2022-03

AN ANALYSIS OF NAVY NURSE CORPS SPECIALTIES AND THE EFFECTS OF CIVILIAN MARKET WAGES ON RETENTION

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MONTEREY, CALIFORNIA

THESIS

AN ANALYSIS OF NAVY NURSE CORPS SPECIALTIES AND THE EFFECTS OF CIVILIAN MARKET WAGES ON RETENTION

by

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March 2022

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REPORT DOCUMENTATION PAGE			Form Approved OMB No. 0704-0188

1. AGENCY USE ONLY *(Leave blank)*	2. REPORT DATE March 2022	3. REPORT TYPE AND DATES COVERED Master's thesis

4. TITLE AND SUBTITLE AN ANALYSIS OF NAVY NURSE CORPS SPECIALTIES AND THE EFFECTS OF CIVILIAN MARKET WAGES ON RETENTION	5. FUNDING NUMBERS
6. AUTHOR(S) Mary K. Looker	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Postgraduate School Monterey, CA 93943-5000	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES) N/A	10. SPONSORING / MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES The views expressed in this thesis are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government.

12a. DISTRIBUTION / AVAILABILITY STATEMENT Approved for public release. Distribution is unlimited.	12b. DISTRIBUTION CODE A

13. ABSTRACT (maximum 200 words)

Between 2000 and 2020, the civilian nursing labor market continued to evolve to meet the needs of society putting additional strain on the military nursing labor market. In particular, the demand for nurses has outpaced supply in specific specialties and geographical regions, resulting in the continued rising of real wages and increased incentives to attract nurses. This can have significant implications for the Navy Nurse Corps planners, as the Nurse Corps is in direct competition with the labor market. This study examines the civilian market wages of nurses between 2000 and 2018 disaggregated by census region, specialty, and years of experience and then assesses the relationship to the military nursing market. Additionally, this study analyzes how the military-civilian wage differential affects retention in the Navy Nurse Corps. The multivariate regression model indicates that while controlling for basic demographics, prior-enlisted experience, duty station census region, and nursing specialty, a $1,000 increase in the military-civilian wage differential will increase the odds of a nurse remaining on active duty by 17.2 percent at the three-year decision point and 9.2 percent at the ten-year decision point. The key findings of this study will enable the Navy Nurse Corps planners to continue to make effective and targeted decisions regarding recruiting and retention while competing in a highly competitive civilian labor market.

14. SUBJECT TERMS Navy, nurse, military wage, retention, civilian wage, wage differential	15. NUMBER OF PAGES 91
	16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
Unclassified	Unclassified	Unclassified	UU

NSN 7540-01-280-5500

Standard Form 298 (Rev. 2-89)
Prescribed by ANSI Std. 239-18

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AN ANALYSIS OF NAVY NURSE CORPS SPECIALTIES AND THE EFFECTS OF CIVILIAN MARKET WAGES ON RETENTION

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Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE IN MANAGEMENT

from the

NAVAL POSTGRADUATE SCHOOL
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Between 2000 and 2020, the civilian nursing labor market continued to evolve to meet the needs of society putting additional strain on the military nursing labor market. In particular, the demand for nurses has outpaced supply in specific specialties and geographical regions, resulting in the continued rising of real wages and increased incentives to attract nurses. This can have significant implications for the Navy Nurse Corps planners, as the Nurse Corps is in direct competition with the labor market. This study examines the civilian market wages of nurses between 2000 and 2018 disaggregated by census region, specialty, and years of experience and then assesses the relationship to the military nursing market. Additionally, this study analyzes how the military-civilian wage differential affects retention in the Navy Nurse Corps. The multivariate regression model indicates that while controlling for basic demographics, prior-enlisted experience, duty station census region, and nursing specialty, a $1,000 increase in the military-civilian wage differential will increase the odds of a nurse remaining on active duty by 17.2 percent at the three-year decision point and 9.2 percent at the ten-year decision point. The key findings of this study will enable the Navy Nurse Corps planners to continue to make effective and targeted decisions regarding recruiting and retention while competing in a highly competitive civilian labor market.

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LIST OF ACRONYMS AND ABBREVIATIONS

AACN	American Association of College of Nurses
APRN	Advanced Practice Registered Nurse
BAH	Basic Allowance for Housing
BAS	Basic Allowance for Subsistence
CNA	Center for Naval Analysis
CNM	Certified Nurse Midwife
CNS	Clinical Nurse Specialist
CRNA	Certified Registered Nurse Anesthetist
DMDC	Defense Manpower Data Center
FY	Fiscal Year
HRSA	Health Resources and Services Administration
NP	Nurse Practitioner
NSSRN	National Sample Survey of Registered Nurses
ROTC	Reserve Officers' Training Corps
RMC	Relative Military Compensation
RN	Registered Nurse
U.S.	United States

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EXECUTIVE SUMMARY

Between 2000 and 2020, the civilian nursing profession continued to evolve to meet the needs of society, thus putting additional strain on the nursing labor market. While these labor market demands are creating shortages that may affect the entire nursing profession at large, there are more noticeable effects for certain specialties and geographical regions than others. For example, in 2030 the states of Alaska, South Carolina, South Dakota, and California are projected to have the highest demand for nurses within the United States. Alaska is projected to have a nursing workforce deficit of 23 percent and California's deficit is projected to be 12 percent (U.S. Department of Health and Human Service, 2017). In addition, the overall average nursing vacancy rate continues to rise after a brief decrease between 2000 and 2004. In 2021, the average nursing vacancy rate was 9.9 percent, an increase of 47.76 percent since 2014 (American Association of College of Nurses, 2002; NSI Nursing Solutions, Inc., 2015; NSI Nursing Solutions, Inc., 2021). Knowing and understanding the changes in the civilian labor market is critical for policymakers within the Navy Nurse Corps to ensure the Nurse Corps has a balanced force ready to support the warfighters.

Previous empirical studies have analyzed various factors that affect retention in the Navy Nurse Corps. Turner (1990) analyzed the effect that the amount of direct patient care, workload, and pay affected a Navy nurse's decision to stay or leave the military service in the pay grades of O-1 through O-4 while also considering the regional vacancy nursing rate and the military nurse's pay. In her analysis, she determined that an average regional vacancy rate above 11 percent decreased the likelihood a Navy nurse would remain on active duty, indicating that increased opportunities available within a Navy nurse's duty station census region were significant in their decision-making process. Krause's research (2010) focused on the effects that the medical facility size at which a Navy nurse was stationed for their first assignment contributed to their stay or leave decision. Her results showed that nurses who were stationed at one of the large three medical treatment facilities produced a negative effect on retention, although, the results were statistically insignificant. Messmer and Pizanti (2007) analyzed the effect that certain demographics,

professional characteristics, and types of military experience would influence the likelihood of a nurse remaining on active duty. They discovered that being male, being a minority, having dependents, being prior-enlisted, having a subspecialty, and having a postgraduate degree increased the likelihood of remaining on active duty. In a cost-benefit analysis, Harvie (2014) looked at how a nurse's commission source contributed to retention. He learned that nurses commissioned through the Seaman to Admiral and the Medical Enlisted Commissioning Program had significantly higher retention rates at six years of commissioned service compared to other commissioning programs that targeted non-prior enlisted service members.

A review of prior empirical studies revealed a significant gap in the research on Navy Nurse Corps retention regarding the military-civilian wage differential. In addition, civilian nursing wages for the basic level nurses are not easily assessable beyond the national average nursing salary, which is critical for an accurate analysis. The purpose of this research is to fill the gap and provide a comprehensive, up-to-date analysis of the civilian nursing labor market, determine the wage differential between military and civilian nurses by census region and years of nursing experience that impacts retention within the Navy Nurse Corps. This study also analyzes retention probability within the basic level Nurse Corps specialties.

In the first part of the study, I analyzed the civilian nursing labor market to identify trends in wages and identify where nursing shortages have been and where they are likely to continue. This can be achieved by looking at the change in real wage value over time, which acts as a signal indicating continued and rising demand with a particular specialty or geographical region. Rising demand and rising real wages have implications for the Navy Nurse Corps, since the Nurse Corps is in direct competition with the civilian labor market. The health of the civilian labor market will impact the Nurse Corps' ability to recruit and retain nurses. In my civilian labor market analysis, I found that between 2000 and 2018, the Pacific census region had the largest increase in nursing real wage value, with a 22 percent increase in average nursing wages. All other regions experienced increases in wages between 2000 and 2008, but following the 2008 recession, these regions saw a stagnation in wages. In addition, several specialties saw a persistent increase in

wages between 2000 and 2018, including nurses in a supervisory role who saw an overall increase of 41.4 percent in real wage values. Several advanced practice nursing specialties also saw sustained increases in their wages. Certified nurse-midwives had a real wage increase of 19.46 percent and nurse practitioners saw their real wages increase 7 percent between 2000 and 2018.

In the second portion of this study, I utilized a Kaplan-Meier survival curve to calculate the probability that nurses within specific specialties will remain on active duty at various decision points within their first ten years of commissioned service. When analyzing specialties within the critical warfighter specialties and the non-critical warfighting specialties, there were a few notable differences in their retention probability. Of note, perioperative nurses have a significantly higher probability of remaining on active duty across all ten years of commissioned service compared to nurses in the psychiatric, emergency health, and critical care specialties. At ten years of commissioned service, a nurse working in the perioperative specialty has a 0.54 probability of remaining on active duty, while nurses in the other three specialties range between a probability of 0.38 and 0.40. Nurses working in the medical-surgical and the neonatal intensive care specialty consistently have higher probabilities of remaining on active duty compared to nurses in the maternal and infant health and pediatric specialties between four and ten years of commissioned service.

In the last part of this research, I analyzed the effects of the military-civilian wage differential had on retention utilizing several multivariate logit regression models. Rather than basing the civilian wage calculation on the national nursing wage average, I utilized national survey results to calculate an average nursing wage that is based on their geographic census region and a nurse's number of years of nursing experience. At the national level, between 2001 and 2013, the military-civilian wage differential ranged between 2.5 percent and 3.5 percent, and then grew to 4.6 percent by 2018. However, within the Pacific census region, the military-civilian wage differential is not as pronounced, as the average civilian nursing wage and the average military nursing wage were very similar within the Pacific region. However, when the Navy nurses are separated into two groups based on having prior-enlisted experience or not having prior-enlisted

experience, there was a more significant and pronounced difference in each group's average wage. In general, between 2000 and 2008, the difference between the average civilian nursing wages and the average non-prior enlisted nurses was 3.2 percent less. These findings emphasize the need to examine wage differences not only at a national level but also at a regional level to obtain an accurate wage differential calculation. The logit regression results indicated that an increase of $1,000 in a Navy nurse's annual salary would increase the odds of a nurse remaining on active duty by 17.2 percent at the three-year decision point while accounting for other variables such as race, prior-enlisted status, duty station census region, and nursing specialty.

Based on the findings in my thesis, I developed a couple of key recommendations for the Navy Nurse Corps planners and policymakers. Without a doubt the COVID-19 pandemic has significantly affected the civilian nursing market, making prior civilian nursing surplus and deficit projections likely inaccurate. My first recommendation is to reevaluate the health of the civilian nursing workforce after the COVID-19 pandemic has subsided to reidentify changes in real wage values with respect to specialty, geographical region, and years of nursing experience. My other recommendation is to conduct a more in-depth analysis focusing on supervisory and advanced nursing specialties that were experiencing a surge in demand in the civilian labor market to analyze the effect of the wage differential may have on retention. Overall, I am hopeful that the findings of this study will enable the Nurse Corps planners to continue to make effective and targeted policy decisions regarding recruiting and retention, especially within the specialties that have experienced shortages or geographical areas that have experienced higher attrition rates or difficulty in meeting recruiting quotas.

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ACKNOWLEDGMENTS

First and foremost, I would like to express my deepest gratitude to my husband, Donny, and our four children, who have provided me with their utmost support in my endeavor to return to school and further my career. Without their support and encouragement, I would not have been able to complete this research with the same level of dedication. I would also like to express my appreciation to my advisors, Dr. Tom Ahn and Dr. Latika Hartmann, for their guidance and expertise as I navigated the thesis research and thesis writing process.

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I. INTRODUCTION

In the United States (U.S.), the shortage of nurses within the medical community is not a new phenomenon. It is a cycle that started in the mid-1930s and has continued through the early 2000s. The shortages experienced thus far have varying underlying challenges depending on the time period. However, the most prominent challenge has been caused by increased utilization of the nursing profession within the healthcare sector, as the civilian healthcare industry has evolved to meet the growing demands of society. Despite the nursing profession increasing to a workforce of nearly 2.6 million, the shortage of nurses continues to plague the U.S. healthcare system (University of Pennsylvania School of Nursing, n.d.). The nursing shortage had showed signs of improvement when the average registered nurse (RN) hospital vacancy rate decreased from 10.2 percent in 2000 to 6.7 percent in 2014. However, since 2014, the average hospital RN vacancy rate has once again steadily climbed to 9.9 percent in 2021 (American Association of College of Nurses, 2002; NSI Nursing Solutions, Inc., 2015; NSI Nursing Solutions, Inc., 2021). The dynamics within the civilian nursing labor market likely have affected and will continue to affect the Navy Nurse Corps' ability to recruit and retain nurses, as the military's demand for nurses is in direct competition with the private sector.

A. PURPOSE

The purpose of this thesis is to provide an in-depth and comprehensive analysis of the civilian nursing market from 2000 to 2018 and gain insight as to where the shortages have occurred and are most likely to occur in the future with a focus on specific nursing specialties and geographical regions that are relevant to the Navy Nurse Corps. In my analysis, I study shifts and trends in the civilian nursing profession by using nursing workforce datasets that are available to the public. The civilian datasets also give me the ability to analyze the differences in civilian and military annual salaries with a more in-depth analysis than previous studies have done. The civilian wages within the dataset allow for a more accurate military-civilian wage analysis that allows me to determine the effect the wage gap had on retention within the Nurse Corps. The findings of this study will

enable the Navy Nurse Corps planners to make more effective and targeted decisions regarding recruiting and retention policies.

B. RESEARCH OBJECTIVE

Within my thesis, I address the following research questions:

- How is the civilian nursing labor market likely to affect the Navy Nurse Corps' ability to attract and retain nurses?
- How has the military-civilian pay gap changed between 2001 and 2018 with respect to census region and years of nursing experience?
- How does the probability of remaining on active-duty change based on a Navy Nurse Corps subspecialty within the basic level nursing specialties?
- What effect does the military-civilian wage differential have on retention in the Nurse Corps between 2001 and 2018?

Several methods of analysis are utilized to answer these research questions. In the first part of the study, I analyze the civilian nursing labor market to identify trends in wages and identify where nursing shortages have been and where they are likely to continue. I accomplish this by looking at the changes in real wage value over time, which acts as a signal indicating continued and rising demand with a particular specialty or geographical region. Rising demand and rising real wages have implications for the Navy Nurse Corps since the Nurse Corps is in direct competition with the civilian labor market. In the second portion of this study, I utilize a Kaplan-Meier survival curve to calculate the probability that nurses within specific specialties will remain on active duty at various decision points within their first ten years of commissioned service. Finally, I analyze the effects of the military-civilian wage differential had on retention utilizing several multivariate logit regression models. Rather than basing the civilian wage calculation on the national nursing wage average, I utilize national survey results to calculate an average nursing wage that is based on their geographic census region and their number of years of nursing experience.

In my civilian labor market analysis, I found that between 2000 and 2018, the Pacific census region had the largest increase in nursing real wage value, with a 22 percent increase in average nursing wages. All other regions experienced increases in wages between 2000 and 2008, but following the 2008 recession, these regions saw a stagnation in wages. In addition, several specialties saw a persistent increase in wages between 2000 and 2018, including nurses in a supervisory role who saw an overall increase of 41.4 percent in real wage values. Several advanced practice nursing specialties also saw sustained increases in their wages. Certified nurse-midwives had a real wage increase of 19.46 percent and nurse practitioners saw their real wages increase 7 percent between 2000 and 2018.

