member of the institutions research office, and the researcher agreed to maintain all documents for seven years in a secure area, and to destroy the flash drive after this time period. The collected data was only reviewed by the researcher, and was not shared with anyone else in order to protect the participants,

and the flash drive was hand carried in order to ensure the security of the information at all times during the study.

Chapter 3 Summary

Logistical regression is the appropriate research method when the dependent variable is dichotomous, or consisting of two possible outcomes such as program completion or non-completion (Ravid, 2011). When considering prediction variables, the assumption is that when two variables are strongly correlated, one may be used to predict the other. For example, age at the time of program entry or gender are independent variables (*X*), which may predict or show a strong probability of predicting the criterion variable of program completion or non-completion (*Y*). To this end, logistical regression is the appropriate research methodology to determine student factors or characteristics which lead to program completion within associate degree, healthcare-related programs in four urban community colleges. The following chapter will provide supporting data, tables, and figures in regards to the research questions, in order to describe the data and validate the study on factors which lead to student persistence within healthcare program areas.

CHAPTER 4. DATA ANALYSIS AND RESULTS

Introduction

Chapter 4 presented the results of this study by first detailing descriptive statistics of the variables included within the study, and by detailing the statistical analysis of the findings for the study via logistic regression. Archived data was collected from the Datatel system in a spreadsheet format from four colleges, and transferred into the IBM SPSS Statistics v. 22 software package to analyze the 552 students accepted into associate degree healthcare-related programs of study. If community colleges are to remain the primary point of training for healthcare workers within the United States (National Commission on Community Colleges, 2008), research in the area of characteristics or factors which lead to persistence is essential in order to improve institutional and student success within the higher education system.

The purpose of this research was to determine factors or characteristics, which may predict program completion within six associate degree programs of study across four community colleges within an urban setting. The chapter is organized to analyze student persistence related to age, gender, programs of study, remedial or developmental coursework, advising, program completion, receipt of financial aid, grade point averages (cumulative and program), number of courses completed, and impact of prerequisites on the students ability to persist to program completion. The data will also be measured in terms of those who persisted to program completion, and those who stopped out or

withdrew from the programs of study, with an emphasis on traditional (students between the ages of 18 and 23) verses non-traditional students (students age 24 and older). One primary research question and twelve research sub questions were developed to present the analysis and direct the study in an organized manner. Logistical regression was used to predict the dependent dichotomous variable from the predictor independent variables.

Description of the Sample

Four public, colleges within an urban, community college setting served as the case study for this research paper with a combined population in academic year 2010-2011 of 44,742 students. Of this group, 3,237 (or 7.2%) were enrolled in associate degree healthcare-related programs, and the sample for this study consisted of 552 unduplicated students. Logistical regression requires a minimum sample size in order to reach the maximum likelihood estimation and to increase the reliability of the estimate (Tabachnick & Fidell, 2001). When considering a normally distributed dependent variable, the minimum sample size for detecting medium size R^2 is calculated as 50 plus 8 times the number of independent variables, 50 + (8)(12) = 146. Additionally, the minimum samples size for detecting a medium-size beta is calculated as 104 plus the number of independent variables, or 116. To this end, a sample size of 552 meets both of these requirements (Spicer, 2009). The data received from institutional research comprised of 3,237 students between the academic years 2005 through 2011. To derive the sample, students enrolled in the health professions courses prior to 2005 or those with incomplete datasets, such as prerequisite course grades, were removed from the data set, leaving 552 participants.

Summary of the Results and Detailed Analysis

Demographic variables will be detailed within this section, including frequencies and percentages for the dichotomous independent variable, program completion, in addition to Table 7. Correlation of the independent variables will be evaluated to determine any relationships between the variables, but does not rule out the cause of the relationship (Boslaugh, 2013). Logistic regression will be used to explore the data set further, and better understand the relationships between the variables. Descriptive statistics will be used evaluate the associations between the variables, and logistical regression will be performed to determine the degree to which those independent variables predicted program completion or retention, with a significance level of $p < .05$. The outcome variable was converted into a categorical dichotomy to determine the odds of a health professions student becoming a program completer versus non-completer; completion was determined by evaluating the grade in their final clinical externship class of C or better, or failure or non-completion of the final courses via withdrawal. Logistic regression was also used to test the null hypothesis of each variable.

The predictions for each independent variable were analyzed using the IBM SPSS Statistics version 22 (or SPSS) in order to test each hypotheses, and predict or describe the relationship between the categorical outcome variable, student program completion, and the twelve categorical predictor variables (Peng, Lee, & Ingersoll, 2002). The goodness-of-fit of the logistic model is also evaluated using SPSS, via the Cox and Snell R^2 and the Nagelkerke R^2 (Peng, Lee, & Ingersoll, 2002). According to Peng et al. (2002), these descriptive measures of goodness-of-fit are variations of the R^2 concept within the ordinary least squares regression model, but within linear regression, the "R^2 has a clear definition: It is the proportion of the variation in the dependent variable that can be explained by predictors in the model" (p. 6). Since an equivalent of this concept does not exist for logistic regression, it is an accepted practice for a researcher to treat the Snell R^2 and the Nagelkerke R^2 as informative evaluations related to

the effectiveness of the goodness-of-fit model, and to test the regression coefficients. The likelihood that the coefficient could have occurred by chance will be interpreted by evaluating the significance of the coefficient (Peng, et. al., 2002).

Table 7 provides results of the frequencies and percentages comparing completers and non-completers of the associate degree healthcare programs of study, and the demographic characteristics to describe the sample of the participants based on program completion or non-completion. Of the total sample of 552 students, Table 3 demonstrates that 473 (85%) completed the healthcare related program; whereas, 70 (14%) failed to complete the program of study. First, completers and non-completers were compared. Of the non-completers, the majority were females (361 or 76%) as compared to 112 (24%) male. For non-completers, the ratio of males to females were similar with 61(77%) of females failing to complete, and 18 (23%) males also failing to complete. When examining age, similarities were noted between the completers and non-completers. Of those age 23 and under who completed the program, they accounted for 105(22%), of the sample of 473. Comparatively, for this same age cohort, the non-completers comprised of 21 (27%) of the sample. For the group ages 24-30, 164 (35%) completed versus 19 (24%) who did not complete. For those ages 31-40, 148 (31%) completed versus 24(30%) who did not complete. In the age range 41-50, 47 (10%) were shown to have completed compared to 10 (13%) who did not. For the last age group, 51 and over, 9 (2%) completed, and 5 (6%) did not.

Table 7 also provided information on those who received financial aid, and those who did not. Of the completers, 290 (61%) received financial aid as compared to 38 (48%) of the non-completers. Conversely 183 (39%) of the completers did not receive

financial aid versus 41 (52%) of those who failed to complete their program of study. Furthermore, when examining the 6 programs of study, we noted that 12.5% of the radiology students were completers as opposed to 11% who did not completed. Of the diagnostic medical sonography, echocardiology, and invasive cardiovascular groups, it was demonstrated that respectively 2%, 3% and 2% of the completers fell into these categories, noting that they all completed their programs, and none failed to complete. The vast majority of students were in the nursing program and of those, 356 or 75% completed and 63 out of the 79 non-completers represented 79.7% within the non-completer group. Very few of the cohort attended the advising center, 3 of our completers or 2.5% attended, and 2 of the non-completers did not, which was found to be not significant due to the low number attending the center. Interestingly, 309 of the completers or 65% were enrolled, and successfully finished developmental courses, and 164 (35%) were not enrolled in developmental education. This percentage is nearly identical for the non-completers, where 51 (65%) took developmental courses, and 28 (35%) did not.

When examining the grade distribution for the completers and non-completers, the similarities between the two groups should be noted. For English 1301 (prerequisite) grades each group had 73% A's, 24% B's, 3% C's, and 0% D's and F's. College Algebra (also a prerequisite) grades between completers and non-completers was also almost identically distributed with 70% of each group receiving A's , 21% of completers and 20% of non-completers receiving B's, and 9% of completers verses 10% of non-completers receiving C's. For anatomy and physiology grades, differences between the two groups with the completers' grade distribution slightly higher than the non-

completers (A's 66% versus 61%, B's 28% for each group, C's 6% for completers and 11% for non-completers, with virtually no D's or F's for either group) were noted.

Table 7

Frequencies and Percentages of Participant Characteristics

	Completer		Non-Completer		% Totals
Variable	*n*	%	*n*	%	
Total Sample – Completed Program	473	85.7%	79	14.3%	
Gender					
Female	361	76.3%	61	77.2%	76.4%
Male	112	23.7%	18	22.8%	23.6%
Age					
Under 23	105	22.2%	21	26.7%	22.8%
Ages 24 – 30	164	34.7%	19	24.1%	33.2%
Ages 31 – 40	148	31.3%	24	30.4%	31.2%
Ages 41 – 50	47	9.9%	10	12.7%	10.3%
51 and over	9	1.9%	5	6.3%	2.5%
Received Financial Aid					
Yes	290	61.3%	38	48.1%	59.4%
No	183	38.7%	41	51.9%	40.6%
Program of Study					
Radiologic Sciences	59	12.5%	9	11.4%	12.6%
Diagnostic Medical Sonography	8	1.7%	0	0%	1.5%
Echocardiology Technology	14	3.0%	0	0%	2.6%
Invasive Cardiovascular Technology	8	1.7%	0	0%	1.5%
Respiratory Care	28	5.9%	7	8.9%	5.9%
Nursing	356	75.3%	63	79.7%	75.9%
Attended Advising Center	3	2.5%	2	.6%	.9%
Completed Developmental Coursework					
Yes	309	65.3%	51	64.6%	65.2%
No	164	34.7%	28	35.4%	34.8%

Table 7. Frequencies and Percentages of Participant Characteristics (continued)

Variable	Completer		Non-Completer		% Totals
	n	%	*n*	%	
English 1301 Grades					
A = 4.0	345	72.9%	58	73.4%	73.0%
B = 3.0	113	23.9%	19	24.1%	23.9%
C = 2.0	14	3.0%	2	2.5%	2.8%
D = 1.0	1	.2%	0	0%	.1%
F = 0.0					
College Algebra 1314 Grades					
A = 4.0	329	69.6%	55	69.6%	69.6%
B = 3.0	99	20.9%	16	20.3%	20.8%
C = 2.0	43	9.1%	8	10.1%	9.2%
D = 1.0	2	.4%	0	0%	.4%
F = 0.0					
Anatomy & Physiology Grades					
A = 4.0	310	65.5%	48	60.8%	64.9%
B = 3.0	132	27.9%	22	27.8%	27.9%
C = 2.0	30	6.3%	9	11.4%	7.1%
D = 1.0	1	.2%	0	0%	.1%
F = 0.0					
Program Grade Point Average					
4.0	10	2.1%	2	2.5%	2.2%
3.0 – 3.99	415	87.7%	23	29.1%	79.3%
2.0 – 2.99	47	9.9%	38	48.1%	15.4%
1.99 and below	1	.2%	16	20.3%	3.1%
Total Credit Courses Completed					
24 and below	108	22.8%	30	38.0%	25.0%
25-48	348	72.3%	40	50.6%	70.3%
49 and above	23	4.9%	9	11.4%	5.7%
Cumulative Grade Point Average					
4.0	7	1.5%	0	0%	1.3%
3.0 – 3.99	426	90.1%	51	64.6%	86.4%
2.0 – 2.99	40	8.5%	28	35.4%	12.3%
1.99 and below	0	0%	0	0%	0%

The following descriptive statistics in Table 8 shows the mean, standard deviation, and range for the continuous, scaled variables of age at the time of program completion ($\mu = 30.71$, $\sigma = 8.510$, range = 18 – 68), cumulative GPA ($\mu = 3.39$, $\sigma =$

.3516, range = 1 – 4), program GPA (μ = 3.21, σ = .6924, range = 1 – 4), number of credit courses completed (μ = 31.53, σ = 9.244, range = 8 – 61, English 1301 course grade (μ = 3.57, σ = .590, range = 1 – 4), anatomy and physiology course grade (μ = 3.57, σ = .630, range = 1 – 4), and mathematics course grade (μ = 3.60, σ = .669, range = 1 – 4).

