

**An Examination of the Influence of Nursing Resources
and Policies on Care Quality Outcomes**

by

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A dissertation submitted to the Graduate Faculty of
Auburn University
in partial fulfillment of the
requirements for the Degree of
Doctor of Philosophy

Auburn, Alabama
December 14, 2019

Keywords: Quality Outcomes, Nursing, Staffing, Policy, Nursing Homes, Hospitals

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Abstract

The nursing shortage has become a top priority in the evaluation of health care quality outcomes. The issue is confirmed by the combination of public availability of care quality ratings in both hospitals and nursing homes as well as the enactment of nursing workforce improvement policy. The included dissertation presents three studies, each with the purpose of extending our understanding of the nursing market and the role that geographical location of nursing resources and nursing workforce improvement policies characteristics play in creating positive (or negative) care quality outcomes. In the pursuit to understand the antecedents and consequences of care quality outcomes, previous scholars have consistently linked outcomes to the nursing supply. However, little is known about the relationship between the supply of nursing education resources and these resource's locality to hospitals and nursing homes on care quality outcomes. The first study, *Examining the Influence of Proximal Density to Nurse School Location on Quality of Care Outcomes in United States Nursing Homes* seeks to determine the degree to which proximal density of resources has an effect on care quality outcomes in nursing homes via the use of geographical information system software tools and an ordered logistic analysis. In the second study, *Examining the Influence of Proximal Density to Nurse School Location on Quality of Care Outcomes in United States Hospitals*, the same relationship is examined but with a focus on hospitals instead of nursing homes. Doing so allows for a more complete view of the nursing market. The third study, *Examining the Influence of Nurse Staffing Policy on Nurse Staffing Levels, 2004 - 2016*, explores the impact of nurse staffing policy on nurse staffing between 2004 - 2016 via a time series regression analysis. The purpose of this study is to examine if policies are

improving nursing supply in both hospitals and nursing homes. The findings of each of these studies extend our appreciation of the role of nursing education resources, health care providers, and those pushing for the enactment of nursing policies that influence care quality outcomes.

Acknowledgements

First and foremost, praise and thanks goes to my savior Jesus Christ for the many blessing undeservingly bestowed upon me. As I reflect on this journey, there have been many people who have prayed for me, believed in me, and pushed me to finish the marathon. I cannot thank each and every single one of you enough. I would not be where I am today without you. Truly.

Dissertation Committee

I would like to express my sincere gratitude to my mentor, advisor, and friend Dr. Geoffrey Silvera for his continuous support. His guidance has helped me grow and develop during my time in the Ph.D. program. He took me under his wing the first semester of the program, guided me on countless projects, and pushed me to be the best Ph.D. student I possibly could be. I cannot imagine having a better mentor. Thank you so very much for everything.

I would also like to thank my other professors, mentors, and those who served on my doctoral committee. Your insightful encouragement and support is much appreciated. I thank you all for allowing me the opportunity to have you on my team. Without your precious support, I would not be where I am today. I express my eternal gratitude for your genuine concern, inspiration, and input. I have gained valuable lessons from each of you. I especially want to thank you, Dr. Erwin, for opening your door to give me support during the early days of my journey.

Colleagues and Friends

I also want to thank my fellow colleagues and classmates for all of our stimulating discussions on public administration and policy matters, the ever-sleepless nights studying for

comprehensive exams, and for all of the fun and fellowship we have had over the past years. Many of you have served as role models, even though you may not know it. I appreciate your undying support, time, and tolerance that you afforded me from day one until now. A special thank you to Olivia Cook who has proven to be a loyal, knowledgeable, and awesome friend.

My Family

Lastly, but by no means least, I would like to thank my family for supporting me spiritually and emotionally throughout my academic walk and life in general. I am grateful to God for putting you all in my life. To my husband, when we began our journey together as husband and wife during our undergraduate careers, I never would have imagined that we would be finishing our doctorate programs together. We did it! Thank you for your constant support and unconditional love. To Mom and Dad, you have both encouraged my curiosity since I was a child. You have allowed me to conquer any task that I have set out to complete. You have loved me, supported me, and never doubted the end result of my doings. I love you both so much. To my sister and two sweet, precious nieces, you will never understand the love I have for you all and how much you drive me to do what I do. I will always appreciate the love, understanding, and faith exhibited by my family. You have *all* been the torch that has inspired me.

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List of Abbreviations

BON	Board of Nursing
CMS	Centers for Medicaid and Medicare Services
CNA	Certified Nursing Assistant
GIS	Geographical Information System Software
IOM	Institute of Medicine
LPN	Licensed Practical Nurse
NPA	Nurse Practice Act
RN	Registered Nurse

Chapter 1

Introduction

In this dissertation, *An Examination of the Influence of Nursing Resources and Policies on Care Quality Outcomes*, five chapters are included. This chapter, Chapter 1, illuminates the reasoning behind the dissertation and provides context for the completed studies. In order to clearly articulate the background of existing literature, definitions of the terms surrounding the subject matter are included. This depiction includes the different types of health care facilities and the different types of nurses employed within these health care organizations.

Overall, each study will address issues relating to the nursing shortage, patient outcomes, and regulatory policies. A previous pilot study examines the effect of proximity to nurse staffing resources (i.e. nursing schools) on care quality in nursing homes in Alabama. In examining this relationship, existing theories present differing conclusions. However, results from the pilot study concluded that the closer nursing schools were to nursing homes, the lower the quality outcomes were. This result serves as a foundation for the studies in this dissertation. Because of the limitation presented by sampling only the state of Alabama, this study serves as an introduction to the nursing market for the rest of the nation.

The studies revolve around the conceptual model of how proximal density correlates with quality outcomes. By looking at organizational resources such as nursing schools, we are also indirectly examining staffing and how it correlates to outcomes. The same is true for Study 3, which examines nurse staffing policies relationship with nurse staffing and, in turn, care quality outcomes. Figure 1 provides a conceptual model of the primary variables of interest.

Why Nurses and Healthcare?

In the past decade, the U.S. government and researchers have given much attention toward the need for health insurance among its citizens, yet little attention has been given to the ability to supply nursing services to the ever-growing and aging population. The aging of the population in the forthcoming decades will likely result in an increased demand for long-term care and other health care services, thus contributing to the need for a larger supply of nurses (McGinnis & Moore, 2006). Without the proper supply of a healthcare workforce, the rendering of health services to the older adult population will be more difficult.

Approximately 12 million older adults in the U.S. currently require long-term care, and this number is projected to rise to 27 million by 2050 (Kaye, Harrington, & LaPlante, 2010). Although informal caregivers provide the majority of long-term care services, a greater number of older adults will need formal care from nurses and other health care providers (McGinnis & Moore, 2006). This care will be rendered via home and community-based services such as assisted living and nursing home settings where many patients come from a hospitalization (Calmus, 2013). A proper supply of nurses is required to provide health care in these settings (Carayon & Gurses, 2008). Their services are essential to the provision of safe, effective care (Joanne Spetz, Lee, Harless, Herrera, & Mark, n.d.). Because of the inadequate supply of nurses, the results are adverse impacts on the health of the aging population (Weech-Maldonado, Meret-Hanke, Neff, & Mor, 2004).

The nursing shortage poses a large challenge for policy makers, health care administrators, and patients alike. In these realms, organizational outcomes are increasingly important. The lack of the nursing workforce may be contributing to monetary burden within organizations (Needleman, Buerhaus, Stewart, Zelevinsky, & Mattke, 2006). For patients, this is

equating to higher healthcare costs and lower healthcare outcomes. Given these trends, understanding health and quality outcomes of care in health care settings is a topic of increasing importance.

Health Care Industry

For the discussion of the included research studies, some brief definitions of terms used throughout the dissertation are offered.

Types of Health Care Facilities

Long-term care facilities provide assistance to persons with physical or cognitive impairments that result in functional limitations in activities of daily living (NIH, n.d.). The continuum of long-term care services includes home and community based services, assisted living, and nursing home facilities as well as an array of at-home services (LeBlanc, Tonner, & Harrington, 2001). Home and community based services offer an array of services, including case management, home health care, and personal care assistance with daily living activities, with 53% of all Medicaid long-term care spending going towards home and community based services in 2014 (Medicaid.gov, n.d.). Assisted living refers to a variety of residential care settings that provide personal care and 24-hour assistance with daily living activities within an environment that focuses on maximizing dignity, privacy, and autonomy (Lutfiyya, Gessert, & Lipsky, 2013). Nursing homes, a target population for one of the studies, operate under a medical model of care and provide acute rehabilitation and 24-hour skilled nursing care to the most functionally impaired (Murad, 2012).

Hospitals are another type of health care facility that is studied. This type of facility possesses a broad variety of medical professionals who offer a range of acute and terminal care services (WHO, 2017). In 2012, 34.9% of hospital stays consisted of patients 65 years of age or

older (Weiss & Elixhauser, 2012). However, in many cases, hospital stays serve as the initial entry into healthcare and are sometimes followed by discharge into a long-term care facility (Byrne & Dougherty, 2013). Organizational outcomes in a nursing home may be partially predicated on the prior care they received from nursing staff at a hospital (Freiman & Murtaugh, 1995). Additionally, healthcare organizations that are in a shortage of nurses will be competing for the same workforce in a network (Davis, Sloan, & Wunderlich, 1996). As such, these dynamic healthcare facilities are important to consider when examining the nursing market holistically.

Types of Nurses in Health Care Settings

Central to the delivery of quality nursing home and hospital care are registered nurses (RNs), licensed practical nurses (LPNs), and certified nursing assistants (CNAs). RNs require at least two years of nursing school and must be licensed in their state of employment. LPNs are not required to have a college degree, but they must pass an exam in their state of employment to become licensed. To take this exam, they must complete a state-approved training program. A CNA, also termed nurse's aide, must study between four and six weeks at an approved facility, such as a community college, and then pass an exam for certification. Typically, RNs and LPNs supervise CNAs. According to data from 2014, 13% of RNs, 49% of LPNs, and 46% of CNAs work in residential care facilities and home health care service settings. In the hospital setting, nursing staff was split into 61% RNs, 17% LPNs, and 25% CNAs (BLS, 2015b, 2015a). It is evident that nurses with a higher level of education tend to work in hospital settings as opposed to long-term care facilities.

Purpose of Studies

By combining geographical information system software (GIS) with existing nursing data, the first two studies in the dissertation will determine the influence of local nursing markets on health care quality outcomes. More specifically, the studies examine the influence proximal density of health care facilities to nursing schools has on care quality outcomes. Previous scholarship (Haun, Mahafza, Cook, & Silvera, 2018) has shown a negative relationship between proximal density to nurse education resources (nursing schools) and nursing home care quality outcomes. However, this was limited to a single state. The dissertation's studies will explore the relationship between local nursing markets via a national sample. The purpose of the third study will further illustrate the nursing market at the state and federal level, establish the extent to which nurse staffing policies are enacted, and provide insight into whether these policies have a relationship with care quality outcomes over time.

The overall goal of the dissertation will be to provide a glimpse into one aspect of the complexities that affect the quality of health care (particularly in nursing homes and hospitals). This will be accomplished through a focused exploration of the nursing market and its implications for care quality outcomes. This research is necessary to understand the current state of the nursing system and to find solutions to the problem (such as improvement in nursing workforce policies). Understanding the explored components will assist experts in the healthcare industry to improve supply and demand for nurses in terms of improving quality and educating future workforce generations. Additionally, the use of GIS is important in determining the future directions of research tools and methods.

Statement of the Problem

There is a well-established link between nurse staffing levels and health care quality outcomes (Bowers, Esmond, & Jacobson, 2000; Kim, Harrington, & Greene, 2009; Park & Stearns, 2009a) with shortages in nursing supply directly threatening health care facilities' ability to meet their quality goals. A known driver of the nursing shortage is the inadequate number of nursing schools and shortages in faculty at these schools (Allen, 2008; Janiszewski-Goodin, 2003; Nevidjon & Erickson, 2001). While researchers have established the influential drivers of the nurse shortage in hospitals, few scholars have examined the impact of nursing supply on quality outcomes in long-term care facilities, such as nursing homes.

Representing the largest group of health care professionals, nurses are a primary health care resource (Rosseter, 2011). Previous research indicates a strong association between quality of care and nurse staffing across health care settings and contexts (Needleman, Buerhaus, Mattke, Stewart, & Zelevinsky, 2002). The link between nurse staffing and quality of care has been found in nursing homes and hospitals, where nursing care is a reason for admission (Bowers et al., 2000; Shields & Kick, 1982). Still, the nursing shortage has been acknowledged and has persisted despite extensive scholarship pointing to its negative impact on care quality (L. H. Aiken et al., 2002; Janiszewski et al., 2003; Kutney-Lee et al., 2009).

Vacancy rates for RNs across health care facilities continue to rise and as of 2016 are at 8.5 percent (NSI Nursing Solutions Inc., 2016a). These vacancy rates, along with the overall shortage, are associated with higher levels of turnover and burnout among nurses. This has a direct influence on organizational performance and profitability, aligning with much of the public administration literature (Andrews & Dziegielewski, 2005; Cyert & March, 1963). In addition, negative ramifications of the nursing shortage can result in unnecessary safety concerns as well as reduced patient satisfaction (Roberts, 2003).

Of course, job dissatisfaction leads to nursing staff leaving the profession to find other types of work (Janiszewski-Goodin, 2003). In 2005, Dr. Peter Beurhaus “found 98 percent of nurses felt that the nursing shortage would negatively impact stress levels and 93 percent agreed that it would negatively impact patient care” (Needleman et al., 2006). Additionally, Tubbs-Cooley and others found that the instance of patient readmission increased when nurses were assigned four (or more) patients (Tubbs-Cooley, Cimiotti, Silber, Sloane, & Aiken, 2013a). All of these conditions lead to lower levels of patient satisfaction.

Previous research has established that the nursing shortage has resulted in burnout and job dissatisfaction (Aiken et al., 2002). According to Kutney-Lee and others, the nursing work environment is significantly related to patient satisfaction measures (Kutney-Lee et al., 2009). It was recommended that better nurse staffing could improve the overall patient experience and quality of care in hospitals (Kutney-Lee et al., 2009). These specific patient outcomes have been examined over time in hospital state cases from 1995 to 2000. Needleman was a leading researcher on a project which revealed that different patient outcomes are indeed affected by the nurses’ work (Berney & Needleman, 2006).

Beyond patient outcomes, there are multiple organizational costs connected to the nursing shortage, making the shortage a major economic issue as well. High nursing turnover rates represent organizations’ inability to retain their workforce (Jones & Gates, 2007). Along with this turnover, the lack of an adequate supply of nurses exacerbates the costs of declined care quality outcomes (Spetz, 2015). Therefore, it is clear that we are in dire need of more nurses in health care (Aiken, 2008).

A key factor in the persistence of the nursing shortage is the number of nursing schools equipped to prepare the next generation of nurses (Anderson, 2014). In the U.S., aging faculty,

budget constraints, and limited student capacities at existing nursing school programs limit the schools' ability to increase the number of workforce-ready nurses (Rosseter, 2015a). In addition to the shortage of nurses, there has been a shortage for nursing student capacity since the 1990s that is expected to worsen in the coming years (Janiszewski Goodin, 2003). Just like the rest of the nursing population, nursing faculty are aging and retiring from their work positions. Other reasons for leaving include low compensation, high cost of preparation for a position, and negative working conditions (Nevidjon & Erickson, 2001).

Nursing workforce policies are being implemented in an attempt to recruit high school students and educate them about the nursing field (Nevidjon & Erickson, 2001). To aid in this endeavor, some hospital systems in the U.S. are creating "support programs" to add more faculty and student slots to college nursing programs (Nevidjon & Erickson, 2001). At Texas A&M, \$425,000 in scholarships was awarded to students by a local hospital to complete a four-year bachelor's program in nursing (Nevidjon & Erickson, 2001). Other policy initiatives are in the realms of staff-to-patient ratios, retention of staff strategy implementation, and other financial incentives. Collaborative efforts like these provide a glimpse at the various possible solutions to the nursing shortage. In summary, it is clear that we are in need of more nurses to improve care quality outcomes. Moreover, further research is necessary to uncover how this need can be met and which practical strategies policymakers can employ to efficiently meet said need.

Research Questions

Three research questions are evaluated. The first research question for the studies is motivated by a past work (Haun et al., 2018). Building from a study with a sample from a single state, the three research questions are derived for an examination at the national level.

1) *What is the relationship between proximal density of nursing schools to nursing homes and care quality outcomes in nursing homes in the United States?*

The second research question builds from the first research question and expands to another healthcare facility type, hospitals.

2) *What is the relationship between proximal density of nursing schools to hospitals and care quality outcomes in hospitals in the United States?*

The third research question considers how the nursing shortage is currently being addressed, largely through regulation. The healthcare political environment is an inherent mainstay. Therefore, this research question seeks to uncover if nurse staffing policies are effective in efforts to improve the amount of nurses; or, perhaps, if other solutions are needed.

3) *What is the relationship between nurse staffing policies and the amount of nurses in the United States?*

Methods

Study 1 & Study 2

Logistic Regression

In the first two studies, the dependent variable of interest is care quality outcomes. This variable takes shape as a star-rating from 1 (much below average) to 5 (much above average) stars for a facility. The independent variables are a mix of continuous and categorical variables. The dependent variable is treated as ordinal in Study 1 and dichotomous in Study 2; therefore, Ordinary Least Squares (OLS) regression is not the most appropriate statistical model to utilize. Instead, logistical regression is the more appropriate model in the studies.

In logistic regression, the goal is the same as OLS regression; the researcher wishes to model a dependent variable in terms of one or more independent variables. However, the OLS

method is useful only for continuous dependent variables. Logistic regression is useful for dependent variables that are categorical. These variables can have two categories (e.g., male/female) or more than two categories. When there are more than two categories, they can be ordered (e.g., weak/neutral/strong) or unordered (e.g., married/single/divorced/other). In Study 1, the dependent variable has more than two categories and is ordered. The star-ratings are ordered 1 to 5, 1 being the lowest quality score for a healthcare facility and 5 being the highest quality score. In Study 2, the dependent variable has two categories and is dichotomized. The star ratings were dichotomized as “high rating,” “low rating,” 1-star, 3-star, and 5-star.

Logistic regression can be further depicted in these studies as ordered logistic regression for Study 1. In logistic regression, the model deals with the ordered variable by transforming it (Dayton, 1992). This is an extended technique from OLS analysis where the outcome variable is categorical, otherwise a good statistical method for modeling the care quality outcomes of healthcare organizations. Ordered (or ordinal) logistic regression is sometimes referred to in the literature as the constrained cumulative logit model, proposed by Walker and Duncan (1967). Then, the model was later referred to as the proportional odds model (Agresti, 2007; Ananth & Kleinbaum, 1997; McCullagh, 1980). Ordered logistic regression has been applied to multiple studies regarding quality outcomes due to the nature of the dependent variable being ordinal (Capezuti, Strumpf, Evans, Grisso, & Maislin, 1998; Nicholas G Castle, Engberg, & Liu, 2007). These studies focus specifically on care quality outcomes for nursing homes and hospitals. Interpretation of the model parameters yields the selection of an appropriate and parsimonious model and their implications for care quality outcomes in healthcare facilities.

When a dependent variable is ordinal or dichotomous, there is a quandary. A multinomial logit model ignores the ordering of values. Since the dependent variable is categorized in Study

1, we use an Ordered Logistic Regression model. Because the dependent variable is dichotomous in Study 2, we use a Binary Logistic Regression model -

$$\text{logit}(\text{star_rating}) = \beta_0 + \beta_1(\text{size}) + \beta_2(\text{ownership}) + \beta_3(\text{chain}) + \beta_4(\text{medicaid_occupancy}) + \varepsilon$$

Where:

β_0 = threshold

β_{1-4} = parameter

ε = error term

Model Fitting and Statistical Software

The above model will be utilized with the data below using SPSS software with ordinal outcomes link function specification.

Independent Variable	Operationalization	Source
Size	the number of residents in the facility during the 2-week period prior to inspection, discrete variable	Nursing Home Compare, Hospital Compare
Ownership	whether facility identifies as for-profit, nonprofit, or government entities, with nonprofit as the reference category, dichotomous variable	Nursing Home Compare, Hospital Compare
Chain	whether facility is member of facility chain, dichotomous variable	Nursing Home Compare, Hospital Compare
Medicaid Occupancy	average daily Medicaid occupancy rate, continuous variable	Nursing Home Compare, Hospital Compare

These variables have been selected based on a variety of studies looking at care quality outcomes for nursing homes and hospitals (N. G. Castle, Engberg, & Men, 2007; Needleman, Buerhaus, Mattke, Stewart, & Zalevinsky, 2002; Tubbs-Cooley, Cimiotti, Silber, Sloane, & Aiken, 2013b; Zinn, Spector, Hsieh, & Mukamel, 2005). Other indicators of quality outcomes such as quality measures (e.g., pressure sores, severe pain) and nursing turnover are included in

the dependent variable star-ratings. The model is fit through the procedure of maximum likelihood estimation. The assumption that all the logit surfaces are parallel should be tested. If non-significant, this would be evidence that the logit surfaces are parallel, and that the odds ratio can be interpreted as constant across all possible cut points of the outcome. Cut points, in this case, would be a star-rating of 1 to 2, 2 to 3, 3 to 4, and 4 to 5 stars. We hypothesize that there will be a negative relationship between proximity to nurse staffing resources and nursing home/hospital quality outcomes.