The Kaplan-Meier survival analysis showed that perioperative nurses have a significantly higher probability of remaining on active duty across all ten years of commissioned service compared to the psychiatric, emergency health, and critical care specialties. At ten years of commissioned service, a nurse working in the perioperative specialty has a 0.54 probability of remaining on active duty, while the other three specialties range between a probability of 0.38 and 0.40. Nurses working in the medical-surgical and the neonatal intensive care specialty consistently have higher probabilities of remaining on active duty compared to nurses in the maternal and infant health and pediatric specialties between four and ten years of commissioned service.

The logistical regression revealed that an increase of $1,000 in a Navy nurse's annual salary would increase the odds of a nurse remaining on active duty by 17.2 percent at the three-year decision point while accounting for other variables such as race, prior-enlisted status, duty station census region, and nursing specialty. Additionally, when comparing the military-civilian wage differential, the analysis showed that at the national level, between 2001 and 2013, the military-civilian wage differential ranged between 2.5 percent and 3.5 percent, and then grew to 4.6 percent by 2018. However, the results based on geographical region and years of experience produce different outcomes and need to be taken into consideration.

C. ORGANIZATION

This thesis is divided into seven chapters. Chapter II provides a background on the civilian nursing market and highlights some key areas where the nursing profession has changed from 2000 to 2018. It also provides a detailed wage analysis based on the nurses' census region, years of nursing experience, and specialty. Chapter III discusses how a military nurse's wages are determined and includes a brief introduction to the Nurse Corp's subspecialties. Chapter IV provides a literature review of previous empirical studies that have also analyzed how various factors affect retention within the Navy Nurse Corps. It also includes a summary of previous Center for Naval Analysis (CNA) studies that analyzed the military-civilian pay differential, and it also describes the methodology of their analysis. Chapter V describes the data utilized in this study, defines the variables, and outlines the methodology utilized to answer the previously stated research questions. In addition, this chapter provides the summary statistics of both the independent and dependent variables utilized in the analysis. Chapter VI provides the results and the interpretation of the analysis for each of the research questions. Chapter VII provides recommendations and suggestions for future areas of research.

II. CIVILIAN NURSING BACKGROUND

This chapter provides an overview of the civilian nursing profession including the trends in education attained by nurses, the increasing scope of practice within the health care setting, and the evolution of wages over time with regards to education level, geographical region, and level of experience. This chapter also offers a glance into the possible changes in wages in relation to varying levels of supply and demand mismatch going into 2030 and how that may affect future real wage values.

A. THE PROFESSION OF NURSING

The profession of nursing has changed significantly between 2000 and 2020 due to an increase in healthcare demands, shortages of physicians, and several healthcare initiatives and reforms that have affected the level of education nurses obtain and their scope of practice.

Healthcare demands continue to increase due to an aging population, as the baby boomer generation become seniors and chronic diseases become more complex and prevalent (Anyssa, 2016). In 2013, about 14.1 percent of the U.S. population was 65 years or older, and by 2040, the percent of the population in that category is expected to rise to about 21.7 percent (Salmond & Echevarria, 2017). The aging population's increasing healthcare demands have outpaced the supply of physicians, and coupled with soaring healthcare costs, have resulted in several healthcare reforms that have affected the nursing profession. The reforms that have been set in place have led to stronger support for nurses obtaining higher levels of education and expanding their scope of practice (Woo et al., 2017).

Several goals have been addressed in healthcare reforms that have affected the demand of the Advanced Practice Registered Nurse (APRN), which include nurses working as Nurse Practitioners (NP), Certified Registered Nurse Anesthetist (CRNA), Certified Nurse-Midwives (CNM), and Clinical Nurse Specialists (CNS). One goal is to help ease the shortages in physicians, as the physician shortage is estimated to be 35 percent by 2030. Nurses can help ease the shortage of physicians by working in various healthcare

settings as an APRN in roles that were previously only open to physicians (Woo et al., 2017). The passing of the Affordable Care Act in 2010 facilitated the removal of some barriers that APRNs have faced that restricted their ability to maximize the scope of their roles, and it also increased access to care to those who previously did not have access to health insurance (Institute of Medicine, 2011). Shortly following the passing of the Affordable Care Act, 13 states allowed APRNs full practice authority, which granted them the ability to operate independently without direct physician oversight. Since then, other states have continued to follow suit, which has further expanded the demand for APRNs (Brom et al., 2018). The significant demand for APRNs has contributed to advanced practice nursing to be one of the fastest-growing occupations, as the expected rate of job growth is projected to increase 45 percent between 2020 and 2030. (U.S. Bureau of Labor Statistics, 2021b). According to the survey, National Sample Survey of Registered Nurses (NSSRN), that was conducted by the National Center for Health Workforce Analysis in 2018, about 11.5 percent of registered nurses stated they were an APRN, an increase of about 3.4 percent since 2008 (U.S. Department of Health and Human Services, 2019).

Not only is the baby boomer generation increasing the demand for healthcare, but they too make up a large percentage of the nursing profession, which can be seen in the rising median age within the nursing population. Figure 1 shows the trend in the aging nursing population between 2000 and 2020. Data for the years 2000, 2004, and 2008 were provided by publicly available databases that were compiled based on the results of the NSSRN that was conducted by the National Center for Health Workforce Analysis (Health Resources and Services Administration [HRSA], n.d.). The data for the years 2013, 2015, 2017, and 2020 were provided by the National Council of State Boards of Nursing and the National Forum of State Nursing Workforce Centers as part of the *2020 National Nursing Workforce Survey Report* (Smiley et al., 2021). The two sources of data were combined to highlight the long-term trends in the median nursing age.

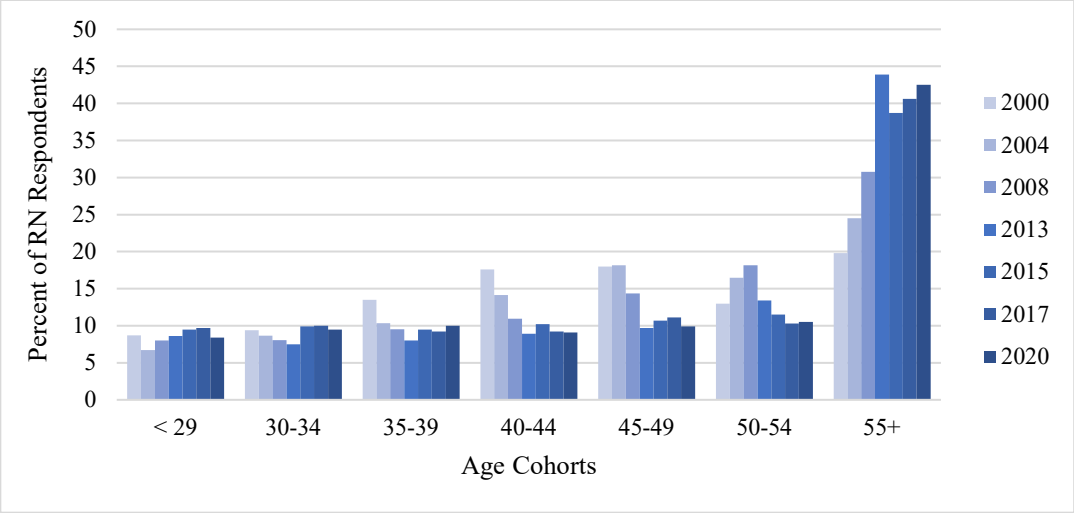

Figure 1. Age Distribution of RNs by Year, 2000–2020. Source: Image created using NSSRN survey results (2000-2008) (Health Resources and Service Administration, n.d) and National Nursing Workforce Survey Results (2013-2020) (Smiley et al., 2021).

As of 2020, the median age of an RN was 52 years old and about 42.5 percent of RNs with an active license were at least 55 years old.[1] The aging nursing population is also notable among the nursing school faculty. In 2013, a survey conducted by the National Council of State Boards of Nursing indicated that the average age of a doctorally prepared nurse faculty working in the role of a professor was 61.3 years old and the average age of a master's degree-prepared nursing professor was 57.2 years old (American Nurses Association, 2015).

The RN profession has grown between 2000 and 2020 and is expected to continue to grow nine percent between 2020 to 2030 with about 200,000 job openings becoming available annually (U.S. Bureau of Labor Statistics, 2021). Coupled with the growing demand for nurses and the aging nursing population, the shortage of nurses is not likely to ease up anytime soon, especially since the academic setting is unable to produce enough nurses to keep up with the increased demand. The American Association of College of Nurses (AACN) stated that in 2018 over 80,000 qualified nursing student applicants were

[1] A RN with an active license does not indicate that they are actively working as a nurse. Some may be retired, volunteering, out of the workforce, or working in a non-nursing field.

unable to be admitted into a nursing program due to facility, classroom space, clinical sites, clinical preceptors, and budgets constraints (2020). In addition, 22.1 percent of RNs who responded to the 2020 National Nursing Workforce Survey indicated that they either planned to retire or leave nursing within the next five years (Smiley et al., 2021). Nurses can gain a registered nursing license by completing the minimal level of accredited education and passing the National Council Licensure Examination. The education requirement can be obtained by completing either a diploma program that is typically offered by a hospital or medical center, an associate degree in nursing, or a Bachelor of Science in Nursing (U.S. Bureau of Labor Statistics, 2021a).

The level of education that nurses are expected to obtain has also changed over time due to several nursing initiatives set by the Institute of Medicine in 2010. The first goal was for 85 percent of all nurses to hold at least a bachelor's degree by 2020 and the second was to double the number of nurses with a doctoral degree (AACN, 2020). In 2018, a survey of nursing employers showed that 46 percent of employers required an RN to have at least a bachelor's degree and 88 percent stated they strongly preferred an RN with at least a bachelor's degree (AACN, 2019). Figure 2 illustrates the shift in the highest level of nursing education obtained by RNs over the last 20 years. Diploma and associate degrees have decreased, while nurses with a bachelor's degree continue to rise. In addition, there has been a modest increase in the percent of nurses with master's and doctoral degrees. In 2020 approximately 65.2 percent of nurses who responded to the survey had at least a bachelor's degree, an increase of nearly 50 percent.

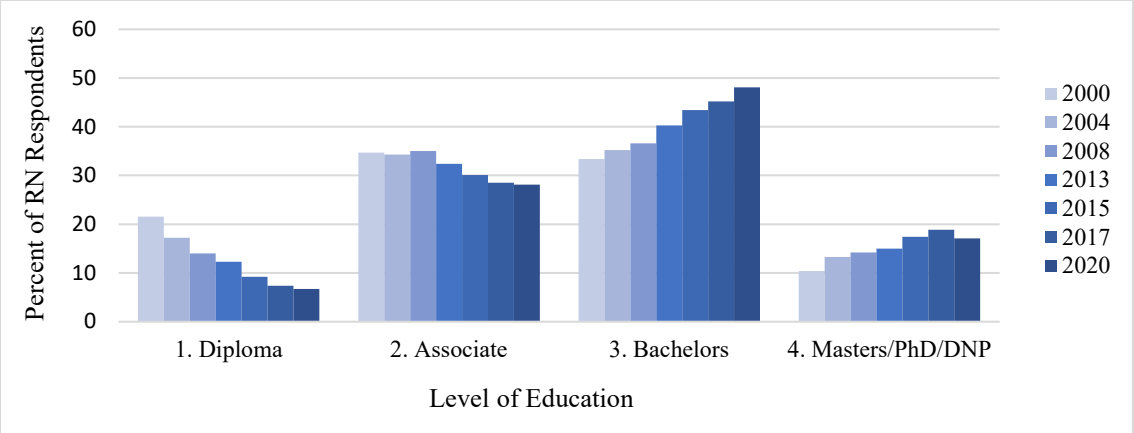

Figure 2. Distribution by RN Education Level, 2000–2020 Source: Image created using NSSRN survey results (2000-2008) (Health Resources and Service Administration, n.d) and National Nursing Workforce Survey Results (2013-2020) (Smiley et al., 2021).

B. NURSING WAGES IN THE CIVILIAN SECTOR

Due to the nursing profession's scope of practice expanding, a tightening supply of nurses available, and nurses becoming more educated, nurses are also becoming more expensive. Between 2000 and 2008, across all census regions and specialties, bachelor's degree prepared nurses saw their real wage values increase. However, following the great recession in 20008, real nursing wages began to stagnate. While the wages may have stagnated for most of the basic level nurses, the expenditure for the health care facilities would likely increase due to nurses becoming more educated and requiring higher pay. For example, in 2018, an average bachelor's degree-prepared nurse made about 6.4 percent more than an associate-degree nurse on average. Other factors that have affected a nurse's wage over the past twenty years include their specialty, level of position, level of education, region of employment, and years of nursing experience.

The summary statistics in this section were derived from the databases provided by the National Center for Health Workforce Analysis, a section of the HRSA. The National Center for Health Workforce Analysis provides data that is collected from the NSSRN and publishes it on a publicly available website. The survey was administered to actively licensed RNs across the country with varying levels of experience, varying specialties, and employed in various health care settings. The surveys were designed to collect data on

various topics and were conducted every four years, except for 2012. In this section, I analyze the years 2000, 2004, 2008, and 2018 (HRSA, n.d.). All wages listed in the following tables and figures are pre-tax annual incomes that are based only on the nurses' primary full-time nursing position.[2]

Table 1 shows the real wages, in 2018 dollars for the nursing population who reported their highest level of education as having at least a bachelor's degree in nursing, or a nursing-related field, but excludes nurses certified as an APRN. An average RN's real wage increased by 11.7 percent between 2000 and 2004, continued to increase through 2008, before slightly decreasing through 2018. Overall, the percent of change from 2000 to 2018 was an increase of about 14.86 percent.

Table 1. Average RN Annual Salary, 2000–2018

Year	Average Nominal Salary	Average Real Salary*	Percent Change	Percent Change/Year
2000	$48,256.12	$68,230.05	-	-
2004	$58,589.85	$76,184.14	11.67	2.9
2008	$68,959.78	$80,573.95	5.76	1.44
2018	$78,500.61	$78,500.61	-2.57	-0.26

Source: Table created using NSSRN survey results (Health Resources and Service Administration, n.d).

Note: Average real salary brought to 2018 values. Percent change is calculated using the average real salary value.

Table 2 shows average annual salaries for nurses with at least a bachelor's degree in nursing or nursing-related field by various nursing specialties that are often found in an inpatient or hospital setting. A medical-surgical nurse is defined as someone who indicated they worked in an inpatient general medical-surgical unit that is not associated with another specific inpatient nursing specialty. In comparing the difference of average wages, labor and delivery nurses had the lowest average wage between 2000 and 2008, which then

[2] Full-time in this context is defined by those from the sample that indicated they were employed in a full-time position, have worked at least 11 months out of the past year, and worked at least 36 hours in an average week.

shifted to the medical-surgical nurse in 2018. Between 2000 and 2008, the highest average wage was the emergency room nurse, which then transitioned to critical care nurses in 2018. In general, the medical-surgical nurses' and labor and delivery nurses' wages were most comparable to each other, whereas the critical care and emergency room nurses' wages were most comparable to each other.