Table 8

Descriptive Statistics of the Independent Variables

Variable	Mean (μ)	Standard Deviation (σ)	Range
Age	30.71	8.510	18 - 68
Cumulative GPA	3.39	.3516	1 - 4
Program GPA	3.21	.6924	1 - 4
No. of Credit Courses Completed	31.53	9.244	8 - 61
English 1301 Course Grade	3.57	.590	1 - 4
Anatomy & Physiology Course Grade	3.57	.630	1 - 4
Math Course Grade	3.60	.669	1 - 4

Table 9 describes the number of male students (23.6%) verses the number of female students (76.4%) with a total of 552 for the entire sample of both completers and non-completers.

Table 9

Healthcare Students by Gender

Gender	Number	Valid Percent	Cumulative Percent
Male	130	23.6	23.6
Female	422	76.4	100.0

Total	552	100.0	100.0

Table 10 describes the age ranges of students accepted into the healthcare-related programs of study sample. The sample comprised of 22.8% of traditional students, those under the age of 23, and 77.2% of non-traditional students, those age 24 and older. The percentage of students between the ages 24 to 30 was 33.2%; ages 31 to 40 was 31.2%; ages 41 to 50 was 10.3%, and students over the age of 51 comprised 2.5% of the sample.

Table 10

Healthcare Students by Age

	Number	Valid Percent	Cumulative Percent
Under 23	126	22.8	22.8
Ages 24 – 30	183	33.2	56.0
Ages 31 – 40	172	31.2	87.1
Ages 41 – 50	57	10.3	97.5
51 and over	14	2.5	100.0
Total	552	100	100

Table 11 details the number of students within each healthcare program of study. The sample comprised of 68 radiologic science students (12.3%), 8 diagnostic medical sonography students (1.4%), 14 echocardiology students (2.5%), 8 invasive cardiovascular students (1.4%), 35 respiratory care students (6.3%), and 419 nursing students (75.9%). The programs of study intentionally have small cohorts in order to prevent flooding the healthcare sector with too many students, and not enough jobs. Also,

of note is the large number of nursing students (419 or 75.9%), which comprises a large portion of the student population.

Table 11

Healthcare Students by Program of Study

Program of Study	Number	Valid Percent	Cumulative Percent
Radiologic Sciences	68	12.3	12.3
Diagnostic Medical Sonography	8	1.4	13.8
Echocardiology technology	14	2.5	16.3
Invasive Cardiovascular Technology	8	1.4	17.8
Respiratory Care	35	6.3	24.1
Nursing	419	75.9	100.0
Total	552	100.0	100.0

Table 12 describes the number of students receiving financial aid (40.6%) verses the number of students who did not receive financial aid (59.4%) with a total of 552 students within the sample. See Table 7 to view the financial aid variable based on program completion and non-completion, which indicated 61.3% of the program completers, received financial aid, and 38.7% of the program completers did not receive financial aid. This points to financial aid as having an impact on the student's ability to persist to program completion.

Table 12

Healthcare Students by Receipt of Financial Aid

Received Financial Aid Percent	Number	Valid Percent	Cumulative
No	224	40.6	40.6
Yes	328	59.4	100.0
Total	552	100.0	100.0

Table 13 describes the number of students that completed developmental or remedial coursework (65.2%) verses the number of students who did not take developmental or remedial coursework (34.8%) with a total of 552 students within the sample.

Table 13

Healthcare Students by Developmental or Remedial Coursework Completion

Completed Developmental Courses Percent	Number	Valid Percent	Cumulative
No	192	34.8	34.8
Yes	360	65.2	100.0
Total	552	100.0	100.0

Table 14 indicates the number of students who received pre-program healthcare advising, rather than receiving advising through the centralized advising areas of the colleges. Of the 552 students, less than 1% attempted to meet with the specialized

advisors. There were too few students to effectively analyze this variable for the purpose of inferential testing.

Table 14

Healthcare Students who Attended Healthcare Specific Advising Sessions

Received Healthcare Advising	Number	Valid Percent	Cumulative Percent
No	547	99.1	99.1
Yes	5	.9	100.0
Total	552	100.0	100.0

Students completing their selected programs of study is described in Table 15, and indicates a completion rate of 85.7% (or 473 students) within healthcare-related associate degree programs, and a 14.3% non-completion rate (or 79 students) out of 552 students.

Table 15

Healthcare Students who Completed Programs of Study

Completed Programs of Study	Number	Valid Percent	Cumulative Percent
No	79	14.3	14.3
Yes	473	85.7	100.0
Total	552	100.0	100.0

Within descriptive statistics, it is helpful to consider correlation between variables; correlation, according to Ravid (2011), is "a statistical test that is designed to

study relationship and association between variables" (p. 113). The correlation coefficient is used to determine the significance of the relationship (low, moderate or high) with a p value <.05. The coefficient can range between -1.00, indicating a perfect negative correlation; to 0.00, indicated no correlation; to +1.00, indicating a perfect positive correlation (Ravid, 2011). Table 17 provides a correlation of variables related to age, gender, programs of study, remedial or developmental coursework, advising, program completion, receipt of financial aid, grade point averages (cumulative and program), number of courses completed, and impact of prerequisites on the students ability to persist to program completion. This information does not imply causation, where one variable may have caused the other, but indicates where variables may be related with the coefficient ranging between ±1 with p values ≤ .05 (Ravid, 2011). For the purposes of this research study the coefficients will be described as low (.00 to .33), moderate (.34 to .66), and high (.67 to 1.00).

In regards to the correlation table of variables, variables with a positive relationship, meaning as the value of one variable increases, the value of the second variable also increases, to inform the study that a relationship does exist, but does not indicate causation (Boslaugh, 2013). The correlation table was analyzed for concerns of multicollinearity, and found a large number of variables with demonstrated correlations or relationships, but none were greater than .7, and therefore will be included in the logistic regression analysis. Within a positive correlation as the value of one variable increases, the value of the other variable also increases, and within a negative relationship, as the value of one variable increases, the value of the other variable decreases (Boslaugh, 2013). As stated previously, correlations point to relationships

between two variables, not to causation. With this in mind, logistical regression analysis has been completed in order to determine predictors of student success within the variables outlined within this study. Of the 66 correlation, 37 (or 56%) were found to be significant ($p < .05$). The Pearson correlation (*r)* displays correlations between the variables as follows:

Table 16

Variable Comparison of Significance

Variables	*r*	Significance p<.05
Positively Correlated Variables		
Age and Program GPA	.115	.007**
Gender and Program of Study	.176	.000**
Gender and Received Financial Aid	.089	.036*
Gender and Cumulative GPA	.089	.036*
Age and English	.124	.003**
Age and A&P	.084	.048*
Program GPA and A&P	.098	.021*
Program GPA and Received Financial Aid	.105	.013*
Program GPA and Completed Program	.533	.000**
Developmental Course Work and Received Financial Aid	.086	.044*
Developmental Course Work and Number of Credit Courses	.227	.000**
Program of Study and Cumulative GPA	.153	.000**
English and A&P Grades	.179	.000**
English and Math Grades	.187	.000**
A&P and Math Grades	.288	.000**
Received Financial Aid and Number of Credit Courses	.142	.001**
Received Financial Aid and Completed Program	.094	.027*
Number of Credit Courses and Cumulative GPA	.126	.003**

Table 16. Variable Comparison of Significance (continued)

Variables	*r*	Significance p<.05
Negatively Correlated Variables		
Gender and Age	-.114	.007**
Gender and A&P	-.104	.014*
Gender and Math	-.093	.029*
Age and Program GPA	-.180	.000**
Age and Received Financial Aid	-.094	.027*
Age and Number of Credit Courses	-.184	.000**
Age and Cumulative GPA	-.127	.003**
Program GPA and Cumulative GPA	-.435	.000**
Developmental Course Work and A&P	-.107	.012*
Developmental Course Work and Math	-.100	.019*
Program of Study and Received Financial Aid	-112	.009**
Program of Study and Number of Credit Courses	-.135	.002**
Program of Study and Completed Program	-.533	.000**
ENGL 1301 and Cumulative GPA	-.220	.000**
A&P and Received Financial Aid	-.108	.011*
A&P and Number of Credit Courses	-.150	.000**
A&P and Cumulative GPA	-.213	.000**
Math and Received Financial Aid	-.102	.017*
Math and Cumulative GPA	-.188	.000**
Cumulative GPA and Completed Program	-.283	.000**

Interestingly, while many of the correlations were deemed to be statistically significant at the $p < .05$ level, the correlation coefficients were relatively weak (e.g. A&P and math grades were significant, but the correlation coefficient was .288). As sample sizes increase, the more likely it is that correlation coefficients will appear to be significant (Abbott & McKinney, 2013). Prior research as well as further analysis such as regression analysis, and using *r* squared, to determine the amount of variation explained in the dependent variable by the independent variable, helped to determine how strong or significant the association between variables actually are within the study

(Abbott & McKinney, 2013; Boslaugh, 2013). Table 17, the Correlation Table of Variables, provides a detailed analysis of the correlation between independent and dependent variables.