Key Dependent Variables

Although the dependent variables for each study is care quality outcomes, it is important to highlight the fact that the care quality score is calculated from the following scoring categories: overall care rating, health inspection rating, quality measure rating, and staffing rating. These variables will be modeled individually and collectively as the *Overall* care rating. The five measures are derived as star ratings, ranging from 1 star (much below average) to 5 stars (much above average). These quality ratings are part of the *Nursing Home Compare* and *Hospital Compare* public reporting site for nursing homes and hospitals that participate in Medicare or Medicaid. The five-star rating system considers the multi-dimensional nature of nursing home and hospital quality to determine facility performance.

In the *Nursing Home Compare* dataset, *Overall* rating is based on facility performance for all star rating measures collectively, each of which has its own five-star rating. *Staffing* rating is based on two measures: 1) Registered nurse (RN) hours per resident day, and 2) total staffing hours (RN+ licensed practical nurse (LPN) + nurse aide hours) per resident day. *Quality Measure* rating is centered on performance in 16 of the 24 QMs that are currently posted on the *Nursing Home Compare* website, and that are based on MDS 3.0 assessments. *Health Inspection*

rating is created by the number, scope, and severity of deficiencies identified during the three most recent annual inspection surveys, as well as substantiated findings from the most recent 36 months of complaint investigations (“Design for Nursing Home Compare Five-Star Quality Rating System: Technical Users’ Guide,” 2017).

The *Overall* rating is assigned in a five-step process: 1) begin with health inspection rating, 2) add one star if the staffing rating is four or five stars and greater than the health inspection rating. Reduce one star if the staffing rating is one star, 3) add one star if quality measure rating is five stars and subtract one star if it is one star, 4) if health inspection rating is one star, overall rating cannot change by more than one star based on staff and quality measure rating, 5) if a facility is a special focus facility, the maximum overall rating is three stars.

In the *Hospital Compare* dataset, the *Overall* hospital rating includes 57 of the more than 100 measures reported on Hospital Compare, divided into 7 measure groups or categories: mortality, safety of care, readmission, patient experience, effectiveness of care, timeliness of care, and efficient use of medical imaging. This rating is based on facility performance for all star rating measures collectively, each of which has its own five-star rating, just like in the *Nursing Home Compare* dataset.

Key Independent Variables

The key independent variables include: 100-mile proximal density, 50-mile proximal density, 20-mile proximal density, and 10-mile proximal density. These proximal densities were chosen based on the literature regarding nursing supply and demand, later discussed in this chapter. Generally speaking, nurses typically remain in the same state when entering the workforce post graduation. However, migration of nurses may be influenced by whether a facility is within a rural or urban area. Nurses typically lean towards pursuing jobs in urban areas

where there are typically higher pay scales. These movement patterns are also influenced by a nursing school's relationship with healthcare organizations in its surrounding area. The proximal densities also help shed light on the strength of the ties of the nursing resources (Friedkin, 1980; Marsden & Campbell, 1984). The ties can be quantified by the amount of "resources" there are in a given area. However, the extent of these chosen proximal densities are exploratory in nature at the national level and yield a limitation to the studies.

Proximal Densities

The proximal density data will be developed by using GIS software to examine the proximate relationships between nursing schools and healthcare organizations. Graph layout algorithms visualized proximity matrices from the results leading to the ability to convey specific characteristics of the data. To identify the distance between the healthcare facility and nursing schools, geocoding was utilized. Using Google Maps, addresses were obtained for all schools and nursing facilities and stored in Excel. The addresses were then used through the geocoding provider MapLarge1 in order to identify their exact latitude and longitude.

These coordinates were then added to a shapefile of the nation which was obtained from the Census Bureau's Tiger/Line ® Files. Some errors existed in the geocoding which led to a low amount of the point estimates being slightly off target (i.e., P.O. Box location instead of building location). These points were then re-projected along with the U.S. shapefile into UTM 16N, Universal Transverse Mercator projection for which the nation is most accurately displayed. The procedures created our key-independent variables at the differing proximities from 100-miles to 10-miles. The densities of resources were then counted within each set proximity.

Study 3

The primary objective of Study 3 is to explore nurse staffing policies relationship to nurse staffing levels in nursing homes and hospitals. Specifically, staff-to-patient ratio policies are examined. To analyze this effect, time series regression analysis were utilized from 2004 and 2016. These years were selected based on the availability of data for all variables in the study. The sample includes every state in the nation and nursing policies that are implemented within those states. This mirrors the samples in Study 1 and Study 2. Initially, summary statistics and plots were created to familiarize results from the data and test for assumptions of linear regression tests.

Time Series Analysis

To explore the empirical linkage between enacted policy and care quality outcomes the following specific time series model can be utilized:

$$\begin{aligned} \text{nurse staffing}_{s,t} = & \beta_0 + \beta_1 (\text{policy amount}_{s,t}) + \beta_2 (\text{state population}_{s,t}) + \\ & \beta_3 (\text{state spending}_{s,t}) + \beta_4 (\text{median household income}_{s,t}) + \\ & \beta_5 (\text{percent of population in urban area}_{s,t}) + \beta_6 (\text{percent of area in urban area}_{s,t}) + \\ & \beta_7 (\text{health ranking}_{s,t}) + \beta_8 (\text{state control}_{s,t}) \varepsilon_{s,t} \end{aligned}$$

Where:

β_0 = intercept

β_{1-8} = parameter

s = state

t = year

ε = error term

Key Dependent Variables

The dependent variable is amount of nurse staffing. The nursing workforce data includes registered nurses, licensed practical nurses, and nurse aides, all of the nursing professions included in the U.S. Census Bureau database. The primary dependent variable is the number of nurses and then standardized by the number of beds at hospitals and nursing homes. For

example, if Alabama reported a total of 1000 nurses in 2010, 100 hospital beds, and 10 nursing home beds. Then, the dependent variable for hospitals would be 10 and for nursing homes would be 100.

Key Independent Variables

The independent variable of interest is nursing staffing policy, specifically, staff-to-patient ratio policies. This data comes from the National Conference of State Legislatures and Congress and the GovTrack.us databases. Along with those sources, the Nursing Practice Act websites at each state's Board of Nursing can be utilized to easily triangulate state regulations (NCSBN, 2016). The policies that will be included directly relate to the nursing workforce and their supply. The following bibliographic search strategy was utilized.

Bibliographic search databases: The National Conference of State Legislatures and Congress, GovTrack.us, and the Congress.gov.

Search Terms: The following keywords were the search terms – nurse, nursing, nursing law, nurse staffing, health, certification, license, and staffing.

Legislation selection criteria: Policies chosen were enacted status between 2004 and 2016.

Controls were selected based on past research regarding the best predictive indicators for care quality outcomes. Many controls come from state census data which can be obtained from the U.S. Census Bureau website (US Census Bureau, 2017). Census data reveals the number of nurses in a state, both RNs and LPNs. The amount of nursing schools, hospitals, and nursing homes by state per year is included as well. The population of individual states, their budgets, median household income, and percentage of population in urban area of the state is included as

well. Additionally, the state's health care ranking and amount of state's residents is included.

Definitions of the variables can be found in the table below.

Definitions of Variables

Variable	Definition
Policy Amount	= number of policies enacted/adopted between 2006 – 2016, by state
State Population	= total amount of individuals between 2006 – 2016, by state
State Spending	= total spending amount between 2006 – 2016, by state
Median Household Income	= amount of income earned by given household where half of the homes in the area earn more and half earn less between 2006 – 2016, by state
% of Pop in Urban Area	= percent of population living in an urbanized area (population of 50,000<) between 2006 – 2016, by state
% of Area in Urban Area	= percent of land area in an urbanized area (population of 50,000<) between 2006 – 2016, by state
Health Ranking	= state health ranking between 2006 – 2016, by state ranging from 1 (worst) to 50 (best)
State Control – Split	= split party control between 2006 – 2016, by state
State Control – Republican	= republican party control between 2006 – 2016, by state

Literature Review

Addressing the Problem

Health policies have been created relating to the nursing workforce shortage in an effort to improve nursing supply, their educational levels, and patient healthcare outcomes (Buchan & Aiken, 2008a). Provoking the nursing shortage over the past decade has been due to the rise in health care expenses, lack of healthcare personnel, poor clinical outcomes, and the aging population, making these policies even more important than before (Janiszewski-Goodin, 2003). Nursing policies are heavily influenced by the nursing market that exists in each state (Buchan & Aiken, 2008a), as well as the health status of the state as a whole (Mosadeghrad, 2014). The number of nursing educational institutions and faculty available to prepare more nurses for the workforce might also be a variable (Peterson, 2001). Because of the unique landscape of the

nursing profession and the work they perform, those working in this field are at risk based on ever-present poor work environments (Trinkoff et al., 2008). As stated by Russell, because “the United States Constitution does not include provisions to regulate the practice of nursing, the responsibility falls to the states” (2012). The protection, in this case, comes in the form of laws and regulations (Russell, 2012).

Approximately 14 states are currently addressing nurse staffing numbers in hospitals through laws and regulations, but not necessarily in other facilities, such as nursing homes (ANA, 2016). The lack of policy in some states is mainly due to a slow progression of legislation and lack of research (ANA, 2015). This persists despite evidence that shows that states with policies regarding specific ratios have seen improved quality outcomes and higher levels of workplace productivity (Aiken, 2010).

Nurse-to-patient ratios are dependent upon the facility type, patient acuity, and overall staffing plan of the establishment (Holcomb, Hoffart, & Fox, 2002). For example, in a hospital’s intensive care unit where patients need more care, there may be a 1:1 staff/patient ratio (ANA, 2015). In contrast, many states do not have regulations requiring appropriate nurse staffing (Hyun Shin, Eun Koh, Eun Kim, Jin Lee, & Song, 2018). However, there is a lack of research regarding the appropriate levels of nursing within other types of organizations, such as nursing homes (Werner, Konetzka, & Polsky, 2013).

In order to inform nurses on what laws exist regarding standards of practice, all states possess a Nurse Practice Act (NPA), which is reviewed and approved by each individual state's legislature. Through the NPA, a Board of Nursing (BON) is established that “has the authority to develop administrative rules or regulations to clarify or make the law more specific. Rules and regulations must be consistent with the NPA and cannot go beyond it. These rules and

regulations undergo a process of public review before enactment” (Russell, 2012). Together, in all 50 states, the BON represents the National Council of State Boards of Nursing (NCSBN).

Although a NPA is distinguished as providing guidelines to better quality of care, some—but not all—of the acts also detail rules and regulations to dissipate the nursing shortage issue. As previously mentioned, these policies are largely predicated on the nursing market supply, health of the state, availability of nursing education, and each particular state’s need overall. State’s policy preferences are a mechanism to address the nursing shortage and need to be studied further in order to determine what elements are working and which are not. Other types of legislation that have been created in an effort to maintain and increase the nursing workforce include loan forgiveness, career progression initiatives, and long-term work contracts (ANA, 2016).

The nursing workforce shortage issue is complex, and developing effective solutions is difficult due to the inability to isolate contributing factors. Systematically speaking, the greatest impact on the nursing shortage will involve multiple interrelated variables. The lack of nursing educators and adequate facility size is one of these variables. With a shortage of nurses, this creates stressful work conditions such as long work hours and lower pay grades. The health care delivery system then becomes a broken machine that cannot effectively deliver care to patients without the correct numbers of healthcare providers. One must also consider the impact of reimbursement, legislation, and regulation. Failure to consider all of these relationships will ultimately lead to a limitation of appropriate and necessary solutions.

Another area for improvement is the poor work environments that contribute to high nursing turnover rates. Retaining nurses may go beyond how the organization values its staff, though, and this is foundational to understanding the nursing turnover issue. Attracting and

retaining staff is vital to health care facilities' success in the ever-present competitive market (Nevidjon & Erickson, 2001). Reasons behind such high nursing turnover rates include “autonomy, salaries, schedules, credibility gap, and professional respect” (Nevidjon & Erickson, 2001). This goes hand-in-hand with overall job dissatisfaction. After finding the issues that are particular to a specific organization, flexible and supportive policies and benefits should be created accordingly in order to dissolve the nursing shortage crisis (Nevidjon & Erickson, 2001).

The ANA recommends for organizations to “investigate the potential for using technological advances to enhance the capacity of a reduced nursing workforce” (ANA, 2016). Higher education is another solution and one that is more likely to lead to better patient quality outcomes (Rosseter, 2015). Vacancy rates for registered nursing positions across health care facilities are on the rise, a trend that suggests that existing solutions have not been effective in addressing the nursing shortage problem (NSI Nursing Solutions Inc., 2016b).

Measuring Quality

In 2010, the Institute of Medicine (IOM) report, *The Future of Nursing: Leading Change, Advancing Health*, gave thorough recommendations for states to implement regarding nursing workforce improvement (IOM, 2011). This report came about after a large amount of evidence-based research came forth showing the strong ties between the mix of the nursing workforce and patient quality outcomes, as well as the costs associated with these outcomes. The IOM report identifies the nursing profession, whose more than three million members make it the largest healthcare profession, as central to efforts to remake the U.S. health care system so that all Americans have access to high-quality and cost-effective care. The committee's report provides a blueprint for transforming the nursing profession to improve the quality of healthcare and the way it is delivered (IOM, 2011).

Quality standards are just one of a plethora of regulatory compliance mandates that health care facilities must meet. The Department of Health and Human Services (HHS) and the Centers for Medicare & Medicaid Services (CMS) recognize quality in health care as a priority. According to the CMS, quality measures are tools that help “quantify healthcare processes, outcomes, patient perceptions, and organizational structure and/or systems that are associated with the ability to provide high-quality health care and/or that relate to one or more quality goals for health care. These goals include: effective, safe, efficient, patient-centered, equitable, and timely care” (CMS, 2016b). The quality measures are used for evaluation, public reporting, quality improvement, and pay-for-reporting programs (AHRQ, 2016; CMS, 2016b).

Quality measures found in the Nursing Home Compare database are created from health inspections, staff ratings, and 11 physical and clinical measures of quality for nursing home residents (Medicare.gov, 2017b). In the Hospital Compare database, overall quality measures are generated from mortality, safety of care, readmission, patient experience, effectiveness of care, timeliness of care, and efficient use of medical imaging (CMS, 2016a).

These quality measures are important because they aid in improving the quality of health care organizations (Berwick, James, & Coye, 2003; Lazar, Fleischut, & Regan, 2013). It has been proposed that quality measurement and the improvement of these measures can significantly help “cure” the health care industry in terms of costs and patient outcomes (Berwick & Godfrey, 1991; Chassin & Galvin, 1998; Fallowfield, 1990). Quality measurement, through the continuous examination of volume, structure, outcomes, and processes, can be a useful guide for the public when deciding where to obtain their health care services. Additionally, these measurements are of importance for researchers and practitioners wanting to further research the relationship between quality and outcomes.

Theoretical Lenses

The purpose of this dissertation is to expand the knowledge about how local nursing markets influence care quality. In doing so, geographical implications that highlight fundamental organizational theories are taken into consideration. These theoretical lenses serve as a foundation for the development of hypotheses for the research studies. The objective of the studies is to determine the influence of proximal density of nurse staffing resources (i.e. nursing schools) on care quality outcomes. Proximal density is a measure of the concentration of resources relative to a specific location. In this study, proximal density is used to measure the number of nurse education resources within a specified proximity to a health facility (i.e. 100-miles). As this relationship has yet to be explored in a national context, it is unclear whether we should expect a positive relationship, as suggested by social network theory (Granovetter, 1983), or a negative relationship, as resource dependence theory would advocate (Pfeffer & Salancik, 1978).

Social Network Theory

Social network theory suggests that as proximal density increases, health care facilities will make stronger ties to nursing staffing resources (Granovetter, 1983), which will lead to better overall outcomes. Conversely, the resource dependence theory suggests that ready access to nurse staffing resources will decrease replacement costs of nursing staff, in turn lowering commitment between health care organizations and their nurses and diminishing care quality (Wernerfelt, 1984). Comparing the outcomes from national studies to the state level examination opens a discussion about individual versus aggregate effects on quality outcomes.

Proximity's connection to social network theory makes this conceptual lens the most appropriate for this examination. Social network theory is defined as "a tool for linking micro

and macro levels of sociological theory. The procedure is illustrated by elaboration of the macro implications of one aspect of small-scale interaction: the strength of dyadic ties” (Granovetter, 1973, p. 1360). In a recent study, the social network theory served as the basis for interpreting worker mobility and movement patterns, resulting in the discovery of the strength of social ties as an influence of movement (Musolesi & Mascolo, 2007). Relevant to this study, social network theory suggests that human and nonhuman elements work together to describe how organizations work in autonomy while remaining in a network (Granovetter, 1983); in addition, this theory is applied to different health care organizations, professional types, and their working social networks (Cott, 1997). In this case, the network involves nursing homes and schools that make up the *physical proximity* and nursing students, and professional nurses are the *professional proximity* (Cott, 1997). In this study, the network consists of the *physical proximity* which includes the nursing homes and nurse education resources as well as the *professional proximity* consistent of nursing students and professional nurses (Cott, 1997). Ultimately, the network is made up of subparts which work together to create associations (Granovetter, 1983).

Depending on where nurses work, the relationships between schools and facilities, and other socio-complex elements, the network may be strong or weak. Based on the theory, weak ties are less likely to be involved with each other, and strong ties are more apt to be tightly knitted relationships. Granovetter describes the “strength” of a tie as a combination of the “amount of time, the emotional intensity, and the intimacy (mutual confiding), and the reciprocal services which characterize the tie) (1977, p. 1361). In this case, time may equate to schools sending their nursing students to particular nursing facilities to complete practicum hours. Emotional intensity may relate to the success or failure of students in their fields of study at said facilities and potential job placement afterwards. Nursing schools and healthcare facilities may

develop mutual confidence through these relationships. Both wish for highly equipped students, which will result in increased benefits for both parties. Reciprocal services may be the ability of a facility to help prepare a student to enter the field and the ability of a nursing school to supply students that can fill vacant nursing positions in the surrounding geographic area.

The closer and stronger ties would suggest that the outcomes would be better (Granovetter, 1983). In other words, the organizations within those strong social ties will have better outcomes than those who have weak ties. These strong social ties will have the identity of the above discussed characteristics such as time and mutual confiding. The social network theory focuses on how the strength of the network can depict outcomes for the organizations within the network (Uzzi, 1996). In the nursing market, there may or may not be a resource output (nursing school) in close distance to a nursing home. If this is the case, there may be a low resource output of nursing students that would work in that particular healthcare organization. There would be a lack of reciprocal services to and from nursing schools and nursing facilities that characterize their tie. In turn, if there is a low resource output, there may also be lower outcomes in those organizations. Social network theory suggests that the closer staffing resources are to organizations, the better the staffing. In this study, it is most appropriate to offer a hypothesis in which there is a positive relationship between proximity to nursing staff resources and health care quality outcomes.

Resource Dependence Theory

Resource dependence theory argues that an organization's performance determines organizational access to critical resources (Pfeffer & Salancik, 2003) and looks at the ways in which access to these resources can offer organizations a competitive advantage (Hillman, Withers, & Collins, 2009). Organizations typically depend on resources for survival where

environmental pressures determine resources (Hillman & Withers, 2009). The supply of the workforce and the demand of goods/services from an organization can play a role in these pressures.

In the studies, nurses are a human capital resource, and, in instances when resources are more difficult to obtain, competition rises, creating an environment where resources are harder to sustain (Pfeffer & Salancik, 2003). Currently, there is a lack of qualified nurses and nursing students preparing to enter the workforce. This creates a market where resources are sparse and hard to obtain. Therefore, competition increases in an effort to gain nursing resources. In turn, when access to these resources is lost, replacement costs will increase. Thus, commitment to nursing staff, training, and their satisfaction would be lower, leading to lower levels of patient satisfaction (Vahey, Aiken, Sloane, Clarke, & Vargas, 2004).

When there is a higher proximal density of nurse staffing resources surrounding a nursing home, the resources likely will not be viewed as a valuable commodity because they are readily available. In this case, nurses who originate from the nurse staffing resources may become less committed to the facilities they are serving, leading to more turnover and lower quality outcomes. This information suggests that nursing home administrators should be more aware of the ways proximal density to nurse staffing resources could be used to their advantage.