Table 2. Average RN Annual Salary by Specialty, 2000–2018

Year	Specialty	Average Nominal Salary	Average Real Salary	Percent Change	Percent Change/Year
2000	Medical-Surgical	$44,380.65	$62,750.63	-	-
2004	Medical-Surgical	$54,535.98	$70,912.91	13.01	3.25
2008	Medical-Surgical	$64,496.95	$75,359.49	6.27	1.57
2018	Medical-Surgical	$68,503.12	$68,503.12	-9.10	-0.91
2000	Critical Care	$46,078.77	$65,151.63	-	-
2004	Critical Care	$58,107.67	$75,557.16	15.97	3.99
2008	Critical Care	$68,981.60	$80,599.45	6.67	1.67
2018	Critical Care	$76,620.49	$76,620.49	-4.94	-0.49
2000	Labor & Delivery	$42,047.93	$59,452.35	-	-
2004	Labor & Delivery	$53,738.74	$69,876.26	17.53	4.38
2008	Labor & Delivery	$62,493.42	$73,018.53	4.50	1.12
2018	Labor & Delivery	$72,547.65	$72,547.65	-0.64	-0.06
2000	Emergency Room	$46,728.90	$66,070.86	-	-
2004	Emergency Room	$59,008.84	$76,728.95	16.13	4.03
2008	Emergency Room	$69,789.22	$81,543.09	6.27	1.57
2018	Emergency Room	$75,818.14	$75,818.14	-7.02	-0.70

Source: Table created using NSSRN survey results (Health Resources and Service Administration, n.d).

Note: Average real salary brought to 2018 values. Percent change is calculated using the average real salary value.

Based on the 2018 survey results in general, all four inpatient nursing specialties experience lower than average wages. A medical-surgical nurse's salary was 12.74 percent less than the average nursing wage in 2018. With a slightly higher wage, labor and delivery nurses still had an average wage of 7.58 percent less than the nursing average. Emergency

room and critical care nurses' average wages were 3.42 percent and 2.4 percent less than the average nursing wage, respectively. Out of these specialties, however, medical-surgical nurses on average had the highest overall growth in wage between 2000 and 2018, with an overall increase of 29 percent, whereas the emergency room nurse saw the lowest increase in wage at 14.6 percent.

Nurses who stated they worked in a supervisory role are highlighted in Table 3. The supervisory role is not delineated by specialty, healthcare setting, or level of the supervisory position. It only includes those working full time and excludes APRNs. While most of the basic level inpatient nurses saw a decrease in real wages between 2008 and 2018, those working in supervisory positions continued to see a modest increase. Overall, between 2000 and 2018, a supervisory nurse saw their wage increase by 41.4 percent. The average supervisory nurse wage in 2018 was 29.3 percent higher than the average wage of a bachelor prepared nurse working in a non-supervisory position.

Table 3. Average Supervisory RN Annual Salary, 2000–2018

Year	Average Nominal Salary	Average Real Salary	Percent Change	Percent Change/Year
2000	$50,770.94	$71,785.98	-	-
2004	$60,386.08	$78,519.77	9.38	2.35
2008	$80,382.50	$93,920.48	19.61	4.90
2018	$101,529.30	$101,529.30	8.10	0.81

Source: Table created using NSSRN survey results (Health Resources and Service Administration, n.d).

Note: Average real salary brought to 2018 values. Percent change is calculated using the average real salary value.

It is unsurprising to see that APRNs make on average 45.9 percent more than nurses possessing a bachelor's degree, due to their higher education requirements and scope of practice based on 2018 survey results. However, the range of pay for an APRN is widely dependent on the type of certification and specialty. Table 4 highlights the range of pay among NPs, CRNAs, CNMs, and CNSs, and the variation in the rate of wage growth between 2000 and 2018. CRNAs saw a similar stagnation in wage growth in real wages

following 2008 that the basic level of RNs saw, while CNMs saw an increase of 19.46 percent between 2008 and 2018. NPS saw an average increase of 7.04 percent.

Table 4. Average APRN Annual Salary by Certification, 2000–2018

Year	APRN Type	Average Nominal Salary	Average Real Salary	Percent Change	Percent Change/Year
2000	NP	$60,128.46	$85,016.75	-	-
2004	NP	$70,911.96	$92,206.52	8.46	0.85
2008	NP	$85,400.39	$99,783.48	8.22	0.82
2018	NP	$106,808.10	$106,808.10	7.04	0.70
2000	CRNA	$92,959.50	$131,437.16	-	-
2004	CRNA	$127,815.00	$166,197.31	26.45	2.64
2008	CRNA	$153,746.70	$179,640.64	8.09	0.81
2018	CRNA	$167,358.10	$167,358.10	-6.84	-0.68
2000	CNM	$63,204.47	$89,365.97`	-	-
2004	CNM	$65,853.26	$85,628.72	-4.18	-0.42
2008	CNM	$77,119.14	$90,107.51	5.23	0.52
2018	CNM	$107,642.60	$107,642.60	19.46	1.95
2000	CNS	$59,723.59	$84,444.29	-	-
2004	CNS	$72,563.62	$94,354.17	11.74	1.17
2008	CNS	$84,440.04	$98,661.39	4.56	0.46
2018	CNS	$100,339.40	$100,339.40	1.70	0.17

Source: Table created using NSSRN survey results (Health Resources and Service Administration, n.d)

Note: Average real salary brought to 2018 values. Percent change is calculated using the average real salary value.

Another significant factor that affects a nurse's wage is the region of their employment. The U.S. consists of nine census regions that are grouped by similar characteristics and geographic locations. The regions are illustrated in Figure 3.

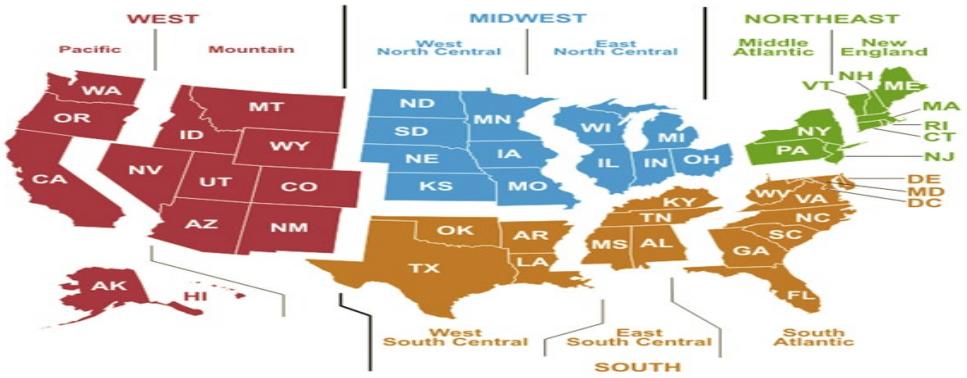

Figure 3. U.S. Census Regions and Divisions. Source: U.S. Energy Information Administration (2021).

Figure 4 highlights the spatial and temporal variation in nursing wages across regions and over time. The regions that saw a similar pattern with the gradual rise in real wages between 2000 and 2008 before stagnating or slightly decreasing include the East North Central region, the Middle Atlantic, Mountain, New England, South Atlantic, and West South Central region. The overall twenty-year wage change in the East South Central region saw a decrease in real wages of 0.02 percent. The West North Central region nearly maintained its wage growth as the average nurses' wage saw a 0.22 percent decrease between 2008 and 2018.

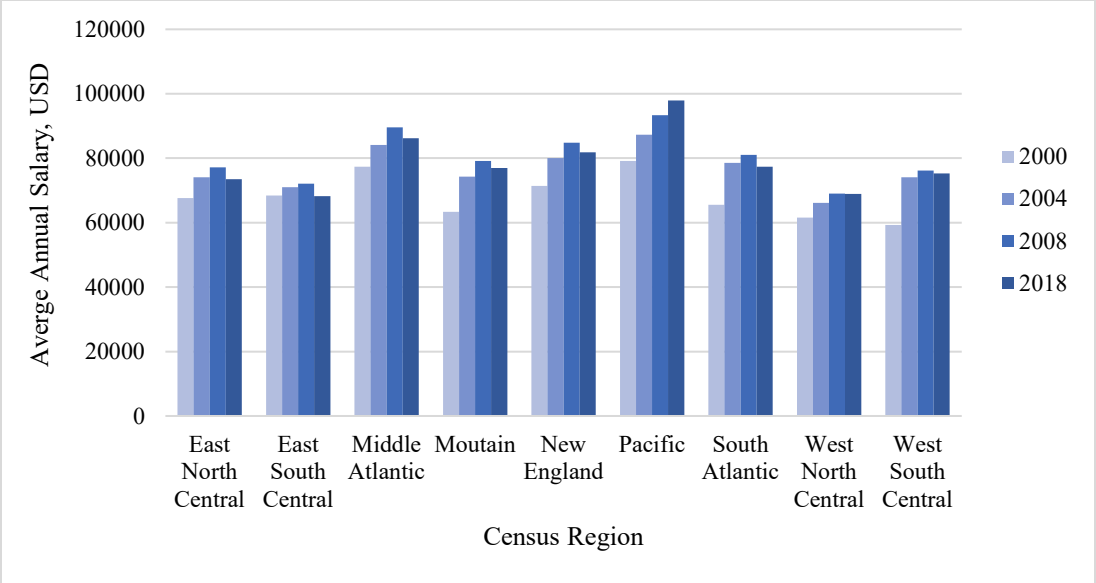

Figure 4. Average RN Wages by Census Region in 2018 Real Wage Values, 2000–2018. Source: Image created using NSSRN survey results (Health Resources and Service Administration, n.d).

Overall, the only region that saw significant and consistent growth in their average real wages was the Pacific region, where between 2000 and 2018, nursing wages saw an average increase of 22 percent. In 2018, the lowest average wage for nurses with at least a bachelor's degree was in the East South Central region with an average wage of $68,266.32. The West North Central was similar and had an average wage of only 0.9 percent more than the East South Central region. However, the East North Central's nursing salary was 7.6 percent higher than the East South Central region. The regional variation was even more significant in the West South Central, Mountain, and South Atlantic where the average nursing wages were 10.2 percent, 12.8 percent, and 13.3 percent higher, respectively, than the East South Central region. The highest-earning regions were New England, Middle Atlantic, and Pacific regions. The New England region made on average 19.8 percent more than the East South Central region, where the Middle Atlantic and Pacific region had nursing wages that were 26.3 percent and 43.4 percent higher than in the East South Central region, respectively. In general, nurses working in the Middle Atlantic, New England, and Pacific census regions in 2018 had wages higher than the average nursing wage.

Apart from region and specialty, experience is another driver of differences in nursing wages. The amount of experience nurses have significantly influenced their earning potential throughout their career, and like many previous factors, the earning potential varies from year to year. Figure 5 shows the differences in wages for at least a bachelor's prepared registered nurse, but one who is not working as an APRN, based on their years of nursing experience in real wage values. A nurse entering the field of nursing had the potential to increase their wages by 36 percent in both 2000 and 2008. Even though the average real wage fell in 2018, the earning potential after gaining 12 years of nursing experience increased by 47 percent compared to a nurse just entering the nursing profession. However, the starting wage for a nurse with one year of experience in 2018 was lower than a nurse entering nursing in 2008 by 5.8 percent.

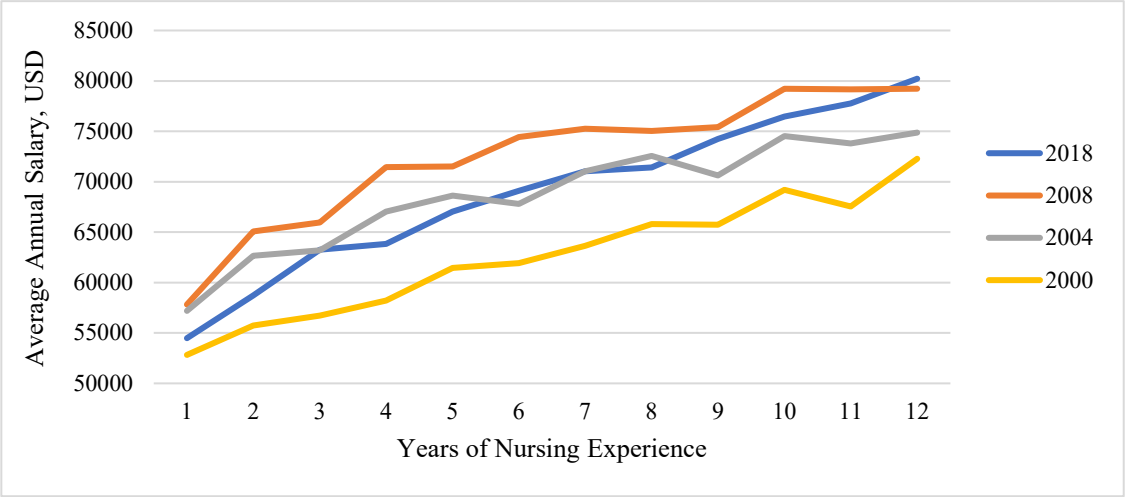

Figure 5. Annual RN Real Wages by Experience in 2018 Values, 2000–2018. Source: Image created using NSSRN survey results (Health Resources and Service Administration, n.d).

Looking at the wages by experience over 20 years does not tell the complete story, as the averages on a national level are different from those in various regions of the U.S. Figure 6 shows this difference by breaking down the average wage by years of experience and by census region. In addition to various starting wages, the value of experience is highlighted in several of the regions. The average increase in earnings from one year of

experience to twelve years is about 47 percent. The two lowest earning potential regions were the Middle Atlantic and West South Central region, which were at 30 percent and 28 percent, respectively. The highest earning potential region was the East South Central at 71 percent; however, this region also had the lowest starting average wage.

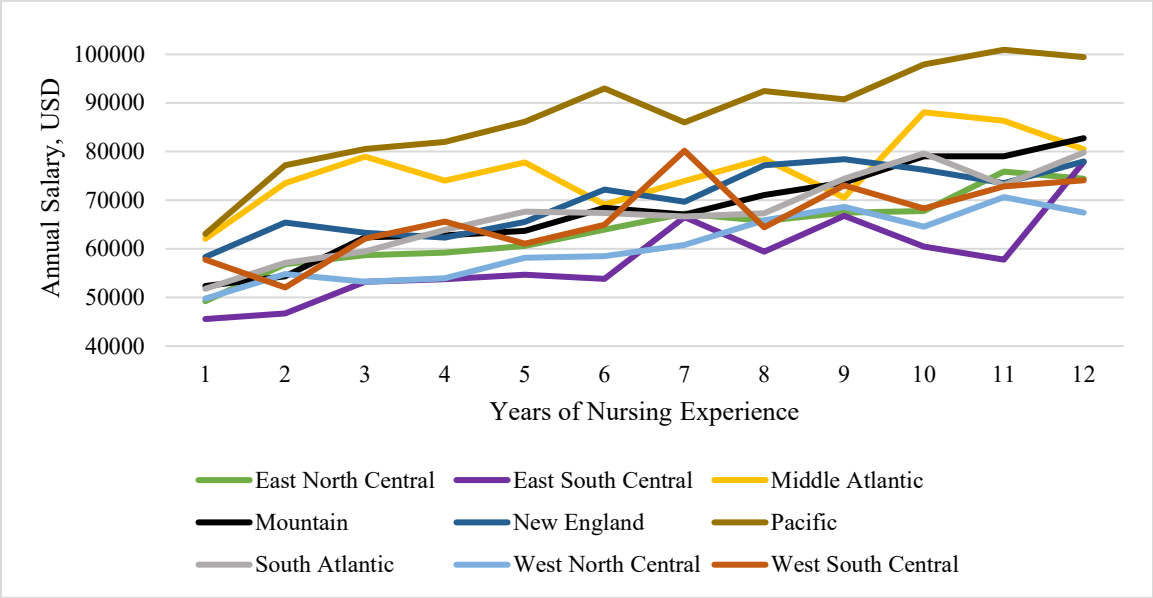

Figure 6. Average RN Salary by Years of Experience and Region, 2018
Source: Image created using NSSRN survey results (Health Resources and Service Administration, n.d).

