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# An Analysis of Turnover Among the Civil Service Components of the Department of Defense Acquisition and Medical Workforces

December 22, 2020

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Graduate School of Defense Management

**Naval Postgraduate School**



Prepared for the Naval Postgraduate School, Monterey, CA 93943.


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# Executive Summary

This study is an analysis of workforce turnover behavior among two segments of the Department of Defense (DoD) civilian workforce. Its research objective is to identify turnover trends among the civil service medical health care workforce and the civilian component of the defense acquisition workforce. The focus on the civilian medical workforce is notable because the Defense Health Agency is currently undergoing a significant reorganization. Establishing baseline turnover patterns prior to the completion of the reorganization will facilitate future program evaluations of the impact of the reorganization on the medical workforce.

In both groups, the overall pattern of attrition was consistent with the life-cycle model of turnover behavior. Employees that are not yet eligible for retirement had higher propensities to separate at early stages of their careers and relatively low attrition rates as they approach retirement eligibility. Retirement-eligible personnel conversely separate at an accelerating rate as they move past their earliest eligibility date. The preliminary statistical analysis illustrated how these two overall patterns hold for both medical and acquisition employees but also highlighted how the acquisition workforce benefits much more from midcareer appointments. This surge of older appointees flowing into the workforce from uniformed services also affects the outflow years later as these employees retire. Even if medical and acquisition employees respond relatively similarly to advancement in age and tenure, the difference in the composition of the workforce will change the recruitment, training, and succession planning strategies needed to manage the two types of employees.

Another finding from this study is that the DoD can do much better in hiring racial minorities into technical and white-collar positions. This analysis of the medical workforce found that personnel identifying as Black, Native American, and Hawaiian or Pacific Islander were almost twice as likely to be employed in blue-collar work, while employees identifying as White or Asian were nearly evenly distributed between the two labor categories. Pursuing diversity and representation within occupational categories, and not just within the workforce as a whole, is essential to achieving a public workforce

that aligns with the American public. Furthermore, our attrition analysis found that employees identifying as Black, Asian, and Hawaiian and Pacific Islander had lower likelihoods of voluntarily separating when compared to white employees. Attaining diversity within these technical fields will also bring a more stable workforce.

For the acquisition workforce, the study employed command-level employee satisfaction survey results to estimate whether organizational climate affects turnover behavior. On this point, the model output was inconclusive, and no statistically significant relationship between turnover and employee satisfaction was identified. Sensitivity analysis revealed a similar life-cycle trend for employees in both the medical and acquisition workforces. The primary difference in turnover incidence between the two segments of the workforce is the much larger intake of employees at the midcareer level of experience within the acquisition workforce. This difference in the inflow of acquisition personnel leads to a different demographic profile of the workforce when compared to the medical professionals.

# Acknowledgments

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# Introduction

## Purpose

This study is an analysis of workforce turnover behavior among two segments of the Department of Defense (DoD) civilian workforce. Its research objective is to identify turnover trends among the civil service medical healthcare workforce and the civilian component of the defense acquisition workforce. This research is sponsored by the Acquisition Research Program at the Naval Postgraduate School (NPS).

Understanding how specific subsets of the civilian workforce are experiencing turnover is important to addressing the human resource challenges facing the DoD. As the Defense Health Agency (DHA) undertakes a significant reorganization as part of its transition to a combat support agency (CSA) and simultaneously assumes control of 400 military treatment facilities (MTFs), the nature of the work conducted by civilian healthcare workers is transitioning. These changes may impact quality of life and job satisfaction for these employees and subsequently alter their turnover behavior for the coming years. Establishing a baseline for turnover behavior prior to this transformation will be important for facilitating future evaluations of how this transformation impacted the civilian workforce.

Analyzing turnover among the defense acquisition workforce is important to ensuring adequate human capital to implement the acquisition process. The DoD requires a skilled and knowledgeable workforce that can perform procurement actions in a timely manner and in compliance with federal laws and regulations. These skills are highly valued in the private sector, and recruitment and retention of this workforce is an ongoing challenge. Understanding recent trends in turnover within this subset of the workforce will help guide strategic workforce management.

The quantitative analyses described in this report make use of employee personnel records maintained in the Army Analytics Group's (AAG) Person–Event Data Environment (PDE). The PDE enables access to records describing individual turnover behavior without exposing the personally identifiable information (PII).

## Background

This project is a continuation of a multiyear investigation into turnover behavior among the DoD civilian workforce. The research team includes faculty from the NPS Graduate School of Defense Management (GSDM) and the Operations Research Department. This team also works in collaboration with personnel from the Army's the Research and Analysis Center (TRAC) Monterey office. Prior products from this research team include two technical reports (Brien, 2019; S. Buttrey et al., 2018) and a working academic manuscript (Brien et al., 2020). Prior studies examined the civilian workforce as a whole; this report narrows its focus to look at medical and acquisition personnel separately.

Team members include

- Dr. Lyn R. Whitaker, Associate Professor, NPS
- Dr. Samuel E. Buttrey, Associate Professor, NPS
- Dr. Spencer T. Brien, Assistant Professor, NPS
- Major Kurt Klingensmith, Combat Analyst, TRAC–MTRY

This report was heavily supported by two NPS MBA students that pursued this topic as part of their respective master's theses:

- Commander Stephanie Paone, MBA, GSDM, March 2020
- Lieutenant John McCauley, MBA, GSDM, March 2020

CDR Stephanie Paone defended a thesis examining turnover among the civilian medical workforce, while LT John McCauley examined the acquisition workforce.

# Scope

The objective of this study is to develop estimates of the determinants of workforce turnover among two subpopulations within the DoD civilian workforce. One section of the study examines the civilian medical workforce and seeks to establish baseline turnover estimates for the DHA prior to its reorganization. These baseline estimates were generated using 2014 data. Future efforts to estimate the impact of the DHA reorganization on civilian turnover can use the estimates generated in this study as an initial comparison point.

The second branch of this study examines turnover among the civilian acquisition workforce. The latter analysis of acquisition employees is distinct because it incorporates employee satisfaction survey data repurposed from prior research conducted by NPS GSDM professors Rene Rendon and Ned Powley. Integrating employee satisfaction measures along with economic factors such as retirement eligibility status, pay, and geographic cost indicators has not yet been accomplished in the workforce turnover literature. These results have the potential to significantly advance the study of turnover behavior.

The analysis is conducted using logistic regression analysis to estimate the relationship between individual and organizational characteristics and the likelihood that an individual would voluntarily separate from civil service within the year. This approach applies a life-cycle model of turnover behavior. This model uses employee age and years of service as the primary drivers of turnover behavior. It then estimates turnover differentials across organizational and demographic classifications within the workforce.

An additional component of this analysis is a descriptive review of the features of the medical and acquisition workforces. The medical workforce analysis explores differentials in the demographic characteristics of employees filling white-collar versus blue-collar occupational categories. The study reveals significant differentials across racial categories, with employees identifying as Black, Native American, and Hawaiian or Pacific Islander being highly concentrated in blue-collar work, while a nearly 50–50

split across white- and blue-collar work exists for employees identified as White or Asian.

# Literature Review

## Turnover Behavior in the DoD

Understanding turnover behavior among the DoD civilian workforce is an important component of strategic workforce management. Civilian personnel perform a variety of functions that are crucial to the operations of the DoD. This workforce, however, has for decades been subject to a variety of adverse environmental conditions, such as pay freezes, furloughs, and other factors that can contribute to increased rates of voluntary separation (Fernandez et al., 1985). While turnover among uniformed military personnel has been a topic of focused study for many years, the civilian DoD workforce has received less attention (Baldor, 2018; Buddin, 1984; Gebicke, 1998; Government Accountability Office, 1997; Rabkin, 2000).

This study explicitly builds off of prior research by Brien (2019), S. Buttrey et al. (2018). These studies, conducted in collaboration with TRAC–Monterey and the DoD Office of People Analytics, include nonparametric survival analyses of turnover among civilian employees across the entire DoD. Collectively, the studies examined gender-based turnover differentials in a variety of different contexts, such as the variation in gender-based turnover differentials across different military branches. Their work also explored gender differentials across different categories of science, technology, engineering, and mathematics (STEM)-affiliated occupation statuses. The key findings of those studies centered on the lack of a gender differential in turnover for women filling STEM occupations, while a significant gender gap persists in non-STEM job categories.

This study advances research on turnover among the civilian DoD workforce by examining two subsets of the workforce in greater detail. The healthcare workforce and the acquisition workforce constitute two distinct subsets within the DoD. The nature of their work and their skillsets are crucial to continued DoD operations. Analyzing the trends associated with turnover in each of these communities separately may help produce insights that improve the administration of these populations.

