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THESIS

**ANALYSIS OF PROMOTION OUTCOMES FOR NAVY
NURSE CORPS OFFICERS**

by

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June 2019

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**ANALYSIS OF PROMOTION OUTCOMES FOR NAVY NURSE CORPS
OFFICERS**

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ABSTRACT

Using individual-level data on active duty naval officers in fiscal years 2010 to 2018, I estimate predictive models for Nurse Corps officers' promotions to the ranks of lieutenant commander, commander, and captain. Among Nurse Corps lieutenants eligible for lieutenant commander promotion, I find that Nurse Corps-specific professional qualifications, such as duty under instruction, Additional Qualification Designators, and being a nurse provider, are associated with positive promotion outcomes, all else equal. Similar results are found for the lieutenant commander promotion to commander, with the exception that being a prior-enlisted Nurse Corps officer is associated with reduced promotion probabilities to the grade of commander. Among eligible commanders, having Additional Qualification Designators is associated with increased promotion probabilities, while being a nurse provider is associated with reduced probability of promotion to the grade of captain. For all three considered promotion milestones, being married is associated with increased promotion probabilities, while having dependent children as well as commissioning at a later age are associated with lower promotion probabilities, all else equal. The findings of this analysis can inform Navy Nurse Corps policy-makers on the likelihood of promotion at different milestones in a Nurse Corps officer's career.

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LIST OF ACRONYMS AND ABBREVIATIONS

BUMED	Bureau of Medicine and Surgery
BUPERS	Bureau of Naval Personnel
CRNA	Certified Registered Nurse Anesthetist
CWS	critical wartime specialties
DC	Dental Corps
DHA	Defense Health Agency
DoD	Department of Defense
DOPMA	Defense Officer Personnel Management Act
DUINS	duty-under-instruction
GS	General Schedule Employee
HM	Hospital Corpsman
JPME	Joint Professional Military Education
LPN	Licensed Practical Nurse
MANMED	Manual of the Medical Department
MC	Medical Corps
MP&P	Manpower Plans and Policy
MHS	Military Health System
MOS	Military Occupational Specialty
MSC	Medical Service Corps
NDAA	National Defense Appropriations Act
NPS	Naval Postgraduate School
NP	Nurse Practitioner
OEF	Operation Enduring Freedom
OIF	Operation Iraqi Freedom
OPINS	Officer Personnel Information System
PPM	Professional Practice Model
TIG	time-in-grade
URL	unrestricted line
YCS	years of commissioned service

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I. INTRODUCTION

New Navy Nurse Corps (NC) officer accessions via the various recruiting pipelines do not seem to pose an immediate threat to the inventory of deployable junior officer (JO) ranks. Nevertheless, involuntary separations of mid-grade NC officers are on the rise due to failures to promote, with close ties to the few senior-level vacancies relative to the number of candidates. A threat to the retention of skilled and experienced NC leaders in control grades during the Department of Defense's (DoD) end-strength reduction plan can adversely affect the overall mission and performance of the Defense Health Agency (DHA) and Military Health System (MHS) moving forward.¹

The current officer promotion system was designed to promote fairness among the services, and routinely does so based on service recommendations, year-group and time-in-grade (TIG) within each category, but without regard for specialty.² Under the guidelines of the Defense Officer Personnel Management Act (DOPMA), Public Law 96-51 of 1980, deepening limits are placed on the numbers of field grade active-duty officers allowed for each five-year projection during the military forces' drawdown (Rostker, Thie, James, Kawata, & Purnell, 1993).³ With fewer vacancies, the opportunities for promotion may not only continue to hold their broad-based, pyramid structure for NC officers, but

¹ The creation of the Defense Health Agency (DHA) in 2013, as a Combat Support Agency within the MHS is responsible for the execution of policy, management of services that support service medical department missions including the TRICARE Health Plan, pharmacy operations, health information technology, medical logistics, health facilities, medical education and training, public health, research, development and acquisition, budget and resource management and procurement. Its design indicates an immediate and future need for more leaders, not fewer (Health.mil, 2018). The DHA, a new endeavor in itself, recently began shifting millions of records from outdated computing and paper charting systems to the GENESIS system of integrating records from all branches of the military.

² Navy specialties are professional disciplines earned by meeting the Education Skill Requirements (ESRs) and Core Skill Requirements (CSRs) prescribed by the OPNAVINST 1000.16 series and OPNAVINST 1520.23 series. Subspecialties are in addition to an officer's primary specialty (or designator) and apply to the Unrestricted Line, Restricted Line and Staff Corps officers. NC officers may possess more than one and are required to maintain proficiency in order to be considered for special pay or assignment related to that subspecialty.

³ In the Army, Air Force and Marine Corps, officers in the pay grades of O1 to O3 are called company grade officers, O4 to O6 are field grade officers while the Navy uses junior grade officers for pay grades of O1 to O3, and mid-grade officers in pay grades O-4 to O-6 (Department of Defense, Officer Rank Insignias).

could also cause a sharp increase in attrition or shift in precedence from what was important for promotion in the past, if the remaining candidates lose enough variance.⁴

Using multivariate regression analysis on individual-level personnel data from 2010 to 2018 of U.S. Navy NC officers in the Officer Personnel Information System (OPINS), my thesis analyzes factors that may influence the probability of promotion for Navy NC officers to the control grades of lieutenant commander (O4), commander (O5) and captain (O6). I focus on testing for the relations between personal and professional characteristics such as gender, nursing subspecialty, age categories, and promotion outcomes.

The results will inform NC policy-makers of the likelihood of promotion at different milestones in a NC officer's career, and assist in fine-tuning retention of critical personnel through career advising and mentoring.

A. OBJECTIVES

Previous studies have analyzed the probable effects of changes to Navy NC policy, the DOPMA, the military drawdown and officer accession sources in their infancy and growing stages on promotion and retention. However, significant policy maturation and amendments indicate the need for a fresh analysis of those effects on promotion using updated information. For instance, the NC now boasts of an increased officer diversity with more advanced degree holders, less restrictions on positions of leadership and a reduction in the frequency of hostile-region deployments (or higher opportunities for humanitarian assistance); these have all been reported to influence promotion in the past.

Given the continuing and incremental nature of drawdowns in the DoD and the MHS, with increased requirements toward a leaner, more integrated force, the purpose of this study is to analyze the following specific queries:

⁴ The pyramid structure contains more JOs at the bottom than the number of senior officers above them. As officers enter the field grades, which may be indicative of ability to assume greater responsibility due to some competitive edge, the number of vacancies gets smaller. The challenge of differentiation or variation then becomes making a competitive edge believable to decision-maker or who writes the best FITREP.

Research Questions:

- Among promotion board–eligible lieutenants (O3) in the Navy NC, which demographic, military, and professional (NC-specific) variables are significantly associated with the probability of promotion to the control grade of lieutenant commander (O4)?
- Among promotion board–eligible lieutenant commanders (O4) in the Navy NC, which demographic, military, and professional (NC-specific) variables are significantly associated with the probability of promotion to the control grade of commander (O5)?
- Among promotion board–eligible commanders (O5) in the Navy NC, which demographic, military, and professional (NC-specific) variables are significantly associated with the probability of promotion to the control grade of captain (O6)?

Using individual level data on active-duty naval officers in fiscal years 2010 to 2018, I estimate predictive models for Navy Nurse Corps officers' promotion to the ranks of lieutenant commander, commander, and captain, respectively, controlling for individual officer's demographics and professional characteristics such as nursing subspecialty, DoD-sponsored duty-under-instruction training (DUINS) and Additional Qualification Designators (AQDs).

B. SCOPE AND LIMITATIONS

In this thesis, I will take a detailed look at the Navy NC structure, promotion flow points, how they relate to promotion opportunities to the control grades of O4, O5 and O6, the effects of the current DOPMA on those opportunities with regard to active-duty officer

end-strength restrictions, and reviews of previous quantitative and qualitative studies on military promotion.⁵

The data source used for this study contains historical personnel records from the OPINS on 2900-designated officers who are on active duty in fiscal years 2010 to 2018. Individual personnel Fitness Reports (FITREPs) data were not available for this study. FITREPs contain the reporting senior officer's cumulative average by paygrade, comments, justification for exceptionally high or low scores, and subspecialty specific achievements, which may be weighted against all other performance measures reviewed by the promotion boards. Therefore, my analysis is limited in score by the data available for this analysis.

C. ORGANIZATION OF THE STUDY

The seven chapters included in this study are organized as follows: Chapter I contains an introduction, the motivation for this analysis and thesis research questions. Chapter II is an overview of the Navy NC, recommended career tracks and current promotion challenges of the NC that are linked to the DOPMA. Chapter III is a review of past Navy and Marine Corps officer probabilities of success, promotion and retention studies with findings, which drive the need for this NC-specific analysis using updated information. In Chapter IV, I describe the data source (OPINS) coding methods used, a presentation of this data set's descriptive statistics with visual illustrations, as well as detailed variable descriptions, and how I generated each variable used for this analysis. I also offer postulates on the effects of my explanatory variables on the probability of promotion. In Chapter V, I present the quantitative analyses with regression models and estimations for answers to my proposed research questions. Chapter VI aligns my results with the current NC promotion policy, subspecialties, officer inventory, and the DOPMA's guidelines on shaping the force of the future. My recommendations are based on the goal

⁵ Flow points are the calculated average number of years of *active* commissioned service for each control officer grade. Unlike the minimum number recommended by the DOPMA, this number can be adjusted to suit the needs of the services and is affected by number of available vacancies. Five-year projections are created for planning purposes, which are adjusted annually according to loss behavior and changes in authorized end-strengths.

of Congress, through the DOPMA, to “maintain high-quality, numerically sufficient NC officers, provide career opportunities that would attract and retain the numbers of high caliber officers needed in the control grades and, provide reasonably consistent career opportunity among them” in light of military downsizing and shifting platform requirements (Rostker et. al., 1993, p. 1).

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II. NAVY NURSE CORPS AND PROMOTION

We are in a war for talent. The propensity to serve is declining amidst an improving economy and it's adversely impacting both recruiting and retention.

—Navy Vice Adm. Robert P. Burke, Deputy Chief of Naval Operations,
2018

A. INFORMATION

U.S. Navy NC officers form a vital part of the Navy medical department, which is composed of Dental (DC), Medical (MC) and Medical Service Corps (MSC). The size of this distinctive group of Staff Corps officers is dependent on the size of the active-duty force. Put differently, it is assumed that, given a smaller magnitude of active-duty personnel, this could translate to a reduced need for a large peacetime medical department, and require an even smaller selection of skilled officer personnel. The planned downsizing of U.S. military forces, plus defense budget and spending cuts post-WWII by Congress, signaled the creation of the DOPMA. Through the DOPMA, the goal of Congress was to “maintain a high-quality, numerically sufficient officer corps, provide career opportunity that would attract and retain the numbers of high caliber officers needed, [and] provide reasonably consistent career opportunity among the services” (Rostker et. al., 1993, p. v). Further, the MHS is in a phased transfer of all Military Treatment Facilities’ (MTFs) management and administrative operations to the DHA. This move, according to the U.S. Navy Surgeon General and Chief of the U.S. Navy Bureau of Medicine and Surgery, Vice Admiral Forrest Faison, is to refocus Navy medicine’s mission on readiness and deployability within an integrated military medical department (Faison, 2019). Naturally, promotion of those high caliber officers remaining will likely become more competitive.

Within the U.S. Navy’s medical department, NC officer selections for promotion are still strictly based on seniority and vacancy rather than an expertise or specific knowledge, as seen in the Medical and Dental Corps. By excluding physicians and dentists from computations and authorizations of active-duty end-strengths, the DOPMA specifically facilitates their availability by permitting them to remain in senior leadership

positions without the strict administration of the “up or out” system.⁶ NC and MSC officers are not allowed such liberty and, therefore, face subspecialty shortages as a result of the DOPMA’s assumption of interchangeability within officer jobs. A combination of the lack of vacancies and the up or out system leads to separations based on the inability to promote alone.

