Examining Nursing Student Dropout Behavior: An Event History Analysis

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EXAMINING NURSING STUDENT DROPOUT BEHAVIOR:
AN EVENT HISTORY ANALYSIS

A Dissertation
Submitted to the Graduate Faculty of the
Louisiana State University and
Agricultural and Mechanical College
in partial fulfillment of the
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Doctor of Philosophy
in
The Department of Educational Leadership and Research

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Abstract

This study examined student-level data to identify factors that predict student departure from an undergraduate nursing program. National nursing shortages, declining enrollment, and high rates of attrition pose significant concerns for undergraduate nursing programs. The following research questions guided this study: 1) Which student-level variables predict nursing student dropout risks over time? 2) Which student-level variables predict nursing student retention over time? and 3) When are nursing students most likely to drop out?

The methodological approach was event history analysis, a form of linear regression that measures the likelihood of an event (nursing student dropout) at a particular time (semesters in the nursing program), based on covariate factors. Variables included age at admission, race/ethnicity, gender, pre-nursing GPA, grade in the pre-requisite pathophysiology course, and entrance exam score. Time-varying regressors included semester-specific GPA and financial aid status. Data analysis revealed a significant dropout risk associated with older age at admission, lower entrance exam scores, lower pre-nursing GPA, and lower grades (C or lower) in the pathophysiology course. In models including the time-varying regressors, only semester-specific GPA achieved statistical significance in predicting dropout risk. In both unadjusted and adjusted models, students of Color were more likely to drop out than White students, with Asian students being at highest risk. Financial aid presented a complex effect on dropout risk, with conflicting predictions for different semesters. When coded as a dichotomous variable, some financial aid decreased overall dropout risk compared with no aid. Students were most likely to drop out in the first semester of the 5-semester clinical program. The study institution can use these results to inform decisions on retention efforts aimed at first-semester students, increased efforts for scholarships, and potential curricular changes in the pathophysiology course.
Introduction

The aging U.S. population and expanded health coverage guarantees an expanded need for nurses. However, the nursing shortage is expected to intensify as schools of nursing struggle to expand capacity (American Association of Colleges of Nursing [AACN], 2017b; U.S. Department of Health and Human Services, 2017). Research has shown that lower patient mortality, fewer medication errors, and better patient outcomes are linked to nurses prepared at the baccalaureate level (AACN, 2017b). Employers are demonstrating preference for baccalaureate nursing graduates over those with associate degrees or diplomas, and baccalaureate graduates are more than three times more likely to pursue advanced degrees than graduates of associate degree or diploma programs (AACN, 2017b). The Institute of Medicine (2011) called for increasing the percentage of nurses with at least a baccalaureate degree from the current 55% to 80% by 2020, but this goal does not seem feasible given the current graduation rates for baccalaureate nurses (AACN, 2017a, 2017b). Some contributing factors to the deficit in baccalaureate nursing graduates include a nursing faculty shortage and high rates of student attrition.

In today’s economy, higher education is an expense that must be justified. The U.S. Department of Education (n. d.) has developed the readily-accessible College Scorecard so that prospective students (or alumni and potential donors) can see how the institution compares to national averages for practical matters such as tuition cost, graduation rates, and average salary after graduation. The inherent cost in professional programs, coupled with the lower rates of student retention, make nursing programs seem unattractive—a problem acknowledged by the Institute of Medicine’s (2011) comprehensive report, *The Future of Nursing: Leading Change, Advancing Health*. 
Problem Statement

Nursing shortages, declining enrollments, and high rates of attrition in baccalaureate nursing programs present a public health concern, and the ill-understood nature of nursing student dropout behavior leaves nursing programs guessing at ways to improve student retention. On average, nursing student attrition has been reported in the literature as 50% (Harris, Rosenberg, & O’Rourke, 2014; Merkley, 2016; Newton & Moore, 2009). The nursing shortage makes these high rates of attrition in nursing programs a public health concern. “Every nursing student who leaves before completing their BN course is not just a loss to the university but also a potential loss to the nursing workforce and community” (Andrew et al., 2008, p. 871). An aging nursing workforce coupled with an aging national population creates a critical need for nurses in the near future (AACN, 2017a; Harris et al., 2014; Merkley, 2016).

Student attrition is a problem for all types of higher education institutions. Attrition rates affect reputation and revenue, costing institutions millions (Frankfort, O’Hara, & Salim, 2015; Raisman, 2013). Nursing programs are tasked with providing high-quality, high-value education in the face of budget cuts, declining enrollment and faculty shortages (Horns & Turner, 2006; Yucha, Smyer, & Strano-Perry, 2014), not to mention the added expense of retaining quality faculty who could earn far greater salaries in the field than they can in the classroom (Starck, 2005; Yucha et al., 2014). To remain competitive, programs must not only meet minimum accreditation standards, but strive for continuous quality improvement (Phillips & Valiga, 2014).

Nursing programs are required to maintain high rates of student success on the National Council Licensure Exam for Registered Nurses (NCLEX-RN) in order to remain in good standing with the State Board of Nursing (Professional Occupational Standards, 2016), and to maintain accreditation with national accrediting bodies such as the Commission on Collegiate
Nursing Education (CCNE), the accrediting arm of the American Association of Colleges of Nursing (CCNE, 2013) and/or the Accreditation Commission for Education in Nursing (ACEN). Maintaining these high standards requires programs to “select and retain students with greater likelihood of success” (Vandenhouten, 2008, p.ii). In order to improve the likelihood of first-time passing the licensure exam, programs implement progression policies that prevent students who do not meet certain benchmarks from graduating and attempting the licensure exam, and high admission standards restrict access (Merkley, 2016; Vandenhouten, 2008).

For underrepresented students, attrition in nursing programs can reach as high as 85% (Harris et al., 2014). With an increasingly ethnically diverse population, more racial, ethnic and gender diversity among nurses is needed to improve healthcare quality and reduce disparities (AACN, 2017b; IOM, 2011; NLN, 2016). Nursing education leadership must create inclusive environments that support the recruitment, retention and graduation of diverse students. It is not enough to simply include cultural competence in the nursing curricula, diverse faculty and students must be welcomed and sustained (NLN, 2016). Benner, Sutphen, Leonard, and Day (2010) called for a radical transformation of nursing education to meet the healthcare needs of the nation in the future, including recruiting and retaining a diverse faculty and student population.

Academic failure is a primary reason for attrition of student nurses, but studies have uncovered a multitude of other reasons students leave nursing programs. These include family circumstances, illness or pregnancy, financial concerns, or simply a dislike of nursing (Andrew et al., 2008; Jeffreys, 2007; Urwin et al., 2010). Others found that nursing institutions contribute to the attrition as well (Merkley, 2016). Policies for dismissal after second course failure, inconsistent grading scales, and high stakes testing all contribute to attrition (Merkley, 2016).
Student attrition is a loss of revenue for a program, and administrators expect nursing programs to implement measures to retain students. The challenge is to retain more students while ensuring the probability that those students will pass the licensure exam after graduation (Jeffreys, 2007; Oklahoma Board of Nursing, 2003).

Nursing programs are obligated to collect assessment data for accreditation purposes, but also for continuous program improvement, ensuring that decisions are made based on evidence of student achievement, not on feelings or perceptions (Kumm & Godfrey, 2017; Mandinach, 2012). “It is no longer acceptable to simply use anecdotes, gut feelings, or opinions as the basis for decisions. The emerging emphasis is placed strongly on the use of data and hard evidence from which to inform practice” (Mandinach, 2012, p. 71). Nursing programs perform evidence-based educational practices with frequent collection of data and feedback to inform curricular changes and policies (Oermann, 2017).

**Background on Nursing Programs**

Nursing is a diverse field with multiple paths to licensure. First, there are two types of entry-level nursing licenses: licensed practical/vocational nurse (LPN/LVN), and registered nurse (RN). There are multiple educational paths to registered nursing licensure including certificate/diploma, associate degree and baccalaureate degree nursing programs. Graduates from registered nursing programs all take the same licensure exam, the National Certificate of Licensure Exam for Registered Nurses (NCLEX-RN). Each level of program (ASN, BSN) must meet minimum accreditation standards set forth by national accrediting agencies such as the Commission on Collegiate Nursing Education (CCNE) and the Accreditation Commission for Education in Nursing (ACEN). Baccalaureate standards include criteria for clinical sites and
contact hours, specific curricular requirements, faculty qualifications, and licensure pass rates (CCNE, 2013).

In nursing programs, the focus of most assessment activities is program effectiveness in achieving student learning outcomes and in licensure pass rates (Oermann, 2017; Sewell et al., 2008). The use of standardized tests for predicting and improving pass rates is common, though studies are emerging that question the wisdom of using standardized exams as a gatekeeper for program completion (Oklahoma Board of Nursing, 2003). Programs are struggling to find the right combination of rigor and resources to increase the number of students who are retained throughout the program and go on to pass the licensure exam (Oklahoma Board of Nursing, 2003).

Nursing programs must balance high quality instruction and high licensure pass rates, while considering tuition cost and access. Student attrition is costly, but so are retention efforts (Raisman, 2013). Student retention services and programs including tutoring, supplemental instruction, intrusive advising practices, and predictive analytics all come at an institutional cost (Eduventures, 2013; Frankfort et al., 2015). In order to make cost-effective program decisions that will satisfy constituents and accrediting bodies, institutions must use data to inform those decisions as sound and meaningful (Kumm & Godfrey, 2017). Utilizing predictive measures to identify students who are most at risk of failure, and at what point in the program, can help institutions target their retention efforts to the students who need them most, at the appropriate times.

There is no shortage of theories of student retention in the literature, and the various retention models have usefulness in different contexts (Melguizo, 2011; Morrison & Silverman, 2012). Most student retention theories trace back to the work of Tinto (1973) or Bean (1980),
and focus on the characteristics that contribute to students staying in college, including pre-college variables, social variables and psychological variables of first-time-in-college traditional freshmen. Seidman (2012) developed an inclusive model that describes persistence for all types of students, including minorities, non-traditional, and those attending virtual institutions. In his model, he describes early identification of at-risk students and early, intensive and consistent retention efforts (Seidman, 2012). Cabrera, Nora, and Castaneda (1993) also developed an integrated model of student retention which combined the models of Tinto and Bean. Jeffreys (2013) developed the Nursing Universal Retention and Success (NURS) model, specifically focusing on retention of nursing students. Jeffreys (2012) focuses on factors that contribute to student retention in nursing programs, but takes student persistence further to include retention in the profession of nursing after graduation. In order to identify at-risk students, there must be some systematic review of student data. Timing of student departure decisions is another important factor, and is largely unexplored (DesJardins, Ahlburg, & McCall, 1999).

**Purpose of the Study**

Assessment of student data is a multi-faceted and complex task, but one that must be used to make sound decisions to improve student retention and institutional effectiveness. The purpose of this quantitative study is to examine student-level data to identify factors that predict student departure from an undergraduate nursing program. These findings will be used to inform decision-making regarding program-level retention efforts. I will use student-level data from a single undergraduate pre-licensure nursing program in a small (less than 2000 students) Catholic commuter college in a mid-sized southeastern city. Data will be gathered from an electronic database for the study institution, utilizing data from all students accepted to the pre-licensure Baccalaureate Nursing program for a period of four years.
Nursing student attrition is a major concern for institutions, and ongoing efforts to improve retention of nursing students must be supported. If certain characteristics of students put them at risk of dropping out, or if certain points in the program have higher dropout rates, that information can be used to further develop retention efforts for the program. With the large volumes of data collected in higher education, institutions can use this data to inform decisions on all levels (Daniel, 2015; Eduventures, 2013; Villano, 2007). Bernhardt (2016) advocates for the use of all types of data (demographics, processes, perceptions and evaluation data) for continuous program improvement. Salt peter (2004) also points out that utilizing multiple types of data from multiple sources helps inform decisions for curricular change much more completely than student performance alone. Kumm and Godfrey (2017) advocate for the use of student- and program-level data in nursing education, requiring communication through all levels of the process and between all stakeholders.

**Significance of the Study**

In addition to program assessment, student data can be utilized to predict student outcomes (Daniel, 2015; Eduventures, 2013; Min et al., 2011; Vandenhouten, 2008). Daniel (2015) describes the growing research area of Big Data and its use in higher education. Utilizing predictive analytics, schools can “look at students who are exhibiting risk behaviours early in the semester that might result in dropping out or failing a course” (Daniel, 2015, p. 915). The ability to predict which students are most at risk for dropout has far-reaching implications for a nursing program. Retention efforts can be targeted to the students who most need them, facilitating both cost-effective efforts and revenue-saving retention of students.

Min et al. (2011) used survival analysis (a type of predictive analytics also known as event history analysis) to examine what types of students were leaving an undergraduate
Student attrition is a complex problem, and not an isolated, abrupt event (Ameri, Fard, Chinnam & Reddy, 2016). Event history modeling is a statistical method that studies the cause of an event with time as the outcome variable (Allison, 2014; Ameri et al., 2016). This method allows for time-varying explanatory variables (such as a student’s GPA that changes over time), and censored data (such as students who have not yet graduated by the end of the study but have not experienced dropout) (Allison, 2014). This approach allows researchers to study the longitudinal nature of events such as student attrition when other statistical methods are inadequate, and allows prediction of the timing of an event such as student dropout so that retention efforts can be targeted to the students who need them, at the time they are most needed (DesJardins et al., 1999; McCallon, 2001; Min, Zhang, Long, Anderson, & Ohland, 2011; Murtaugh, Burns & Schuster, 1999). This method has been used with success to predict student attrition, though not in nursing.