Table 17

Correlation Table of Variables

		Gender	Age By Group	Prog GPA	Dev Course Work	Program of Study	ENGL 1301 Grade	A&P Grade	Math Grade	Received Financial Aid	Attended Advising	No of Credit Courses	Cum GPA	Completed Program of Study
Gender	Pearson Correlation	1												
	Sig. (2-tailed)													
Age By Group	Pearson Correlation	-.114**	1											
	Sig. (2-tailed)	.007												
Prog GPA	Pearson Correlation	-.010	.115**	1										
	Sig. (2-tailed)	.814	.007											
Dev Course Work	Pearson Correlation	.061	.042	-.024	1									
	Sig. (2-tailed)	.154	.326	.575										
Program of Study	Pearson Correlation	.176**	-.055	-.180**	.007	1								
	Sig. (2-tailed)	.000	.196	.000	.878									
ENGL 1301 Grade	Pearson Correlation	-.003	.124**	.071	-.044	.046	1							
	Sig. (2-tailed)	.950	.003	.095	.305	.279								
A&P Grade	Pearson Correlation	-.104*	.084*	.098*	-.107*	.070	.179**	1						
	Sig. (2-tailed)	.014	.048	.021	.012	.101	.000							
Math Grade	Pearson Correlation	-.093*	.052	.015	-.100*	.046	.187**	.288**	1					
	Sig. (2-tailed)	.029	.224	.730	.019	.280	.000	.000						
Received Financial Aid	Pearson Correlation	.089*	-.094*	.105*	.086*	-.112**	-.075	-.108*	-.102*	1				
	Sig. (2-tailed)	.036	.027	.013	.044	.009	.078	.011	.017					
Attended Advising	Pearson Correlation	.008	.078	.036	.030	-.036	.055	-.026	.029	.001	1			
	Sig. (2-tailed)	.851	.067	.395	.487	.404	.200	.535	.494	.979				
No of Credit Courses	Pearson Correlation	-.016	-.184**	-.051	.227**	-.135**	-.060	-.150**	-.041	.142**	.072	1		
	Sig. (2-tailed)	.706	.000	.228	.000	.002	.162	.000	.340	.001	.091			
Cum GPA	Pearson Correlation	.089*	-.127**	-.435**	.024	.153**	-.220**	-.213**	-.188**	-.003	.024	.126**	1	
	Sig. (2-tailed)	.036	.003	.000	.574	.000	.000	.000	.000	.952	.568	.003		
Completed Program of Study	Pearson Correlation	-.007	-.046	.533**	.006	-.037	-.009	.052	.001	.094*	-.070	.058	-.283**	1
	Sig. (2-tailed)	.863	.281	.000	.894	.389	.836	.220	.988	.027	.100	.174	.000	

** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed).

Logistic Regression

In order to further explore the research question "What are the factors within Associate in Applied Sciences Degrees (AAS), which predict the likelihood of associate degree completion within healthcare-related programs (Diagnostic Medical Sonography, Echocardiology Technology, Invasive Cardio Vascular Technology, Nursing, Radiologic Sciences, and Respiratory Care programs)?" the following sub questions were evaluated using logistic regression with program completion as the constant, and twelve student characteristics or factors as independent variables (or predictor variables). Students who completed their selected program of study were coded as 1, and those that did not were coded as 0. Logistic regression models are considered to be a stronger predictor model or better fit to the data, if the analysis determines an improvement in the findings over the original model (Peng, Lee, & Ingersoll, 2002). This study revealed that 85.7% of the students completed their selected programs of study, which established the base classification of program completion. Binary logistic regression was completed for each sub question to evaluate its predictive power of the independent variable, and the extent to which the variable adds additional prediction power to the overall logistic regression model.

Overall Model

To begin with, an analysis of the individual variables was completed considering the full model, as depicted in Table 18. Using the maximum likelihood method the coefficients are identified to evaluate the probability of obtaining the observed dependent variable based on the likelihood of students to persist to degree completion, variables which indicate significance ($p < .05$), include age at the time of program entry ($p = .003$),

cumulative grade point average (p = .003), number of credit courses completed (p = .010), and program grade point average (p = .000). The goodness-of-fit test (Omnibus Tests of Model Coefficients) indicates the probability of obtaining the chi square statistic if the null is true, or if there is not a significance predictive contribution of the independent variable toward degree completion. Since p = .000, this test indicates that the independent variables do contribute to the overall fit of the model. The Omnibus Test of the Model Coefficients indicates if the model is better than the null model with no coefficients. The model is significant with X^2 (1, N=552) = 157.877, p = .000. This result tests to see if the observations are purely by chance, with a significance factor of p = .000, the independent variables are significant predictors of program completion. The Cox and Snell R^2, another test of the goodness-of-fit, which explains the amount of variance within the model as variables are added. Within this model, higher values indicate a greater fit, and the strength of the relationship between the dependent variable (program completion), and the twelve independent variables. The Cox and Sell R^2 value for this study was not significant at .249, and the Nagelkerke value for this study was not significant at .444, indicating a weak relationship between independent variables and program completion, or a 44% variation. It was expected that each variable would be a predictor of success toward program completion based on the literature review. The odds ratio for each variable is as follows: gender is .850 and the 95% confidence internal for the odds ratio is (.397, 1.819). This means that the odds of students persisting to program completion based on gender are .850 times greater (p > .05; p = .850), or the probability of a male student completing decreases by 15% within the overall model. Age at the time of program entry indicated an odds ratio of .950 and range of .918 to .982 indicating

that the odds of non-traditional students decreases by 5%; cumulative grade point average indicated an odds ratio of .277 and range of .119 to .645 indicating the likelihood of students completing based on grade point average decreases by more than three-fourths with each change in letter grade; program of study indicated an odds ratio of 2.0351and range of .916 to 4.500; Grade in English 1301 indicated an odds ratio of .680 and range of .366 to 1.263, noting that those completing English were just over a third likely to be retained, but were more likely to be retained based on grades in anatomy and physiology indicated an odds ratio of .981 and range of .583 to 1.649; grades in mathematics indicated an odds ratio of .864 and range of .521 to 1.432. The receipt of financial aid indicated an odds ratio of 1.048 and range of .557 to 1.972, noting that students were more likely to complete programs of study based on receipt of financial aid, with similar finding regarding attending specialized healthcare advising indicated an odds ratio of .142 and range of .014 to 1.492, number of credit courses completed indicated an odds ratio of 2.195 and range of 1.202 to 4.008, and program grade point average indicated an odds ratio of 14.043 and range of 7.648 to 25.785. With 85.7% of the students completing healthcare related programs of study or degrees, the overall model predicted an 88.9% completion rate based on the described independent variables. The overall model is as follows:

Table 18

Prediction of all Independent Variables

	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B) Lower	Upper
Gender	-.163	.388	.176	1	.675	.850	.397	1.819
Age at time of Program Entry	-.052	.017	8.920	1	.003	.949	.917	.982
Program GPA	2.642	.310	72.614	1	.000	14.043	7.648	25.785
Developmental Course Work	.051	.330	.024	1	.877	1.052	.551	2.007
Program of Study	.708	.406	3.045	1	.081	2.031	.916	4.500
ENGL 1301 Grade	-.386	.316	1.492	1	.222	.680	.366	1.263
A&P Grade	-.020	.265	.005	1	.941	.981	.583	1.649
Math Grade	-.146	.258	.322	1	.570	.864	.521	1.432
Received Financial Aid	.047	.322	.021	1	.884	1.048	.557	1.972
Attended Advising	-1.950	1.199	2.645	1	.104	.142	.014	1.492
No. Credit Courses	.786	.307	6.556	1	.010	2.195	1.202	4.008
Cumulative GPA	-1.285	.432	8.838	1	.003	.277	.119	.645
Constant	-.430	2.380	.033	1	.857	.650		

The overall model depicted in Table 18 indicates significance in age at the time of program entry (p = .003), cumulative grade point average (p = .003), number of credit

courses completed (p = .010), and program grade point average (p = .000), the following sub questions were evaluated to determine rejection or acceptance of each null by evaluating the independent variable and program completion.

Sub Question 1: Gender

What is the unique contribution of gender in predicting the likelihood of persistence to degree completion?

$H_0$1: There is no statistically significant predictive contribution based on gender in predicting persistence to degree completion.

The Omnibus Test of the Model Coefficients indicates if the model is better than the null model with no coefficients. The model is not significant with X^2 (1, N=552) = .030, p = .862. This result tests to see if the observations of gender are purely by chance, with a significance factor of p = .862, or 86%, gender of the students was not a significant predictor of program completion (p = .862). The Cox and Snell R^2 value for this variable was significant at .000, and the Nagelkerke value for this study was significant at .000, indicating a strong relationship between gender and program completion or minimal variation regarding program completion. It was expected that gender would be a predictor of success toward program completion, as females tend to complete at higher levels than male students (Renn & Reason, 2012). In reviewing Exp(B), it demonstrates that the odds ratio of program completion, if you are a male is .951. Or alternatively, the probability of program completion for males' decreases by 5% compared to a females. Holding all other predictor variables constant, this variable was not significant at the .05 (.862) in explaining differences between gender in completion. Therefore, the null

hypotheses will fail to be rejected as there is no difference in gender outcomes for program completion. The number of female students to complete 76.3% versus not complete was 77.2%, and males had a similar consistency of 23.7% completing verses 22.8% not completing further indicating gender is not a significant predictor of program completion as the overall program completion rate is 85.7%, so gender does not fit the model.

Table 19

Prediction of Gender (N = 552)

	B	S.E.	Wald	Df	Sig.	Exp(B) Odds Ratio	95% C.I.for EXP(B) Lower	Upper
Gender	-.050	.289	.030	1	.862	.951	.540	1.677
Constant	1.828	.254	51.827	1	.000	6.222		

Sub Question 2: Age

What is the unique contribution of age in predicting the likelihood of persistence to degree completion?

$H_0$2: There is no statistically significant predictive contribution based on age in predicting persistence to degree completion.

In regards to age, the mean age of students within the healthcare-related associate degree programs was 30.71 years of age, with a range of 18 to 68 years of age, indicating that the majority of the students are non-traditional (447 out of 552, or 77.8% as indicated in Table 2). The goodness-of-fit test (Omnibus Tests of Model Coefficients) indicates there is not a significance predictive contribution of age at the time of program entry

toward degree completion. Since $p = .283$, this test indicates that age does not contribute to the overall fit of the model as X^2 (1, N=552) = .030, df=1, $p = .283$; age of the students was not a significant predictor of program completion ($p = .281$). In reviewing Exp(B), it demonstrates that the odds of program completion, based on age is .881. Or alternatively, the probability of program completion for a non-traditional student decreases by 12% compared to traditional students. Holding all other predictor variables constant, this variable was not significant at the .05 (.281) in explaining differences between age at the time of program entry and completion. The Cox and Snell R^2 value for this study was significant at .002, and the Nagelkerke value for this study was significant at .004, indicating a strong relationship between age and program completion, or minimal variation in regards to program completion. Therefore, the null hypotheses will fail to be rejected as there is no difference in age outcomes for program completion.

