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MONTEREY, CALIFORNIA

THESIS

**POST-FIRST TERM ENLISTMENT RETENTION
ANALYSIS FOR THE SELECTED MARINE CORPS
RESERVE**

by

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June 2018

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**POST-FIRST TERM ENLISTMENT RETENTION ANALYSIS FOR
THE SELECTED MARINE CORPS RESERVE**

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Submitted in partial fulfillment of the
requirements for the degree of

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ABSTRACT

This study concerning retention of Marines serving in SelRes (Selected Reserve) units is conducted at the request of the Retention Analysis Division, Manpower & Reserve Affairs, Headquarters Marine Corps. Through developing career milestone-based logistic regression models aimed at predicting the likelihood of an individual Marine being retained, we can identify significant factors that lead to continued service.

Significant predictor variables common to each of the logistic regression models for the career milestones include total years credited toward retirement and age. These more senior individuals have likely made a career decision in continuing their military service, which explains the consistently positive effect on retention. Marines with prior active duty service, which often correlates to an increase in age and total years credited toward retirement, exhibit significantly better retention than their counterparts for the latter milestones. Deployment experience shows a consistently positive effect on retention across milestones. This suggests that Marines serving in SelRes units view deployment opportunities as favorable, and even upon completion of only single deployment, they are much more likely to continue their military service. This study validated previous research concerning similar subject matter and provides a means to forecast retention for up to 12 years in the future.

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TABLE OF CONTENTS

I.	INTRODUCTION.....	1
A.	PURPOSE.....	1
B.	BACKGROUND	1
C.	UNITED STATES MARINE CORPS RESERVE STRUCTURE	3
1.	Ready Reserve	4
2.	Selected Reserve	5
3.	Individual Ready Reserve	6
D.	OVERVIEW OF THESIS.....	7
E.	LITERATURE REVIEW	7
1.	Gender.....	8
2.	Race/Ethnicity	8
3.	Occupational Specialty	9
4.	Rank/Paygrade.....	9
5.	Mobilization.....	10
6.	Mental Health.....	11
7.	Region.....	12
8.	Additional Factors	13
II.	DATA AND METHODOLOGY	15
A.	INTRODUCTION.....	15
B.	DATA	15
1.	Data Compilation	17
2.	Response Variables	17
3.	Predictor Variables.....	18
C.	METHOD	20
1.	Univariate Analysis.....	20
2.	Multivariate Analysis.....	21
3.	Comparison of Models.....	23
III.	DESCRIPTIVE STATISTICS.....	25
A.	INTRODUCTION.....	25
B.	COHORT CHARACTERISTICS BY MILESTONE	25
1.	Cohort 1	25
2.	Cohort 2	36
3.	Cohort 3	46
C.	MERGING COHORTS 1–3.....	56
1.	Traditional Demographics	56

2.	Military Demographics.....	60
3.	Characteristics by Milestones	67
D.	UNIVARIATE EXPLORATION	77
1.	Milestone A	77
2.	Milestone B	81
3.	Milestone C	85
IV.	RESULTS AND ANALYSIS	91
A.	INTRODUCTION.....	91
B.	DESCRIPTION.....	91
1.	Milestone A	91
2.	Milestone B	93
3.	Milestone C	94
C.	MODEL DIAGNOSTICS	96
1.	Milestone A	97
2.	Milestone B	98
3.	Milestone C	100
D.	COMPARISON.....	101
1.	Milestone A	101
2.	Milestone B	103
3.	Milestone C	105
E.	ANALYSIS AND ADDITIONAL CONSIDERATIONS	107
V.	CONCLUSIONS AND RECOMMENDATIONS.....	109
A.	INTRODUCTION.....	109
B.	CONCLUSIONS	109
C.	RECOMMENDATIONS FOR FUTURE STUDIES.....	111
	APPENDIX.....	113
	LIST OF REFERENCES.....	115
	INITIAL DISTRIBUTION LIST	119

LIST OF FIGURES

Figure 1.	SelRes end strength by fiscal year.	3
Figure 2.	Marine Forces, Reserve (MARFORRES) main subordinate element structure. Source: USMC (2015).	4
Figure 3.	Marine Corps RC breakdown. Source: USMC (2015).	4
Figure 4.	Personnel breakdown by SelRes component. Adapted from Dausman (2017).	5
Figure 5.	Initial active duty service contract. Source: Reserve Affairs, Manpower and Reserve Affairs (2017).	5
Figure 6.	Retention rates according to days deployed and dependents. Source: Quester A et al. (2006).	11
Figure 7.	Cohort attrition by fiscal year. Adapted from Retention Analysis Division, M&RA, HQMC (2017).	16
Figure 8.	Education demographics for merged cohort (n=1,490).	57
Figure 9.	Marital status demographics for merged cohort (n=1,490).	57
Figure 10.	Race demographics for merged cohort (n=1,490).	58
Figure 11.	Age demographics for merged cohort (n=1,490).	59
Figure 12.	Home state demographics for merged cohort (n=1,490).	59
Figure 13.	Dependent demographics for merged cohort (n=1,490).	60
Figure 14.	Cohort demographics for merged cohort (n=1,490).	61
Figure 15.	Reenlistment recommendation demographics for merged cohort (n=1,490).	61
Figure 16.	Rank demographics for merged cohort (n=1,490).	62
Figure 17.	PMOS demographics for merged cohort (n=1,490).	63
Figure 18.	AFQT score demographics for merged cohort (n=1,490).	63
Figure 19.	Present unit location demographics for merged cohort (n=1,490).	64
Figure 20.	Personal award demographics for merged cohort (n=1,490).	64

