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This thesis examined the quality of Marines broken down by the Marine Corps Recruiting Command trimester phasing model. The research determined a statistically significant difference exists when comparing the June, July, August, September (JJAS) cohort to the other two trimester cohorts. The research also provides a theoretical framework to analysis Marines Awaiting Training by trimester cohort.

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*United States Marine Corps
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Marine Corps University
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United States Marine Corps First Term Enlistment Quality: The relationship between shipping
trimester and quality

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AUTHOR:

Gregory T. Moynihan
Major, United States Marine Corps
B.S., United States Naval Academy

AY 2019-20

Mentor and Oral Defense Committee Member: Dr. Eric Shibuya

Approved: //Signed//

Date: 16 April 2020

Oral Defense Committee Member: Lieutenant Colonel Christopher Curtain

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DISCLAIMER

THE OPINIONS AND CONCLUSIONS EXPRESSED HEREIN ARE THOSE OF THE INDIVIDUAL STUDENT AUTHOR AND DO NOT NECESSARILY REPRESENT THE VIEWS OF EITHER THE MARINE CORPS COMMAND AND STAFF COLLEGE OR ANY OTHER GOVERNMENTAL AGENCY. REFERENCES TO THIS STUDY SHOULD INCLUDE THE FOREGOING STATEMENT.

QUOTATION FROM, ABSTRACTION FROM, OR REPRODUCTION OF ALL OR ANY PART OF THIS DOCUMENT IS PERMITTED PROVIDED PROPER ACKNOWLEDGEMENT IS MADE.

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Introduction

Recruiting and training Marines consumes a significant amount of the manpower budget. On average, the Marine Corps spends approximately \$20,000 to recruit and train a basically qualified Marine.¹ Depending on their military occupational specialty, the Marine Corps spends anywhere from more than \$100,000 on job-specific training before a Marine reports to the operating forces. As such, the Marine Corps strives to select the most qualified candidates for recruit training who have the highest chance of success.

The Marine Corps looks for specific characteristics which indicate a candidate has the best chance of success. The Marine Corps Recruiting Command, through policy, selects individuals with specific criteria such as age, physical and mental aptitude, education, and conduct.² Although those metrics are specific in allowing individuals to join the Marine Corps, they are primarily used to select individuals with the best chance of success at recruit training as that is the Marine Corps Recruiting Command's mission. Based on the trimester phasing model explained below, this thesis looks to determine which trimester produces the highest quality Marine at the end of their enlistment. Further, this thesis provides a methodology on studying the effects of time awaiting training during the enlisted entry level training pipeline on quality and retention of each cohort.

¹ Jared J. Hansbrough, "An activity-based cost analysis of recruit training operations at Marine Corps Recruit Depot, San Diego, California" (master's thesis, Naval Postgraduate School, 2000), Calhoun, https://calhoun.nps.edu/bitstream/handle/10945/9269/00Jun_Hansbrough.pdf?sequence=1&isAllowed=y. I adjusted the cost to train a Marine calculated in the thesis from 2000 dollars to 2019 dollars.

² Commanding General of Marine Corps Recruiting Command, *Marine Corps Recruiting Command Enlistment Processing Manual (Short Title: MCRC EPM)*, MCRCO 1100.1, November, 9, 2011, 3-7 – 3-114, <https://www.hqmc.marines.mil/Portals/61/Docs/FOIA/MCRCO1100.1EPM.pdf>.

Background and Literature Review

The Marine Corps Recruiting Command divides the fiscal year calendar into trimesters for purposes of sending individuals to recruit training. Colloquially known as shipping, the Marine Corps divide the calendar year as follows: October, November, December, January (ONDJ); February, March, April, May (FMAM); and, June, July, August, September (JJAS). Aline Quester conducted a multi-decade study review accession quality of Marine Corps recruits from fiscal years 1979 to 2009. Quester discussed the evolution of improved quality metrics instituted in the armed forces, specifically the Department of Defense's introduction of the education tiers and required distribution of the established education tiers in each year's accession cohort as well as the Marine Corps' introduction of the Crucible serving as the culminating event of recruit training. Quester's study identified trends in recruit attrition and indicated recruits with the following attributes have a higher probability of successfully completing recruit training: higher Armed Forces Qualification Test (AFQT) scores, better educational credentials, spent three or more months in the delayed entry program (DEP), longer initial contracts, ship to boot camp in JJAS, met the height-for-weight standard, were recruited as seniors, and access without enlistment waivers.³ Quester cites a multitude of studies corroborating her finding which continues to permeate Marine Corps manpower planner thinking.

Shannon Desrosiers and Elizabeth Bradley conducted a detailed literature review on predictors of success in the Marine Corps by gender. Citing Defense Secretary Carter's 2016 decision on integrating females into previously closed combat arms military occupational

³ Aline Quester, *Marine Corps Recruits: A Historical Look at Accessions and Bootcamp Performance*. (Arlington, VA: Center for Naval Analyses Corporation, 2010).
Anita U. Hattiangadi, *Endstrength: Forecasting Marine Corps Losses Final Report*. (Arlington, VA: Center for Naval Analyses Corporation, 2005).

specialties, understanding the quality metrics in gender differences becomes important for the Marine Corps. Their study confirmed many of Quester's findings and concluded those with more time in the DEP, higher AFQT score, higher education tier, or recruited while a high school senior exhibited lower attrition rate.⁴

The study titled "An Analysis of Marine Corps Female Recruit Training Attrition" looked at attrition factors specific to female recruits. Female recruits with tier 1 education credentials (a high school diploma or a General Educational Development certification) and higher AFQT scores exhibited lower attrition behaviors. Although this study was gender-specific, the results may suggest similar parallels in male recruits. The study was conducted after the institution of the initial strength test (IST) and the study found that those with higher IST scores had lower attrition rates. With the physical demands of recruit training and the Marine Corps writ large, higher physical fitness as measured by the IST appears to more recently have a significant effect in lower attrition.⁵

Upon his assumption of the role as Commandant of the Marine Corps, General Amos published his planning guidance to drive action within the Marine Corps. He specifically directed the Marine Corps to improve the reenlistment process.⁶ In response to the Commandant's Planning Guidance, the Marine Corps conducted a comprehensive review of the reenlistment process for enlisted Marines. As a result of the study, the Marine Corps adopted the

⁴ Not all recruits who ship during the JJAS trimester are recruiting while in high school. Shannon Derosiers and Elizabeth Bradley, *Differences in Male and Female Predictors of Success in the Marine Corps: A Literature Review* (Arlington, VA: Center for Naval Analyses Corporation, 2014).

⁵ *An Analysis of Marine Corps Female Recruit Training Attrition* (Arlington, VA: Center for Naval Analyses Corporation, 2014).