Table 20

Prediction of Age at the Time of Program Completion (N = 552)

	B	S.E.	Wald	Df	Sig.	Exp(B) Odds Ratio	95% C.I.for EXP(B) Lower	Upper
Age at time of Program Entry	-.126	.117	1.162	1	.281	.881	.700	1.109
Constant	2.095	.313	44.756	1	.000	8.123		

Sub Question 3: Program Cumulative Grade Point Average

What is the unique contribution of program cumulative grade point average in predicting the likelihood of persistence to degree completion?

$H_0$3: There is no difference statistically significant predictive contribution based on program cumulative grade point average in predicting persistence to degree completion.

In regards to program grade point average, 2.1% (10 students) of program completers had a program GPA of 4.0; 87.7% (415) students had a program GPA between 3.00 and 3.99; 9.9% (47 students) had a program GPA between 2.00 and 2.99, and .2% (or 1 student) had a program GPA below 1.99. The goodness-of-fit test (Omnibus Tests of Model Coefficients) indicates there is a significance predictive contribution of program grade point average toward degree completion. Since $p = .000$, this test indicates that program grade point average does contribute to the overall fit of the model as X^2 (1, N=552) = 126.555, df=1, $p = .000$; program grade point average was a significant predictor of program completion (p =.000). For program GPA, Exp(B) at 12.246 can be interpreted as the odds ratio of program completion based on program grade point average is 12.246. This variable was found to be significant at .000, with the p value set at .05, with students with higher grade point averages as being twice as likely to complete. The Cox and Snell R^2 value for this study was significant at .205, and the Nagelkerke value for this study was significant at .366, indicating a weak relationship between program grade point average, and program completion or 37% of the variation in program completion. The odds ratio is 12.246 and the 95% confidence internal for the odds ratio is (7.360, 20.374). To this end, the null was rejected, as there is a significant

difference in persistence rates of students based on program grade point average. This variable will be included in the parsimonious model.

Table 21

Prediction of Program GPA (N = 552)

	B	S.E.	Wald	Df	Sig.	Exp(B)	95% C.I.for EXP(B) Lower	Upper
Program GPA	2.505	.260	93.014	1	.000	12.246	7.360	20.374
Constant	-4.763	.664	51.405	1	.000	.009		

Sub Question 4: Type of Degree

What are the unique contributions of the type of degree (Associate in Applied Sciences Degree (AAS) in Diagnostic Medical Sonography, Echocardiology Technology, Invasive Cardiovascular Technology, Nursing, Radiologic Sciences, and Respiratory Care programs) in predicting the likelihood of persistence to degree completion?

$H_0$4: There is no statistically significant predictive contribution based on the type of degree or program of study in predicting persistence to degree completion.

In regards to program of study or type of degree selected, the goodness-of-fit test (Omnibus Tests of Model Coefficients) indicates there is not a significance predictive contribution of the type of program or associate degree students select toward degree completion. Since p=.381, this test indicates that type of program of study does not contribute to the overall fit of the model as X^2 (1, *N*=552) = .769, *df*=1, *p* = .381; program of study was not a significant predictor of program completion (*p* =.381). In reviewing Exp(B), it demonstrates that the odds ratio of program completion, based on type of program is .773. Or alternatively, the probability of program completion based

on type of degree selected is likely to decrease by 23% within particular degrees of study. Holding all other predictor variables constant, this variable was not significant at the .05 (.389) in explaining differences between degrees and completion. The Cox and Snell R^2 value for this study was significant at .001, and the Nagelkerke value for this study was significant at .002, indicating a strong relationship between program of study and program completion, or minimal variation within the model. Therefore, the null hypotheses will fail to be rejected as there is no difference regarding type of degree selected and program completion.

Table 22

Prediction of Program of Study (N = 552)

	B	S.E.	Wald	Df	Sig.	Exp(B)	95% C.I.for EXP(B) Lower	Upper
Program of Study	-.258	.300	.741	1	.389	.773	.430	1.390
Constant	1.990	.267	55.716	1	.000	7.312		

Sub question 5: Developmental Coursework

What is the unique contribution of developmental course requirements in predicting the likelihood of persistence to degree completion?

$H_0$5: There is no difference statistically significant predictive contribution based on developmental coursework in predicting persistence to degree completion.

Completion of developmental coursework indicated a goodness-of-fit test (Omnibus Tests of Model Coefficients) of not being a significant predictive contribution

toward degree completion. Since $p = .894$, this test indicates that completion of developmental coursework does not contribute to the overall fit of the model as X^2 (1, N=552) = .018, df=1, p=.894; to this end, completion of developmental coursework was not a significant predictor of program completion ($p = .018$). The Cox and Snell R^2 value for this study was significant at .000, and the Nagelkerke value for this study was significant at .000, indicating a strong relationship between completion of remedial courses and program completion, or minimal variation. In reviewing Exp(B), it demonstrates that the odds ratio of program completion, based on completion of developmental coursework is 1.034. This means that the odds of students persisting to program completion based on completing developmental coursework are 3% more likely; holding all other predictor variables constant, this variable was not significant at the .05 (.894) in explaining differences between the independent variable of developmental coursework and completion. Therefore, the null hypotheses will fail to be rejected as there is no difference regarding completion of developmental course work and completion of a healthcare related program.

Table 23

Prediction of Development Coursework (N = 552)

	B	S.E.	Wald	Df	Sig.	Exp(B)	95% C.I.for EXP(B) Lower	Upper
Developmental Course Work	.034	.254	.018	1	.894	1.034	.628	1.703
Constant	1.768	.204	74.731	1	.000	5.857		

Sub question 6: English 1301

What is the unique contribution of student's course grades in English 1301 in predicting the likelihood of persistence to degree completion?

$H_0$6: There is no difference statistically significant predictive contribution in student's course grades in of English 1301 in predicting persistence to degree completion.

Course grades within English 1301 indicated a goodness-of-fit test (Omnibus Tests of Model Coefficients) of not being a significant predictive contribution toward degree completion. Since p=.835, this test indicates that course grades in English 1301 did not contribute to the overall fit of the model as X^2 (1, *N*=552) = .043, *df*=1, p=.835; to this end, completion of English prerequisite requirements was not a significant predictor of program completion. In reviewing Exp(B), it demonstrates that the odds of program completion, based on completion of English course prerequisites is .953. Or alternatively, the probability of program completion for a student completing the English 1301 prerequisite decreases by 5%. Holding all other predictor variables constant, this variable was not significant at the .05 (.836) in explaining differences between completion of English and program completion. The Cox and Snell R^2 value for this study was significant at .000, and the Nagelkerke value for this study was significant at .000, indicating a strong relationship between English 1301 and program completion, or minimal variation. The odds ratio is .953 and the 95% confidence internal for the odds ratio is (.603, 1.505), but not significant (*p* = .836). Therefore, the null hypotheses will fail to be rejected as there is no difference regarding completion of the English 1301 prerequisite and completion of a healthcare related program.

Table 24

Prediction of English 1301 Course Grades (N = 552)

	B	S.E.	Wald	Df	Sig.	Exp(B)	95% C.I.for EXP(B) Lower	Upper
ENGL 1301 Course Grade	-.048	.233	.043	1	.836	.953	.603	1.505
Constant	1.968	.873	5.083	1	.024	7.158		

Sub Question 7: Anatomy and Physiology

What is the unique contribution of student's course grades in Anatomy and Physiology I (BIOL 2401) or Applied Human Anatomy and Physiology I (SCIT 1407) in predicting the likelihood of persistence to degree completion?

$H_0$7: There is no difference statistically significant predictive contribution in student's course grades in Anatomy and Physiology I (BIOL 2401) or Applied Human Anatomy and Physiology I (SCIT 1407) in predicting persistence to degree completion.

Course grades within anatomy and physiology indicated a goodness-of-fit test (Omnibus Tests of Model Coefficients) of not being a significant predictive contribution toward degree completion. Since $p = .228$, this test indicates that course grades in anatomy and physiology did not contribute to the overall fit of the model as X^2 (1, N=552) = 1.451, df=1, $p = .228$; to this end, completion of anatomy and physiology coursework was not a significant predictor of program completion. In reviewing Exp(B), it demonstrates that the odds of program completion, based on completion of anatomy and physiology course prerequisites is 1.251. Or alternatively, the likelihood of program

completion for a student completing the anatomy and physiology prerequisites increases by 25%. Holding all other predictor variables constant, this variable was not significant at the .05 (.221) in explaining differences between completion of the anatomy and physiology prerequisite requirements and program completion. The Cox and Snell R^2 value for this study was significant at .003, and the Nagelkerke value for this study was significant at .005, indicating a strong relationship between completion of anatomy and physiology course work and program completion. The odds ratio is 1.251 and the 95% confidence internal for the odds ratio is (.874, 1.789), but was not significant (p =.221). Therefore, the null hypotheses will fail to be rejected as there is no difference regarding completion of anatomy physiology prerequisite courses and program completion.

Table 25

Prediction of (N = 552)

	B	S.E.	Wald	Df	Sig.	Exp(B)	95% C.I.for EXP(B) Lower	Upper
A&P Course Grade	.224	.183	1.501	1	.221	1.251	.874	1.789
Constant	.997	.652	2.335	1	.126	2.710		

Sub question 8: Math 1314/1414

What is the unique contribution of student's course grades in Math 1314 in predicting the likelihood of persistence to degree completion?

$H_0$6: There is no difference statistically significant predictive contribution in student's course grades in Math 1314 in predicting persistence to degree completion.

Course grades within college algebra (Math 1313 or Math 1314) indicated a goodness-of-fit test (Omnibus Tests of Model Coefficients) of not being a significant predictive contribution toward degree completion. Since p=.988, this test indicates that course grades in anatomy and physiology did not contribute to the overall fit of the model as X^2 (1, *N*=552) = .000, *df*=1, p=.988; to this end, completion of college algebra was not a significant predictor of program completion. In reviewing Exp(B), it demonstrates that the odds of program completion, based on completion of math course prerequisites is 1.003. Or alternatively, the likelihood of program completion for a student completing the mathematics prerequisites increases by .003%. Holding all other predictor variables constant, this variable was not significant at the .05 (.988) in explaining differences between mathematics coursework and completion. The Cox and Snell R^2 value for this study was significant at .000, and the Nagelkerke value for this study was significant at .000, indicating a strong relationship between completion of mathematics course work and program completion. The odds ratio is 1.003 and the 95% confidence internal for the odds ratio is (.703, 1.431), but not significant (p = .988). Therefore, the null hypotheses will fail to be rejected as there is no difference regarding completion of prerequisite courses and program completion.