B. BACKGROUND

The importance of NC commander and captain positions cannot be overstated. They are the Navy NC’s executives and administrators who work behind the scenes to ensure the best patient outcomes within the military healthcare system and in coordination with DoD’s private sector counterparts. Although the general image of nursing is centered around bedside, clinical and maybe home healthcare, senior leaders oversee an array of duties including training and placement of the right nurse in the right job at the right time for manpower and personnel efficiency, evidenced-based nursing practices, budgeting, policy development and implementation. To ensure effective management of patient care, nursing requires the echelons of leadership represented by the junior grade to flag officer pipeline. Experience gained from progressing through the ranks enables the growth and differentiation of being great managers to decisive military healthcare leaders within the MHS.

On the other end of the spectrum, a unique difference between new nurse graduates in the civilian sector and commissioned Navy JOs, is the assumption of leadership capability on arrival at the officer’s first command. Upon completion of nursing orientation (often very soon after), the new nurse is assigned as first line manager and leader of a team comprising, at a minimum, a Licensed Practical Nurse (LPN) who is a civilian contractor or General Schedule (GS) employee, and enlisted Hospital Corpsmen (HM). Confidence-

⁶ The “up or out” system allows officers two opportunities for promotion. The first opportunity is while “in-zone,” where the requirements for TIG have been met and the officer is counted among the authorized promotion numbers with his or her cohort. The next opportunity is “above-zone,” which accounts for officers not previously promoted while in-zone. The officer will not be considered for promotion beyond this point. In rare cases, officers may be promoted “below-zone” in which case, exceptional officers proven by merit are added to the pool of “promotable” officers for consideration. This does not count toward the officer if he or she is not promoted.

building and decision-making abilities are nurtured within the first three JO ranks of O1 to O3 without the pressures of meeting promotion requirements other than the minimum TIG, maintaining readiness through physical fitness assessments, and completion of job-specific training. The advantage of this method of instruction is further enhanced for new accessions by a high likelihood of initial placement in one of the DoD’s “big 3” MTFs. This provides exposure to the greatest number and variety of cases the nurse will encounter throughout his or her military nursing career, opportunities for deployment to humanitarian or combat missions, in addition to mentorship from middle and senior level management.

As of October 2018, the U.S. Navy NC active-duty officer inventory totaled 2,889 for an overall manning level of 96.6 percent. The rank of NC lieutenant (O3) made up the highest percentage of the total manpower at 35 percent, which was 999 officers filling 917 authorized billets, or standing at 109% overmanned (NC Planner, personal communication, December 2018). Table 1 shows the numbers of active-duty NC officers by grade in inventory as of the end of October 2018.

Table 1. Active-Duty NC Officer Distribution, FY2018. Adapted from NC Planner (personal communication, December 2018).

Rank	Number of Personnel	Manning Level*	Percent of Manning Level	Percent of NC Personnel
FLAG	1	0	**	0%
CAPT	137	148	93%	5%
CDR	327	332	98%	11%
LCDR	607	634	96%	21%
LT	999	917	109%	35%
LTJG	463	546	85%	16%
ENS	355	414	86%	12%
Total	2,889	2,991	96.6%	100.0%

*The manning levels are the number of billets available for each active-duty NC grade.

Also, in 2018, NC Director RDML Tina Davidson, reaffirmed her support of the NC Professional Practice Model (PPM). It is a model based on professional development, transformational leadership, operational readiness and jointness. To be successful as a NC leader, the recommended career paths of officers in each level of nursing service are

provided. The checklists are named, the “Trusted Leader” for O1 to O2, the “Motivational Leader” for O3 to O4 and the “Inspirational Leader” for senior level, O5 and O6 officers. Table 2 lists some of the expected milestones for the O3, O4, O5 and O6 NC officer grades, which my thesis studies.

Table 2. NC Officer Recommended Officer Milestones for O3 to O6. Adapted from Riggs (2017).

O3-O4 <i>Motivational Leader</i>	O5-O6 <i>Inspirational Leader</i>
Obtain a specialty certification	Maintain specialty certification
Pursue a post-Baccalaureate Degree	Complete advanced degree if not already completed
Complete Joint Professional Military Education (JPME) Phase I	Complete Joint Professional Military Education (JPME) Phase II
Seek positions of leadership such as division officer, department head, specialty leader or advanced practice nurse	Achieve appropriate Additional Qualification Designations (AQDs) for level of leadership
Complete an Individual Augmentation (IA), other operational deployment or Humanitarian mission	Seek IA, operational or Humanitarian billets
Engage in evidence-based practice /research	Engage in evidence-based practice /research
Become a member or leader in a professional organization	Become a mentor
Seek BUMED involvement, strategic goals team or working groups	Pursue executive medicine as a Senior Nurse Executive (SNE), Director, Executive Officer or Commanding Officer

In this thesis, I analyze individual level factors that may influence the possibility of promotion for Navy NC officers to the control grades of lieutenant commander (O4), commander (O5) and captain (O6). This chapter provides the necessary background information on the Navy NCs, NC manpower requirements and expected NC career progression in order to get a clear understanding of the framework of this study, of its scope and of its limitations.

C. NAVY NURSE CORPS

1. Navy Nurse Corps Organization

An Act of Congress initially created the Navy Nurse Corps in May of 1908, although it was not established as a staff corps of the Navy until April 16, 1947. Two Navy admirals (one for the active-duty component and one for the reserves) currently head the corps. The directors of the Nurse Corps are appointed by the Secretary of the Navy (SECNAV) on the recommendation of the Chief of the Bureau of Medicine and Surgery (BUMED) to serve for a term of four years (Navy Medicine, 2009). Additionally, the authorized strength and grade levels of the NC are prescribed by the SECNAV. Per the Manual of the Medical Department (MANMED), the highest grade of the NC is rear admiral. In order to derive statistical significance within my models, and due to the extremely small sample size of NC flag officers (admirals), only the grades of captain, lieutenant commander and lieutenant are considered.

2. Navy Nurse Corps Manpower Requirements

Manpower requirements are the type and level of strength needed for a specified capability (Secretary of the Navy, 2015). Navy medicine's mission is facilitated by its capability through qualified personnel. The manpower requirements or billets alone (sometimes called *spaces*), however, do not mean they will be automatically filled. Funded or authorized billets are the only types, which send the necessary demand signal for NC accession, training and delivery to the manpower requirements. The types and experience levels of NC personnel (*faces*) are what are called subspecialties and, those are filled by the creation of funded billets. The signal to hire certain types of specialties and subspecialties, train existing nurses or increase recruiting efforts for experienced providers, are functions of the current inventory and loss predictions.

Navy nursing has 17 subspecialty codes (see Table 3). A 1900 code, called Professional Nursing, is the initial code given to recently commissioned NC officers in on-the-job or other training, for one or more of the available subspecialties. The 1900 code also indicates in a platform's manning document that a billet requirement exists for a NC

officer who is qualified in any of the 17 subspecialty codes as indicated by level of education, training or experience.

Table 3. Navy Nurse Corps Subspecialty Codes

Code Subspecialty	Code Subspecialty
19XX	<i>NURSE CORPS</i>
1900	Professional Nursing
1901	Nursing Administration
1903	Nursing Education
1910	Medical/Surgical Nursing
1920	Maternal and Infant Health Nursing
1922	Pediatric Nursing
1930	Psychiatric Nursing
1940	Public Health Nursing
1945	Emergency Trauma Nursing
1950	Preoperative Nursing
1960	Critical Care Nursing
1964	Neonatal Intensive Care Nursing
1972	Certified Registered Nurse Anesthetist
1973	Psychiatric Mental Health Nurse Practitioner
1974	Pediatric Nurse Practitioner
1976	Family Nurse Practitioner
1980	Women's Health Nurse Practitioner
1981	Nurse Midwife

3. Navy NC Officer Promotion

Promotion of officers in grades ensign to lieutenant are based on the recommendation of one's commanding officer confirming physical, mental, moral and professional qualification. Officer promotions to the control grades are made on the recommendations of selection boards, which compare and rank the officer's performance against other NC officers of the same rank based on fitness reports. NC officers within this data set have varying precedence numbers and year-groups, so they fall into the categories of below, in or above-zone for promotion within each fiscal year. A NC officer may be promoted within any of the three zones, which makes the officer eligible and therefore promotable in each zone. In other words, Navy officer promotions to the control grades,

apart from spot promotions, occur when certain criteria are met and when there is a vacancy for promotion to the next higher grade. One of the main criteria for promotion is meeting the minimum TIG or years of commissioned service (YCS) per the DOPMA. At the time the promotion board convenes, the officer's YCS should be at least the DoD minimum, match or fall within range of his or her current permanent grade's flow points to be considered for promotion. Table 4 shows a list of typical flow points by grade.

Table 4. Flow points and opportunity for promotion. Adapted from Secretary of the Navy (2006).

Promotion To:	Flow Point*	Variance	Opportunity**	Variance
O4	10 years	9–11 years	80%	70-90%
O5	16 years	15–17 years	70%	60-80%
O6	22 years	21–23 years	50%	40-60%

Promotion flow points for the Medical and Dental Corps will normally be six years of service in grade from date of rank.

*This includes years of active commissioned service plus all entry grade credit.

**Opportunity refers to the percentage promoted from the surviving cohort of officers.

In lieu of individual officer lineal numbers, it would seem easier to derive and work with all the officers' total YCS by simply using the Active Commissioning Base Date (ACBD). A distinctive feature of the Navy nursing community is the application of constructive credits for experience gained in professional nursing prior to commissioning. This means that not all commissioned NC officers start at the rank of O1 and may have advanced standing upon entry into the military. The ACBD, therefore, may be not be accurate as an across-the-board determinant of promotion eligibility for all NC officers. In fact, during preliminary data analysis of the data set, I found that only 747 officer candidates out of 3,867 were initially commissioned as Ensigns. Therefore, to account for possible broken service (as in the case of some prior reservists) or advance grades on commissioning, I determine promotion eligibility by considering the officer's date of rank in his or her current permanent grade.

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III. RELATED RESEARCH

A. CHAPTER OVERVIEW

The military does not operate in a vacuum. As an all-volunteer force, recruiting and retention efforts are affected by the socio-economic conditions in which we operate, both domestically and globally. The U.S. military is thus a reflective mix of present-day society and consequently, it fluxes as society does. Recent revisions in military policy such as considering transgender candidates for service, and women on submarines or in combat roles are some of the instances which show the military's adaptation to changing societal norms and shifts in the needs of recruiting and retention.

By current law, U.S. National Security is upheld through an able military force, which depends on volunteers and not conscription as it has in the past.⁷ According to a 2014 Pentagon report, seven in ten young applicants aged 17 to 24 would not qualify for military service due to health, education, background or physical appearance (i.e., visible tattoos when in uniform, ear gauges or being overweight). Further, of those eligible, only 1% were inclined to show an interest in military service (Feeney, 2014). During times of conflict such as during the Iraq war, services such as the Army, relaxed enlistment restrictions or increased waiver approvals to meet recruitment goals. While waivers for the slightly obese by military standards and non-high school graduates may have been deemed "correctible," a felony conviction was not, and constituted grounds for denial of enlistment. Officer candidates, on the other hand, must meet even higher standards for consideration and are recruited in smaller numbers.

Interest in securing the best and brightest for commissioned military service to reach DoD end-strength goals adequate for our National Defense, as well as retention of that talent, have therefore been studied extensively. Commissioned officers are

⁷ Signed into law by President Roosevelt in 1940, the U.S. initiated its first peacetime draft or what is known as conscription. The Selective Service required all males between the ages of 21 and 35 to register for a year of mandatory military service when called upon through a lottery selection by the President. Exceptions were incorporated for those currently enrolled in college, seriously ill or recently widowed. The conscription was officially stopped in January 1973.

professionals who can be influenced by the labor market and are also volunteer service members. The unique nature of this analysis of promotion outcomes for NC officers is that it takes a quantitative and qualitative look at some of the newer conditions, which were not present during previous studies. It also considers individual influences on promotion across the various domains, as policies change over time.