There is a plethora of studies on predicting success in nursing programs and on the licensure exam, and to a lesser degree, predicting failure (Jeffreys, 2007; Vandenhouten, 2008). There are also numerous studies exploring reasons for student attrition in nursing (Harris et al.,
Where the literature is lacking is how a nursing program can use student demographics and performance data to predict the timing of student attrition. Identifying at-risk students early will allow the institution the opportunity to make cost-effective decisions on curricular changes, instructional methodology, student services, and a host of other areas to improve student retention and subsequent success on the NCLEX-RN. This study begins the conversation about nursing student departure. Future qualitative research can expand on the quantitative findings of this study to further understand the nursing student experience.

**Research Questions and Hypotheses**

As previously indicated, nursing student attrition is a significant issue, not only for the students themselves and the institutions they attend, but also for the healthcare of the communities in which they are situated. Nursing programs must become better informed about how individual factors affect student attrition, and this study will provide insights into how program leaders can use the information to improve retention efforts. The proposed study will draw on data already collected by institutions, alleviating the need for time-consuming and costly surveys. Research supports further exploration of the factors that may contribute to nursing student attrition, as well as the timing of student dropout, so that retention efforts can be targeted toward the students who most need them, at the time they are most needed. The following three research questions guide this research study:

1. Which student-level variables predict nursing student dropout risks over time?
2. Which student-level variables predict nursing student retention over time?
3. When are nursing students most likely to drop out?

The hypothesis is that there is no difference in the risk of student dropout among the student-level variables.
This study will focus on a single undergraduate nursing program in a small (less than 2000 students) Catholic commuter college in a mid-sized southeastern city. Data analysis will be retrospective, the data will be de-identified, and students will be assigned random identification numbers. All data collected for a four-year period will be analyzed for trends and correlations. This information can be used to inform faculty and administration what the students’ needs are, and ideas for meeting these needs will be presented at the conclusion of the study report. The hypothesis is that there is no difference in the time to student dropout among the student-level variables.

**Study Context**

The study institution is a small (less than 2000 students) Catholic commuter college in a mid-sized Southeastern city. The university, henceforth referred to as Catholic University (CU), has an annual average enrollment of 1700 students. The mission and vision of CU are based on the tenets of St. Francis of Assisi and the University also follows the directives of *Ex Corde Ecclesiae*, the Apostolic Constitution on Catholic Higher Education, issued by Pope John Paul II in 1990, thus embracing its Catholic heritage and identity.

The University offers degrees in nursing, health sciences, humanities, behavioral sciences, and arts and sciences at the associate, baccalaureate, masters and doctorate levels. Within the University, there are three academic schools: the School of Arts and Sciences, the School of Health Professions, and the School of Nursing. The School of Nursing offers a traditional pre-licensure Bachelor of Science in Nursing (BSN) program. It also offers an RN-BSN program for the licensed registered nurse (RN) who has graduated from an accredited associate degree or diploma/certificate program and currently has an unencumbered registered nurse license. The programs offered by the School of Nursing are accredited by the Accreditation
Commission for Education in Nursing, and the University is accredited by the Southern Association of Colleges and Schools Commission on Colleges (SACS-COC).

CU is surrounded by medical centers, outpatient services, primary care, and specialty offices. It is located in a mid-sized urban community with a mean family income and educational level below the national norm. CU currently offers one of three baccalaureate degree nursing programs in the area. Three baccalaureate nursing programs, and one associates degree program are offered at neighboring institutions.

**Definition of Terms**

The following is a list of terms defined to ensure clarity and consistency in this paper.

- **Age at enrollment**: a student’s age at the time of enrollment in the undergraduate nursing program. This is distinct from their age at enrollment in the university, as some students take longer than others to complete pre-requisite courses, or may not get accepted the first time they apply. This is also distinct from simply “age” because a student’s age is time-varying, but age at enrollment is a static number for the purposes of the event history model used for this study.

- **Attrition**: loss of a student from enrollment in the nursing program. Attrition may be due to failure to complete course requirements, or due to voluntary withdrawal from the university.

- **Bachelor of Science in Nursing (BSN)**: degree awarded to students who complete an accredited baccalaureate nursing program with an average of 120 total credit hours.

- **Catholic University (CU)**: the study institution. This University has a total average annual enrollment of 1700 students and is located in a mid-sized Southeastern city,
and is fully accredited through the Southern Association of Colleges and Schools Commission on Colleges.

- **Dropout**: permanent withdrawal from the nursing program.

- **National Certificate of Licensure Exam for Registered Nurses (NCLEX-RN)**: the national licensure exam that all BSN graduates must pass to obtain a registered nursing license.

- **Nursing student**: a student enrolled in a BSN program.

- **Retention**: remaining enrolled in the nursing program.

- **Stopout**: temporary withdrawal from the nursing program. Students may opt to temporarily withdraw for various reasons, including poor performance or for medical or family reasons. The result of a stopout is reinstatement in the program the following semester. Progression policies prevent any student from stopping out for longer than two consecutive semesters.

- **Success**: successful completion of the requirements of the BSN program, ending with graduation.
Literature Review

The problem of the high rates of nursing student attrition is well documented in the literature (Harris et al., 2014; Merkley, 2016). Schools of nursing must carefully balance accessibility and graduation rates with rigor and high board pass rates (Sewell, Culpa-Bondal, & Colvin, 2008; Urwin et al., 2010). The cost of nursing programs is high; declining enrollments and the nursing faculty shortage necessitate efficiency and cost-effectiveness (Booker & Hilgenberg, 2010; Yucha et al., 2014). Student attrition represents massive loss of revenue for institutions, so targeted retention efforts could save money (Andrews & Schulze, 2018; Frankfort et al., 2015). Nursing programs are well accustomed to collecting, analyzing and utilizing evaluation data for accrediting purposes, but utilizing student data to predict failure in nursing is not well represented in the literature. This review will summarize the literature on the problem with nursing student attrition, cost of nursing education, evaluation methods, factors affecting dropout, and retention strategies. Finally, the chapter will conclude with a review of student retention theories and the framework for this study, Jeffrey’s (2015) Nursing Undergraduate Retention and Success Model.

Nursing Student Attrition

In 2008, the Robert Wood Johnson Foundation partnered with the Institute of Medicine on a two-year initiative to assess the state of nursing in the U.S. and make recommendations considering the changing healthcare landscape. In 2010, the Institute of Medicine released its comprehensive report, The Future of Nursing: Leading Change, Advancing Health. This report explicitly identified a need to transform nursing education to improve access to nursing education, improve diversity, and facilitate transition to advanced practice degree programs (IOM, 2011). Having been an active participant in the IOM study, a prominent nursing theorist,
Patricia Benner, took up the call to help nursing programs operationalize these recommendations and produced a book, along with colleagues, entitled *Educating Nurses: A Call for Radical Transformation* (Benner, Sutphen, Leonard, & Day, 2010).

Benner et al. (2010) recommend specific pedagogical changes for both classroom and clinical teaching, but also recommended changes at the program level. These recommendations include recruiting a more diverse faculty and student body and providing more financial aid (Benner et al., 2010). Jeffreys (2012) echoed this sentiment, pointing out that currently, 83% of all registered nurses are White, non-Hispanic. “Mismatches between the cultural diversity in society and diversity within the nursing profession will persist into the future unless strategies for recruitment and retention are more successful” (Jeffreys, 2012, p. 5).

**Cost of Nursing Education**

Nursing programs face increased costs, budget cuts and lower enrollment (Booker & Hilgenberg, 2010; Horns & Turner, 2006; Rich & Nugent, 2010; Starck, 2005; Yucha, Smyer, & Strano-Perry, 2014). Yucha et al. (2014) give strategies for nursing program administrators to address the issues of budget cuts and faculty shortages. In their study, Yucha et al. (2014) describe a partnership with a nearby hospital to provide clinical teaching by the staff nurses, adding an online doctoral program which generated tuition revenue without much overhead cost, and increasing the fees for nursing students to offset much of the instructional cost for the university. The problem with increasing costs is that it may drive students away, when higher education costs are already high, and enrollment is already low. This study does not address enrollment, or the rate of attrition.

Higher education funding is a delicate balance of budgeting, expenditures, appropriations, and revenue generation. Horns and Turner (2006) explain the difficulties of
nursing program administrators in budgeting with such funding schemes as performance-based or formula funding. The low faculty-to-student ratios in clinical courses and direct faculty supervision of student clinical time dramatically increase the cost of nursing education above that of liberal arts or other disciplines. Horns and Turner (2006) remind us “The education of nurses carries considerable risks for public safety, unlike any other undergraduate major on college campuses” (p. 223).

Starck (2005) explored the production cost of delivering a Bachelor of Science in Nursing degree and compared it to the cost of other health professions. The researcher used a revenue-based approach and also provided the financial benefit of nursing programs to their communities. The largest contributor to increased cost was found to be faculty salaries, followed by lower enrollment, and student attrition (Starck, 2005). Financial benefits identified included job creation, improved local tax base from the earning power of baccalaureate-educated graduates, the economic activity generated by the school itself, and the value of nursing services provided by the graduates. Starck explicitly points out the value to a healthcare institution of having qualified nurses: “The absence of nurses is a major causative factor in [medical] errors being committed. Errors are costly not only in terms of human life and suffering but also in terms of law suits as well as general efficiency of operation” (p. 188). The researchers actively challenge leaders in nursing education programs to actively educate university administrators and state legislators of the unique needs of nursing education to help secure adequate funding (Starck, 2006).

Booker and Hilgenberg (2010) examined a program assessment model called the “Quality, Potential and Cost (QPC) model” (p. 201). This model accounts for the higher revenue potential of nursing programs, not just the higher cost of nursing education. Nursing programs
generate credit hours outside of nursing (arts and science prerequisites that are not attributed to the school of nursing), thereby adding revenue to other programs. These may not be enough to offset the high program costs due to low student-faculty ratios for clinical courses, and the reduced likelihood for program expansion due to the nationwide nursing faculty shortage (Booker & Hilgenrein, 2010; Benner et al., 2010; Yucha et al, 2014).

Faculty shortage and budget cuts are not the only problems nursing programs face. According to Rich and Nugent (2010), programs are also challenged with “eliminating inconsistent and confusing educational choices, taking responsibility for mandates to stay on the cutting edge of quality initiatives, providing excellent clinical experiences for students, and being willing to step out of old comfort zones to engage in designing imaginative and innovative ways to educate nurses in the future” (p. 228). While the article does an excellent job articulating the challenges faced by nurse educators, the authors only provide broad suggestions for solving the issues. For example, in order to help solve the faculty shortage, the authors suggest “reducing financial gaps between clinical and academic practice and reducing the costs of advanced education” (p. 229) and “achieving robust collaborative partnerships between nursing service and nursing education” (p. 231). These are good ideas, but not something nurse educators can do without substantial support from university administration (Benner et al., 2010; Yucha et al, 2014). Horns and Turner (2006) warn against transferring the cost of educating students from the school to the clinical facility, considering the limits on how much and how long the facilities are willing to bear the cost, as well as regulatory and accreditation requirements.

**Nursing Education Evaluation Methods**

The push toward evidence-based decision making is widespread in nursing education (Oermann, 2017). Sewell et al. (2008) also looked at NCLEX-RN pass rates and HESI scores,
implementing program changes based on their data. The implementation of a new NCLEX-RN preparation course, modification of their progression policy, and addition of student resources increased the pass rates (Sewell et al., 2008). Banta and Palomba (2015) discuss assessment at the program level and acknowledge it must include evaluation of experiential learning, such as clinical performance, and employer perception of graduates’ performance. Data must be collected regularly, analyzed and systematically reported and used for program improvements (Banta & Palomba, 2015; Oermann, 2017).

Gathering assessment data must utilize a complex method of both direct and indirect measures of student learning (Oermann, 2017). Course evaluation and program evaluation surveys ask the students’ opinion on how well they achieved the learning outcomes of the course or program (indirect measures). Direct measurements of student achievement include performance on standardized exams, performance on faculty-created exam items, rubrics for written work, and clinical performance evaluations. These allow faculty to measure the students’ achievement of the learning outcomes. While there is some dissent in the literature about which form of measurement is more accurate (Weldy & Turnipseed, 2010; Calderon, 2013; Luce & Kirnan, 2016), there is little debate that using both methods is necessary to provide a full evaluation of student learning (Schellenbarger, 2017; Kumm & Godfrey, 2017; Karsten & Roth, 2015).

Karsten and Roth (2015) studied an information systems program and Luce and Kirnan (2016) studied a psychology program, but both studies found value in measuring student perception of content mastery (an indirect measure of student learning) as well as direct measurements on objective tests. Weldy and Turnipseed (2010) warn against putting too much emphasis on indirect measurements of student learning. They studied a business program and
found that students’ perceptions of their mastery of learning outcomes were much higher than their actual learning demonstrated by objective measures. Because nursing graduates must pass an objective licensure exam after graduation, nursing programs must also be wary of too much emphasis on indirect measures to gauge student learning. By utilizing both direct and indirect measures of student learning, large amounts of data are collected each semester and programs must expend resources to analyze this data.

Schellenbarger (2017) reviews issues related to evaluation data quality such as reliability and validity of data, as well as internal and external factors affecting data collection. Internal factors such as demographics and enrollment status (full-time or part-time) of the students may affect strategies for data collection as well as student willingness to participate in program evaluation activities. Particular care must be taken to assure students that evaluations are confidential, and survey length and timing of administration greatly affects participation, “as participants may get tired and not pay attention during lengthy surveys” (Schellenbarger, 2017, p. 63). Collection of evaluation data from external stakeholders must be carefully planned, making sure the materials get delivered to the right people, are brief, well-organized with clear directions, and are easy to complete. (Schellenbarger, 2017).