Table 26

Prediction of Math 1314 (N = 552)

	B	S.E.	Wald	Df	Sig.	Exp(B)	95% C.I.for EXP(B) Lower	Upper
Math Grade	.003	.182	.000	1	.988	1.003	.703	1.431
Constant	1.780	.664	7.184	1	.007	5.927		

Sub Question 9: Financial Aid

What is the unique contribution of students receiving financial aid in predicting the likelihood of persistence to degree completion?

$H_0$9: There is no difference statistically significant predictive contribution based on students receiving financial aid in predicting persistence to degree completion.

In regards to financial aid, 61.3% (or 290 students) of program completers received financial aid. The goodness-of-fit test (Omnibus Tests of Model Coefficients) indicates a significance predictive contribution of receipt of financial aid toward degree completion. Since $p = .028$, this test indicates that financial aid does contribute to the overall fit of the model as X^2 (1, N=552) = 4.818, df=1, $p = .028$, and was a significant predictor of program completion ($p = .028$). For financial aid, Exp(B) at 1.710 can be interpreted as the odds ratio of program completion based on receiving financial aid is 1.710, with those completing programs as being more likely to complete with the receipt of financial aid. This variable was found to be significant at .028, with the p value set at .05 with a 95% confidence internal for the odds ratio is (1.060, 2.759). The Cox and Snell R^2 value for this study was significant at .009, and the Nagelkerke value for this study was significant at .016, indicating a weak relationship between receipt of financial aid and program completion. This means that the odds of students persisting to program completion are 54% greater based on receiving financial aid. To this end, the null was rejected, as there is a significant difference in persistence rates of students based on receiving financial aid. This variable will be included in the parsimonious model.

Table 27

Prediction of Receiving Financial Aid (N = 552)

	B	S.E.	Wald	Df	Sig.	Exp(B)	95% C.I.for EXP(B) Lower	Upper
Received Financial Aid	.536	.244	4.826	1	.028	1.710	1.060	2.759
Constant	1.496	.173	74.955	1	.000	4.463		

Sub Question 10: Specialized Healthcare Advising

What is the unique contribution of students receiving specialized healthcare program advising in predicting the likelihood of persistence to degree completion?

$H_0$10: There is no difference statistically significant predictive contribution based students receiving specialized healthcare program advising in predicting persistence to degree completion.

Students who met with a specialized healthcare advisor indicated a goodness-of-fit test (Omnibus Tests of Model Coefficients) of not being a significant predictive contribution toward degree completion. Since $p = .158$, this test indicates that specialized healthcare advising did not contribute to the overall fit of the model as X^2 (1, N=552) = 1.998, df=1, $p = .158$; to this end, meeting with a specialized advisor was not a significant predictor of program completion. In reviewing Exp(B), it demonstrates that the odds of program completion, based on meeting with an advisor is .246 with a 95% confidence internal and range of .703, 1.431. Holding all other predictor variables constant, this variable was not significant at the .05 (.128) in explaining differences between meeting with an advisor and program completion. The Cox and Snell R^2 value

for this study was significant at .004, and the Nagelkerke value for this study was significant at .006, indicating a strong relationship between completion and meeting with a healthcare advisor. Therefore, the null hypotheses will fail to be rejected as there is no difference regarding meeting with a specialized healthcare advisor and program completion.

Table 28

Prediction of Receiving Healthcare Advising (N = 552)

	B	S.E.	Wald	Df	Sig.	Exp(B)	95% C.I.for EXP(B) Lower	Upper
Attended Advising	-1.403	.921	2.322	1	.128	.246	.040	1.495
Constant	1.809	.123	216.493	1	.000	6.104		

Sub Question 11: Number of Credit Courses Completed

What is the unique contribution of total credit hours in predicting the likelihood of persistence to degree completion?

H011: There is no difference statistically significant predictive contribution based total credit hours in predicting persistence to degree completion.

Students who completed additional credit courses indicated a goodness-of-fit test (Omnibus Tests of Model Coefficients) of not being a significant predictive contribution toward degree completion. Since $p = .175$, this test indicates that the number of credit courses completed did not contribute to the overall fit of the model as X^2 (1, N=552) = 1.840, df=1, $p = .175$; to this end, additional completion of credit course work was not a significant predictor of program completion. In reviewing Exp(B), it demonstrates that the odds of program completion, based on additional courses is 1.370 with a 95%

confidence internal and range of .870, 2.158, noting that program completers are one third more likely to complete based on the number of credit courses completed. Holding all other predictor variables constant, this variable was not significant at the .05 (.174) in explaining differences between additional coursework and program completion. The Cox and Snell R^2 value for this study was significant at .003, and the Nagelkerke value for this study was significant at .006, indicating a strong relationship between completion and credit course completion. Therefore, the null hypotheses will fail to be rejected as there is not a significant difference regarding persistence rates of students based on credit course completion.

Table 29

Prediction of Total Credit Hours (N = 552)

	B	S.E.	Wald	Df	Sig.	Exp(B)	95% C.I.for EXP(B) Lower	Upper
No. Credit Courses	.315	.232	1.846	1	.174	1.370	.870	2.158
Constant	1.230	.423	8.460	1	.004	3.421		

Sub Question 12: Cumulative Grade Point Average

What is the unique contribution of cumulative grade point average in predicting the likelihood of persistence to degree completion?

$H_0$12: There is no difference statistically significant predictive contribution based on cumulative grade point average in predicting persistence to degree completion.

In regards to cumulative grade point averages, the goodness-of-fit test (Omnibus Tests of Model Coefficients) indicates a highly significance predictive contribution toward degree completion. Since $p = .000$, this test indicates that cumulative grade point

average does contribute to the overall fit of the model as X^2 (1, N=552) = 36.478, df=1, p = .000, and was a significant predictor of program completion (p = .000). The Cox and Snell R^2 value for this study was significant at .064, and the Nagelkerke value for this study was significant at .114, indicating a weak relationship between cumulative grade point average and program completion, and 11% of the variance. The odds ratio is .169 and the 95% confidence internal for the odds ratio is (096, .295). To this end, the null was rejected, as there is a significant difference in persistence rates of students based on cumulative grade point average and program completion. This variable will be included in the parsimonious model.

Table 30

Prediction of Cumulative Grade Point Average (N = 552)

							95% C.I.for EXP(B)	
	B	S.E.	Wald	Df	Sig.	Exp(B)	Lower	Upper
CUMGPA	-1.780	.285	39.018	1	.000	.169	.096	.295
Constant	5.689	.658	74.835	1	.000	295.708		

Based on the levels of significance when individually evaluating the independent variables for program grade point average, cumulative grade point average, and receipt of financial aid, which indicated significance when testing the null hypothesis, a parsimonious model was developed to further evaluate the predictors, which lead to program completion within healthcare-related programs of study. In regards to cumulative grade point averages, program grade point average, and receipt of financial aid, the goodness-of-fit test (Omnibus Tests of Model Coefficients) indicates a highly significance predictive contribution toward degree completion. Since p = .000, this test

indicates that cumulative and program grade point averages do contribute to the overall fit of the model as X^2 (1, N=552) = 130.811, df=1, p = .000, and were a significant predictor of program completion (p = .000). The Cox and Snell R^2 outputs indicate a weak relationship between the independent variables (program grade point average, cumulative grade point average, and receipt of financial aid), and the dependent variable (program completion). Since this measure functions similar to R^2, the higher values indicate a better goodness-of-fit of the overall model. To this end, the Cox and Snell R^2 output was .211, which explains 21% of the variance. Since this test is limited by its inability to reach the maximum value of 1, the Nagelkerke value provides higher reliability to access the strength of the relationship between the variables by included the range from 0 to 1. The Nagelkerke value for this study was .377, or 38% of the variance, which indicates a moderate relationship between the independent and dependent variables. Program grade point average was found to be a highly significant contributor to program completion (p < .000), whereas cumulative grade point average was moderately significant at p < .05, and receipt of financial aid was found to not be an overall contributor (p = .420) in predicting program completion of students in healthcare-related associate degree programs.

Table 31

Prediction of Program Completion Parsimonious Model 1 (N = 552)

	B	S.E.	Wald	Df	Sig.	Exp(B)	95% C.I.for EXP(B) Lower	Upper
Program GPA	2.298	.273	70.668	1	.000	9.957	5.826	17.015
Cumulative GPA	-.720	.361	3.985	1	.046	.487	.240	.987
Received Financial Aid	.240	.297	.651	1	.420	1.271	.710	2.274
Constant	-2.778	1.207	5.298	1	.021	.062		

The total sample (N=552) consisted of 85.7%, or 473 students, completing the associate degree healthcare-related programs of study, and 14.3%, or 79 students, not persisting to program completion. The logistic regression analysis predicted an 88.4% completion rate (or a difference of 2.7%) as indicated in the following Table 32.

Table 32

Assessment of the Model Fit – Parsimonious Model 1

Observed		Predicted Completed Program of Study No	Yes	Percentage Correct
Completed Program of Study	No	32	47	40.5
	Yes	17	456	96.4
Overall Percentage				88.4

Based on the overall model presented in Table 18, levels of significance in the areas of age at the time of program entry (p = .003), cumulative grade point average (p = .003), number of credit courses completed (p = .010), and program grade point average (p = .000), an additional parsimonious model was developed to further evaluate the predictors which lead to program completion within healthcare-related programs of study. In regards to age at the time of program entry, cumulative grade point averages, program grade point average, and number of credit courses, the goodness-of-fit test (Omnibus Tests of Model Coefficients) indicates a highly significance predictive contribution toward degree completion. Since p=.000, this test indicates that cumulative grade point average does contribute to the overall fit of the model as X^2 (1, N=552) = 149.727, df = 4, p = .000, and was a significant predictor of program completion (p = .000). The Cox and Snell R^2 output was .238, which explains 23% of the variance, and the Nagelkerke value for this study was .424, or 42% of the variance, which indicates a moderate relationship between the independent and dependent variables. In regards to significance of the variables, program grade point average was found to be a significant contributor to program completion (p = .000), age (p = .001), cumulative grade point average (p = .006), and number of credit courses (p =.023) were also considered significant at the .05 level.