Supply and Demand

The state of Alabama is projected to operate within a persistent and sustaining nursing shortage (ANA, 2014; Kaiser Family Foundation, 2016). Alabama ranks among the 50 U.S. states as existing with one of the lowest numbers of nurses (HRSA, 2015). Along with a shortage of nurses, the state has been identified as bearing some of the worst health care outcomes in the nation (AHR, 2016). Because of these reasons and its unique health-related landscape, Alabama

is interesting in this context. There are many areas, both rural and urbanized, within Alabama (and the nation) that may be negatively affecting the nursing market.

In contrast to the state level example above, projections state that there will be an overall growth in the supply of nurses nationwide, but not before a shortfall to meet the demand by 193,000 nurses in 2020 (Carnevale, Smith, & Gulish, 2015). Other sources indicate contradictions in the literature when it comes to supply and demand projections. In 2000, it was estimated that the gap between supply and demand for RNs would be 110,800 full-time employees, and by 2020 the deficit was projected to exceed 1 million (HRSA, 2002); it is now estimated that 36% of RN jobs will be vacant (HRSA, 2015). However, the Spetz model forecasts a surplus of about 9.7%, 340,000 RNs, by 2025 (2015).

Causes of Supply and Demand

The first signs of the nursing shortage in the U.S. date back to 1970s. After World War II, there was a spike in the population's growth which increased the need for nurses (Janiszewski-Goodin, 2003). Since that time, there has been a series of surpluses and shortages within the nursing supply (Kimball & O'Neal, 2002). These changes have varied in different areas of the country, not just the country as a whole (HRSA, 2002). Today, the nursing shortage is driven by a new set of factors far wider than those in years past: the aging population, fewer workers, work environment issues, and the ballooning costs within the health care system (Kimball & O'Neal, 2002). It is apparent that there is an ongoing trend in the nursing shortage throughout the U.S. Because of this, it is crucial to consider how the shortage is affecting organizational outcomes at large.

A significant influence on the nursing decline is related to the nursing school faculty shortage and other resource constraints (Rosseter, 2015a). According to an American

Association of Colleges of Nursing (AACN) report on 2014–15 enrollment in and graduations from baccalaureate and graduate programs in nursing, “U.S. nursing schools turned away 68,938 qualified applicants from baccalaureate and graduate nursing programs in 2014 due to an insufficient number of faculty, clinical sites, classroom space, clinical preceptors, and budget constraints. Almost two-thirds of the nursing schools responding to the survey pointed to faculty shortages as a reason for not accepting all qualified applicants into baccalaureate programs” (Rosseter, 2015a). This report suggests that many individuals want to earn a degree and have a career in nursing; however, there are too few nursing faculty members to meet the high demand.

According to a survey entitled “Special Survey on Vacant Faculty Positions,” released by AACN in October 2014, there were a total of 1,236 faculty vacancies in nursing schools with a baccalaureate and/or graduate programs. This survey also revealed that more faculty positions are needed to meet the student demand. This report also finds that two-thirds of the nursing schools point to faculty shortages as a reason for not accepting all qualified applicants into baccalaureate programs, suggesting that this shortage persists despite popular interest in a nursing career. It is clear there are not enough nursing professionals available to fill the vacant faculty positions in nursing schools.

Further edifying the issue, Anderson states that the “American health care infrastructure has had workforce shortages for decades and is not prepared to meet such a vast influx of patients effectively or efficiently” (2014). She goes on to say that training “new physicians, nurses, and other health professionals [can] take years, sometimes decades. Without more graduates from nursing and medical schools and increased innovation in shared roles and responsibilities among doctors, nurses, and other medical professionals, individuals and families

will face longer wait times, greater difficulty accessing providers, shortened time with providers, increased costs, and new frustrations with care delivery” (2014).

Another explanation for the projected lack of growth in this occupational industry may be due to nurses’ job satisfaction (ANA, 2014). “Nurses often need to work long hours under stressful conditions, which can result in fatigue, injury, and job dissatisfaction. Nurses suffering in these environments are more prone to making mistakes and medical errors. Patient quality can suffer” (ANA, 2011). Because of these reasons and more, many states are having a difficult time combating the nursing shortage, which has created nearly unbearable working conditions.

MacKusick has added another angle to the issue, looking at discovering *why* the nursing shortage problem exists through qualitative studies. The results found that nurses left their profession because of unfriendly work environments, emotional distress, and fatigue (Mackusick & Minick, 2010). Another article, in which nurses were interviewed, looked specifically at how nurses affect organization daily outcomes, but the researchers did not focus on the patient outcomes within the organization. They found that nine major factors are associated with nurses’ commitment to the organization: “(1) personal factors, (2) opportunities for learning, (3) job satisfaction, (4) a plan to retire from the organization, (5) monetary benefits, (6) patient care, (7) coworkers, (8) cultural factors, and (9) job security” (McNeese-Smith & Nazarey, 2001). Once again, they focused on nurses within the hospital setting.

Supply and demand may be further affected by *where* nurses are locating for employment upon completion of their education. Geographic mobility of workers is emphasized by factors such as wage structure, the supply of jobs, and rural-to-urban influences (Ladinsky, 1967). Further affecting where someone relocates for work is the state in which they earned their education. One study found that “those who attended college in a [particular] state are much

more likely to work in the [same] state 15 years after college than are those who attended college in another state” (Groen, 2004). Proximity to nursing resources is another way to describe the relationship between nursing students and where they go to work. In one study, it was discovered that students’ top two reasons for choosing a job are the flexibility of a work schedule and convenience of location (Larkin, LaPort, & Pines, 2007).

For students in a health profession, such as nursing, the mobility may also be related to whether or not the location of the workplace is in a rural or urban area (Schofield, Fletcher, & Fuller, 2009). Playford and Larson found that 25% of allied health and nursing students entered the rural workforce, but this workplace choice may be influenced by a student’s background or where they lived before gaining their education (Playford & Larson, 2006). Workforce data has also revealed that rural areas have more LPNs/LVNs per capita when compared to urban areas, which have more RNs (HRSA, n.d.). Baernholdt and Mark found that less rural hospitals exist, and those that do have less technology, fewer beds, were smaller in size, and have significantly fewer nursing staff. However, job satisfaction and turnover rates were not associated with location type (Baernholdt & Mark, 2009). Likewise, job satisfaction and turnover in long-term care facilities has also yielded no differences in terms of location (Coward et al., 1995). Rural RNs are also more likely to work in “public/community health, long-term care, and ambulatory care” than in hospitals (Skillman, Palazzo, Keepnews, & Hart, 2006), but this may be simply because there are less hospitals in those areas, as previously mentioned.

A survey completed by 793 undergraduate nursing students revealed that they wanted to work with children or in midwifery as their first two preferences and geriatrics was their last choice (Happell, 1999). These preferences are concerning when considering the size of the aging population and the already existent lack of nurses. Although the study did not ask about

preferences between rural and urban employment locations, it brought forth nurses' specialty areas and what populations they are the most interested in serving.

The nursing shortage is affecting both patients and nurses as well as those who have the most continuous and closest relationship with patients and their families (Nevidjon & Erickson, 2001), making it an even more complicated issue. The issues discussed play essential roles in patient outcomes. This dissertation is relevant to exploring the problem further and aiding in finding appropriate solutions. Unless actions are taken to address the nursing shortage issue, those who are receiving (and providing) health care services will continue to be negatively affected.

Outcomes from Supply and Demand

As previously mentioned, research shows that nursing turnover is costly not only to the health care facilities involved, but also to the individuals receiving care, the population, and the overall economy (IOM, 2011). A highly researched contributing result from the shortage is patient quality outcomes. Errors and mistakes warrant these quality issues that health care professionals, such as nurses, make. Stress caused by the nursing shortage can result in safety concerns for patients as well as reduced patient satisfaction outcomes overall (Roberts, 2003). With the increase in patient acuity, the concerns over medical errors and the declining number of ancillary personnel are of greater concern as well (Needleman, Buerhaus, Mattke, Stewart, & Zalevinsky, 2002).

Needleman and Buerhaus also found that both "a higher proportion of licensed-nurse care provided by registered nurses (model 1) and more registered-nurse-hours per day (model 2) were associated with a shorter length of stay and lower rates of urinary tract infections and upper gastrointestinal bleeding. A higher proportion of registered-nurse-hours (model 1), but not a

greater number of registered-nurse-hours per day (model 2), was associated with lower rates of three other adverse outcomes: pneumonia, shock or cardiac arrest, and failure to rescue” (Needleman, Buerhaus, Mattke, Stewart, & Zalevinsky, 2002). The same researchers within a different study found that, again, by raising the proportion of nursing hours, there is an association with a reduction in costs and better patient outcomes (Needleman et al., 2006).

Other research has aimed at looking for variables relating to nursing shortage besides patient outcomes only. In the March 2005 issue of *Nursing Economics*, “Dr. Peter Buerhaus and colleagues found that more than 75% of RNs believe the nursing shortage presents a major problem for the quality of their work life, the quality of patient care, and the amount of time nurses can spend with patients. Looking forward, almost all surveyed nurses see the shortage in the future as a catalyst for increasing stress on nurses (98%), lowering patient care quality (93%) and causing nurses to leave the profession (93%)” (Rosseter, 2014). Further providing evidence for how supply affects outcomes, Dorning found that “the percentage of temporary nurses employed goes up; the quality of patient care tends to go down. Hospitals with temporary nurse staffing fewer than five percent reported fewer hospital-acquired infections and fewer patient falls than hospitals with temporary nurse staffing at five to 15 percent. The percentage of nurse work-related injuries was also significantly higher in hospitals where temporary nurses made up more than 15 percent of the total nursing staff” (2016).

There is also literature that combines qualitative studies with patient outcomes, not just reasoning behind why nurses leave the profession. Some of the same researchers who have conducted quantitative studies have also studied nursing perceptions through surveys. In 2005, Buerhaus used surveys as a means to determine nurses’ and nursing leaderships’ perceptions of how the nursing shortage affects the quality of patient care. His results revealed a “minority of

both RNs and CNOs reported the shortage was a minor problem, and only a handful reported the shortage was not a problem for the overall quality of care” (Buerhaus et al., 2005). Once again, this research was done in hospitals, not in a nursing home setting.

The geographical implications of where nurses are going to work post-education has led to areas in the U.S. experiencing surpluses of nurses while other areas experience shortages (HRSA, 2002). Although there is an array of influences regarding where a nurse wants to work, such as pay grade, family location, work environment, and where they earned their education, some areas of shortage may be based on present conditions alone. Areas of low supply may be the outcome of conditions such as “inadequate workforce planning and allocation mechanisms, resource constrained undersupply of new staff, poor recruitment, retention and ‘return’ policies, and ineffective use of available nursing resources through inappropriate skill mix and utilisation, poor incentive structures and inadequate career support” (Buchan & Aiken, 2008a).

Where the Literature Stands

Throughout the leading pieces of literature in this area, there is a primary focus on nursing shortages in hospitals, with little focus on other types of health care organizations. For the research designs, it is evident there is a lack of research in nursing homes. However, based on the high number of nurses that work in the hospital setting, hospitals are still a health care facility of interest. By including both hospitals and nursing homes in this dissertation, I will present a unique perspective on health care that does not solely focus on one or the other.

There are innovative methods for looking at the nursing market that are seldom used. Geographical information systems are an analysis method that can provide unique insights regarding the extent of the nursing shortage dilemma. GIS yields the opportunity to measure where nursing market resources exist and how these resources are affecting outcomes in health

care settings. By using GIS, researchers and policymakers can better analyze utilization and outcomes that cut across multiple domains (McLafferty, 2003). GIS has also been used in health care as a tool to study patterns of disease and other related epidemiological studies (Foody, 2006); however, more recently, GIS is being used as a tool to answer other research questions with a vast amount of potential to be molded to find unique applications in an array of fields (Haggett, 2005). GIS creates an avenue for looking at the same problem in a different light by providing a geographical representation of the nursing market.

Another gap in the existing literature that has been identified is the lack of qualitative studies examining *why* the nursing shortage is occurring, as opposed to what it is causing. Though limited, several qualitative studies already exist that search for answers as to *why* nurses are leaving their professions. Although the research included in this dissertation is quantitative in nature, future research involving a qualitative study may help fill this gap.

Summary of the Research Studies

Study 1

The first study is conducted using the same methods as a previous study (Haun et al., 2018) but on the national scale. These methods have been identified in the above (pp. 9-15). This study will include nursing homes and nursing schools examined in all states. The objective of this examination is to determine the effect of proximal density to nursing schools on care quality outcomes. Proximity data will be developed using GIS software and will be analyzed via an ordered logistic regression using data from CMS's Nursing Home Compare database and nursing school online resources. Additional analysis is offered to examine whether the nature of this relationship is due to sensitive health care facilities that are located in "hot spots," areas of high

density of competition or staffing resources. Further details about the GIS study's controls, methods, and study procedures can be found in Chapter 2 of this dissertation.

Study 2

A *binary* logistic regression analysis is applied for the second study but for hospitals and nursing schools. Including another type of health care facility outside of long-term care allows for better generalizations to be made in accordance with the results of other types of health care organizations. At the national level, there will be greater opportunity to depict the differences between rural and urbanized areas as well. Again, the objective of the examination is to determine the effect of proximal density to nursing staffing resources on care quality; proximity data collected from GIS software is analyzed via an ordered logistic regression using data from CMS's Hospital Compare database and nursing school online resources.¹ Viewing these relationships alongside the possible differences in the nursing market, such as regional divides across the U.S., will contribute to existing research on the subject. It is hypothesized that there will be a negative relationship between proximity to nurse staffing resources and hospital quality outcomes.

The sample for hospitals is derived from CMS's *Hospital Compare* (n = 2,205) and nursing school data from the American Association of College of Nursing (n = 811). It contains quality outcomes of care and staffing estimates for all U.S. hospitals participating in Medicare and Medicaid programs. Information about the nursing schools included in the studies will be triangulated across multiple online sources. This examination offers a new approach to understanding the relationship between nurse staffing and care quality by considering the role of proximal density to nurse staffing resources.

¹ Those areas may or may not be made up of "hotspots."

Study 3

To partner with the first two GIS studies, study three is formulated to give insight into nurse staffing policies and their effects on nurse staffing levels. By utilizing online legislative databases, each state will have a unique mix of nursing policies that may or may not be correlated with care quality outcomes and staffing supply. In turn, one can see which policies are having an effect (if any) and which ones could be applied to other state constituencies. To better understand policies that have been created to aid in resolving the nursing shortage and whether or not they are working, a time series regression analysis will be provided. An analysis, 2004-2016, of major national nursing policies will be reviewed along with the nurse staffing. Based on the results, there may be evidence that would suggest which future types of policies would be more beneficial to the nursing market. It is hypothesized that there will be a positive relationship between enacted nurse staffing policies and nurse staffing levels. Primary policy information will come from the National Conference of State Legislatures and Congress and the GovTrack.us database. Each nursing policy will be recorded at the state level based on the year it was enacted. Then, it will be compared to the state's nursing population, which will come from the Bureau of Labor Statistics. Care quality outcomes from *Nursing Home Compare* and *Hospital Compare* will also be included. Nurses represent the largest portion of health care professionals, and appropriate policies help create and sustain better health outcomes for those served by this population.

Dissertation Organization

The dissertation is organized into five chapters. Chapter One, the Introduction, provides background information on the existing research for the studies. This includes identification of the problem that is being addressed. The purpose of the studies, research questions, and

significance of the studies are outlined as well. The chapter concludes with a scope and limitations section. Chapters Two, Three, and Four consist of the distinct studies that are being conducted. Chapter Two encompasses the national study and examines the nursing staffing resources on quality in nursing homes. Chapter Three includes the national study and examines the nursing staffing resources on quality in hospitals. Chapter Four discusses the nursing staffing policies on nurse staffing amounts in both nursing homes and hospitals. Chapter Five, the final chapter included in the dissertation, is dedicated to discussions and conclusions as they pertain to the entirety of the research studies. A summary of the purpose of the study, procedures and methods, results and conclusions, and the significance of the study is offered in this section as well. Attention is given to the implications of this research for relevant audiences alongside suggestions for future research on the subject matter.

Chapter 2

Examining the Influence of Proximal Density to Nurse School Location on Quality of Care Outcomes in United States Nursing Homes

Abstract

A positive relationship has been demonstrated between nurse staffing and care quality. However, the extent of this relationship has been sparsely studied in long-term care facilities. The objective of this examination is to determine the influence of proximal density to nurse education resources (nursing schools) on care quality in nursing homes throughout the United States. Building from a previous study (Haun et al., 2018) that demonstrates a negative relationship as the resource dependence theory would advocate (Pfeffer & Salancik, 1978), this paper expands to include nursing homes throughout the entire nation. Thus, the study tests the hypothesis that there is a negative relationship between proximal density to nurse education resources (nursing schools) and care quality. Proximal density data is developed utilizing geographic information systems (GIS) software and analyzed via an ordered logistic regression utilizing nursing home data from CMS's *Nursing Home Compare* (n=15,760) and nursing school data from the *American Association of College of Nursing* (n=811). This examination finds that proximal density to nurse education resources has a positive influence on nursing home quality outcomes, with the exception of one rating variable, health inspection. Additional analysis is offered to examine if the nature of this relationship is sensitive to health care facilities in locations of high or low resource densities. The results of this sensitivity analysis confirm principal findings. This examination builds on a previous study to better understand the relationship between nurse

education resources and care quality by considering the role of proximal density to nurse education resources.

Keywords: quality outcomes, geographic information systems, nursing, nursing homes

Introduction

The long-term supply of nurses in the United States (U.S.) has focused on several key determinants of supply, including its cost, quality, and the availability of nurse education programs (Jones, 2004; Mukamel et al., 2009; Rosseter, 2015b; Spilsbury, Hewitt, Stirk, & Bowman, 2011). However, few studies have examined how nurse education resources affect the quality of care outcomes (Kovner, Corcoran, & Brewer, 2011). The extent of which the geographical location of nursing schools are in proximity to long-term care facilities such as nursing homes shapes the landscape of the nursing workforce and labor market (Estaville, 2012). Because of this, there are important implications for policymakers, practitioners, and educators alike, such as where new nursing schools and healthcare facilities should be located. With longstanding nursing shortage throughout the country, rapidly increasing demands for medical care, and poor-quality outcomes, there is a need for a better understanding of the nursing market (Duvall & Andrews, 2010).

One of the well-known issues facing the U.S. healthcare system is the aging population (Knickman & Snell, 2002). It is expected that Americans 65 and older will more than double by 2060, reaching over 98 million (Mather, 2016). As the population ages, a higher demand for healthcare services and facilities such as nursing homes and nursing personnel persists (Carnevale et al., 2015). The implications of this situation include those requiring more skilled health services that postulate towards rehabilitation, chronic illness, and multiple health issues (McGinnis & Moore, 2006). The nursing shortage adds to the growing problem of how to

provide appropriate care for those who are aging and need nursing home services (P. Buerhaus, Staiger, & Auerbach, 2000). The shortage has been acknowledged as a chief threat and has remained despite the level of scholarship pointing to its negative impact on care quality (L. H. Aiken et al. 2002; Janiszewski et al. 2003; Kutney-Lee et al. 2009).

As of 2017, vacancy rates for Registered Nurses (RNs) across healthcare facility types continue to rise and are currently at 8.1 percent, a slight reduction from 2016 (NSI Nursing Solutions Inc., 2016a, 2017). RNs provide clinical care, coordination of care, oversight of care planning and its implementation in nursing homes (“Types of Nursing Home Employees - Nursing Home Abuse,” 2013). Licensed Practical Nurses (LPNs) and Certified Nursing Assistants (CRNs) provide paraprofessional care, such as activities of daily living, and have similar shortage outputs as RNs (HRSA, 2015). These direct care employees have a substantial impression on the quality outcomes for the patients within nursing homes (Spilsbury et al., 2011).

Within healthcare facilities, nursing shortages have been associated with nursing turnover and burnout, which have a direct influence on organizational performance and profitability (Andrews & Dziegielewski, 2005). Nurse stress related to the nursing shortage can result in safety concerns for patients as well as reduced patient satisfaction outcomes (Roberts, 2003). More specific to long-term care facilities, it has been established that the same trends of nursing turnover and job dissatisfaction occur in the nursing home setting (Coward et al., 1995). In some cases, studies recognize that nursing turnover rates can reach as high as 400% in nursing homes (Decker, Gruhn, & Matthews-Martin, 2003). Consequently, the high amounts of turnover have been found to decrease the quality of care; however, the overall evidence has been mixed (N. G. Castle et al., 2007).