C. PROJECTED SURPLUS AND DEFICIT OF NURSES

In projecting opportunities and potential increases in real wages, it is important to understand where the civilian market is expected to experience both shortages and surpluses of nurses. The National Center for Health Workforce Analysis projected the supply and demand market of nurses through 2030 by modeling with the 2014 nursing market as a framework. In doing so, they assumed that the supply and demand of nurses would remain constant between the periods of 2014 and 2030. Figure 7 shows the potential deficits or surplus in the nursing workforce in 2030 in each of the states.

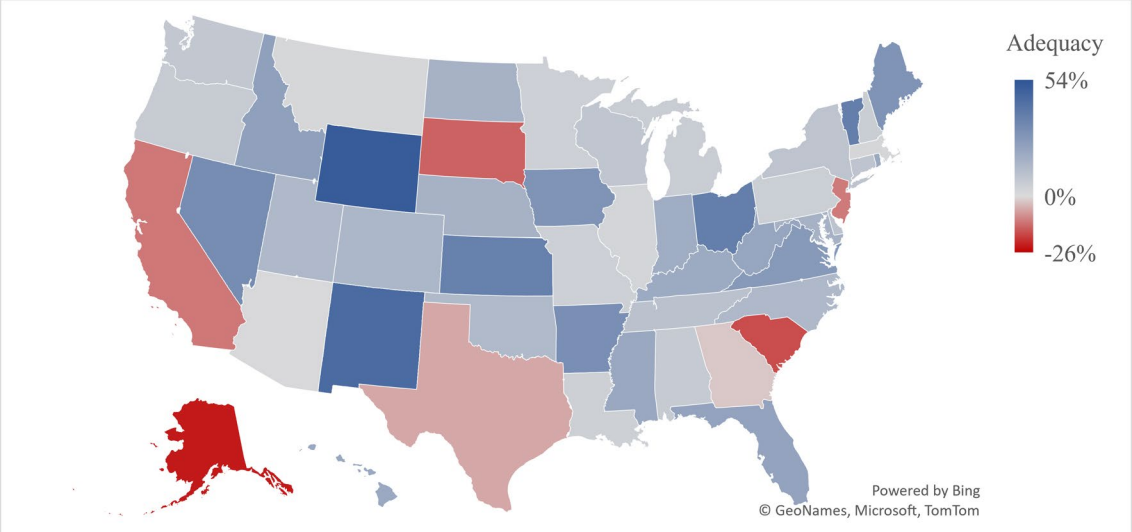

Figure 7. Projected RN Supply Versus Demand by State, 2030. Source: Image produced using a report provided by the Nation Center for Health Workforce Analysis. (U.S. Department of Health and Human Services, 2017).

The states looking to have a significant gap of at least ten percent include South Dakota, South Carolina, Alaska, and California. While other states are projected to have a surplus of at least 30 percent, such as Vermont, Kansas, Ohio, Arkansas, the District of Columbia, Nevada, New Mexico, and Wyoming (U.S. Department of Health and Human Services, 2017). It is clear, that while there may be an overall national shortage of nurses, the resources that will be projected to be available are unevenly distributed throughout the country.

III. NAVY NURSE CORPS BACKGROUND

This chapter offers an overview of the categorization of Navy nurses based on specialty and scope of practice. In addition, I discuss how military nurses' wages are determined and the specific components of each type of pay, allowances, and retention incentives.

A. NAVY NURSING

Navy nurses are categorized by their specialty in the form of a subspecialty code followed by a suffix that indicates their level of experience and/or level of education. Table 5 lists both the basic and APRNs' subspecialties within the Navy Nurse Corps as outlined in the Navy Officer Occupational Classification System Manual, Volume 1, Part B (Navy Personnel Command, 2022). The specialties that work in a direct patient care environment are included, whereas the other specialties that fall into administrative or education and training roles are omitted due to the limited scope of my analysis. Some specialties are deemed critical warfighting specialties due to their necessity to be forward deployed supporting the Navy and Marine Corps forces. Maintaining manning levels within these specialties is crucial for overall mission readiness and effectiveness.

Table 5. Direct Patient Care Specialties within the Navy Nurse Corps

Specialty Title	Subspecialty Code	Level of Practice
Professional Nursing	1900	Basic/ Advanced
Medical/Surgical Nursing	1910	Basic
Maternal and Infant Health Nursing	1920	Basic
Pediatric Nursing	1922	Basic
Psychiatric Nursing	1930	Basic
Public Health Nursing	1940	Basic
Emergency Trauma Nursing*	1945	Basic
Perioperative Nursing*	1950	Basic
Critical Care Nursing*	1960	Basic

Neonatal Intensive Care Nursing	1964	Basic
Certified Registered Nurse Anesthetist*	1972	Advanced
Psychiatric Mental Health Nurse Practitioner*	1973	Advanced
Pediatric Nurse Practitioner	1974	Advanced
Family Nurse Practitioner	1976	Advanced
Women's Health Nurse Practitioner	1980	Advanced
Nurse Midwife	1981	Advanced

Note: All basic specialties have an advanced practice component if the nurse has graduate education and certification approved for their specific specialty.

Source: NOOCS/Vol1/Manual I 74 PT B (Navy Personnel Command, 2022).

*Indicates critical wartime specialties

B. NURSE CORPS WAGES

Nurse Corps wages do not adjust as readily as the civilian nursing market. Rather the structure of military nursing wages is based on the overall base pay that is set in the National Defense Authorization Act that must be passed by the U.S. House, the U.S. Senate, and signed into law by the president each year. Starting in the fiscal year 2004, each year's pay raise is equal to the Employment Cost Index provided by the Bureau of Labor Statistics, which is calculated based on changes in general civilian market wages and salaries. Congress has the authority to increase military pay above the Employment Cost Index, which they did in 2008 and 2009 (Department of Defense, 2022c). Figure 8 shows the annual increase in military base pay between the years of 2000–2021 (Goering, n.d.).

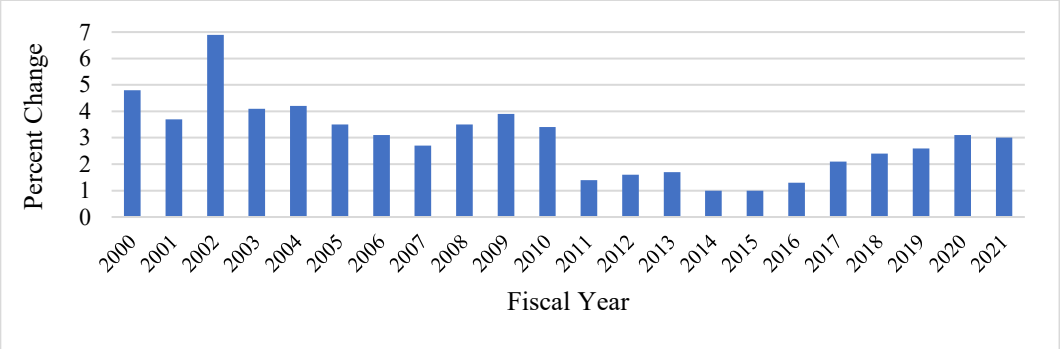

Figure 8. Annual Percent Change in Military Base Pay, 2000–2021. Source: Image created using data provided from Navy Cyber Space (Goering, n.d.).

The base pay is determined by a nurse's specific grade and time in service (Department of Defense, 2022b). Standard military pay also includes a basic allowance for subsistence (BAS) and a basic allowance for housing (BAH) that is based on the geographical location of the service member's duty station, both of which are nontaxable (Department of Defense, 2022a). The Nurse Corps can use incentives such as accession bonuses or retention bonuses to assist with recruiting and retaining nurses when manning levels become critical or hard to fill. Some basic-level nurses are eligible to receive a retention bonus. According to the FY21 Active-Duty Nurse Corps Special Pays Guidance, medical-surgical, emergency room, critical care, perioperative, and psychiatric/mental health nurses are eligible for a retention bonus if they meet the required criteria. Some of the criteria outlined in the special pay guidance state that the nurse must be in a permanent active-duty status and has completed any previous obligated service. In addition, each specialty must meet the required education suffix code as outlined in Table 6 and have completed the required courses or graduate program.

Table 6. Education Suffix Requirement by Specialty

NURSE CORPS	Required Education Suffix	Tertiary Suffix "V" Required if Education Suffix "K"	Eligible For RB if Under DUINS Obligation Period	Eligible to Enter DUINS Master's Degree Program for Same Specialty Receiving RB	Eligible to Decline Accession Bonus and Enter RB Agreement Upon Meeting Eligibility
Medical-Surgical Nursing	Q or C	NA	No	No	No
Emergency Room Nursing	Q or C	NA	No	No	No
Critical Care Nursing	K, Q, or C	Yes	No	Yes	No
Perioperative Nursing	K, Q, or C	Yes	No	No	No
Psychiatric/Mental Health Nursing	K, Q, or C	Yes	No	Yes	No
Family Nurse Practitioner	Q, or C	NA	No	No	No
Certified Registered Nurse Anesthetist	Q or C	NA	No	No	No

Source: Bureau of Medicine and Surgery (2021).

Key for the education codes:

C = Doctor of Philosophy (Ph.D.) and has served 18 or more consecutive months in the coded subspeciality billet, would be considered an APRN/CNS

Q = Master's degree and has served 18 or more consecutive months in the coded subspeciality billet; would be considered an APRN/CNS

K = Professional Certification

Failing to select to the rank of Lieutenant Commander (O-4) and Commander (O-5) will disqualify an otherwise eligible nurse from receiving any retention bonuses. In return for accepting the bonus, the nurse will be required to sign a new obligated service requirement that corresponds to the amount of retention bonus selected, outlined in Table 7 (Bureau of Medicine and Surgery, 2021).

Table 7. FY21 Special Pays by Specialty

NURSE CORPS	Fully Qualified IP only 1-year rate (prorated monthly)	RB 2-Year Rate (Paid Annually)	RB 3-Year Rate (Paid Annually)	RB 4-Year Rate (Paid Annually)	RB 6-Year Rate (Paid Annually)
Medical-Surgical Nursing	-	$8000	$13,000	$18,000	-
Emergency Room Nursing	-	$8,000	$13,000	$18,000	-
Critical Care Nursing	-	$10,000	$15,000	$20,000	$35,000
Perioperative Nursing (< 22 YCS)	-	$8,000	$13,000	$18,000	-
Psychiatric/Mental Health Nurse (< 22 YCS)	-	$8,000	-	-	-
Family Nurse Practitioner (< 22 YCS)	-	$8,000	$13,000	$18,000	-
Pediatric Nurse Practitioner (< 22 YCS)	-	$8,000	-	-	-
Nurse Midwife (< 22 YCS)	-	$8,000	-	-	-
Mental Health Nurse Practitioner	-	$10,000	$15,000	$25,000	$40,000
Certified Registered Nurse Anesthetist	$15,000	$10,000	$20,000	$40,000	$60,000

Source: Bureau of Medicine and Surgery (2021).

While both medical-surgical and emergency room nurses require experience and a master's degree to be eligible for a retention bonus, critical care, perioperative, and psychiatric/mental health nurses only need to have their certification in their specialty to be eligible. Certification requirements may vary by specialty, but typically require a certain number of hours providing direct patient care in the specialty and passing of a certification exam. For example, a critical care nurse can obtain certification by completing 1,750 hours of direct patient care of acute or critically ill adult patients within the past two years. After hours have been verified, the nurse is eligible to take an exam. Once both requirements are met, the nurse is certified in their specialty (American Association of Critical Care Nurses, 2022).

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IV. LITERATURE REVIEW

This chapter summarizes the literature on retention in the Navy Nurse Corps over the past thirty years. In this section, I also discuss the findings of those studies, along with the results from several Center for Naval Analyses reports regarding military-civilian wage differential analysis.

A. FACTORS AFFECTING NURSE CORPS RETENTION

Turner (1990) examined how factors such as the amount of direct patient care, workload, and pay affected a Navy nurse's decision to stay or leave the military service in the pay grades of O-1 through O-4 by using logistic regressions. She controlled for the vacancy nursing rate within each census region, the military nurse's pay, and the responses from the 1987 Navy Occupational Task Analysis survey in her analysis. This survey provided data on the number of hours a military nurse reported he or she worked, the percent of their time that was spent doing direct patient care, and how many years it had been since the nurse completed the survey.

In Turner's analysis (1990), the regional vacancy rate was squared since the effect the vacancy rate had on retention produced nonlinear results and produced a parabolic curve instead. The vacancy rate had a positive effect on retention up to a vacancy rate of 11 percent before transitioning to a negative effect. Therefore, any vacancy rate above 11 percent would increase the probability of a nurse leaving military service. Pay was found to have a positive effect on retention with the higher the pay, the higher probability of staying on active duty. The percent of time spent doing patient care and hours working in a week both produced negative effects. The coefficients of the logistic regression were then converted into elasticities. The highest elasticity was with the regional vacancies followed by pay, indicating that the opportunities available within the area a nurse is stationed and their military pay does contribute to their stay or leave decision. The elasticity for pay was 2.39, indicating that for a one percent increase in pay, the likelihood of a nurse remaining on active duty increased by 2.39 percent.

By utilizing the regional vacancy rate in place of a military-civilian wage differential, Turner (1990) was able to provide useful insights to see at what point nurses start to increase their probability of leaving the military to peruse opportunities in the civilian sector. It is likely the regions that had more vacancies were increasing their pay and other incentives to try to attract more nurses to their open positions. This is a key marker that the Navy Nurse Corps should monitor regularly, as it can help shape their recruiting and retention strategies, especially within the regions where the Navy has a prominent presence. Her study also provided a holistic approach and attempted to capture both the effect wages and civilian labor market opportunities have on retention, but also addressed variables that are typically not included in wage analysis, to include the number of hours a military nurse works, which can be widely varied based on the duty station and operational tempo at the time.

Krause (2010) analyzed what effect the medical facility size that a nurse corps officer was assigned to on their initial assignment had on Navy nurses' retention rate. In general, nurses report having greater job satisfaction and retain at a higher rate when they are clinically prepared and feel confident in their nursing role. Therefore, Krause hypothesized that nurses who were stationed at one of the three Naval medical centers would have a positive effect on retention due to the medical centers having a higher patient census and acuity. She analyzed nurses whose active duty start date was between 1994 and 1998 and used a linear probability regression to estimate the effects the size of duty station had on retention. The findings of the study did not find a positive correlation on retention for nurse corps officers who were stationed at one of the three large medical centers but instead resulted in a non-statistically significant negative result.

While experience and competency play a significant role in retention within the civilian sector as Krause (2010) mentions in her study, other variables should have been included in her analysis that may have altered her regression outcome to be a positive indicator for retention, such as the specialty of the nurse and controlling for civilian opportunities through regional vacancy rates, as Turner (1990) did in her analysis. The reason it would be important to control for the specialty of the nurse is that each specialty within the Nurse Corps retains at very different rates. In addition, the largest three Navy

medical facilities are also located in larger metropolitan areas that may have greater civilian nursing career prospects. Another issue that needs to be addressed is burnout and the number of hours worked and the number of additional hours a nurse may be called in for at the large three medical centers versus the medium to smaller medical facilities. While the larger commands may have a larger number of patients available to improve their nursing experience and develop competency within new nurses, these nurses may experience burnout at a faster rate, which in turn reduces the likelihood of retaining that is not captured in the regression models.

Messmer and Pizanti (2007) analyzed what characteristics influenced the likelihood a nurse corps officer retained on active duty between the years 1990 and 2005. They looked at three categories of characteristics to include basic demographics, professional characteristics, and types of military experience. To determine the effects these variables had on retention, they utilized a multivariate logit regression. The results of their analysis showed that being male, belonging to a minority group, having dependents, being prior-enlisted, having a subspecialty, and having obtained a postgraduate degree were all positively correlated. In addition, when analyzing retention rates among the various commissioning sources, those who accessed via the Medical Enlisted Commissioning Program and Direct accession programs had the highest retention rates. These basic characteristics cover a wide range of variables. The only area of improvement with the regression model would be to create separate categories for nurses working as APRNs rather than grouping them within the broad specialty categories due to APRNs being distinctively different than the basic level nurses working in those same areas.