⁶ The Commandant of the Marine Corps, *Commandant's Planning Guidance* (Washington, DC, 2010), <https://www.hqmc.marines.mil/Portals/142/Docs/CMC%2035%20Planning%20Guidance%20FINAL%5B1%5D.pdf>.

tiered evaluation system⁷ to categorize Marines eligible for reenlistment to aid in institutional decisions.⁸

Cole conducted a study of the effectiveness of the tiered evaluation system in 2014. She conducted a longitudinal study using data from fiscal year 2009 through 2014 to determine if the Marine Corps experienced any improvement in quality with the new tiered system. She concluded that some independent quality metrics showed improvement; however, overall quality did not increase. Further, Cole stated quality under the new tiered system was indistinguishable from the non-tiered system.⁹

Crider also looked at the tiered evaluation system in 2015 as a predictor of future success. His study focused on reenlistments in the Marine Corps from fiscal year 2000 through 2012. He used the computed tier to observe promotions, career longevity, and performance evaluations. Crider concluded the tiered evaluation system is a viable indicator for individual quality but stated the system could be improved to ensure the Marine Corps retains the highest quality Marines each fiscal year.¹⁰

⁷ Per the provisions of MARADMIN 273/11, the Marine Corps adopted the tier evaluation system. A Marine submitted for reenlistment will get a computed tier score ranging from 1 to 4 with 1 defined as “Eminently Qualified Marine” and 4 is defined as “Below Average Marine.” The tiered evaluation score has seven components which are used to calculate the tier score; Physical, Fitness Test, Combat Fitness Test, Proficiency Marks in Service, Conduct Marks in Service, Rifle Score, Marine Corps Martial Arts Program Belt, and Meritorious Promotion. U.S. Marine Corps. *Commandant Approved Updated Reenlistment Procedures* (Quantico, VA: Manpower and Reserve Affairs, 2011), <https://www.marines.mil/News/Messages/Messages-Display/Article/888185/commandant-approved-updated-reenlistment-procedures/>.

Lucas A. Crider, “Effectiveness of the United States Marine Corps Tiered Evaluation System” (master’s thesis, Naval Postgraduate School, 2015), Calhoun, https://calhoun.nps.edu/bitstream/handle/10945/45175/15Mar_Crider_Lucas.pdf?sequence=1&isAllowed=y.

⁸ U.S. Marine Corps. *Commandant Approved Updated Reenlistment Procedures* (Quantico, VA: Manpower and Reserve Affairs, 2011), <https://www.marines.mil/News/Messages/Messages-Display/Article/888185/commandant-approved-updated-reenlistment-procedures/>.

⁹ Alexandra L. Cole, “U.S. Marine Corps enlisted retention: an analysis of stakeholder incentives for the retention of tier 1 first-term Marines” (master’s thesis, Naval Postgraduate School, 2014), Calhoun, https://calhoun.nps.edu/bitstream/handle/10945/41360/14Mar_Cole_Alexandra.pdf?sequence=1&isAllowed=y.

¹⁰ Lucas A. Crider, “Effectiveness of the United States Marine Corps Tiered Evaluation System” (master’s thesis, Naval Postgraduate School, 2015), Calhoun, https://calhoun.nps.edu/bitstream/handle/10945/45175/15Mar_Crider_Lucas.pdf?sequence=1&isAllowed=y.

Numerous studies have been conducted evaluating the entry level training pipeline. The pipeline begins with a recruit reporting to recruit training and ends with a fully trained Marine in the operating forces. Training Command closely monitors the pipeline in order to minimize Marines Awaiting Training (MAT). As defined by Training Command, MAT is any time between a formal learning center graduation date and a formal learning center report date. To better schedule Marines into the Marine Corps Communication-Electronics School (MCCES), Justice conducted a study to maximize the productivity of the school and reduce MAT. At the conclusion of Justice's research, he proposed a mixed-integer program which reduced MAT at MCCES by 62 percent. Justice stated his model could be applicable to other military occupational specialties.¹¹

Neu, Davenport, and Smith also looked at MCCES MAT in order to reduce wasted contract time for the enlisted force. MCCES was the subject of another study as it is a Marine Corps formal learning center and owns a few entry level training courses. The authors argued MAT weakened the operating forces and the Marine Corps because the school was not producing enough fully qualified Marines to meet the demands of the service. They explored options ranging from local changes at no cost to the commander to a complete change to the model. Although local commander changes did result in some positive effects, the model change recommendation provided the most substantial change to the system. Neu, Davenport, and Smith recommended MCCES change from a scheduling system of mapping out courses a year in advance to an on-demand model which maximized instructor time while minimizing time awaiting training. If all the researcher's recommendations were implemented by MCCES, Neu, Davenport, and Smith claimed the potential value of the new model was \$1.6 million in terms of

¹¹ Barry D. Justice, "A scheduling model for the U.S. Marine Corps Communication-Electronics School" (master's thesis, Naval Postgraduate School, 1993), Calhoun, <https://calhoun.nps.edu/bitstream/handle/10945/26234/schedulingmodel00just.pdf?sequence=1&isAllowed=y>.

salary and a potential savings of \$1.9 million through efficient use of the barracks and base support.¹²

Detar researched MAT through the lens of reducing lost man-years and provided a recommendation on implementing change. Detar used fiscal year 2003 data while developing an integer linear programming model to optimize the scheduling of courses based on the timing and quantity of new Marines reporting to formal learning centers. Prior to Detar's research, the Marine Corps experienced 2,800 lost man-years in fiscal year 2001. During the life cycle of each cohort of accessions, that level of lost time increasingly concerned the Marine Corps. Detar's linear programming model optimized course scheduling to minimize time awaiting training while balancing the classification needs of the Marine Corps. Detar's model reduced time awaiting training to 1,665 man-years resulting in a 40 percent improvement from fiscal year 2001.¹³

Bostick and Booth conducted a study on the naval aviator pipeline. Although the officer corps is not the subject of this research, understanding previous work conducted provides not only context but also the understanding that MAT is an institution-wide concern for the Marine Corps. Bostick and Booth's study was during a time when the aviation community experienced an increase in pilot demand by the Navy and Marine Corps. Although the demand for pilots increased, the resources at the various training squadrons did not and therefore failed to meet the increase in demand. Bostick and Booth developed a decision support system (DSS) which better forecasted student pilot production and used resources more efficiently. Although the DSS

¹² Charles R. Neu, William R. Smith, and Jon Davenport, "U.S. Marine communication-electronics school training process: discrete event simulation and lean options" (master's thesis, Naval Postgraduate School, 2007), Calhoun, https://calhoun.nps.edu/bitstream/handle/10945/10217/07Dec_Neu_MBA.pdf?sequence=1&isAllowed=y.

¹³ Paul J. Detar, "Scheduling Marine Corps entry-level MOS schools" (master's thesis, Naval Postgraduate School, 2004), Calhoun, https://calhoun.nps.edu/bitstream/handle/10945/1444/04Sep_Detar.pdf?sequence=1&isAllowed=y.

developed by Bostick and Booth was a prototype, they provided crucial insight and recommended follow-on research to better implement the DSS in the aviation pipeline.¹⁴

Alfonso, Younger, and Oh evaluated the entry level training pipeline through the lens of supply chain management. The researchers conducted their research just after the Marine Corps' increase to 202,000 Marines in fiscal year 2009. As a result of the end strength increase to support the mission in Iraq and Afghanistan, Training Command struggled to ensure Marines were optimally trained to meet the needs of the operating forces. The authors utilized supply chain management to optimize the timeline from recruit training into the operating forces while managing the resources and minimizing costs. The researchers produced six conclusions termed as critical components of the supply chain. Each conclusion came with a recommendation from the researchers to increase the entry level training system productivity while reducing costs.¹⁵

Ezell built upon Alfonso, Younger, and Oh's research of the entry level training pipeline. Ezell's desired research end state was to develop a model using Alfonso et al's recommendations. Due to the complexity of the system, Ezell was unable to meet his original research goal; however, he provided a methodology for model development and recommendations for further research. Ezell specifically identified numerous practices at

¹⁴ Randall W. Bostick and William D. Booth II, "Prototyping a web-enabled decision support system to improve capacity management of aviation training" (master's thesis, Naval Postgraduate School, 2009), Calhoun, https://calhoun.nps.edu/bitstream/handle/10945/2009/05Sep_Bostick.pdf?sequence=1&isAllowed=y.