The objective of this examination is to determine the effect of proximal density to nurse education resources (nursing schools) on quality care outcomes in U.S. nursing homes. Proximal density is a measure of the concentration of resources relative to a specific location. In this study, proximal density is used to measure the number of nurse education resources within a specified proximity to a health facility (i.e. 100-miles). In a previous study, it was found that proximal density to nurse education resources has a negative influence on nursing home quality outcomes in Alabama (Haun et al., 2018). Now, with the complete population of nursing homes in the nation, we report additional findings. Social network theory suggests that as proximal density increases, healthcare facilities will make stronger ties to nurse education resources (Granovetter, 1983), thus leading to better care quality outcomes. Conversely, the resource dependence theory suggests that readily available access to nurse education resources will decrease replacement costs (1978) of nursing staff, lowering commitment between healthcare organizations and their nurses, thereby diminishing care quality (Pfeffer & Salancik). Within the U.S., a mix of individual states operating in a surplus of nurses exists while others function in a deficiency (HRSA, 2002). Moreover, the nursing supply is also coupled with the dynamic population context of the nation and its rural/urban regions (Baernholdt & Mark, 2009).

Consideration of nursing schools and nursing homes reside within this multifaceted healthcare landscape. Data from CMS' *Nursing Home Compare* and *the American Association of College of Nursing* is analyzed using geographic information systems (GIS) software and ordered logistic regression via STATA statistical software. There were 15,486 nursing homes and 811 nursing schools included in the sample. The results of the primary and sensitivity analysis indicate a positive relationship between proximal density of nurse education resources and nursing home quality outcomes, suggesting that as access to nurse education resources

increases, the quality of care also increases. This outcome, therefore, provides evidence in support of a social network theory.

Background

A critical factor in the persistence of the nursing shortage is the lack of the number of nursing schools equipped to prepare the next generation of nurses (Anderson, 2014). In the U.S., aging faculty, budget constraints, and limited student capacities at existing nursing school programs limit schools' ability to increase workforce-ready nurses (Rosseter, 2015a). According to AACN's report on *2016-17 Enrollment and Graduations in Baccalaureate and Graduate Programs in Nursing*, U.S. nursing schools continually turn away qualified applicants from nursing programs due to an insufficient number of faculty, clinical sites, classroom space, clinical preceptors, and budget constraints (AACN, 2017). The report suggests that many individuals desire to earn a career in nursing; however, there is an issue with the amount of nursing faculty to meet the demand.

According to a *Special Survey on Vacant Faculty Positions* a total of 1,567 faculty vacancies were identified in a survey of 821 nursing schools with baccalaureate and/or graduate programs across the country. Besides the vacancies, schools cited the need to create an additional 133 faculty positions to accommodate student demand. The data show a national nurse faculty vacancy rate of 7.9%. Most of the vacancies (56.2%) were faculty positions requiring or preferring a doctoral degree. The top reasons cited by schools having difficulty finding faculty were insufficient funds to hire new faculty (63.9%) and unwillingness of administration to commit to additional full-time positions (49.6%) (Li, Kennedy, & Fang, 2017). Therefore, nursing professionals are also scarce to fill the vacancies in the nursing schools.

Furthermore, the nursing graduates that do persevere and graduate from nursing programs typically remain in the same region as their educational institution location (Groen, 2004). If this is in fact the case, nursing students are more likely to find employment in areas of higher concentrations of nursing schools (Groen, 2004). However, nursing graduates may also be influenced to find employment opportunities in areas where there are more profound incentives such as higher pay and job availability (Schofield et al., 2009). An underlying issue to the shortage is the lack of mobility for nurses and its association to stress in the workplace, unreasonable workload, and other harsh work environment conditions (Garnett, Coe, Golebiowska, Walsh, & Zander, 2008).

In the context of the present examination, the U.S. is projected to operate in a persistent and sustained nursing shortage (Allen, 2008; HRSA, 2002; Nevidjon & Erickson, 2001). By 2020, there will be 1.6 million nursing job openings, 700,000 of which will be newly created jobs to meet the demand for services (Carnevale et al., 2015). Adding to the nursing landscape in the nation, there is a unique mix of states with surpluses and shortages of nurses (Cook, 2016). The same is true for nursing homes and nursing schools where rural and urbanized areas may be affecting the nursing market (Coward et al., 1995).

In areas where the nation's population is larger, more nursing schools and nursing homes can be found. Figure 2 represents the location of all nursing homes (blue) and schools (red) are located in the U.S.

Insert Figure 2 about here

An analysis of the descriptive locality data displays that nursing homes and nursing schools (nurse education resources) reside within "hot spots." Densities were obtained at the 100,

75, 50, 20, 10, 5, 1, 0.5, and 0.25-mile proximity level. High density areas are those with more than average nurse education resources. The inverse can be applied to explain cold spots. Figure 3 illustrates these hotspots, marking areas of high densities (red) and cold densities (blue) of nurse education resources and nursing homes. “Hot spots” occur where the number of facilities and schools are significantly different and higher than neighboring counties.

Insert Figure 3 about here

Based on the descriptive figures, it appears that while the existence of a nursing shortage is generally true, the degree to which organizations are operating within a deficiency may vary. It could be the case that while some, typically rural, nursing homes are in chronic short supply of nurse education resources; others seem to have a persistent surplus of newly-minted nurses. This variation suggests that the deleterious effects of the nursing shortage on health care quality outcomes may be responsive to whether or not an organization has access to nurse education resources.

Hypothesis

When examining the relationship between the localized staffing markets and health care quality outcomes, two theoretical lenses offer credible, yet conflicting, logics. On the one hand, social network theory (MS Granovetter, 1973) suggests that close ties between organizations might lead to positive organizational outcomes. And, on the other hand, resource dependency theory (Pfeffer & Salancik, 1978) suggests that having ready access to a resource makes that resource less valuable which could lead to negative outcomes. Each of these respective lenses

generate a conflicting hypothesis with regard to the direction of the relationship between proximity to nurse education resources and nursing home quality outcomes.

Social network theory is defined as a tool for linking micro and macro levels of sociological theory and is illustrated by elaboration of the macro implications of the strength of dyadic ties (MS Granovetter, 1973). Relevant to this study, social network theory suggests how human and nonhuman elements work together to describe how organizations work in autonomy while remaining in a network (Granovetter, 1983). The application of this theory extends to different healthcare organizations, professional types, and their working social networks (Cott, 1997). In this case, the network involves nursing homes and schools that make up the *physical proximity*, nursing students and professional nurses are the *professional proximity* (Cott, 1997). Ultimately, the network is made up of subparts which work together to create associations (Granovetter, 1983).

Depending on where nurses locate for work, the relationships between nurse education resources and facilities, and other complex socio-complex elements, the network may be strong or it may be weak. Based on the theory, weak ties are less likely to be involved with each other, and strong ties are more apt to be tightly knitted relationships. The closer and stronger ties would suggest from the theory that the outcomes would be better (Granovetter, 1983). In other words, areas where there are strong social ties, the organizations within those ties will have better outcomes than those who have weak ties. The social network theory frames how the strength of the network can depict outcomes for organizations within (Uzzi, 1996). Within a proximity network, there may or may not be a resource output (nursing school) in close distance to a nursing home. Therefore, based on the theory, if there is a low resource output, there may also be lower outcomes in those organizations.

Conversely, the resource dependence theory argues that an organization's performance is predicated by organizational access to critical resources (Pfeffer & Salancik, 2003) and how access to these resources can offer organizations competitive advantage (A. J. Hillman et al., 2009). Pfeffer and colleagues explore how organizations should be analyzed from the resource side rather than the product side in order to bring forth new strategic options for organizations (Aldrich & Pfeffer, 1976; Pfeffer, 2007). Later work has assessed empirical support for this theory concluding that there are overwhelming research and acceptance of this theory (Casciaro & Piskorski, 2005; G. F. Davis & Cobb, 2010). For this study, nurses within nursing homes are a human capital resource. When these resources are more difficult to obtain, competition rises creating an environment where resources are harder to sustain. In turn, when access to these resources is lost, replacement costs will increase. Thus, commitment to nursing staff, training, and their satisfaction would be lower, leading to lower levels of patient satisfaction (Vahey et al., 2004).

Network theory proposes that the closer education resources are to organizations, the better the quality results would be, and resource dependence theory suggests that being close to education resources lessens commitment between staff and outcomes because organizations may not be as worried about retaining their resources. In a previous examination, proximal density to nurse education resources had a negative influence on nursing home quality outcomes (Haun et al., 2018). Therefore, it is most appropriate to offer a directional hypothesis that there is a negative relationship between proximity education resources and quality.

Hypothesis 1: A negative relationship between proximal density to nursing education resources and nursing home quality outcomes exists.

Methods

An ordered logistic regression analysis controlling for variables likely to change quality was completed. The analysis was used to combine effects of all study measures on quality outcome ratings. A series of models were undertaken based on the proximal density variables on five outcome ratings. Robust regression procedures were used to account for the effects of nurse staffing within nursing homes. In each model, estimation of standard errors along with the model's residuals occurred. The analysis differed slightly from the target sample's (15,760) key study variables based on missing data in the dataset (n = 15,486). The difference was an outcome from the data point availability for all variables.

Data and sample

The sample of nursing homes in the U.S. came from the *Nursing Home Compare* dataset hosted by Medicare.gov. The *Nursing Home Compare* database provides information on all nursing homes that are Medicare and Medicaid certified in the nation. As of July 2017, there were 15,760 nursing home providers in the data set, 15,024 were utilized for this study. The database provides the organization's overall rating score, staffing, and patient outcome information. For this research, downloaded data in a CVS file for the integration of Microsoft Excel and STATA pursued.

For the nurse education resources, data came from the *American Association of Colleges of Nursing's* dataset of accredited schools. It contains accreditation dates, nursing degrees

offered, and zip code information that was utilized to calculate proximal density. For the nation, as of July 2017, there were 811 accredited nursing schools. The information was stored in a Microsoft Excel spreadsheet to compare the nursing home database easily. Furthermore, the accredited nursing schools were cross-referenced with *The Campaign for Nursing's Future* - Johnson & Johnson and other Boards of Nursing datasets to validate the geographical data and other related descriptive data.

Variables

A model of the components of nursing home overall quality scores and proximal density to schools was constructed. Key-dependent variables examined in the study include the following: overall care rating, health inspection rating, quality measure rating, staffing rating, and RN staffing rating. The five measures include star ratings, ranging from 1 star (much below average) to 5 stars (much above average). These quality ratings are part of the *Nursing Home Compare* public reporting site for nursing homes that participate in Medicare or Medicaid. The five-star rating system considers the multi-dimensional nature of nursing home quality to determine facility performance.

Overall rating is based on facility performance for all star rating measures collectively, each of which has its own five-star rating. *Staffing* rating is based on two measures: 1) Registered nurse (RN) hours per resident day, and 2) total staffing hours (RN+ licensed practical nurse (LPN) + nurse aide hours) per resident day. *Quality Measure* rating is centered on performance on 16 of the 24 QMs that are currently posted on the *Nursing Home Compare* website, and that are based on MDS 3.0 assessments. *Health Inspection* rating is created by the number, scope, and severity of deficiencies identified during the three most recent annual inspection surveys, as well as substantiated findings from the most recent 36 months of

complaint investigations (“Design for Nursing Home Compare Five-Star Quality Rating System: Technical Users’ Guide,” 2017). The overall rating is assigned in a five-step process: 1) begin with health inspection rating, 2) add one star if the staffing rating is four or five stars and greater than the health inspection rating. Reduce one star if the staffing rating is one star, 3) add one star if quality measure rating is five stars and subtract one star if it is one star, 4) if health inspection rating is one star, overall rating cannot change by more than one star based on staff and quality measure rating, 5) if a nursing home has a special focus facility, the maximum overall rating is three stars.

The key independent variables include: 100-mile proximal density, 75-mile proximal density, 50-mile proximal density, 20-mile proximal density, 10-mile proximal density, 5-mile proximal density, 1-mile proximal density, .5-mile proximal density, and .25-mile proximal density. Additional variables are included to control for variation across nursing homes. These control variables each come from the Nursing Home Compare data set and include size, ownership, and whether the nursing home resides within a hospital. The number of residents is coded as a continuous variable and is the number in the facility during the 2-week period prior to inspection, used to measure the *Size* of the nursing home. Ownership is comprised of 3 dichotomous variables to assess whether nursing homes identify as for-profit, nonprofit, or government entities, with nonprofit as the reference category. And, In Hospital is a dichotomous variable which measures whether the nursing home operates within a hospital which may indicate additional resource availability (Medicare.gov, 2017a).

The proximal density data was developed by using GIS software to examine the proximate relationships between nursing schools and nursing homes. Graph layout algorithms visualized proximity matrices from the results leading to the ability to convey specific

characteristics of the data. To identify the distance between the nursing homes and nursing schools, geocoding was utilized. Using Google Maps, addresses were obtained for all schools and nursing facilities and stored in Excel. The addresses were then used through the geocoding provider MapLarge1 in order to identify their exact latitude and longitude. These coordinates were then added to a shapefile of the nation which was obtained from the Census Bureau's Tiger/Line ® Files. Some errors existed in the geocoding which led to a low amount of the point estimates being slightly off target (i.e., P.O. Box location instead of building location). These points were then re-projected along with the U.S. shapefile into UTM 16N, Universal Transverse Mercator projection for which the nation is most accurately displayed. The procedures created our key-independent variables at the differing proximities from 100 miles to .25 of a mile.

Analysis

The distance between the schools and nursing home facilities was calculated using the Near as Table tool in ArcMap 10.4.1. This provided a measurement in meters between a school and the nearest nursing facility and the nursing facility to the nearest school. Near measurements were the outcomes from the analysis. To assess the number of facilities within 100, 50, 20, and 10 miles of a school, we utilized several geoprocessing tools. First, a Buffer tool was used to generate nine buffers at the set mile distances around each school. Then, the Intersect tool was used to find which facilities fell within these buffers. After that, the Dissolve tool helped to obtain a count of facilities in this range. As a final step, we repeated the processes for facilities to find how many schools are within the set miles of their location.

Facility and school locations were then joined with a county using the Intersect tool, and a count was obtained using the Dissolve tool, providing a count of the number of schools and the number of facilities in each county. Using these counts, we then utilized a spatial statistics tool to

identify optimized hotspots within the nation in terms of the number of facilities and schools within a county. Optimized hot spot analysis works by comparing geophysical neighbors to one another and indicates the probability of a county with an unusually high or low count of a feature (in this case schools and nursing facilities) relative to their neighbors is a function of random chance. Hot spots can help reveal competition in different industry environments (Pouder & St. John, 1996).

A series of analyses were undertaken to determine the influence of proximal density of nurse education resources on nursing home quality outcomes. In each model, ratings were broken down into categories to examine proximal density association with nursing home's star rating. This analysis was used to assess the influence of each proximity variable (schools within 100, 50, 20, and 10 miles) on select nursing home quality rating variables. Summary statistics relating to the dependent and independent variables are presented in Table 1. Summary statistics reveal that nursing homes have relatively lower health inspection ratings (average rating of 2.82) when compared to the other star ratings. Additionally, the best rating for nursing homes is the quality measure rating averaging at 3.76. On average, there are 15 nurse education resources within a 100-mile proximal density, 5 within 50 miles, 1 within 20 miles, and 0 within 10 miles.

Insert Table 1 about here

Results

The results from an ordered logistic regression model in the form of odds ratios are presented in Tables 2a-2d with significance reported at the .05 level. Table 2a shows the results for *Overall Star Rating*. These results show a positive and significant association of proximal

densities of nurse education resources with nursing home overall star ratings at the, 100-mile (odds ratio = 1.003, $p = 0.002$), 50-mile (odds ratio = 1.003, $p = 0.019$), and 20-mile (odds ratio = 1.007, $p = 0.036$) proximities. A negative significant association of *Size* and a positive significant association with nursing homes located within a hospital was found with all proximities for *Overall Star Rating*.

Insert Table 2a about here

In Table 2b, *Health Inspection Star Rating* results also indicate a positive significant association of proximal density of nurse education resources but only at the 100-mile proximity (odds ratio = 1.003, $p = 0.001$). Again, a negative significant association with *Size* and a positive significant association with nursing homes located within a hospital was found with all proximities.

Insert Table 2b about here

In Table 2c, *Quality Measure Star Rating* results show a positive and significant association of proximal densities of nurse education resources at all proximities, 100-mile (odds ratio = 1.003, $p = 0.000$), 50-mile (odds ratio = 1.008, $p = 0.000$), 20-mile (odds ratio = 1.020, $p = 0.000$), and 10-mile (odds ratio = 1.038, $p = 0.000$). Results for *Size* indicate no significance for this particular rating; however, unlike the *Overall* and *Health Inspection* ratings, a negative significant association was found with nursing homes located within a hospital at all proximities.

Insert Table 2c about here

In Table 2d, *Staffing Star Rating* results show both positive and negative results at the differing proximities. The results find that there is a negative significant association at the 100-mile proximity (odds ratio = 0.998, $p = 0.011$). However, there is a positive significant association at the 50-mile (odds ratio = 1.006, $p = 0.000$), 20-mile (odds ratio = 1.012, $p = 0.000$), and 10-mile (odds ratio = 1.016, $p = 0.028$) proximities. Both the *Size* and *For-profit* variables indicate a significant negative association with staffing star rating at all proximities. And, nursing homes within hospitals reveal a significant positive association.

Insert Table 2d about here

An additional sensitivity analysis was administered to determine whether the results of the principal findings are responsive to whether or not a nursing home is located within a “hot spot.” Hot spots areas are where the number of facilities is significantly different and higher than in neighboring counties. Because of the intensity of competition in hot spots, it may be the case that the nature of this relationship is different, in kind, based on whether a nursing home is in a “hot spot” or not. To account for this, an additional sensitivity analysis is offered to determine if the results are responsive to whether or not a nursing home is located within a “hot spot”. In the nation, 29.5% of nursing homes are in a “hotspot”. These areas are where the number of facilities is significantly different and higher than neighboring counties.

In Figure 3 above, the map shows the “cold spots,” which would be marked by significant low densities instead of high densities of nursing homes and nurse education resources. Cold spots are located in a vertical string in the middle of the nation as well as in East Tennessee, Southeast West Virginia, and South Georgia. To compare with the previous study in Alabama, the state has four counties in cold spots at this aggregate level and at individual state

level has no cold spots. The results from this analysis yielded the same positive relationship of the principal analysis. Results of this analysis are presented in Table 3 and reveal that facilities in a “hot spot” versus a “cold spot” have a positive, significant influence on all quality measures with a $p < 0.01$.

Insert Table 3 about here

Discussion

An objective of this paper was to utilize a new, innovative approach to studying factors involved with the nursing shortage. Distance to and from care has been cited as important; however, little is known about how distance from nursing resources (i.e. nursing schools and nursing homes) contribute to quality outcomes. This regression analysis coupled with GIS analysis shows that proximal density is important in determining the quality outcomes in nursing homes, with the greater the distance and lower amount of resources resulting in lower quality outcomes.

Building from a previous study with the focus on the state of Alabama, the differing outcomes may be due to aggregate affects at the national level versus the individual state level. At any rate, further research is encouraged to determine the validity of this relationship across differing healthcare domains and professional types. It is possible that general ratings for more rural areas were skewed because of outliers in nursing home measures (i.e. severely deficient homes). Another threat to the study was particular nursing programs within given nursing schools not being controlled for. However, the majority of nursing schools that offer higher level nursing programs (RN and above) also offer lower level (LPN and lower) programs as well. Therefore, potential influence of quality based on the type of programs present in a nursing

school exists, but the differences are few and far between. Expanding further, it is important to mention that other confounders may be at play in the association of proximity and quality such as population density, median income, or even the age of a given nursing home or nursing school.

This study's data revealed that there are areas in the U.S. with high concentrations of rural and urban markets. Specifically, California, Florida, New York, Michigan, and a portion of Iowa and Indiana reside in "hot spots." To contrast, a string of states in the middle of the nation operate in a "cold spot" as well as part of southwest Virginia, northeast Tennessee, and a large portion of Georgia. Part of the explanation to these differing densities of resources is where Americans tend to locate when they retire and seek long-term care services.

Within such areas, prevalence of higher or lower facility outcomes was found. Based on this information, while being aware that the information is not completely error free, supply and demand of health services for those aging may be affected by a population's age density of the area. The integration of this data in a GIS platform proved to be a powerful measuring and analytic tool. Also, the mapping of nursing homes and nursing schools allows for the identification of geographic inequities and to pinpoint specific areas where more nurses may be needed because of the lack of nursing resources.