Harvie (2014) during his analysis of Navy Nurse Corps accession sources also found similar findings concerning retention rates. He utilized a logistical regression model to find the retention rates at six and eleven years of commissioned service based on the nurse's accession source. His analysis of nurses that were commissioned between the fiscal year 2000 and fiscal year 2013, showed that the Seaman to Admiral commissioning program produced a retention rate of 91.23 percent at six years of service, and the Medical Enlisted Commissioning Program had a retention rate of 89.65 percent at six years of service. The commissioning source with the lowest retention rate was the Navy Reserve

Officer Training Corps (ROTC) commissioning program with a retention rate of 54.62 percent at six years of service followed by the Nurse Candidate Program at 59.47 percent. Direct accession fell in the middle with a six-year retention rate of 54.62 percent. Understanding the cost and benefits is a unique piece to consider when determining how to maximize recruiting and retention policies. This information along with the results of previous studies helps to provide a clear picture of how different variables contribute and affect retention within the nurse corps.

B. CNA STUDIES

While few empirical research studies have looked at how civilian wages have affected retention within the Navy Nurse Corps, several CNA studies have done some research in this area. Cooke (1989) provided an overview of the wage structure in the civilian sector from 1983 through 1987 and compared it to the wage structure of the Navy Nurse Corps. In his analysis, the following decision points were utilized when he calculated the wage differentials: accession, the end of the initial obligation which was at four years of service (one year after contracts were typically completed), and the end of augmented obligation, which was at seven years of commissioned service. The military pay for those associated decision points was obtained from the average relative military compensation (RMC) for each year.[3] The civilian wages that were used to calculate the wage differential were based on the median pay reported on the annual survey National Survey of Hospital and Medical School Salaries, based out of the University of Texas Medical Branch at Galveston, Texas. While it was able to provide annual wage snapshots, the data did not allow for comparison based on years of nursing experience, but rather provided the starting wage rate to compare with the military accession pay and utilized the maximum wage rates for both staff nurses and head nurses for the four and seven years of experience comparison.

The results of Cooke's analysis (1989) showed that at each of the three decision points for each year of the analysis, the military RMC was higher than the comparable civilian pay, with the largest differential at the four years of military experience. However,

[3] RMC includes both taxable (basic pay) and nontaxable allowances (basic allowance for quarters, the variable housing allowance, and BAS), and the tax advantage associated with those allowances.

the findings show that the wage differential for all three decision points decrease each year between 1983 and 1987, with the differences ranging from $866 to $2,190 for the fiscal year 1987. In the civilian sector in 1986, a nurse's career wage potential was much smaller than most other occupations at that time. The difference between the starting and maximum wage was only growth in a salary of 36.4 percent. On the other hand, the growth that a Navy nurse experienced with additional years of experience was much higher. During the first four years of commissioned service between the fiscal years of 1983 and 1987, a Navy nurse would see an increase in salary on average of 10 to 11 percent per year, which is about three times higher than seen in the civilian sector. Between 4 and 20 years of commissioned service, this salary increase on average slowed to about 3.1 percent per year, which was comparable to the civilian sector (Cooke, 1989).

To analyze the effects of the wage differential retention and how it may affect the stay or leave decisions in the year 1989, Cooke used a logistic regression model to estimate the effects of various variables (Cooke, 1989). The model estimated how the following individual characteristics affected nurses' decision to stay or leave military service: whether they had a specialty, their pay differential, years of experience, education, and fiscal year. Using an estimated decrease of $1,500 in annual RMC, the model was then used to predict the effects on the retention rate. The model estimated that a reduction of $1,500 in annual RMC would result in a decrease in the retention rate of about three to four percentage points more if there was no decrease in RMC, which equates to about 10 nurses out of a cohort of 300.

A more recent CNA study (Brannman et al., 2001) analyzed the compensation of all major players on the military healthcare team to see how the military-civilian pay gap has changed over time by calculating the military-civilian wage differentials. The analysis included physicians, other non-physician health care professionals including pharmacists, optometrists, dentists, optometrists, clinical psychologists, physician assistants, and a nursing category that included RNs, CRNAs, and APRNs. Non-physician health care civilian wage data was sourced from data sources that reported the wages for each group in the mean, median, and percentile format. To compare years of military experience working in the field, those health care professionals with one to five years of experience

were matched with the civilian wages found at the 25th percentile for their field and labeled as the entry point, 6–10 years were matched with the 50th percentile and was labeled as the midpoint, and 11–15 were matched with the 75th percentile and labeled as the senior midpoint. Most of the different health professions had a civilian compensation survey that was used to determine the salary range for their fields. The military RMC in this analysis included base pay, (BAH), (BAS), and the tax advantage for the housing and subsistence allowances.

For the nursing portion of the wage analysis (Brannman et al., 2001), only the first two experience levels were compared, both of which the military compensation was higher than the civilian sector. At the entry level, a military nurse made about 27 percent more than their civilian counterpart, and at the midpoint level, this gap increased to 34 percent. However, it is important to note that this evaluation did not consider years of experience, as the reported average salary for a diploma nurse was about the same as a nurse with a bachelor's degree. This is likely because nurses who have a diploma are older and thus have more years of experience, whereas the nurses with a bachelor's degree may have less experience on average. This may highlight that it is the amount of experience that is driving the wages rather than the level of education, even though bachelor's degrees are becoming the preferred level of education by employers. This analysis provided a single snapshot by comparing wages for one year and did not provide the trends or the effects that the changes over time may have on retention.

C. SUMMARY

While Turner (1990) comes close to analyzing the effect of the military and civilian wage gap and its effect on retention by using civilian regional vacancy rates as a proxy, none of the other previous empirical studies control for this important variable in their regression models even though it could significantly affect the results of their analysis. There is a clear gap in research in identifying how the military-civilian wage differential affects retention in the Nurse Corps, especially at the basic level of nursing before the nurse advances into leadership roles later in their career or broadens their scope of practice as an APRN. APRN nursing wage data is more readily available than wage differences in the

basic level of nursing; however, there are still resources available that can provide this information. The focus of my research is to fill in some of the gaps found in the literature with the overall goal being to provide a more comprehensive, up-to-date analysis of the civilian nursing sector and the wages associated with it between 2000 and 2018.

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V. DATA AND METHODOLOGY

In this chapter, I describe the data used for the military-civilian wage analysis, as well as the data used for the Kaplan-Meier survival analysis and regression analysis. I will also describe the construction of key independent and dependent variables that are used in my regression models.

A. DATA SOURCES

1. Nurse Corps Data and Wages

I obtained all active-duty Navy Nurse Corps officers' data from the Defense Manpower Data Center (DMDC). The data was provided in two datasets; the first one was a master file that included basic demographic information, service-related data, and occupation information, and the second dataset contained the nurses' monthly salary. Both datasets were panel data with the annual snapshot occurring on 30Sep of each year from FY2000 through FY2020. The variables that were in the original datasets that were used in the analysis or for the construction of additional variables include gender, race, marital status, officer appointment date, date of initial entry to uniformed service, secondary service occupation, assigned unit location state, basic pay, basic allowance for housing, and basic allowance for subsistence. *Marital status* is defined as either married or never married. The *officer appointment date* is the date that the nurse was commissioned into active duty. The variable *date of initial entry to uniformed service* is the date the service members start their active-duty service, which may not be the same date they were commissioned due to various commissioning programs or if the nurse was prior enlisted. The variable *secondary service occupation* is a categorical variable indicating the four-digit numerical code that corresponds to the specialty of the nurse and a suffix, when applicable, that indicates the level of experience and level of education obtained within their field.

After I merged the two files, there were 63,388 observations before any modifications were made to the dataset. I removed 6,953 observations from the dataset, or 10.97 percent of the sample, due to missing values or a value of zero in the *officer*

appointment date variable. Typically, Navy Nurse Corps officers are assigned a subspecialty code of 19XX that corresponds to their specific specialty within the Nurse Corps. Observations that had invalid subspecialty codes in the *secondary service occupation* variable, such as those having less than four digits, a zero, or ZZZs, were dropped from the dataset. Additionally, I dropped the observations that were assigned into subspecialties that were typically assigned to officers in the Judge Advocate General's Corps (12XXs) and Medical Corps (15XXs). Essentially, the only subspecialty codes retained in the data set were those with a four-digit code of 19XXs, 3130s (Manpower Analysis Management), and 3150s (Education and Training Management). While the subspecialty codes 3130s and 3150s are not traditional nursing roles, it is common for a nurse to work in these areas as they advance in their careers, thus the need to retain them in the dataset. After I made all the initial modifications to the dataset, 54,652 observations were remaining.

2. Civilian Sector Wages

I used databases provided by the National Center for Health Workforce Analysis to calculate the military-civilian wage differential. The National Center for Health Workforce Analysis administered the NSSRN during the years 2000, 2004, 2008, and 2018 (Health Resources & Services Administration, n.d.). I used the wage data from those surveys to create a civilian nursing wage database. To create an accurate and direct comparison between the military and civilian wages, I calculated the average civilian nursing wage only using survey respondents who indicated their highest level of nursing education or nursing-related degree was at least a bachelor's degree and that they worked in a full-time nursing position. The nurses who responded that they worked as an APRN, worked less than eleven months in the past year, or worked less than an average of 36 hours a week were excluded from the wage calculations.

Once the inclusion and exclusion criteria were set, the average nursing wages were calculated through Stata for each of the survey years. A separate calculation was done for each year of nursing experience between one and ten years of experience within each census region. The output of these calculations produced an Excel database that had the

average nursing wage by years of experience in each census region for each of the survey years. To determine the average nursing wage for the years that did not have a survey, I calculated the annual percent difference between the survey years that could be used to interpolate the missing data. For example, to determine the average wage for a nurse with two years of experience in the Pacific census region in 2001, I calculated the percent change in wages for a nurse with two years of experience in the Pacific region in 2000 and 2004. This percent change was then divided by the number of years in the range to determine on average how much wages changed each year. The 2000 wage was then multiplied by the annual percent change and added to the original 2000 wage to determine the approximate wage in 2001. This process was completed for each year not included in original databases until a complete database was constructed that provided the average nursing wage between the years of 2000 and 2018 for a nurse with one to ten years of experience within each census region. I limited the average wage calculation to ten years of nursing experience to maintain an accurate comparison between military and civilian wages. After gaining ten years of clinical experience, a military nurse most likely would be working in management-related roles. These roles in the civilian sector have a significant difference in pay than those of a staff nurse. Therefore, comparing a Navy nurse working as a unit manager would not provide a similar wage comparison with a civilian nurse working on an inpatient nursing unit.

3. Merging the Military Dataset with Civilian Wage Dataset

To accurately merge the civilian wage dataset to the military dataset, I created additional variables within the military dataset. The variable *year* was created based on the *file date* variable by removing the month. This variable matches with the year category in the civilian wage dataset. Moreover, I similarly constructed the variable commission year using the *officer appointment date*. Using the variable *year* and *commission year*, I created a variable for *years of commissioned service* to correspond to years of nursing experience within the civilian wage dataset. I also created a *duty station census region* variable based on the *assigned unit location state* variable. Table 8 describes the duty station census region variable and definition.

Table 8. Duty Station Census Region Categorical Variables

Pacific	1 = if the nurse was stationed in Washington, Oregon, California, Alaska, or Hawaii
Mountain	2 = if the nurse was stationed in Montana, Idaho, Wyoming, Nevada, Utah, Colorado, Arizona, or New Mexico
West North Central	3 = if the nurse was stationed in North Dakota, South Dakota, Nebraska, Kansas, Minnesota, Iowa, or Missouri
East North Central	4 = if the nurse was stationed in Wisconsin, Michigan, Illinois, Indiana, or Ohio
West South Central	5 = if the nurse was stationed in Oklahoma, Texas, Arkansas, or Louisiana
East South Central	6 = if the nurse was stationed in Kentucky, Tennessee, Mississippi, or Alabama
South Atlantic	7 = if the nurse was stationed in Delaware, Maryland, the District of Columbia, West Virginia, Virginia, North Carolina, South Carolina, Georgia, or Florida
Middle Atlantic	8 = if the nurse was stationed in New York, Pennsylvania, or New Jersey
New England	9 = New England if the nurse was stationed in Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, or Connecticut
Other	10 = if the nurse was stationed as part of the Armed Forces Europe, Armed Forces Pacific, Guam, Puerto Rico, or it was unknown

Since the civilian wage database did not have an average salary for less than one year of experience, I adjusted the Navy nurses who had not yet reached one full year of service by converting their zero years of experience to one year of military service to ensure they had a corresponding civilian wage for the analysis. Once the additional variables were created, I merged the civilian wage database to the military database by matching the corresponding civilian wage to the appropriate Navy nurse with regards to the year, years of nursing experience, and the census region of their duty station.

B. METHODOLOGY

1. Kaplan-Meier Survival Analysis

A Kaplan-Meier survival analysis calculates the probability a Navy nurse is likely to remain on active duty based on their years of service given that they remained on active duty the year prior. In this analysis, I did not left censor any of the observations since there was not any treatment being applied to the sample such as a changing event or major policy shift that would have significantly altered the stay or leave decision of Navy nurses. Therefore, if the first observation observed for a nurse was at three years of commissioned service, this nurse was not removed from the Kaplan-Meier survival analysis, since I assumed they did complete one and two years of commissioned service previously. The ending period of interest in this analysis is the probability a nurse will remain on active duty given their specialty at ten years of commissioned service. Therefore, I dropped all individuals who commissioned after 2010, since I would be unable to follow them for a minimum of ten years. This reduced the sample by 10,018 observations or 18.3 percent, leaving the actual sample size for this analysis at 44,634 observations or 5,124 nurses.

In this analysis, the survival function for the nurse is the probability of remaining on active duty at ten years of commissioned service. Kaplan-Meier survival analysis only allows for one variable to be analyzed at one time, so other variables such as race, gender, and marital status that may also contribute to the probability of staying on active duty were not controlled for in this analysis. I created two models that were based on whether the nurse's basic specialty is considered a critical warfighting specialty or not. A critical wartime specialty is defined as Psychiatric Nursing (1930), Emergency Room Nursing (1945), Perioperative Nursing (1950), and Critical Care Nursing (1960). The non-critical wartime specialty includes Medical-Surgical Nursing (1910), Maternal and Infant Health Nursing (1920), Pediatric Nursing (1922), Public Health Nursing (1940), Neonatal Intensive Care Nursing (1964), and Professional Nursing (1900).

I did not include the observations with subspecialty codes with the suffix "Q" in the basic level specialties variables but rather placed them in a category specifically for APRNs. Since Navy nurses can transition to them later in their career, I did not want to

drop them from this analysis. I also included the observations with the subspecialty codes of 1972, 1973, 1974, 1976, 1981, and 1981, into the APRN category. These subspecialty codes indicate the nurse is working as an NR, CRNA, CNM, or CNS. The subspecialty codes that end with a "T" within the basic level specialties were also excluded from the basic level subspecialties since the "T" suffix indicates a nurse is in a training status where they will likely be in an advanced practice specialty following the completion of their training. Therefore, the subspecialty codes with the "T" were also included in the APRN category to ensure they were not dropped from the dataset. It is not uncommon for Navy nurses to advance into the APRN roles after completing the required education after spending some time as a basic level nurse; therefore, it is essential to keep them in the dataset.