¹⁵ The six principle conclusions provided by Alfonso et al's are as follows: MCRC is overburden during the summer months (JJAS) which translates to an overburden at Marine Combat Training and formal learning centers during the fall; optimized scheduling is complicated with the push inventory system of entry level training; the recruit depots have excess annual trainee capacity while the formal learning centers have an insufficient annual trainee capacity; the holiday period respites at the formal learning centers exasperate the already taxed formal learning centers during their busy months (ONDJ); the information technology system for training has the capacity to optimize the flow of trainees; and greater integration of the organizations that handle the entry level pipeline is critical for process improvement.

Steven Alfonso, Dingjin Oh, and Larry M. Younger, "An analysis of United States Marine Corps Enlisted Entry-Level Training using supply chain and operations management" (master's thesis, Naval Postgraduate School, 2010), Calhoun, <https://calhoun.nps.edu/bitstream/handle/10945/10480/10Dec%25FAlfonso%25FMBA.pdf?sequence=1&isAllowed=y>.

individual locations that need to be reviewed and adjusted. Further, he suggested the model and planning process needs to be more flexible to handle external factors, such as errors or changes in manpower planning to accommodate shifts while still producing the necessary output to the operating forces.¹⁶

The studies provide numerous insights into the Marine Corps' entry level training model. Further, numerous research efforts seek to improve the model and reduce time awaiting training. From supply chain management to better forecasting models, there appears to be a plethora of options the Marine Corps could implement to help reduce wasted man-hours. The studies address, indirectly, the wasted man-hours may affect first-term quality retention. The more time a Marine waits to start training and ultimately report to the Fleet Marine Force may reduce quality, disenfranchise a Marine from serving longer in the Marine Corps, and eroding the Marine Corps' ability to retain quality. This study has two purposes. First, this study seeks to identify which trimester produces the highest quality Marines at the end of their enlistment based on quality metrics exhibited by Marines demonstrated throughout their first enlistment. Second, this study seeks to provide insight on how MAT effects overall quality and retention behavior in Marines at the end of their first enlistment. Although this study does not research the Marine Corps Tiered Evaluation System, the variables used in this study correlate to the tiered evaluation system but with a different intent.

¹⁶ Roy H. Ezell, "Analysis of select military occupational specialty schools in the Marine Corps Enlisted Entry-Level Training pipeline" (master's thesis, Naval Postgraduate School, 2011), Calhoun, https://calhoun.nps.edu/bitstream/handle/10945/5723/11Mar_Ezell.pdf?sequence=1&isAllowed=y.

Data Analysis

Overview

The Total Force Data Warehouse (TFDW) provided data for this study which included all accessions between fiscal years 2004 and 2009. Each fiscal year contains individual data on Marines during their accession time frame, data collected throughout each Marine's career as well as data at the end of their first term of enlistment or termination of Marine Corps service. Table 1 provides the numbers of observations received from TFDW by fiscal year.

Table 1. Data Total for each Fiscal Year

Fiscal Year	Observations
2004	25,536
2005	29,161
2006	28,913
2007	31,584
2008	34,082
2009	27,670
2010	23,912
2011	25,833
2012	25,411
2013	26,041
2014	20,524
Total	298,667
Average	27,152

The focus of the study is to investigate Manpower and Reserve Affairs' planning assumption that the JJAS trimester produces the best quality of Marine who display the highest likelihood of reenlistment. Enlisted Plans in Manpower Plans and Policy Division of Manpower and Reserve Affairs manages the total end strength for the active component of the Marine Corps. Understanding the retention behavior of Marines helps Enlisted Plans accurately project

end strength so the Marine Corps does not fall outside of the service size limit published each fiscal year.

When asked to conduct this study for Manpower and Reserve Affairs, Enlisted Plans provided a specific framework to research. The key variables correlate with variables of interest for Retention Branch in the Manpower Management Division. Retention Branch uses an algorithm with quality metrics which bins Marines into retention tiers. The key variables of interest to Enlisted Plans are provided in Table 2.

Table 2. Variables of Interest

Initial Strength Test Events
Physical Fitness Test Score
Combat Fitness Test Score
Proficiency Marks
Conduct Marks
Rifle Scores
Pistol Scores
Rank at end of first term
Number of nonjudicial punishments
Number of courts martial
Armed Forces Qualification Test score

Historical Context

To fully understand the value of each variable listed in Table 2, an explanation of each variable is provided below.

Armed Force Qualification Test

During the enlistment process, potential applicants must report to a Military Entrance Processing Station to undergo various testing. In order to evaluate the mental aptitude of each applicant, the Department of Defense administers a standardized test to all applicants regardless of the intended branch of the armed forces. Although the Army General Classification Test (AGCT) was originally designed as a classification test, the Army primarily used the test for

applicants to qualify for service in the Army during the late 1940s. With the Selective Service Act of 1948, the Department of Defense was required to institute a department-wide qualification test for entry into the military service. As such, the AFQT was first developed in 1950 and expanded on the AGCT with additional special tests to measure mechanical, clerical, and other aptitude areas.¹⁷

The AFQT has undergone multiple changes since its inception. The content of the test has changed over time to respond to technological advances as well as the educational system of the United States. With content changes, the test is renormed for accurate measurements in applicant aptitude. Scoring mechanisms changed over time as context and difficulty changed. Further, the test was originally scored using both right and wrong answers and now only uses right answers to not penalize guessing.¹⁸

The AFQT was ultimately consolidated in the Armed Services Vocational Aptitude Battery (ASVAB) in 1974. The ASVAB now serves as both a qualification test with the AFQT as well as a classification test aiding the military services in placing the various applicants in the different military specialties. The Department of Defense controls the ASVAB and its content as well as the scoring formula for the AFQT. However, the military services maintain their own composite scores to classify applicants into specialties.¹⁹

¹⁷ ASVAB Working Group, *History of The Armed Services Vocational Aptitude Battery (ASVAB): 1974-1980* (Washington, DC: Office of the Assistant Secretary of Defense for Manpower, Reserve Affairs and Logistics, 1980), <https://apps.dtic.mil/dtic/tr/fulltext/u2/a125865.pdf>.

¹⁸ The ASVAB score is based on the number of questions answered correctly rather than the number wrong. Statistically speaking, if one guesses every answer on a subtest, they will likely only get 25% of those questions correct. The ASVAB Working Group conducted that applicants who guess correctly on the ASVAB will not change their overall score with any degree of statistical significance.

ASVAB Working Group, *History of The Armed Services Vocational Aptitude Battery (ASVAB): 1974-1980* (Washington, DC: Office of the Assistant Secretary of Defense for Manpower, Reserve Affairs and Logistics, 1980), <https://apps.dtic.mil/dtic/tr/fulltext/u2/a125865.pdf>.

¹⁹ ASVAB Working Group, *History of The Armed Services Vocational Aptitude Battery (ASVAB): 1974-1980* (Washington, DC: Office of the Assistant Secretary of Defense for Manpower, Reserve Affairs and Logistics, 1980), <https://apps.dtic.mil/dtic/tr/fulltext/u2/a125865.pdf>.

Physical Fitness Test (PFT)

Marines conduct the PFT on an annual basis to as a quantitative measure to evaluate general fitness through the Marine Corps. “The PFT was specifically designed to test the strength and stamina of the upper body, midsection, and lower body, as well as efficiency of the cardiovascular and respiratory systems.”²⁰ The PFT is comprised of three events, each with a maximum score of 100 for a total maximum score of 300. For the population of Marines used in this study, the three events are pull-ups for males and flexed arm hang for females, sit-ups, and a three-mile run.