Conclusion

Yielding important new information regarding the extent of the patient outcome/nursing shortage problem in nursing homes, this study sheds light on *new* techniques to study *old* problems. Despite the information that currently exists on the nursing supply, there has been a lack of attention given to nursing homes and long-term care facilities, in general. Another contribution of this study is that it depicts a novel measure for proximal density with regard to nurse education resources, nursing schools. The influence, of which, can be examined with

regard to other health care facilities. The findings confirm that there is a relationship between nursing school proximity and overall care ratings for nursing homes, lending to the social network theory. With the use of a GIS platform, different scenarios could be evaluated in the same manner to look at trends in healthcare involving educational supply, patient demand, and facility networks. Ultimately, this can assist in optimizing decisions about location allocation of resources to make access to nurses, healthcare, and educational facilities more equitable.

Chapter 3

Examining the Influence of Proximal Density to Nurse School Location on Quality of Care Outcomes in United States Hospitals

Abstract

With the persistent nurse shortage and recent calls for nursing workforce improvement across the nation, there is an institutional demand to understand how nurse staffing is affecting organizational outcomes in hospital practice. This study seeks to determine the effects of proximal density of nurse staffing resources (nursing schools) on quality outcomes in hospitals. Proximal density, a measure of the concentration of resources relative to a specific location, data is developed utilizing geographic information systems (GIS) software and is analyzed via binary logistic regression model using hospital data from CMS's *Hospital Compare* (n = 2,205) and nursing school data from the American Association of Colleges of Nursing (n = 811). Proximal density of nurse staffing resources for low rated hospitals has a negative influence on quality outcomes. The odds of receiving a 1-2 star or a 5 star rating increase in areas of higher proximal density and the odds of receiving a 3 star rating decrease. Additional analysis is offered to examine if the nature of this relationship is sensitive to whether health care facilities are located in areas of high density (i.e. hot-spots). The results of this sensitivity analysis support a negative influence of hot-spots on quality outcomes. This examination offers a new approach to understanding the relationship between nurse staffing and care quality by considering the role of proximal density to nurse staffing resources.

Keywords: *quality outcomes, geographic information systems, nursing, hospitals*

Introduction

Proper nurse staffing is a critical component to the delivery of high-quality, efficient care (Needleman & Hassmiller, 2009). Many studies have examined the relationship between nurse staffing ratios and patient quality outcomes (Aiken et al., 2011; Bowblis, 2011; Cho & Yun, 2009). While it is clear that nursing availability within hospitals has this positive effect (Needleman et al., 2011; Joanne Spetz et al., n.d.), what remains unclear is the degree to which nurse availability in hospital markets influence care quality outcomes. These studies lack precluding information regarding where nurses are entering the workforce from, whether that be straight from an educational institution or another healthcare facility. It is important to note that the extent to which nursing schools are geographically located in proximity to hospitals shapes the landscape of the nursing workforce and labor market. Because of this, there are important implications for policymakers, practitioners, and educators alike.

This chapter seeks to explore whether higher or lower hospital quality outcomes are expected in areas that have a surplus or shortage of nurse staffing resources. Proximal density is a manner in which to measure the local geographic availability of resources. Geographical information systems (GIS) software is utilized to examine the effect of proximal density of nurse staffing resources (nursing schools) on care quality outcomes in hospitals. In this study, the influence of proximal density of nursing schools and hospitals on hospital care quality outcomes in the United States (U.S.) is examined. In addition, it is ascertained that there is a mix of individual states operating in a surplus of nurses while others operate in a deficiency. The supply is also coupled with the dynamic population context of the nation and its rural/urban regions.

Moreover, nursing schools and hospitals that are examined reside within this multifaceted context.

Data from CMS' *Hospital Compare* and the American Association of Colleges of Nursing was analyzed using GIS software and binary logistic regression via STATA statistical software. There were 2,205 hospitals and 811 nursing schools included in the sample. The results of the primary analysis indicate an increase in the likelihood of a low star rating in areas of higher 20-mile and 10-mile proximal density. Additionally, the likelihood of a 5 star rating increases in areas of higher 10-mile proximal density. The sensitivity analysis reveals a negative relationship between hot-spots of nurse staff resources and hospital quality outcomes, suggesting that as access to nurse staffing resources increases, the quality of care decreases.

Background

The link between nurse staffing and quality has been found in hospitals, in which a need for nursing care is a reason for admission (Bowers et al., 2000; Shields & Kick, 1982). As a significant threat to health care, the nursing shortage has been acknowledged as a major threat and has persisted despite the level of scholarship pointing to its negative impact on care quality (Aiken et al. 2002; Janiszewski et al. 2003; Kutney-Lee et al. 2009). Due to this issue, multiple hospitals have shut down in recent years where their services are vitally needed in the communities in which they reside (Cramer, Nienaber, Helget, & Agrawal, 2006). The lack of hospitals, whether a government, for-profit, or nonprofit facility type, across the U.S. creates a lack of access to health care services, part of which is driven by the lack of nurses to provide appropriate care services.

Nursing education resources, such as nursing schools, have strategic partnerships with hospitals and other types of health care facilities. These networks provide an opportunity to

remedy the nursing shortage through partnership incentives, increased wages, loan forgiveness, and more (Buchan & Aiken, 2008b). Additionally, the partnership between facility and school creates a potential funnel of newly minted students and employees. At the same time, both can share in the cost of marketing and promoting nursing careers. However, these strategic partnerships are not a guarantee for current or future nurses.

In nursing workplaces, such as hospitals, there is a lack of nurses available to fulfill the need for services by patients. In the institution of educational facilities, there is a lack of the number of nursing schools and faculty equipped to prepare the next generation of nurses (Anderson, 2014). The actors involved with where the problem is occurring such as patients, nurses, and healthcare facility administrators are the closest to the nursing shortage problem. Therefore, because the issue is closest to those working in and around these institutions, advocacy groups and professional organization have been created. These groups are vast in numbers creating a plethora of resources that have been and will be used to continue nursing workforce improvement efforts.

Hypothesis

Two theoretical lenses offer logic when examining the relationship between proximal density of nurse education resources and care quality outcomes in hospitals. Social network theory (Granovetter, 1973) proposes that the closer education resources are to organizations, the better the quality results would be. Resource dependence theory (Pfeffer & Salancik, 1978) suggests that being close to education resources lessens commitment between staff and outcomes because organizations may not be as worried about retaining their resources. Because of the confliction between lenses, this creates a dilemma with regard to the direction of the hypothesis.

Therefore, a previous examination and Study 1 of this dissertation are relied on to offer insight into the direction of the relationship between proximal density of nurse education resources and hospital quality outcomes. In a previous examination, proximal density to nurse education resources had a negative influence on nursing home quality outcomes in a single state (Haun et al., 2018). In Study 1 of this dissertation, where the context was extended to the entire nation, proximal density had a positive influence on nursing home quality outcomes. With Study 1 in mind that provides a national context, just as this study will yield, it is most appropriate to offer a directional hypothesis. The following provides this hypothesis:

Hypothesis₀: No relationship between proximal density to nursing education resources and hospital quality outcomes exists.

Hypothesis_A: A positive relationship between proximal density to nursing education resources and hospital quality outcomes exists.

The social network theory asserts a positive relationship between proximal density of nurse education resources and hospital care quality outcomes. With that said, social network theory is a tool that allows the illustration of micro and macro organizational ties (Granovetter, 1973). The theory suggests how human and nonhuman organizational elements work together and create a social network (Granovetter, 1983). Relevant to this study, this theory applies to hospitals and nursing schools, which ultimately play a role in their social network. The network involving hospitals and nursing schools make up the *physical proximity*, nursing students and professional nurses are the *professional proximity* (Cott, 1997). These parts of the network work together to create associations (Granovetter, 1983).

According to the social network theory, these networks can be strong or weak. When there are strong, tightly knitted relationships, the stronger the social ties will be. When this is the case, the organizations within those ties will have better outcomes than those who have weak ties (Uzzi, 1996). Within a proximity network, there may or may not be a resource output (nursing school) in close distance to a hospital. Therefore, based on the theory, if there is a low resource output, there may also be lower outcomes in those organizations. In summation, social network theory proposes that the closer the education resources, the better the quality outcomes will be. The hypothesis that there will be a positive relationship coincides with the premise of the social network theory as well as the results from Study 1 of this dissertation.

Methods

A binary logistic regression was completed. The analysis was used to combine effects of all study measures on care quality outcome ratings. A series of models were undertaken based on the proximal density variables on hospital overall outcome rating. The star ratings were dichotomized (“high rating,” “low rating,” 1-star, 3-star, 5-star). Robust regression procedures were used to account for the effects of nurse staffing within hospitals. In each model, standard errors were estimated along with the model's residuals. The analysis differed slightly from the target sample's (n = 4,813) key study variables based on available data in the dataset (n = 2,205), a difference of 2,608.

Data and Sample

The sample of hospitals in the U.S. came from the *Hospital Compare* dataset hosted by Medicare.gov. The *Hospital Compare* database provides information on all hospitals that are Medicare-certified in the nation. As of July 2017, there were 4,813 hospital providers in the data

set. The database provides the organization's general information, overall rating scores, staffing, and patient outcome information. For this research, the data was downloaded as a CVS file for the integration of Microsoft Excel and STATA, a statistical software program.

For the nursing schools, the American Association of Colleges of Nursing's dataset of accredited schools was used. It contains accreditation dates, nursing degrees offered, and zip code information to calculate proximal density. For the nation, as of July 2017, there were 811 accredited nursing schools. The information was stored in a Microsoft Excel spreadsheet to compare the hospital database easily. Furthermore, the accredited nursing schools were cross-referenced with the *The Campaign for Nursing's Future* - Johnson & Johnson and other Boards of Nursing datasets to validate the geographical data and other related descriptive data.

Variables

A model of the components of hospital overall quality scores and proximal density to schools was constructed. Key dependent variables examined in the study included hospital overall care rating. The measures includes a star rating, ranging from 1 star (much below average) to 5 stars (much above average). In the *Hospital Compare* dataset, the *Overall* hospital rating includes 57 of the more than 100 measures reported on Hospital Compare, divided into 7 measure groups or categories: mortality, safety of care, readmission, patient experience, effectiveness of care, timeliness of care, and efficient use of medical imaging. This rating is based on facility performance for all star rating measures collectively, each of which has its own five-star rating. The star ratings were dichotomized ("high rating," "low rating," 1-star, 3-star, 5-star) with a high rating equaling a 4- or 5-star rating and a low rating equaling a 1- or 2-star rating.

The key independent variables of proximity included: (a) number of schools within 20 miles and (b) number of schools within 10 miles. These proximities were chosen based on the average commuting distance across the U.S. (US Census, 2017). Controls included: (a) hospital size, (b) ownership type, and (c) facility type. A descriptive table of the proximal density, independent variables can be found in Table 3 (page 121).

Analysis

The distance between nursing schools and hospitals was calculated using the Near as Table tool in ArcMap 10.4.1. This provided a measurement in meters between a school and the nearest hospital and the hospital to the nearest school. Near measurements were the outcomes from the analysis. To assess the number of facilities within 20 miles and 10 miles of a school, we utilized several geoprocessing tools. First, a Buffer tool was used to generate two buffers at the set mile distances around each school. Then, the Intersect tool was used to find which facilities fell within these buffers. After that, the Dissolve tool helped to obtain a count of facilities in this range. As a final step, we repeated the processes for facilities to find how many schools are within the set miles of their location.

Hospital and school locations were then joined with a county using the Intersect tool, and a count was obtained using the Dissolve tool, providing a count of the number of schools and the number of facilities in each county. Using these counts, we then utilized a spatial statistics tool to identify optimized hotspots within the nation in terms of the number of facilities and schools within a county. Optimized hot spot analysis works by comparing geophysical neighbors to one another and indicates the probability of a county with an unusually high or low count of a feature (in this case schools and nursing facilities) relative to their neighbors is a function of random

chance. Hot spots can help reveal competition in different industry environments (Pouder & St. John, 1996).

A series of analyses were undertaken to determine the influence of proximal density of nurse education resources on hospital quality outcomes. In each model, ratings were broken down into categories to examine proximal density association with hospital star rating. This analysis was used to assess the influence of each proximity variable (schools within 20 and 10 miles) on select hospital quality rating variables. Summary statistics relating to the dependent and independent variables are presented in Table 4. Summary statistics reveal that the average overall star rating for hospitals is 3 stars. Additionally, the best rating for hospital is the quality measure rating averaging at 3.76. On average, there are 2 nursing schools within 20 miles and 1 within 10 miles.

Insert Table 4 about here

Results

The results from a via binary logistic regression are presented in Table 5 with significance reported at the .05 level. Table 5 shows the results for hospital *Overall Star Rating* sorted by low, high, 1-star, 3-star, and 5-star rating. These results show a significant association of proximal densities of nurse education resources with hospital overall low star ratings at the, 20-mile (coefficient = 0.054, $p = 0.000$) and 10-mile (coefficient = 0.101, $p = 0.000$) proximities. This means that a 0.054 unit increase in the log odds of a low rating (1-2 stars) is expected for every one-unit increase in nursing schools within 20 miles, holding all other variables constant in the model. And, a 0.101 unit increase in the log odds of a low rating (1-2 stars) is expected for every one-unit increase in nursing schools within 10 miles, *ceteris paribus*. A similar relationship

was found for *1-Star Rating* at the 20-mile (coefficient = 0.106, p = 0.000) and 10-mile (coefficient = 0.234, p = 0.000) proximities. Therefore, the higher the proximal density, the more likely a facility is to receive a low star rating or a 1-star rating.

A 3-star rating also was significant at the 20-mile (coefficient = -0.032, p = 0.003) and 10-mile (coefficient = -0.081, p = 0.000) proximities. However, these results show that the higher the proximal density, the less likely a facility is to receive a *3-Star Rating*. High-rating was not significant at the 20-mile or 10-mile proximities. *5-Star Rating* was significant at the 10-mile proximity (coefficient = 0.120, p = 0.039). Therefore, the higher 10-mile proximal density, the more likely a hospital is to receive a 5-star rating.

A significant association of *Size*, *For-profit*, and *Government hospitals* was found with at the 20-mile and 10-mile proximities for *Overall Low Star Rating*. For *Overall High Star Rating*, *Size*, *For-profit*, *Government*, *General Acute Care*, and *Critical Access* at the 20-mile proximity and at the 10-mile proximity, all were significant except *Critical Access*. For *1-Star Rating*, *Size*, *For-profit*, and *Government* were significant at the 20-mile and 10-mile proximities. For *3-Star Rating*, *Size* was significant at the 20-mile and 10-mile proximities. For *5-Star Rating*, *General Acute Care* and *Critical Access* were significant at the 20-mile proximity and *Critical Access* was significant at the 10-mile proximity.

Insert Table 5 about here

Mimicking Study 1, an additional sensitivity analysis was administered to determine whether the results of the principal findings are responsive to whether or not a hospital is located

within a “hot spot.” “Hot spots” occur where the number of facilities and schools are significantly different and higher than neighboring counties. Hot spot analysis works by comparing geophysical neighbors to one another and indicates the probability of a county with an unusually high or low count of a feature (in this case schools and hospitals) relative to their neighbors is a function of random chance. Hot spots can help reveal competition in different industry environments (Pouder & St. John, 1996). In the nation, 18% of hospitals are in a “hotspot”.

Insert Figure 5 about here

The map in Figure 5 (page 132) shows the “cold spots,” which would be marked by significant low densities instead of high densities of hospitals and nurse education resources. Hospitals cold spots are similar to population patterns across the U.S. with the northeast and southeast remaining predominantly “hot” compared to the rest of the nation. The results from this analysis yielded the same negative relationship of the principal analysis. Results of this analysis are presented in Table 6 and reveal that hospitals in a “hot spot” versus a “cold spot” have a negative, significant influence on all quality measures with a $p < 0.01$.

Insert Table 6 about here

Discussion

An innovative approach was utilized in this study to examine factors related to nursing shortage in hospitals. Based on outcomes from a previous study (Haun et al., 2018) and Study 1

included in this dissertation, it was unclear whether or not proximal density would have a significant relationship with care quality outcomes in the hospital context. Similar to nursing homes in Study 1, this study revealed hospitals are located in areas of high and low concentration, creating rural and urban settings for care resources. These densities almost synonymously align with population densities in the U.S. However, one particular difference is the fluctuation of resources in Washington.

Given the geographic implications of both hospitals and nursing schools, it appears that that higher amount of nursing resources, the more likely a hospital is to receive a low rating or a 5 star rating but less likely to receive a 3 star rating. This interesting outcome reveals the importance of context in these given organizational relationships. Perhaps, the relationship between proximal density and care quality outcomes has less to do with whether or not a hospital has nursing resources. Instead, perhaps it has more to do with how hospitals are relating with and utilizing these given resources. Based on this information, practitioners and administrators alike should understand the importance of their relationships with other healthcare resources, such as nursing schools. As the social network theory proposes, strong close ties lead to better quality outcomes. It is not just about the closeness of those ties but also how strong those ties are with other organizations.

The results of the analyses conflict with underlying assumptions regarding the availability of nurses and care quality outcomes. The results indicate that the more resources there are, the more likely a hospital is to receive a low rating or a 5 star rating. This conflicting result is rectified with the sensitivity analysis. Although proximal density is associated with hospital quality outcomes, the results from the hot spot analysis indicate a negative influence of hot-spots of nursing resources on care quality outcomes. The study identifies the exploratory

predictor of proximal density and subsequently denies the given hypothesis. The results suggest that densities of resources may offer meaningful insight into care quality in a variety of contexts.

Efforts have been made to ensure any potential threats to validity are eliminated, but some remain. There is a specific limitation with the use of proximal density as the mile proximities, to some degree, have been arbitrarily set. Additionally, the sample of hospitals for this study solely consists of hospitals that are included in the *Hospital Compare* dataset. There is potential that these hospitals are different, in kind, than hospitals not included in this dataset. Therefore, the sample analyzed may limit the generalizability of the findings. Despite the limitations, the study produces opportunities for future research. Proximal density and the relationship between the geographical implications on care quality can be used in the continued exploration of other health care facility types and educational facility types. By doing so, other geographical implications can be examined to better understand the extent of the healthcare market in its entirety.

Conclusion

In light of the dissertation in its entirety, this study sheds light on the multifaceted differences between facility types, such as hospitals and nursing homes, and care quality outcomes. By doing so, focusing on hospitals allows for a more holistic view of the healthcare industry and how organizational resources play a role in optimizing population health. Another contribution of this study is the further depiction the novel measure for proximal density with regard to nurse education resources, nursing schools. In Study 1, the unit of analysis was nursing homes where this study turns to focus on hospitals. With that said, the use of proximal density as a measure can be extended to other health care facility types as well. The findings confirm that a

low rating or a 5 star rating is more likely for hospitals with the increase in proximal density while there is a decrease in likelihood for a 3 star rating. This finding conforms with a past study (Haun et al., 2018) and with Chapter 2 of this dissertation. With information at the state and national level, GIS can be utilized to look at the individual differences per state and the aggregate affects at the national level. Perhaps the relationship between proximal density and care quality outcomes is dependent upon these differing levels and facility types. Either way, examining facility networks is an evaluation tool for a better understanding of educational supply and patient demands for healthcare resources. This information is helpful in the decision-making process of where to locate health care and educational resources. If proximal density of nursing resources can lead to lower or higher hospital care quality outcomes, the relationships between organizations may matter more than the actual resources themselves.

Chapter 4

Examining the Influence of Nurse Staffing Policy on Nurse Staffing Levels, 2004 - 2016

Abstract

Nursing policy reform in the United States (U.S.) during the late 2000s impacted health facility operations, the nursing workforce, and care quality outcomes. The objective of this study is to evaluate the impact of nurse staffing policy on nurse staffing levels over time. A systematic review of legislative databases revealed that 14 states have enacted regulation addressing nurse staffing specifically. To understand if these policies are helping to resolve the nursing workforce shortage, policy data from 2004 and 2016 are assessed via a time series regression analysis. It is hypothesized that there will be a positive relationship between enacted nurse staffing policies and nurse staffing levels. Primary policy information will come from the National Conference of State Legislatures and Congress, GovTrack.us, and Congress.gov databases. Each policy is recorded based on the year it was enacted. State nursing population data comes from the Bureau of Labor Statistics. Results indicate a statistically significant positive relationship between enacted nurse staffing policies and nursing amounts over time. This study contributes to the growing understanding of the impact of nursing regulation on health care facility operations, ultimately effecting care quality outcomes. It is timely to have appropriate policies that establish needed levels of health professionals, in turn creating and sustaining better health outcomes for those served by this population.

Introduction

Health policies have been created by the federal government and state governments relating to the nursing workforce shortage in an effort to improve nursing supply, educational levels, and healthcare outcomes (Buchan & Aiken, 2008a). These policies are implemented by institutions such as nursing schools and healthcare facilities in which nurses work where the policies are created to improve and increase the nursing labor market. The importance of nursing supply on the quality of health care services has become a top priority in national health care policy discussions (IOM, 2011). While health care quality outcomes are important, nursing care alone has the ability to influence overall care outcomes in a large capacity as they are directly linked to the care received by the patient (Needleman, Buerhaus, Mattke, Stewart, & Zelevinsky, 2002).