2. Logistic Regression Model

For the multivariate regression analysis, I chose to use a logit regression model, because the outcome variable - to stay or leave military service is a binary variable. The analysis in this section included the nurses who were commissioned after 2010, which were were dropped from the survival analysis. Therefore, the starting sample size for this analysis is 54,652 observations. Since the civilian wage data only encompasses the years between 2000 and 2018, I dropped the observations that occurred after 2018 and the observations with greater than 12 years of commissioned service. This adjusted the sample size to 35,944 observations and 6,001 individuals. Since the focus of this research is on the basic level specialties, the nurses that were classified as APRN by their subspeciality code and suffix, which was 2,366 or 6.58% of the sample, and nurses working within other non-basic level specialties, which was 674 or 1.88% of the sample, were removed from the sample. Also, nurses who are stationed at an overseas location do not have a direct census region for an accurate wage comparison and had incomplete wage data. The wage data was incomplete for those stationed overseas because it did not include the nurses' overseas housing allowance in the dataset. Due to these issues, the nurses that were stationed at overseas locations were dropped from the database, which was an additional 5,599 observations. After making all the modifications, the final sample size included 27,305 observations or 5,758 nurses.

a. Key Variables

I constructed four logit regression models that corresponded to various stay or leave decision points that Nurse Corps officers likely face during their first ten years of commissioned service. The dependent variables in the models are the probability a nurse would remain on active duty at three, five, seven, and ten years of commissioned service.

(1) Outcome Variables

The first model uses the variable *Retain_3*, where a "1" indicates the nurse remained on active duty up to at least three years of commissioned service, and a "0" indicates the nurse left active duty before their third year of commissioned service. For the second model, I used the outcome variable *Retain_5,* where a "1" indicates the nurse retained for at least three years and continued to remain on active duty for at least a total of five years of commissioned service, and a "0" indicates the nurse stayed on active duty up to three years but left the service before reaching the five years of commissioned service. The third model uses the variable *Retain_7.* For this variable, a "1" indicates the nurse retained for at least five years of commissioned service and continued to retain for at least seven years. A "0" indicates the nurse retained at least five years but failed to stay on active duty for at least seven years of commissioned service. I constructed the outcome variable for the fourth model, *Retain_10*, in a similar manner as the previous three, where a "1" indicates the nurse completed at least seven years of commissioned service and also retained to at least ten years, and a "0" indicates the nurse completed seven years but did not stay on active duty long enough to reach ten years of commissioned service.

(2) Wage Variables

My primary independent variable of interest is the *military-civilian wage differential*. The basic pay, BAS, and BAH values in the military dataset consist of one-month snapshots. I converted the monthly values to an annual salary by multiplying the base pay, BAS, and BAH times twelve and then adding them together. When looking at each pay component, there were some outliers that I had to address. If the monthly pay snapshot happened to be a month where the nurse was having adjustments made to their pay from either previously being overpaid or underpaid the month prior, their monthly base

pay, BAS, or BAH was listed as either a negative value or a value that exceeded the amount that was on the pay chart for that year for their associated pay grade. This means their monthly wage snapshot was not representative of their actual pay and needed to be dropped from the sample, along with any observations that had missing data in any of these three categories. This removed an additional 902 observations from the sample. Once the *annual military wage* variable was created, I was able to create the military-civilian wage differential variable by subtracting the *annual military salary* variable from the *annual civilian wage* variable.

(3) Subspecialty Variables

I created binary subspecialty variables for the following subspecialties: medical-surgical, maternal-infant, emergency health, perioperative, critical care, professional nursing, and other subspecialties. The other subspecialty category consisted of the specialties that comprised less than three percent of the sample population and included pediatric, psychiatric, public health, and neonatal intensive care.

(4) Census Region Variables

I created the census region variables based on the previously defined census region variables that were listed in Table 8. Since most Navy nurses were stationed in only two of the census regions, only three census region variables were created for the regression. The first variable created was the *pacific census region*, where the variable is a "1" if the *duty station census region* categorical variable equals "1" and "0" otherwise. The *south Atlantic census region* equals "1" if the *duty station census region* equals "7" and "0" otherwise. The last census region was the *other category* which equals "1" if the *duty station census region* was equal to anything other than "1" or "7," otherwise "0."

(5) Demographic and Service Variables

I created indicators for females and married. Also included were indicators for white, black, Asian, and other races. I created another variable, *prior*, to identify those nurses who served as an enlisted service members before commissioning into the Nurse Corps. However, before creating this variable, several other variables had to be

constructed. First, I created the variable *entry year* by converting the *date of initial entry to uniform* variable to a year format and removing the day and month component. Next, I created the variable *commission and entry year gap*. This variable allowed me to identify those nurses who have been in the military before their commission date, thus indicating they were prior enlisted. The *commission and entry year gap* variable was created by subtracting the variable *commission year* and *entry year*. Any observations that were missing their entry year date were converted to missing. The variable *prior* equaled "1" if the commission entry year gap was greater than four years to ensure that those who attended ROTC were not captured since they could have up to a four-year gap as well.

b. Regression Models

Below is the regression model that was used to evaluate the effect that the military-civilian wage differential has on the odds a Navy nurse retains at three, five, seven, and ten years of commissioned service. In the regression models, the reference categories are male, never married, white, not prior, Pacific census region, and the medical-surgical subspecialty. This model was repeated for each dependent variable that corresponded to the four outcomes, namely retain at three, five, seven, and ten years The subscript "i" identifies the unit of observation, which is specific to the nurse, and the "t" identifies that the variable is conditioned on the time.

$$y_{it} = \beta 0 + \beta 1 \text{military\_civilian\_wagediff}_{it} + \beta 2 \text{female}_{i} + \beta 3 \text{married}_{it} + \beta 4 \text{Asian}_{i} + \beta 5 \text{black}_{i} + \beta 6 \text{race\_other}_{i} + \beta 7 \text{prior}_{i} + \beta 8 \text{south\_atlantic\_CR}_{it} + \beta 9 \text{other\_CR}_{it} + \beta 10 \text{critical\_care}_{it} + \beta 11 \text{maternal\_infant}_{it} + \beta 12 \text{perioperative}_{it} + \beta 13 \text{professional\_nursing}_{it} + \beta 14 \text{other\_specialties}_{it} + \text{year}_{t} + e_{it}$$

It is worth noting that there are a couple of variables that were omitted from the regression analysis that would likely affect the results. As noted in several of the other research studies, the source of a nurse's commissioning plays a significant factor in retention rates. The data that was used in this analysis did not provide enough detail to accurately assign commissioning sources for each of the nurses in the dataset and thus was omitted. However, if it had been included it would likely be statistically significant and would slightly reduce the effects of other variables. Although, I would not expect it to reduce the significance that the wage differential had on the odds of remaining on active

duty. The other variable that was not included in the regression model was a potential military-civilian wage differential that captures a differential five years into the future of a nurse's career as most rational workers do not base their career decision based on their current wage differential, but also consider how that differential will change as they progress into their career field. Therefore, the odds ratio on the civilian-military wage differential in my analysis would likely decrease if the potential wage differential was included. In addition, there are likely many other factors that contribute to a nurse's decision-making process on whether to remain on active duty aside from wages or to stay in the profession in nursing altogether, that would be difficult to capture in a quantitative analysis without robust, regular survey results addressing other factors such as work-life balance, an individual's preference for military service – or the nursing profession, and effects of leadership and mentorship may have contributed to their decision.

VI. RESULTS

This chapter describes the results of the quantitative analyses, including the military-civilian wage analysis, the Kaplan-Meier survival estimates for the Nurse Corps subspecialties, and the multivariate logit regression that explores the effects the military-civilian wage differential has on retention across several decision points within the nurses' first ten years of commissioned service.

A. DESCRIPTIVE STATISTICS

The summary statistics for the Navy nursing sample population are outlined in Table 9. The first column represents the entire sample population – 26,403 observations, while the remaining four show the shifts in the mean of the independent variables in relation to the outcome variables. The second outcome variable, Retain_5, makes up 65.4 percent of the sample, while Retain_7 and Retain_10 make up 46.4 percent and 31.8 percent of the initial sample size, respectively. The military-civilian wage statistics will be discussed in detail in the following section of this chapter.

Table 9. Descriptive Statistics

	Retain_3	**Retain_5**	**Retain_7**	**Retain_10**
	N=26,403	**N=17,264**	**N=12,248**	**N=8,407**
Variables	**Mean**	**Mean**	**Mean**	**Mean**
Demographics				
Female	0.636	0.605	0.577	0.559
White	0.708	0.722	0.730	0.739
Black	0.130	0.130	0.129	0.126
Asian	0.057	0.057	0.060	0.061
Other Race	0.105	0.092	0.081	0.073
Marital Status				
Married	0.594	0.681	0.710	0.725
Military Experience				
Prior[a]	0.502	0.569	0.605	0.626
Duty Station Census Region				
Pacific	0.364	0.362	0.357	0.351
South Atlantic	0.556	0.534	0.524	0.529
Other Regions	0.080	0.104	0.119	0.120

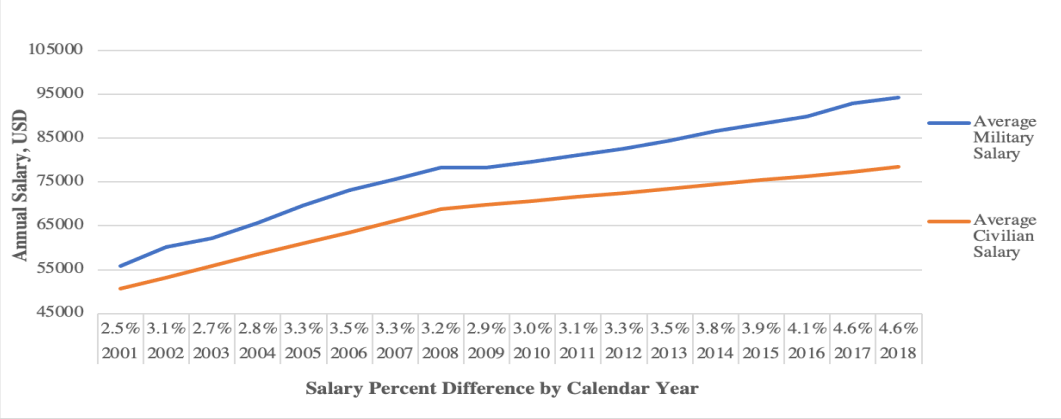
	Retain_3	Retain_5	Retain_7	Retain_10
	N=26,403	N=17,264	N=12,248	N=8,407
Variables	**Mean**	**Mean**	**Mean**	**Mean**
Nursing Subspecialty				
Medical-Surgical	0.206	0.238	0.234	0.221
Critical Care	0.120	0.156	0.158	0.161
Maternal Infant Health	0.076	0.089	0.085	0.077
Perioperative	0.069	0.101	0.130	0.147
Professional Nursing	0.389	0.238	0.210	0.209
Other Specialties	0.064	0.076	0.073	0.078

Note: The first column is representative of the entire Navy nursing sample population that was evaluated with the dependent variable retain_3, whereas the remaining columns represent the sample of those nurses who were analyzed at five, seven, and ten years of commissioned service. Standard deviations were omitted since all variables are binary.

[a] Prior indicates a nurse who had prior enlisted experience before commissioning into the Navy Nurse Corps

B. COMPARATIVE WAGE ANALYSIS

When taking an initial eagle-eye view of the difference in the military versus civilian wages over 18 years, the difference seems straightforward. Between 2001 and 2013 the military-civilian wage differential ranged from 2.5 percent to 3.5 percent. However, in 2014 the wage gap began to widen beyond 3.5 percent. In 2017 and 2018, the wage gap had reached 4.6 percent, as seen in Figure 9.



Note: The average military wage was calculated using those observations with up to ten years of commissioned service and excluded those working as an APRN or in a non-basic level specialty.

Figure 9. Military vs. Civilian Annual Average Salary, 2001–2018. Source: Image created using NSSRN survey results (Health Resources and Service Administration, n.d).and military data from DMDC.

However, when taking into account that anywhere between 50 percent and 63 percent of the observations any given year include nurses with prior enlisted experience, which overinflate the average military nurses' wage due to prior-enlisted nurses having a higher number of years of service, to accurately analyze the wage gap, the two military wage averages need to be separated and evaluated independently from one another. This is something that has not been captured in previous wage analyses. Figure 10 shows how significant the pay differential is between nurses who have prior enlisted experience compared to those who do not. On average the pay differential between the two ranges between 4.8 percent and 6.9 percent. The average non-prior enlisted salary follows relatively close to the average civilian nursing wage until 2014 when the wages begin to diverge. In 2018, a non-prior Navy nurse made on average 2.4 percent more than a civilian nurse. While a prior-enlisted nurse increased their civilian wage gap from 4.9 percent in 2001 to 7.2 percent in 2018.

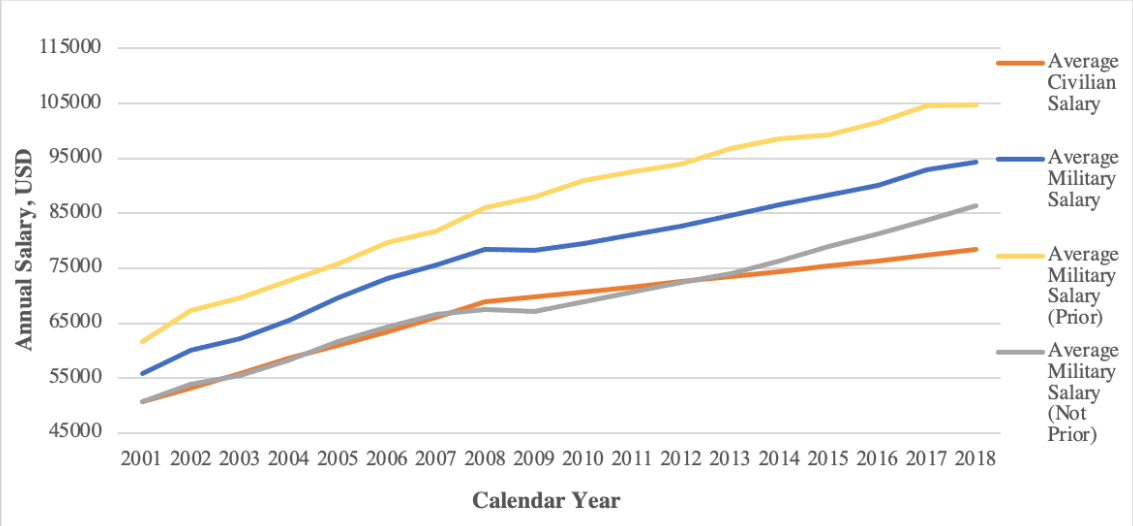


Figure 10. Military vs. Civilian Nursing Salaries Including Prior vs. Not Prior, 2001–2018. Source: Image created using NSSRN survey results (Health Resources and Service Administration, n.d) and military data from DMDC.

While taking the national civilian wage averages at face value is informative, it still leaves out a great deal of pertinent detail. This is because, in any given year between 2001

and 2018, 73% and 78% of the nursing sample falls into just two of the nine U.S. Census Regions, the Pacific and the South Atlantic. Therefore, to gain the most insight into the wage differentials, the military and civilian wages need to be compared on a regional level, while still accounting for the difference between the prior and non-prior enlisted nurses. Figure 11 shows the wage differentiation within the Pacific census region. Within this region, the prior vs. non-prior Navy nurses' wage gap is similar to that of the wage gap found at the national level with the average gap being 5.9 percent. However, the non-prior nurses' average annual salary is consistently below that of the average annual civilian nursing wage with a non-prior Navy nurse making on average 3.2 percent less. Although since 2013, it has started to narrow with non-prior Navy nurses making 1.8 percent less than a civilian nurse.