The issue of content-saturation and ever-evolving role of nurses in healthcare reform has the majority of nursing programs undergoing curricular changes to consider the concept-based curriculum (Giddens & Brady, 2007; Hendricks, Taylor, Walker, & Welch, 2016; Oermann, 2017), but not much research has been done on evaluating these types of curricula. Giddens and Morton (2010) explored ways to evaluate a concept-based curriculum, but their focus remained on student achievement and licensure pass rates.
Student learning can be assessed in a multitude of ways, but knowledge and skills are not the only qualities that must be measured in nursing. Hendricks et al. (2016) explored a method for curricular revision that included building students’ knowledge and understanding of concepts, skills competencies, and a professional identity. They admit that measuring the achievement of professional identity is challenging, but an imperative aspect of nursing education. This domain can be measured using reflective writing and active learning activities aimed at “developing graduates who embody professionalism in their nursing practice” (Hendricks et al., 2016, p. 35). Some examples of these activities include portfolios and simulation (Benner, et al., 2010; Schellenbarger, 2017). Biesta (2010) advocates for the use of reflective writing assignments to gauge student learning as well, valuing portfolios and reflections as highly as exams.

Kumm and Godfrey (2017) advocate using program evaluation data to make organizational decisions about curricular changes, course offerings, and resources “not only for accountability, but to stimulate and inform continuous improvement” (p. 141). Data can be used to understand program costs and the efficacy of resources. Programs can then use this knowledge to maximize resources and cut costs. Collecting student achievement data can inform the efficacy of resources provided to students (such as standardized testing programs, online resources), helping programs to determine if resources provided are worth the cost (Kumm & Godfrey, 2017). An important barrier to the process of using evaluation data to make program decisions includes “lack of release time for analysis and planning” (Kumm & Godfrey, 2017, p. 141).

Several studies have been done to assess whether instructional methods, testing services or other assessment tools bring value to student learning or to assessment practices (Morris & Hancock, 2008; Liu, 2010; Starck, 2005). Liu (2010) examined various methods of computing value-added and discovered that institutional differences contribute significantly to the scores,
and can potentially negatively impact struggling institutions. In a budget-conscious institution, costs must be a factor in choosing assessment methods or tools. Such tools include testing software, standardized testing services, and data-collection programs. The institution also must consider if these costs will be funded by the institution itself or passed on to students in the form of increased fees (Morris & Hancock, 2008; Starck, 2005). Morris and Hancock (2008) conducted a study to determine if a new nursing curriculum improved achievement of program outcomes by utilizing the standardized HESI Exit Exam and first-time NCLEX-RN pass rates. They determined that while there was no statistically significant difference between scores of the old curriculum and the new curriculum, they did find that HESI scores were highly correlated with NCLEX-RN pass rates.

Evans (2011) cautions against allowing administration too much power in decision-making based on student assessment and warns that student performance should not be used to evaluate faculty effectiveness. Evans (2011) prompts students and academics to resist the “corporatization of the Western university” (p. 222), and to think and speak of the educative process “in non-administrative ways” (p. 222). So often, program effectiveness is measured solely by student performance. Institutions must look at the human side of program effectiveness, especially in nursing (Benner et al., 2010). Nursing students are not just “performers” (Evans, 2011, p. 221), but future healthcare providers. Focus must be shifted to student retention (Andrews & Schulze, 2018; Braxton et al., 2013; Frankfort, O’Hara, & Salim, 2015). Retention makes good financial sense as well. Billions of dollars are lost annually to student attrition. “Each student who walks out the door takes his or her tuition, fees, and other revenue the school might have been able to receive” (Raisman, 2013, p. 3).
Factors Affecting Nursing Student Dropout

Much research has been done on factors affecting student dropout behavior. Age, gender, race/ethnicity, financial aid status, and prior educational experience have all been examined as contributing factors to student success or failure. The literature is conflicting as to whether these factors affect student success.

Age. Age at time of enrollment has been shown to both increase (Jeffreys, 2012; Pence, 2011) and decrease (Jeffreys, 2012; Mooring, 2016; Murtagh et al., 1999) likelihood of student persistence. With declining numbers of graduating high school students, the traditional college-age applicants are being replaced with older students, “with projected increases to persist in the future” (Jeffreys, 2012, p. 25). One factor that may contribute to older students’ attrition is the stereotype that they are less equipped to meet the demands of higher education than their younger counterparts, having been out of school and out of practice with studying and test-taking, less able to socially integrate into the campus atmosphere, etc. (Jeffreys, 2012; Mooring, 2016). Another factor is the “additional role responsibilities” (Jeffreys, 2012, p. 27) which may include being married and/or having children. Mooring (2016) adds that non-traditional students are more likely to have had previous negative educational experiences, and these may create further difficulties in retaining these students. Murtagh et al. (1999) also pointed out that in general, a barrier to non-traditional student retention is a lack of course offerings at times that are more convenient to working parents.

On the other hand, additional responsibilities and maturity level may contribute to the older students’ being more self-directed, having better study habits, and more goal commitment than their younger classmates (Jeffreys, 2012). While Pence (2011) found that older students were slightly more likely to drop out, that only held true in the first semester; after that, they
were just as likely to persist to degree completion. Clearly more research is needed to determine the effect of age on student nursing persistence and success.

**Gender.** Gender is a factor in the attrition of nursing students. Females represent 93% of all nurses and 94% of nursing faculty nationwide (NLN, 2016). Among nursing students, females represent 85% of enrollees (NLN, 2016). For this reason, male students are considered underrepresented in nursing majors (Benner et al., 2010; Jeffreys, 2012). McLaughlin, Muldoon, and Moutray (2010) identified gender bias and stereotyping as a barrier to male nursing student retention. Male students “reported feelings of isolation and loneliness which was exacerbated by underlying assumptions of nurses as female in both lectures and textbooks” (McLaughlin et al., 2010). Kouta and Kaite (2011) found that gender bias and stereotypes were well documented in the literature and heavily contribute to male attrition in nursing schools. Male students are often limited to caring only for male patients and therefore lack substantial educational opportunities, though female students are allowed to care for both male and female patients (Kouta & Kaite, 2011). There is little support for men breaking gender barriers to enter female-dominated professions, and efforts must be made to improve retention of male students (Benner, et al., 2010; Jeffreys, 2012; McLaughlin et al., 2010).

**Race/ethnicity.** Several studies have attempted to identify what characteristics place a student at risk for dropout, and ethnically diverse students routinely are listed. Harris, Rosenberg and O’Rourke (2014) attribute this to “lack of awareness of their cultural needs by nursing programs, feelings of isolation, lack of faculty support, academic disadvantages, and language barriers” (p. 32). Mooring (2016) added that cultural differences between ethnically diverse students and the majority of nursing faculty members contribute to communication difficulties, “leaving the student feeling disconnected from the school and create barriers to success” (p.
Chen and DesJardins (2010) found that Asian students were less likely to stopout in the first year of college, and Latino students were more likely to drop out, no other adverse relationships were identified for any other race/ethnicity. Pence (2011) found ethnic diversity to be a predictor of attrition at some schools, but not at others, suggesting institutional environment may influence persistence. While race and ethnicity do play a role in identifying at-risk students, a holistic appraisal of other profile characteristics including academic preparedness, advisement, and financial support must be considered when designing retention efforts (Braxton et al., 2013; Chen & DesJardins, 2010; Jeffreys, 2012; Mooring, 2016; Pence, 2011).

**Financial status.** Lower family income is often associated with higher risk of attrition (Chen & DesJardins, 2008; Jeffreys, 2012). Financial pressures adversely affect students’ ability to devote adequate study time, as they may be required to work to afford tuition and living expenses. Receipt of financial aid significantly improves student persistence (Pascarella & Terenzini, 2005). The type of financial aid (e.g. merit-based, need-based, grant, loan) plays a role as well (Chen & DesJardins, 2010; Dynarski & Scott-Clayton, 2013; Jeffreys, 2012). Chen and DesJardins (2008) discovered lower income students’ risk of dropout was best improved by receipt of Pell grants, whereas middle-income students’ risk was best lowered by receipt of student loans. Dynarski and Scott-Clayton (2013), however, found that loans did not affect enrollment and completion as much as grants do at any income level. They posited that students are “debt averse” (Dynarski & Scott-Clayton, 2013, p. 83), and the details about different types of loans and repayment options are unknown and confusing to students.

**Prior educational experience.** Prior educational experience such as high school GPA, performance on standardized entrance exams, and grades in prerequisite courses are all determinants of a student’s acceptance into a nursing program. These factors have varying
predictive value on student success (Jeffreys, 2012; Tinto, 2012; Vandenhouten, 2008). Urwin’s (2010) study revealed a general likelihood of those with higher academic achievements to successfully complete a nursing program, and those with lower academic achievement were most likely to drop out, and most of those were lost in the first year. Tinto (2012) posited that institutions set expectations of first year students too low, not requiring them to study enough. This may be a central issue with nursing student attrition in the first semester, as students do not have realistic expectations of the time required for adequate study (Merkley, 2016; Mooring, 2016).

Nursing programs generally measure program success by producing quality entry-level nurses who can pass the licensure exam, the NCLEX-RN (Sewell et al., 2008; Urwin et al., 2010, Vandenhouten, 2008). Much research has been done on the predictors of first-time NCLEX-RN pass rates. Vandenhouten (2008) conducted a retrospective analysis of students in a single school of nursing and found the expected predictors of success to be older age at admission, higher ACT scores, higher grades in certain predictor courses, higher scores on standardized exams and higher GPA at graduation. She also noted that predictors of failure were less significant, citing younger age at admission and lower grades in certain predictor courses as the only two variables that produced a significant relationship to licensure exam failure (Vandenhouten, 2008). Yeom (2013) also analyzed predictors of licensure exam success and failure, but only used standardized exam scores.

**Student Retention Strategies**

Andrews and Schulze (2018) argued that the focus on graduation rates could easily hamper access for underrepresented students. Rather than limit access to improve graduation rates, institutions must focus on retaining students, providing services when and where they are
most needed (Andrews & Schulze, 2018; Frankfort et al., 2015). Institutions have begun to use intrusive advising practices informed by early alert systems and predictive analytics to “nudge” students who need help persisting in college (Frankfort et al., 2015, p. 152). Specific recommendations included social norming (conveying the notion that everyone is actively seeking success and using campus resources), social belonging (conveying underrepresented students are not alone in their struggles), planning behavior (prompting to write down dates, create study schedule, etc), and promoting a growth mindset (helping students internalize the notion that “intelligence is malleable” (Frankfort et al., 2015, p. 150) and seeking help is a normal part of learning).

Braxton et al. (2013) refer to the “ill-structured nature of the problem of student departure” and suggest using an integrated design approach for retention programs, coordinated centrally, with buy-in across campus, and with particular attention to evaluation of the efficacy of each facet of the program. These authors advocate for a “strategic retention initiative” (p. 42) that involves calling students a few weeks in to their first semester, with a follow-up call in the next semester, to determine if the student requires referrals to any support services and to provide such referrals. Campuses should provide ample parking, general-use computers, ample study space, IT support, and access to student services personnel in the evenings and on weekends (Braxton et al., 2013). They also encourage institutions to provide family services including website information, family orientation, and on-campus family-friendly activities (Braxton et al., 2013). These can be particularly helpful for nursing students, as support from families is often lacking due to a lack of understanding of the rigors of healthcare professional programs.

Selective admissions and data-driven policies can hamper access to nursing programs to marginalized groups (Bissett, 1995; Merkley, 2015). These policies also put more emphasis on
the numbers than on the people involved and their abilities. Bissett (1995) admonishes community college programs for selective admissions practices, stating that standardized test scores and GPA are not valid predictors of success in nursing programs, and restricting access undermines the mission of open-access institutions. Merkley (2015) advocates for retention-friendly policies to improve student nursing degree completion, such as eliminating high-stakes testing and more standardized grading and progression policies. State legislatures are encouraged to consider improving funds to nursing programs, improving faculty salaries to alleviate faculty shortages, thereby allowing increased capacity for nursing programs (Merkley, 2015). While nursing has an obligation to the public to produce competent nurses, and an obligation to the university to maintain accreditation standards, there are ways to increase access to nursing education for marginalized groups while still maintaining high academic standards.

Intrusive or proactive advising practices would work well in nursing programs, as the class size is relatively smaller and interaction with course faculty is much more frequent. Andrews and Schulze (2018) advocate for this type of advising, including calling students when they miss class or when their interim grade reports reflect poor performance. Braxton et al. (2013) place high value on the role faculty plays in student retention, and even advocate that possession of “student-centered values” (p. 44) should be considered during the hiring process and included in new-faculty orientation programs.

It is difficult to apply traditional retention models to nursing students, as their university experience is quite different from other undergraduate majors (Harris et al., 2013; Jeffreys, 2012; Urwin et al., 2010). Several studies have used Jeffreys’s NURS model to explore retention of undergraduate nursing students, finding that data collection and targeted retention strategies are key to nursing student persistence and success (Beauvais et al., 2014; Mooring, 2016; Pence,
2011). Beauvais et al. (2014) points out that despite numerous retention efforts at nursing programs across universities nationwide, attrition rates remain high. More must be done to promote nursing student success, not just referring students for counseling, but perhaps including psychological factors such as emotional intelligence, resilience, and empowerment into nursing curricula (Beauvais et al., 2014).

Jeffreys (2012) advocates for the use of enrichment programs targeted toward nursing students. These programs would necessarily be program-specific and designed to support students in areas identified as weak by careful assessment of students and program retention rates. Some suggestions included family orientation, peer mentor-tutors, a student newsletter, organized study groups, and a “transitional workshop” (Jeffreys, 2012, p. 300) hosted by peer mentor-tutors to assist students in what to expect as they transition from one semester to the next. The idea of peer tutoring in nursing is further supported by the work of Blowers, Ramsey, Merriman, and Grooms (2003) as well as that of Stone, Cooper, and Cant (2013) who found that student tutors contributed to improved academic skills and performance.