Combat Fitness Test (CFT)

The CFT was introduced to the Marine Corps in 2008 to serve as a complement to the PFT to measure “additional functional elements of general fitness to include agility, coordination, and anaerobic capacity.”²¹ Like the PFT, the CFT is comprised of three events with the same scoring breakdown as the PFT. For the population of Marines used in this study, the three events are an 880-yard run, 30-pound ammunition lift, and a maneuver under fire event consisting of dragging and carrying a simulated casualty drag and running with two ammunition boxes.²²

Rifle Score

The Marine Corps values Marine’s ability to employ the primary weapon system of individual Marines to “[obtain] dominance over the enemy and neutralizes the effects of enemy

²⁰ Commandant of the Marine Corps, *Marine Corps Physical Fitness and Combat Fitness Tests (PFT/CFT)*, MCO 6100.13A CH-2, December 30, 2019, 2-1, <https://www.fitness.marines.mil/Portals/211/documents/MCO%206100.13A%20CH-2.pdf>.

²¹ Commandant of the Marine Corps, *Marine Corps Physical Fitness and Combat Fitness Tests (PFT/CFT)*, MCO 6100.13A CH-2, December 30, 2019, 3-1, <https://www.fitness.marines.mil/Portals/211/documents/MCO%206100.13A%20CH-2.pdf>.

²² Commandant of the Marine Corps, *Marine Corps Physical Fitness and Combat Fitness Tests (PFT/CFT)*, MCO 6100.13A CH-2, December 30, 2019, <https://www.fitness.marines.mil/Portals/211/documents/MCO%206100.13A%20CH-2.pdf>.

weapons.”²³ Marines must complete two courses of fire as prescribed by the Marine Corps Marksmanship Program. The first course is the known distance range where Marines shoot at various targets from different positions and distances with a maximum score of 250. The second course of fire consists of firing the service rifle under conditions more like combat. Marines wear their personal protective equipment, conduct high rates of firing, and shoot at stationary and non-stationary targets with a maximum score of 100. The scores from the two courses of fire are combined for the final rifle score.²⁴

Pistol Score

All first term Marines are not required to qualify on the service pistol. However, if the pistol is the required weapon as detailed on the unit’s table of organization, Marines must qualify annually. The pistol range consists of one course of fire across various distances with rapid firing and quick reloading drills. The maximum score for the pistol is 400.²⁵ Because firing the pistol is not required of all Marines, the score is not used in reenlistment and retention decisions, writ large.

Initial Strength Test (IST)

The Initial Strength test was instituted to capture physical abilities prior to recruit training. The IST mirrors the individual PFT events with pull-ups for males and flexed arm hang for females, crunches, and a one and half mile run. The Marine Corps set a minimum standard to qualify for service. The IST is an indicator of performance on the PFT but also provides recruiters the ability to identify applicants who may struggle with the physical requirements of

²³ Commandant of the Marine Corps, *Marine Corps Combat Marksmanship Programs (MCCMP)*, MCO 6100.13A CH-2, September 4, 2014, 1-1, <https://www.marines.mil/portals/1/MCO%203574.2L.pdf>.

²⁴ Commandant of the Marine Corps, *Marine Corps Combat Marksmanship Programs (MCCMP)*, MCO 6100.13A CH-2, September 4, 2014, <https://www.marines.mil/portals/1/MCO%203574.2L.pdf>.

²⁵ Commandant of the Marine Corps, *Marine Corps Combat Marksmanship Programs (MCCMP)*, MCO 6100.13A CH-2, September 4, 2014, 8-1, <https://www.marines.mil/portals/1/MCO%203574.2L.pdf>.

recruit training. Recruiters can develop physical training plans for the applicants to help them improve their physical performance prior to shipping to recruit training.

Data Methodology

In reviewing the TFDW data, I made assumptions to remove likely erroneous data from the dataset. Removing the erroneous data provided more accurate analysis and actionable results for Enlisted Plans. I first reviewed the IST scores. In order to make the most informed assumption in my data cleaning phase, I needed to first review the policy governing the IST. Each event has a minimum score required for an applicant to enlist in the Marine Corps. I first used the minimum standards to remove observations failing to meet the standards. For each observation in my data who reported to recruit training, I determine IST scores provided in my dataset had to be an error. If a potential recruit does not meet the minimum standards for each IST event, Marine Corps policy bars them from reporting to recruit training. In speaking with the Marine Corps Recruiting Command, I discovered there is no maximum score cutoff for any event.²⁶ However, the data received from TFDW had numerous observations with scores that appeared incorrect.²⁷ As such, I limited the data to scores that fell between a score range.

After removing observations with erroneous IST scores, I looked to the rifle and pistol scores. I first removed any observation with a score of 0 on either the rifle or pistol. In comparing the scores to the marksmanship categories of each observation, a score of “0” did not always correlate with a marksmanship category of “unqualified.” As such, it suggested data errors of any Marine with a score of “0” and therefore I removed those observations. In speaking

²⁶ Major Daniel Sanchez (Market Research and Analysis Officer with Marine Corps Recruiting Command), discussion with author, February 12, 2020.

²⁷ When reviewing my data, I create tables with scores of each event. I determined some of observations contained errors as I had pull-up scores of over 1,000 pull-ups. While speaking with Major Sanchez, Marine Corps Recruiting Command, I set score ranges based on his recommendation. Major Daniel Sanchez (Market Research and Analysis Officer with Marine Corps Recruiting Command), discussion with author, February 2020.

with the Weapons Field Training Battalion aboard Marine Corps Base Quantico, I discovered the lowest score a Marine can score on the annual rifle range requirement is 120, so I limited my data to rifle scores of 120 or higher. I also eliminated all observations in fiscal year 2004 from any rifle and pistol score analysis. Fiscal year 2004 was the last year of the Marine Corps' previous rifle qualification test, and the scores were not analogous to the current rifle qualification test.

When reviewing the physical and combat physical test scores, I needed to remove scores that correlated with specific categories. If a Marine ran a partial physical or combat fitness test, their scores did not carry the same weight as those scores based on a full fitness test from an analysis standpoint. Further, I eliminated all test scores in a Marine's record except for the last score of record. That score would have been the score used in computing a reenlistment tier.

My data from TFDW also provided observations on individual Armed Forces Qualification Test percentiles. As previously mentioned, the Department of Defense controls the AFQT and established mental categories through the binning of test scores. Additionally, the Defense Department established a minimum requirement. As such, any score lower than the minimum score mandated by the Department of Defense was removed from the data.²⁸

Enlisted Plans specifically asked for an analysis on the averages of the variables of interest. In order to provide the requested analysis, I calculated the averages for the various variables of interest and their standard deviations by trimester phasing, gender, and fiscal year. I then compared the means to each using a t-test. Statistical difference provides understanding of the various averages provided in the analysis. I also used the Kaplan-Meier survival analysis for length of service and compared the differences between the trimesters and gender.

²⁸ Under Secretary of Defense for Programs and Resources, *Qualitative Distribution of Military Manpower*, DoDI 1145.01, December 12, 2013, <https://www.esd.whs.mil/Portals/54/Documents/DD/issuances/dodi/114501p.pdf?ver=2019-03-22-095340-833>.

Results

After removing erroneous observations from each data set, I joined all the observations to the accession data set. Table 3 provides the total number of observations by fiscal year after joining all the usable observations into one master file.

Table 3. Data Total for each Fiscal Year

Fiscal Year	Observations
2004	24,439
2005	27,868
2006	28,267
2007	30,943
2008	33,433
2009	27,110
2010	23,332
2011	25,060
2012	24,456
2013	25,110
2014	19,627
Total	289,645
Average	26,331

The usable data set includes 289,645 Marines. Variables used in the research are provided in Table 4.