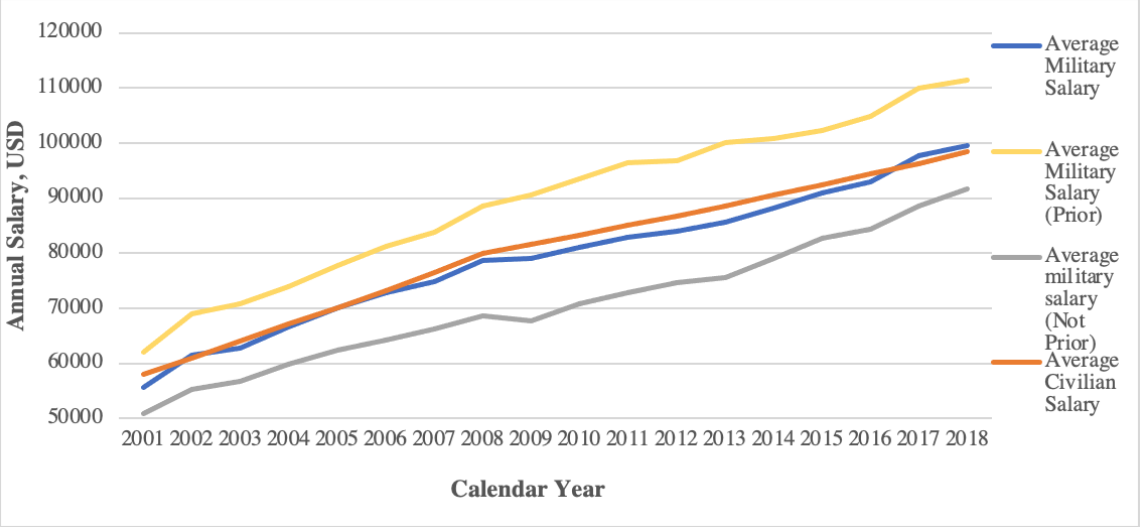


Figure 11. Nursing Wage Comparison in the Pacific Region, 2001–2018. Source: Image created using NSSRN survey results (Health Resources and Service Administration, n.d) and military data from DMDC.

In the South Atlantic region, the wage gap between prior and non-prior Navy nurses was slightly higher than when previously compared at the national level and the Pacific region, with the gap being 6.1 percent in the South Atlantic region. Figure 12 also shows that the non-prior nurses and civilian nursing wages follow one another consistently with

only minor deviations. The prior-enlisted nurses continued to widen their wage differential, most notably where the wage gap as consistently been above the six percent threshold.

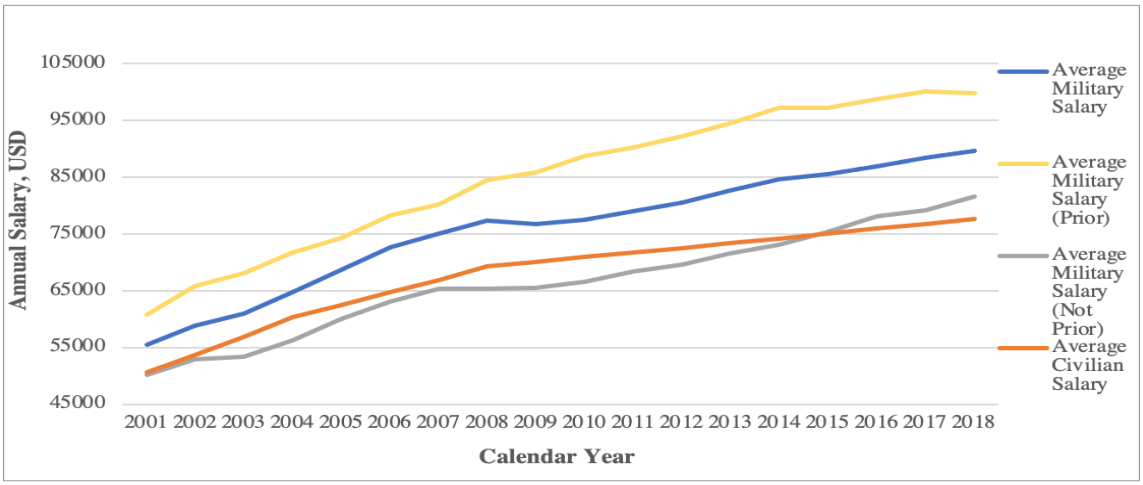


Figure 12. Nursing Wage Comparison in the South Atlantic Region, 2001–2018. Source: Image created using NSSRN survey results (Health Resources and Service Administration, n.d) and military data from DMDC.

While taking a deeper dive into the wage differentials at the regional levels provides valuable results, the most direct and accurate wage comparison comes by comparing the nurses based on their years of nursing experience within each census region. Figure 13 shows the wage comparison between nurses within the Pacific region who have between one and ten years of nursing experience. It is within this comparison that the true wage differential can be observed. While previously it seemed that non-prior nurses made less than their civilian counterparts within the Pacific region, when looking at nurses with the same amount of experience, both non-prior and prior Navy nurses consistently made more than civilian nurses. Between years one through three a non-prior Navy nurse makes on average 2.3 percent before widening the gap to 6.3 percent at ten years. Also notable, the wage advantage that was observed for prior enlisted nurses in the previous comparisons begins to dissipate around ten years of experience in the Pacific region. In addition, by ten years of experience, the wage gap between military nurses and civilian nursing increased to 6.7 percent.

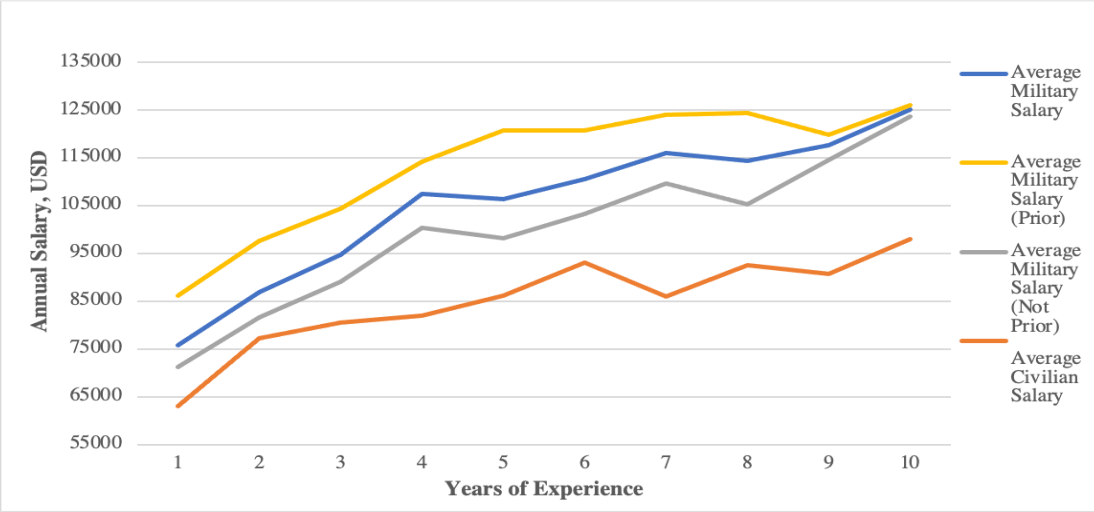


Figure 13. Average Annual Salary by Years of Experience in the Pacific Region, 2018. Source: Image created using NSSRN survey results (Health Resources and Service Administration, n.d) and military data from DMDC.

Figure 14 shows the wage comparisons within the South Atlantic region in 2018. In this region, the average wage gap is more significant between the average civilian and average military salary. Between one to ten years of experience, the wage gap ranges between 6.9 and 12 percent with the overage average being 10 percent, nearly double the average wage gap found within the Pacific region. Overall, in the South Atlantic region, the wage gap between prior and non-prior military nurses is consistent with the average being 3.4 percent. It is important to note that the Navy medical treatment facilities are in some of the higher cost of living areas within the region such as near the District of Columbia and the Virginia Beach metropolitan areas, which may overinflate the military wage gap within this region. To determine a more precise wage differential, obtaining data within the nearest metropolitan area would provide an even more accurate analysis.

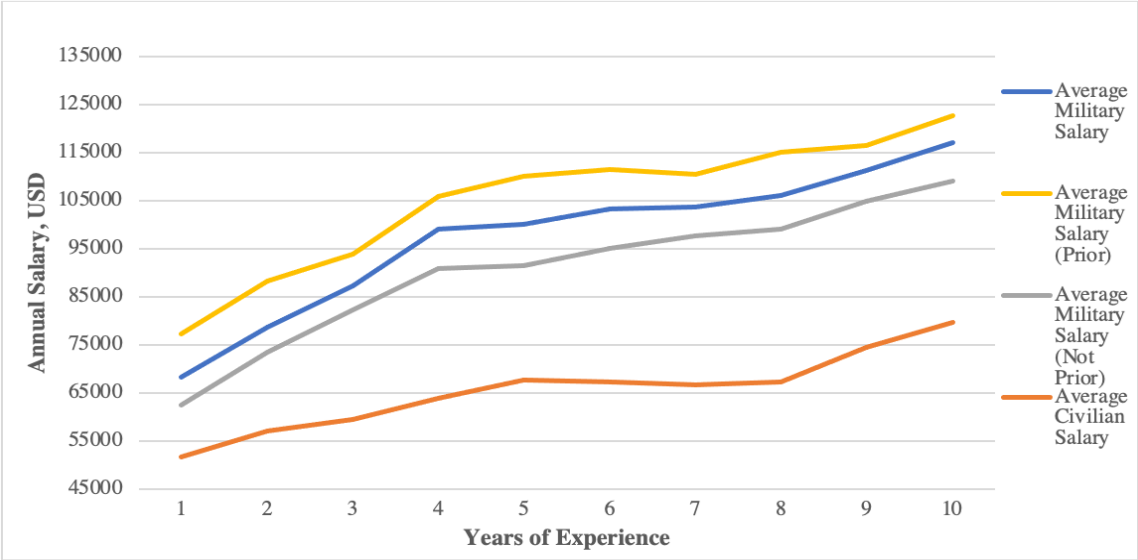


Figure 14. Average Annual Salary by Years of Experience in the South Atlantic, 2001–2018. Source: Image created using NSSRN survey results (Health Resources and Service Administration, n.d) and military data from DMDC.

C. SURVIVAL ANALYSIS

I first estimated the survival function for the Nurse Corps subspecialties that are considered critical warfighting specialties to determine the probability that a nurse working within a specific specialty would likely remain on active duty. In this analysis, it is important to note that a nurse's specialty may not be constant over time. For example, a nurse may be classified as a professional nurse while working at their first command until a specialty is pursued and competency is established. Therefore, the probability of retaining is credited to whichever specialty the nurse is working in at the snapshot in time that the data was obtained. The x-axis on the survival estimate is expressed in terms of years of commissioned service, and the y-axis shows the probability of a nurse within a specific specialty will retain, which is a number between zero and one. This probability can be determined for each specialty between the years of zero and ten by finding the corresponding coordinate on the graph.

Figure 15 shows the Kaplan-Meier survival estimates for the psychiatric, emergency health, perioperative, and critical care nursing specialties. The survival

estimates indicate the likelihood a nurse in one of these four specialties will remain on active duty between one and ten years of commissioned service. Psychiatric, emergency health, and critical care nurses all converge along a similar curve around six years of service, and their likelihood of remaining on active duty at ten years of commissioned service ranges between 0.38 and 0.40, with the critical care nurse being on the lower end of the range. However, the perioperative nurses have a significantly higher probability of remaining on active duty across all ten years. At ten years of commissioned service, a nurse working in the perioperative specialty has a 0.54 probability of remaining on active duty. This difference is not surprising, however, and is likely due to the application and selection process that attracts and selects nurses who are required to have several years of service and can remain on active duty for at least two years before completing the education and training requirements for the specialty.

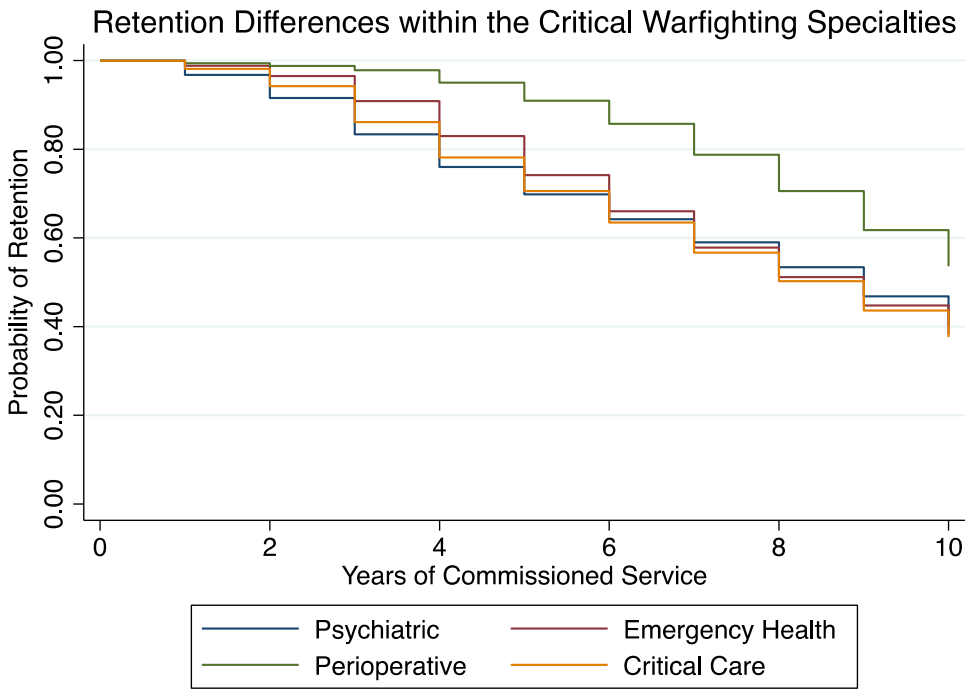


Figure 15. Kaplan-Meier Survival Estimates for the Critical Warfighter Specialties. Source: Image created from military data provided from DMDC.

Figure 16 shows the difference in probability of remaining on active duty between zero and ten years for the non-critical warfighting specialties. Within these specialties, nurses working in the public health specialty have a significantly higher probability of remaining on active duty with a 0.81 probability of retaining at ten years of commissioned service. However, this specialty also only accounts for 1.15 percent of the Nurse Corps population within this sample. Between four and eight years of commissioned service, the maternal health and pediatric specialties follow a similar survival curve. However, these differences are less significant by year ten, when the probability range of retaining for the medical-surgical, pediatric, maternal and infant health, and neonatal intensive care specialties are between 0.29 and 0.35. The other outlier within this group is professional nursing, especially between years one and six being the most distinct. At the basic level of nursing, nurses who are most likely to work within the category are those who are new to nursing and working on gaining experience before transitioning into a specific specialty.