Harris et al. (2013) describes a similar student success plan targeted toward students who were identified as at-risk based on prior academic performance. In this program, students completed learning modules geared toward improving study skills, organization, time management, test taking, critical thinking, identifying stressors, and developing coping mechanisms (Harris, 2013). Students were also introduced to campus resources including counseling, career services, and financial aid. The results of the program were not significant, likely because they limited the inclusion criteria to prior academic performance only.

In order to maintain standards of the profession and maintain high pass rates on the licensure exam, some degree of attrition is inevitable, admitting “an ethical and professional
imperative for attrition in some circumstances” (Urwin et al., 2010, p. 202). Jeffreys (2012) reiterates “the need to assure client safety and maintain professional standards outweighs the risks of lenient retention policies” (p. 159). In keeping with Jeffreys’s (2015) model, “retention is evidence of a successful relationship between student and institution and by inference attrition is evidence of a failed relationship” (Urwin et al., 2010, p. 206). Schools of nursing must strive to discover and enhance those policies and services that maximize student retention without relaxing professional standards.

**Conceptual Framework**

Traditional models of student retention such as those of Tinto (1993) and Bean (1980), and more recent models such as those of Cabrera et al. (1993) and Seidman (2012) examine factors that contribute to student departure decisions. Tinto’s (1993) model focuses on pre-college factors and attitudinal factors related to a student’s commitment to the institution. Urwin (2010) cautions against using this model to examine persistence of nursing students because their university experience is quite different from other university students. In nursing, a student is on the college campus for classes but also spend a large portion of their time in a hospital setting for clinical instruction. For this reason, it is also necessary to consider not only student integration and socialization into the educational environment, but also into the professional environment (Jeffreys, 2015).

Bean’s (1980) model emphasizes external factors, especially social factors related to student support, but with some overlap of Tinto’s model. Bean’s Student Attrition Model emphasizes factors affecting student retention from outside of the college environment, whereas Tinto’s Student Integration Model emphasizes the effects of academic and social integration on student retention from within the college environment. In testing the Student Attrition Model,
Bean and Vesper (1980) found that only six of the environmental, personal, and organizational variables account for the majority of the variance in the attrition among freshmen, suggesting non-intellectual factors play a major role in student dropout.

Cabrera et al. (1993) developed a model that combines Tinto and Bean, offering “an integrative framework in understanding the interplay among individual, institutional, and environmental variables in the college persistence process” (p. 136). In testing their new model, Cabrera et al. (1993) found that only in combining the effects of internal and external factors do we gain an appreciation for the complex interplay among these factors affecting student retention. While they found that support from friends and family and prior educational experience (GPA) were highly predictive of student retention, they caution that external and internal variables substantially interact, and the combined effects should not be overlooked.

Seidman (2012) developed an inclusive model that describes persistence for all types of students, including minorities, non-traditional, and those attending virtual institutions. Seidman found that retention depended on early identification combined with “early, intensive, and continuous intervention” (qtd. in Morrison & Silverman, 2012, p. 75). Programs recommended by Seidman (2012) include mentoring programs by minority faculty, ethnic-oriented clubs, small culturally-oriented summer programs, and financial literacy programs. Multicultural centers are another technique that can be used to improve retention of minority students by “providing a specific office—a point of contact—to go to in time of need, where a plethora of services are collected and provided to needy students” (Seidman, 2013, p. 270).

Applying these retention theories specifically to undergraduate nursing students, Jeffreys’s (2015) Nursing Undergraduate Retention and Success (NURS) model (Figure 1) presents a framework that includes “the multidimensional factors that affect nursing student
retention and success in order to identify at-risk students, develop diagnostic-descriptive strategies to facilitate success, guide innovations in teaching and educational research, and evaluate strategy effectiveness” (p. 426). The model was developed with an understanding of the “dynamic phenomenon” (Jeffreys, 2012, p. 4) of nursing student retention, the complex interaction of influencing factors, and with insight into the student nurse’s perspective. Jeffreys’s NURS model will be used as the theoretical framework of this study.

Figure 1. Jeffreys Nursing Universal Retention and Success (NURS) Model (Jeffreys, 2015)

The NURS model includes student profile characteristics, student affective factors, environmental factors, academic factors, and professional integration factors, all of which affect both academic and psychological outcomes. These outcomes are responsible for the student’s
decision to stay in the program or drop out, their ability to pass the licensure exam, and their decision to stay in the profession of nursing after graduation. Student profile characteristics include age, ethnicity and race, gender, language, prior educational experience, family’s educational background, prior work experience, and enrollment status. Student affective factors include cultural values and beliefs, self-efficacy, and motivation. Environmental factors in the model include financial status, family financial and emotional support, family responsibilities, employment hours, living arrangements, and transportation. Academic factors include study skills, study hours, class schedule and attendance, and general academic services offered. Professional integration factors include helpfulness and advisement by nursing faculty, membership in professional organizations and attendance at professional events, peer support, peer-mentoring and -tutoring, and enrichment programs. Jeffreys (2012) also identifies outside surrounding factors such as politics and economics, the healthcare system, nursing professional issues, and job security as contributing to a nurse’s decision to remain in the profession.

Jeffreys (2012) outlines the student profile characteristics that affect student success, including age, ethnicity and race, gender, prior educational experience, and enrollment status. Most universities already have access to this data, along with financial aid status (identified as an environmental factor in the model) and course grades (classified as academic outcomes in the model). These may be used to build a predictive model for student success (Jeffreys, 2012; Pence, 2011). Jeffreys (2012) further suggests that nursing faculty use the data gathered by their institutions to implement retention strategies that target those students identified as most at risk and suggests a multitude of solutions (Jeffreys, 2015). “The assessment of student profile variables can give a general description of the student population or can help the nurse educator target a specific student group” (Jeffreys, 2012, p. 286).
There is abundant literature describing the challenges facing nursing education, extolling the importance of sound evaluative processes, as well as ideas for improving learning outcomes. The deficit lies in utilizing student data to identify at-risk students and the time they are most at risk, and then using that information to inform program and policy changes. Nursing needs to know more about what students’ needs are, what challenges they face, when those challenges arise, and what we can do to help them. With this information, schools should be able to anticipate student needs and implement appropriate retention strategies at the appropriate times (Andrews & Schulze, 2018).

Longitudinal analysis of student data can be used to identify the factors contributing to attrition so that student services can be targeted specifically toward those factors. Event history analysis can help identify when those services are most needed and for which students. Tutoring can be targeted for those courses that most need it; specific needs can be addressed once those needs are known. The overall goal is to decrease attrition rates and improve student persistence and success.

In review, the following three research questions guide this research study:

1. Which student-level variables predict nursing student dropout risks over time?
2. Which student-level variables predict nursing student retention over time?
3. When are nursing students most likely to drop out?

The hypothesis is that there is no difference in the risk of student dropout among the student-level variables.
Methodology

Identification of at-risk students utilizing all of the factors in the NURS framework requires substantial data collection that is not ordinarily done by institutions, such as surveys to ascertain student attitudes about finances, or level of family support. Analyzing data normally collected by institutions provides an important first step in understanding student departure and student services that may be needed to improve student retention. Another important factor in improving retention efforts is the timing of student departure, a variable that most theoretical models do not take into account.

DesJardins et al. (1999) used Cabrera’s model to formulate a “reduced-form approach” (p. 376), utilizing event history modeling techniques to predict student departure. Their Event History Model of Student Departure (Figure 2) will be used as the statistical model for this study. Where the previous models rely on external data, the DesJardins model only utilizes data readily available to institutions. Other student retention models require survey data which is dependent on response rates which greatly reduces sample size. Utilizing complete institutional data avoids any selection bias that may be present in survey completion. DesJardins et al. (1999) hold that their model, while it leaves out the attitudinal measures, “may actually be more statistically robust than the structural studies done to date” (p. 377). Event history modeling can handle longitudinal data, censored data, different types of data (both discrete and continuous variables), and variables that change over time (such as student GPA).

The exogenous (pre-program) variables are static and will not change over time, though their influence on departure decisions may change over time. These variables include age at admission, race/ethnicity, gender, high school GPA, entrance exam scores, etc. The time-varying regressors change over time, and include current GPA and financial aid status. These factors
contribute to a student’s decision to remain in the enrolled in the program or not. Some students opt to leave the program temporarily (example: sit out for one semester due to pregnancy and childbirth), noted as “stopout” in the model. Some students are either dismissed from the program due to course failures or choose not to return at all, noted as dropout in the model. Other students complete the program and graduate. Students who have not dropped out and have not yet graduated by the end of the data collection period are said to be censored, but their data can still be used to predict the time to dropout.

![Event History Model of Student Departure](DesJardins, Ahlburg & McCall, 1999)

**Research Design**

A longitudinal statistical analysis of retrospective student data was used to identify factors that are associated with nursing student attrition at different times in the nursing program. Event History Analysis (EHA) is a form of linear regression that measures the likelihood of an
event (in this case, student dropout) at a particular time (in this case, semesters in the nursing program), based on covariate factors. This type of analysis can be used to complete the picture of student success and failure (Ameri et al., 2016; Murtaugh, Burns, & Schuster, 1999; Min et al., 2011). EHA is a form of logistic regression analyzing duration-to-event data, where events are discrete occurrences (Allison, 2014). EHA methods originated in biomedical research, where it was used to study subjects’ survival time during an experiment and was originally termed survival analysis. In different disciplines, survival analysis has different names. In the social sciences, it is called event history analysis, and engineers call it failure-time analysis (Allison, 2014).

EHA techniques investigate the probability that an event will occur as a linear function of one or more explanatory variables (Tabachnick & Fidell, 2013). By modeling the length of time it takes for the occurrence of the event of interest, this approach is well suited for investigating what factors explain whether and when the event occurred (Allison, 2014). In the current study, the event of interest is student dropout. Another benefit to event history analysis is that it can account for incomplete data, known as censoring (Tabachnick & Fidell, 2013). Censoring in the data means that the exact event time for some individuals is unknown because by the end of data collection, the event has not yet occurred (Allison, 2014). Accounting for censoring means that the model can estimate how likely the event is for an individual, even if this event has not yet occurred. The use of censored cases also allows for a more efficient use of the data associated with longitudinal studies because in EHA, censored cases do not need to be omitted (Allison, 2014).

EHA is a collection of methods that can be used for measuring likelihood of event occurrence, each method having its own usefulness depending on the nature of the data and the
event of interest. There are parametric and non-parametric models, and events can be discrete-time or continuous-time, repeated or non-repeated, and there may even be multiple types of events (Allison, 2014). The Cox regression model, also known as the proportional hazards model, is most useful because it allows for evaluation of the contributions of multiple covariates and interactions between them on the time-to-event, as well as the ability to estimate the effect of a covariate while controlling for the effects of the other covariates (Allison, 2014; Tabachnick & Fidell, 2013). Allison (2014) refers to the Cox proportional hazards model as “unequivocally the best all-around method for estimating regression models for event history data” (p. 35). For instances when the event time is the same for multiple individuals (as in this case, multiple students will experience dropout in the same semester), the discrete time method can be used (Allison, 2014; DesJardins, et al., 1999).

**Data Source**

The data for this study comes from a single undergraduate pre-licensure nursing program in a small (less than 2000 students) Catholic commuter college, henceforth known as Catholic University (CU) in a mid-sized southeastern city. The program awards a Bachelor of Science degree in Nursing (BSN), and is accredited by the Accreditation Commission for Education in Nursing (ACEN). Data will be gathered from an electronic database for the study institution, utilizing data from all students accepted to the pre-licensure Bachelor of Science in Nursing (BSN) program for a period of four years, 2015-2019. Within the study period, no significant curricular or faculty changes took place. There were no changes to student learning outcomes or course requirements, and the same faculty taught the same courses throughout the study period.

The CU BSN program is five semesters, beginning with Fundamentals of Nursing Practice and Pharmacology in the first semester, followed by three semesters of nursing concepts
courses that include didactic and clinical credit hours, and ending with Transition to Professional Practice (primarily a licensure exam preparatory course) and a clinical immersion course (precepted clinical practice) (see Table 1). Prerequisites for the program take a minimum of three semesters to complete and include two anatomy and physiology courses and a pathophysiology course. The grading scale for the pathophysiology course is the same as for the nursing program (a 7-point scale with 80 as the lowest C), but the remainder of the prerequisite courses following the university standard 10-point scale. The admission criteria for the nursing program includes a minimum overall GPA of 2.75. Students are also required to take an entrance exam, the Test of Essential Academic Skill (TEAS) created by Assessment Technologies Institute ®, LLC, unless they have previously earned a baccalaureate degree. Admission requirements stipulate a minimum TEAS score of 75.

Table 1. Pre-licensure Bachelor of Science in Nursing Curriculum

<table>
<thead>
<tr>
<th>Course</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
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<tbody>
<tr>
<td>Semester 1</td>
<td>NURS 2330 Pharmacology (3T)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>NURS 2750 Fundamentals of Nursing Practice (3T/4C)</td>
<td>7</td>
</tr>
<tr>
<td>Semester 2</td>
<td>NURS 3710 Nursing Concepts I (4T/4C)</td>
<td>8</td>
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<tr>
<td></td>
<td>NURS 3720 SL Nursing Concepts II (3T/1C)</td>
<td>4</td>
</tr>
<tr>
<td>Semester 3</td>
<td>NURS 3730 Nursing Concepts III (4T/4C)</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>NURS 3740 SL Nursing Concepts IV (3T/2C)</td>
<td>5</td>
</tr>
<tr>
<td>Semester 4</td>
<td>NURS 4750 Nursing Concepts V (4T/4C)</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>NURS 4760 Nursing Concepts VI (3T)</td>
<td>3</td>
</tr>
<tr>
<td>Semester 5</td>
<td>NURS 4790 Clinical Immersion (1T/4C)</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>NURS 4910 Transition into Practice (4T)</td>
<td>4</td>
</tr>
</tbody>
</table>

The CU BSN nursing program requires students to be able to adhere to core performance standards in order to remain in good standing and progress through the program. The cognitive and behavioral criteria include critical thinking ability, interpersonal skills, mobility, sensory and
motor skills, emotional and mental stability, and ethical standards. If a student is unable to meet these standards, he/she may be withdrawn from the program or dismissed. All courses in each level of the program must be successfully completed before a student may progress to the next level/semester. The progression policy states that a student may only enroll in a nursing course twice (this allows a student to withdraw from a course and reattempt it the following semester), but only two withdrawals are allowed in the program. The progression policy also holds that a student may only fail one nursing course once. Any subsequent course failure during the program will result in program dismissal. In accordance with state law, the student must also be in compliance with all requirements set forth by the State Board of Nursing and maintain that compliance throughout the program. The State Board may require that the student be withdrawn from the program for noncompliance pending investigation and may deny the student approval to progress.