B. QUANTITATIVE PROMOTION STUDIES

The optimistic prospect of professional development with steady and fair promotions is one of the main drivers of retention for most civilian and military careerists alike. The uncertainty of future positive net benefits, alternatively, can only be realized from successful retention.⁸ In a study by Zangaro (2013) of Army, Navy and Air Force nurses in the ranks of O1 to O6, he concluded that positive promotional opportunities were found to be “the most significant predictor of job satisfaction and intent to stay on active-duty across all three services” (p. 3). However, for senior military officers, promotion, which influences job satisfaction, is far from arbitrary. Rather, it follows the strict guidelines of a force-structure management tool even after meeting the mandatory TIGs. Zangaro’s survey analysis confirmed that, given the choice and under the right circumstances, the subjects would gladly stay on active-duty. Those results from examining military nurses across the three branches would be linked to endogenous factors. Although the author suggests some correlation, or that the probability of retention increases with promotion, my study goes to further examine the interrelationship of factors, which may lead to the outcome of being promoted. With a focus on NC officers entering and progressing through the control grades, I plan to analyze the marginal effects on promotion of one’s fixed endogenous factors (such as gender and race), along with those he or she can change (for example, certification in a subspecialty, additional training or command visibility through AQDs).

⁸ For the purposes of this analysis ‘successful retention,’ is retention to the point of promotion after serving the minimum TIG per DOPMA’s guidelines and being eligible for board consideration in promotion to the next higher grade.

Zangaro also included in his study, officers in the grades O1 to O3 whose promotion probabilities were almost automatically at or near 100%. By analyzing promotion rates of officers in grades O3 to O6, I stand to get a clearer picture of what actually happens within the control grades and when policy mandates sorting.

Naval Postgraduate School (NPS) student researcher LCDR Heather Ray (2012) performed probit regressions on important service and educational factors affecting Navy NC officers' promotion rates to the control grades of lieutenant commander (O4), commander (O5) and captain (O6) in a wartime environment. It not only focused on the Navy but also zeroed in on the control grades. In her analysis, unlike Zangaro's, the explanatory factors were the officer's demographics with the assumption that, given the choice, they would all prefer to remain in uniform. While Ray (2012) focused, primarily on promotion with wartime effects for nurses with Critical Wartime Specialties (CWS), my analysis covers the continuation of the DOPMA with an even smaller force and numerous policy updates aimed at recruitment and retention in a transitioning peacetime environment. The MHS is also becoming increasingly integrated, with a growing number of active-duty, NC advanced degree holders. This could mean the past estimates of effects will inevitably shift. Her analysis of the probable changes in determining eligibility and selection for promotion of those NC officer in specific specialties (due to an increase in operational tempo), make this study a nice reference point for my study.

Ray further concluded that predictors of promotion changed from one rank to the next. In her report, the explanatory variable "deployment" increased the probability of promotion to lieutenant commander (O4) but did not significantly affect that probability to promote to commander or captain. In addition, having an advanced degree positively affected the probability of promotion to commander and captain, while overseas assignments negatively affected promotion to commander. Currently, within the NC, a shortage of CWS nurses is being observed. I hypothesize that as a retention, and possibly recruiting tool, the power of CWS on promotion will increase in the determination of control grade advancement. I also examined the probability of promotion for other specialties, in addition to the CWSs using a probit approach.

In 2009, a proposal for the study on the decreased promotion rates of United States Marine Corps (USMC) aviator majors (O4) to the rank of lieutenant colonel (O5) was made by the Marine Corps Deputy Commandant for Aviation (DCA) (Reynolds, 2011). Approximately two years later, NPS student, Captain Jacob Reynolds applied quantitative and qualitative analyses to data collected between 2004 and 2012 in Total Force Data Warehouse (TFDW) and Marine Manpower Support Branch (MMSB) stored records to investigate the DCA's claims. Reynolds's study of the USMC aviation community addressed a similar case as that of the Navy NC.

The aviation and NC communities consist of state or federally licensed personnel integrated within the officer corps. Aviator skills, much like nursing, are not exclusive to the military (as say, a Torpedo's Mate would be to the Navy). The less than optimum consideration for promotion and retention may result in critical losses of senior-level talent and experience to a highly competitive and evolving civilian labor market. As an integral part of the Marine Air-Ground team structure, Reynolds suggested that the perishable nature of an aviator's skills should be factored into the planning, strategic and operational spectrum. Nursing skills also fade over time with infrequent use and extended assignments outside of the hands-on operational area. Promotion from within ensures fresh talent flows through to the control grades as well as updates ideas for today's military force. In this instance, I agree with Reynolds's suggestion that senior leadership should be concerned with improving promotion and retention of mid-grade officers for force resilience.

In 2006, prior to Reynolds's study, Captain Tracy Perry analyzed the effects of mid-grade USMC officer Primary Military Occupational Specialties (PMOS) on retention and promotion. For her analysis, she used two sources of data, which were the Marine Corps Commissioned Officer Accession Career (MCCOAC) and the Marine Officer Cohort data files. Perry observed cohort information of 27,659 officers from FY1980 to FY1999 in ranks up to O5. She found significant correlations between survival through the 10-year flow points and beyond to promotion eligibility and promotion. Perry (2006) also noted that the promotion of military officers did not support a balanced number of PMOSs as it did the overall inventory. According to the five-year planning documents published by the Manpower Plans and Policy (MP&P) committee, authorized active-duty officer strength

guidance may be aware of specific PMOS deficiencies. MP&P tries to maintain the initial order of fairness across the board by instructing promotion board members to focus primarily on officers' year-groups, grades and available vacancies, according to the Title 10, U.S. Code, Section 523 or DOPMA. The date of this study notwithstanding, Perry mentioned a similar issue with current Navy NC subspecialty shortages due to the officer promotion structure and discussed it as part of her analysis. According to Captain Perry, promotion from the rank of captain in the USMC (equivalent to lieutenant O3 in the USN) reaches a bottleneck at the flow point as all O3 officers wait on few vacancies for promotion to the control grade of O4. Meanwhile, promotion eligible O4 officers wait on even fewer vacancies for O5 regardless of PMOS. The author cited that this causes a critical shortage in some PMOSs in the control grades, which is the case seen in the Navy NC today. The U.S. military's bottom-up system of cultivating leadership further compounds the bottleneck, as accessions (to sustain the force) are not fully balanced with its losses (U.S. General Accounting Office, 1993). This is evident within the NC.

Both USMC researchers studied officers up to the grade of O5 using longitudinal data from a combination of sources. Similar explanatory variables were also used, which included demographics, Military Occupational Specialty (MOS) or PMOS, performance, training and education, experience and Promotion Boards and Zones. The findings in each study were that, the explanatory variables of MOS and PMOS were statistically significant influencers on retention and promotion when compared to others within or outside of their respective communities.

Reynolds (2011) observed and compared influential effects on promotion of USMC and Naval aviators as a group, against other communities. Perry's analysis looked at the retention and promotion of groups of communities compared to Infantry. Ideally, as in Reynolds's study, future comparison of NC officers with all other eligible Navy O3s should be studied but with one major caveat. Within the medical community, NC control officers, unlike the MC and DC, are still regulated by the DOPMA alongside the MSC. Comparisons of eligible O3s across all occupational fields would be akin to comparing apples to oranges. Although the running mate system is no longer used (NC officers were originally matched by lineal number with an unrestricted line (URL) officer and considered for promotion

when he or she was), NC vacancies still occur from unused URL vacancies. A reduction in vacancies from the URL is an automatic reduction in vacancies and strain on NC promotion. The opposite has no effect on the URL. To conduct a meaningful comparison of NC officers to all other eligible officers, the opportunities for promotion should be similar and not dependent on another to prevent biased results.

Perry (2006) discussed previous studies, which do not differentiate between occupational field effects and PMOS effects, as these involve different meanings and therefore different results interpretations. In her analysis, however, she combined all medical personnel into one group for simplicity. A separate analysis of NC or NC versus MSC in future studies will produce findings that are more accurate, since similar restraints apply. There is also the risk of some omitted variables bias. Although Perry's conclusions mirror Reynolds's for fixed-wing pilots, the training for fixed-wing pilots was not discussed for its possible influence on survivability in light of extended training times or occupational pull from the civilian sector.

Finally, Reynolds's study made use of subject-specific performance evaluation, board and zone information, physical fitness and other USMC occupational data. Unlike the USMC researchers, I did not have access to the same level of information for the Navy NC officers, which adds an even greater individual performance layer to promotion outcomes. That notwithstanding, my analysis of the possibility of promotion incorporated some features of Reynolds's approach but with proxies producing very close predictions such as current grade and TIG for current grade, to compute promotion eligibility suitable for estimations of the NC promotion outcomes. Other statistical models further supported this methodology. Perry's study is of particular interest because it uses specific explanatory variables found in my analysis with a broad look at other PMOSs compared to the baseline of Infantry as well as retention up to the point of promotion or separation.

I did not merge data sources as in either case previously discussed, but I conducted analyses on independent variables obtained from OPINS for the effects on NC promotion up to FY2018. Having access to Navy-only data, restricted my thesis to analysis of all eligible or in-zone NC officers, within cohorts, subspecialties and an aggregate comparison to between NC officer grades. For a clearer picture of possible trends, I analyzed promotion

into the control grade of O4 from O3 and on to O6. I hypothesize that trends may be significantly affected in the coming years with the passing of laws such as the John S. McCain National Defense Appropriations Act (NDAA) for fiscal year 2019. Among the list of amendments, it allows certain officers to stay on active-duty longer with recommendations in critical specialties, gives promotion board participants authority to place eligible candidates higher in the promotion list based on merit, and adds more flexibility in hiring control grade leaders (U.S. Congress, 2018).

Nurses recalled to active-duty are often experienced nurses on reserve duty (active and inactive) or with broken service and the incentive of promotion with constructive credits may have been used or required. As the ROTC and WAVE (or the Nurse Candidate program) commissioning sources evolve, accession of enlisted or fresh candidates may have increased in proportion to direct commission nurses. My suggestion on change regarding the NC officer accession sources is confirmed by studies of previous researchers. In a 1996 study by Tu on promotion to O4 in a 1983 cohort using the logistic method, the researcher concluded that the marginal effects of a direct commission were higher than for ROTC and other commissioning sources in promotion to LCDR. Not long after, in a 1998 study by Jonak and Paradis on the effects of accession sources as predictors of NC officer success, the authors concluded that direct commission pipelines produced officers with higher retention rates beyond their initial obligated service than other sources. Those higher rates, they argued, were due to an increased sense of military and perseverance, which translated into increased chances of promotion. In Jonak and Paradis's conclusion and recommendation statements, they suggested further studies on accession sources including the ROTC, which was new and "unknown" then and only had one NC candidate at the time of their study. In a more recent study, Ray's conclusion on accession sources was that even though the LT sample had the highest occurrence of ROTC and Other commissioning sources graduates, direct accession nurses still maintained an advantage in promotion to O4 when compared to the other pathways.

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IV. DATA AND DESCRIPTIVE STATISTICS

I used data drawn from the Officer Personnel Information System (OPINS). The OPINS is a corporate data generating system, which records and maintains information on all United States Navy (USN) and United States Naval Reserve active-duty officers. It also maintains records of personnel serving in other-than-regular active-duty status, such as Active-Duty for Special Work (ADSW), Full Time Support (FTS) staff, Naval Reserve Officer Training Corps (NROTC), the United States Naval Academy and, the Officer Candidates Accounting and Recording Subsystem (OCARS). For this analysis, I used annual snapshots of the population of active-duty 2900 (NC) designated officers for the fiscal years 2010 to 2018, observed at the end of the fiscal year. I removed from the analysis data set all officers who had not achieved the permanent grade of O3 as of September 30, 2010. I then restricted the data set to all active-duty NC officers up to the permanent grade of O6 as of September 30, 2018. The officers removed were ensigns (O1s), lieutenant junior grades (O2) and ranks above captain (O6). The resultant sample population contains data on active-duty NC officers observed from the fourth quarter of FY2010 to FY2018, within the ranks of O3, O4, O5 and O6. Per the DOPMA, reserve component officers are not counted under active-duty officer end-strengths and, are therefore promoted separately. In this case, although some officers listed were commissioned as reservists, they were recalled to or appointed as active-duty staff and, therefore left in the sample since their time in service occurred within the restricted dates.

The final data set used in this analysis contains 19,472 officer-year observations on about 3,600 active-duty NC officers from the fourth quarter of FY2010 to FY2018, within the ranks of O3, O4, O5 and O6.

The main objective of my analysis is to study factors that may predict the probability of promotion to the NC control grades. Retention up to the point of promotion is key to the outcome of an increase in current pay grade. Hence, my study begins at the end of successful retention for NC officer ranks O3 to O5 and, the promotions between them.