## The Medical Civilian Workforce

Understanding the institutional background of the ongoing reorganization of the DoD civilian medical workforce is provides context for current turnover trends within this subpopulation. In a thesis completed in collaboration with this research project, Paone (2020) described the motivation for this reorganization:

> In fiscal year 2018, the Defense Health Agency (DHA) began a four-year transition plan to assume authority of the Department of Defense's (DoD) Military Healthcare System (MHS) including over 400 military treatment facilities (MTFs) that serve over 9.4 million patients worldwide (Defense Health Agency [DHA], 2019a). The U.S. Congress mandated the formation of a centralized governance of the MHS in 2013, and subsequently, the Deputy Secretary of Defense directed the official establishment of the DHA as a Combat Support Agency (CSA) in March of the same year (DoD Directive: 3000.06, 2013). However, the proposal to integrate military medical services into a joint system to increase quality of care and efficiency is not a new concept and is one experts have been proposing repeatedly since the 1980s. The most recent push and subsequent creation of the DHA followed a 2011 DoD special task force report on MHS governance that cited inconsistencies and inefficiencies in the delivery system (DHA, 2017). Under the previous system, each of the armed services (U.S. Navy, Army, and Air Force), respectively, managed its own medical treatment facilities in a jointly supportive but non-integrated system.
>
> The purpose of the DHA is to ensure the standardization of quality of care to all its military healthcare beneficiaries as part of a larger effort to provide greater integration of services and a more centralized control over purchased care. The DHA reports its mission is to achieve greater integration of direct and purchased care delivery systems, so it can accomplish a "4-point aim"—achieve medical readiness, improve the health of its beneficiaries, enhance the experience of care, and lower healthcare costs (DHA, 2019a). The DHA further establishes its agency goals as follows:
>
> > "Empower and Care for Our People
> >
> > Optimize Operations Across the Military Health System
> >
> > Co-create Optimal Outcomes for Health, Well-Being and Readiness
> >
> > Deliver Solutions to Combatant Commands" (DHA, 2019a, p. 1).
>
> The DHA is expected to complete a full transition of operations governance before fiscal year 2022 across all armed services and their respective MTFs. At this time, military active duty manpower will fall under the command of a joint readiness center environment which will share a

> commanding officer with the MTF during the transition. The commanding officer will be accountable to both the DHA and Combatant Commanders. This proposed organizational structure has remained fluid with evolving strategy, and it may continue to change with strategy implementation as this landmark organizational transition continues. (Paone, 2020, pp. 1–2)

Examining the healthcare workforce separately from the rest of the civilian workforce may help reveal the ways that the unique aspects of healthcare work impact turnover decisions. Healthcare workers experience unique training, labor hours, and environmental conditions relative to other DoD employees. Recent research on turnover among the broader healthcare community highlights the role of burnout in increasing employees' intention to voluntarily separate from medical employment (Aiken et al., 2002; Gesesew et al., 2016; Rambur et al., 2008).

Although medical professionals endure many years of specialized training to become doctors, nurses, physician's assistants, and the other various forms of medical professionals, recent research has identified relatively high turnover rates among younger professionals. McGrail et al. (2017) examine physician turnover rates in both rural and urban communities. Their analysis revealed that, during the 2000–2014 period, physicians under the age of 45 had double the turnover rate of their older colleagues. The authors identify institutional sorting as one problem; it led to poorer and more rural areas losing their physicians at a higher rate.

The institutional factors that McGrail et al. (2017) identify as having an impact on turnover behavior may manifest in the DoD medical workforce. As organizations undergo periods of transition, it is more complicated and challenging to offer the institutional support that younger professionals need to keep them in the profession. Additionally, adverse institutional conditions may cause older professionals to accelerate their retirement plans. Understanding the baseline turnover prior to the organizational changes will enable future researchers to perform a program evaluation of the impact of DHA's transition plan on employee retention.

## The Defense Acquisition Workforce

Ensuring that the Defense Acquisition Workforce is sufficiently staffed, both in terms of size and breadth of skills, is essential to maintain the pace of defense procurement. McCauley's (2020) thesis, written in collaboration with this research project, describes the challenge of monitoring and stabilizing turnover within this workforce:

> The U.S. government annually spends hundreds of billions of dollars on national defense; although this is a tremendous amount of money, every cent of that is needed to ensure that the United States remains the world's strongest military power. The DoD Acquisition Workforce (AWF) oversees the utilization and spending of large amounts of this budget. These General Schedule (GS) employees are responsible for the "development, acquisition and sustainment of warfighting capabilities, systems and services" (Secretary of the Navy [SECNAV], 2019, p. 1). In keeping with the Defense Acquisition Workforce Improvement Act (DAWIA) of 1990, the AWF is made up of highly skilled and qualified federal employees. For example, most of the Department of the Navy's acquisition employees are a GS-13, which is two below the max rank for the General Schedule system; their military counterparts are usually an O-4 ([SECNAV], 2019). These are relatively senior positions that require a great deal of training and responsibility.
>
> However, due to contractual differences between military and civilian personnel, civilian employees can be much harder to maintain and replace. Civilians can decide to terminate from a position whenever they choose, regardless of whether there is a scheduled replacement or not. Acquisition employees also have incredibly valuable skills that can easily transfer to high paying, private sector positions. The very jobs and contracts that the AWF oversees provides the expert experience needed for the lucrative civilian market. For this exact reason, it is critical that the DoD does its absolute best to retain the talent it already has. Hiring new employees within the GS system is incredibly difficult as well. There is a great deal of litigation that goes along with the process that keeps it from being quick and timely. This same process makes it equally difficult to fire or terminate undesirable employees. That is why it's so important to acquire and retain qualified workers the first time around. If the AWF is experiencing high attrition rates, the entire acquisition process can sometimes come to a screeching halt. This is not only a waste of millions—and sometimes billions—of taxpayer dollars but in some instances, it can cost the lives of U.S. military members. It is always of the utmost importance that we get safe, reliable, and superior equipment to our fighting forces as fast as humanly possible. Therefore, every action possible must be taken to mitigate civilian acquisition attrition and ensure that the AWF always employs the best and brightest people. (McCauley, 2020, pp. 1–2)

A series of studies published by RAND have sought to document changes in the inventory of the defense acquisition workforce over the last 2 decades (Gates et al., 2008, 2009, 2013, 2018). These reports provide a detailed descriptive analysis of various characteristics of acquisition employees, such as the distribution of new acquisition hires across the military service branches, the relative level of education of employees, and the pace of retirements among this workforce. Key findings include observations that (1) new hires into acquisition job categories have a higher level of education in 2017 than they did a decade prior, and (2) the civilian acquisition workforce has a lower turnover rate that the rest of the civilian DoD workforce (Gates et al., 2018).

The authors of the RAND studies note that a key limitation of their work is the lack of data on contracted workers performing acquisition tasks. This is a near universal constraint on studies relying on extracts from the Defense Manpower Data Center, which only contains records of direct employees of the DoD. Another aspect of the RAND studies that is not a limitation, but a feature that differs from this analysis, is that they do not engage in statistical modeling to identify the relationships between employee characteristics and turnover behavior. The studies provide deep and detailed historical descriptions of trends within the acquisition workforce, but they do not seek to identify causal relationships between different features of the workforce.

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# Methodology and Data

## Data

The data for this analysis are obtained from the civilian master files maintained by the Defense Manpower Data Center. These data were accessed through the PDE operated by the AAG. The data used in this study consist of two subsets of the full civilian workforce data set used in Brien (2019) and S. Buttrey et al. (2018). As described in the prior report,

> the civilian master files contain demographic and detailed information found in an employee's personnel file. We merge the civilian transaction files with the civilian master files to catch all the data transactions that take place within each employee's record. These transactions are changes in the employee's career, which include salary changes, changes of appointment, and, most importantly, separation. We flag those employees with separation transactions to determine which employees attrite during the eight years of our study. We also classify employees as "disappeared" who do not have a separation transaction file, but their master file quarterly snapshots end during the research period, indicating they are no longer employed. (S. Buttrey et al., 2018, p. 30)

After the separations were identified in the data, we limited the data set to a cohort of civilian DoD employees that were appointed to their positions in 2009. This reduced the total count of individuals tracked in our study to 102,009. Another 4,355 records were dropped due to missing or inconsistent data. The total number of individuals tracked in the 2009 employee cohort was 97,654. These individuals were observed over an 8-year period. As time passed, we were able to observe members of the 2009 cohort separate from federal employment and then conduct statistical analyses of the employee attributes that were associated with higher turnover rates.

Limiting the analysis to the 2009 cohort provides a comparable sample of individuals for an analysis of separation behavior. Members of the cohort were subject to the same macroeconomic effects that influence turnover behavior. Although cohort members were all newly appointed to federal service in 2009, the sample contains considerable variation in the age at entry, level of education, and employment history

characteristics[1]. This study examines two subsets of this cohort: the acquisition and medical workforces.