At CU, there are seventeen full-time faculty members with teaching and clinical responsibilities in the BSN program. Five of these faculty members have an earned doctorate degree, and the remaining twelve have master’s degrees in Nursing. The licensure pass rate for this program is currently (2019) 100%. The state and national averages for the same year, first-time, baccalaureate candidates are 94.4% and 91.8%, respectively. The program admits approximately 80 students per semester, but graduates only 35-45 per semester, a completion rate of 44-56%. This is consistent with the averages reported in the literature (Harris et al., 2014; Merkley, 2016), but the institution is committed to improving retention.

During the time period from Fall 2015 to Spring 2019, 532 students were admitted but only 498 students were enrolled in the Nursing program. The students who were admitted but did not attend were not included in the study. Potential reasons for not attending included being
accepted into another program elsewhere, changing majors prior to beginning classes, relocation, or being prohibited from starting the program due to issues with the State Board of Nursing.

Data Collection

Student data was collected by the Enrollment Management department of Catholic University (CU), compiled and deidentified prior to distribution to the researcher. Student demographic data, enrollment data and transcripts are in one system in the institution, while financial aid data and standardized exam score data are housed in separate systems. The compilation of the data was a manual process. Standardized exam scores at CU are manually entered each semester by the nursing program secretary, as time allows, thus many scores for the students were missing. The scores typically correspond with the students’ mastery of the course content, thereby offering no new insight into the students’ performance in the corresponding courses. Thus, these standardized exam scores (with the exception of the entrance exam score) were left out of the data analysis. Financial aid status on program admission was used as an exogenous variable as a baseline, then as financial aid status changed per semester, it was used as a time-varying regressor.

Variables

In event history modeling, the dependent variable is the time to event. The event of interest for this study is the time of student dropout. Dropout is defined as exiting the program and not returning. For students who do not complete the program, reason for dropout (dismissal due to course failure, or withdrawal from the program) are also reported.

Utilizing the DesJardins Event History Model for Student Departure, explanatory variables (independent variables) for this study are identified as exogenous variables (age, sex,
race/ethnicity, pre-nursing GPA, grades in Pathophysiology, scores on the entrance exam) and time-varying regressors (financial aid status and GPA during the nursing program).

**Exogenous variables.** The factors that are present upon admission to the program and will not change are henceforth known as exogenous variables. These include age at admission to the Nursing program, sex (male or female), race/ethnicity, grades in the pre-nursing Pathophysiology course, and pre-nursing GPA (overall college GPA prior to admission to the Nursing program). Race and ethnicity data is collected by the University according to US Department of Education guidelines, with the categories being American Indian or Alaska Native, Asian, Native Hawaiian or Pacific Islander, Black or African American, Hispanic/Latinx, and White (non-Hispanic).

**Age at enrollment.** This program changed from an associate degree program to a traditional pre-licensure baccalaureate program two years prior to the beginning of the study period. The composition of the student body with regard to age has gradually become similar to the typical undergraduate population, with more traditional first-time-in-college students.

**Sex.** Nursing remains a predominantly female profession, with males representing only 7% of all nurses (NLN, 2016). The effect of gender on student persistence should be examined. The current student body of the subject program is 90.5% female, 9.5% male.

**Race/ethnicity.** In the county where the study institution is located, the racial makeup of the population is as follows: 49% White (non-Hispanic), 45% Black/African American, 4% Hispanic/Latinx, and 3% Asian (U.S. Census Bureau, 2010). The current nursing student population in the study institution is approximately 73% White (non-Hispanic), 14% Black/African American, 7% Hispanic/Latinx, 3.6% Asian, 0.4% Native Hawaiian/Pacific Islander, 0.6% American Indian/Alaskan Native, and 1.4% Other.
**Pre-nursing GPA.** The admission criteria for the nursing program includes a minimum overall GPA of 2.75. Average GPA on admission for the study period was approximately 3.16, with a range of 2.04 to 4.00.

**Nursing entrance exam scores.** The admission criteria for the program includes a minimum score of 75% on the entrance exam. The program is currently using the Assessment Technologies Incorporated Test of Essential Academic Skill (TEAS). This test is designed to measure preparedness to enter a degree program in the health sciences.

**Time-varying regressors.** Those factors that are subject to change each semester are known as the time-varying regressors. These include financial aid status (grants, loans, scholarships, a combination of these, or none), and semester-specific GPA. Because these values may change, these variables will be included at each individual time (semester) for the study period. CU requires students to have a minimum cumulative GPA of 2.0 at the time of graduation to receive a degree.

**Data Analysis**

Event history analysis (EHA) has several features that make it ideal for studying student attrition: the ability to combine both discrete and continuous variables, allowing for both time variant and time invariant factors, and the ability to address censored cases (in this case, data from students who have not yet graduated but have not dropped out). This approach has been particularly useful in the study of student retention, and the potential to inform policy decisions in the study institution is great (Ameri et al., 2016; DesJardins et al., 1999; Murtaugh et al., 1999; Min et al., 2011).

**Key terms.** EHA uses longitudinal data to model the probability of the occurrence of an event. An event is defined as a definitive change in status that occurs at a specific point in time.
The survival function is the survival probability of a subject at a particular time. Prior to the event’s occurrence, a subject is at risk of experiencing the event. The set of subjects who are at risk of experiencing the event at a given time is known as the risk set. The risk of event occurrence is quantified in the hazard rate. The hazard of a subject depends on the covariates (gender, age, GPA, etc). For any two subjects at any point in time, the ratio of their hazard of the event is a constant, hence the name proportional hazard model. The Cox proportional hazards model does not rely on specified parametric relationships between covariates and is therefore known as semi-parametric.

Mathematical concepts. EHA defines time as a non-random variable denoted as $T$. The actual time of the event of interest is noted as $t$. $S(t)$, the survival function, is the probability of surviving beyond time $(t)$; i.e. the probability that the event occurs after time $t$: $S(t) = P(T > t)$. The hazard function, denoted $h(t)$, is the probability of the event occurring at time $t$, provided it has not previously occurred: $h(t) = P(T = t \mid T \geq t)$. Essentially, $h(t)$ is the probability of the event occurring at time $t$ among those at risk at that time. As in the case of this study, time is measured in discrete units, namely semesters. The event can occur in one of the five semesters of the program, or not at all, indicating the student persisted and graduated, or continued to persist through the end of data collection and is censored. In this case, the hazard rate is the conditional probability that a student will drop out in a given semester, provided the student remains in the risk set for that semester.

Next, we determine how the hazard is influenced by the explanatory variables. Let $P(T = t \mid T \geq t-1, x_1, x_2, ..., x_t, \theta)$ represent the conditional probability that the event occurs in semester $t$, given that it has not yet occurred in the first $t-1$ semesters of enrollment. The values of the explanatory variables in each time period ($x_1, x_2, ..., x_t$) are observable, and $\theta$ represents the
unobserved heterogeneity variable (those factors that may contribute to student dropout that were not included in the data set). It is therefore assumed that $P(T = t | T \geq t - 1, x_1, x_2, ..., x_t, \theta) = 1 - \exp(-\exp(\alpha t + \beta x_i)\theta)$ where $\beta_i$ is a vector of coefficients that describe the change in log-odds for each unit increase in the explanatory variables at time interval $t (x_i)$ and $\alpha$ is a time-varying constant term.

Predicting survival rates requires calculating parameter estimates for each of the explanatory variables. These parameter estimates (regression coefficients) “give the relative effect of each covariate on the survival function, but the size depends on the scale of the covariate” (Tabachnick & Fidell, 2013, p. 544). We must also consider the direction of the coefficient. A negative coefficient implies a decrease in the risk of dropping out, while a positive coefficient implies an increase in the risk. The Cox regression model can also deliver predicted survival functions for individuals (actual or hypothetical) at each observed time interval. For example, with the Cox regression model, we can predict a student’s chance of dropping out each semester based on their values of the explanatory variables.

Data Management

Handling of missing data. Pair-wise deletion was selected as the most appropriate approach for handling missing data. Specifically, for each analysis, all observations with non-missing values for all variables relevant to that analysis were included. List-wise deletion of all observations with any missing variables would lead to significant attrition of the original sample size. Such attrition invariably increases the risk of selection bias, with the exception of those rare situations where it can be proven to have occurred completely at random.

Variable management. The outcome or dependent variable (student dropout) was analyzed as a binary variable. Demographic variables including race and gender were analyzed
as categorical variables. Age was analyzed as a continuous variable. Grade point average (GPA) and all test scores were analyzed as continuous variables. Financial aid status was operationalized as a categorical variable of financial aid received (grants only, loans only, scholarships only, a combination of these, and no aid).

Continuous variables were reported using means and standard deviations while categorical variables were presented using frequencies and percentages. Baseline characteristics were compared between students who dropped out and those that were retained, using two-sample t-tests for continuous variables and Pearson’s chi square for categorical variables. Hypothesis testing was considered statistically significant at $p < 0.05$. 
Findings

Previous research has shown that student data can be used to predict student outcomes (Daniel, 2015; Eduventures, 2013; Min et al., 2011; Vandenhouten, 2008). The purpose of this study is to examine student data and identify factors that predict student departure in an undergraduate nursing program. The research questions were as follows:

1. Which student-level variables predict nursing student dropout risks over time?
2. Which student-level variables predict nursing student retention over time?
3. When are nursing students most likely to drop out?

The hypothesis is that there is no difference in the time to student dropout among the student-level variables.

Descriptive Statistics

Descriptive statistics for the exogenous variables appear in Table 2. Of the 498 students who began the program, 89% were female, 11% were male. Race and ethnicity data was collected by the University according to US Department of Education guidelines, with the categories being American Indian or Alaska Native, Asian, Native Hawaiian or Pacific Islander, Black or African American, Hispanic/Latinx, and White (non-Hispanic). White students represented 64.7% of the total, 13.7% were Black or African American, 14.9% were Hispanic/Latinx, 2.8% Asian, 1% American Indian, and 3% were listed as “unknown.”

Financial aid status was categorized as no financial aid; grants only; scholarships only; loans only; and some combination of grants, scholarships, and loans. Students with no aid accounted for 12.2% of those admitted; 1.4% had grants only, 20.3% had scholarships only, 17.3% had loans only, and 48.8% had a combination of aid.
The average GPA prior to Nursing courses was 3.17, with a range of 2.04 to 4.00 for students entering the program. The average score on the entrance exam was 82.30%, with a range of 41.1 to 96.3. The recommended score was 75 or higher for admission. Admission to the program is based on a combination of factors, including GPA and entrance exam scores. The average age on admission to the Nursing program was 24.4 years, with a range of 17.75 years to 56.1 years and a standard deviation of 5.7 years.

Table 2. Participant Characteristics

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<tr>
<th>Characteristics</th>
<th>Frequency</th>
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</tr>
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</tr>
<tr>
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<td>3.0%</td>
</tr>
<tr>
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<td></td>
</tr>
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</tr>
<tr>
<td>B</td>
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</tr>
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<tr>
<td>Combinations of grants, scholarships, and loans</td>
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<td>48.8%</td>
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</table>

Mean       | SD
---|---
Age (years) | 24.4 | 5.70
Pre-nursing GPA | 3.17 | 0.41
Entrance Exam Score | 82.3 | 5.82
**Descriptive statistics by outcome.** Of the 498 students in the study group, 121 (24.3%) experienced dropout during the study period. Descriptive statistics by outcome (retained or dropped out) can be found in Table 3. The average age of retained students was 24.1 years and the average age of students experiencing dropout was 25.5 years. 76% of female students were retained and 72.7% of male students were retained. Retained students included 80% of the American Indian/Alaska Native students, 57% of the Asian students, 64.7% of the Black/African American students, 77% of the Hispanic/Latinx students, 80% of the White/Caucasian students, and 80% of those whose race was unknown. Students who experienced dropout included 20% of the American Indian/Alaska Native students, 43% of the Asian students, 35% of the Black/African American students, 23% of the Hispanic/Latinx students, 21.7% of the White/Caucasian students, and 20% of those whose race was unknown.

The average pre-admission GPA of retained students was 3.2, while the average GPA of students who experienced dropout was 3.0. Mean entrance exam scores were 83.0 for retained students and 80.1 for students who experienced dropout. In comparing the first-attempt grades in the pre-nursing Pathophysiology course (NURS 2410), those who were retained earned more As (12.4% compared to 3.3%), B+s (11.1% compared to 2.5%), Bs (23.9% compared to 9.9%), and C+s (20.7% compared to 15.7%) than those who experienced dropout. In contrast, those who experienced dropout earned more Cs (33.9% compared to 18.3%), D+s (9.9% compared to 5%), and Fs (21.5% compared to 4.8%) than those who were retained.