Scholarly work has revealed that the rise of the nursing shortage over the past decade has been due to the increase in health care expenses, lack of healthcare personnel, poor clinical outcomes, and the aging population, thus making these policies even more important than before (Janiszewski-Goodin, 2003). At the same time, there is a lack of nursing schools and nursing faculty to prepare the next generation of workforce ready nurses, creating a significant challenge in bridging the gap between the nursing supply and the ability to provide appropriate levels of health care services (L. H. Aiken, Cheung, & Olds, 2009). In response, states have begun enacting nurse staffing policies to increase nursing supply and, ultimately, care quality outcomes. For example, in 2004 California became the first state to implement a minimum nurse staffing ratio policy in order to increase the number of nurses providing care.

Because of the significant nursing shortage issue, the purpose of this study is to explore the effects of enacted nurse staffing policies on nurse staffing amounts in hospitals and nursing

homes. Part of this examination includes comparing pre and post nurse staffing ratio data, part of which is conducted through a time series regression analysis. The present analysis examines nurse staffing and nurse staffing policies between 2004 – 2016, based on available data.

Policy Background

Prior to the Industrial Revolution in the U.S., the nursing workforce was made up of family and friends who delivered care to their loved ones. After this time, there was a sharp turn in the advancement of technology and knowledge, ultimately leading to better quality of care provided. The care that was administered was in need of regulation, but because the U.S. Constitution “does not include provisions to regulate the practice of nursing, the responsibility falls to the states” (Russell, 2012). In the 1990s, health reforms began to take shape at the state level (L. Aiken, Clarke, & Sloane, 2000).

In 1903, the state of North Carolina enacted the first nursing regulation to protect and improve the practice of nursing (Russell, 2012). This bill allowed nurses to register with the state after receiving an education from an approved public or private hospital. After that, nursing exams and licenses were created and regulated by the North Carolina Board of Nursing. Many other states quickly followed suit including New Jersey, New York, and Virginia. By the 1970s, all states required licensure for registered and practical nurses. Since this time, the nursing practice has evolved into a formal scope of healthcare practice within legislative statutes (Russell, 2012). This has led to a need for nursing labor in differing sectors of healthcare such as hospitals and nursing homes.

All states have enacted a nurse practice act (NPA), passed by the state’s individual legislature, to aid in the dissemination of policy information to practicing nurses. Through the

NPA, a board of nursing (BON) must be established that “has the authority to develop administrative rules or regulations to clarify or make the law more specific. Rules and regulations must be consistent with the NPA and cannot go beyond it. These rules and regulations undergo a process of public review before enactment” (Russell, 2012). Together, in all 50 states, the BON represents the National Council of State Boards of Nursing (NCSBN). The NCSBN collectively maintains nursing regulation and disseminates policy information for nurses to stay informed. Although NPAs are distinguished as providing guidelines to a better quality of care, the acts also detail rules and regulations to alleviate nursing shortages. However, not every state has policies in place to aid with the nursing shortage issue. These policies are largely predicated by the nursing market supply, health status of the state, and state’s particular overall need.

In 2010, the Institute of Medicine (IOM) report, *The Future of Nursing: Leading Change, Advancing Health* gave thorough recommendations for states to implement regarding nursing workforce improvement (IOM, 2011). This report was published after a large amount of evidence-based research came forth showing the strong ties between the nursing workforce and patient quality outcomes, as well as the costs associated with these outcomes. The IOM report identifies the nursing profession, whose more than three million members make it the largest healthcare profession, as central to efforts to remake the U.S. health care system so that all Americans have access to high-quality and cost-effective care. The committee’s report provides a blueprint for transforming the nursing profession by increasing nursing supply, ultimately leading to the improvement of quality health care and the way it is delivered (IOM, 2011).

Following this report, although not legally required, all 50 states began pursuing solutions to the pressing issues facing the nursing profession through “action coalitions.” The Campaign

for Action, one of the many action coalitions, was formed shortly after the IOM report with the purpose of taking action to improve the amount and quality of the nursing workforce. States began initiatives to improve access to care, foster nursing leadership, transform nursing education, increase diversity in nursing, and collect workforce data. Although the issues from the report seem ambiguous, they all link back to the underlying issue of the nursing shortage. The Campaign for Action, a primary stakeholder in this matter, chartered an extensive network and stakeholder group to chase after the problem as a team (Campaign for Action, 2017). These groups have helped push nursing workforce improvement policy onto the agenda at the state and federal level. By doing so, a mix of nurse staffing policies have been enacted.

The Future of Nursing was a pivotal report that garnered attention at the state, national, and international level and is used in this study as the peak during the policy reform period. Despite the report, neither large-scale increases in staffing nor substantial improvements in care quality have been achieved by these vast health policy changes. Nursing shortages across the U.S. still exist and low state health status remains an issue (Buchan & Aiken, 2008; Mosadeghrad, 2014). For example, Alabama has persistently had the worst health ranking among the states and still resides in a consistent shortage of nurses, despite the policy reforms that have taken place. Now, many states are individually mandating higher healthcare outcomes through their health professional network.

Health Policy Literature

One of the reasons that states differ in their nursing shortage policies leans towards the nurse staffing market operating in a shortage or a surplus. Imbalance in the health care workforce, in this case nurses, tends to affect policies that will be implemented (Fox & Abrahamson, 2009; Zurn, Dal Poz, Stilwell, & Adams, 2004). In the past, it has been found that

federal policy has had a tremendous effect on the amount of nurses earning an education and obtaining employment (Bovbjerg, Ormond, & Pindus, 2009). Nurse staffing legislation may increase staffing ratios; however, this can be difficult for some healthcare facilities without mechanisms to help achieve these ratios (Conway, Tamara Konetzka, Zhu, Volpp, & Sochalski, 2008).

Extant research has identified multiple examples of policies that shape the nurse staffing market. Examples of policy tools include nursing schools to provide education and state funding for health programs. These mechanisms can also be referred to as resources. With a given set of resources, facilities may be better equipped to achieve mandated nurse staffing levels through recruitment, new partnerships, and better salary/working conditions. States may be further persuaded to implement nurse staffing policies if other states have success with such policies (Volden, 2006). For example, if a state that has a consistent shortage of nurses, implements a nurse staffing policy and their staffing rates improve, another state may be persuaded to follow suit. The adoption of state policy may also be dependent upon Medicaid and Medicare funds (E. Miller & Politics, 2009; Miller, 2006). Medicaid and Medicare funding can be looked upon as a valuable resource for healthcare facilities. With more funding, a facility may have the capacity to care for more patients, in turn creating a need for more nurses. The need for more nurses may lead to the implementation of nurse staffing policy. If facilities can meet the staffing ratio requirements, it is widely supported that quality of care increases with appropriate staffing levels (Harrington et al., 2000; Joanne Spetz et al., n.d.).

States also adopt health policies to try and solve public problems. In this case, the public problem is the lack of readily available nurses to provide health care services and one solution is nurse staffing ratio policies. Pushing the need for states to implement health policies such as this

includes citizens, advocates, and intellectuals. A state's motivation to adopt a given policy includes the push from these entities as well as the yearn to increase the health of their constituency, reduce healthcare costs, and, ultimately, solve the public problem.

Theoretical Lens

The resource dependence theory (Pfeffer & Salancik, 1978) suggests that being close to education resources lessens commitment between staff and outcomes because organizations may not be as worried about retaining their resources. Pfeffer and Salancik (1978) note that external resource providers often attach conditions to the continuation of resource provision. Policy is treated as an environmental condition that requires organizations to react in order to survive. In the healthcare setting, these conditions come in the form of accountability and reporting standards. These standards, in part, include compliance of appropriate nurse staffing levels in health care facilities. If facilities do not meet these standards, their organization may be forced to comply or shut down operations. Furthermore, if a facility cannot meet certain quality outcomes, they may seek policies that aim to reach a certain standard.

Pfeffer and Salancik (1978) note several conditions which are likely to "affect the extent to which an organization will comply" with such external demands (p.44). A major condition is a dependence on the resource in question, the viability of alternative sources, and the extent to which the resource provider is codependent on the recipient for additional outcomes. In the case of nurse staffing policy, these factors vary based on facilities type and needs within the state (i.e., surplus or shortage of nurses). Based on the premises of resource dependence theory, a state's efforts toward appropriate nurse staffing may increase with its degree of dependence on factors.

Examples of factors include a state's budget, current workforce, and past policies that have been implemented.

Resource dependence theory argues that an organization's performance determines organizational access to critical resources (Pfeffer & Salancik, 2003) and looks at the ways in which access to these resources can offer organizations a competitive advantage (A. J. Hillman et al., 2009). An organization's performance may play a role in state policy implementation as well. Organizations typically depend on resources for survival where environmental pressures determine resources (Hillman & Withers, 2009). The supply of the workforce and the demand for goods/services from an organization can play a role in these pressures.

Nurses are a human capital resource, and, in instances when resources are more difficult to obtain, competition rises, creating an environment where resources are harder to sustain (Pfeffer & Salancik, 2003). Currently, there is a lack of qualified nurses and nursing students preparing to enter the workforce. This creates a market where resources are sparse and hard to obtain. Therefore, competition increases in an effort to gain nursing resources. In turn, when access to these resources is lost, replacement costs will increase. Thus, commitment to nursing staff, training, and their satisfaction would be lower, leading to lower levels of patient satisfaction (Vahey et al., 2004).

According to Hillman et al., a limited area of study utilizing resource dependence theory is temporal models (2009). Examining interdependencies over time may reveal a broader landscape of the theory as well as the ways the theory may be restrained in its application. This study allows the gap in the literature to be explored by looking at nurse staffing policies and nurse staffing amounts overtime. Resource dependence theory has been applied extensively to

the healthcare setting; however, the theory has been seldom applied to the field of nursing specifically (Yeager, 2013).

Hypotheses

Based on the nursing landscape and the contextual elements within, many factors affect the state motivation to enact nurse staffing policies. One important determinant at the state level is whether or not the state is operating in a shortage or surplus of nurses (Fox & Abrahamson, 2009). Directly related to this shortage or surplus is the state's health outcomes and ability to deliver healthcare services. A broad expectation is that the policy increases will positively affect nurse staffing levels by increasing nurses in the labor pool. It is expected that nurse staffing rates increase after the reform period relative to the pre-reform period, and that they then become stagnant in the postreform period. Additionally, it is thought that the nurse staffing levels to increase in both the hospital and nursing home setting.

H₀: There will be no relationship between the enactment of state nursing staffing policy and nurse staffing levels.

H_A: There will be a positive relationship between the enactment of state nurse staffing policy and nurse staffing levels.

- *There will be a positive relationship between the enactment of state nurse staffing policy and both hospital and nursing home nurse staffing levels.*

Methods

The analysis was conducted in two steps to first identify nurse staffing policies and the second to explore relationships between nurse staffing policy and nurse staffing levels. All

analyses were performed for nursing homes and hospitals separately. These facility types have inherent differences in their patient populations with resulting differences in their nurse staffing amounts.

Insert Table 7 about here

The first step of the analysis was to identify nurse staffing policies in the U.S. A nurse staffing policy is a regulation that mandates a particular ratio of nurses, which is determined by the number of patients present in a healthcare facility. The following bibliographic search strategy was utilized.

Bibliographic search databases: The National Conference of State Legislatures and Congress, GovTrack.us, and Congress.gov.

Search Terms: The following keywords were the search terms – nurse, nursing, nursing law, nurse staffing, health, certification, license, and staffing.

Legislation selection criteria: Policies chosen were enacted status between 2004 and 2016.

The analysis explored relationships between the enactment of nurse staffing ratio policies and nurse staffing levels. All analyses were conducted with SPSS statistical software. A time series regression analysis is utilized for years between 2004 and 2016. Basic descriptive statistics of variables in this study are available in Table 8. Summary statistics and plots were created to familiarize results from the data and test for assumptions of linear regression tests. Controls for potential confounders have been added to correct methodological issues including state

population, state spending, median household income, percent of the population in an urban area, percent of the area that is urban, health ranking, and state party control (i.e. Republican or split between Democratic and Republican). Other potential threats to validity such as autocorrelation are also accounted for through controls. Together, the regression analysis helps clarify the degree to which nursing indicators are positively or negatively associated with nurse staffing amounts or if there is any relationship at all.

Insert Table 8 about here

Data and Sample

This study utilizes a times series analysis of state nurse staffing policies between 2004 and 2016. These years were selected based on the availability of data for all variables in the study. The unit of analysis in this study is state/year, which created an $n = 553$. The analysis differed slightly from the target sample's ($n = 600$) key study variables based on available data in the dataset ($n = 553$).

The primary objective of this policy analysis is to explore the impact of nurse staffing policies on staffing levels. Therefore, the enactment of state nurse staffing policies between 2004 and 2016 is the primary independent variable. The nursing workforce data includes registered nurses, licensed practical nurses, and nurse aides, all of the nursing professions included in the U.S. Census Bureau database. The primary dependent variable is the number of nurses and then standardized by the number of beds at hospitals and nursing homes. For example, if Alabama reported a total of 1000 nurses in 2010, 100 hospital beds, and 10 nursing home beds. Then, the dependent variable for hospitals would be 10 and for nursing homes would be 100.

The primary independent variable is whether a state adopted a nurse staffing ratio policy, a yes/no dichotomous variable. The data comes from the National Conference of State Legislatures and Congress, GovTrack.us, and the Congress.gov. Along with those sources, the NPA websites at each state's BON were collected in order to easily reference and triangulate individual states regulations (NCSBN, 2016). The only policies that were reviewed directly relate to nursing workforce staffing. Policy data collection methodology and analysis have followed past scholarly works (Burnes Bolton et al., 2007; Hyun Shin et al., 2018; Park & Stearns, 2009b). A list of the nurse staffing policies by state between 2004 and 2016 is available in Table 9.

Insert Table 9 about here

A time series regression analysis of statewide nursing policies between 2004 to 2016 was conducted. These years were selected based on the availability of data for all variables in the study. The sample includes every state in the nation and nursing policies that are implemented within those states. The inclusion of all individual states was determined in order to examine differences at the state level.

Controls were selected based on past research regarding the best predictive indicators for health policies (E. A. Miller, 2005). Controls come from state Census data, which was obtained from the U.S. Census Bureau website (US Census Bureau, 2017). Census data reveals ratio information regarding a number of nurses in a state to the rest of the population. The population of individual states, their spending, median household income, and urbanization of the state are included based on their predictive power. Additionally, the state's health care ranking and state

party control are controlled for. Full definitions of the variables, how they are measured, and how they are labeled can be found in Table 10.

Insert Table 10 about here

Results

Figure 6 shows total amount of nurses by type between 2004 – 2016. There was a major increase of Registered Nurses (RNs) after the IOM report was released in 2010. It is unknown why this might be the case, but perhaps the report did in fact spark recruitment and retention of nurses. Overall, there was a 15.69% increase in RNs after the release of the IOM report. Nurse Aides increased by 7.68% while LPNs decreased by 12.67%. Information for NPs only includes post IOM report. Figure 7 displays this increase with all nursing types collectively. Based on this trend, it appears that the nursing workforce will continue to grow; however, the future of the LPN workforce is uncertain.

Insert Figure 6 about here

Insert Figure 7 about here

Figures 8 displays the total enacted state nurse staffing policies between 2004 and 2016. Interestingly, Figure 8 reveals an irregular pattern of policy enactment across this particular timespan. From 2005 to 2006, there are no state nursing policies enacted. Then, there is a

sudden spike until 2009, with four policies enacted that year, followed by a sudden decline to zero in 2010. Part of the sudden increase may have been due to discussion around the nursing shortage crisis, right before the IOM: Future of Nursing report. After the report was released in 2010, there is then another increase in policies until 2013, with four policies enacted that year. Following that, there were zero policies enacted in 2015 and 2016. Figure 9 shows a map of the United States and the individual states that have enacted nurse staffing policies during the same timeframe.

Insert Figure 8 about here

Insert Figure 9 about here

For the times series regression analysis, this model was utilized to examine the effects of nurse staffing policy on state nurse staffing levels. Preliminary analysis was performed to ensure there was no violation of the assumption of covariation between designated data levels. For hospitals, a positive significant relationship was found for policy amount (coefficient = 0.093, $p = 0.000$), therefore accepting the identified positive directional hypothesis of the study. Therefore, for every one unit increase in nurse staffing ratio policy, a 0.093 unit increase in hospital nurses is predicted, holding all other variables in the model constant.

There was also a positive significance found for state population (coefficient = 0.894, $p = 0.000$) and state spending (coefficient = 0.323, $p = 0.001$). Thus, for every one unit increase in state population, a 0.894 unit increase in hospital nurses is predicted, *ceteris paribus*. And, for every one unit increase in state spending, a 0.323 unit increase in hospital nurses is predicted,

ceteris paribus. In contrast, there was a negative significance for percent of area in urban area (coefficient = -0.119, $p = 0.000$) and health ranking (coefficient = -0.129, $p = 0.001$). That being so, for every one unit increase in percent of area in urban area, a 0.119 decrease is predicted, holding all else constant. Also, for every one unit increase in health ranking, a 0.129 decrease is predicted for hospital nurses, ceteris paribus.

For nursing homes, there was no statistically significant relationship between staffing ratio amount and number of nurses. State population (coefficient = -0.117, $p = 0.019$) was negatively statistically significant. However, state spending (coefficient = 1.470, $p = 0.000$), median household income (coefficient = 1.375, $p = 0.000$), and health ranking (coefficient = 0.345, $p = 0.000$) were all positively statistically significant.

Table 10.1 – 10.2 presents results from each of the models. Overall, the convoluted results across facility types do not indicate any particular pattern between policy amount and indicators across time. Results indicate a statistically significant relationship between nursing policy amounts and nurse staffing in hospitals between 2004 - 2016. Based on these results, the null hypothesis that the enactment of nurse staffing policy has no effect on nurse staffing levels is rejected.

Insert Tables 10.1 – 10.2 about here

The models yield limited explanation of the dependent variable being explored. Additionally, it is important to note the lack of research for comparative state analysis involving nursing specific policies. At the individual state level, only 14 states have implemented nurse staffing policies. Figure 9 further depicts individual states that have enacted nurse staffing policy.

Insert Figure 9 about here

Discussion

The results from the time series regression analysis from 2004 to 2016 indicate the potential association between enacted nurse staffing policies and nurse staffing levels. The results suggest that nurse staffing amounts may be influenced in particular healthcare facility types in a given time frame. This may be due to the push for more nurses in a particular facility type. Perhaps, nurse staffing policy has a stronger impact in hospitals due to the type of nurses that are affected by these policies in this particular health care setting. More RNs, who have a higher degree of medical responsibility in comparison to LPNs, work within the hospital setting. Therefore, the need for more RNs and the care they can provide may be more prevalent in hospitals. In nursing homes, the amount of LPNs may be a further influential factor over other types of nurses because more of this nursing type is needed in this particular health care organization. This need may cause stronger mandates for nurse-to-patient ratios.

With a positive relationship found for state population and state spending, states may work to implement more policies where there is a greater need for more nurses. With a state's given amount of resources and their capacity to provide resources, they may implement more policies for their set constituency. As for nursing homes, no significant relationship was found; however, state population and state spending along with median household income and health ranking were all found to be positively correlated with nursing amounts, much like hospitals. Additionally, with these higher amounts of resources comes a greater number of nurses in these areas who are providing care. Table 10.1 and 10.2 present the time series regression results and the specific relationships with these variables.

Although not all indicators of state care quality outcomes were explored, the research design is replicable and can be built upon to allow for the inclusion of time points beyond 2016. However, there are a number of distinctive limitations to the study that warrant mention. Threats to causality may be directly linked to endogeneity. The inclusion of other omitted variables, such as state nursing incident rates, may arrive at determining nurse staffing policy influence in a different type of study design. Another issue with the analysis is that other external time-varying effects or autocorrelation may be occurring. An example of this phenomenon is the characteristics of the population changing over time such as aging. Another limitation of the study is that the generalized linear model only accounts for years 2004 - 2016 based on available variable information, making findings less generalizable to the entire history of nursing supply. Future research should include exploring significant differences in the amount of nurse staffing policies at the state level, such as the 14 states that have enacted policies. Other research could help indicate early adopters, such as California, when it comes to nursing policy. Policy diffusion may be another indicator of nurse staffing policy adoption that should be further studied.