Table 4. Descriptive Statistics of the Sample

	Average (s.d.)
Male	0.924 (0.265)
Female	0.076 (0.265)
Crunches on IST	74.394 (18.835)
Run time on IST	694.771 (77.897)
Pull Ups on IST	9.943 (5.134)
Flexed Arm Hang on IST	46.913 (20.139)

	Average (s.d.)
AFQT Score	60.998 (18.381)
Rifle Score	292.841 (40.121)
Pistol Score	322.491 (40.224)
Number of NJPs	1.292 (0.802)
Number of Courts Martial	0.176 (0.419)
Proportion of Marines shipped during ONDJ	0.299 (0.458)
Proportion of Marines shipped during FMAM	0.216 (0.411)
Proportion of Marines shipped during JJAS	0.486 (0.5)
PFT	237.738 (35.405)
CFT	277.267 (22.298)
Proportion of E1s	0.124 (0.33)
Proportion of E2s	0.068 (0.252)
Proportion of E3s	0.16 (0.366)
Proportion of E4s	0.482 (0.5)
Proportion of E5s	0.166 (0.372)

Table 5 provides the descriptive statistics of the variables by trimester.

Table 5. Descriptive Statistics of the Sample by Trimester Phasing

	ONDJ Average (s.d.)	FMAM Average (s.d.)	JJAS Average (s.d.)
Male	0.922 (0.269)	0.9 (0.299)	0.935 (0.246)
Female	0.078 (0.269)	0.1 (0.299)	0.065 (0.246)
Crunches on IST	71.91 (18.277)	71.569 (18.255)	77.177 (19.027)
Run time on IST	700.817 (76.757)	704.232 (76.824)	686.85 (78.263)
Pull Ups on IST	9.427 (5.011)	9.38 (5.031)	10.492 (5.17)
Flexed Arm Hang on IST	45.938 (19.078)	46.151 (19.157)	48.381 (21.254)
AFQT Score	61.316 (18.737)	61.855 (18.719)	60.416 (17.983)
Rifle Score	238.984 (42.691)	241.107 (41.965)	241.093 (41.577)
Pistol Score	226.466 (39.393)	228.198 (39.48)	228.035 (39.811)
Number of NJPs	0.361 (0.716)	0.35 (0.714)	0.36 (0.717)
Number of Courts Martial	0.051 (0.238)	0.048 (0.234)	0.047 (0.232)
Proportion of Marines shipped	0.486 (0.5)	0.299 (0.458)	0.216 (0.411)
PFT	236.667 (49.519)	237.103 (49.373)	237.222 (49.986)
CFT	273.354 (53.096)	272.498 (54.054)	274 (48.655)
Proficiency Mark	4.337 (0.208)	4.337 (0.2)	4.324 (0.204)
Conduct Mark	4.301 (0.286)	4.304 (0.272)	4.292 (0.279)
Proportion of E1s	0.133 (0.34)	0.137 (0.344)	0.113 (0.316)
Proportion of E2s	0.068 (0.252)	0.071 (0.257)	0.067 (0.25)
Proportion of E3s	0.153 (0.36)	0.154 (0.361)	0.166 (0.372)

	ONDJ Average (s.d.)	FMAM Average (s.d.)	JJAS Average (s.d.)
Proportion of E4s	0.449 (0.497)	0.458 (0.498)	0.514 (0.5)
Proportion of E5s	0.196 (0.397)	0.18 (0.384)	0.141 (0.348)

Table 6 and 7 provides the descriptive statistics of the variables by trimester and gender.

Table 6. Descriptive Statistics of the Sample by Trimester Phasing for Males

	ONDJ Average (s.d.)	FMAM Average (s.d.)	JJAS Average (s.d.)
Crunches on IST	72.285 (18.265)	72.095 (18.273)	77.641 (18.948)
Run time on IST*	692.539 (71.273)	693.841 (70.204)	679.517 (73.115)
Pull Ups on IST**	9.427 (5.011)	9.38 (5.031)	10.492 (5.17)
Flexed Arm Hang on IST**			
AFQT Score	61.533 (18.796)	62.158 (18.815)	60.538 (18.031)
Rifle Score	238.988 (42.689)	241.11 (41.964)	241.093 (41.579)
Pistol Score	226.467 (39.394)	228.194 (39.48)	228.034 (39.81)
Number of NJPs	0.369 (0.723)	0.361 (0.725)	0.365 (0.722)
Number of Courts Martial	0.054 (0.244)	0.051 (0.242)	0.05 (0.237)
Proportion of Marines shipped	0.298 (0.457)	0.21 (0.408)	0.492 (0.5)
PFT	236.666 (49.52)	237.105 (49.375)	237.222 (49.982)
CFT	273.354 (53.097)	272.497 (54.056)	274 (48.659)
Proficiency Mark	4.334 (0.21)	4.334 (0.203)	4.322 (0.205)
Conduct Mark	4.297 (0.288)	4.3 (0.276)	4.289 (0.282)
Proportion of E1s	0.133 (0.339)	0.135 (0.342)	0.112 (0.315)
Proportion of E2s	0.066 (0.249)	0.069 (0.254)	0.066 (0.248)

	ONDJ Average (s.d.)	FMAM Average (s.d.)	JJAS Average (s.d.)
Proportion of E3s	0.154 (0.361)	0.155 (0.362)	0.166 (0.372)
Proportion of E4s	0.451 (0.498)	0.46 (0.498)	0.516 (0.5)
Proportion of E5s	0.196 (0.397)	0.181 (0.385)	0.14 (0.347)

Note: * IST run time measured in seconds.
 **Only used the pull-up score for males.

Table 7. Descriptive Statistics of the Sample by Trimester Phasing for Females

	ONDJ Average (s.d.)	FMAM Average (s.d.)	JJAS Average (s.d.)
Crunches on IST	67.494 (17.833)	66.808 (17.375)	70.47 (18.907)
Run time on IST*	798.279 (71.712)	798.227 (69.963)	792.853 (73.327)
Pull Ups on IST**			
Flexed Arm Hang on IST	45.938 (19.078)	46.151 (19.157)	48.381 (21.254)
AFQT Score	58.867 (17.89)	59.211 (17.643)	58.721 (17.207)
Rifle Score	186.471 (37.688)	221.048 (49.742)	241.517 (32.297)
Pistol Score	220.75 (30.522)	261.333 (21.008)	236.455 (46.326)
Number of NJPs	0.264 (0.618)	0.252 (0.6)	0.287 (0.634)
Number of Courts Martial	0.02 (0.148)	0.019 (0.141)	0.017 (0.137)
Proportion of Marines shipped	0.306 (0.461)	0.282 (0.45)	0.412 (0.492)
PFT	252.551 (37.829)	226.645 (28.861)	234.912 (61.482)
CFT	282.143 (25.628)	284.25 (11.104)	274.38 (36.903)
Proficiency Mark	4.374 (0.185)	4.369 (0.171)	4.365 (0.178)
Conduct Mark	4.345 (0.246)	4.342 (0.228)	4.337 (0.234)
Proportion of E1s	0.141 (0.348)	0.155 (0.362)	0.119 (0.324)
Proportion of E2s	0.088 (0.283)	0.089 (0.285)	0.087 (0.282)

	ONDJ Average (s.d.)	FMAM Average (s.d.)	JJAS Average (s.d.)
Proportion of E3s	0.147 (0.354)	0.15 (0.357)	0.161 (0.367)
Proportion of E4s	0.43 (0.495)	0.438 (0.496)	0.48 (0.5)
Proportion of E5s	0.194 (0.395)	0.169 (0.375)	0.153 (0.36)

Note: * IST run time measured in seconds.
 **Only used the flexed arm hang score for females.