Table 33

Prediction of Program Completion Parsimonious Model 2 (N = 552)

	B	S.E.	Wald	Df	Sig.	Exp(B)	95% C.I.for EXP(B) Lower	Upper
Age at time of Program Entry	-.058	.017	11.299	1	.001	.944	.913	.976
Cumulative GPA	-1.044	.381	7.527	1	.006	.352	.167	.742
Number of Credit Courses	.653	.287	5.178	1	.023	1.921	1.095	3.370
Program GPA	2.507	.285	77.390	1	.000	12.262	7.015	21.434

The total sample (N=552) consisted of 85.7%, or 473 students, completing the associate degree healthcare-related programs of study, and 14.3%, or 79 students, not persisting to program completion. The second parsimonious model using logistic regression analysis predicted an 88.6% completion rate (or a difference of 2.9% as compared to 2.7% in the first model) as indicated in the following Table 34. The overall model, represented in Table 18, predicted 88.9% or a 3.2% prediction difference.

Table 34

Assessment of the Model Fit – Parsimonious Model 2

		Prediction		
		Completed Program of Study		Percentage
Observed		No	Yes	Correct
Completed Program of Study	No	32	47	40.5
	Yes	16	457	96.6
Overall Percentage				88.6

To this end, based on the levels of significance when individually evaluating the independent variables and program completion, the first parsimonious model (Table 31) established a better model regarding goodness-of-fit (albeit by only .2%) in predicting factors which lead to program completion using the independent variables program grade point average, cumulative grade point average, and receipt of financial aid, of which, cumulative and program grade point averages were found to be the strongest predictors of student persistence at $p = .046$ and $p = .000$, respectively. Furthermore, cumulative and program grade point averages were found to be significant within the overall model, testing of the null hypothesis, and parsimonious models 1 and 2. To this end, a higher level of confidence related to program and cumulative grade point averages exists.

Chapter 4 Summary

Chapter 4 provided the results regarding the main research question related to factors within Associate in Applied Sciences Degree (AAS), which predict the likelihood of degree completion within associate degree healthcare-related programs (Diagnostic Medical Sonography, Echocardiology Technology, Invasive Cardio Vascular Technology, Nursing, Radiologic Sciences, and Respiratory Care programs). Presented in this chapter were the analysis and outputs of the data, which was derived from descriptive statistics, correlations, and logistic regression analysis. Conclusions and discussion related to the results and literature will be discussed in Chapter 5.

CHAPTER 5. CONCLUSIONS AND DISCUSSION

Introduction

The purpose of this study was to identify student characteristics and academic program factors, which influence the student's ability to persist through degree completion within healthcare-related, associate degree programs within four urban, community colleges. The "Figure 1. Conceptual Model of Non-traditional Undergraduate Student Attrition" by Bean and Metzner (1985) was adapted, and provided the theoretical framework for this study. A number of factors have been studied to predict characteristics which may increase the possibility of students persisting to program completion such as socio-economic status (Tinto, 2006; Wolniak et al., 2012), successful academics prior to college (Braxton, Bray& Berger, 2000; Reason, 2009), financial aid (Tinto, 2006; Wolniak et al., 2012), institutional characteristics (Ewell, 2011), academic and social integration (Tinto, 2006; Pascarella & Terenzini, 1995), and college grades (Wolniak, Mayhew, & Engberg, 2012). Bean and Metzner (1985) evaluated background, social interaction, academic, environmental, and psychological outcomes. This study evaluated predictors of program completion in the areas of gender, age, program of study, developmental coursework, receipt of healthcare advising, receipt of financial aid, prerequisite course grades, program grade point average, cumulative grade point average, and total number of credit courses completed related to healthcare,

associate degree programs of study. Determining factors associated with program completion in these areas will benefit healthcare education in order to graduate students at a faster rate to fill the shortage of workers within the healthcare sector across the nation, as this sector is expect to grow rapidly at 24.5% through 2020 (United States Department of Labor, 2009b).

This was a quantitative, *ex post facto*, non-experimental research study using descriptive statistics, correlation, and logistic regression to predict student characteristics which lead to program completion within the healthcare field of study. The study included 552 students from four urban community colleges enrolled in radiologic sciences, diagnostic medical sonography, echo cardiology, invasive cardiovascular technology, respiratory care, and nursing programs. The adapted model of the Bean and Metzner Conceptual Model of Non-traditional Student Attrition focused on the background and academic variables in relation to the student's intent to leave or complete the selected program of study. Logistic regression, correlation, and descriptive statistics were analyzed in relation to each null hypothesis to determine if a difference existed between the independent variables (gender, age, program of study, developmental coursework, receipt of healthcare advising, receipt of financial aid, prerequisite course grades, program grade point average, cumulative grade point average, and total number of credit courses completed) and the dichotomous dependent variable (program completion or non-completion), and to evaluate the goodness-of-fit for the parsimonious models. This primary research question and sub questions will be summarized within this chapter, and the conclusions and recommendations will be discussed.

Summary of the Results

Description of the Study Sample

The four urban colleges within the study do not have dormitory or residential living facilities affiliated with the institutions, so all the 552 students were commuter students, which is one of the variables in describing non-traditional students (Bean and Metzner, 1985). Also, all students within the sample had completed prerequisite course work in the areas of English I (ENGL 1301), mathematics (MATH 1313/1413), and anatomy and physiology (BIOL 2401 or SCIT 1407). The majority of the students, as indicated in Table 7, completed their selected healthcare related programs of study (473 or 85.7%), with 76.3% being female, and 23.6% male. The number of females within healthcare programs of study is slightly higher than the demographic data of community colleges with females representing 63% of the population (United States Department of Education, 2009b), and De Lima, London and Manieri's (2001) study indicating women had higher rates of completion at 54% compared to the males at 42%. In regards to age, 87.2% of the students under the age of 40 (22.8% under the age of 23, 33.2% between the ages of 24 and 30, 31.2% between the ages of 31 and 40), and 10.3% were 41 to 50 years old, and 2.5% were over the age of 51. The non-traditional group, meaning age 24 and over, comprised of 77.2% of the overall sample being studied (Bean & Metzner, 1985), with an overall average age of 30.71, and age ranges from 18 to 68. Within the programs of study, nursing had the highest enrollment representing 75.9% (or 419 students, with 356 completing), radiology represented 12.6% of the sample (or 68 students, with 59 completing), respiratory care was 5.9% of the sample (or 35 students, with 28

completing), and diagnostic medical sonography (1.5%, 8 students), echocardiology (2.6%, 14 students), and invasive cardiology (1.5%, 8 students) had all students successfully complete. These successful completion rates exceed the average persistence rate of students in community colleges across the nation with an average 19% completion rate, according to the United States Department of Education (2012). Within community colleges across the nation, during 2009-2010, 88% of the students received financial aid (United States Department of Education, 2012); whereas, 59.4% of the students within this study were financial aid recipients.

In considering the academic course work requirements, it was not surprising to find more than 90% of the completing students with grades of 3.0 or higher within the prerequisite courses. For example, 96.8% of the students had a 3.0 or higher in English 1301, 90.5% in Math 1313/1314, and 93.4% in anatomy and physiology. The program grade point average indicated similar findings 89.8% of the students maintaining a grade of 3.0 or higher within the program, and cumulative grade point average of 3.0 or higher representing 91.6% of the healthcare related associate degree completers. Akin (2008) and Madan (2012) found grade point average to also be a predictor of student success toward degree completion, and Rogers (2009) also found grade point averages within science courses as predictors of success. In regards to the number of math and science courses completed, Hamilton (2011) found a significant difference in persistence for those students that had completed additional courses, including coursework in anatomy and physiology, math (statistics), and English.

When viewing the overall sample, the majority of the students (n=552), 76% or 420, had completed more than 25 credit hours, with 77.2%, or 371 students, being

program completers. Within this sample, then number of students to attend the specialized healthcare advising area was insignificant (n = 5 out of 552, or .9%); therefore, it is difficult to extract meaningful data from this subject area. However, in viewing the overall demographics of the sample, a typical profile of a healthcare student within an associate degree program, according to Table 7 is as follows: (a) female (76.3%); (b) between the age of 24 to 30 (34.7%); (c) received financial aid (61.3%); (d) received specific healthcare advising (2.5%); has prerequisite grades of 4.0 in English 1301 (72.9%), college algebra (69.6%, and anatomy and physiology (65.5%); (e) program grade point averages between 3.0 and 3.99 (87.7%); (f) cumulative grade point averages between 3.0 and 3.99 (90.1%), and (g) has completed between 24 to 48 credit hours of coursework (72.3%). %). Of the students that did not complete programs, results differed as follows: (a) students between the age of 31 to 40 (30.4%); (b) received financial aid (51.9%), and program grade point average of 2.00 – 2.99 (48.1%). In regards to non-traditional students, or those over the age of 24, 77.8% (or 368 students) completed their selected healthcare program of study compared to 73.5% (or 58 students).

Correlation of the Variables

Correlation research is a measure of an observed relationship, and is useful in determining if a relationship between variables exists due to chance without proving causation (Boslaugh, 2013). Of the 66 correlations, 37 (or 56%) were found to be significant. A positive correlation ($p < .05$) existed between 18 of the variables; number of courses completed was positively correlated with cumulative grade point average, and completion of developmental coursework. We would expect a positive correlation in

these areas as students' progress through educational attainment, and completion of courses. Wolniak, Mayhew, and Engberg (2012) noted the impact of college grades on student persistence to degree completion; this was also indicated with the significant correlation of grades in English, anatomy and physiology, and mathematics, cumulative grade point averages, and program grade point averages. Receipt of financial aid also indicated a significant positive correlation with the variables of completion of developmental coursework, gender, program grade point average, and number of credit hours. Tinto (2006) and Wolniak et al. (2012) emphasized the importance of financial aid in regards to student success in supporting students toward degree completion. With 59.4% of the students in this study receiving financial aid, it would be expected that financial aid would be significant in supporting students in persistence.

In considering the significance ($p < .05$) of the negative correlations, Table 16 indicates that as the value of one variable increases the value of the second variable decreases. To this end, it would be expected that students completing the higher levels of anatomy and physiology would have a negative correlation with completion of developmental coursework ($p = .012$), receipt of financial aid ($p = .011$), gender ($p = .014$), cumulative grade point average ($p = .000$), and number of credit hours completed ($p = .000$), and the similar observations with English 1301, and mathematics, as noted in Table 12. Interestingly, a negative correlation between age at the time of program entry was observed between gender ($p = .007$), cumulative grade point average ($p = .003$), receipt of financial aid ($p = .027$), and number of courses completed ($p = .000$). With the majority of the students within this study being non-traditional students (over the age of 24 or 77.2%), as described by Bean and Metzner (1985), in observing indicators which

may impact a student's intent to leave the academic institution with defining variables described as age, enrollment status, and residence retention within the programs was relatively high at 85.7%. The difference between program grade point average, and cumulative grade point average would be expected as well as the observed association as it is likely due to the rigor of the curriculum within the healthcare related programs or the lack of preparedness for high education as noted by Boyd and McHendry (2010), and Hamshire, Willgross, and Wibberley (2013).