The vast majority of both groups had some form of financial aid on admission to the program, with a combination of grants, scholarships and loans accounting for the largest category in both groups. Of those who had no aid, 82% were retained and 18% experienced
dropout. Those with scholarships only fared better, with 83.2% retained and only 16.8% experiencing dropout.

**Progression by cohort.** Of the 498 students enrolled in the study time frame, 211 were still enrolled and progressing through the program at the end of the study period. For the Fall 2015 cohort, 86 were enrolled, 63 (73.3%) completed the program and graduated, 13 (15.1%) were dismissed due to course failure, and 10 (11.6%) were eligible to return but chose not to. In the Spring of 2016, only 48 students were new admits to the program. Of those, 31 (64.6%) have graduated, 7 (14.6%) were dismissed, and 4 (8.3%) were eligible to return but chose not to. One student from that cohort is still enrolled in the program, scheduled to graduate in the Fall of 2019. The Fall 2016 cohort had 60 new students enrolled, 36 (60%) graduated, 16 (26.7%) were dismissed due to course failure, and 8 (13.3%) were eligible to return but chose not to. In the Spring 2017 cohort, 75 new students were enrolled. Of these, 20 (26.7%) are still enrolled, 38 (50.7%) have graduated, 14 (18.7%) were dismissed due to course failure, and 3 (4%) were eligible to return but chose not to.

In the Fall 2017 cohort, 53 new students were enrolled, 36 (68%) are still enrolled, 13 (24.5%) were dismissed due to course failure, and 4 (7.5%) were eligible to return but chose not to. In the Spring 2018 cohort, 55 new students were enrolled. Of these, 47 (85.5%) are still enrolled, 6 (10.9%) were dismissed due to course failure, and 2 (3.6%) were eligible to return but chose not to. In the Fall 2018 cohort, 69 new students were enrolled, 58 (84%) are still enrolled, 9 (13%) were dismissed, and 2 (2.8%) were eligible to return but chose not to. Thus far in the Spring 2019 cohort, of the 52 enrolled, 46 (88.5%) are still enrolled, 3 (5.8%) were dismissed due to course failure, and 3 (5.8%) were eligible to return but chose not to.
Table 3. Distribution of characteristics by outcome

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Retained Frequency</th>
<th>Retained Percentage</th>
<th>Dropped Out Frequency</th>
<th>Dropped Out Percentage</th>
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<tr>
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<table>
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<th>SD</th>
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<th>SD</th>
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<td>25.5</td>
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<tr>
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<td>80.1</td>
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</table>

* p<0.05, ** p<0.01, ***p<0.001

Regression Models

To explore the impact of student-level characteristics on dropout risk, Cox regression models were constructed. Initial models included student dropout as the dependent (failure) variable and each of age, gender, race, prior GPA, entrance exam score, first-attempt grade in the
pre-nursing pathophysiology course (NURS 2410), and financial aid at program entry were included in separate unadjusted models as predictors. Predictors that were statistically significant in the unadjusted models were included in the final adjusted model. Semester-specific GPA was included as a time-varying covariate in the final model.

**Two-group comparisons.** Overall, 121 students (24.3%) dropped out of the program during the study period (Table 3). Compared to students who graduated or were still in the program at the end of the study period, on average, students who experienced dropout were older (25.5 [SD 6.6] vs. 24.1 [SD 5.4] years, \( p = 0.02 \)), and had lower pre-admission GPA (3.0 [SD 0.4] vs. 3.2 [SD 0.4], \( p < 0.001 \)) and entrance exam scores (80.1 [SD 7.0] vs. 83.0 [SD 5.2], \( p < 0.001 \)). Race, gender, and financial aid status were not statistically significantly associated with dropout risk.

**Unadjusted Cox regression models.** In unadjusted regression, age, race, pre-admission GPA, entrance exam score, and NURS2410 grade were statistically significant predictors of the risk of dropout (Table 4). Although the risk of dropout was lower when comparing students who received only scholarships versus students who had no financial aid (HR 0.47, \( p = 0.03 \)), during their first semester, there were no statistically significant associations when comparing other categories of financial aid versus no financial aid. All other predictors were not associated with the risk of dropout. For each additional year of age, the risk of dropout increased by three percent (hazard ratio [HR] 1.03, \( p = 0.03 \)). Compared to Black students, White students were 41% less likely to drop out (HR 0.59, \( p = 0.03 \)). Risk of dropout decreased by 62% per unit increase in pre-admission GPA (HR 0.38, \( p < 0.001 \)) and six percent per unit increase in entrance exam score (HR 0.94 \( p < 0.001 \)).
Table 4. Results of Univariate Cox Regression Models

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<tr>
<th>Characteristics</th>
<th>Age</th>
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<th>Entrance Exam</th>
<th>NURS2410</th>
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<td>n = 498</td>
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<tr>
<td></td>
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<tr>
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<tr>
<td>Pre-admission GPA</td>
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<tr>
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<td>ref</td>
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<tr>
<td></td>
<td>C</td>
<td>4.903**</td>
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<tr>
<td></td>
<td>C+</td>
<td>2.367</td>
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<td></td>
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</tr>
<tr>
<td></td>
<td>D+</td>
<td>5.277**</td>
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<tr>
<td></td>
<td>F</td>
<td>8.559***</td>
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<tr>
<td>Financial Aid at Program Entry</td>
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<td>Scholarships only</td>
<td>0.47*</td>
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<tr>
<td></td>
<td>Loans only</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Combinations of grants, scholarships, loans</td>
<td>0.85</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

* p<0.05, ** p<0.01, *** p<0.001

Compared to having a grade of A, having a grade of B, C, C+, D, D+, or F in NURS2410 was associated with a higher risk of dropout and the risk ranged from 1.4 times higher for a
grade of B (HR 1.43) to 8.6 times higher for a grade of F (HR 8.6). The association was only
significant for grades of C (HR 4.90, \( p = 0.002 \)), D+ (HR 5.28, \( p = 0.004 \)), and F (HR 8.6, \( p < 0.001 \)).

Table 5. Results from Adjusted Model (not including time-varying covariates)

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>HR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>1.013</td>
</tr>
<tr>
<td>Race</td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td>ref</td>
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<td>Hispanic</td>
<td>0.969</td>
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<tr>
<td>American Indian</td>
<td>0</td>
</tr>
<tr>
<td>Asian</td>
<td>3.586*</td>
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<tr>
<td>Unknown</td>
<td>0.547</td>
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<tr>
<td>Pre-admission GPA</td>
<td>0.601</td>
</tr>
<tr>
<td>Entrance exam score</td>
<td>0.966</td>
</tr>
<tr>
<td>NURS2410 grade</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>ref</td>
</tr>
<tr>
<td>B</td>
<td>0.217</td>
</tr>
<tr>
<td>B+</td>
<td>0.596</td>
</tr>
<tr>
<td>C</td>
<td>1.612</td>
</tr>
<tr>
<td>C+</td>
<td>0.938</td>
</tr>
<tr>
<td>D</td>
<td>1.0</td>
</tr>
<tr>
<td>D+</td>
<td>1.326</td>
</tr>
<tr>
<td>F</td>
<td>2.959</td>
</tr>
</tbody>
</table>

N = 290; * \( p < 0.05 \), ** \( p < 0.01 \), *** \( p < 0.001 \)

**Adjusted Cox regression models including fixed/baseline covariates.** In the baseline
covariate-adjusted Cox regression model, age and letter grade in NURS2410 first attempt were
not statistically significant predictors of the risk of dropout (Table 5). Among Asian students, the
risk of dropout was more than three times as high as among Black students (HR 3.679 \( p = 0.03 \)).
There was no difference, comparing other racial categories versus Black. Although there was a
40% reduction in risk of dropout per unit increase in pre-admission GPA, this did not attain
statistical significance (HR 0.60, \( p = 0.16 \)). The risk of dropout decreased by three percent per
unit increase in entrance exam score. This association did not attain statistical significance (HR
0.97, \( p = 0.07 \)).
### Table 6. Results from adjusted model (including time-varying covariate)

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>HR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
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<td>Race</td>
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<tr>
<td>Black</td>
<td>ref</td>
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<td>0.858</td>
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<tr>
<td>Hispanic</td>
<td>0.905</td>
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<tr>
<td>American Indian</td>
<td>0</td>
</tr>
<tr>
<td>Asian</td>
<td>1.347</td>
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<tr>
<td>Unknown</td>
<td>0.043*</td>
</tr>
<tr>
<td>Pre-admission GPA</td>
<td></td>
</tr>
<tr>
<td>Entrance exam score</td>
<td>0.829</td>
</tr>
<tr>
<td>NURS2410 grade</td>
<td>0.990</td>
</tr>
<tr>
<td>A</td>
<td>ref</td>
</tr>
<tr>
<td>B</td>
<td>0.049*</td>
</tr>
<tr>
<td>B+</td>
<td>0.248</td>
</tr>
<tr>
<td>C</td>
<td>0.457</td>
</tr>
<tr>
<td>C+</td>
<td>0.347</td>
</tr>
<tr>
<td>D</td>
<td>0.321</td>
</tr>
<tr>
<td>D+</td>
<td>0.439</td>
</tr>
<tr>
<td>F</td>
<td>0.587</td>
</tr>
<tr>
<td>Semester-Specific GPA (time-varying)</td>
<td>0.411***</td>
</tr>
</tbody>
</table>

N = 290; * p<0.05, ** p<0.01, *** p<0.001

**Adjusted Cox regression models including fixed and time-varying covariates.** In the time-varying covariate-adjusted Cox regression model, after accounting for age, race, pre-admission GPA, entrance exam score, and NURS2410 grade, only semester-specific GPA (time varying) was a statistically significant predictor of dropout risk (HR 0.41, p < 0.001). For every unit increase in semester-specific GPA, the risk of dropout decreased by 59% (Table 6).

Semester-specific financial aid was not included as a time-varying covariate because, while the scholarships-only category appeared to be statistically significantly associated with the risk of dropout in unadjusted models, there were many students who also received scholarships in the combined category. This variable was therefore excluded from the adjusted regression model to avoid a biased inference.
When financial aid is re-coded as a dichotomous variable (no aid vs. some aid), there does appear to be a statistical significance. Compared to students who had no financial aid, the risk of dropout was twice as high in students who had some financial aid during the first semester (HR 2.41, \( p = 0.001 \)). However, the risk of dropout was lower among students who had some financial aid during the second (HR 0.61, \( p = 0.05 \)), third (HR 0.67, \( p = 0.09 \)), fourth (HR 0.76, \( p = 0.51 \)) and fifth (HR 0.21, \( p = 0.003 \)) semesters, compared to students who had no financial aid, although this association did not attain statistical significance for the third and fourth semesters (Table 7).

Table 7. Results from adjusted model (including time-varying covariates)

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Time-varying GPA (n = 168)</th>
<th>Time-varying financial aid (n = 498)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main predictor</td>
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<td></td>
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<tr>
<td>Age</td>
<td>0.376</td>
<td>1.035**</td>
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<tr>
<td>Time-varying covariates</td>
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<td></td>
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<tr>
<td>Semester 1 GPA</td>
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</tr>
<tr>
<td>Semester 2 GPA</td>
<td>0.535</td>
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<tr>
<td>Semester 3 GPA</td>
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<tr>
<td>Semester 4 GPA</td>
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</tr>
<tr>
<td>Semester 5 GPA</td>
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</tr>
<tr>
<td>Semester 1 Financial Aid</td>
<td>2.411***</td>
<td></td>
</tr>
<tr>
<td>Semester 2 Financial Aid</td>
<td>0.617*</td>
<td></td>
</tr>
<tr>
<td>Semester 3 Financial Aid</td>
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<tr>
<td>Semester 4 Financial Aid</td>
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<tr>
<td>Semester 5 Financial Aid</td>
<td>0.207**</td>
<td></td>
</tr>
</tbody>
</table>

* \( p<0.05 \), ** \( p<0.01 \), *** \( p<0.001 \)

**Timing of Student Dropout**

Of 121 students who dropped out of nursing school, 84 (69.4%) dropped out in the first semester, 21 (17.4%) dropped out in the second semester, 12 (9.9%) dropped out in the third semester, 4 (3.3%) dropped out in the fourth semester, and no student dropped out in the fifth semester (Table 8).
Table 8. Distribution of dropouts by nursing school semester

<table>
<thead>
<tr>
<th>Semester</th>
<th>Retained n (%)</th>
<th>Dropped out n(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>68 (18.0%)</td>
<td>84 (69.4%)</td>
</tr>
<tr>
<td>2</td>
<td>53 (14.1%)</td>
<td>21 (17.4%)</td>
</tr>
<tr>
<td>3</td>
<td>43 (11.4%)</td>
<td>12 (9.9%)</td>
</tr>
<tr>
<td>4</td>
<td>43 (11.4%)</td>
<td>4 (3.3%)</td>
</tr>
<tr>
<td>5</td>
<td>170 (45.1%)</td>
<td>0 (0.0%)</td>
</tr>
</tbody>
</table>

Retention (cumulative) decreased from 82% at the end of the first semester to 71% by the end of the fifth semester. The life table for dropout was built on one-semester increments for a total of five semesters. The survivor function is the cumulative proportion of the students that had not experienced dropout at the beginning of each interval. Table 9 displays the lifetable for student retention during the study period. A lifetable is the number of students who enter each interval (are still enrolled at the beginning of each semester), the number of students who experience dropout within each interval, the cumulative proportion of students surviving each interval, and a 95% confidence interval. A plot of the Kaplan-Meier survival function can be seen in Figure 3, and a plot of the hazard function can be seen in Figure 4. These function curves demonstrate the largest jump in students experiencing dropout at the end of the first semester, with dropout tapering off significantly after the second semester, and no dropout in the fifth semester.