Figure 21.	Days of combat deployment demographics for merged cohort (n=1,490).....	65
Figure 22.	Days of non-combat deployment demographics for merged cohort (n=1,490).....	66
Figure 23.	PFT score demographics for merged cohort (n=1,490).....	66
Figure 24.	Retirement credited years demographics for merged cohort (n=1,490).....	67
Figure 25.	Pearson standardized residuals, leverage and Cook's distances, Milestone A model.....	97
Figure 26.	Cook's Distance values per observation, Milestone A model.	98
Figure 27.	Pearson standardized residuals, leverage and Cook's distances, Milestone B model.	99
Figure 28.	Cook's Distance values per observation, Milestone B model.	99
Figure 29.	Pearson standardized residuals, leverage and Cook's distances, Milestone C model.	100
Figure 30.	Cook's Distance values per observation, Milestone C model.	101
Figure 31.	ROC curve comparison between logistic regression (LR) and random forest (RF) models, Milestone A.	102
Figure 32.	Importance values by predictor variable, Milestone A.	103
Figure 33.	ROC curve comparison between logistic regression (LR) and random forest (RF) models, Milestone B.	104
Figure 34.	Importance values by predictor variable, Milestone B.	105
Figure 35.	ROC curve comparison between logistic regression (LR) and random forest (RF) models, Milestone C.	106
Figure 36.	Importance values by predictor variable, Milestone C.	107

LIST OF TABLES

Table 1.	Limit of Service by Rank in MARFORRES. Source: USMC (2015).	10
Table 2.	Cohort descriptions. Source: RA, M&RA, HQMC (2017).	16
Table 3.	Categorical variable descriptions	18
Table 4.	Numeric variable descriptions	20
Table 5.	Cohort 1 Characteristics for Milestone A (n = 526 [%]).	27
Table 6.	Cohort 1 Characteristics for Milestone B (n = 526 [%]).	30
Table 7.	Cohort 1 Characteristics for Milestone C (n = 526 [%]).	33
Table 8.	Cohort 2 Characteristics for Milestone A (n = 660 [%]).	37
Table 9.	Cohort 2 Characteristics for Milestone B (n = 660 [%]).	40
Table 10.	Cohort 2 Characteristics for Milestone C (n = 660 [%]).	43
Table 11.	Cohort 3 Characteristics for Milestone A (n = 304 [%]).	47
Table 12.	Cohort 3 Characteristics for Milestone B (n = 304 [%]).	50
Table 13.	Cohort 3 Characteristics for Milestone C (n = 304 [%]).	53
Table 14.	Merged Characteristics for Milestone A (n = 1,490 [%]).	68
Table 15.	Merged Characteristics for Milestone B (n = 1,490 [%]).	71
Table 16.	Merged Characteristics for Milestone C (n = 1,490 [%]).	74
Table 17.	Univariate Model Results from merged cohort: Milestone A.	79
Table 18.	Univariate Model Results from merged cohort: Milestone B.....	83
Table 19.	Univariate Model Results from merged cohort: Milestone C.....	86
Table 20.	Coefficient estimates and p-values, Milestone A model.	92
Table 21.	Coefficient estimates and p-values, Milestone B model.	93
Table 22.	Coefficient estimates and p-values, Milestone C model.....	95
Table 23.	Data dictionary for categorical variables.	113

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LIST OF ACRONYMS AND ABBREVIATIONS

SMCR	Selected Marine Corps Reserve
M&RA	Manpower & Reserve Affairs
SelRes	Selected Reserve
NPS	non-prior service
RC	Reserve Component
USMC	United States Marine Corps
MDPSD	Mandatory Drill Participation Stop Date
AC	Active Component
AFQT	Armed Forces Qualification Test
PMOS	primary military occupational specialty
HOR	home of record
GUI	graphic user interface
HQMC	Headquarters Marine Corps
MEF	Marine Expeditionary Force
MARFORRES	Marine Forces, Reserve
ASL	Active Status List
ISL	Inactive Status List
IRR	Inactive Ready Reserve
IMA	Individual Mobilization Augmentee
AR	Active Reserve
IADT	Initial Active Duty for Training
IDT	Inactive Duty Training
AT	Annual Training
MOS	military occupational specialty
EOS	End of Obligated Service
ADT	Active Duty Training
DoD	Department of Defense
CNA	Center for Naval Analysis
RAND	Research and Development Corporation
MLDC	Military Leadership Diversity Commission