Although Brien (2019) and S. Buttrey et al. (2018) employed nonparametric survival analysis methods to examine turnover behavior, this study ultimately used parametric logistic regression methods to model relationships between employee and environmental characteristics and turnover. This change in the methodology from what was initially intended in the project proposal was made for two compelling reasons. First, peer reviewer feedback received on an academic manuscript that was derived from the Brien (2019) report highly recommended using a parametric approach that is more familiar to the academic audience of the public human resource management literature. As noted in Brien (2019), the public human resource management literature contains relatively few studies of turnover behavior, and those that do exist, such as Cho and Lewis (2012), do not have access to individual-level behavior tracked over multiple consecutive years. The relative novelty of the data set used in this series of studies makes replicating some of the earlier estimates in the broader literature of the marginal effects of individual characteristics on turnover behavior a highly desirable contribution. Given this external feedback, the methodology of this study has been adjusted to have greater external impact. A second reason motivating the change in methodology is that it allowed the thesis students who assisted in this research, Paone and McCauley, to participate to a much greater extent because the methods aligned with those presented in their NPS coursework.

Shifting from a survival analysis approach to a logistic regression strategy necessitated a narrowing of the analytic focus of the analysis. Instead of measuring turnover outcomes of the entire cohort from 2009 through 2017, the study instead examines turnover within the cohort that occurred within a single year—2014. This allows the creation of a single binary outcome variable measuring whether the individual separated from employment in 2014.

Two subsets of the data are created: one for the healthcare workforce and the other for the acquisition workforce. The healthcare workforce is identified using the Job

[1]See Brien (2019) for descriptive statistics of the entire 2009 cohort.

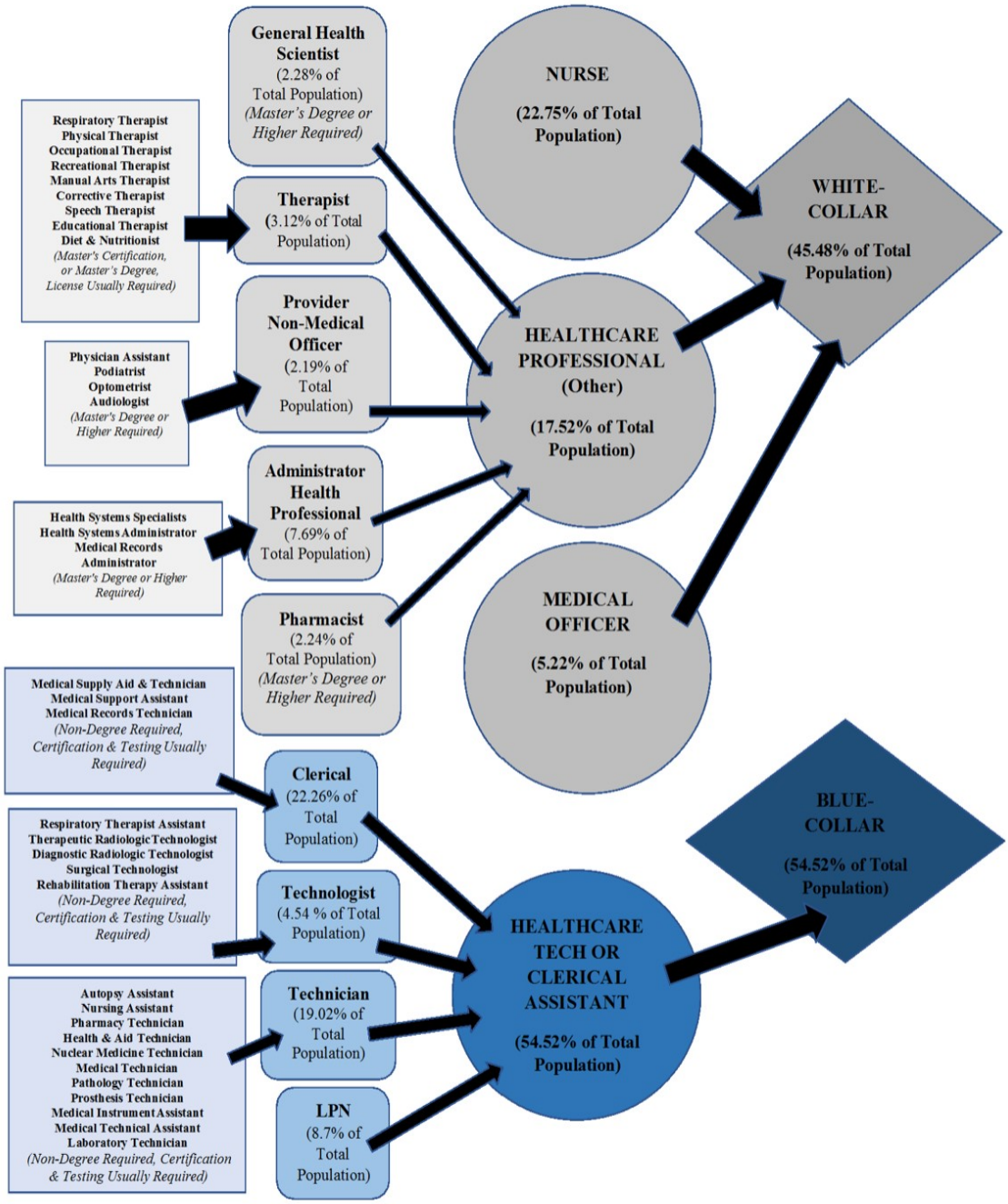
Family Standard (JFS) series code (U.S. Office of Personnel Management, 2017). The 0600 classification identifies jobs in the Medical and Healthcare Group. This includes physicians, nurses, physical therapists, and other categories of medical professionals. Individuals in the 0600 group whose occupation is associated with custodial work or dental care were excluded from the subset. Additionally, individuals whose listed age at time of entry to employment was below 18 or over 80 were dropped from the analysis. The final count of individuals taken from the 2009 cohort that were employed for at least part of 2014 consists of 50,946 unique people.

The acquisition workforce was identified by selecting 20 job series codes that are associated with acquisition work. Table 1 identifies the selected job series. After limiting the 2009 cohort to just these job series and following the same data cleaning process as used with the medical data, a subset of 105,940 individuals were identified.

**Table 1. Job Series Used to Identify Acquisition Workforce**

| Acquisitions | |
|---|---|
| 0346 | Logistics Management Specialist |
| 0530 | Cash Processing |
| 0540 | Voucher Examining |
| 0962 | Contact Representative |
| 1102 | Contracting Series |
| 1105 | Purchasing Series |
| 1106 | Procurement Clerical and Technician Series |
| 1107 | Property Disposal Clerical and Technician Series |
| 1109 | Grants Management Series |
| 1170 | Realty Series |
| 1171 | Appraising Series |
| 1173 | Housing Management Series |
| 1176 | Building Management Series |
| 1654 | Printing Services |
| 1670 | Equipment Services |
| 2131 | Freight Rate Series |
| 2001 | General Supply Series |
| 2003 | Supply Program Management Series |
| 2005 | Supply Clerical and Technician Series |
| 2010 | Inventory Management Series |

The personnel data obtained from the PDE environment contain a variety of individual characteristics that may impact turnover behavior. Individual demographic characteristics such as age, sex, and race are each included in the data. The medical workforce subset includes codes that distinguish between nine different occupational categories. These allow differentiation between occupations that require higher-education degrees versus those that do not. Additionally, some professions, such as nurses, require regular shift work, which may incur a higher physical toll on employees over time. Differentiating between nurses and medical professionals that do not commonly engage in shift work, such as physical therapists, may help further identify differences in turnover behavior within the medical workforce. Figure 1 depicts the occupational codes and the educational requirements of each category.




Notes: Original occupation types derived from OPM 0600 Series occupational codes listed in DMDC data. Percent population is percent from total 2014 cohort population data.

**Figure 1. Occupation Variables Sorting Process. Source: Paone (2020).**

Prior research stemming from this multiyear project focused on turnover differentials between blue-collar and white-collar employees (Morgan, 2019; Urech, 2019). Their studies sought to determine whether employees engaged in different types

of work exhibit different turnover patterns. Copeland's (2008) review of transformational trends in the composition of the federal workforce highlighted the increase in the number of white-collar jobs and the underrepresentation of women in white-collar jobs, particularly among the Senior Executive Service. More recently, some career areas that have been traditionally filled by women, such as nursing, have been described as "pink-collar" (Howe, 2017). These professions traditionally require significant education and credentialing but do not operate in an office environment.