Table 9. Lifetable for student retention during the study period

<table>
<thead>
<tr>
<th>Completed Semesters</th>
<th>At Risk</th>
<th>Dropped Out</th>
<th>Retention (Cumulative %)</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>498</td>
<td>84</td>
<td>82</td>
<td>0.78-0.85</td>
</tr>
<tr>
<td>2</td>
<td>346</td>
<td>21</td>
<td>77</td>
<td>0.72-0.80</td>
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<tr>
<td>3</td>
<td>272</td>
<td>12</td>
<td>73</td>
<td>0.68-0.77</td>
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<tr>
<td>4</td>
<td>217</td>
<td>4</td>
<td>71</td>
<td>0.67-0.76</td>
</tr>
<tr>
<td>5</td>
<td>170</td>
<td>0</td>
<td>71</td>
<td>0.67-0.76</td>
</tr>
</tbody>
</table>
Figure 3. Kaplan-Meier survival curve of student retention during the study period

Figure 4. Hazard function: the cumulative probability curve of student dropout during the study period
Summary

Results of the event history analysis indicate several variables influenced the likelihood of nursing student dropout. Older age, lower pre-admission GPA, lower entrance-exam scores, and lower grades in the NURS 2410 Pathophysiology pre-requisite course were all predictors of dropout risk. Asian students are far more likely to experience dropout than any other race category. Compared to no financial aid at all, students with scholarships only were less likely to drop out, but there were no significant associations when comparing no aid to any other category of aid. The time-varying models showed semester-specific GPA and semester-specific financial aid (dichotomous) as statistically significant predictors of dropout. As students progress through the program, those that had better grades were more likely to persist; those with lower grades were more likely to drop out. The results on financial aid are conflicting, but scholarships do improve chances for success when compared to no aid.
Discussion

This study aimed to explore the problem of nursing student attrition. Current nationwide nursing shortages, declining enrollments, and high rates of attrition in baccalaureate nursing programs present a major shortfall in the nursing workforce (Harris, Rosenberg, & O’Rourke, 2014; Merkley, 2016; Newton & Moore, 2009). The ill-understood nature of nursing student dropout behavior leaves nursing programs guessing at ways to improve student retention. On average, nursing student attrition has been reported in the literature as 50%, and as high as 85% for minority students (Harris, Rosenberg, & O’Rourke, 2014; Merkley, 2016; Newton & Moore, 2009). An aging nursing workforce coupled with an aging national population creates a critical need for nurses in the near future (AACN, 2017a; Harris et al., 2014; Merkley, 2016). The nursing shortage makes these high rates of attrition in nursing programs a threat to public health (Andrew et al., 2008).

Academic failure is a primary reason for attrition of student nurses, but studies have uncovered a multitude of other reasons students leave nursing programs. The theoretical framework for this study was Jeffreys’ (2015) Nursing Undergraduate Retention and Success (NURS) model which includes “the multidimensional factors that affect nursing student retention and success in order to identify at-risk students, develop diagnostic-descriptive strategies to facilitate success, guide innovations in teaching and educational research, and evaluate strategy effectiveness” (p. 426). The model was developed with an understanding of the unique and varying phenomenon of nursing student retention, the complex interaction of influencing factors, and with insight into the student nurse’s perspective.

The problem of the high rates of nursing student attrition is well documented in the literature (Harris et al., 2014; Merkley, 2016). Schools of nursing must carefully balance
accessibility and graduation rates with rigor and high board pass rates (Sewell, Culpa-Bondal, & Colvin, 2008; Jeffreys, 2012; Urwin et al., 2010). The cost of nursing programs is high; declining enrollments and the nursing faculty shortage necessitate efficiency and cost-effectiveness (Booker & Hilgenberg, 2010; Yucha et al., 2014). Student attrition represents massive loss of revenue for institutions, so targeted retention efforts could save money (Andrews & Schulze, 2018; Frankfort et al., 2015). Nursing programs are well accustomed to collecting, analyzing and utilizing evaluation data for accrediting purposes, but utilizing student data to predict failure in nursing is not well represented in the literature. The literature review summarized the existing body of knowledge on the problem of nursing student attrition, cost of nursing education, evaluation methods, factors affecting dropout, and common retention strategies.

The purpose of this study was to examine student-level data to identify factors that predict student departure from an undergraduate nursing program. This study used data from the undergraduate nursing program at Catholic University (CU), a small, Catholic, commuter college in the Southeastern U.S. From the Fall of 2015 through the Spring of 2019, 498 students attended the baccalaureate nursing program. An event history analysis (EHA) was conducted to determine which, if any, student-level variables are predictive of student dropout, and at what point in the program students are most likely to experience dropout. EHA is a form of linear regression that measures the likelihood of an event (in this case, student dropout) at a particular time (in this case, semesters in the nursing program), based on covariate factors. EHA is ideal for studying student attrition because of the ability to combine discrete and continuous variables, and variables that are constant over time and those that vary. EHA also has the ability to include cases that are censored (students who have not yet graduated but have not dropped out at the conclusion of data collection).
The dependent variable in the study was time to event. Independent variables that were examined in this study were exogenous variables factors that are present upon admission to the program and will not change) and time-varying regressors (factors that are subject to change each semester). Exogenous variables included age at admission to the Nursing program, sex (male or female), race/ethnicity, grades in the pre-nursing Pathophysiology course, and pre-nursing GPA (overall college GPA prior to admission to the Nursing program). Time-varying regressors included semester-specific GPA and financial aid status.

**Discussion of Findings**

The attrition rates in the study sample during the study period were comparable to national averages (Harris et al., 2014; Merkley, 2016; Newton & Moore, 2009). During the study period, attrition rates for the cohorts ranged from 26.7% to 41.7%. Of the 498 students in the study, 121 students (24.3%) dropped out. Of those, 82 were dismissed due to course failure and 39 were eligible to return but chose not to. Of those 39, 14 had already failed one nursing course. The progression policy of this program stipulates that a second course failure would result in dismissal.

**Exogenous variables.** Those factors that are present upon admission to the program and will not change are known as exogenous variables. In the unadjusted Cox model, age on admission was found to significantly impact the risk of dropout. For each additional year of age at admission, the risk of dropout increased by three percent. Students who are older tend to have increased responsibilities outside of school, including jobs and families. With the shift from an associate degree program to a traditional baccalaureate program, the number of older students has decreased on campus at CU. Jeffreys (2012) cautions against using age as an independent factor to predict retention. Instead, we should further examine the perceptions of older students.
to determine if it is lack of peers, difficulties with technology, additional commitments, or a combination of these that contribute to the increased risk of dropout.

Though males were a significant minority, gender was not found to be a significant predictor of dropout in neither the unadjusted nor the adjusted Cox regression models. Though gender did not play a role in dropout risk in this study, the gender gap in nursing must not be ignored. Programs must continue to strive for equal clinical opportunities and clinical placements for male students (Jeffreys, 2012; McLaughlin, et al., 2010), and providing male nursing role models (Benner, et al., 2010).

In both unadjusted and adjusted models, students of Color were more likely to drop out than White students, with Asian students being at highest risk. Jeffreys (2012) points out that stereotyping, prejudice, discrimination, and racism exist in nursing education, and insists that “nurse educators need to move beyond passively tolerating diversity to actively embracing it” (p. 29). Lack of role models among classroom and clinical faculty may contribute to social isolation for Asian and Latinx students at CU. Nursing faculty and administrators must recognize the model minority myth that “Asian Americans achieve universal and unparalleled academic and occupational success” (Museus & Kiang, 2009, p. 6). Stereotyping Asian students as a high-achieving group negates the academic diversity within this group and creates pressure to achieve success without much assistance (Jeffreys, 2012; Museus & Kiang, 2009). Faculty must not assume that Asian students understand class material because they did not ask questions in class, and should offer opportunities to ask questions anonymously, such as writing questions on a piece of paper to be answered at the end of class (Xu, Davidhizar, & Geiger, 2005).

Pre-nursing GPA and entrance exam scores were found to significantly affect risk of dropout. In the unadjusted model, for each unit increase in pre-nursing GPA, risk of dropout
decreased by 62%. For each unit increase in entrance exam score, risk of dropout decreased by 6%. Factors such as these contribute to a student’s prior educational experience. Programs, while striving to “select and retain students with greater likelihood of success” (Vandenhouten, 2008, p.ii), could increase retention by increasing admission standards such as raising the required pre-nursing GPA or entrance exam score. However, changes to admission criteria would decrease enrollment numbers even further, unnecessarily restricting access to the program (Bissett, 1995).

In the adjusted Cox regression model, while increased pre-nursing GPA and increased entrance exam scores resulted in decreased dropout risk, neither of these variables achieved statistical significance.

Higher grades in the pre-nursing Pathophysiology course (NURS 2410) were associated with lower risk of dropout, significantly so for grades of C+ or higher. Students achieving a grade of C in Pathophysiology were 4.9 times more likely to drop out than those receiving an A, and 8.6 times higher for a grade of F, even though the grading scale for Pathophysiology is the same as the grading scale for the nursing program (a 7-point scale with the lowest C at 80%, as opposed to the standard 10-point scale used for the other pre-nursing courses). Significant impact on nursing student success could be made in targeting retention efforts toward students in Pathophysiology.

**Time-varying regressors.** Those factors that are subject to change each semester are known as the time-varying regressors. Students whose semester-specific GPA was higher were significantly more likely to persist to graduation than those who failed a course or passed with a C. For each unit increase in semester-specific GPA, the risk of dropout decreased by 59%. CU School of Nursing has recently (Fall 2019) enacted a retention plan that includes intrusive advising for those students who have failed or withdrawn from one course. The plan consists of a
personal inventory of the students’ perception of factors contributing to their performance, what support services the students have used already, and what support services they are interested in using in the future. Students who fail or withdraw from a course are required to sign an action plan that requires them to check in periodically with the Retention Coordinator, attend all exam review sessions for their nursing courses, complete weekly computerized review questions associated with their textbooks, and meet with Student Services for academic coaching resources (learning style inventory, study skills, managing test anxiety, time management, etc.). Jefferies (2012) warns against programs that emphasize retention efforts only at academically weak students. This may “ignore and isolate the strengths and needs of academically well-prepared students” (p. 36), and programs should assess academically well-prepared students for other risk factors for attrition.

Financial aid presented a complex effect on dropout risk. Students who had scholarships only in the first semester were 59% less likely to drop out. This did not hold significance in any other semester. When examined as a dichotomous variable, students with some aid were more likely to persist than those with no aid in the second through fifth semesters, though less likely to persist if they had some aid versus no aid in the first semester. Since scholarships increased likelihood of persistence, especially in the first semester, this should be a priority for the university’s institutional advancement team. Currently, CU is working with their affiliated regional medical center to create sponsorships in which the medical center will pay up to $6000 per semester for eligible students, as long as they agree to work at the medical center after graduation for one calendar year for each sponsored semester. Only students in the second through fifth semesters will be eligible, and the data suggests this aid will have a positive effect on student retention. CU currently offers a Faculty Senate-sponsored scholarship, funded with
donations from Faculty, and a Board of Trustees scholarship, funded with donations from the Board. Efforts to improve participation in giving are underway in the 2019-20 giving cycle.

Attrition was much higher in the first semester than at any other point in the program, suggesting the need for additional support for first-semester students. Beginning a nursing program is a major challenge for students; many of them underestimating the time, effort, and organizational skills required (Jeffreys, 2012). Guidance may be needed for many beginning students in evaluating their study skills in relation to program requirements. The nursing program at CU conducts an orientation for new students with study tips, organizational tips, and even an appearance by a student who is farther along in the program who shares their own success strategies, but often students are overwhelmed with information on this day and do not assimilate the information about study skills until after they are falling behind, seeking help from their course faculty. If the study skills and organizational habits can be introduced earlier, in the pre-nursing Pathophysiology course, the students may have a chance to reap the benefits of forming these habits early, thereby improving their chance of success in the first semester.

**Implications for Practice**

The results of this research on nursing student dropout behavior gives some insight into student-level variables that increase dropout risk. This study provides actionable information for CU, and provides implications for nursing programs of similar size. In this section, I will discuss four implications for practice and two implications for policy informed by this research.

Currently, students who are out of progression due to withdrawal or course failure must meet with the Retention Coordinator and complete an action plan. This plan includes a questionnaire regarding what factors the student perceives have affected their performance and what campus services (if any) and study strategies they are currently using. This process has only
been in effect since data collection for this project concluded, but the data from these questionnaires may provide insight into the barriers to success that these students face. A preliminary examination of these questionnaires reveals that many students (76%) cite difficulty managing stress and too many commitments as factors impacting their performance. The first implication for practice is including a family orientation for new students in the program. This orientation could be helpful in improving family understanding and support and providing a realistic expectation of time commitments for undergraduate nursing students. Additional discussion of student affective and environmental factors is found in the Suggestions for Further Research section.

The findings of this study inform university administrators about effects of financial aid on student outcomes. The second implication for practice is the institutional advancement team can better target their efforts, using the findings that scholarships do improve likelihood of student persistence. The 2019-2020 giving campaign is underway. The data was presented at the CU Faculty Senate meeting in October, along with a statement from the student recipient of the 2018-19 Faculty Senate Scholarship, sharing with the faculty how their giving has impacted the student’s life. Data, along with student testimonial, can be impactful in increasing faculty giving. The Board of Trustees at CU was presented with this same data at their December meeting. Administrators received word of a private donor that has agreed to match the Board’s annual scholarship contribution if it reaches $20,000. This study provides evidence that scholarships impact nursing student persistence.

The significant influence of Pathophysiology grade on dropout risk is another opportunity for change within the program. The third implication for practice is a retention plan for students in the Pathophysiology course. Students in Pathophysiology who were not passing after the first
two tests are now required to meet with the Retention Coordinator and are placed on an action plan. They are given study resources, adaptive quizzing requirements, and a sample organizational calendar. These students are also required to check in with the Retention Coordinator periodically throughout the remainder of the semester. These meetings were offered to all students, but only required for those who did not pass the first two exams. It is the hope that this will translate to higher rates of success in Pathophysiology and habits that will carry over into the first semester of the nursing program.