My multivariate analysis models include the promotion outcome for each control grade, as the dependent variable, and several independent (or explanatory) variables identified from previous studies as potential predictors of promotion outcomes: demographic characteristics, training, educational background, and other professional traits. In the next sections I provide a detailed breakdown of the dependent and independent variables' definition and summary statistics. Although the variables contained in different DoD data files often have dissimilar nomenclature within their data dictionaries, I observed that the variable explanations facilitate cross-referencing for similarity in meaning and accuracy.

A. VARIABLE DEFINITIONS

1. Outcome Variables: LCDR Promotion, CDR Promotion, and CAPT Promotion

The data contained in the OPINS files did not specifically provide a promoted or not promoted variable. In order to arrive at a determination of promotion outcome for eligible officers, a few critical steps were necessary. First, I created indicator variables to show the officers' current grade in each period. For instance, the indicator (binary) variable, *Promoted O3* in FY10 takes a value of 1 if the NC officer has the rank of lieutenant in 2010, and 0 if otherwise. Similar indicator variables are defined for all fiscal years in the data set (FY10 to FY18), and for each grade included in the analysis (lieutenant, lieutenant commander, commander, and captain). Next, I determine the total number of months on active service from the effective date of grade to date of separation, or to September 2018, for those who did not separate. To determine eligibility for promotion to the next higher grade, I used the minimum required number of years or time in grade (TIG) per the DoD policy, which is three years for each grade (Rand.org, n.d.). To avoid underestimating the promotion outcome, I exclude from the eligible sample officers who have less than the minimum required TIG for the next promotion.

The outcome variables used in this analysis are *LCDR Promotion*, *CDR Promotion*, and *CAPT Promotion*. They are indicator variables, each with a value of 1 if the officer is successfully promoted to the respective rank (lieutenant commander, commander, and

captain, respectively), and 0 otherwise. The sample mean, promotion rates to O4, O5 and O6 are presented in Table 5 below.

Table 5. Promotion Rates by Grade Category of Eligible Officers

Promotion to:	Observations	Mean*	Std. Dev.
LCDR Promotion	1665	0.539	0.499
CDR Promotion	1160	0.399	0.490
CAPT Promotion	638	0.262	0.440

*Means for the sample of eligible officers within each grade

Data obtained from OPINS (2010 to 2018)

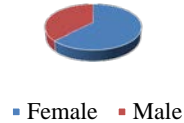
2. The Independent Variables

a. Gender

Although the Navy’s number of officer accession sources have increased over the years, leading to the deletion of some obsolete programs which were sole providers of Navy nurses at one time, the numbers of female Registered Nurse (RN) accessions have remained higher than that of their male counterparts. Officer promotions for all branches of the military follow the DOPMA and that is true for the NC as well. The high ratio of female to male NC officers notwithstanding, it is assumed that equal opportunities for promotion prescribed during each five-year projection are based on individual merit. In each fiscal year within the working data set, the ratio of male to female NC officers as an aggregate of ranks O3 to O6 remains steady, even though the ratios of male to female within the ranks fluctuates. As of September 30, 2018, female Navy nurses in grades O3-O6 made up 64.5 percent of the sample, as shown in Figure 1. This ratio is lower than in the private sector. According to the 2018 Population Survey Report by the Bureau of Labor Statistics, out of the 2,035,000 people employed in the U.S. in nursing, psychiatric and home health aide professions, aged 16 years or older, 89.3 percent were female (Bureau of Labor Statistics, 2019).⁹

⁹ The BLS.gov survey included other healthcare occupations and not just the nursing profession. The depiction illustrates that the composition of the military reflects its society to some extent.

Composition of O3 to O6 NC officers as of September, 2018 in this analysis sample



Bureau of Labor Statistics: Nursing, psychiatric and home health aides, in 2018

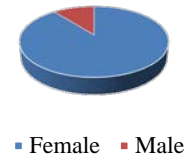


Figure 1. Comparison between Sample Gender Composition, and Bureau of Labor Statistics Nursing and Related Occupations. Adapted from Bureau of Labor Statistics (2019).

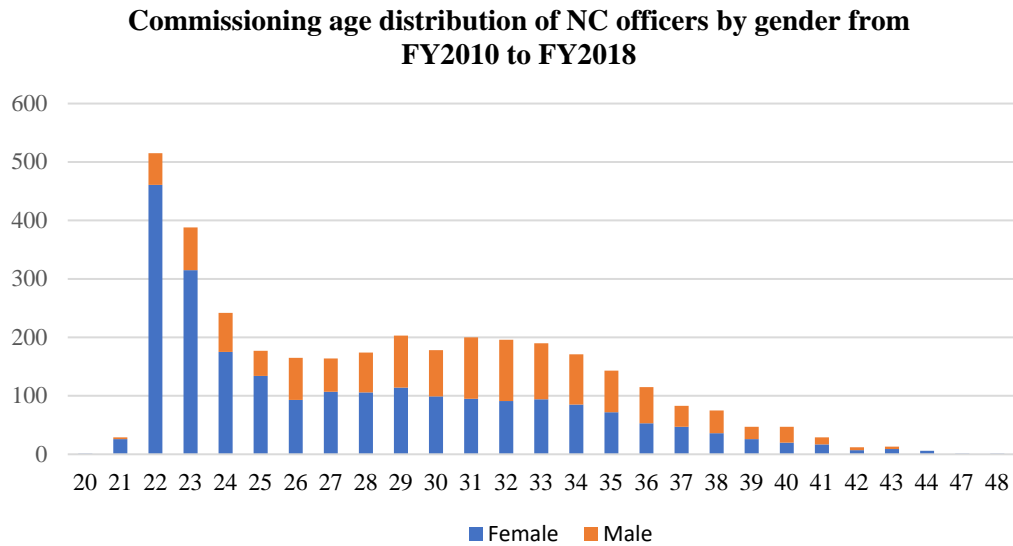
Historically, military service has been a male-dominated career field. However, the nursing profession in the civilian sector as well as the Navy NC has not. For this reason, the chosen gender baseline to which I compare the estimated coefficients for my multivariate prediction models is females. The *Female* indicator variable takes on the value of 1 if the NC officer is female and, 0 if otherwise (i.e. for male NC officers). I hypothesize that if NC promotion occurs without the influence of gender per the DOPMA’s promotion by professional standing and vacancies only, the male or female variable should have no statistically significant effect on the outcome, *ceteris paribus*.

b. Age

DoD policy mandates that all commissioned officers should be able to complete 20 years of service by a maximum age of 62 years old. In special cases, the President has the authority to extend an officer’s commission by up to 2 years. However, typically, the highest allowed initial commission age is 42 years old. Most Navy officer programs maintain their maximum commission ages well below age 42; the NC welcomes nurse professionals at or below 42 years old in order to fill its numerous subspecialty requirements.

The age group with the highest representation at commissioning date for NC officers within my sample was 22-24 years of age, as shown by Figure 2 below. This is also coincidentally the most common age group of new college undergraduates. I

implemented the age group 20-25 as my baseline for comparing multivariate estimates of the promotion models. In this analysis, I also created age groups 26-39, 40+ and *unknown age at commissioning*, for comparisons up to the maximum commissioning age allowed. The definitions of these group variables are presented in the Appendix B, Table 13.



Data obtained from OPINS (2010 to 2018)

Figure 2. Age Distribution of the Navy NC by Gender within This Sample

Due to the DoD policy on the maximum retirement age for officers, I hypothesize that those who receive commissions at a younger age will meet more TIG requirements, and therefore be eligible for promotion in higher frequencies (more observations) than those who enter later in the same grade.

c. Race and Ethnicity

Other than during census surveys, officer information for race and ethnicity is normally obtained during recruitment, enlistment or commissioning into the military services. An officer’s ethnicity therefore, is not assumed based on observed traits of race alone but rather, subjectively provided by the officer. Hence, I created four indicator variables for race categories: *White non-Hispanic*, *Asian*, *Black non-Hispanic*, *Hispanic*

and, *Other/Unknown race/ethnicity* based on categories and interpretations presented by the Manual of Navy Officer Manpower and Personnel Classifications, NAVPERS 15839I (Bureau of Naval Personnel, 2010a). I grouped undocumented race codes, and those with very low frequencies in the dataset, under the *Other/Unknown race/ethnicity* category. For my baseline, I used the race code for *White non-Hispanic*, which occurred with the highest frequency within each fiscal year and overall. The *White non-Hispanic* variable accounted for 70.42 percent of the race categories followed by *Black non-Hispanic*, with 12.75%. *Asian* and “Declined to respond” made up the next highest groups with 6.23% and 5.95% respectively. The ethnic groups within the data set were *Hispanic* or *non-Hispanic*, for which I used *non-Hispanic* as my baseline. Table 6 below, shows the NC officer breakdown by grade within this data set.

Table 6. Mean Distributions of Officers by Race and Ethnicity

Variable	All		Eligible O3		Eligible O4		Eligible O5	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Race & Ethnicity								
White non-Hispanic	0.704	0.456	0.676	0.468	0.722	0.448	0.807	0.395
Black non-Hispanic	0.127	0.334	0.152	0.359	0.141	0.348	0.108	0.311
Asian	0.062	0.242	0.080	0.272	0.068	0.252	0.036	0.187
Hispanic	0.071	0.257	0.087	0.282	0.070	0.255	0.056	0.231
Other/unknown race/ethnicity*	0.091	0.287	0.071	0.258	0.056	0.230	0.039	0.194
Number of observations	3,867		1,665		1,160		638	

Data obtained from OPINS (2010 to 2018)

d. Marital Status

For officers’ marital status, I generated variables for *Single* and *Married*, by the types of primary dependent codes entered. The alphanumeric code listed in the data set, indicated the officer’s relationship to his or her dependents (where applicable), and the number of dependent children or wards. My baseline, on which the other variables were compared, was the single NC officer. During my review of the data, I found that the highest

frequency for NC marital status was married with two dependents. However, my choice to use the single NC officer variable as a baseline was based on creating a starting point of entry into the NC and progression, with each factor added on to the analysis.

Since an NC officer’s marital status may change from one fiscal year to another, I compared the effects of marital status between cohorts, with the *Cohort 01* as my baseline. I postulate that effects of changes in marital status will differ between ranks, and as officer roles evolve from non-administrative to managerial positions or from working on wards with rotating shifts as JOs, to the control grades. Table 7 shows the average distribution of marital status by grade.

Table 7. Mean Distribution of Officers by Marital Status

Variable	All		Eligible O3		Eligible O4		Eligible O5	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Marital Status								
Single	0.230	0.421	0.180	0.384	0.131	0.338	0.150	0.358
Married	0.770	0.421	0.820	0.384	0.869	0.338	0.850	0.358
Dependent children	0.575	0.494	0.605	0.489	0.653	0.476	0.626	0.484
No dependent children	0.425	0.494	0.395	0.489	0.347	0.476	0.374	0.484
Number of observations	3,867		1,665		1,160		638	

Data obtained from OPINS (2010 to 2018)

To account for NC officers whose spouses were also in the military (active or inactive), I utilized the primary dependency and military affiliation codes. I found that 77% of the NC officers were married but only 27% were married to military service members. For married military-military couples, career decisions involve two military careers, with sometimes opposing demands. Per the Military Personnel Manual (MILPERSMAN) 1300-1000, the Chief of Naval Operations (CNO) supports collocation of dual military married couples (Military Personnel Command, 2016).¹⁰ Collocation becomes a high priority for

¹⁰ The Military Personnel Manual (MILPERSMAN) is a frequently updated military document issued by the Naval Personnel Command used to disseminate Navy human resource policy and procedures.

negotiating military orders once a request is submitted, but the same or adjacent duty stations are not always possible. The priority for military-civilian marriages, including government workers, is less and more so for marriages between service members of different branches or U.S. military to other nations' services. I hypothesize that the type of military-spouse affiliation does have some influence on retention and for those retained, some effect on promotion. For instance, if an officer's designator requires frequent career enhancing sea tours for which collocation will not be possible, some marital strain is expected. The MILPERSMAN states, "Military couples will not be permanently assigned to the same ship or the same shipboard deployable command" (Military Personnel Command, 2016). The officer may then opt for orders to avoid as many sea tours as possible, at the expense of promotion opportunities or even apply for separation due to hardship. I anticipate that the effect on NC officers who do not deploy as frequently may be different if married to those officers, than if married to another NC officer. Data in this analysis does not specify the military spouse's designator and may be of interest in future studies.