MCO	Marine Corps Order
PTSD	Post–Traumatic Stress Disorder
DMSS	Defense Medical Surveillance System
PFT	Physical Fitness Test
YOS	years of service
RASP1	Ranger Assessment and Selection Program 1
MCTFS	Marine Corps Total Force System
EDIPI	Electronic Data Interchange Personal Identifier
csv	comma separated values
NA	not applicable
UNK	unknown
AIC	Akaike Information Criterion
ROC	Receiver Operator Characteristic
BIC	Bayesian Information Criterion
ANOVA	analysis of variance
PMOS	primary military occupational specialty

EXECUTIVE SUMMARY

A. PURPOSE

Over the past 20 years, the United States Marine Corps has been tasked with meeting constantly shifting manpower requirements and implementing changes in force structure due to numerous significant world events. Operations Iraqi Freedom and Enduring Freedom, specifically, have forced the Marine Corps to drastically increase and subsequently decrease its manning levels—relying heavily on the Selected Marine Corps Reserve (SMCR). Knowledge of the effect these events have on attrition and retention is a key consideration when planning for future conflicts and manpower levels. Identifying factors that effectively predict retention across a year range that includes peacetime and war will provide a means for Marine Corps planners to forecast retention more than 10 years into the future.

B. BACKGROUND

The high operational tempo since the onset of the Global War on Terror makes it imperative that Manpower and Reserve Affairs (M&RA) meets its retention goals for the Marine Corps Reserve. According to data provided by the Marine Corps Retention Analysis Division, the Marine Corps failed to meet its authorized end strength for the Selected Reserve (SelRes) at the end of fiscal years 2006–2010 by an average of just over 1,000 Marines (Retention Analysis Division, Manpower & Reserve Affairs, Headquarters Marine Corps 2017).

Marines assigned to SMCR units make up the majority of the SelRes at 79 percent, or over 30,000 Marines. (Retention Analysis Division, Manpower & Reserve Affairs, Headquarters Marine Corps 2017) There are two methods of ascension into the SelRes, non–prior service (NPS) and prior service. NPS Marines make up approximately two–thirds of those who enter the Reserve Component (RC) and do so immediately following their initial training pipeline (United States Marine Corps [USMC] 2015). Prior service Marines, on the other hand, have completed their active duty contract and elect to enter either the SelRes or Inactive Ready Reserve.

The primary concern with regard to retention, or continuation, for the scope of this study is if a given Marine continues service through their second and third enlistments in an SMCR unit. In order to determine the likelihood of reaching these career milestones and the factors that lead to Marines doing so, logistic regression models are constructed based on 15 years of data provided by the Retention Analysis Division, M&RA.

C. CONCLUSIONS

The logistic regression models developed for each milestone performed exceptionally well, achieving an average correct classification rate of 90.4 percent for the observations included in this study. Findings from the statistical testing regimen applied to each model strongly suggest sufficient 1) overall fit to the data and 2) ability to explain variance of the response variable.

At Milestone A, or four years of service from a Marine's mandatory drill participation stop date (MDPSD), an increase in rank, total years credited toward retirement, number of combat deployments, and age show a positive effect on retention. Earning at least one personal award also shows a positive effect on retention; which suggests these Marines are high performers, likely displaying attributes allowing for continued service. Present unit location, depending on region, shows both a positive and negative effect on retention. In the event a Marine is serving at a SMCR unit in the Western, Midwestern, or Southern regions of the United States, retention is positively affected while serving in the Northeastern or Pacific region shows a negative effect.

The logistic regression model for Milestone B, or eight years of service from a Marine's MDPSD, has similarities when compared to the Milestone A model in that an increase in rank, total years credited toward retirement, days noncombat deployed, and age show a positive effect on retention. Prior service in the Active Component (AC) shows a positive effect on retention, as does scoring in the highest echelon (76–100 points) on the Armed Forces Qualification Test (AFQT). The Milestone B model also allows for a comparison of retention between primary military occupational specialty (PMOS) categories, with combat service support and aviation and aviation

support PMOS designation showing a negative effect on retention when compared to combat arms. Race also appears to be a factor, with a race designation of “Other” to include Hispanics, Pacific Islanders, and Native Americans showing a positive effect on retention when compared to designations of Asian, African American, and Caucasian.