As shown in Figure 1, we divide the medical workforce into four categories: (1) healthcare tech or clerical assistant, (2) medical officer, (3) healthcare professional, and (4) nurse. We create indicator variables for each category and include them in the model to estimate whether the medical occupation class is associated with differential turnover behavior. Understanding these behavioral differentials may help guide strategic hiring to replace losses to voluntary attrition. It may also help identify subpopulations of the medical workforce that could be targeted for retention policies. The first category, healthcare tech or clerical assistant, is omitted from the model and is treated as the baseline subpopulation. The estimates of the other categories are the differential turnover effect of being in those other categories relative to the base subpopulation's behavior.

The fields from the personnel records that describe the individual's federal work history are especially important to this analysis. The appointment date field, in combination with the employee's age, is used to compute retirement eligibility dates. These dates are also adjusted using records detailing prior years of federal service. From the retirement eligibility dates, we generate indicator variables to identify whether the employee is eligible to retire in 2014. The level of educational attainment is also reported in the civilian records. We create a series of indicator variables to denote different education levels.

The personnel records include fields describing the organizational location of the employee within the DoD. These codes identify both the service branch in the U.S. military and, for the acquisition employees, an organizational code that identifies the naval command employing Navy personnel. Controlling for these organizational

characteristics may help capture some unobserved features of organizational climate and culture that influence employee satisfaction and, subsequently, turnover behavior.

The acquisition data are merged with the survey results from a Director for Acquisition Career Management (DACM) employment satisfaction survey. The results from this survey were used in two NPS theses assessing acquisition command climate (Collins & Garcia, 2018; McKeithen, 2016). In the survey, employees were asked to report on 11 dimensions of job satisfaction. The questions related to job satisfaction, supervisor-related commitment, their job characteristics, job role ambiguity, job stress, commute strain/safety, work/family conflict, organizational justice, job fit, workplace values, and high-quality relationships. These questions were designed from work on organizational theory by Fields (2002). We computed average satisfaction scores by Navy command group and then use the command average for each measure as a control for the overall climate on that measure for all employees in the PDE cohort sample.

There are several limitations to this approach. First, the respondents to the survey are not the same individuals in the 2009 cohort. The survey was administered to both uniformed and civilian personnel, and it is not possible to separate them. Second, the survey was administered on a relatively small sample of acquisition employees. After cleaning the data, complete results that are usable for the analysis were only obtained from 672 respondents. Examining the distribution of responses across the Navy commands, some commands only had a handful of usable results. Table 2 displays the distribution of responses by command and sex.

**Table 2. Survey Observations by Command. Source: McCauley (2020).**

| Observations by Command and Gender | Code | Male | Female | Total |
|---|---|---|---|---|
| NAVAIR (Naval Air Systems Command) | 1 | 46 | 79 | 125 |
| NAVSEA (Naval Sea Systems Command) | 2 | 66 | 73 | 139 |
| NAVSUP (Naval Supply Systems Command) | 3 | 74 | 68 | 142 |
| SPAWAR (Space and Naval Warfare Systems Command) | 4 | 14 | 26 | 40 |
| MARCORSYSCOM (Marine Corps Systems Command) | 5 | 1 | 2 | 3 |
| MSC (Military Sea Lift Command) | 6 | 12 | 6 | 18 |
| SSP (Strategic Systems Programs) | 7 | 1 | 1 | 2 |
| BUMED (Bureau of Medicine and Surgery) | 8 | 1 | 0 | 1 |
| OPNAV (Office of the Chief of Naval Operations) | 9 | 2 | 4 | 6 |
| OSBP (Office of Small Business Programs) | 10 | 2 | 2 | 4 |
| MARCOR I&L (Marine Corps Installations and Logistics Command) | 11 | 2 | 2 | 4 |
| NAVFAC (Naval Facilities Engineering Command) | 12 | 78 | 93 | 171 |
| ONR (Office of Naval Research) | 13 | 8 | 9 | 17 |
| **TOTAL** | | **307** | **365** | **672** |

Due to the limited number of responses in some command units, we exclude those commands from the analysis of acquisition turnover. Only five commands, NAVAIR, NAVSEA, NAVSUP, SPAWAR, and NAVFAC are included in the analysis. Making this restriction reduces the subsample size of the acquisition workforce to 5,541 individuals. Although this is costly in terms of data, the scientific benefits of conducting a turnover analysis with both measures of actual behavior and employee satisfaction justify this limitation. As discussed in Brien (2019), studies of public sector turnover have had very limited access to actual turnover data, and those that have had it relied on agency-level figures of turnover rates. The individual-level data this team has accessed in the PDE environment is still relatively unique in this field. Integrating it with employment data to test a more complete model of turnover behavior that incorporates both economic and psychological factors relating to turnover is a significant advancement to the study of workforce attrition. Table 3 depicts the average employee satisfaction averages for each of the eleven dimensions identified in the survey.

**Table 3. Employee Satisfaction Averages by Command**

| Command | JobSatAve | SupCom | JobChaAve | JobRoleAve |
|---|---|---|---|---|
| NAVAIR | 5.075 | 4.255 | 5.051 | 5.642 |
| NAVSEA | 5.135 | 4.446 | 5.007 | 5.545 |
| NAVSUP | 5.021 | 4.213 | 4.833 | 5.521 |
| SPAWAR | 5.420 | 4.541 | 5.294 | 5.921 |
| NAVFAC | 4.864 | 4.381 | 4.803 | 5.769 |

| Command | JobStressAve | CommStSafAve | WKFMConflictAve | OrgJusticeAve |
|---|---|---|---|---|
| NAVAIR | 2.688 | 2.477 | 3.779 | 3.372 |
| NAVSEA | 2.889 | 2.983 | 3.685 | 3.255 |
| NAVSUP | 2.670 | 2.700 | 3.287 | 3.300 |
| SPAWAR | 2.503 | 2.979 | 3.569 | 3.325 |
| NAVFAC | 2.937 | 2.702 | 4.057 | 3.284 |

| Command | JobFitAver | WkPlaceValuAve | HQCExperiencesAve |
|---|---|---|---|
| NAVAIR | 3.532 | 4.599 | 5.257 |
| NAVSEA | 3.667 | 4.632 | 5.359 |
| NAVSUP | 3.624 | 4.562 | 5.485 |
| SPAWAR | 3.955 | 4.865 | 5.439 |
| NAVFAC | 3.713 | 4.193 | 5.301 |

Note: The columns contain average scores for each of the 11 dimensions of job satisfaction. These are defined as: Overall job satisfaction (JobSatAve), Supervisor Related Commitment (SupCom), Job Characteristics (JobChaAve), Job Role Ambiguity (JobRoleAve), Job Stress (JobStressAve), Commute Strain/Safety (CommStSafeAve), Work/family Conflict (WKFMConflictAve), Organizational Justice (OrgJusticeAve), Job Fit (JobFitAver), Workplace Values (WkPlaceValuAve), and High-quality Relationships (HQCExperiencesAve).

## Model of Turnover Behavior

This study examines turnover behavior among the DoD civilian workforce using a life-cycle model of turnover behavior. This model, described by Cho and Lewis (2012), explores the economic rationale behind the employee's decision to voluntarily separate from their job. This economic model predicts that employees will choose to leave their job when the expected benefits of other employment or retirement exceed their current compensation. Tangible factors such as pay, commuting costs, and health and retirement benefits are key factors in this decision. Other nontangible factors also included in the model are the organizational environment and employee job satisfaction (Pitts et al., 2011).

This analysis employs a logistic regression model. The dependent variable is a binary indicator of whether the individual voluntarily separated from public service in 2014. The model is designed to obtain estimates of the marginal effect of changes in the explanatory variables on the odds that an attrition event will occur.

The estimates generated from a logistic regression are the log of the odds ratio, often referred to as the log-odds ratio. Although the log-odds ratio can indicate the sign and statistical significance of the marginal effect of a variable on the odds of an attrition event, it has relatively little interpretative value. Usually, the log-odds is converted to an odds ratio by exponentiating it. Additionally, because the logistic function is nonlinear, the marginal effects of the odds ratio is calculated at different values of the explanatory variables, especially if they are discrete categorical variables, such as sex, education level, or profession. For continuous variables, the marginal effects are typically calculated at the mean value.

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# Findings

## Preliminary Analysis

Before presenting the results of the logistic regression analysis, this section of the report compares turnover with the distribution of the primary predictive variables used in the model. Doing so helps reveal the differences in the life-cycle characteristics of these two subpopulations of the civilian workforce. Additionally, understanding the features of these groups may help guide the interpretation of the statistical model.

The two primary predictive variables used in the life-cycle attrition model are age and years of service. The civilian employees are separated into two groups: those that experienced attrition in 2014 and those that did not. The decision to voluntarily separate from employment has a different economic and behavioral context if the employee is eligible to begin receiving retirement benefits following their separation. For this reason, both the preliminary analysis and the statistical analyses are conducted separately for those that are and are not eligible for retirement. Retirement eligibility for civilian employees is determined using age, years of service, and Office of Personnel Management (OPM) rules for the earliest eligibility date for a full retirement.