Tables 5, 6, and 7 clearly depicted the averages for the key variables clearly delineating the differences in means. To test that hypothesis, I conducted a t-test across the means with my null hypothesis being the means between the samples are statistically the same. Conversely, my alternative hypothesis is the sample means are statistically different.

At the conclusion of the t-test, I found evidence of statistically significant differences with a 95 percent confidence interval across various variable means within the trimesters. Table 8 provides the t-test output.

Table 8. Statistical Significance Comparisons across Trimesters

	JJAS compared to FMAM	JJAS compared to ONDJ	ONDJ compared to FMAM
Crunches on IST	0.000***	0.000***	0.000***
Run time on IST	0.000***	0.000***	2.49E-17***
Pull Ups on IST	0.000***	0.000***	0.088*
Flexed Arm Hang on IST	1.37E-11***	3.22E-14***	0.526
AFQT Score	1.06E-57***	2.59E-29***	7.91E-08***
Rifle Score	3.06E-22***	4.89E-173***	2.29E-46***
Pistol Score	0.391	1.17E-07***	2.83E-07***
Number of NJPs	0.002***	0.762	0.002***
Number of Courts Martial	0.479	0.000***	0.024**

	JJAS compared to FMAM	JJAS compared to ONDJ	ONDJ compared to FMAM
PFT	9.92E-14***	0.000	8.55E-05***
CFT	7.41E-14***	1.75E-38***	6.37E-65***
Proficiency Mark	3.57E-38***	4.51E-41***	0.584
Conduct Mark	1.44E-17***	9.04E-13***	0.081*

Note: * Significant at the 0.1 level
 ** Significant at the 0.05 level
 *** Significant at the 0.01 level

I conducted the t-test for both males and females. As the Marine Corps continues to compete for talent within the population, understanding the characteristics that will provide the Marine Corps with the largest return on investment remains important for manpower planners. Tables 9 and 10 provides the t-test output for gender differences across the trimesters.

Table 9. Statistical Significance Comparisons across Trimesters for Males

	JJAS compared to FMAM	JJAS compared to ONDJ	ONDJ compared to FMAM
Crunches on IST	0.000***	0.000***	0.059*
Run time on IST	0.000***	0.000***	0.001***
Pull Ups on IST	0.000***	0.000***	0.088*
Flexed Arm Hang on IST			
AFQT Score	1.181E-65***	1.679E-32***	2.616E-09***
Rifle Score	4.14E-14***	5.92E-154***	4.92E-49***
Pistol Score	0.131	1.43E-06***	9.63E-08***
Number of NJPs	0.202	0.208	0.028**
Number of Courts Martial	0.112	0.000***	0.099*
PFT	4.46E-14***	1.43E-03***	1.80E-05***

	JJAS compared to FMAM	JJAS compared to ONDJ	ONDJ compared to FMAM
CFT	1.57E-12***	5.15E-38***	5.67E-61***
Proficiency Mark	9.69E-32***	6.51E-36***	0.733
Conduct Mark	1.55E-13***	1.24E-10***	0.173

Note: * Significant at the 0.1 level
 ** Significant at the 0.05 level
 *** Significant at the 0.01 level

Table 10. Statistical Significance Comparisons across Trimesters for Females

	JJAS compared to FMAM	JJAS compared to ONDJ	ONDJ compared to FMAM
Crunches on IST	6.57E-35***	4.69E-24***	0.026**
Run time on IST*	4.72E-06***	3.06E-06***	0.967
Pull Ups on IST**			
Flexed Arm Hang on IST	1.37E-11***	3.22E-14***	0.526
AFQT Score	0.120	0.589	0.347
Rifle Score	0.031**	4.94E-12***	1.77E-05***
Pistol Score	0.151	0.675	0.088*
Number of NJPs	0.001***	0.025**	0.238
Number of Courts Martial	0.398	0.205	0.700
PFT	0.359	0.135	0.615
CFT	0.042**	0.019**	7.33E-05***
Proficiency Mark	0.319	0.003***	0.070*
Conduct Mark	0.309	0.080*	0.482

Note: * Significant at the 0.1 level
 ** Significant at the 0.05 level
 *** Significant at the 0.01 level

Specific to end strength planning, estimating the length of service for first term enlistments and possibility of reenlistment remains important. Enlisted Plans provides the Marine Corps Recruiting Command with its annual accession requirement, but also provides the retention specialists with the annual requirement for first term reenlistments. Enlisted Plans must continually refine the requirements as it tracks and maintains end strength at the end of each fiscal year. Understanding the characteristics of length of service for the various trimesters will provide insight to the planners so they did not need to make large adjustments towards the end of a fiscal year.

To demonstrate how long first term Marines stay in the Marine Corps, I used the Kaplan-Meier survival analysis to graphically represent the length of service of each trimester and each gender.

For the purposes of the analysis and limitations of the data set, I continued all Marines who reenlisted for a second term of enlistment past the four-year mark which served as the cutoff for the below graph. Figures 1 and 2 provide the graphically representations of the length of service for each trimester and gender, respectively. Figures 3 and 4 provide the graphically representations of the length of service for each trimester by gender.