The logistic regression model for Milestone C, or 12 years of service from a Marine’s MDPSD, yields similar findings from the previous two models with respect to total years credited toward retirement and age. A major driving factor in reaching this milestone appears to be prior service in the AC, showing a highly positive effect on retention. For the first time, home state is significant in predicting retention, with a home of record (HOR) in the Southern, Northeastern, and Pacific regions showing a considerably negative effect on retention when compared to HORs in the Western and Midwestern regions.

Significant predictor variables common to each of the logistic regression models for the three milestones include total years credited toward retirement and age. These more senior individuals have likely made a career decision in continuing their military service, which explains the consistently positive effect. Marines with prior service in the AC, which often correlates to an increase in age and total years credited toward retirement, exhibit significantly better retention than their counterparts for Milestones B and C. Deployment experience, whether combat or noncombat, shows consistently positive effect on retention across milestones. This suggests that Marines serving in SelRes units view deployment opportunities as favorable, and even upon completion of only single deployment, they are much more likely to continue their military service.

D. RECOMMENDATIONS FOR FUTURE STUDIES

The next logical step for follow-on studies is to take the findings presented here and incorporate them into an easy-to-use graphic user interface (GUI) that can be placed in the hands of future force level planners at M&RA, Headquarters Marine Corps (HQMC). Applying the equations obtained from the logistic regression models to a database of readily accessible variables associated with Marines currently serving in

SMCR unit will provide a means to forecast retention for four, eight, and twelve years from each Marine's MDPSD.

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<http://www.marines.mil/Portals/59/MCO%201001R.1L.pdf>.

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I. INTRODUCTION

A. PURPOSE

Over the past 20 years, the United States Marine Corps has been tasked with meeting constantly shifting manpower requirements and implementing changes in force structure due to numerous significant world events. Operations Iraqi Freedom and Enduring Freedom, specifically, have forced the Marine Corps to drastically increase and subsequently decrease its manning levels—relying heavily on the SMCR. Knowledge of the effect these events have on attrition and retention is a key consideration when planning for future conflicts and manpower levels. Due to numerous career options available to Marines now serving in the SMCR, it can be difficult to accurately and efficiently track their attrition, retention, and continuation rates. Identification of key factors associated with retention in the SMCR could result in Marine Corps recruiters more effectively identifying potential recruits most likely to be retained. Knowledge of these factors will also provide active duty support personnel assigned to SMCR units a more effective way to identify Marines with a high likelihood of being retained.

HQMC, M&RA is tasked with developing administrative procedures for the Marine Corps Reserve career planning program. This program is pivotal in achieving retention of qualified SMCR Marines to satisfy manpower requirements based on current and future requirements of the Marine Corps. Providing Marine Corps planners the tools to accurately forecast retention past a Marine's first reenlistment across a wide range of scenarios is the motivation for this thesis. Determining factors that effectively predict retention across the constantly changing manpower requirements of peacetime and war is the goal.

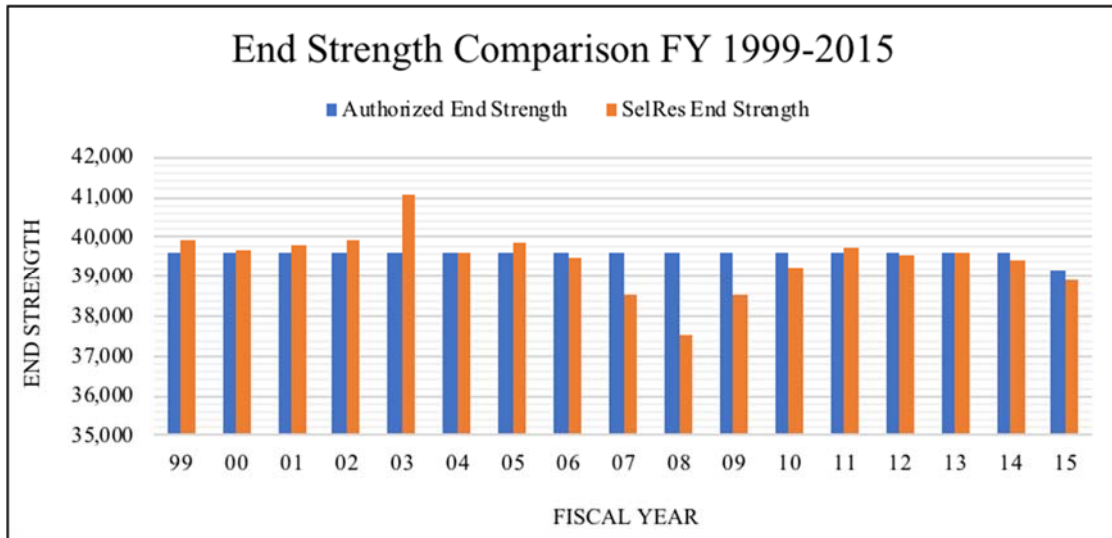
B. BACKGROUND

The development of the Total Force Concept began with President Nixon's initiative to end the draft following the 1968 Tet Offensive during the Vietnam War, which was coupled with lack of stateside popular support for the war (Carafano 2005). The foundation of this concept is largely credited to then Army Chief of Staff General

Creighton Abrams, who developed the Abrams Doctrine that introduced the modern concept of the reserve and afforded the president a means to mobilize a substantial military force to meet the Soviet threat (Carafano 2005). The resulting Total Force Concept, enacted in 1973, completed the transition of the United States military into an all-volunteer force (Carafano 2005).