Logistic Regression Analysis

In considering the primary research question "What are the factors within Associate in Applied Sciences Degree (AAS), which predict the likelihood of degree completion within associate degree healthcare-related programs (Diagnostic Medical Sonography, Echocardiology Technology, Invasive Cardio Vascular Technology, Nursing, Radiologic Sciences, and Respiratory Care programs)?" independent variables of age, gender, programs of study, remedial or developmental coursework, advising, program completion, receipt of financial aid, grade point averages (cumulative and program), number of courses completed, and impact of prerequisites on the students ability to persist to program completion were examined using a logistic regression model, based a thorough literature review, and the Bean and Metzner (1985) "Figure 1. Conceptual Model of Non-traditional Undergraduate Student Attrition."

The overall model (Table 18) included all of the independent variables within this study to evaluate the goodness-of-fit of the model and significant independent variables, which included age at the time of program entry ($p = .003$), cumulative grade point average ($p = .003$), number of credit courses ($p = .010$), and program grade point average

(p = .000). Prerequisite course grades (English, math, and anatomy and physiology), receipt of financial aid, attending specialized healthcare advising, and gender were not found to be of significance in predicting program completion at the .05 level. Metzner and Bean (1987) noted that non-traditional students were less likely to drop out as they studied more, and had fewer absences from class. This study found similar results with a significance of p = .003 in regards to completion rates of the students over the age of 24 (or 78.8% of the sample).

Research Sub Question 1: Gender

What is the unique contribution of gender in predicting the likelihood of persistence to degree completion?

When evaluating the independent variables and program completion, logistic regression found gender to be insignificant in regards to program completion, and the null was accepted as not having a difference. As noted by Bean and Metzner (1985), "women have been drawn into educational programs that were once the exclusive domain of men, so that women now constitute the majority of both full-time and part-time students in American higher education" (p. 487). Overall, the sample consisted of 76.4% (or 473) females, and 23.6% (or 79) males. The number of female students to complete 76.3% versus not complete was 77.2%, and males had a similar consistency of 23.7% completing verses 22.8% not completing further indicating gender is not a significant predictor of program completion as the overall program completion rate is 85.7%, so gender does not fit the model, but indicates the larger portion of female students within the healthcare related programs of study.

Research Sub Question 2: Age

What is the unique contribution of age in predicting the likelihood of persistence to degree completion?

In regards to age at the time of program entry, the overall model found this subject to be significant at $p = .003$, but not significant when compared directly to program completion (Table 20) at $p = .281$. Interestingly, the age range within the study was from 18 to 68, with a mean age of 30.71. The number of traditional students within the study was 126 (or 22.8%), and the number of non-traditional students was 426 (or 77.2%). Age was included in the parsimonious model 2, Table 33, and was found to be significant at $p = .001$, but the exclusion of the variable in the parsimonious model 1, Table 31, indicated that age does not create a stronger goodness-of-fit within the model with only a .2% difference. To this end, the null was accepted as age is not a significant predictor of program completion. Hamilton (2011) also found that age was not significantly related to program retention, and retained the null as well. However, understanding non-traditional students is essential to establish a linkage to program completion (Bean & Metzner, 1985).

Research Sub Question 3: Program Cumulative Grade Point Average

What is the unique contribution of program cumulative grade point average in predicting the likelihood of persistence to degree completion?

Program grade point averages was highly significant in the overall model, and in comparing the independent variable to program completion ($p = .000$) using logistic regression. Of the program completers, 2.1% (10 students) of program completers had a program GPA of 4.0; 87.7% (415) students had a program GPA between 3.00 and 3.99;

9.9% (47 students) had a program GPA between 2.00 and 2.99, and .2% (or 1 student) had a program GPA below 1.99, with a overall mean program grade point average of 3.21. Bean and Metzer (1985) considered grade point average in regards to an academic outcome in supporting student persistence and intent to remain in college. To this end, it is intuitive that stronger performance within programs would lead to persistence to program completion as indicated within the highly significant finding. To this end the null was rejected as there is a significant difference regarding program grade point average and program completion.

Sub Question 4: Type of Degree or Program of Study

What are the unique contributions of the type of degree (Associate in Applied Sciences Degree (AAS) in Diagnostic Medical Sonography, Echocardiology Technology, Invasive Cardiovascular Technology, Nursing, Radiologic Sciences, and Respiratory Care programs) in predicting the likelihood of persistence to degree completion?

The number of students within each program area were as follows: Radiologic Sciences (68 or 12.6% of the sample), Diagnostic Medical Sonography (8 or 1.5%), Echocardiology Technology (14 or 2.6%), Invasive Cardiovascular Technology (8 or 1.5%), Respiratory Care (28 or 5.9%), and Nursing (356 or 75.9%). Major certainty was included within the Bean and Metzner (1985) model as an academic variable, which are the primary way students interact with academy; however, within this study, it found to not be a significant contributor to program completion with $p = .389$, and an odds ratio of .773. Within the overall model, the selected program of study was also found to not be significant at $p = .081$. Of interest within the findings, the students in the smaller programs (Diagnostic Medical Sonography (8 students), Echocardiology (14 students),

and Invasive Cardiovascular Technology (8 students) had a 100% retention rate; whereas, nursing (356 students) retained 84.3% of their students, and radiology retained 86.7%. It should be noted that during this period faculty retention has been strong, and the number of years of teaching experience were not considered within this study. With the competitiveness to be accepted into the healthcare related programs, it is expected that the programs of study would have higher retention rates than the overall study body within community colleges with a persistence rate of 15% for associate degrees and 6% for certificates (United States Department of Education, 2009b). The null was accepted as not having a significant difference in regards to the student's ability to persist to program completion.

Sub Question 5: Developmental Coursework

What is the unique contribution of developmental course requirements in predicting the likelihood of persistence to degree completion?

Spady (1970) notes the importance of college grades from a student's past academic work as having a direct effect on their decision to remain in college; this concept was also cited within the Bean and Metzner (1985) study on non-traditional students and included as one of the academic variables. Within this study, it was found to not contribute to the overall model with a significance level of $p = .877$. With 65.2% (or 360 out of 552 students) taking at least one course in developmental reading, writing or math, the null was not rejected as there was not a significant difference in those who completed developmental coursework verses those who did not. Completion of developmental coursework has been added as one of the milestones for momentum points for the purposes of state funding (Texas Higher Education Coordinating Board, 2011),

and remains as one of the challenges within the community college systems to improve completion rates across the nation (Whissemore, 2010). This evidence is 65% of the students taking developmental courses prior to program acceptance is similar to the finding that 75% of students entering the colleges within the nation require some form of remediation. With colleges being open access institutions, on average two-thirds of incoming students require a form of developmental coursework; however, innovative programs to shorten the pipeline are being developed across the country to assist students in succeeding to graduation, according to Whissemore (2010).

Sub question 6, 7 and 8: English 1301, Anatomy and Physiology and Mathematics

What is the unique contribution of student's course grades in English 1301, mathematics (MATH 1313/1314) and anatomy and physiology (BIOL 2401 or SCIT 1407) in predicting the likelihood of persistence to degree completion?

In regards to prerequisite courses for the healthcare related associate degree programs, this study found that grades within the prerequisite courses are not significant, and the null was accepted within all three areas. English 1301 indicated $p = .836$; mathematics found $p = .988$, and anatomy and physiology indicated a p value of .221. The overall model also indicated non-significance in all three prerequisite courses as follows: English $p = .222$; anatomy and physiology $p = .941$, and mathematics $p = .570$. The mean grade, on a 4 point scale, was found to be 3.57 (*SD*=.590) in English, 3.57 (*SD*=.630) in anatomy and physiology, and 3.6 (*SD*=.669) in mathematics. The unique contribution of English (beta = -.048), anatomy and physiology (beta = .224), and math (beta = .003) indicate the moderation of the prerequisites contribution to program completion with the likelihood of contributing at not more than a 25%. To this end,

grades within prerequisite courses were not included in the parsimonious models. Herrera (2013) found similar results when evaluating prerequisite course within a community college setting. Horner (2005) found anatomy and physiology to be significant at $p = .04$, and it was expected to have similar results within this study due to the types of programs students are entering, but it is noted the higher likelihood of persistence within the anatomy and physiology compared to the English and mathematics betas.

Sub Question 9: Financial Aid

What is the unique contribution of students receiving financial aid in predicting the likelihood of persistence to degree completion?

Bean and Metzner (1985) note the importance of considering finances in relation to program persistence as previous studies found a positive relationship between financial resources and persistence to degree completion. Within this study, 61.3% (or 290 students) received financial aid, and successfully completed their program of study. The overall logistic regression model found financial aid to not be a significant contributor at $p = .884$, but was found to be significant when comparing the contribution of financial aid to completion at $p = .000$. To this end, financial aid was included within the parsimonious model for logistic regression purposes. Furthermore, the goodness-of-fit revealed X^2 (1, N=552) = 4.818, df=1, $p = .028$ as a significant predictor of program completion. With 67% of first-time, full-time in college undergraduates at community colleges receiving financial aid (United States Department of Education, 2012), financial aid is a critical factor in supporting students to program completion. This study found

similar results with 59.4% of the students receiving financial aid (328 out of 552 students) compared to the national average of 67%.

Sub Question 10: Received Specialized Healthcare Advising

What is the unique contribution of students receiving specialized healthcare program advising in predicting the likelihood of persistence to degree completion?

Within this study, of the students attending the specialized healthcare advising center, there was evidence of only 5 attending the center, or .9% of the sample. Of those in attendance, 3 persisted to program completion, and 2 did not persist to program completion. Furthermore, the logistic regression found that attending the advising center did not statistically indicate greater persistence to program completion with $p = .128$; however, with the small sample size it is difficult to achieve meaningful results, and additional research should be pursued within this area. To this end, healthcare advising will not be included within the parsimonious model, and the null was retained as evidence of a difference did not exist within the study. Bean and Metzner (1985) considered academic advising within their model of non-traditional students, and noted the previous studies related to advising as being related to student persistence.

Sub Question 11: Number of Credit Courses Completed

What is the unique contribution of total credit hours in predicting the likelihood of persistence to degree completion?

The majority of the students (348 or 72.3%) had completed between 25 and 48 courses, and 4.9% of the students (or 23 of the completers) had taken more than 49 courses with an overall range of 8 – 61, and mean of 31.53 courses. Within the healthcare related programs, students must complete the designated prerequisite courses.

The following shows the number courses required, including prerequisites) for each program within academic year 2009-2010: Nursing (21), Diagnostic Medical Sonography (25), Echocardiology Technician (22), Invasive Cardiovascular Technology (24), Radiologic Science (28), and Respirtory Care (28). The additional number of courses taken did not indicate a strong significance level with $p = .174$; the null was retained as evidence of a difference was not found within this study. Hamilton (2011) evaluated the number of science courses completed prior to program acceptance, and found a significant relationship.