Figure 1. Kaplan-Meier Survival Analysis Graph by Trimester

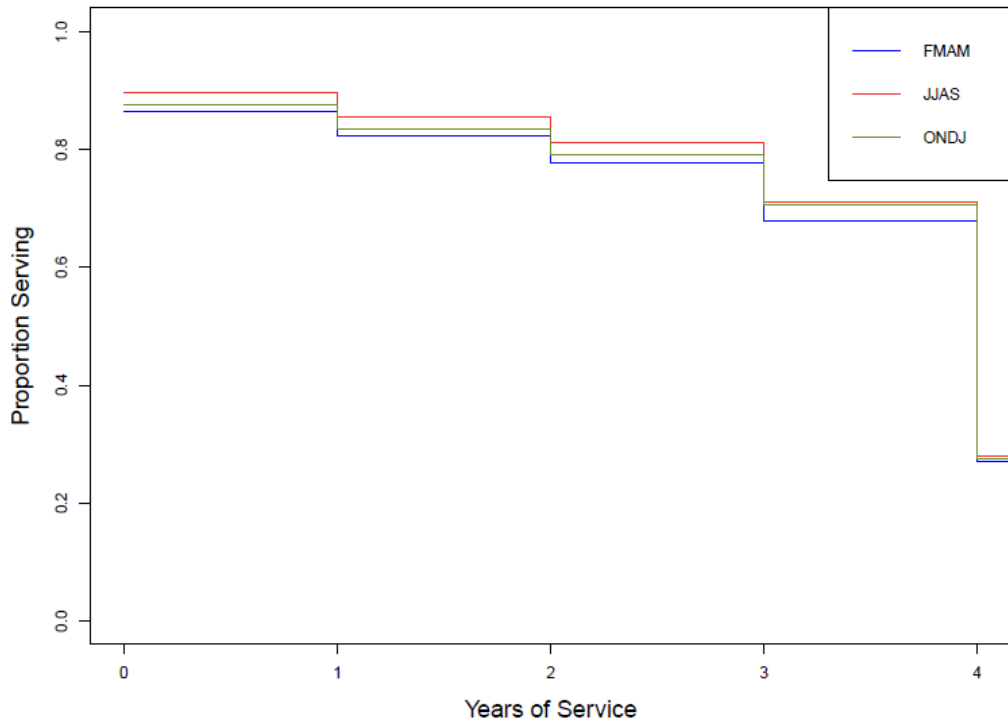


Figure 2. Kaplan-Meier Survival Analysis Graph by Gender

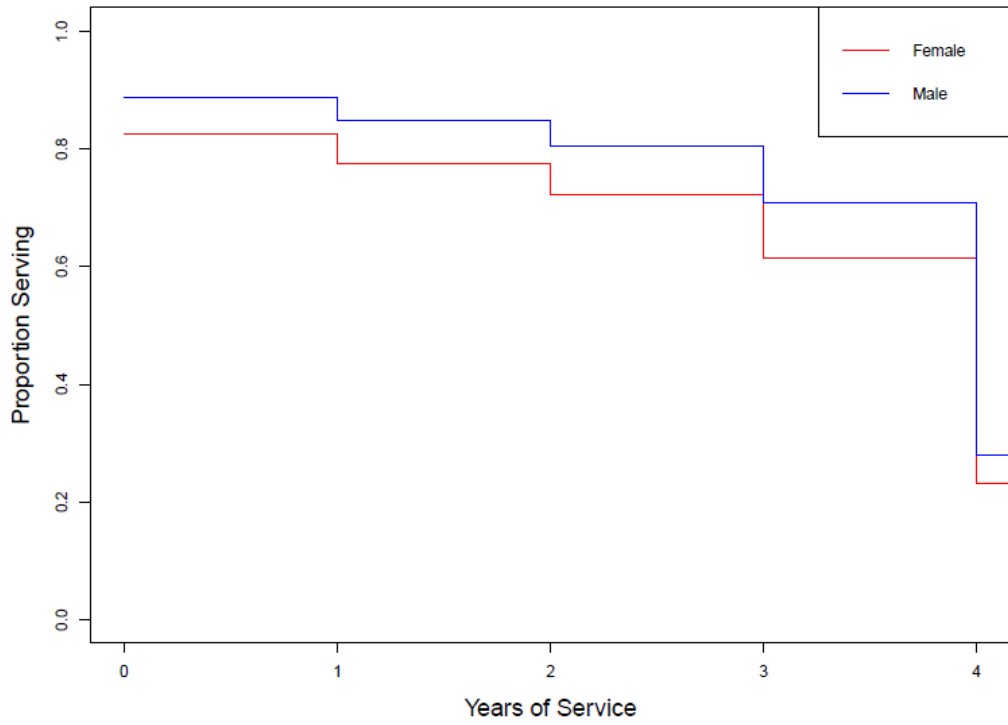


Figure 3. Kaplan-Meier Survival Analysis Graph by Trimester for Males

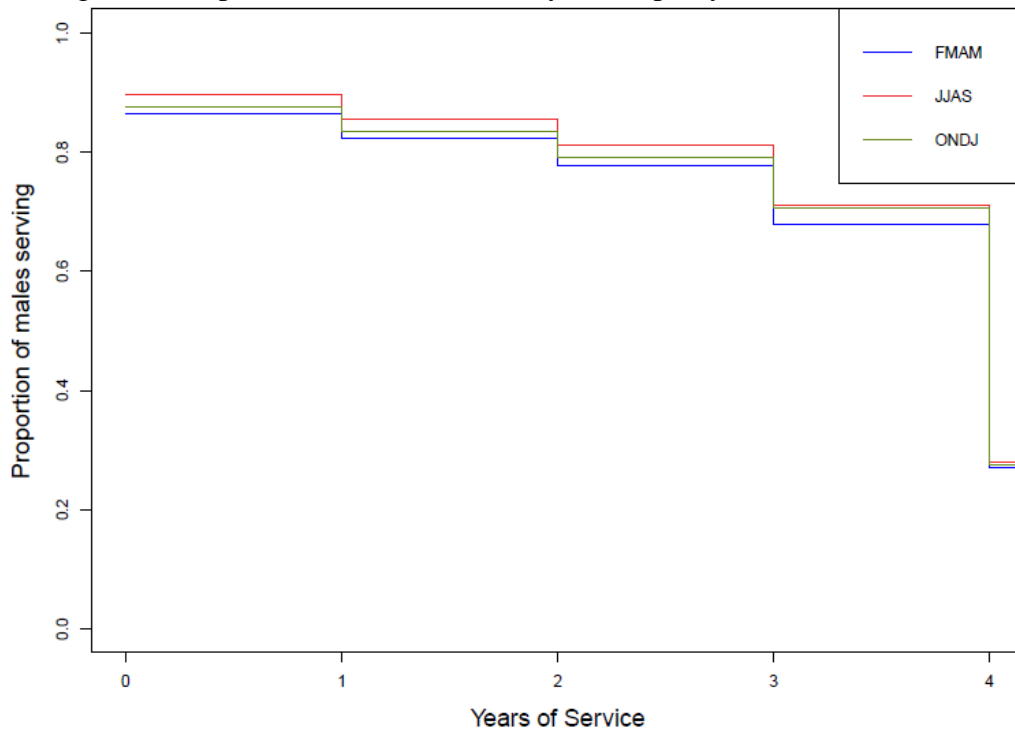
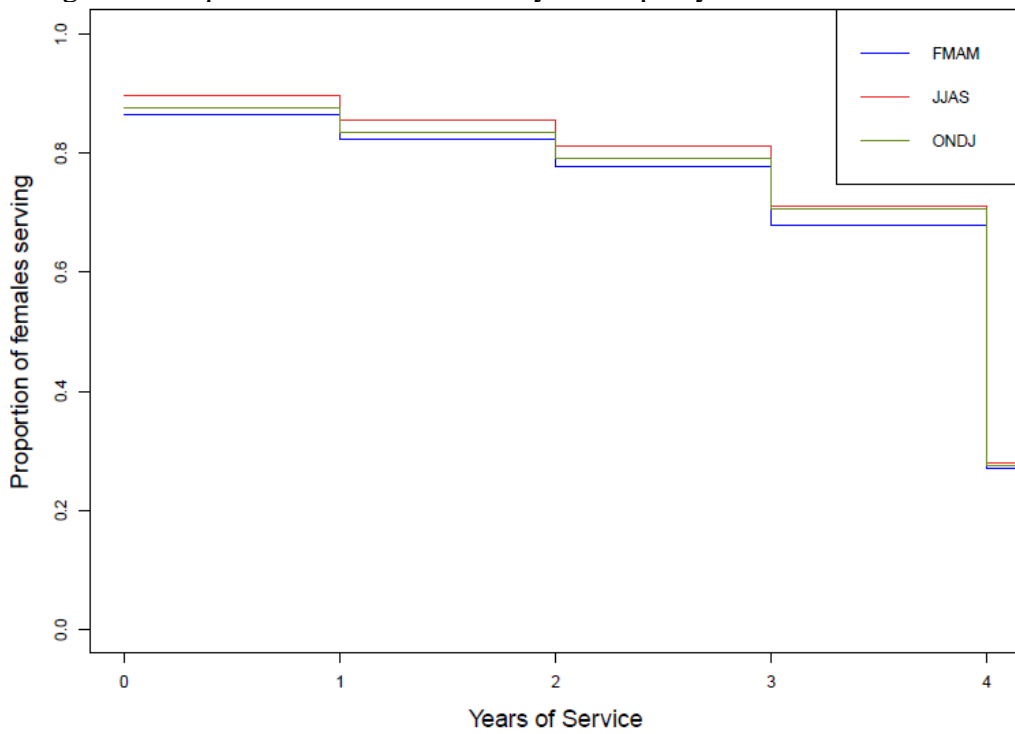


Figure 4. Kaplan-Meier Survival Analysis Graph by Trimester for Females



From the above graphs, the data suggests those Marines who enlist and report to recruit training during the JJAS trimester tend to reenlist and serve longer than the initial contract while those who enlist during the FMAM trimester serve primarily to their initial contract. Additionally, males tend to service longer at a statistically significantly higher rate than females at the 99% confidence interval.