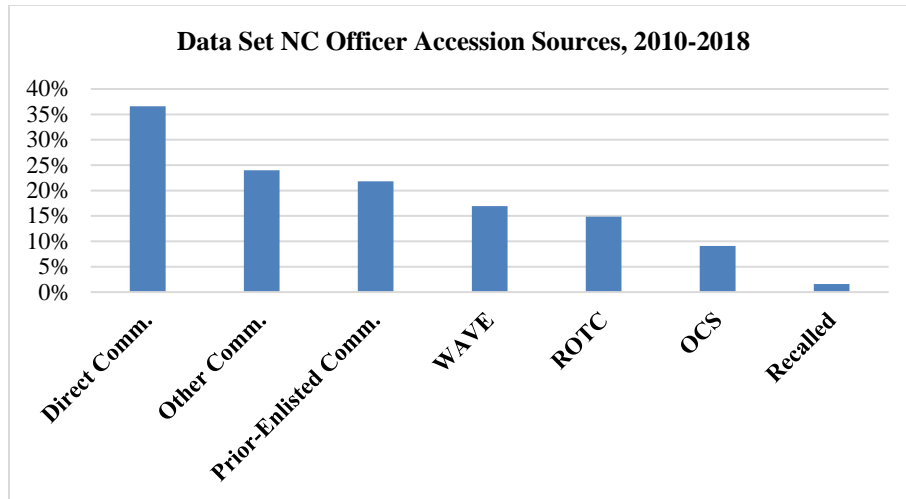
e. Dependents

The number and type of dependents may change from commissioning date to separation, or between promotions. I used the dependency status at the end of each fiscal year as the most current observation for yearly comparisons, and the status at the end of FY2018 for the aggregate analysis. By creating categorical variables to capture the inclusion of dependents (spouse and/or child) ranging from none (or zero), to one or above, I plan to capture any significant changes in the likelihood of promotion, if any exist. I hypothesize that changes in dependency status may have some effect on retention but not on the probability of promotion. I also propose that any deviations in the nurse's productivity, which might affect eligibility for promotion or successful selection, may only be a secondary effect of increased (or reduced) off-duty responsibility, and not have a direct implication on the selection process. The baseline I selected for this study was a nurse without dependents, or the *no dependents* indicator variable. On review of the available data, I found that not all entries were noted as having dependent children or not (78 missing or 2.02%). Personal information entries in the officer's record, such as reporting changes

in dependency status to Defense Enrollment Eligibility Reporting System (DEERS), are the officer's responsibility. Very recent changes from a previous report may have not been recorded and are not ordinarily assumed. Of the total observations available, 57.5% were coded as having dependent children and 42.5% without dependent children, which is sufficient for this analysis.

f. Commissioning Sources

NC officer accessions and commissioning sources range from new entrants into military service to prior-enlisted sailors, and even inter-service programs. A number of NC officers within this data set received their commissions as a result of recalls to active service from the active and inactive reserves. The overall goal, besides augmenting the active NC component in times of shortages or high tempo operations, is maintaining the resiliency of the Corps through all types of loss. I grouped the NC officer commissioning source indicators (initial and current programs) into categories representative of what each program is today. Some programs no longer exist but if the NC officer was still on active-duty during the changes, his or her commissioning program code was changed. The categories I used for this analysis were *Direct*, *Officer Candidate School (OCS)*, *Reserve Officer Training Corps (ROTC)*, *Prior-Enlisted commissioning sources*, *Recalled*, *WAVE* (or Nurse Corps Candidate) and *Other Commissioning Programs*. I used the *Direct* commissioning source as my baseline. The bar chart in Figure 4 below shows the aggregate distribution of NC commissioning sources within this data set.



Data obtained from OPINS (2010 to 2018)

Figure 3. Grouped Officer Commissioning Sources within This Sample

I hypothesize that my results may or may not produce different results from previous studies due to grouping differences and coding. The *ROTC* program for example, contains of prior-enlisted sailors, as well as, new accession officer candidates. Combining the *Prior-Enlisted* and *ROTC* programs as a single category, introduces the possibility of over-estimating the effects of both or either variable. The data set only lists officers as one or other.

g. Subspecialties

I grouped the NC subspecialties into *CWS* and *non-CWS* nurses. *CWS* nurses are those with the Critical Care, Psychiatric and Preoperative codes, while *non-CWS* nurses are all other coded Navy nursing subspecialties. I then generated *Nurse Provider* and *non-Provider* variables using the alphanumeric codes within the data set. My *Nurse Provider* indicator variable included certified nurses with a practitioner status, in which I clustered the CRNAs, Family Nurse Practitioners, Psychiatric, Pediatric, Nurse Midwives, and Women’s Health nurses. *Non-Providers* were all others without a provider status. The generated indicator variables for *non-CWS* and *non-Provider* variables were my baselines.

Unlike some officer designators in the Navy, NC officers often earn and maintain more than one subspecialty and can make major job swaps within the same command or between duty stations. Nurses with CWSs for instance, have been known to fill non-CWS positions, and volunteer to deploy in their subspecialties when needed. This can have positive effects on promotion possibilities, when compared to an officer who is locked into a particular billet type by degree or designator. When categorized into *CWS* and *non-CWS* O3 to O6 NC officers, this data set showed that only 15% were coded as *CWS* nurses. Nurse providers or practitioners made up 6.56% of the set, with CRNAs being the largest group at 8.9% followed by Family Nurse Practitioners at 4.78% of the sample. I also observed that, in the sample, the lowest group (Women's Health Nurse Practitioner at 0.47%) did not have a "T" code in any of the years as the others did. This either means that the sample had not coded for a nurse trained through the DUINS program or all Navy Women's Health Nurse Practitioner (subspecialty, 1980) hires were previously trained, and possibly commissioned into advanced grades. The codes for master's level and significant experience are the only ones listed for the 1980 subspecialty.

NC subspecialty codes depict the various areas of training, certification and expertise a NC officer is qualified for by the end of each fiscal year. For nurses with more than one subspecialty code, the first code entered is the one in which the nurse is currently, fully credentialed and, actively practicing as a primary duty (Bureau of Naval Personnel, 2010b). A second code entered indicates that although the nurse is fully trained, he or she may not be currently credentialed (or possibly, an expired credentialing license) and not actively working in that subspecialty area. The second code recorded for the nurse, is often the last subspecialty in which the officer worked, prior to the one listed as subspecialty number one. A third and later specialties indicate that the required training has also been completed, but there is further disassociation from that subspecialty with an increased need for refresher training, recertification and practice. I grouped all specialties by category including all training and education levels. For this analysis, I included the subspecialty variable to study the marginal effects of ever having a recorded subspecialty code, which means the nurse is qualified and may be utilized in that area. For future studies on how

levels of education and training may influence promotion probabilities, the letter following the numerical subspecialty indicator may be used.

h. Year-Group Cohorts

The complete data set for NC officers in grades O3 to O6 was comprised of 40 year-groups. Year-groups 2015 and 2016 were missing (or no observations) from the data set. Each year-group represented a set of officers with closely similar TIGs (assuming the officer remains on active-duty for the duration), and they should all reach each milestone around the same time. By grade, the totals for each were 17 year-groups for eligible O3s, 23 year-groups for the O4s, and 20 for O5 promotion eligible officers. The earliest year-group for the aggregate, was 1977 but for O3s, the earliest was 1991, 1985 for O4s and 1980 for eligible O5s. This created problems during my initial regression analyses as the spacing between year-groups resulted in numerous dropped or failed attempts at creating the best model estimates. Instead, I generated 12 year-group cohorts (*Cohort 01* to *Cohort 11* and *Other Cohorts*), each representing a year-group and *Other Cohorts*, which contains all others for the eligible O3 NC officers. *Cohort 01* (Year-Group 2010) was my baseline for that analysis. I also created lieutenant commander and captain cohorts to cover the earlier year-groups characteristic of those groups of officers, which do not work with the later officer year-groups. The year-groups from 1980 to 1989 were my baseline on which year groups 1990 to 1995, 1996 to 2000 and *Other cohorts* were compared for the captain analysis while year-groups 1990 to 1994 became my baseline for the O4 analysis. My generated cohorts follow individual officers by the year, from when they first become eligible for promotion to a higher grade, and subsequent eligibility milestones.

i. Additional indicators (DUINS, AQDs)

DUINS is a program through which active-duty officers may obtain Fellowship, Masters or Doctorate level degrees while attending classes full time with pay and compensation. Successful completion of the program produces positive benefits for both the Navy and the sailor. I created the variable *DUINS* to test whether having attended any of the programs is associated with the probability of promotion. DUINS programs are vigorously pursued but are not a requirement for Navy nursing practice. I also put forward

that, unlike other certifications the highly competitive selection process involved, could indicate that selected officers were already more likely to promote than their peers. This fact may have also introduced some omitted-variable bias.

In Table 8 below, the data revealed that in each year, from fiscal year 2010 to 2018, approximately 3 percent of the officers O3 to O6 were coded for training in DUINS.

Table 8. NC Officers O3 to O6 Coded as DUINS by Fiscal Year

Variable	Mean	Std. Dev.
Fiscal Year 2010	0.0341	0.1816
Fiscal Year 2011	0.0269	0.1618
Fiscal Year 2012	0.0295	0.1692
Fiscal Year 2013	0.0300	0.1706
Fiscal Year 2014	0.0240	0.1532
Fiscal Year 2015	0.0321	0.1762
Fiscal Year 2016	0.0310	0.1734
Fiscal Year 2017	0.0341	0.1816
Fiscal Year 2018	0.0326	0.1776
Number of Observations	3867	

Data obtained from OPINS (2010 to 2018)

AQDs capture extra skills, qualifications and knowledge bases earned by the nurse beyond what the billet or designator requires in performing his or her duties. AQD codes which start with the number “6” reference healthcare related designations but there only a few which are validated by the NC Personnel Plans Analyst (Eckenrode, 2014). To analyze the AQD’s relation with NC promotions I only selected those AQDs that are recognized by the NC. I then created the binary variable, *AQD* for their use in my study , to indicate whether a NC officer has such qualifications.

An analysis of NC officer promotions would not be complete without first assessing the characteristics of the corps and personnel compositions at each grade such as subspecialties, demographics, rank distributions and professional achievements. In Table 9, I provide a description of the demographic composition of the eligible officer observations within this data set.