The Total Force Concept retains some of the tenets of the Abrams Doctrine, to include the force structure of the RC mirroring that of the AC. The turning point, however, in terms of how the reserve force is employed occurred during Operations Desert Shield/Desert Storm, which was the first major mobilization of the reserve following the advent of the Total Force Concept (Marine Reserve Centennial Project 2016). Comprising 15 percent of the Marine forces dedicated to the conflict, the Marine Corps mobilized more than 63 percent of its RC (Marine Reserve Centennial Project 2016). Following Desert Shield/Desert Storm, the Marine Reserve Force was created and included an air wing, infantry division, logistics group, and headquarters battalion following the original intent of the Abrams Doctrine, mirroring the active duty Marine Corps in structure, capabilities, and readiness (Marine Reserve Centennial Project 2016). After the attacks on September 11th, 2001 and the resulting Global War on Terror, the Marine Corps Reserve mobilized to an extent not seen since Desert Shield/Desert Storm. To put this in perspective, as of 2014, each Marine Corps Reserve unit at the battalion and squadron level has been activated at least once for deployment to either Iraq or Afghanistan (Marine Reserve Centennial Project 2016).

This high operational tempo stemming from the Global War on Terror makes it imperative that M&RA meets its retention goals for the Marine Corps Reserve. As per U.S. Code § 115, the United States Congress determines the end strength of the Selected Reserve for each fiscal year (Research and Development Corporation 2018). As depicted in Figure 1, the Marine Corps failed to meet its authorized end strength for the Selected Reserve at the end of fiscal years 2006–2010 by an average of just over 1,000 Marines (Retention Analysis Division, Manpower & Reserve Affairs, Headquarters Marine Corps 2017).



Data from Retention Analysis Division, Manpower & Reserve Affairs, Headquarters Marine Corps [RA, M&RA, HQMC] (2017).

Figure 1. SelRes end strength by fiscal year.

One factor that may have attributed to this trend is the 2007 surge in troops deployed in support of Operation Iraqi Freedom with the aim to provide additional security to the city of Baghdad and the Al Anbar province, which resulted in increased deployments and activations of SelRes troops. Failure to retain these individuals, many with combat experience from multiple tours, may serve as a detriment to the cohesion and combat readiness of SelRes units.

C. UNITED STATES MARINE CORPS RESERVE STRUCTURE

The command structure of the Marine Forces Reserve mirrors that of the AC Marine Expeditionary Force (MEF), with a mission to provide a “professionally ready, responsive, and relevant force comprised of units and individuals as Marine Corps solution capable of responding to the full range of military operations as necessitated by the Combatant Commanders” (USMC 2015). The Marine Corps Reserve has five major components depicted in Figure 2: the 4th Marine Division, 4th Marine Air Wing, 4th Marine Logistics Group, Force Headquarters Group, and Headquarters Battalion (USMC 2015).



Figure 2. Marine Forces, Reserve (MARFORRES) main subordinate element structure. Source: USMC (2015).

Within the Marine Corps Reserve, there exist three components into which Marines may be categorized as depicted in Figure 3: the Ready Reserve, Standby Reserve, and Retired Reserve (USMC 2015).

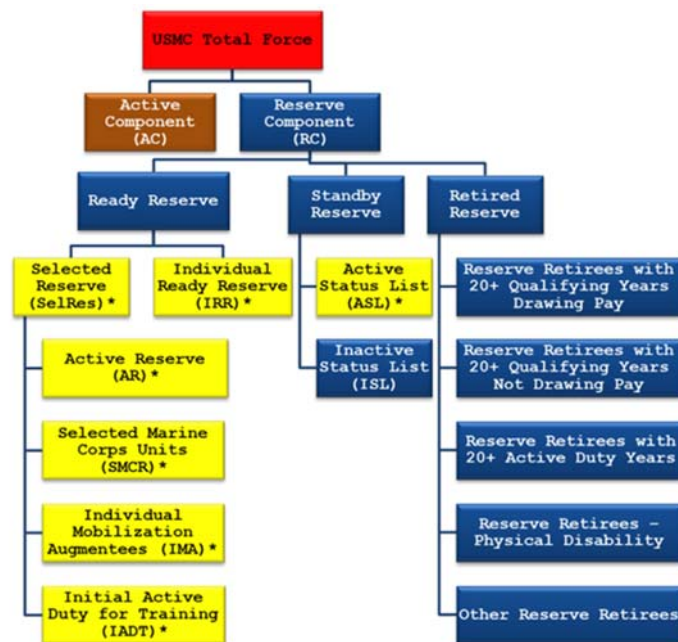


Figure 3. Marine Corps RC breakdown. Source: USMC (2015).