Despite these caveats, this study contributes to the empirical literature on the resource dependence theory. Specifically, this study examines nurse education resources and how these resources influence nurse staffing amounts. Rather than focusing on workers as a human capital resource alone, a precise type of worker that is an important resource in the healthcare landscape is provided – nurses. With the lack of studies applying the resource dependence theory, this chapter helps to bridge this gap by focusing on the ties between nurse staffing policies and nurse staffing amounts. The enactment of a nurse staffing policy can be viewed as a factor that influences the human capital resource of nurses. In the healthcare landscape, nurse staffing policies have a positive, significant relationship with the labor market, specifically the nursing

market. This chapter highlights the practical implications for states and healthcare organizations that seek to understand the importance of their resources. The study is particularly important for healthcare organizations who suffer from a large degree of nursing turnover or a lack of nurses to provide services.

Conclusion

The results of this study contribute to the knowledge of state factors such as policy implementation and nursing supply. Findings also support the notion that certain state characteristics have a stronger influence than others. However, in this given study, the influences vary across years leading to the inability to decipher which ones have the greatest impact. These findings may not be able to be translated to other healthcare policies indefinitely. What can be noted is the relationships that were studied in the given time frame. In this context, the nature of state's nursing supply is predicated by state spending, health ranking, and median household income more so than other indicators across this timespan.

The study provided allows for a modeling approach to examine the impact of nurse staffing policies over time. Findings indicate that changes in nurse staffing were consistent with increases in policy. With these same changes in nurse staffing, it is thought that there would be higher care quality rates in these facilities. The convoluted associations from 2004 to 2016 suggest that no particular relationship exists between the amount of policies in a given state and nurse staffing levels. Instead, this relationship may be more significant depending on health care facility type, such as a hospital. Regardless, states are in need of policies that are objective and accountable for aiding in the supply of nurses based on the current problem.

Furthermore, this time series analysis is a useful tool for future research regarding nurse staffing policies at the state and federal levels. Importantly, based on the findings, healthcare

administrators and policymakers alike should be aware of the incongruence of the nursing shortage problem and appropriate policies. This research is appropriate to be built from to understand the extent of the effects (or the lack thereof) of nursing policies on nursing supply. Through the final study of this dissertation, there is an aspiration to strengthen the evidence in support for more nursing workforce improvement policies in order to increase the supply of nurses, in turn increasing care quality outcomes across organizational types.

Chapter 5

Conclusion to Examining the Influence of Proximal Density to Nursing Resources in the United States

Introduction

The principle aim of this dissertation was to extend knowledge of care quality outcomes and to strengthen the supporting evidence of the importance of nurse staffing in determining outcomes. In addition, this dissertation has sought to examine the degree to which organizational aspects, such as density and location of resources, can influence care quality outcomes. Towards these aims, three studies are provided, each supporting the significance of nursing resources on care quality outcomes. This chapter will offer a brief overview of the three examinations presented in this dissertation. The chapter will end with a summary of the study findings and the implications of these findings theoretically and practically.

Research Contributions

This dissertation produces valuable new information regarding the extent of care quality outcomes and the nursing shortage problem in health care settings across the nation, specifically nursing homes and hospitals. Despite the information that currently exists regarding nursing supply, there has been a lack of attention given to nursing homes and long-term care facilities in general. In an effort to fill a gap in the existing literature, the similarities and differences between nursing homes and hospitals are revealed while examining these two types of facilities throughout the studies. The results of the ordered logistic regression analysis yield that nursing home care quality outcomes may be positively influenced by a higher density of resources while

hospital care quality outcomes may be negatively influenced. The additional hot spot analysis confirms the strong, differing associations in GIS studies. However, the binary logistic regression analysis in Study 2 reveals that a negative relationship exists between proximal density of nurse education resources and care quality outcomes in hospitals. The time series analysis in the third study offers insight into nurse staffing policy on nurse staffing amounts in both facility types. Furthermore, the analysis shows a statistically significant positive relationship between nurse staffing policy and nurse staffing amounts.

Another contribution to existing research from the studies is a depiction of the novel measure for proximal density with regard to nursing schools, the influence of which can be examined with other health care facilities as well. The quantitative portion of the studies consists of information about what extent the nursing shortage affects patient outcomes in nursing home and home health care settings while looking at the nursing school proximity. Much research has been credited to using GIS as a means to study health care utilization by the public (Higgs, 2009), but far less attention has been given to health care professional workforce studies using GIS (Estaville, 2012).

Additionally, the studies provide insight into how nursing resources can correlate with the nursing supply and quality outcomes in both the state and national context. If the amount of nursing resources does in fact have a significant association to quality outcomes, this means that when there are more nursing resources, there could be better health care outcomes. Furthermore, the amount of nursing resources could ultimately save more lives. This should be expanded to fully understand the extent of the effects of nursing resource geographical location on care quality outcomes.

Outcomes from this dissertation further illustrate nursing shortages or surpluses in individual states, establish exactly where nursing market resources do not exist, and provide solutions that can assist in resolving the nursing supply problem. With the state of Alabama as the pilot study, this dissertation signifies the extent to which the same study can be applied to the rest of the nation. By combining multiple research methods, the results of this dissertation are further strengthened. Collectively, the included studies reveal new ways to view an old problem.

Scope and Limitations

In Study 1 and Study 2, the population of interest includes both nursing homes and hospitals. However, some data points were dropped based on missing variable information, particularly for satisfactory GIS coordinate information. For the national level GIS studies, further research is encouraged to determine the extent of which these findings may be generalized to other health care facilities and health care professions. It is also possible that general quality ratings for rural areas are skewed due to outliers in nursing home and hospital measures (e.g. severely deficient facilities). Other threats to causality may be directly linked to endogeneity. Research shows that nursing turnover is costly to the health care facilities and for the individuals receiving care, the population, and the overall economy (IOM, 2011). This is indirectly examined through the star rating system and may result in a skewed relationship between variables.

Study 3 provides insight into how nurse staffing policy correlates with the nursing supply amounts at the national level. A time series regression analysis as a modeling approach can potentially help project the future nurse staffing in differing facility types. If significant associations are found between effective nurse staffing policies and nurse staffing, it can be

suggested that other states consider similar policies to implement. States need objective policies that aid in the supply of nurses, therefore potentially increasing care quality outcomes. Based on the study, nurse staffing policies are a significant factor relating to nursing supply. In turn, this research is necessary to build on in order to understand the extent of the effects of nursing workforce improvement policies and if these policies are ultimately playing a fundamental role in shaping care quality outcomes in the U.S.

The results from this study can provide an indication of the potential association between nurse staffing policies and nurse staffing amounts. Although not all indicators are explored, the research design is replicable and can be built upon to allow for the inclusion of time points before 2004 and after 2016. However, there are a number of limitations to the study that need to be mentioned. Threats to causality may be directly linked to endogeneity. Another issue with the analysis is that other external time-varying effects, or autocorrelation, may be occurring. An example of this phenomenon is the characteristics of the population changing over time, such as the factor of aging. Another limitation of the study is that the time points accounted for only include 2004 - 2016, making findings less generalizable to the entire history of nursing workforce improvement policies. Future research should include looking into the significant differences in other types nursing workforce improvement policies, such as loan forgiveness programs.

In Study 3, the use of time series regression analysis as a modeling approach can help to project future federal nursing policy. Based on the shortage of professionals in the nursing profession, states may be in need of policies that aid in the supply of nurses. Furthermore, this policy analysis is a useful tool for future research regarding nursing policies at the state and federal level. Healthcare administrators and policymakers alike should be aware of the

incongruence of the nursing shortage problem and appropriate policies. In turn, this research should be built on to understand the extent of the effects (or the lack thereof) of nurse staffing policies on nurse staffing amounts.

This dissertation takes a new approach to studying these relationships by considering the nursing market holistically and with the inclusion of nursing school data. Additionally, the studies contribute to existing research via inclusion of proximal density of staffing resources as an important factor of care quality outcomes. Alabama is examined carefully in a pilot study (Haun et al., 2018) and serves as a glimpse into ways the same study can be applied at a national level. The information gathered is useful to policymakers and practitioners in this market as well. In particular, the relationship between proximity staffing resources and quality outcomes begins to fill the gap that currently exists in literature regarding the use of GIS.

Conclusion

The examinations presented in this dissertation seek to improve our understanding of care quality outcomes. The contributions of this dissertation have identified an underlying factor of care quality outcomes that is related to the geophysical location of nursing resources and their density. Further examination of the role of healthcare organizational characteristics on care quality outcomes offers additional insight into the degree to which resource location, nursing workforce improvement policy, and nurse staffing are influencing the nursing landscape and organizational outcomes alike.

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Tables

Table 1. Summary Statistics

Variable <i>n</i> (15,024)		Mean	Standard Deviation	Min	Max
Star Rating	Overall Rating	3.31	1.40	1	5
	Health Inspection Rating	2.82	1.28	1	5
	Quality Measure Rating	3.76	1.30	1	5
	Staffing Rating	3.20	1.18	1	5
Size		106.19	60.96	2	1389
Ownership Type	For-profit	0.70	0.46	0	1
	Government	0.07	0.25	0	1
Within Hospital		0.05	0.22	0	1
Proximal Density	100 miles	14.78	16.14	0	95
	50 miles	4.77	9.41	0	56
	20 miles	1.19	4.47	0	55
	10 miles	0.36	2.03	0	50
	Hot or Cold Spot	1.10	1.47	-3	3

Table 2a: Ordered Logistic Regression Analysis for Factors Associated with Overall Rating

Variables n=15,024		Odds Ratio	P-Value	Odds Ratio	P-Value	Odds Ratio	P-Value	Odds Ratio	P-Value
Proximal	100 miles	1.003	0.002						
Density									
	50 miles			1.004	0.019				
	20 miles					1.007	0.036		
	10 miles							1.013	0.075
Size		0.995	0.000	0.995	0.000	0.995	0.000	0.995	0.000
Ownership	For-profit	0.969	0.361	0.970	0.382	0.970	0.374	0.970	0.377
Type									
	Government	1.063	0.331	1.066	0.309	1.065	0.314	1.066	0.307
Within		1.922	0.000	1.922	0.000	1.920	0.000	1.916	0.000
Hospital									
Thresholds	1-2 Stars	-2.367		-2.386		-2.394		-2.398	
	2-3 Stars	-1.222		-1.242		-1.249		-1.253	
	3-4 Stars	-0.483		-0.503		-0.510		-0.514	
	4-5 Stars	0.506		0.486		0.478		0.474	

95% confidence interval. Coefficients reported for thresholds.

Table 2b: Ordered Logistic Regression Analysis for Factors Associated with Health Inspection Rating

Variables n=15,024		Odds Ratio	P-Value	Odds Ratio	P-Value	Odds Ratio	P-Value	Odds Ratio	P-Value
Proximal Density	100 miles	1.003	0.001						
	50 miles			0.998	0.313				
	20 miles					0.995	0.087		
	10 miles							0.988	0.093
Size		0.995	0.000	0.995	0.000	0.995	0.000	0.995	0.000
Ownership Type	For-profit	0.986	0.686	0.987	0.698	0.987	0.707	0.987	0.701
	Government	1.062	0.335	1.064	0.315	1.065	0.312	1.064	0.320
	t								
Within Hospital		1.908	0.000	1.894	0.000	1.892	0.000	1.895	0.000
Thresholds	1-2 Stars	-1.898		-1.940		-1.940		-1.938	
	2-3 Stars	-0.774		-0.817		-0.817		-0.815	
	3-4 Stars	0.212		0.169		0.169		0.172	
	4-5 Stars	1.725		1.681		1.682		1.684	

95% confidence interval. Coefficients reported for thresholds.

Table 2c: Ordered Logistic Regression Analysis for Factors Associated with Quality Measure Rating

Variables n=15,024		Odds Ratio	P-Value	Odds Ratio	P-Value	Odds Ratio	P-Value	Odds Ratio	P-Value
Proximal Density	100 miles	1.004	0.000						
	50 miles			1.008	0.000				
	20 miles					1.020	0.000		
	10 miles							1.038	0.000
Size		1.000	0.175	1.000	0.132	1.003	0.103	1.000	0.104
Ownership Type	For-profit	1.022	0.539	1.022	0.535	1.021	0.554	1.023	0.523
	Government	1.085	0.199	1.087	0.191	1.085	0.198	1.090	0.174
Within Hospital		0.685	0.000	0.687	0.000	0.686	0.000	0.684	0.000
Thresholds	1-2 Stars	-2.485		-2.501		-2.512		-2.520	
	2-3 Stars	-1.271		-1.288		-1.298		-1.307	
	3-4 Stars	-0.409		-0.426		-0.436		-0.445	
	4-5 Stars	0.446		0.430		0.420		0.412	

95% confidence interval. Coefficients reported for thresholds.

Table 2d: Ordered Logistic Regression Analysis for Factors Associated with Staffing Rating

Variables n=15,024		Odds Ratio	P-Value	Odds Ratio	P-Value	Odds Ratio	P-Value	Odds Ratio	P-Value
Proximal Density	100 miles	0.998	0.011						
	50 miles			1.006	0.000				
	20 miles					1.012	0.000		
	10 miles							1.016	0.028
Size		0.994	0.000	0.994	0.000	0.994	0.000	0.994	0.000
Ownership Type	For-profit	0.893	0.001	0.892	0.001	0.891	0.001	0.892	0.001
	Government	1.004	0.952	1.003	0.965	1.001	0.982	1.003	0.961
Within Hospital		6.104	0.000	6.174	0.000	6.169	0.000	6.139	0.000
Thresholds	1-2 Stars	-2.820		-2.770		-2.780		-2.787	
	2-3 Stars	-1.840		-1.789		-1.799		-1.807	
	3-4 Stars	-0.484		-0.432		-0.442		-0.451	
	4-5 Stars	1.347		1.398		1.388		1.380	

95% confidence interval. Coefficients reported for thresholds.

Table 3: Relationship between Hotspots on Care Quality

Variables n=15,024	Hotspot
Overall Care Rating	.080*** (0.008)
Health Inspection Rating	0.027*** (0.007)
Quality Measure Rating	0.171*** (0.007)
Staffing Rating	0.091*** (0.007)

*** Stat. sig. at $p < 0.01$; ** stat. sig. at $p < 0.05$; *stat. sig. at $p < 0.10$; robust standard errors in parentheses

Table 4. Summary Statistics

Variable <i>n (2,205)</i>		Mean	Standard Deviation	Min	Max
Star Rating	Overall Rating	3.04	.817	1	5
	Low Rating	1.87		1	2
	High Rating	4.07		4	5
Size		161.46	181.20	8	1763
Ownership Type	For-profit	0.21	0.41	0	1
	Government	0.27	0.44	0	1
Facility Type	General Acute Care	0.85	0.36	0	1
	Critical Access	0.11	0.31	0	1
Proximal Density	20 miles	2.21	4.19	0	30
	10 miles	1.09	2.16	0	16

Table 5: Binary Logistic Regression Analysis for Factors Associated with Low & High Overall Rating

Variables <i>n=2,205</i>		Low Rating	High Rating	1-Star Rating	3-Star Rating	5-Star Rating	Low Rating	High Rating	1-Star Rating	3-Star Rating	5-Star Rating
Proximal	20 miles	0.054	-0.018	0.106	-0.032	0.037					
Density		(0.000)	(0.165)	(0.000)	(0.003)	(0.247)					
	10 miles						0.101	-0.009	0.234	-0.081	0.120
							(0.000)	(0.717)	(0.000)	(0.000)	(0.039)
Size		0.003	-0.001	0.003	-0.001	-0.002	0.003	-0.001	0.002	-0.001	-0.003
		(0.000)	(0.000)	(0.000)	(0.000)	(0.075)	(0.000)	(0.000)	(0.000)	(0.000)	(0.043)
Ownership	For-profit	0.707	-0.789	0.759	0.105	0.047	0.702	-0.789	0.740	0.108	0.046
Type		(0.000)	(0.000)	(0.021)	(0.338)	(0.895)	(0.000)	(0.000)	(0.026)	(0.325)	(0.897)
	Government	0.452	-0.617	1.200	0.187	-1.178	0.445	-0.611	1.215	0.189	-1.173
		(0.001)	(0.000)	(0.000)	(0.098)	(0.055)	(0.002)	(0.001)	(0.000)	(0.095)	(0.056)
Facility	GAC	0.823	-1.052	0.151	0.419	-2.030	-0.541	-1.017	-0.407	0.422	-2.005
Type		(0.103)	(0.012)	(0.895)	(0.276)	(0.001)	(0.360)	(0.014)	(0.342)	(0.271)	(0.001)
	Critical	-0.467	-0.909	-0.048	0.609	-3.154	-0.541	-0.866	-0.183	0.611	-3.113
	Access	(0.425)	(0.041)	(0.597)	(0.270)	(0.007)	(0.046)	(0.054)	(0.063)	(0.136)	(0.080)

95% confidence interval. Coefficients on top, P-value reported in parentheses
 Low rating = 1-2 stars, High rating = 3-4 stars

Table 6: Relationship between Hotspots on Care Quality

Variables <i>n=2,205</i>	Hotspot
Overall Care Rating	- 0.032*** (0.007)

*** Stat. sig. at $p < 0.01$; ** stat. sig. at $p < 0.05$; *stat. sig. at $p < 0.10$; robust standard errors in parentheses

Table 7. Policies & Staffing in the U.S., 2004 – 2016

Year	Policies Enacted	RNs	LPNs	Nurse Aides	Total Nursing Workforce
2004	1	2,218,360	706,340	1,395,000	4,319,700
2005	0	2,368,070	710,010	1,391,420	4,469,500
2006	0	2,417,150	720,380	1,376,700	4,514,230
2007	1	2,468,380	718,560	1,387,180	4,574,120
2008	3	2,542,730	730,480	1,422,750	4,695,960
2009	4	2,583,770	728,660	1,437,990	4,750,420
2010	0	2,655,000	730,270	1,451,080	4,836,350
2011	0	2,724,570	729,080	1,466,690	4,920,340
2012	1	2,633,950	718,780	1,420,060	4,878,580
2013	4	2,661,870	705,210	1,427,840	4,908,280
2014	1	2,687,320	695,600	1,427,750	4,932,720
2015	0	2,745,920	697,260	1,420,580	4,999,810
2016	0	2,857,220	702,380	1,443,120	5,152,960
2017	2	2,906,830	702,710	1,453,690	5,229,530
2018	1	2,951,970	701,650	1,450,950	5,284,240

Note: RN=Registered Nurse, LPN=Licensed Practical Nurse

Table 8. Summary Statistics

Variable (n=553)	Mean	Standard Deviation	Minimum	Maximum
Nurses - Hospitals	35883.6750	38443.6319	1842.50	245500
Nurses - Nursing Homes	35883.6750	38443.6319	1.172258	12.371601
Policy Amount	0.03	0.173	0	2
State Population	4334310.70	6233321.85	4800	2724570
State Spending	14777.597	24306.1075	640	729080
Median Household Income	35346.0692	22786.1421	2090	1466690
% of Pop in Urban Area	48.3618	30.71632	567725	37676861
% of Area in Urban Area	12.1376	14.86706	6017179	336780223
Health Ranking	18.635	16.6546	39856	68876
State Control - Split	0.27	0.442	0	1
State Control – Republican	0.34	0.475	0	1

Table 9. Definitions of Variables

Variable	Definition
Policy Amount	= number of policies enacted/adopted between 2006 – 2016, by state
State Population	= total amount of individuals between 2006 – 2016, by state
State Spending	= total spending amount between 2006 – 2016, by state
Median Household Income	= amount of income earned by given household where half of the homes in the area earn more and half earn less between 2006 – 2016, by state
% of Pop in Urban Area	= percent of population living in an urbanized area (population of 50,000<) between 2006 – 2016, by state
% of Area in Urban Area	= percent of land area in an urbanized area (population of 50,000<) between 2006 – 2016, by state
Health Ranking	= state health ranking between 2006 – 2016, by state ranging from 1 (worst) to 50 (best)
State Control – Split	= split party control between 2006 – 2016, by state
State Control – Republican	= republican party control between 2006 – 2016, by state

Table 10.1. Hospitals - Time Series Regression Results, 2004 – 2016

Parameter (n=553)	Beta	t	p-value
Policy Amount	0.093	3.804	0.000
State Population	0.894	29.575	0.000
State Spending	0.323	3.333	0.001
Median Household Income	-0.096	-0.952	0.342
% of Pop in Urban Area	0.053	1.057	0.291
% of Area in Urban Area	-0.119	-4.009	0.000
Health Ranking	-0.129	-3.298	0.001
State Control - Split	0.041	1.431	0.153
State Control – Republican	0.003	0.116	0.908
Constant		1.720	0.086

Note - 95% confidence interval

Table 10.2. Nursing Homes - Time Series Regression Results, 2004 – 2016

Parameter (n=553)	Beta	t	p-value
Policy Amount	-0.028	-0.682	0.495
State Population	-0.117	-2.345	0.019
State Spending	1.470	9.166	0.000
Median Household Income	1.375	8.197	0.000
% of Pop in Urban Area	-0.138	-1.643	0.101
% of Area in Urban Area	-0.049	-0.995	0.320
Health Ranking	0.345	5.341	0.000
State Control - Split	0.091	1.946	0.052
State Control – Republican	0.039	0.848	0.397
Constant		-2.066	0.039

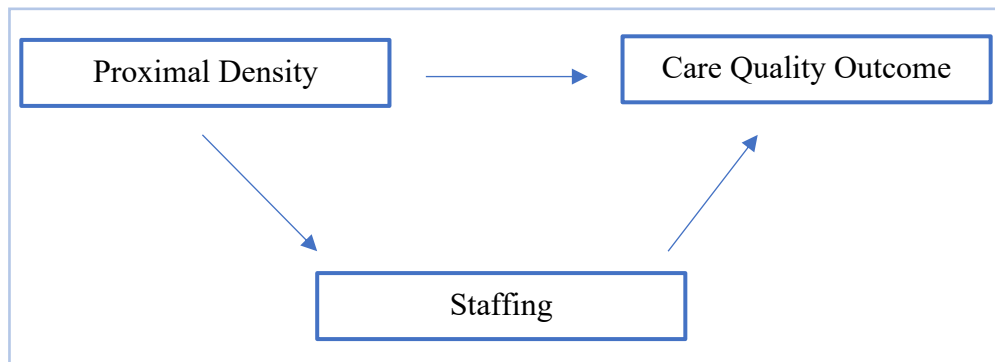
Note - 95% confidence interval

Table 11. State Nurse Staffing Policies, 2004 – 2016

Year	State	Law
2004	California	California RN Staffing Ratio Law A.B. 394 (Cal. 2004)
2005	N/A	N/A
2006	N/A	N/A
2007	California	California Nurse-to-Patient Ratio Law A.B. 394, 1999-2000 Reg. Sess. (Cal. 2007).
2008	Illinois	Public Act 095-0401
	Rhode Island	Rhode Island Las § 23-17.17-8
	Washington	RCW § 70.41.420
2009	Connecticut	Public Act 08-79, An Act Concerning Hospital Staffing
	Texas	Health and safety code Chapter 257. Nurse Staffing
	Nevada	Patient Protection and Safe Staffing bill (SB 362)
	New Jersey	C.26:2H-5f F
2010	N/A	N/A
2011	N/A	N/A
2012	Vermont	VT Statute Title 18 § 1854
2013	California	Nurse Staffing Standards for Patient Safety and Quality Care Act of 2013 (H.R. 1907)
	New York	Safe staffing for quality care act S3691A-2013
	New York	Safe Staffing for Hospital Care Act Bill S. 1634-2013
	Minnesota	H.F. No. 588, sec. 2
2014	Massachusetts	Bill H. 4228
2015	N/A	N/A
2016	N/A	N/A

Figures

Figure 1: Conceptual Model of Key Variables



Proximal Density – Proximal densities from nursing schools to healthcare facilities (100, 50, 20, 10 miles).