Figures 2a and 2b present, for the nonretirement eligible population, employee age in 2014 for the medical and acquisition workforces, respectively. The two lines in each graph separate the age distributions of the employees that did separate from federal employment from those that remained in employed status. Figure 2a illustrates that among the nonretirement eligible medical employees, a higher percentage of those that separated fell within the ages of 23 to 40. For those between the ages of 40 and 61, a higher percentage did not experience turnover. Among the acquisition employees depicted in Figure 2b, the younger workforce between 23 and 40 does not appear to show a difference in turnover behavior, while those aged between 40 and 55 show a relatively lower propensity to separate from federal employment. This indicates that retaining medical employees at earlier stages in their careers may be a greater challenge than retaining acquisition workers.

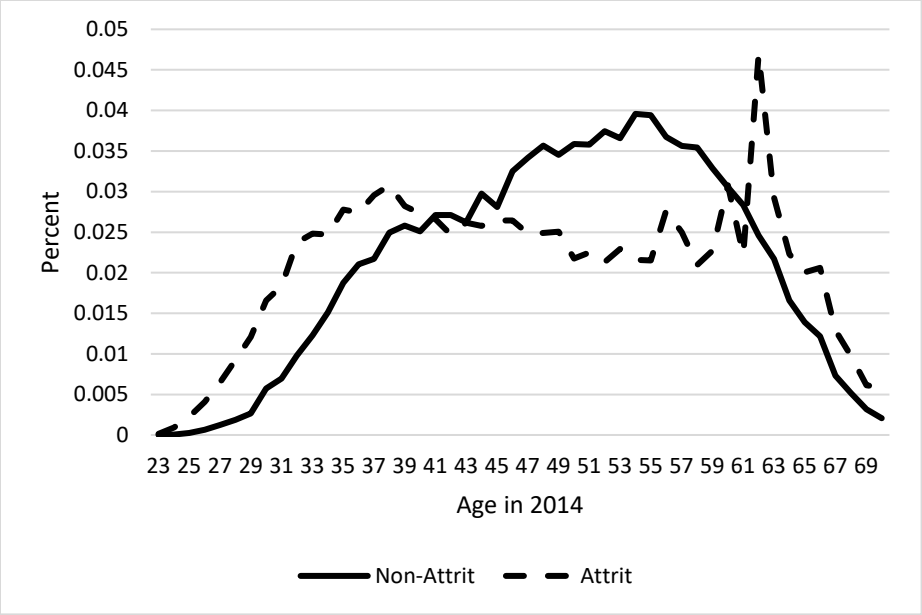


**Figure 2a. Nonretirement Eligible Medical Employees' Age by Turnover Outcome**

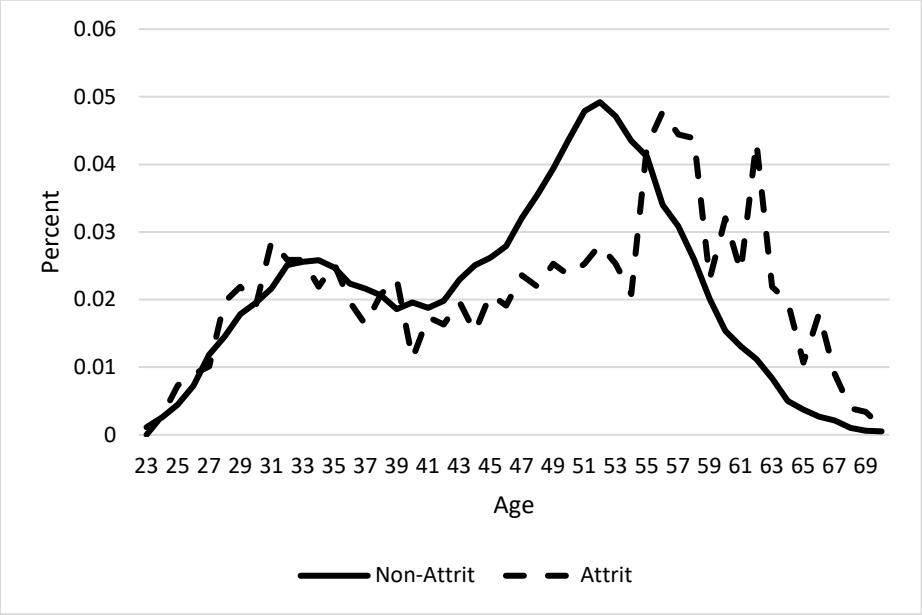


**Figure 2b. Nonretirement Eligible Acquisition Employees' Age by Turnover Outcome**

The retirement-eligible workforce depicted in Figures 3a and 3b exhibits a sharply different age distribution than the nonretirement eligible workers. The age distribution of the retirement-eligible medical workers show that relatively few are younger than 60 years of age. Additonally, the age distribution of those that separate and those that remain is relatively similar. There is a slightly higher percentage of

employees older than 65 among those that do turn over than those that remain within the retirement-eligible medical workforce.

The age distribution of the acquisition workforce is much more lumpy than the medical workforce, which had a single peak in the mid-60s. The prior reports issued from this research project by Brien (2019) and S. Buttrey et al. (2018) showed that the relatively large number of civilians entering employment with the DoD in their 50s is driven by retirements among uniformed personnel and their subsequent rehiring in civilian positions. The difference in the age profiles between the medical and acquistions employees illustrates that the medical workforce does not receive the same level of intake of former uniformed personnel as the DoD at large. In contrast, the acquisition workforce appears highly reliant on military rehires. Age does not appear to be associated with a turnover differential among acquistions workers between the ages of 58 and 64. Workers younger than 58 appear to have a lower rate of turnover, while those above 64 have a higher rate of turnover. This observation is consistent with a life-cycle model of employee turnover.