Table 9. Descriptive Statistics of the NC Officer Analytical File

Variable	Eligible O3s		Eligible O4s		Eligible O5	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Male	0.416	0.493	0.460	0.499	0.370	0.483
Female	0.584	0.493	0.540	0.499	0.630	0.483
White non-Hispanic	0.676	0.468	0.722	0.448	0.807	0.395
Black non-Hispanic	0.152	0.359	0.141	0.348	0.108	0.311
Asian	0.080	0.272	0.068	0.252	0.036	0.187
Hispanic	0.087	0.282	0.070	0.255	0.056	0.231
Other/unknown Race/Ethnicity	0.071	0.258	0.056	0.230	0.039	0.194
Single	0.180	0.384	0.131	0.338	0.150	0.358
Married	0.820	0.384	0.869	0.338	0.850	0.358
Dependent children	0.605	0.489	0.653	0.476	0.626	0.484
No dependent children	0.395	0.489	0.347	0.476	0.374	0.484
One dependent child	0.336	0.473	0.347	0.476	0.276	0.447
Two dependent children	0.384	0.487	0.441	0.497	0.375	0.484
Three dependent children	0.195	0.396	0.228	0.419	0.185	0.389
Four or more dependent children	0.074	0.263	0.091	0.288	0.086	0.281
Age at Commissioning 20-25	0.287	0.453	0.265	0.441	0.411	0.492
Age at Commissioning 26-39	0.653	0.476	0.698	0.459	0.563	0.496
Age at Commissioning 40+	0.035	0.183	0.033	0.178	0.025	0.156
Age at Commissioning is unknown	0.025	0.155	0.004	0.066	0.002	0.040
CWS	0.182	0.386	0.147	0.354	0.108	0.311
Non CWS	0.818	0.386	0.853	0.354	0.892	0.311
Nurse Provider	0.206	0.405	0.304	0.460	0.329	0.470
Non-Provider	0.794	0.405	0.696	0.460	0.671	0.470
DUINS	0.259	0.438	0.253	0.435	0.091	0.288
Non DUINS	0.741	0.438	0.747	0.435	0.909	0.288
AQD	0.562	0.496	0.791	0.407	0.853	0.355
No AQDs	0.438	0.496	0.209	0.407	0.147	0.355
Direct	0.305	0.460	0.226	0.418	0.110	0.313
OCS			0.008	0.088	0.014	0.118

Variable	Eligible O3s		Eligible O4s		Eligible O5	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
ROTC	0.131	0.337	0.122	0.327	0.058	0.234
Prior-Enlisted Commission	0.350	0.477	0.173	0.379		
Recalled	0.011	0.106	0.035	0.185	0.019	0.136
WAVE	0.194	0.396	0.101	0.301	0.003	0.056
Other Commissioning	0.010	0.098	0.334	0.472	0.796	0.403
Cohort 01 (O4: 1990-1994/O5: 1980-1989)	0.077	0.266	0.063	0.243	0.150	0.358
Cohort 02 (O4: 1995-2001/O5: 1990-1995)	0.073	0.260	0.557	0.497	0.541	0.499
Cohort 03 (O4: 2002-2009/O5: 1996-2000)	0.063	0.243	0.360	0.480	0.307	0.462
Cohort 04	0.077	0.266	-	-	-	-
Cohort 05	0.070	0.255	-	-	-	-
Cohort 06	0.094	0.291	-	-	-	-
Cohort 07	0.101	0.301	-	-	-	-
Cohort 08	0.098	0.297	-	-	-	-
Cohort 09	0.115	0.319	-	-	-	-
Cohort 10	0.089	0.286	-	-	-	-
Cohort 11	0.103	0.304	-	-	-	-
Other Cohorts (O3, O4 and O5)	0.041	0.199	0.020	0.139	0.002	0.040
Number of Observations	1665		1160		638	

Grouped year-group cohorts only apply to eligible O4s and O5s as indicated

Data obtained from OPINS (2010 to 2018)

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V. RESULTS

A. PROBIT REGRESSION MODEL

My predicted outcomes of promoted or not promoted to the next grade are binary variables, therefore I use probit regression models for my analysis. An outcome of 1 indicates promotion, while 0 means not promoted to the next higher grade. In the tables and discussion below I present the marginal effects of each independent variable within my models in relation to the outcome, that is, for each unit increase in the value of independent variable x , there is a percentage-point change in probability of promotion, holding all else constant. This makes it possible to measure nonlinear or small changes in x from 0 to 1 (hence, all changes in a category of x should equal to approximately 1 when added). For example, when comparing promotion of NC officers with dependents to the probability of promotion of the baseline group (officers without dependents), I present the marginal effect of having dependents and its association with the promotion probability, compared with the chance of promotion of the baseline (comparison) group, all else held constant.

My baseline promotion model is a probit regression of personal characteristics, professional (or service-specific) attributes and cohort year indicators on the probability of promotion, as shown in the regression equation below:

PROMOTE ($y=1|x$) = *probit* (**individual demographic, commissioning/accession source, subspecialty, provider status, AQDs, DUINS, year-group cohort**).

I estimate three promotion models, one for each of the officer grades. The base promotion model for the promotion to each grade (O4, O5 and O6) includes controls for gender, age at commissioning, race and ethnicity, marital status and cohort years. The second and third models add additional factors as controls, such as commissioning source, subspecialty, and AQDs for a deeper analysis. Again, per the DOPMA, when estimated, I expect the marginal effects of gender, dependents, race and ethnicity to not be associated with promotion outcomes. However, age at commissioning, NC-specific professional characteristics such as CWS, Nurse practitioner, AQDs and DUINS are expected to show

a positive correlation with the promotion probability, as found in previous studies. Wielsma (1996) found that graduate education (in my case, DUINS) does have a positive correlation with promotion for USMC officers. In Ray's 2012 study on older NC cohorts, she not only reported gender to be insignificantly associated with promotion, but also concluded that advanced degrees have positive association with promotion outcomes, especially for promotion to O5 and O6, adding that CWS and provider status positively correlates with promotion probabilities..

B. LIEUTENANT

Based on Tables 6, 9 and Figure 3, I define the following as the comparison, reference group for the promotion multivariate models: white non-Hispanic, female NC officers with a direct commission who are unmarried and with no dependent children. Figure 6 also showed that on average, more NC officers commissioned at earlier ages (specifically, commissioning ages of 20 to 25) than later. Table 10 shows the three probit model estimates, as described above. When compared to my baseline, the results will show whether the probability of promotion to LCDR is higher, the same, or lower compared to the reference group, holding all else constant. For example, the negative coefficient on the variable *Age at commissioning of 26 to 39* indicates that being 26 to 39 years old when commissioned is associated with a lower probabilities of promotion to LCDR than being 20 to 25 years of age at commissioning.

Table 10. Probit Regression Results: Lieutenants (O3) Promotion for Eligible NC Officers

VARIABLES	(1)	(2)	(3)
	LCDR Promotion		
Male	0.00653 (0.0289)	-0.00134 (0.0294)	0.00454 (0.0293)
Asian	-0.0707 (0.0559)	-0.0541 (0.0559)	-0.0181 (0.0544)
Black non-Hispanic	0.0112 (0.0388)	0.0222 (0.0385)	0.0684* (0.0355)
Hispanic	-0.0314 (0.0508)	-0.0147 (0.0499)	-0.00855 (0.0497)
Other/Unknown Race/Ethnicity	-0.000199 (0.0563)	0.0139 (0.0555)	0.0337 (0.0534)
Married	0.212*** (0.0444)	0.196*** (0.0453)	0.193*** (0.0476)
Dependent children	-0.0542* (0.0315)	-0.0364 (0.0325)	-0.0105 (0.0330)
Age at Commissioning 26 to 39	-0.0309 (0.0342)	0.00278 (0.0396)	0.0135 (0.0410)
Age at Commissioning 40+	-0.0451 (0.0781)	0.00511 (0.0755)	0.0385 (0.0699)
Age at Commissioning is unknown	-0.229* (0.121)	-0.169 (0.125)	-0.154 (0.125)
CWS		0.0156 (0.0356)	-0.0187 (0.0377)
Nurse Provider		0.230*** (0.0267)	0.0692 (0.0426)
ROTC		0.00186 (0.0511)	-0.0381 (0.0554)
Recalled		0.168* (0.0861)	0.144* (0.0842)
Prior-Enlisted Commissioning		-0.0559 (0.0381)	-0.0341 (0.0380)
WAVE		0.0184 (0.0406)	-0.00418 (0.0424)
Other Commissioning		-0.236* (0.143)	-0.261* (0.154)
DUINS			0.265*** (0.0305)
AQD			0.321*** (0.0284)
Cohort 02	0.0246 (0.0641)	0.0144 (0.0652)	-0.0212 (0.0676)
Cohort 03	0.0337 (0.0656)	0.0317 (0.0667)	0.0223 (0.0661)
Cohort 04	0.0274	0.0267	0.0240

VARIABLES	(1)	(2)	(3)
	LCDR Promotion		
Cohort 05	(0.0623) -0.100	(0.0629) -0.0951	(0.0628) -0.139*
Cohort 06	(0.0692) -0.0215	(0.0702) -0.0177	(0.0761) -0.0301
Cohort 07	(0.0623) -0.0808	(0.0632) -0.0710	(0.0659) -0.0450
Cohort 08	(0.0628) -0.102	(0.0634) -0.0908	(0.0638) -0.0413
Cohort 09	(0.0637) -0.551***	(0.0645) -0.536***	(0.0628) -0.537***
Other cohorts	(0.0486) -0.449***	(0.0526) -0.450***	(0.0582) -0.403***
Observations	(0.0718) 1,320	(0.0775) 1,320	(0.0911) 1,320
Standard errors in parentheses		Pseudo R2	
*** p<0.01, ** p<0.05, * p<0.1	0.1989	0.3121	0.3121

Data obtained from OPINS (2010 to 2018)

In my sample, 897 NC LTs were promoted to LCDR out of 1,665 eligible officers in this data set. This is about a 54% promotion rate, which falls below the officer opportunities for promotion at 80 +/-10%. It is also 6% lower than the previous study on NC LT promotion within the cohort 2001 to 2010 by Ray (2012).

1. Individual Characteristics

In the first analysis (Model 1), I did not find gender or race and ethnicity to be statistically significantly associated with a promotion probability to LCDR. On average, being married was associated with an increased probability of promotion to LCDR by 21.2 percentage points (or 30.60%) when compared to single NC officers. In other words, a married Navy nurse had a higher probability of being promoted to O4 compared to a single unmarried NC officer by 0.212 (p<0.01), holding all else constant. My results on LT promotion and marriage are similar to the study by Ray (2012). In contrast, I find that having dependent children was associated with a lowered probability of being promoted to LCDR, by 5.42 percentage points (or 7.80%). When studied by each incremental child, a NC officer's first child indicated an association with a higher probability of promotion to

LCDR but a lower probability with each addition of a dependent child. (See Appendix C, Table 14).

In this model, having unknown commissioning ages ($n=41$ or 2.5% of the eligible O3s), had the highest association with the probability of promotion to LCDR when compared to the probability of promotion for baseline group of officers commissioned at the age of 25 to 25 years of age, all else equal. The estimate indicates a reduced likelihood of promoting to LCDR than for those officers with documented ages, at 22.9 percentage points or 32.96% less likely to promote. Officers with missing or unknown commissioning ages may include NC officers from other services, recalled or from obsolete NC commissioning programs. There were no significant differences in promotion probabilities between NC officers who commissioned between ages 20 to 25 and those who commission at 26 years of age or above.

2. Professional Attributes

Being a CWS NC officer had a similar promotion probability as non-CWS nurses (the reference group). Surprisingly, being a nurse provider was associated with an increased promotion probability to LCDR by 23.0 percentage points (32.45%). This may be partly due to the structure of NC officer promotions (which still requires a vacancy for promotion, even as a provider), and if nurse providers are receiving commissions as control grade officers.

I was unable to use a variable for the highest levels of education in this analysis due to over 70% of the codes missing from several years. The highest level of education is another entry (as DEERS updates mentioned earlier), which is the responsibility of each officer and is not assumed on record. Ideally, the highest level of education could indicate the level of human capital the nurse has attained, his or her productivity, and the correlation with promotion probabilities, if any. An accurate count would be best in order to arrive at the best estimates of marginal effects in each year, and overall. In its place, I created the *DUINS* and *AQD* variables to indicate if the NC officer ever attended one of the DoD-sponsored programs, and his or her levels of nurse-specific achievements. When comparing LCDR promotion probabilities of eligible NC officers, higher promotion probabilities were

associated with both indicator variables. DUINS program completion was associated with a 26.5 percentage points (35.37%) higher probability of promotion than those who had not attended while having healthcare-related AQDs were associated with even higher promotion probability of 43.02% more likely, when compared to those without them.

3. Commissioning Source

Older studies have concluded that direct commission officer programs consistently produce higher retention and/or promotion outcomes than the other officer accession or commissioning sources. In this analysis on promotion to LCDR, I found that there were no observations for OCS but more prior-enlisted commissioning programs under the current programs than the program sets they replaced. As a result, OCS was not included in my analysis on promotion to LCDR. The *Recalled* commissioning sources showed an association with higher promotion probability than direct commissioning, at 16.8 percentage points (23.73%) more likely to be promoted. Other commissioning sources were associated with a 23.6 percentage points (or 33.33%) reduced likelihood of promoting to LCDR when compared to direct commission NC officers. I did not find significant differences in the probability of promotion to LCDR from the other commissioning sources. Notably, there were no *OCS* NC officer commissioning coded for O3s in the data set.

4. Year-Groups

Eligible lieutenants in cohorts *09* and *other cohorts* showed associations with the least likelihoods of promotion to LCDR when compared NC officers in year-group 2010 (*Cohort 01*). My results indicate a gradual drop in marginal effects from *Cohort 03* as the year-groups near 2018. NC officers in *Cohort 09* and *Other cohorts* were 55.1 and 44.9 percentage points (or 79.31 and 64.74%, respectively) less likely to promote to O4 than their fellow NC officers in year-group 2010 would. This makes sense, as those in later year-groups would have less time to become eligible for promotion based on TIG.