Care Quality Outcome – 5-star rating system measures including: Overall Care Rating (staffing included), Health Inspection Rating, Quality Measure Rating, and Staffing Rating (staffing included).

Staffing – Amount of nursing staff may mediate the effect of proximal density on outcomes.

Figure 2: National Points for Nursing Homes and Nursing Schools

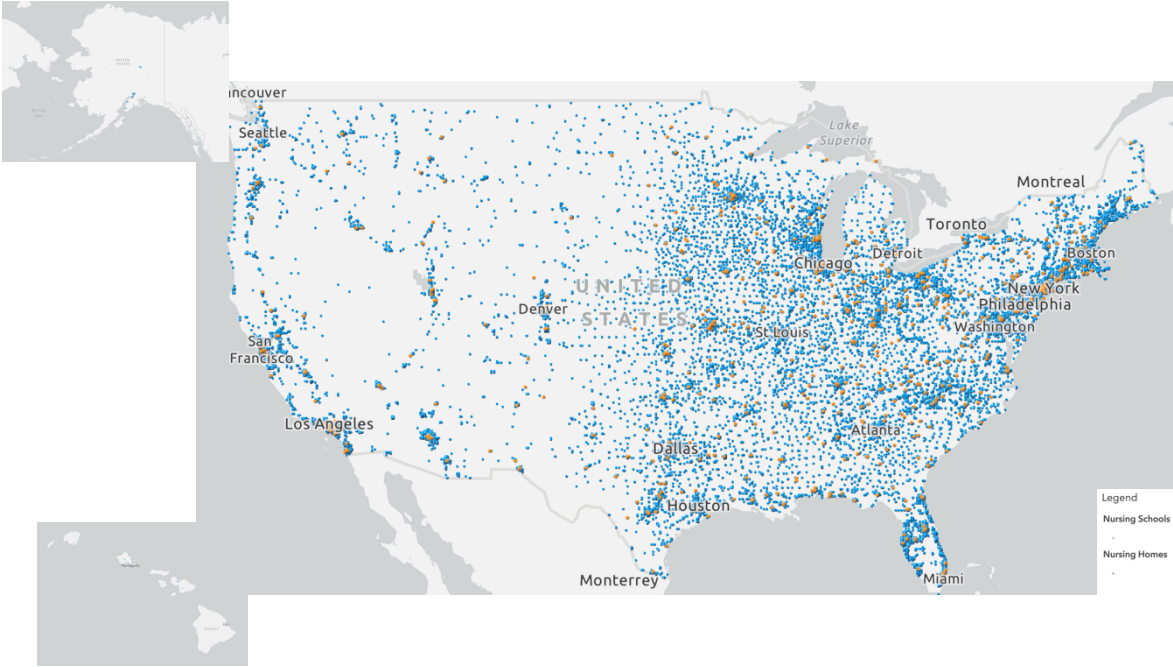


Figure 3: National Hot Spot Analysis

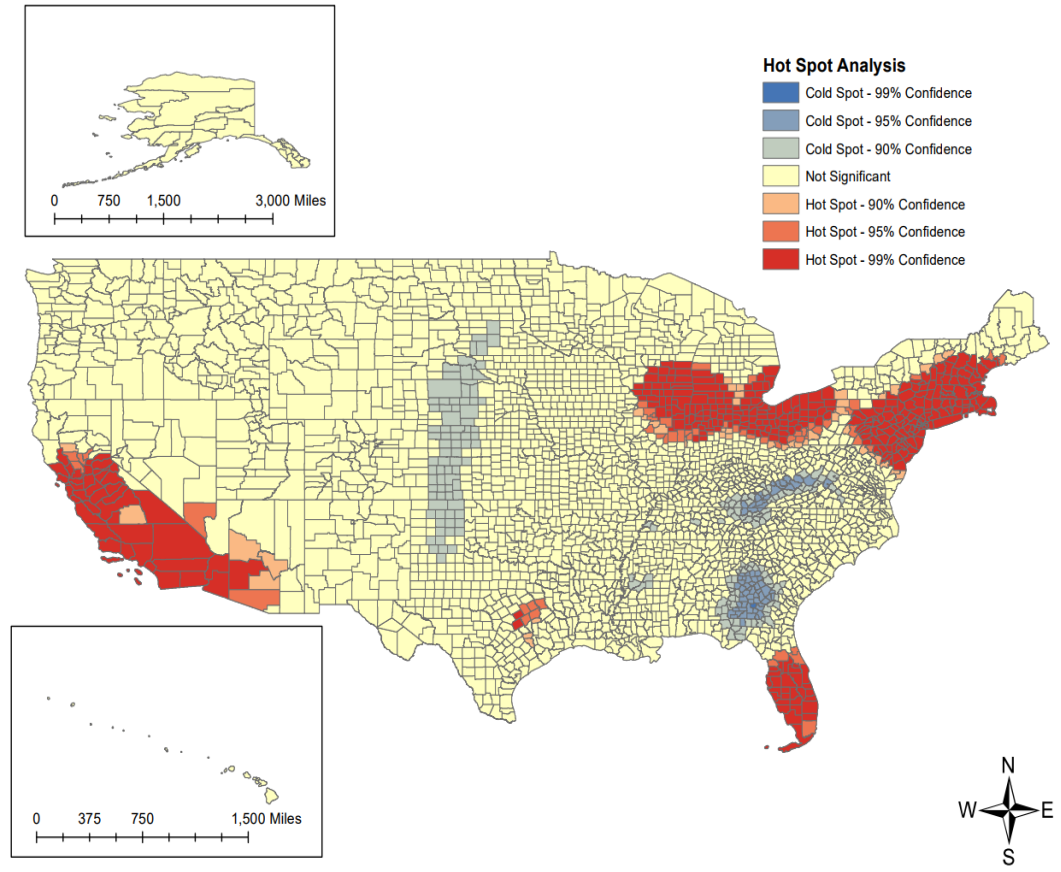


Figure 4: National Points for Hospitals and Nursing Schools

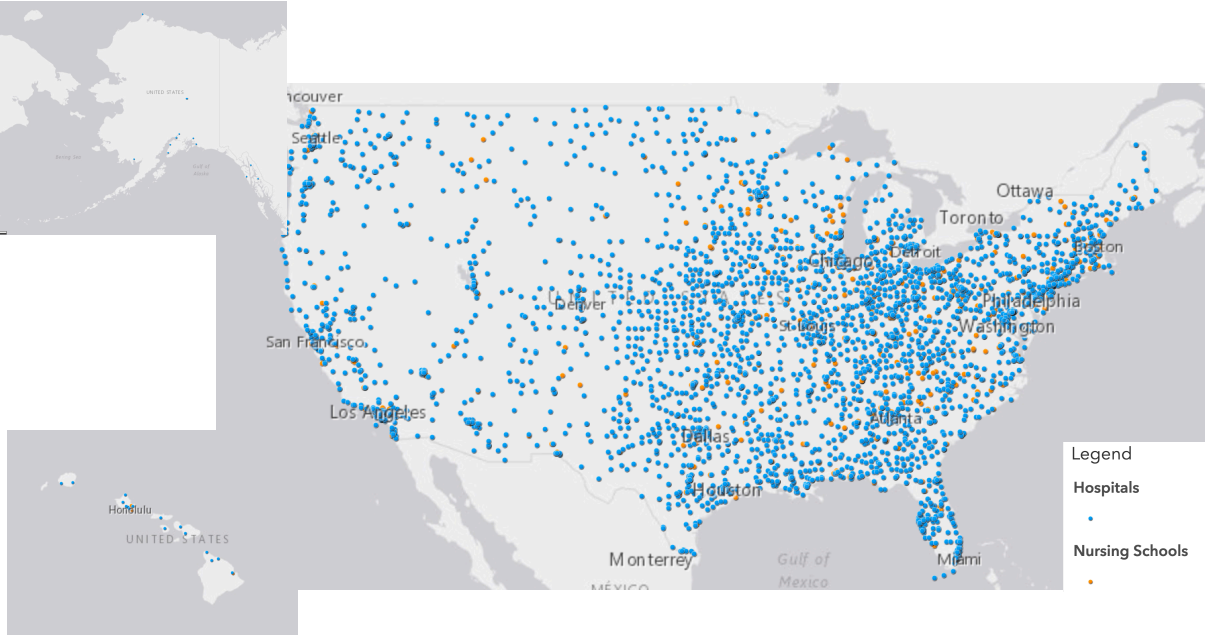


Figure 5: National Hot Spot Analysis

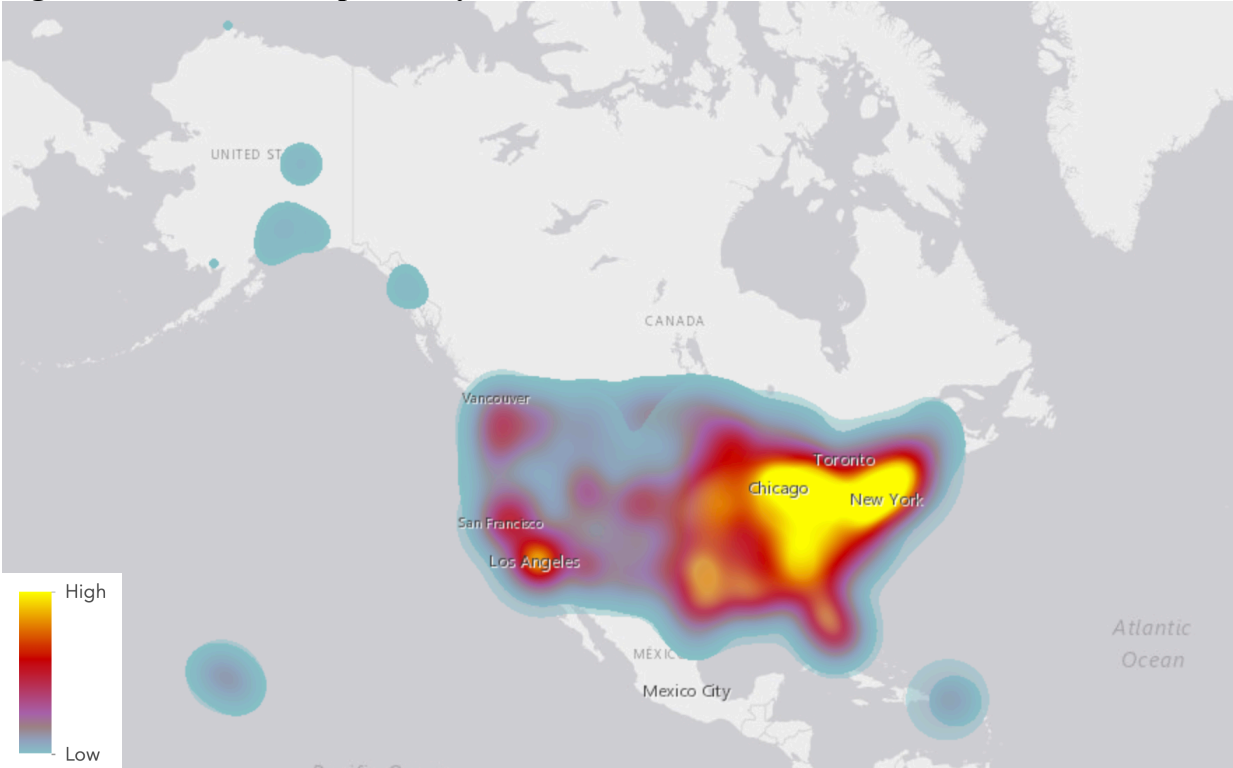


Figure 6. Total amount of nurses by type, 2004 – 2016

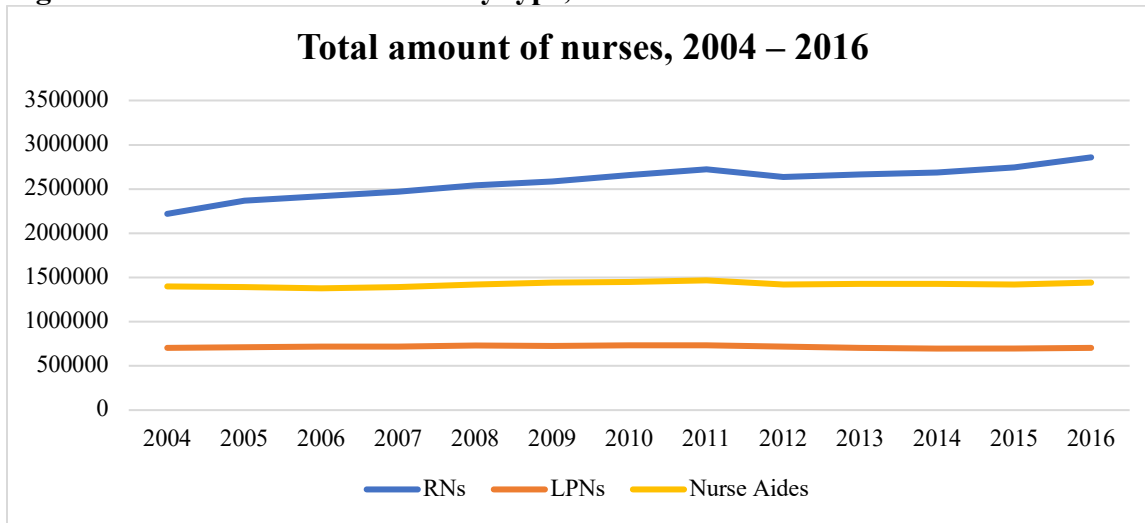


Figure 7. Total amount of all nurses, 2004 – 2016

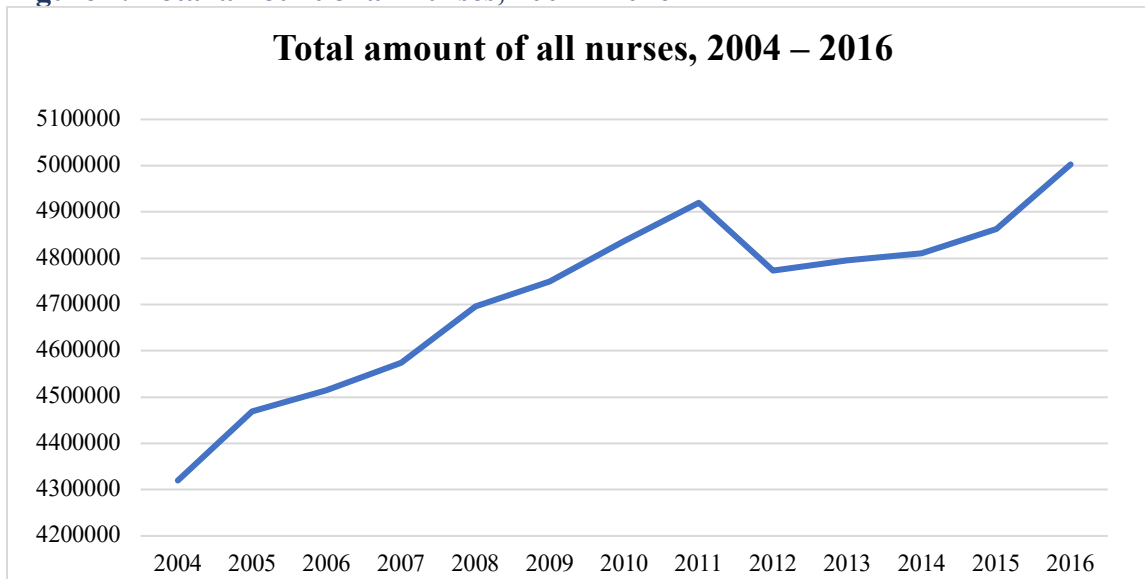
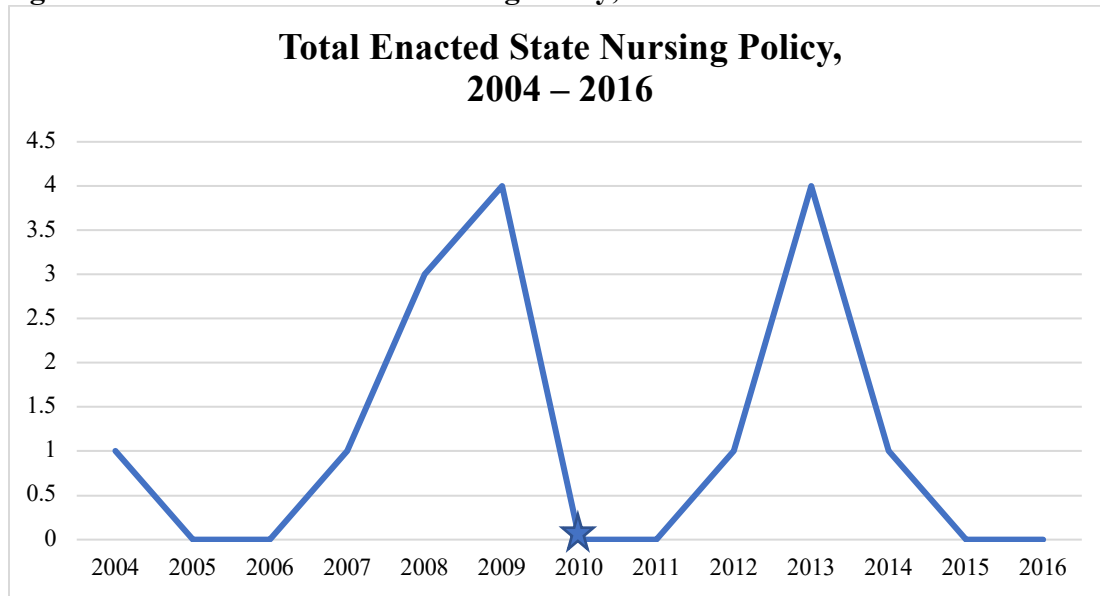


Figure 8. Total Enacted State Nursing Policy, 2004 – 2016



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Figure 9. States that Enacted Nurse Staffing Policies Between 2004 – 2016