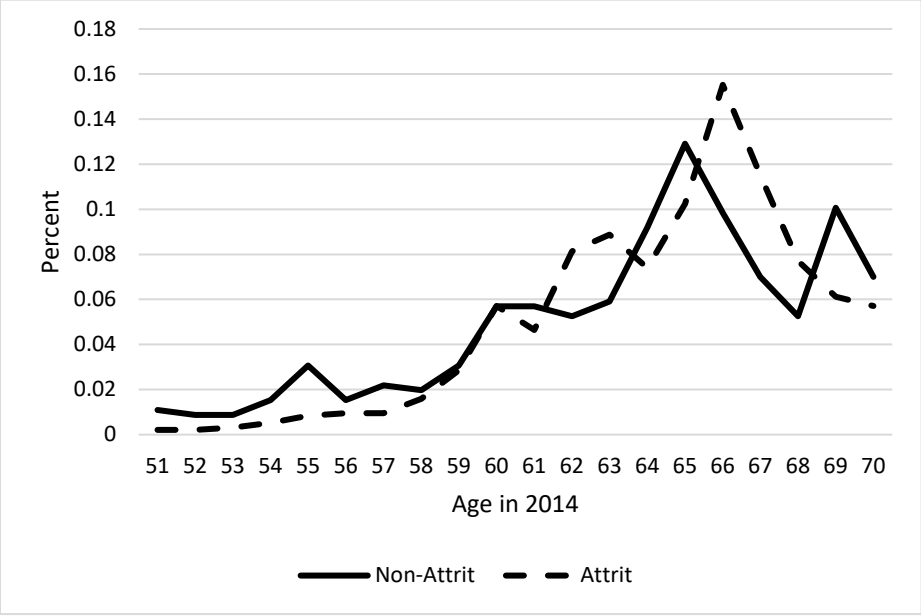


**Figure 3a. Retirement Eligible Medical Employees' Age by Turnover Outcome**

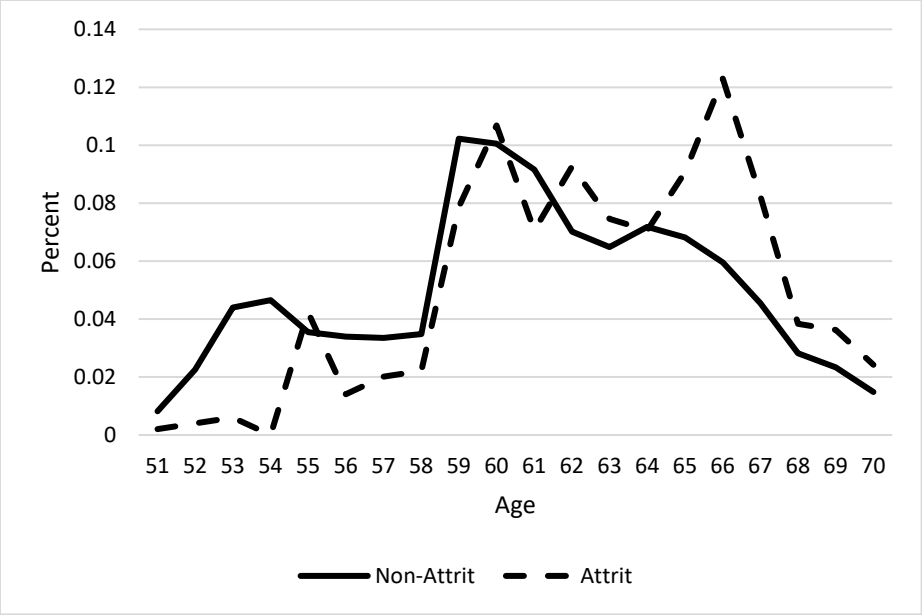


**Figure 3b. Retirement Eligible Acquisition Employees' Age by Turnover Outcome**

Figures 4a, 4b, 5a, and 5b depict the distribution of years of federal civilian service among the workforce groups. In all tables, the number of years of service has a lower bound at 4 years. This is because the sample comes from the 2009 cohort, where all members were appointed to their positions in 2009. All members of the sample have been employed at least since 2009. This constraint introduces a limitation to the study that it does not examine turnover among newly hired employees with less than 3 years of service. Instead it is constrained to turnover among those that have at least 4 years. The variation in the total years of service comes from employees having prior federal service in other agencies prior to their appointment within the DoD.

Figures 4a and 4b depict the distribution of years of service among nonretirement eligible workers in both occupational categories. For both groups, the distribution of years of service is right-skewed, with the majority of the population at relatively fewer years of service and a declining number of employees at higher levels of tenure. Within the acquisition workforce, there appears to be a minor bump around 24 years of service that continues to the end of the distribution, indicating that the acquisition sector has a larger share of highly experienced workers than the medical sector.

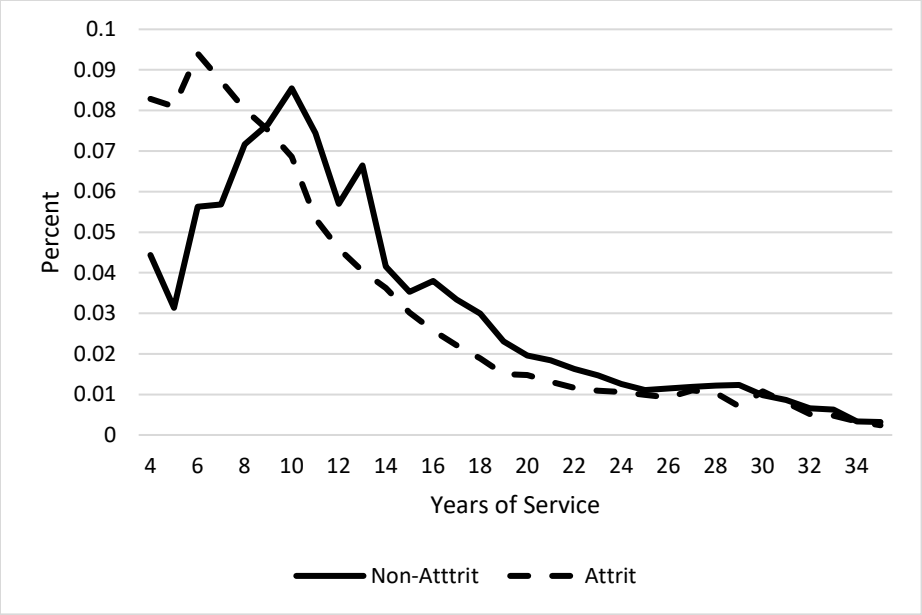


**Figure 4a. Nonretirement Eligible Medical Employees' Years of Service by Turnover Outcome**

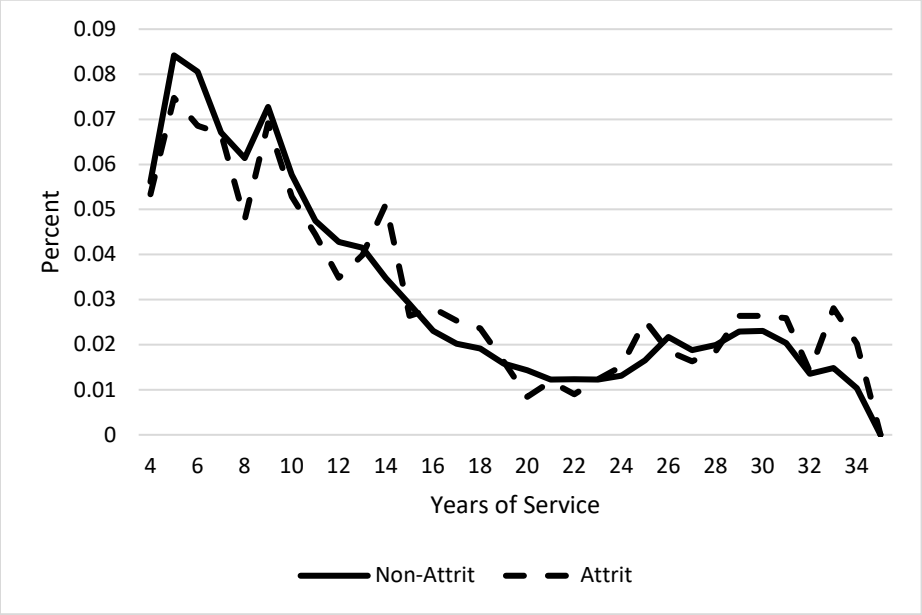


**Figure 4b. Nonretirement Eligible Acquisition Employees' Years of Service by Turnover Outcome**

The distribution of years of service across both retirement eligible occupation groups is the inverse of the nonretirement eligible groups. See Figure 5a and 5b. The key point to observe in these figures is that the medical workforce has a higher proportion of retirement eligible employees with relatively fewer years of service than the acquisition employees. These may be medical professionals that are transferring to

DoD medical positions from the private sector or from other federal agencies at late stages in their careers.

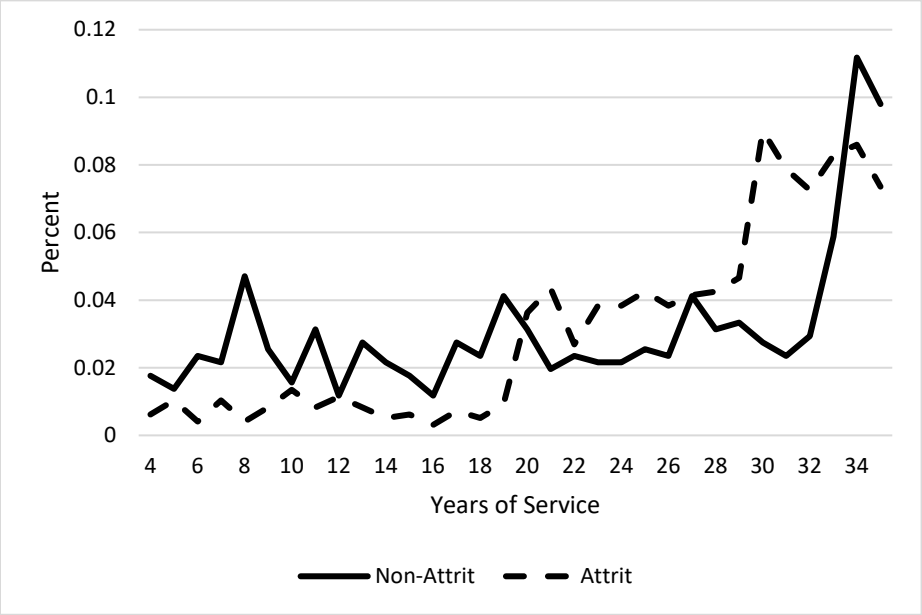


**Figure 5a. Retirement Eligible Medical Employees' Years of Service by Turnover Outcome**

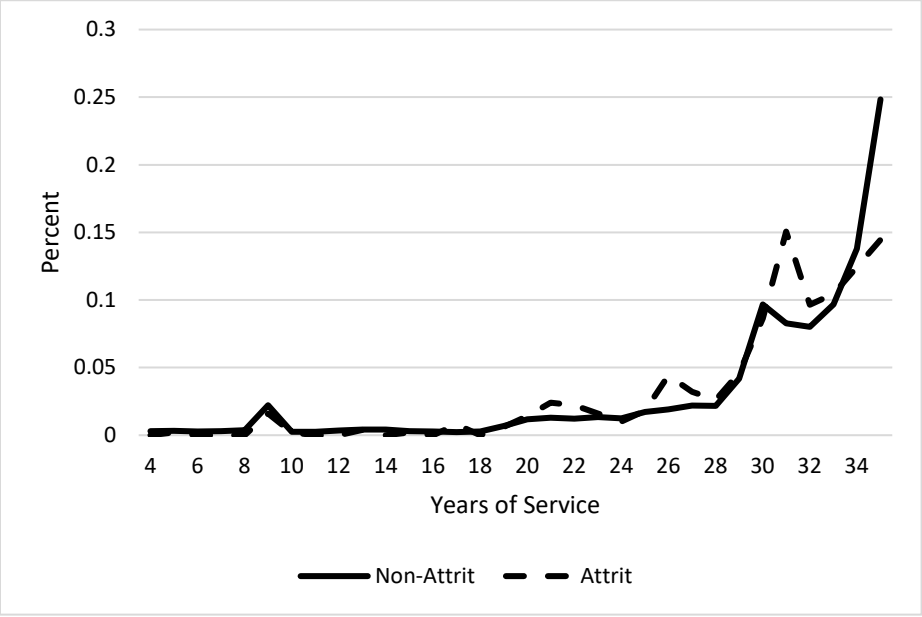


**Figure 5b. Retirement Eligible Acquisition Employees' Years of Service by Turnover Outcome**

These distribution graphs show that, in general, turnover within both the acquisition and medical workforces is consistent with the life-cycle model of turnover