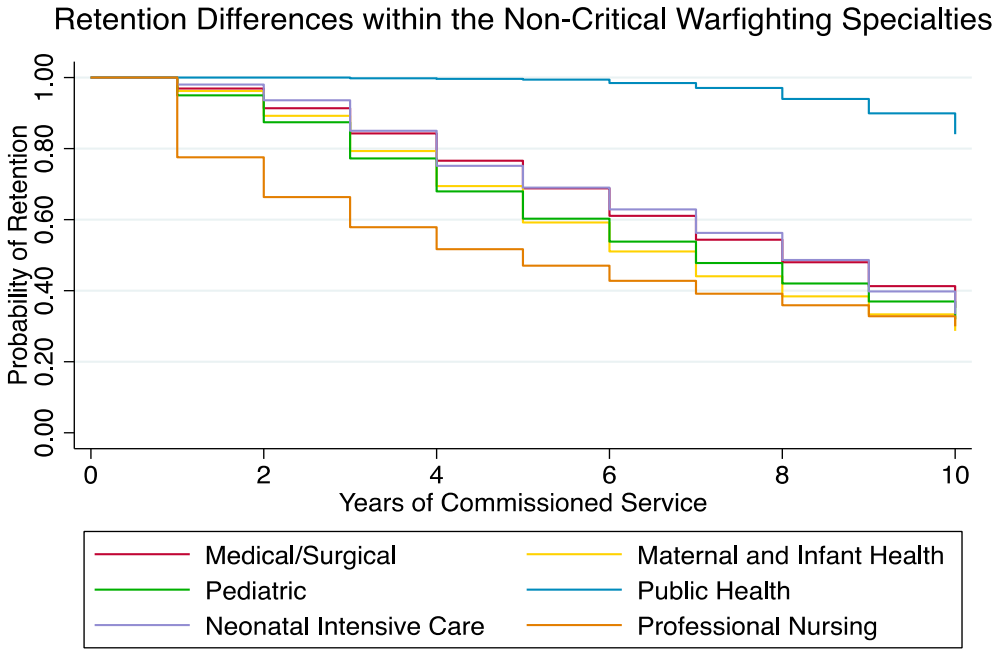


Figure 16. Kaplan-Meier Survival Estimates for the Non-Critical Warfighting Specialties. Source: Image created from military data provided from DMDC.

Just as the military nursing specialties have different retention rates, the civilian sector also has varying turnover rates among nursing specialties. According to the *2021 NSI Nursing National Health Care Retention & RN Staffing Report*, the annual nursing turnover rate in 2020 was 18.7 percent. The report does not specify if the specialties include both inpatient or outpatient nurses, but nurses who work in surgical services, women's health, and pediatric specialty had some of the lowest turnover rates at 13.2 percent, 14.0 percent, and 14.9 percent, respectively, followed by medical-surgical, which was at 17.1 percent. Critical care nursing specialty had a turnover rate was at the national average of 18.7 percent, whereas emergency nurses' turnover rate was 20.0 percent. Behavioral health had a turnover rate of 22.7 percent. While the step-down nursing specialty had a rate of 24.4 percent.

D. LOGISTIC REGRESSIONS

I ran four logistic regression models to determine the effect that the military-civilian wage differential has on retention within the Navy Nurse Corps at various decision points during a nurse's first ten years of commissioned service. The multivariate logit regression model results with the decision points taking place at three, five, seven, and ten years are listed in Table 10. To facilitate the ease of interpretation, the results are expressed as odds ratios rather than coefficients. Odds ratios that are greater than one, positively affect the odds of a nurse remaining on active duty, while odds less than one are negatively correlated.

Table 10. Logit Regression Results, Expressed in Odds Ratios

	Retain for 3 Years	Retain for 5 Years	Retain for 7 Years	Retain for 10 Years
Military-Civilian Wage Differential per $1,000	1.172***	1.101***	1.061***	1.092***
	(0.003)	(0.003)	(0.003)	(0.004)
Female	1.509***	0.956	0.943	1.077
	(0.064)	(0.042)	(0.044)	(0.058)
Married	1.384***	1.099*	1.013	0.932
	(0.054)	(0.045)	(0.047)	(0.052)
Asian	0.837*	1.106	1.009	0.832+
	(0.068)	(0.094)	(0.089)	(0.085)
Black	0.691***	0.821***	0.837**	0.844*
	(0.039)	(0.047)	(0.052)	(0.062)
Other Race	0.756***	0.677***	0.752***	0.774**
	(0.044)	(0.042)	(0.055)	(0.072)
Prior Enlisted	0.279***	0.514***	0.669***	0.415***
	(0.014)	(0.025)	(0.036)	(0.025)
South Atlantic Region	0.271***	0.379***	0.596***	0.449***
	(0.012)	(0.018)	(0.031)	(0.026)
Other Region	0.657***	0.641***	0.548***	0.372***
	(0.060)	(0.050)	(0.042)	(0.033)
Critical Care Nursing	1.137+	0.910+	1.065	0.994
	(0.078)	(0.052)	(0.067)	(0.072)
Maternal Infant Nursing	0.995	0.959	0.925	0.983
	(0.075)	(0.066)	(0.071)	(0.095)
Perioperative Nursing	2.449***	2.970***	1.589***	1.077
	(0.314)	(0.275)	(0.113)	(0.080)
Professional Nursing	0.118***	0.444***	0.857*	0.893
	(0.006)	(0.025)	(0.057)	(0.067)
Other Specialties	0.816*	0.797**	1.332***	1.137
	(0.066)	(0.058)	(0.114)	(0.107)
Observations	26,403	17,264	12,248	8,407

Reported as Odds ratio, Standard errors in parentheses, Fixed effect for year included
+ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The military-civilian wage differential is significant at all four decision points at the 0.001 significance level. For a nurse at three years of commissioned service, an increase in the military-civilian wage differential by $1,000 increases the odds of remaining on

active duty by 17.2 percent holding all the other variables constant. While at five years, an increase to the differential by $1,000 increases the odds of a nurse remaining on active duty by 10.1 percent. At seven years and ten years, a differential increase of $1,000 only increases the odds of a nurse remaining on active duty by 6.1 percent and 9.2 percent, respectively.

Gender is only statistically significant at the three-year decision point, where being a female nurse, while holding all other variables constant, increases the odds of remaining on active duty by 50.9 percent compared to being male. Being married is significant at the 0.001 level at the three-year decision point, with nurses who are married increasing their odds of remaining on active duty by 38.4 percent compared to nurses who have never been married. At five years of commissioned service, the odds of nurses remaining on active duty are 9.9 percent higher at the 0.05 significant level, before losing all significance at seven and ten years.

Being Asian at the three-year decision point decreases the odds of remaining on active duty by 16.3 percent at the 0.05 significance level compared to a nurse being white. At the five and seven-year decision point, being Asian increases the odds, but not at a level of any statistical significance. At the 0.1 significant level, being Asian at the ten-year decision mark again reduces the odds of remaining on active duty by 16.8 percent compared to a nurse being white. A black nurse consistently has fewer odds of remaining on active duty across all four decision points. Compared to white nurses, while holding all other variables constant, a black nurse has a 30.9 percent decrease in odds of remaining on active duty at the three-year decision point and a 17.9 percent decrease in odds at the five-year decision point, both at the 0.001 level of significance. Races that fall into the other category also have lower odds of remaining on active duty at each decision point compared to white nurses. At three years of commissioned service, the odds of a nurse remaining on active duty are 24.4 percent less than a nurse who is white, whereas, at five years, the odds of a nurse of another race remaining on active duty decreases further to 32.3 percent. At the seven and ten-year decision point, the odds remain stable between 24.8 percent and 22.6 percent less likely.

In general, a nurse having prior enlisted experience, while holding all the other variables constant, has a significant and negative correlation with remaining on active duty across all four decision points compared to nurses who do not have prior enlisted experience. This negative correlation is most notable at the three-year decision point and then again at ten years. At the three-year mark, most newly commissioned prior-enlisted nurses have completed their formal education and have experienced one tour as an officer. At this point, they can decide whether they want to continue active duty as an officer or pursue their new career in the private sector. Also, at the ten-year mark, prior-enlisted officers are now eligible to retire as an officer and begin to choose retirement over remaining on active duty. Holding all other variables constant, a prior-enlisted nurse has 72.1 percent lower odds of remaining on active duty at the three-year mark, 48.6 percent lower odds at the five-year mark, 33.1 percent lower odds at the seven-year mark, and 58.5 percent at year ten. However, previous studies have shown that prior-enlisted nurses retain at much higher rates through ten years of commissioned service than nurses who commissioned from other sources, and there is likely some correlation to having a higher wage differential compared to military nurses who do not have the higher salary (Harvie, 2014). However, there are also other likely contributing factors that the model is unable to capture, such as the desire to serve.

When compared to nurses in the Pacific census region, nurses who are stationed in the South Atlantic and other regions significantly have lower odds of remaining on active duty when holding the other variables constant. Most notably, at the first decision point, the odds of a nurse remaining on active duty in the South Atlantic region are 72.9 percent less than nurses in the Pacific region. The odds improve slightly, but on average the odds of remaining on active duty are still 52.5 percent less between five and ten years of commissioned service in the South Atlantic region. The nurses who are serving in the other census regions on average have odds of remaining on active duty that are 44.6 percent less than nurses working in the Pacific region, with the odds being the lowest at the ten-year decision point.

Unsurprisingly, the nursing specialty influences the odds of a nurse remaining on active duty, especially after analyzing their survival estimates across all the basic level

nursing subspecialties. However, the correlation of the specialty on retention is a little less in some specialties compared to others when holding the other variables, such as race, gender, marital status, wage differential, and region constant. For example, nurses who work in the maternal-infant specialty have lower odds of remaining on active duty on average of 3.5 percent less than a nurse who works in the medical-surgical subspecialty; however, this value is not statistically significant. When compared to the medical-surgical subspecialty, critical care nurses have higher odds, 13.7 percent, of remaining on active duty at the three-year mark and have slightly lower odds, 9 percent, at the five-year mark before losing any statistically significant correlation one way or the other at year five and ten.

On the other hand, perioperative nurses have much higher odds of remaining on active duty at each of the first three decision points compared to a medical-surgical nurse, most notably at the first decision point. At three years of commissioned service, a perioperative nurse's odds of remaining on active duty are 144.9 percent higher than a medical-surgical nurse. These odds increase even higher to 197 percent at five years of commissioned service. However, at seven years of commissioned service, the odds of remaining on active duty are only 58.9 percent higher than the odds for a medical-surgical nurse. The strong positive correlation in the first three to five years is likely due to the eligibility requirements that must be met before nurses apply and are selected into the perioperative subspecialty. Before applying a nurse must have several years of experience and must have at least two years of service remaining at the time of applying. Therefore, a perioperative nurse will not be eligible to leave military service until their five- or six-year mark, depending on when they were accepted into the subspecialty. While at the ten-year mark, a perioperative nurse still has slightly higher odds of remaining on active duty the results are no longer statistically significant.

Nurses who do not have a specialty and are categorized in the professional nursing bin are less likely to remain on active duty, as observed with the survival estimates. When compared to medical surgical nurses, the odds of a nurse in the professional nursing category remaining on active duty at the first decision point are 88.2 percent less. At the five-year mark, the odds are still 55.6 percent less before becoming less statistically

significant at seven and ten years of commissioned service. Nurses that are working in professional nursing from the ten-year mark forward are likely not working as a basic nurse but are in leadership and management-related billets. Nurses that are working in other specialties have odds of remaining on active duty that are 18.4 percent less than medical-surgical nurses at three years of commissioned service at the 0.1 significance level. However, the odds of a nurse working in other specialties are 20.3 percent less than medical-surgical at the fifth year of commissioned service at the 0.01 significance level. At the seven-year mark, the odds of remaining on active duty are now 33.2 percent higher than a medical-surgical nurse. At year ten, the odds are still higher for nurses in the other specialties, but it is no longer statistically significant.

E. KEY FINDINGS

There are several key takeaways that I would like to highlight from this analysis. The first is to highlight the trends of the regression results as a nurse makes stay or leave decisions over the first ten years of commissioned service. For most of the demographic variables such as gender and marital status, they are only statistically significant at the three-year decision point. After that, the nurses who remain on active duty to the five-year mark gender and marital status are no longer significant variables that affect the probability of remaining on active duty. On the other hand, a nurse who is black or in the other race category affects the probability of retaining for a much longer period compared to the other demographical variables since the statistical significance persists into the ten-year decision point. When controlling for other variables, except for perioperative nurses, there does not seem to be a key decision point where a nurse's specialty affects the probability of retaining. However, the duty station region and whether the nurse was prior enlisted affects the odds of retaining across all decision points.

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VII. CONCLUSION AND RECOMMENDATIONS

When I initiated this research, my goal was to provide a more in-depth, comprehensive analysis of the civilian nursing market and deepen the body of knowledge that would be available to the Navy Nurse Corps planners that went beyond a comparison of the average annual nursing salary to the average Navy nurse's annual salary. In addition, I want to emphasize that each nursing specialty, whether at the basic or advanced level, receives a different salary within the civilian labor market that can have implications on recruiting and retention efforts in the Nurse Corps.

While using the data available from the civilian nursing market, my thesis set out to answer the following research questions:

- How is the civilian nursing labor market likely to affect the Navy Nurse Corps' ability to attract and retain nurses?
- How has the military-civilian pay gap changed between 2001 and 2018 with respect to census region and years of nursing experience?
- How does the probability of remaining on active-duty change based on a Navy Nurse Corps subspecialty within the basic level specialties?
- What effect does the military-civilian wage differential have on retention in the Nurse Corps between 2001 and 2018?

Based on the key findings of my research, there are several recommendations that I can provide, as listed below.

1. **Reevaluate the health of the civilian nursing workforce after the COVID-19 pandemic has subsided and adjust recruiting and retention policies accordingly.** The civilian supply of nurses will not likely improve drastically over the next few years. Based on the data that was available for this research, one of the most important pieces of data that can be used to shape policy decisions is knowing what specialties and geographical locations have a surplus or deficit of nurses. For example, before the pandemic, California,

Texas, Alaska, North Carolina, Georgia, and New Jersey were projected to have a nursing deficit. The labor market will respond to this deficit through higher wages and incentives to bring more nurses to these areas or encourage more of the local population to pursue nursing as a career. The implications of the civilian market in areas projected to have a nursing deficit may make it more difficult for the Nurse Corps to recruit nurses in these geographical areas. In addition, retention rates may be affected in areas projected to have a deficit as well, as these may offer better incentives and higher real wages within the civilian sector. If meeting recruiting goals becomes more challenging or costly, it may be more beneficial to focus efforts in areas that are projected to have a surplus of nurses, such as states within the New England, Mountain, or East North Central census regions. This research was done mostly utilizing data that was available before the COVID-19 pandemic. As the pandemic transitions to an endemic, it will be vital to obtain updated supply and demand data to determine the health of the civilian nursing workforce.

2. **Conduct a more in-depth analysis focusing on supervisory and the APRN specialties that are experiencing a surge in demand in the private sector and evaluate how their military-civilian wage differential may impact retention within the Navy Nurse Corps**. In general, real wage values within the basic level specialties declined slightly between 2008 and 2018, indicating overall there was not a shortage of basic level specialties in general. These values, however, will need to be reevaluated following the pandemic once the market begins to normalize. On the other hand, nursing supervisory real wage values continued to rise despite the 2008 recession, which could potentially be a trouble spot for Navy nurses who are undecided on whether to remain on active duty at the ten-year mark, which is when Navy nurses start to transition into the supervisory and management roles. A more focused analysis would be warranted to determine how the wage differential within these roles will likely impact retention efforts. While this study did not determine the effects of the military-civilian wage differential for APRNs, it was noted during the civilian wage analysis that the civilian real wage values were also increasing among several APRNs to include NPs, CNMs, and CNSs that has the potential to impact retention efforts within the Nurse Corps as well if this trend continues in the civilian nursing labor market.

Overall, the profession of nursing and the civilian nursing market is likely to continue to adapt to the needs of society, and due to the flexibility of the profession, the span and scope of nursing will likely continue to broaden. Combined with the increased nursing demands related to COVID, the likelihood of continued nursing shortages in various specialties, supervising roles, and geographical regions are reasonably high within the private sector. Navy medicine continues to rely on nurses to meet the mission, especially the specialties deemed critical in support of the warfighters across the globe. If the civilian labor market continues to tighten, so will the market of nurses available to serve in the Nurse Corps. I am hopeful that the findings of this study will assist the Navy Nurse Corps planners in their ability to continue to make effective and targeted recruiting and retention policies and also provide insight into vital areas of future research.

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