1. Ready Reserve

The Ready Reserve has two subcomponents, the Selected Reserve and the Inactive Ready Reserve (IRR). Both of these components include those Marines who are subject to immediate recall to active duty in the event of war, domestic disaster response, or any other time when authorized by law (USMC 2015).

2. Selected Reserve

The Selected Reserve consists of four major groups: Marines and the SMCR units they are a part of, Individual Mobilization Augmentee (IMA), Marines serving on the Active Reserve (AR), and Marines serving on Initial Active Duty for Training (IADT) (USMC 2015). Marines assigned to SMCR units make up the majority of the SelRes as depicted in Figure 4. There are two methods of ascension into the SelRes, NPS and prior service as depicted in Figure 5. NPS Marines make up approximately two-thirds of those who enter the RC and do so immediately following their initial training pipeline (USMC 2015). Prior service Marines, on the other hand, have completed their active duty contract and elect to enter either the SelRes or IRR, as depicted in Figure 5.

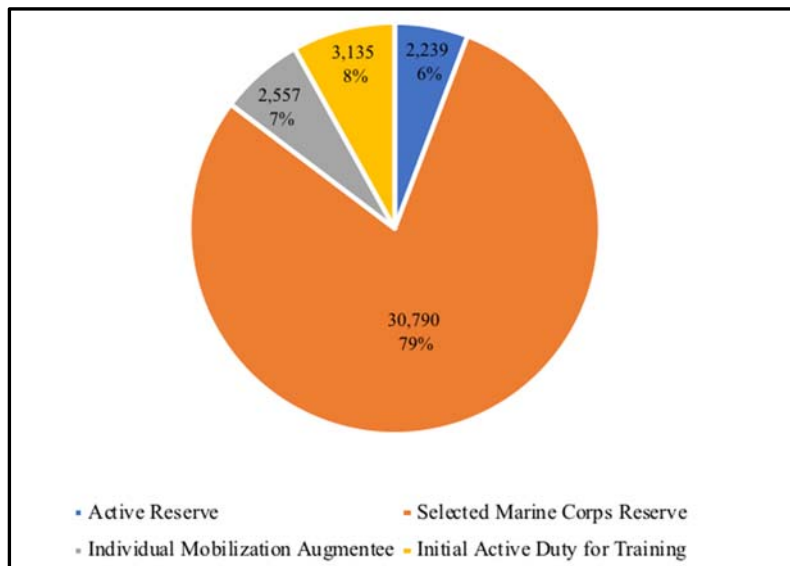


Figure 4. Personnel breakdown by SelRes component.
Adapted from Dausman (2017).



Figure 5. Initial active duty service contract. Source: Reserve Affairs, Manpower and Reserve Affairs (2017).

a. *Active Reserve*

The AR consists of RC full—time support Marines that fill “billets that support the organization, administration, recruiting, retention, instruction, and training of the Marine Corps Reserve” (USMC 2015).

b. *Selected Marine Corps Reserve Units*

Marines assigned to an SMCR unit are required to participate in monthly Inactive Duty Training (IDT) and yearly two—week long Annual Training (AT) activations. When not mobilized for deployment or called to active duty for training, administrative command of these SMCR units lies with Commander, MARFORRES (USMC 2015).

c. *Individual Mobilization Augmentee*

In the event there exists a personnel shortfall in an AC unit, the IMA program allows for Reserve Marines, on an individual basis, to be called to active duty to fill billet vacancies. This program can only be facilitated for the purpose of meeting wartime military manpower requirements prior to the mobilization of the IRR (USMC 2015).

d. *Initial Active Duty for Training*

IADT consists of Marines on an initial Reserve contract that are in an active status to undergo basic recruit training, Marine Combat Training, or any military occupational specialty (MOS) school. Upon completion of training, these Marines will fall back into their respective RC (USMC 2015).

3. *Individual Ready Reserve*

The IRR functions as a manpower resource composed of Marines who have either 1) served in the active component or SelRes component 2) completed their initial Marine Corps basic training pipeline. These Marines, while not actively assigned to a SelRes unit, are available for mobilization when conditions exist that warrant mobilization of the Ready Reserve (USMC 2015).