Marines Awaiting Training (MAT)

Introduction

From the perspective of the Marine Corps, any time a Marine is not being utilized in their primary military occupational specialty is wasted money. With the enlisted first term manpower model, the Marine Corps is designed to experience approximately 75 percent attrition at the end of the four-year contract. As such, the Marine Corps places extreme value on all time they can maximize from the first term contracts. To expedite Marines reporting to their first units fully trained, the manpower planners work to reduce the time Marines await training.

Proposed Methodology

To examine the effects of MAT on retention and quality for the first term enlisted force, a researcher would need data from TFDW and the Retention Branch of Manpower Management Division, Manpower and Reserve Affairs for about 10 fiscal years. Data from TFDW provides demographic data, accession data, and classification data on individual Marines while data from the Retention Branch provides individual Marine's computed tier scores, whether a Marine was offered reenlistment, and if a Marine reenlisted. As mentioned previously, the computed tier score is used to aid the Marine Corps in reenlistment decisions. To evaluate quality, it is recommended a researcher use the computed tier score as a proxy for quality in this portion of the study as the Marine Corps has already created a quality metric in evaluating performance with an eye towards reenlistment.

Currently, the Marine Corps uses 166 formal learning centers to train Marines which are not all controlled by the Marine Corps. The Marine Corps sends 52 percent of new Marines to other service's schools for training.²⁹ The Marine Corps has little flexibility in the system when utilizing other service's schools as those services are managing their training pipeline to maximize their required production coupled with their manpower planning models. The scope of the preliminary study should be focused on Marine Corps owned schools. Through the course of a study, the Marine Corps can adjust the easiest to counter any observed negative trends or effects of MAT. Further, when applying the algorithm suggested above, a researcher should look at the single course military occupational specialty (MOS) producing schools meaning a Marine attends only three formal learning centers prior to reporting to their first unit: recruit training, Marine Combat Training, and an MOS producing school. When considering MOSs that require multiple courses in order to obtain the qualification, MAT comparisons lose meaning as they cannot be compared to each other. Marines attending more than one course will naturally experience more MAT.

While looking at these formal learning centers, it is important to note the Marine Corps end strength during the suggested data set. In 2007, the Commandant of the Marine Corps published a message to the Marine Corps stating he would advocate for end strength increases in the National Defense Authorization Act to ensure the Marine Corps could continue to support the wars in Iraq and Afghanistan while also reducing the operational tempo on the individual Marines and support all missions from the President.³⁰ With the Commandant's advocacy,

²⁹ Major John Dick (Enlisted Production Management, Training Command), discussion with author, February 26, 2020.

³⁰ Commandant of the Marine Corps. *Marine Corps End Strength Increase* (Washington, DC: United States Marine Corps, 2007), <https://www.marines.mil/News/Messages/Messages-Display/Article/886553/marine-corps-end-strength-increase/>

Congress raised the end strength level of the Marine Corps to 194,000 in fiscal year 2009³¹ and 202,100 in fiscal year 2010³². This end strength is important as the increase in accessions had subsequent effects on the formal learning centers which might skew the study results of the analysis.

Another factor that may skew research results is the definition of MAT. Researchers need to clearly define MAT and how it is calculated for each Marine. As previously mentioned, Training Command defines MAT as any time between a graduation date and a report date to the next course. However, that definition encapsulates other periods of time such as leave granted to recruit training graduates and the permissive recruiter assistant program (PRASP)³³. Those two periods do not necessarily equate to a Marine waiting to start school and wasted man-hours. Including programs like PRASP will perhaps skew a study's results as not all Marines participate in the program. Further, Marines who are removed from a course for various reasons and are either redesignated or need to wait until the next class do not fit into the Training Command definition of MAT. However, those periods of time can be defined as wasted man-hours if the Marine Corps truly wants to maximize contract utilization.

Understanding the data and timeframe for this proposed research, researchers should use regression analysis to measure the effects of MAT on retention, researchers must study the effects of time in MAT on the probability of Marines reenlisting. Comparing the effects of

³¹ *National Defense Authorization Act for Fiscal Year 2009* S 3001 110th Cong., (October 14, 2008), <https://www.govinfo.gov/content/pkg/PLAW-110publ417/pdf/PLAW-110publ417.pdf>.

³² *National Defense Authorization Act for Fiscal Year 2010* HR 2647 111th Cong., (October 28, 2009), <https://www.congress.gov/111/plaws/publ84/PLAW-111publ84.pdf>.

³³ Per the provisions of MCO 1130.62B, PRASP is an opportunity for Marines who recently graduate recruit training to return to the Recruiting Station where they enlisted and assist the recruiting effort in that area. The program provides incentives for Marines to participate in the program. The Marine Corps benefits from a new Marine describing their recent experiences in the Marine Corps in hopes of recruiting new applicants. Commandant of the Marine Corps, *Command Recruiting Program*, MCO 1130.62B, April 24, 1998, <https://www.marines.mil/Portals/1/Publications/MCO%201130.62B.pdf>.

reenlistment as a result from increased time in MAT across the quality tiers may indicate a relationship between MAT time and retention across the compute tier score range.

Recommendations

Any relationship should be explored further by using occupational specialties to narrow the focus to determine if effects are localized to particular occupational fields. If so, the results of the study could be handed over to the stakeholders in the Human Resources Development Process for the Marine Corps to develop a plan to address any negative effects along with the Marine Corps Logistics Command. Any positive effects should also be explored by the stakeholders in the Human Resources Development Process to determine the cause, if any exist.

This study provided insight for manpower planners on the characteristics of Marines who enlist and report to recruit training across the three trimesters. Further, the research provided an understanding of the historical length of service for Marines enlisting during the three trimesters. Follow-on research may be necessary to determine if manpower planners can estimate the probability of reenlistment given various variables of interest. Additionally, manpower planners may be able to estimate the reenlistment tiers Marines will be categorized in later in their career.

This study also provided a framework on how to research the effects of MAT on quality and retention. The Marine Corps, specifically Training Command, closely monitors MAT. It is also important to note time awaiting training is not a Marine Corps specific problem as all the services struggle with this issue. However, the Marine Corps places greater emphasis on time awaiting training as the Marine Corps first term retention model allows for approximately 25 percent of the first term population to reenlist each year compared to 40 percent in the Army and 45 percent in the Air Force.³⁴ As such, the Marine Corps needs to maximize the utility out of each contract. Further, units are only staffed with the available inventory which does not include

³⁴ Military Leadership Diversity Commission, *Reenlistment Rates Across the Services by Gender and Race/Ethnicity*, (Arlington, VA: Military Leadership Diversity Commission, 2010), <https://www.hsdl.org/?view&did=716162>.

Marines in the training pipeline. This staffing model results in units not receiving Marines to fill all the unit's billets. Any research to identify trends in MAT on retention and quality will not only assist in better quality and retention opportunities but also staff the Marine Corps units more fully. Although the study proposed in this thesis will only assist in identifying trends in particular occupational specialties, stakeholders in the Human Resources Development Process will need to examine any studies on MAT to then research any changes that could be made writ large or at a specific formal learning center to ultimately reduce MAT. Or, if a positive relationship exists, identify what causes lead to higher quality and retention in that given occupational specialty.