Sub Question 12: Cumulative Grade Point Average

What is the unique contribution of cumulative grade point average in predicting the likelihood of persistence to degree completion?

Cumulative grade point average was found to be highly significant $p = .000$ as a predictor of program completion, and the null was rejected as evidence indicated a relationship between the two variables as cumulative grade point average does contribute to the overall fit of the model as X^2 (1, $N = 552$) = 36.478, $df = 1$, p=.000. Of the students completing programs of study, 90.1% (or 426 students) had cumulative grade point averages between 3.0 and 3.99, with 1.7% (or 7 students) with a 4.0, and 8.5% (or 40 students) with a cumulative g.p.a. between 2.0-2.99. Bean and Metzner (1985) considered study habits or skills within their model of non-traditional students as an indicator towards the academic outcome of cumulative grade point average. This study included the cumulative grade point average as a quantitative measure of academic achievement. With cumulative grade point average being statistically significant at

predicting program completion, the null hypothesis was rejected, and cumulative grade point average was retained for the parsimonious model.

Of the twelve independent variables analyzed (age, gender, programs of study, remedial or developmental coursework, advising, program completion, receipt of financial aid, program and cumulative grade point averages, number of courses completed, and prerequisite courses), program grade point average (p = .000), cumulative grade point average (p = .046), and receipt of financial aid (p = .420) were analyzed using logistic regression. The total sample (N=552) consisted of 85.7%, or 473 students, completing the associate degree healthcare-related programs of study, and 14.3%, or 79 students, not persisting to program completion. The logistic regression analysis predicted an 88.4% completion rate, compared to the 85.7% observed program completers, and the null was rejected for program and cumulative grade point averages, but retained for financial aid. Overall, grade point average, either program or cumulative, is the strongest predictor of completion within healthcare associate degree programs.

Limitations

Data for this study was limited to existing databases and archived transcript or demographic information of the four colleges. This limited the resulting study in regards to analyzing variables related to the reason students did not complete healthcare related programs of study, extent to interaction with faculty or program coordinators to mentor programs to degree completion, teaching modalities within the classroom leading to increased persistence, and considering the work schedules or number of hours students worked per week within the programs of study. A survey of students that did not complete the programs of study to access reasons for not completing programs would

have been beneficial in obtaining qualitative information to provide additional factors related to persistence to program completion.

A second limitation was the low response rate on the healthcare advising area. All students within the colleges are required to meet with an advisor through the general advising area, but a higher response would have provided more meaningful information with statistical significance. This is an area where an additional study may be conducted to determine program completers and non-completers based on those that received advising within the specialized area.

Implication of the Results for Practice

Overall, the number of program completers, 85.7% or 473 students out of 552, indicated a strong persistence to degree completion within the sample. In order to improve the practice of increased completion rates, it is recommended that programs begin to embed certificates to provide students with opportunities to complete within shorter periods. Additionally, the length of the programs should be evaluated to determine if a shortened program or consolidation of curriculum or content within the courses would assist students in completing at a faster rate, and reduce the number of semester for students to complete within 60 credit hours, or 20 courses, compared to the 21 to 28 classes within the programs of study. A second recommendation is to establish an advising system to ensure students are entering a program of study, which is a good fit for their skills and abilities; this practice will enhance program completion as students will be more motivated to complete based on their increased interest within the program of study. Third, in regards to developmental coursework, establishing courses which include healthcare content in addition to learning developmental reading or mathematics

may enhance the student's ability to matriculate to college level courses through an applied learning approach of interest to the student. Last, the requirement of the need for prerequisite courses should be evaluated in regards to predicting student success at each institution, as grade point average appears to be a stronger predictor of student success. These prerequisite courses could begin within the dual credit models of the high schools to prepare graduating high school students for the rigor of the programs within the community college or university setting. Evaluating practices such as these may increase the likelihood of student success and retention in regards to healthcare related programs of study, and reduce the number of barriers students much complete prior to entering programs of study.

Recommendations for Further Research

In order to enhance this research study, one recommendation is to design two survey instruments to assess reasons that students complete programs of study or do not complete, and triangulate the information with focus groups and quantitative measures, such as this study. Qualitative information such as this may allow for curriculum enhancements, increased tutoring resources, and mentorship programs to assist students in persisting to degree completion. The application of a mixed-methods approach will provide greater depth and certainty regarding persistence within healthcare related programs of study. An additional recommendation is in regards to teaching pedagogy as it was not evaluated within this study, and students do complete prerequisite courses both online and in the classroom. Assessment of persistence for non-traditional students in healthcare programs of study, and predictors of completion in regards to distance

education verses in class sessions would provide an additional predictor variable in assessing a student's persistence to degree completion.

With cumulative grade point average being the strongest predictor of program completion (Kudlas, 2006), and prerequisite course grades showing as insignificant within this study, it is recommended to research the need for such prerequisites prior to program entry, and to evaluate the need for such requirements, which may impact the amount of time students are enrolled in higher education. An evaluation of the number of course requirements within the healthcare programs of study may provide rationale in regards to the number of courses within the various degree plans as there is a significant difference in the number of courses required across academic institutions. This type of study could be evaluated across specific degree areas with varying credit hours, such as radiology sciences or nursing programs. This will assist institutions in graduating students at a faster pace in order to serve the needs of the employer community will benefit the academic organizations, students, and the healthcare employers. Additional studies may also consider the number of times students withdrawal from prerequisite courses prior to achieving the desired 4.0 grade to be competitive within the admissions process in regards to predicting persistence within the healthcare programs, or the extent to which students persist to degree completion in comparison to pass rates of licensure exams.

The advising of students within healthcare related programs is critical to help students navigate the numerous healthcare degree options, and to determine which area is the best fit for the student's abilities related to administration, clinical, or diagnostic program options. It is recommended that an additional study be conducted to analyze the

persistence of students that attend specialized advising areas versus those that meet with general advising centers within a colleges or university setting to assess the likelihood of persistence.

Within this study, financial aid was found to be significant in regards to program completion, but not significant within the parsimonious model. It is recommended that a study be conducted related to persistence of students in healthcare programs receiving financial aid verses those that did not receive financial aid using a logistic regression model. Furthermore, the inclusion of interviews of the non-completers would provide valuable information in regards to the qualitative component of non-completion.

Additional variables could be included within the study to determine additional factors which may increase or decrease the likelihood of program completion. These may include items such as ethnicity, high school grade point averages, healthcare specific entrance exams, college entrance tests, English as a second language, hours of work per week, and commuter status of the students. Furthermore, a study evaluating student persistence to determine correlations between licensure and certification examinations with program course grades, entrance exam assessments, and high school achievement may serve to determine additional factors which lead to persistence within healthcare related programs of study. With the limited research in respiratory care, invasive cardiovascular technology, and echocardiology, addition research related to factors of persistence and completion would be instrumental in filling a void within the healthcare sector.

Last, this study evaluated multiple programs across four, public, urban, community colleges. A similar research study would further enhance the literature by

conducting a similar analysis in university or rural settings, or to analyze singular programs of study, such as nursing, invasive cardiology, or radiology science, within public colleges or universities across an entire state or region. This would allow for expansion on the traditional university students, and the various environmental factors exhibited within a rural community.

Conclusion

According to the Association of American Community Colleges (2012), "In 2012 alone, the net total impact of community colleges on the U.S. economy was $809 billion in added income, equal to 5.4% of GDP. Over time, the U.S. economy will see even greater economic benefits, including $285.7 billion dollars in increased tax revenue as students earn higher wages and $19.2 billion in taxpayer savings as students require fewer safety net services, experience better health, and lower rates of crime" (para. 2). Within North Texas the overall economic impact of the healthcare industry equate to $14 billion and 265,000 jobs per year (Dallas-Fort Worth Hospital Council, 2013); this is one example of the healthcare impact within urban communities. The purpose of this study is to identify student characteristics and academic program factors, which influence the student's ability to persist through degree completion within healthcare-related, associate degree programs within an urban, highly complex, community college system. To achieve this outcome, the Bean and Metzner (1985) model of non-traditional student attrition was adapted to analyze academic and demographic variables which may lead to degree completion within healthcare programs of study. This study found that cumulative and program grade point averages are the strongest, significant predictor of program completion. This finding is critical in order to assist in increasing the number of

healthcare graduates and address the shortages of these high skilled workers across the nation. Developing effective practices which assists students in degree attainment will be a critical factor to serve the employers and students within the healthcare areas. Also, with funding, or momentum points, being tied to program completion, colleges must seek new ways to assist students in persisting to degree completion in order to compete within a system funded by accountability measures.

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APPENDIX A. STATEMENT OF ORIGINAL WORK

Academic Honesty Policy

Capella University's Academic Honesty Policy (3.01.01) holds learners accountable for the integrity of work they submit, which includes but is not limited to discussion postings, assignments, comprehensive exams, and the dissertation or capstone project.

Established in the Policy are the expectations for original work, rationale for the policy, definition of terms that pertain to academic honesty and original work, and disciplinary consequences of academic dishonesty. Also stated in the Policy is the expectation that learners will follow APA rules for citing another person's ideas or works.

The following standards for original work and definition of *plagiarism* are discussed in the Policy:

> Learners are expected to be the sole authors of their work and to acknowledge the authorship of others' work through proper citation and reference. Use of another person's ideas, including another learner's, without proper reference or citation constitutes plagiarism and academic dishonesty and is prohibited conduct. (p. 1)
>
> Plagiarism is one example of academic dishonesty. Plagiarism is presenting someone else's ideas or work as your own. Plagiarism also includes copying verbatim or rephrasing ideas without properly acknowledging the source by author, date, and publication medium. (p. 2)

Capella University's Research Misconduct Policy (3.03.06) holds learners accountable for research integrity. What constitutes research misconduct is discussed in the Policy:

> Research misconduct includes but is not limited to falsification, fabrication, plagiarism, misappropriation, or other practices that seriously deviate from those that are commonly accepted within the academic community for proposing, conducting, or reviewing research, or in reporting research results. (p. 1)

Learners failing to abide by these policies are subject to consequences, including but not limited to dismissal or revocation of the degree.

Statement of Original Work and Signature

I have read, understood, and abided by Capella University's Academic Honesty Policy (3.01.01) and Research Misconduct Policy (3.03.06), including the Policy Statements, Rationale, and Definitions.

I attest that this dissertation or capstone project is my own work. Where I have used the ideas or words of others, I have paraphrased, summarized, or used direct quotes following the guidelines set forth in the APA *Publication Manual*.

Learner name and date: [signature] 6/11/14

Mentor name and school: Dr. Barbara Keener, Capella University