C. LIEUTENANT COMMANDER

In this data set of 1,160 eligible LCDRs, 463 promoted for an average of a 40% promotion rate. This is well below the officer-prescribed promotion opportunity of 70% (variance: 60 to 80%) for promotion to O5. At face value, the effects of retirement and attrition may not be evident, although, some prior-enlisted officers leave the NC at this grade with new entrants entering into needed subspecialties. The largest BUPERS loss code for O4 officers in this data set was 90.2% “unknown” while the largest separation program designator was 70.6%, which is described as sufficient service for retirement. The analysis of LCDR promotion to CDR is contained in Table 11.

Table 11. Probit Regression Results: Lieutenant Commander (O4) Promotion for Eligible NC officers

VARIABLES	(1)	(2)	(3)
	CDR Promotion		
Male	-0.0278 (0.0335)	-0.0161 (0.0343)	-0.0179 (0.0348)
Asian	-0.0868 (0.0586)	-0.0922 (0.0588)	-0.0870 (0.0608)
Black non-Hispanic	-0.0711 (0.0450)	-0.0444 (0.0469)	-0.0482 (0.0475)
Hispanic	0.0272 (0.0629)	0.0165 (0.0628)	-0.00417 (0.0629)
Other/Unknown Race/Ethnicity	0.0375 (0.0683)	0.00620 (0.0685)	0.0176 (0.0698)
Married	0.126*** (0.0447)	0.121*** (0.0448)	0.117*** (0.0453)
Dependent children	-0.0670* (0.0352)	-0.0506 (0.0355)	-0.0424 (0.0359)
Age at Commissioning 26 to 39	-0.231*** (0.0368)	-0.173*** (0.0406)	-0.154*** (0.0413)
Age at Commissioning 40+	-0.315*** (0.0438)	-0.295*** (0.0492)	-0.281*** (0.0529)
CWS		0.0179 (0.0466)	-0.000694 (0.0473)
Nurse Provider		0.0657* (0.0356)	0.0519 (0.0375)
OCS		0.0900 (0.193)	0.104 (0.196)
ROTC		0.00536 (0.0566)	0.00226 (0.0574)

VARIABLES	(1)	(2)	(3)
	CDR Promotion		
Recalled		0.0712 (0.0921)	0.0732 (0.0941)
Prior-Enlisted Commissioning		-0.237*** (0.0433)	-0.224*** (0.0448)
WAVE		-0.0567 (0.0578)	-0.0741 (0.0568)
Other Commissioning		-0.0657 (0.0434)	-0.0498 (0.0444)
DUINS			0.0999** (0.0443)
AQD			0.235*** (0.0326)
Year-Groups 1995 to 2001	0.467*** (0.0560)	0.453*** (0.0578)	0.452*** (0.0581)
Year-Groups 2002 to 2006	0.0377 (0.0756)	0.0495 (0.0835)	0.0102 (0.0843)
Other cohorts	-0.140 (0.159)	-0.157 (0.151)	-0.194 (0.137)
Observations	1,152	1,152	1,152
Standard errors in parentheses		Pseudo R2	
*** p<0.01, ** p<0.05, * p<0.1	0.1919	0.2124	0.2442

Data obtained from OPINS (2010 to 2018)

1. Individual Characteristics

Similar to the previous probability estimate on promotion to LCDR, gender was not significantly associated with promotion.

Being a married NC was associated with a higher probability of promotion to commander than being single by 12.6 percentage points (33.99%). My results show that the marginal effect of being married were lower than for promotion to LCDR. For Navy nurses with dependent children, the negative marginal effects were higher at 6.70 percentage points or 18.05% less likely to promote than NC officers without dependent children were. Here, my results suggest that having dependent children was associated with lower promotion probabilities as the officer's grade increased. On analysis of incremental marginal effects of each dependent child, I find that the NC LCDR's first child was in fact, associated with an increase in the probability of promotion to CDR but began to decline by the second child when compared to eligible NC lieutenant commanders without dependents

(Appendix C, Table 14). Only the first and second child held significant associations with promotion.

As expected, the marginal effects of advanced age at commissioning, was negative and significant in promotion probabilities to commander when compared to my baseline age group of officers who commissioned between 20 and 25 years old. NC officers, who commissioned between the ages of 26 and 39 years, were 62.19% less likely to be promoted to commander than the baseline while officers, 40 and over were 84.93% less likely. The *Age at Commissioning*, results were statistically significant for promotion to CDR.

2. Professional Attributes

Being a CWS nurse was not associated with promotion probability to CDR as was being a nurse provider. CWS and non-CWS nurse were comparable candidates for promotion. Being a nurse provider was marginally associated with promotion to commander with an 18.08% increased likelihood of promotion when compared to non-Provider nurse professionals.

DUINS training and AQD qualifications were associated with increased probabilities of promotion to CDR when compared to nurses who had not completed either one. The probability of promotion to CDR for DUINS-trained nurses was 9.99 percentage points more likely (27.98%) than non-DUINS while nurses with healthcare-related AQDs were 23.5 percentage points (65.72%) more likely to promote than NC officers who did not possess AQD qualifications. Per the PPM, as NC officers move into more senior-level positions, it is not only expected that they consider BUMED, NAVMED and other big-Navy involvements but my results show some positive association of advanced training in executive-level nursing and healthcare with promotion.

3. Commissioning Source

Of the different commissioning sources in my analysis, only the *Prior-Enlisted commissioning* programs were associated with reduced probabilities of promotion to commander. NC commissioning from this source was associated with a 23.7 percentage

points (65.18%) lowered probability of promoting to CDR, when compared to nurses from direct commissioning programs.

4. Year-Groups

The 1995 to 2001 year-groups (*Cohort 02*) were associated with a significant 46.7 percentage point higher probability of promotion to commander when compared to NC officers in the baseline year-group 1990 to 1994 with all else held constant.

D. COMMANDER

Overall, 26% ($n=167$) of eligible CDRs were promoted to CAPT in this data set of NC officers from 2010 to 2018. This is also well below the prescribed promotion opportunity of 50% (variance: 40 to 60%) for promotion to O6. The analysis of CDR promotion to CAPT is contained in Table 12.

Table 12. Probit Regression Results: Commander (O5) Promotion for Eligible NC Officers

VARIABLES	CAPT Promotion		
	(1)	(2)	(3)
Male	-0.00108 (0.0402)	0.0114 (0.0406)	0.00599 (0.0404)
Asian	0.0183 (0.101)	0.0228 (0.104)	0.0138 (0.100)
Black non-Hispanic	-0.0122 (0.0560)	-0.0110 (0.0568)	-0.00899 (0.0570)
Hispanic	-0.0155 (0.0741)	-0.0303 (0.0728)	-0.0398 (0.0700)
Other/Unknown Race/Ethnicity	-0.0364 (0.0891)	-0.0199 (0.0939)	-0.0315 (0.0909)
Married	0.121*** (0.0430)	0.122*** (0.0426)	0.131*** (0.0411)
Dependent children	-0.0701* (0.0418)	-0.0645 (0.0417)	-0.0697* (0.0419)
Age at Commissioning 26 to 39	-0.0738* (0.0384)	-0.0801** (0.0397)	-0.0817** (0.0394)
Age at Commissioning 40+	-0.216*** (0.0435)	-0.196*** (0.0554)	-0.192*** (0.0554)
CWS		0.0609 (0.0622)	0.0641 (0.0627)

VARIABLES	(1)	(2)	(3)
	CAPT Promotion		
Nurse Provider		-0.0885**	-0.0741**
		(0.0366)	(0.0373)
OCS		0.0664	0.0728
		(0.177)	(0.178)
ROTC		-0.00652	-0.00735
		(0.109)	(0.109)
Recalled		0.0209	0.0254
		(0.169)	(0.172)
Other Commissioning		0.109*	0.102*
		(0.0571)	(0.0573)
DUINS			-0.0998
			(0.0608)
AQD			0.141***
			(0.0379)
Year-Groups 1990 to 1995	0.0443	0.0546	0.0656
	(0.0505)	(0.0507)	(0.0501)
Year-Groups 1996 to 2000	-0.179***	-0.144***	-0.131**
	(0.0483)	(0.0525)	(0.0533)
Observations	635	633	633
Standard errors in parentheses		Pseudo R2	
*** p<0.01, ** p<0.05, * p<0.1	0.0706	0.0874	0.1033

Officers with unknown ages at commissioning, the WAVE commissioning program and other cohorts (year-group 2009 and missing year-groups) were dropped for perfect success and failures respectively.

Data obtained from OPINS (2010 to 2018)

1. Individual Characteristics

For promotion to captain, the race and ethnicity categories were not associated with promotion probabilities or statistically insignificant when compared to the baseline.

Being married was associated with an increased promotion probability to captain (12.1 percentage points or 49.66% more likely to promote), while having dependent children was associated with a lesser promotion probability (7.01 percentage points or 28.87% less likely) when compared to single officers of the same rank and without dependents. These results showed that the positive marginal effects of being married were lowest in promotion to captain while the negative marginal effects of having dependents were at their highest.

The marginal effects of dependent children was only significant and positive for an eligible NC CDR's first at child at 10.3 percentage points (42.72%), after which there was no significant association with promotion for more children (Appendix C, Table 14).

The age at commissioning for officers above the baseline, in the 26 to 39 years age group was associated with reduced promotion probabilities of 7.38 percentage points (30.38%). NC officers who commissioned at 40 years old and above, were even less likely than 20 to 26 year olds at up to 21.6 percentage points (88.93%) less likely to promote to captain when compared.

2. Professional Attributes

My regression model estimated nurse providers were 8.85 percentage points (37.05%) less likely to promote to O6. This could signal negative retention of nurse providers.

DUINS training was no longer statistically significant and therefore, not associated with promotion outcome to captain. The marginal effect of AQDs remained positive with a 14.1 percentage point higher probability of promotion to captain when compared to non-AQD NC commanders.

3. Commissioning Source

Although marginally, only the *Other* commissioning sources were significantly associated with NC officer promotion to captain by 10.9 percentage points (or 45.58%). The other commissioning sources were not associated with promotion probabilities to the grade of captain. I noted that no prior-enlisted commissioning sources were coded for this group of NC officers.

4. Year-Groups

The year-groups 1996 to 2000 were associated a 17.9 percentage point (73.83 percent) reduced probability of promotion to captain in comparison to my baseline group of officers in year-groups 1980 to 1989. There was no significant association of year-groups 1990 to 1995 or *Other cohorts* to NC captain promotion outcomes.

VI. CONCLUSIONS AND RECOMMENDATIONS

This thesis investigates the roles individual level factors might play in selection for, and promotion to the control grades of active-duty Navy Nurse Corps officers from fiscal year 2010 to 2018. Using individual level data and through probit regressions, I estimate predictive models for Navy Nurse Corps officers' promotion to the ranks of lieutenant commander, commander, and captain, respectively.

My results were grouped into personal, professional and NC-cohort attributes for each grade. For NC officer characteristics across the three grades I analyzed, my results were sometimes synonymous with past literature, but different in others based on my updated data set. Gender, for instance, had no overall significant effect on officer promotions when compared to the baseline of female NC officers, and neither was race and ethnicity across the three grades. However, the results for dependent children were varied between officer grade, having dependent children at all, and the number of dependent children. I also find that majority of the NC are married, female and have two dependents. During my analysis, being married was associated with a higher probability of being promoted up to the grade of captain. There is a nonlinear relationship between having dependent children and promotion probabilities throughout. Having one child is associated with higher probability of being promoted, but that association weakens with each additional child (See Appendix C, Table 14).

Of those commissioned into naval service, earlier commissioning ages across all ranks, were associated with increased chances at promotion to the next higher grades. As age increased, the associated probabilities for promotion decreased. Age at commissioning was especially statistically significant for promotions between LCDR to CDR and from CDR to CAPT. On advanced NC-specific education, I find that the marginal effects of certain programs were advantageous at certain grades and then become negative in others. Being part of DUINS is associated with higher promotion probability only up to LCDR when comparing to a comparable non-DUINS NC officer, but lower probability of promotion by CDR to CAPT promotions. Being a nurse provider is associated with higher and statistically significant probability of LCDR and CDR promotions but lower

probability for promotion to CAPT. Healthcare-related AQDs is associated with higher promotion probability to all three grades (statistically significant in O3 to O4 and O5 to O6). CWS was not significant in promotion to any of the control grades when compared to non-CWS nurses.