D. OVERVIEW OF THESIS

The focus of this study is the retention of Marines currently serving in the SelRes assigned to a SMCR unit who have completed their initial enlistment and have decided to reenlist in the SMCR. An initial enlistment for the Marine Corps Reserves is outlined in Marine Corps Order 1001R.1L as an eight-year period of obligated service. This period of obligated service is broken up by a MDPSD and End of Obligated Service (EOS) date. Once a Marine reaches their MDPSD, they may extend their contract by “accepting an incentive, retraining, transitioning/converting, participating in a refresher program, or voluntarily accepting a new MDPSD based on the needs of the Marine Corps” or they can elect to continue their service for the remainder of their contract until their EOS date in the IRR (USMC 2015). For the purposes of this study, retention is defined as a Marine choosing to continue service assigned to a SMCR unit. Attrition is defined as a Marine choosing to not continue their service in the SMCR and electing to either transition to the IRR, any other component of the Marine Corps RC, or to the Marine Corps AC. This does not include SMCR Marines who temporarily fall under Active Duty Training (ADT) later in their career for the purposes formal schooling.

The primary concern with regard to retention, or continuation, within the SMCR for the scope of this study is if a given Marine continues service through their second and third reenlistments. In order to determine the likelihood of reaching these career milestones and the factors that lead to Marines doing so, a logistic regression model will be constructed from 15 years of data provided by Retention Analysis Division, M&RA. This includes three specific cohorts of Marines, each defined by the fiscal year that they reenlisted in the SMCR for the first time—years 1998, 1999, and 2000.

E. LITERATURE REVIEW

From a purely financial standpoint, retaining quality personnel in the armed forces means a return on an investment. This investment begins with recruiting, with the average cost to recruit a single Marine estimated at \$6,539—which accounts for factors such as advertising and enlistment bonuses (Olick 2002). In addition to money spent on basic training for a servicemember and their annual pay, there are numerous indirect costs

that occur as well. Indirect costs such as medical support, family housing, and education and training can average up to \$35,187 per servicemember per year (Horowitz 2016). For the Department of Defense (DoD), a driving factor in maintaining a positive return on the investment of its service members is identifying those factors that lead to retention. The following factors are proven to be historically consistent in predicting whether or not an individual continues their military service.

1. Gender

A 2015 study carried out by the Center for Naval Analysis (CNA) focused on the differences between male and female continuation rates in the Marine Corps found “enlisted women traditionally have higher attrition than their male counterparts in the Delayed Entry Program, in recruit training, and in the first term, but their long-term retention rates have generally been higher, given that they are retained past their initial contracts” (Desrosiers and Bradley 2015). In terms of being eligible for reenlistment and subsequently choosing to reenlist, the study references work that found men and women who were not married or had no dependents were more likely to be eligible and recommended for reenlistment (Malone et al. 2011). Conversely, whether a Marine actually chose to reenlist yields different results. Marines, both male and female, who “had any dependents—whether a spouse, children, or both—or who had dependent enlistment waivers were more likely to reenlist in the Marine Corps than those who did not” (Malone et al. 2011).

2. Race/Ethnicity

In 1998, the Research and Development (RAND) Corporation conducted a study focused on the effect mobilization for Desert Shield/Desert Storm had on reserve retention (Kirby and Naftel 1998). Regarding race and ethnicity, they found that African Americans were “much more likely to stay in the reserves, even after controlling for other factors, than their white counterparts” (Kirby and Naftel 1998). In April 2010, Congress tasked the Military Leadership Diversity Commission (MLDC) to conduct a study to examine existing DoD policies and their effect on continuation rates of various races and ethnic groups. Analyzing data taken from 1967–1991, the study concludes that

minority men are underrepresented in military senior leadership. Primary reasons for this, according to this study, were lower levels of reenlistment and lower rates of promotions when compared to their white counterparts (Military Leadership Diversity Commission 2010).

3. Occupational Specialty

Across the spectrum of occupational specialties in the Marine Corps, there exist many differences in the amount of applicable skills and certifications gained while in service that are applicable in the outside world. These skills obtained through military training make certain Marines highly sought-after by civilian competition, and in turn can lead to lower retention when faced with the decision to reenlist or accept an, at times, significant pay raise from the civilian sector.

In a 2001 thesis, Hall conducted an analysis on the overall job satisfaction of first-term male enlisted Marines, focusing specifically on occupational specialties broken down into five categories: “combat,” “combat service support,” “aviation,” “aviation support,” and “service support” (Hall 2001). Fitting a retention model based on data obtained from 5,526 male enlisted Marines from paygrades E-2 through E-4, Hall came to the following conclusions. “Combat” and “combat service support” Marines were significantly more dissatisfied with their job when compared to Marines in the other three occupational groups (Hall 2001). “Aviation” Marines were significantly more dissatisfied with the hours required for their occupational specialty when compared to Marines in the other four occupational groups (Hall 2001). From Hall’s conclusions, overall job satisfaction is clearly dependent upon an individual Marine’s occupational specialty and will no doubt influence their decision to continue service.