Jeffreys (2012) and others (Blowers et al., 2003; Stone, et al., 2013) suggest peer tutors in nursing, including a peer-mentor-tutor program for all incoming nursing students. CU has had very little success in finding nursing students willing to take on responsibility as paid tutors, and has only had a single student tutor in the Pharmacology course alone for two semesters, despite active efforts to recruit student tutors for all nursing courses in the program. A final implication for practice is the suggestion to implement a peer program as outlined by Jeffreys (2012) as a means to afford the benefit of tutoring without the formal schedule (which makes the idea less attractive to the students), and without the expense incurred by the university for paid tutors.

**Implications for Policy**

The first implication for policy is that there may be a need for a change in the delivery of the prerequisite Pathophysiology course. Faculty in the Pathophysiology course, along with program administrators, have proposed a curricular change. The proposal includes increasing the total credit hours for Pathophysiology from four to six credit hours, splitting the content-laden course into two three-hour courses, Pathophysiology 1 and Pathophysiology 2. Increasing the credit hours will give faculty more time to include active learning and technology, while slowing down the delivery of course content. The new courses will be offered in eight-week format, and
the program eliminated two other credit hours of pre-requisites to keep the required credit hours for the program at 120. Given the significant effect of this course on dropout risk, the School of Nursing and university administration believe a change is warranted. While administration recognizes there can be no panacea, this curricular change has no appreciable financial impact on the program and can be implemented in the 2020-21 academic year.

The second implication for policy is to implement campus initiatives for diversity and inclusion. The campus is small (1200+ students), and there is no budget for an Office of Diversity, but there are currently no dedicated initiatives and no dedicated student organizations to improve feelings of inclusion for the students of Color on the CU campus. Campus Climate surveys have not revealed a high level of dissatisfaction among students of Color, but the fact that the campus is 40% non-white, it is surprising there are no programs dedicated for inclusion for students of Color. This study revealed that students of Color are at greater risk of dropout in the undergraduate nursing program. “To improve persistence for these students, faculty must identify and implement supportive services and assist with social integration” (Mooring, 2016, p. 205). Diversity in nursing is not simply a racial or ethnic issue. Nursing programs must also provide support for male students, older students, veterans, as well as students of varying religions and sexual orientation. Benner, et al. (2010) identifies “recruiting and retaining a more diverse faculty and student body” (p. 217) as an imperative for the future of nursing.

Limitations

Though it is a single-institution study, the variables in the model are all readily available to most nursing programs, and the rigors of nursing programs are very similar due to the uniform standards set forth by the two accrediting bodies for baccalaureate nursing programs. Results of this study may also be useful to programs of similar size.
This study has several limitations. Data collection is limited to a single, small, private, religious, healthcare-niche institution. The results may be applicable only to the study institution, or generalizable only to similar institutions. The study was able to capture data from eight cohorts, and while this is certainly more robust than information from a single cohort, a longer study period may reveal different results. Because the study institution is predominantly (65%) White, the number of minority students was small, especially Asian students (only 14 total during the study period). Another limitation is the missing data. The institution has multiple databases, not all of which are linked for ease of data collection and assembly. Standardized test scores administered throughout the program were not available due to a back-log in data entry, and so were omitted from the study as a time-varying covariate. Some (208) entrance exam scores were missing, partially for the backlog of data entry, partially because not all students entering the program are required to take the exam, specifically those who are transferring in nursing credits.

Student attrition is an issue with multiple contributing factors. This study is limited to those factors that are already measured by the study institution. The multitude of other factors such as family support, a student’s feeling of connectedness to an institution, family and work obligations, sense of self-determination, and mental and physical health issues are lost to this analysis. Another confounding issue is that conditions of the program may change over time. For example, admission criteria, curricular changes, teaching strategies and faculty changes could influence student retention and cannot be accounted for by the model. Though there were no significant changes to these factors during the study period, any analysis of a longer study period at this institution would be affected by policy changes and faculty changes.
Suggestions for Future Research

Retention is a complex issue that cannot be explained or accounted for with only one type of information. Jeffreys’ (2012) Nursing Undergraduate Retention and Success model utilizes individual factors as only one part of the picture. CU will be able to use the results from this study to inform further inquiry into student dropout behavior. Those factors that are identified as contributing to student dropout will inform collection of focused qualitative data that would improve the understanding of the student experience. This data, in turn, can be used to identify specific needs for student services and contribute to improving success.

This study provides valuable information about nursing student dropout behavior, but more investigation is needed. In building a successful retention plan, schools of nursing must gather background information such as was presented in this study, along with qualitative data from students experiencing dropout. Further research at this institution should explore the other aspects of the Nursing Undergraduate Retention and Success model: student affective factors including cultural values and beliefs, self-efficacy, and motivation; environmental factors including socioeconomic status, family financial and emotional support, family responsibilities, employment hours, living arrangements, and transportation; as well as professional integration factors such as student perception of helpfulness and advisement by nursing faculty, membership in professional organizations and attendance at professional events, and peer support. Exploration of these factors will necessitate the collection of qualitative data in the form of interviews and focus groups including all nursing students, not just those deemed “at-risk” for academic performance reasons.

Further research could also explore performance in specific courses, where the student went to high school or where they obtained previous college credits, and whether the students
attended dual-enrollment courses for nursing pre-requisites. These variables are not captured by the university currently. CU does capture whether students are classified as transfer students or not, but where they obtained such credits, or whether any of those credits were obtained via dual enrollment during high school, would require individual transcript searches.

**Conclusions**

Student dropout continues to be an area of concern for undergraduate nursing programs. Nursing programs face budget cuts, declining enrollment and faculty shortages (Horns & Turner, 2006; Yucha, Smyer, & Strano-Perry, 2014). To remain competitive, programs must not only meet minimum accreditation standards, but strive for continuous quality improvement (Phillips & Valiga, 2014). To achieve balance between accessibility, enrollment revenue, and NCLEX licensure exam pass rates, nursing programs must invest in retention efforts that improve student success and satisfaction within the program (Jeffreys, 2012; Merkley, 2016; Vandenhouten, 2008).

Student dropout is a complex, multifactorial problem, necessitating the use of multiple avenues of exploration. Survival analysis was used to explore the temporal nature of nursing student dropout, as well as identifying factors that contribute to dropout. Results demonstrated that previous academic experience (including pre-nursing GPA, entrance exam scores, and grade in the pre-requisite pathophysiology course), age, race, financial aid, and ongoing academic performance (GPA during the program) were predictive of nursing student dropout to some degree.

There is no need, however, to have every aspect of the dropout equation accounted for in order to take action. Jeffreys (2012) reminds us that “taking action and making a difference” (p. 289) far outweighs the risk of doing nothing. Even small gains in student performance can be
used as evidence to enhance and expand retention efforts. This study was able to draw on data already collected by the institution, alleviating the need for time-consuming and costly surveys. Exploration of the factors that may contribute to nursing student attrition, as well as the timing of student dropout, allow us to target retention efforts so that they can be better utilized and effective. In addition, the suggested retention strategies would be open to all students, not just those in jeopardy of dropout. This is an exciting time at CU with a capital campaign underway, and nursing student retention efforts have never been more important. This study has already made a difference in the nursing program at CU, and informs efforts to further explore the nursing student dropout problem.
Appendix: IRB Form

ACTION ON EXEMPTION APPROVAL REQUEST

TO: Michele Blackwell
    Education

FROM: Dennis Landin
    Chair, Institutional Review Board

DATE: April 2, 2019

RE: IRB# E11654

TITLE: Examining Nursing Student Dropout Behavior: An Event History Analysis


Review Date: 4/2/2019

Approved X Disapproved

Approval Date: 4/2/2019 Approval Expiration Date: 4/1/2022

Exemption Category/Paragraph: 4b

Signed Consent Waived?: N/A

Re-review frequency: (three years unless otherwise stated)

LSU Proposal Number (if applicable):

By: Dennis Landin, Chairman

PRINCIPAL INVESTIGATOR: PLEASE READ THE FOLLOWING –
Continuing approval is CONDITIONAL on:
1. Adherence to the approved protocol, familiarity with, and adherence to the ethical standards of the Belmont Report, and LSU’s Assurance of Compliance with DHHS regulations for the protection of human subjects*
2. Prior approval of a change in protocol, including revision of the consent documents or an increase in the number of subjects over that approved.
3. Obtaining renewed approval (or submittal of a termination report), prior to the approval expiration date, upon request by the IRB office (irrespective of when the project actually begins); notification of project termination.
4. Retention of documentation of informed consent and study records for at least 3 years after the study ends.
5. Continuing attention to the physical and psychological well-being and informed consent of the individual participants, including notification of new information that might affect consent.
6. A prompt report to the IRB of any adverse event affecting a participant potentially arising from the study.
8. SPECIAL NOTE: When emailing more than one recipient, make sure you use bcc. Approvals will automatically be closed by the IRB on the expiration date unless the PI requests a continuation.

* All investigators and support staff have access to copies of the Belmont Report, LSU’s Assurance with DHHS, DHHS (45 CFR 46) and FDA regulations governing use of human subjects, and other relevant documents in print in this office or on our World Wide Web site at http://www.lsu.edu/irb
References


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Curriculum Vitae

Michele Lee Blackwell
Michele.Blackwell@FranU.edu

Education
Louisiana State University, Baton Rouge, Louisiana (currently enrolled)
   Doctor of Philosophy in Educational Leadership and Research, 05/2020
Franciscan Missionaries of Our Lady University, Baton Rouge, Louisiana
   Master of Science—Nursing Education, 05/2008
      GPA 4.0, Scholarly Project: “Pediatric Triage Nursing, Trials and Triumphs”
   Bachelor of Science—Nursing, 05/2006
      GPA 3.90, Summa cum Laude, President’s Medal
   Associate of Science—Nursing, 05/1997
      GPA 3.88, Valedictorian, Summa cum Laude, Trustee’s Medal
Louisiana State University, Baton Rouge, Louisiana
   Bachelor of Arts—English Literature, Psychology Minor (05/1995)
      GPA 3.8, Magna cum Laude, College Honors

Teaching Experience
Franciscan Missionaries of Our Lady University School of Nursing:
   Assistant Professor, Nursing 4750, Nursing Concepts V (01/2015-Present)
   Assistant Professor, Nursing 3730, Nursing Concepts III (01/2013-Present)
   Assistant Professor, Nursing 3710, Nursing Concepts I (08/2016-05/2017)
   Assistant Professor, Nursing 4115, Pediatric Emergency Nursing (08/2014-Present)
   Course Development, Nursing 4115, Pediatric Emergency Nursing (02/2014-05/2014)
   Course Development, Nursing 3730, Nursing Concepts III (01/2013-12/2013)
   Assistant Professor, Nursing 2715, Care of Children (08/2008-12/2013)
   Adjunct Clinical Instructor, Nursing 220, Care of Children (08/2007-05/2008)

Professional Experience
RN, Charge Nurse, Pediatric Emergency Care Unit (11/2002—07/2008)
   Our Lady of the Lake Children’s Hospital, Baton Rouge, Louisiana
   Stephanie F. Cave, MD, Baton Rouge, Louisiana
RN, Charge Nurse, Emergency Care Unit (05/1998—07/1999)
   Our Lady of the Lake Regional Medical Center, Baton Rouge, Louisiana
RN, Charge Nurse, Emergency Care Unit (01/1998—07/1999)
   Riverview Medical Center, Gonzales, Louisiana
RN, Adult Emergency Department (06/1997–06/1998)
   University of Mississippi Medical Center, Jackson, Mississippi

Presentations
Poster Presentation: Infusing EBP Through Quantitative Article Critique
   OLOL College Research Showcase (02/2015)
Poster Presentation: Pediatric Patient Safety Checklist Collaborative
Transforming Research Into Practice Conference (08/2012)
Poster Presentation: Teaching Innovations: What Students Think
OLOL College Research Showcase (01/2013)
Panel Discussion: Implementing a Quality Enhancement Plan to improve student learning through writing
International Writing Across the Curriculum Conference, Indiana University (05/2011)

Awards
Sister Mary Crowley Endowed Professorship for Leadership, 2016, 2017, 2018
Baton Rouge District Nurses’ Association Celebrate Nursing Honoree, 2015
Sister Jean Renaux Endowed Professorship, 2014
Our Lady of the Lake College Alumni Association “85 Who Made a Difference” Honoree, 2010
Sister Agnes Fitzsimmons Endowed Professorship, 2009
OLOL College Faculty “Superstar” Award, 2009

Professional Affiliations
American Nurses Association/Louisiana State Nurses Association/
Baton Rouge District Nurses Association
Sigma Theta Tau International
Society of Pediatric Nurses
Phi Beta Kappa
Phi Kappa Phi

Service
Academic:
  FranU Faculty Senate Executive Board (President, 2019-present)
  FranU SON Assessment and Evaluation Committee (Chair 2010-2014)
  FranU Faculty Senate Executive Board (Vice President 2012-14)
  FranU Institutional Effectiveness Committee (Chair 2011, member 2016-pres)
  OLOL College Engaged Learning through Writing Initiative Committee (Chair 2009-10)
Professional:
  OLOL Children’s Hospital Shared Governance Council (College liaison 2009- Present)
  Baton Rouge District Nurses Association (President 2010, President-Elect 2009, Delegate to LSNA House of Delegates, 2011)
  Louisiana State Nurses Association Membership Committee (2010)
Community:
  Volunteer, Girl Scouts Louisiana East, Troop 10160
  Volunteer, St. George Catholic School
  Volunteer, American Red Cross
  Volunteer, United States Practical Shooting Association, Chief Range Officer