behavior. The following statistical analysis using multivariate logistic regression will help provide greater nuance to this overall picture by providing estimates of the marginal effects of individual characteristics on the likelihood of separation.

Another key finding of the preliminary analysis relates to the representativeness of racial groups across blue- and white-collar occupations within the medical workforce. Table 4 depicts the blue/white collar distribution for different racial groups identified within the medical workforce sample. The same statistics are visualized in Figure 6. Whites are distributed almost evenly across blue- and white-collar occupation types, with a slightly higher proportion in white-collar work. All other racial categories had a larger share employed in blue-collar work. Employees that identified as Black, Hawaiian or Pacific Islander, or Native American were highly concentrated in blue-collar occupations. Targeting recruitment to improve representation of racial minorities within while-collar occupations should be an immediate goal of the DoD.

**Table 4. Racial Group Representation Across Occupation Type in the Medical Workforce**

| Racial Group | Total Count | Occupational Type | Counts by Occupation Type | Percent by Occupation Type |
|---|---|---|---|---|
| Asian | 3,475 | Blue Collar | 1,830 | 52.66% |
| | | White Collar | 1,645 | 47.34% |
| Black | 9,972 | Blue Collar | 6,886 | 69.05% |
| | | White Collar | 3,086 | 30.95% |
| Hawaiian or Pacific Islander | 497 | Blue Collar | 354 | 71.23% |
| | | White Collar | 143 | 28.77% |
| Native American | 428 | Blue Collar | 268 | 62.62% |
| | | White Collar | 160 | 37.38% |
| White | 28,918 | Blue Collar | 14,027 | 48.51% |
| | | White Collar | 14,891 | 51.49% |

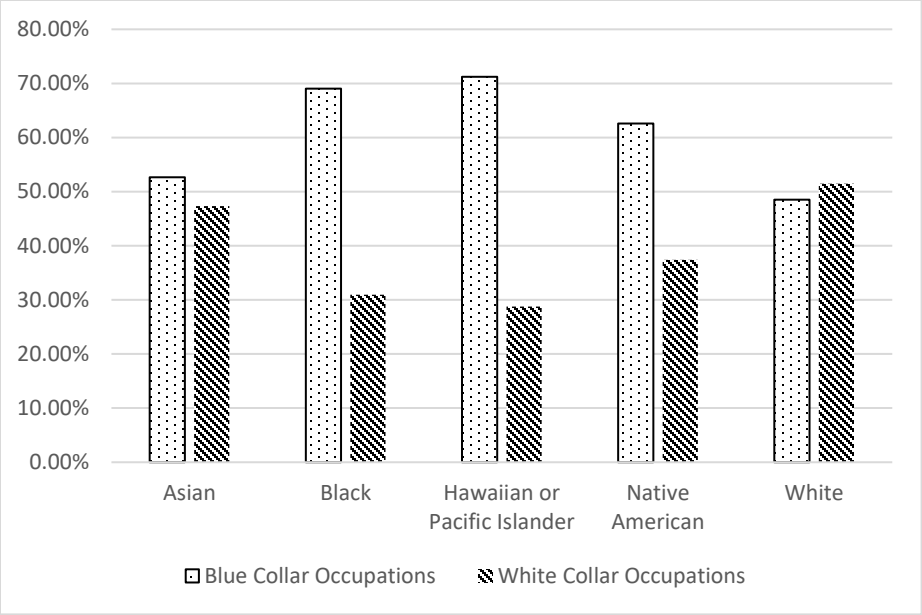


**Figure 6. Racial Group Representation Across Occupation Type in the Medical Workforce**

## Logistic Regression Estimates

The odds ratio estimates obtained from the logistic regressions are presented in Tables 5 and 6. Table 5 shows the results from the medical workforce. After controlling for years of service, age, professional classification, and race, we find that gender has no impact on turnover among medical employees. This is consistent with findings by Lewis and Park (1989) in their study of the determinants of turnover in the federal workforce.

**Table 5. Logistic Regression Results of Medical Workforce 2014 Attrition**

| Variables | Nonretirement Eligible | Retirement Eligible |
|---|---|---|
| Sex | 0.997 | 1.127 |
| | (0.024) | (0.157) |
| Years of Service | 0.863*** | 1.168*** |
| | (0.005) | (0.050) |
| Year of Service^2 | 1.004*** | 0.997*** |
| | (0) | (0.001) |
| Age | 0.710*** | 1.097 |
| | (0.007) | (0.103) |
| Age^2 | 1.003*** | 0.999 |
| | (0.000) | (0.001) |
| Graduate Education | 0.894*** | 0.617** |
| | (0.026) | (0.100) |
| College Graduate | 0.892*** | 0.716** |
| | (0.024) | (0.117) |
| Less Than High School | 1.515 | 0.880 |
| | (0.446) | (0.973) |
| Medical Officer | 1.226*** | 0.550*** |
| | (0.067) | (0.114) |
| Administrative Health Professional | 0.873*** | 1.474* |
| | (0.035) | (0.348) |
| Nurse | 1.033 | 1.161 |
| | (0.028) | (0.182) |
| Black | 0.929*** | 0.638*** |
| | (0.025) | (0.097) |
| Asian | 0.698*** | 1.258 |
| | (0.030) | (0.262) |
| Native American | 0.908 | 0.843 |
| | (0.101) | (0.488) |
| Hawaii or Pacific Islander | 0.740*** | 0.587 |
| | (0.078) | (0.368) |
| Constant | 4,902.237*** | 0.010* |
| | (1334.304) | (0.025) |
| N | 45,151 | 1,475 |
| Pseudo R-Squared | 0.049 | 0.089 |

All estimates have been converted to odds ratios.

Robust standard errors are in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

Years of service is modeled as having a quadratic relationship with turnover. The base estimate of 0.866 and the estimate of 1.004 for the squared term collectively indicate that at relatively low years of service a marginal increase in tenure reduces the likelihood of separating. This marginal effect is diminishing, however. The marginal effects of the quadric relationship were calculated and displayed in Figure 7. These lines represent the first differences of the quadratic relationship between increasing years of service and the percent change in the odds of separating from federal service. For the nonretirement eligible group, the left-hand side of the line is below zero, starting at approximately -2.5%. This is interpreted to indicate that an employee with 5 years of service is 2.5% less likely to separate than an employee with 4 years of service, on average. Moving to the right, however, the effect diminishes. Where the line crosses the axis at 20 years of service, there is essentially no statistically significant marginal effect of another year of service.

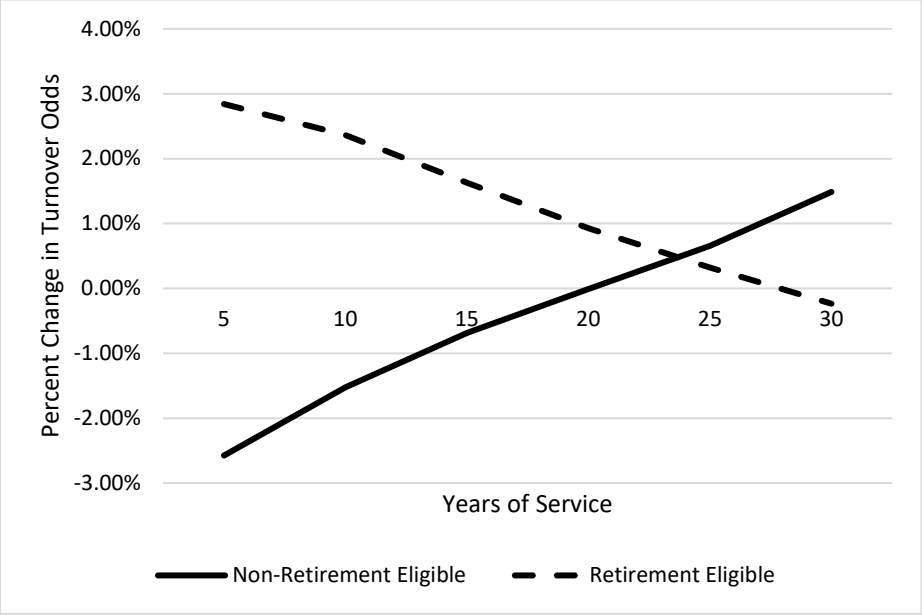


**Figure 7. Marginal Effect of Years of Service on Turnover Odds for Medical Civilians**

This marginal relationship is inverted for the retirement eligible community. For medical personnel eligible for retirement with relatively few years of service, adding 1 more year to their tenure increases their odds of separating by over 2%. As tenure

increases, this effect declines. Once tenure reaches approximately 25 years of service, the marginal effect is not statistically distinguishable from zero, meaning that there is no additional impact on the odds of separating for further years of service. Once employees reach a late career status, length of service has no additional effect.