This thesis has the following limitations. First, I am unable to obtain reliable information on advanced nursing education, history of assignments, and officer fitness reports. These are important factors that would offer a more complete view of each officer promotion. Second, since the nomenclature and description of entries vary between data sources, my coding of different groups used in this analysis was based on subjective conjecture through professional experience. This means, my coding and therefore, results may be different from future researchers'. For instance, there is no code for the overlap of Prior-Enlisted and ROTC commissioning sources. ROTC now comprises contract and enlisted sailors, which would require a separate code. Third, my sample might not be representative of the NC population in general due to missing data for some observations that I am unable to include in the analysis. This limitation would explain why the promotion rate in this sample is lower than published reports.

With these caveats in mind, the research I presented in this study provides a basic view of the changes in promotion probabilities as grades and personal characteristics change. The differences between earlier NC commissioning sources and current programs is noticeable in the near absence of prior-enlisted programs in the captain-eligible officers group, and its near dominance in the eligible lieutenant officer group. The opposite was true, in that, I did not find any coded OCS-commissioned NCs in the eligible lieutenant group but numerous OCS sources (even Aviation Officer Candidate School) in the captain eligible group. In mentoring JOs, leaders should be aware of those shifting demographics, and provide guidance not only based on the NC's manpower requirements but what it takes to retain quality personnel. A push of JOs toward DUINS programs should be replaced by initiating interest in AQDs and nurse provider education and training, beyond the grade of O3. The positive marginal effects of DUINS programs I find, started to decline for officers in grades, O4 and above.

As I mentioned earlier, the highest frequency of NC marital and dependency status was married and two children. These were separate indicator variables. The data set showed that 891 NC officers were single but only 813 had records of with or without dependent children or 665 single and 148 with dependent children (78 records were missing dependency status). My results on CWS and nurse provider status were based on grouped indicator variables. Since Navy medicine is vigorously realigning its structure to better serve the warfighter with increased focus on readiness, jointness and deployability, this study provides opportunities for future studies on the effects of each subspecialty and types of nurse provider certification on the probability of promotion and ultimately, retention of our finest assets.

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APPENDIX A. CONSTRUCTION OF ANALYTICAL FILES

The original OPINS data set was comprised of yearly snapshots of officer records from the different Navy designators. For this analysis, I extracted and stored only records of active-duty naval officers in the 2900 designator, who were in the grades of O1 to O6 and, from fiscal years 2010 to 2018. I then dropped officer files for O1s, O2s, O7s and O8s leaving the officer grades O3 to O6, which is the focus of my analysis. The assembled set of records were my original master files to observe the demographic, professional and personal achievements of each officer from his or her date of first commissioning or active-commission base date until separation. Of course, not all officers separated from military service by the end of 2018, and a large portion had missing separation dates. To ensure all observations were contained between my dates under study, I censored the analysis by adding the end of fiscal year 2018 (30 September 2018) as the separation dates for all records without separation dates.

Each yearly snapshot file represented officers in a fiscal year by generated ID numbers. In order to follow individual promotion progressions and for comparison analysis within one file, I merged all nine files from 2010 to 2018 into an aggregate data set. I used this newer file as my master file. Next, I created lieutenant cohort variables by employing the officer year-groups. Cohorts, 01 to 11 (representing the year-groups 2001 to 2011) facilitated individualized observations of each officer by year. I also generated the cohort, *Other cohorts*, which was comprised of year-groups with very few NC officers, to preserve the predictive power of my sample size. For commander and captain eligible NC officers, I created grouped cohorts to capture the smaller sample of officers who were spread across earlier year groups.

To analyze NC officer promotion outcomes by grade, I generated variables for promotion eligible O3s, O4s and O5s. I then created three new files from the latter master file of those officers for the start of my analysis. The final four analytical files included one master file as my data set for aggregate analysis of all O3 to O6 NC officers, and three subordinate files by grade, for my analysis on eligible versus non-eligible officers within the same grade. Finally, to test for whether an officer ever promoted to LCDR, CDR or

CAPT, I created outcome variables on which I regressed my independent variables within each eligible officer category.

APPENDIX B. BASE MODEL VARIABLE DESCRIPTIONS

Table 13. Probit Model Variables

Variable	Description
Promotion	=1 if promoted to the next higher grade; =0 if not promoted.
Demographics	
Male	=1 if a female NC officer; =0 if not.
Female	=1 if a male NC officer; =0 if not.
White non-Hispanic	=1 if white and not of Hispanic origin; =0 if otherwise.
Black non-Hispanic	=1 if black, African or African-American and not of Hispanic origin; =0 if otherwise.
Asian	=1 if Asian; =0 if not promoted.
Hispanic	=1 if Hispanic and/or Hispanic ethnicity; =0 if otherwise.
Non-Hispanic	=1 if not Hispanic and/or Hispanic ethnicity; =0 if otherwise.
Other/Unknown Race/Ethnicity	=1 if other or unknown race/ethnicity was indicated; =0 if otherwise.
Single	=1 if unmarried; =0 if otherwise.
Married	=1 if married; =0 if otherwise.
No dependent children	=1 if officer does not have dependent children; =0 if otherwise.
Dependent children	=1 if officer has dependent children; =0 if otherwise.
Age at Commission 20 to 25	=1 if officer received his or her commission in this age range; =0 if otherwise.
Age at Commission 26 to 39	=1 if officer received his or her commission in this age range; =0 if otherwise.
Age at Commission 40 and over	=1 if officer received his or her commission in this age range; =0 if otherwise.
Age at Commission is unknown	=1 if officer's age at commission is unknown; =0 if otherwise.

Professional Attributes	
Direct	=1 if officer's commissioning source was via Direct commission; =0 if otherwise.
OCS	=1 if officer's commissioning source was via Officer Candidate School; =0 if otherwise.
ROTC	=1 if officer's commissioning source was via an ROTC program; =0 if otherwise.
Prior-Enlisted Commissioning	=1 if officer's commissioning source was via a Prior-Enlisted comm. source; =0 if otherwise.
Other Commissioning	=1 if officer's commissioning source was inter-service, augment or discontinued; =0 if otherwise.
Recalled to active-duty	=1 if officer's commissioning source was via recall to active-duty; =0 if otherwise.
WAVE Program	=1 if officer's commissioning source was via the WAVE program; =0 if otherwise.
DUINS	=1 if officer ever received training in one of the Duty Under Instruction programs; =0 if otherwise.
Non-DUINS	=1 if officer never received training in one of the Duty Under Instruction programs; =0 if otherwise.
Nurse Corps Specific Professional Characteristics	
CWS*	=1 if officer has one or more of the Critical Wartime Specialties (CWS); =0 if otherwise.
non-CWS	=1 if officer does not have a CWS, other & and is not a nurse practitioner; =0 if otherwise.
Nurse Provider**	=1 if officer is a nurse practitioner; =0 if otherwise.
Non-Provider	=1 if officer is not a nurse practitioner; =0 if otherwise.
AQDs	=1 if officer has a healthcare-related AQD; =0 if otherwise.
No AQDs	=1 if officer does not possess a healthcare-related AQD; =0 if otherwise.
Cohorts	
Cohort 01	=1 if Year-Group is 2001; =0 if otherwise.
Cohort 02	=1 if Year-Group is 2002; =0 if otherwise.
Cohort 03	=1 if Year-Group is 2003; =0 if otherwise.
Cohort 04	=1 if Year-Group is 2004; =0 if otherwise.
Cohort 05	=1 if Year-Group is 2005; =0 if otherwise.
Cohort 06	=1 if Year-Group is 2006; =0 if otherwise.
Cohort 07	=1 if Year-Group is 2007; =0 if otherwise.
Cohort 08	=1 if Year-Group is 2008; =0 if otherwise.
Cohort 09	=1 if Year-Group is 2009; =0 if otherwise.

Cohort 10	=1 if Year-Group is 2010; =0 if otherwise.
Cohort 11	=1 if Year-Group is 2011; =0 if otherwise.
Other cohorts	=1 if Other than the listed cohorts and missing cohort; =0 if otherwise.
Captain Cohorts	
Cohort 1980 to 1989	=1 if Year-Group is 1980 to 1989; =0 if otherwise.
Cohort 1990 to 1995	=1 if Year-Group is 1990 to 1995; =0 if otherwise.
Cohort 1996 to 2000	=1 if Year-Group is 1996 to 2000; =0 if otherwise.
Other cohorts	=1 if Other than the listed cohorts and missing cohorts; =0 if otherwise.
Commander Cohorts	
Cohort 1990 to 1994	=1 if Year-Group is 1990 to 1994; =0 if otherwise.
Cohort 1995 to 2001	=1 if Year-Group is 1995 to 2001; =0 if otherwise.
Cohort 2002 to 2006	=1 if Year-Group is 2002 to 2009; =0 if otherwise.
Other cohorts	=1 if Other than the listed cohorts and missing cohorts; =0 if otherwise.

*Critical Warfare Subspecialties (CWS) include the Critical Care, Psychiatric and Preoperative subspecialties.

**Nurse Providers include Family Nurse Practitioners, Nurse Midwives, CRNAs, Women's Health, Pediatrics and Psychiatric nurse providers.

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APPENDIX C. SUPPLEMENTAL TABLE

Table 14. Probit Regression to Show Marginal Effects of Dependent Children by Grade

VARIABLES	(1) LCDR Promotion	(2) CDR Promotion	(3) CAPT Promotion
Male	0.0143 (0.0294)	-0.0346 (0.0336)	-0.0195 (0.0396)
Asian	-0.0722 (0.0567)	-0.0853 (0.0591)	0.0182 (0.102)
Black non-Hispanic	-0.000425 (0.0395)	-0.0854* (0.0448)	-0.0246 (0.0545)
Hispanic	-0.0250 (0.0510)	0.0324 (0.0637)	-0.0221 (0.0736)
Other/Unknown Race/Ethnicity	-0.00785 (0.0576)	0.0226 (0.0680)	-0.0286 (0.0901)
Married	0.153*** (0.0429)	0.0738 (0.0474)	0.0775 (0.0471)
One dependent child	0.128*** (0.0290)	0.108*** (0.0344)	0.103** (0.0423)
Two dependent children	0.0926*** (0.0291)	0.0675** (0.0328)	0.0522 (0.0384)
Three dependent children	0.0515 (0.0347)	0.0364 (0.0391)	0.0192 (0.0494)
Four or more dependent children	0.0381 (0.0510)	0.0568 (0.0570)	-0.0157 (0.0635)
Age at Commissioning 26 to 39	-0.0631* (0.0333)	-0.238*** (0.0370)	-0.0589 (0.0378)
Age at Commissioning 40+	-0.0744 (0.0802)	-0.308*** (0.0447)	-0.195*** (0.0583)
Age at Commissioning is unknown	-0.283** (0.114)	- -	- -
Cohort 02 (O4: 1995 to 2001/O5: 1990 to 1990)	0.0176 (0.0662)	0.464*** (0.0563)	0.0407 (0.0504)
Cohort 03 (O4: 2002 to 2006/O5: 1996 to 2000)	0.0489 (0.0663)	0.0276 (0.0758)	-0.191*** (0.0477)
Cohort 04	0.0177 (0.0642)	- -	- -
Cohort 05	-0.105 (0.0702)	- -	- -
Cohort 06	-0.0198 (0.0634)	- -	- -
Cohort 07	-0.0801	-	-

VARIABLES	(1)	(2)	(3)
	LCDR Promotion	CDR Promotion	CAPT Promotion
Cohort 08	(0.0642) -0.125*	-	-
Cohort 09	(0.0651) -0.550***	-	-
Other cohorts	(0.0488) -0.426*** (0.0743)	- -0.102 (0.172)	- - -
Observations	1,345	1,155	636
Standard errors in parentheses		Pseudo R2	
*** p<0.01, ** p<0.05, * p<0.1	0.1891	0.1988	0.0786

Data obtained from OPINS (2010 to 2018)

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