The age variable exhibits a similar quadratic relationship, as years of service does for the nonretirement eligible population. For younger employees, growing older is associated with a lower retirement likelihood, but at a diminishing rate. In contrast, age does not have a statistically significant relationship with turnover within the retirement-eligible medical workforce. This is consistent with the years of service estimate that once employees reach retirement eligibility there is an overall shift in turnover behavior, but the marginal effects of additional years of service or age are close to zero.

The occupational classifications show that different medical professions appear to experience significantly different turnover rates within the nonretirement eligible population. In comparison to blue-collar healthcare technicians, medical officers have higher odds (approximately 22.6%) of separating during preretirement eligibility. Nurses, however, appear to have a similar turnover rate to the blue-collar medical workers. Other healthcare professionals, which includes administrators and pharmacists, have a lower turnover rate in comparison to the blue-collar medical workers. Their attrition differential is estimated to be approximately 12.7 percentage points lower (1−0.873). This result invites further studies of the medical workforce to understand the environmental conditions and work schedules of medical employees and how that factors into their turnover decisions.

The results of the regressions using the acquisition data are depicted in Table 6. This table depicts estimates of a model of turnover among a subset of Navy acquisition employees. As discussed earlier, the personnel records are merged with average command-level employee satisfaction survey results. The intent of including these variables was to capture organizational differences in different measures of satisfaction. All 11 measures were tested for fitness in the model with a series of sensitivity tests. Ultimately, none of the satisfaction measures were statistically significant in the turnover model. Sensitivity testing revealed that there was insufficient variation in the satisfaction

scores across organizational groups to reveal a relationship between employee satisfaction and turnover behavior. Table 3 displays one of the permutations of the sensitivity tests that included two of the most salient measures: job satisfaction and job stress.

**Table 6. Logistic Regression Results of Acquisition Workforce 2014 Attrition**

| Variables | Nonretirement Eligible | Retirement Eligible |
|---|---|---|
| Sex | 0.759 | 1.229 |
| | (0.216) | (0.341) |
| Years of Service | 1.038 | 1.329 |
| | (0.059) | (0.244) |
| Years of Service^2 | 1.000 | 0.996 |
| | (0.002) | (0.003) |
| Age | 0.637*** | 3.14** |
| | (0.053) | (1.721) |
| Age^2 | 1.005*** | 0.992* |
| | (0.001) | (0.004) |
| Job Satisfaction Average | 0.266 | 0.636 |
| | (0.327) | (0.922) |
| Job Stress Average | 0.382 | 1.652 |
| | (0.401) | (2.066) |
| Grade | 1.050 | 1.059 |
| | (0.05) | (0.069) |
| College | 0.895 | 1.184 |
| | (0.24) | (0.396) |
| Graduate School | 1.026 | 0.310 |
| | (0.343) | (0.225) |
| Constant | 870,379.8* | 0** |
| | (6960931) | (0) |
| N | 4,839 | 702 |
| Pseudo R-Squared | 0.056 | 0.065 |

All estimates have been converted to odds ratios.

Robust standard errors are in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

The estimates of the two main components of the life-cycle model, age and years of service, fared differently in the acquisition data than in the medical data. The age variable was modeled with a quadratic term, similarly to the medical data, and produced the expected results for both the retirement eligible and ineligible groups. The years of service variable, however, was not statistically significant in the acquisition data. Additionally, none of the other control variables, such as grade and education, were statistically significant in the acquisition data.

The lack of statistical significance on any of the variables except for age raises the question of whether dropping so many records to be able to include the satisfaction survey fields reduced the power of the model to measure differences in turnover behavior. Since the employee satisfaction fields were not providing useful estimates, we decided to drop them from the model and add back in the acquisition employees from other branches of the Navy as well as other service branches of the DoD. The model depicted in Table 6 was rerun on the larger population of acquisition personnel. The results from this sensitivity test showed that years of service continued to be statistically insignificant, while grade and education indicators each became significant. Their estimates were similar in sign and magnitude to those estimates obtained from the medical data.

# Discussion

This analysis of two very different segments of the DoD workforce has helped reveal differences in the composition and behavior of civilian personnel. In both groups, the overall pattern of attrition was consistent with the life-cycle model of turnover behavior. Employees that are not yet eligible for retirement had higher propensities to separate at early stages of their careers and relatively low attrition rates as they approach retirement eligibility. Retirement-eligible personnel conversely separate at an accelerating rate as they move past their earliest eligibility date. The preliminary statistical analysis illustrated how these two overall patterns hold for both medical and acquisition employees but also highlighted how the acquisition workforce benefits much more from midcareer appointments. This surge of older appointees flowing into the workforce from uniformed services also affects the outflow years later as these employees retire. Even if medical and acquisition employees respond relatively similarly to advancement in age and tenure, the difference in the composition of the workforce will change the recruitment, training, and succession planning strategies needed to manage the two types of employees.

Future use of these estimates for strategic workforce management may help defense budgeting. Conducting fiscal impact simulations of different turnover scenarios can prepare the DoD for future fiscal stress (Brien et al., 2020; Hansen et al., 2018). Defense budget cuts or other adverse fiscal conditions may result in hiring freezes or even force reductions. Understanding the pace of attrition behavior may help DoD officials understand the expected losses to the civilian workforce during such a period. Developing a forward-looking fiscal plan that takes into account potential actions by Congress fits within a broader goal of making strategic fiscal policies that are intentionally crafted in response to other levels of government (Brien, 2017; Brien & Sjoquist, 2014; Brien et al., 2017; Brien & Yan, 2020). Additionally, turnover simulations may provide guidance on where to target recruitment to avoid future gaps in workforce capability.

Another finding from this study is that the DoD can do much better in hiring racial minorities into technical and white-collar positions. This analysis of the medical workforce found that personnel identifying as Black, Native American, and Hawaiian or Pacific Islander were almost twice as likely to be employed in blue-collar work, while employees identifying as White or Asian were nearly evenly distributed between the two labor categories. Pursuing diversity and representation within occupational categories and not just within the workforce as a whole is essential to achieving a public workforce that aligns with the American public. Furthermore, our attrition analysis found that employees identifying as Black, Asian, and Hawaiian or Pacific Islander had lower likelihoods of voluntarily separating when compared to white employees. Attaining diversity within these technical fields will also bring a more stable workforce.

The lack of empirical results with respect to the employee satisfaction survey data obtained from the acquisition workforce was a disappointing outcome, but this null result points towards methodological improvements that may be made in future studies. Using average satisfaction rates at the command level was found to be too aggregated at the organizational level. Satisfaction survey results obtained from organizational units lower down within the DoD and naval organizational structures will be necessary to effectively test the relationship between employee satisfaction and turnover behavior. This remains a pressing goal within the public human resource management literature. While there is a broad body of research examining the relationship between reported turnover intention and employee satisfaction, a growing body of research has questioned turnover intention as a valid proxy for actual behavior (Cohen et al., 2016; Dalton et al., 1999). Finding new sources of employee satisfaction data that can be integrated into the PDE environment for secure and PII-protected research into turnover behavior will be part of the next step of this project.

Understanding the patterns of turnover behavior within different segments of the DoD workforce is one part of strategic workforce management. This study, which used a parametric approach to modeling turnover, was able to contrast the break points in life-cycle behavior as employees approach and move into retirement eligibility. One of the primary benefits of estimating these relationships is that it will provide a baseline for turnover behavior prior to the ongoing reorganization of DoD medical operations. In

coming years there will be a pressing need to perform evaluations of the impact of this transformation on the civilian medical workforce. The changes to the nature of the work performed by civilian medical employees may have significant impacts on retention and recruitment. This study lays an important groundwork for the pre–post comparisons that will be conducted.

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