4. Rank/Paygrade

Without conducting any research, it is a likely conclusion that an increase in rank leads to an increase in retention. This is in part due to time limits set by the Marine Corps that a reservist can remain in a current rank at the time of reenlistment. Table 1 outlines these limits according to Marine Corps Order (MCO) 1001R.1L.

Table 1. Limit of Service by Rank in MARFORRES.
Source: USMC (2015).

Rank	Limit of Service (years)
Corporal	8
Sergeant	13
Staff Sergeant	20
Gunnery Sergeant	22
1st Sergeant/Master Sergeant	27
Sergeant Major/Master Gunnery Sergeant	30 years total federal service

Although waivers can be obtained for extensions beyond the limits of service, a reserve Marine is ineligible for reenlistment if they fail to promote. Another factor with regards to rank is proximity to retirement. A RAND study focused on reserve retention determined that lower ranks exhibit lower retention, reflecting fewer promotions and poor performance ratings (Kirby and Naftel 1998). Conversely, reserve Marines promoted to higher ranks with more years of service exhibit higher retention.

5. Mobilization

The scope of this study, ranging from fiscal years 1998 to 2015, saw a heavy reliance on the Marine Corps Reserve to supplement active duty forces deployed to Operations Iraqi Freedom and Enduring Freedom, as well as numerous humanitarian crises at home and abroad. The most recent conflict that even begins to compare to the level of involvement from the Marine Corps Reserves is Operation Desert Shield/Desert Storm. Analyzing data that included 3,268 part-time enlisted reservists with between four and 12 years of service as of September 1994, a 1998 RAND study concluded that mobilized reservists exhibited a five percent lower retention rate when compared to non-mobilized reservists (Kirby and Naftel 1998). Although this study deemed this difference in retention negligible, it also draws the conclusion that “frequent, small-scale, and perhaps unpopular deployments may have different and perhaps adverse effects on retention” (Kirby and Naftel 1998). When compared to Operations Iraqi Freedom and Enduring Freedom, Desert Shield/Desert Storm pales in comparison in terms of length and casualties sustained. This fact, according to the conclusion from the RAND study concerning unpopular deployments, could potentially lead to a larger difference in

retention between mobilized and non-mobilized reservists for the years of this study. In 2006, the CNA conducted a similar study analyzing Marine Corps retention post-9/11, focusing specifically on deployment tempo and if a given Marine had dependents. Dependents aside, the study found a strong association between number of days deployed and lower retention for Marines serving in their first enlistment, depicted in Figure 6 (Quester et al. 2006).

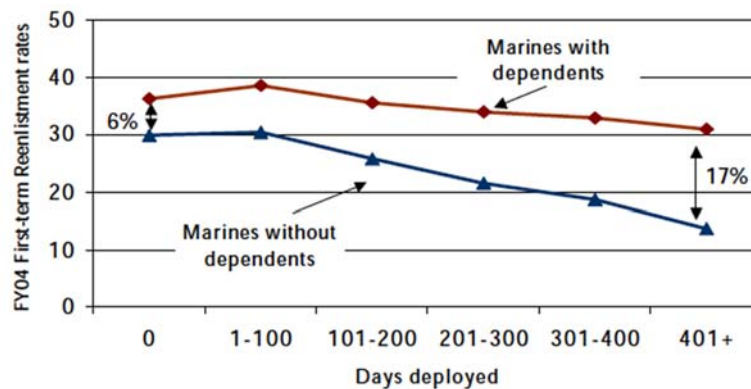


Figure 6. Retention rates according to days deployed and dependents. Source: Quester A et al. (2006).

However, for enlisted Marines serving in their second and third enlistments, no association was found between number of days deployed and retention (Quester et al. 2006). The CNA study concludes that high deployment tempo, specifically to combat zones, causes significant attrition among the enlisted ranks serving their first enlistment and has little effect on senior enlisted and officers (Quester et al. 2006).

6. Mental Health

The Global War on Terror has placed, and continues to exert a heavy burden on those serving in uniform, causing great emotional and physical strain. Much progress has been made in the diagnosis and treatment of the pervasive effects of combat, namely Post-Traumatic Stress Disorder (PTSD). There is no shortage of papers and studies that address this syndrome and how best to treat it, but two applicable to this study examine

mental health and its relation to retention before and during the Global War on Terror. In their paper entitled, “U.S Military Mental Health Care Utilization and Attrition Prior to the Wars in Iraq and Afghanistan,” Wilson, Messer, and Hoge analyze data obtained from the Defense Medical Surveillance System (DMSS) to establish a pre-9/11 baseline of how service members are utilizing health care and the resulting effect on retention which could later be compared to post-9/11 studies. They found that in the year 2000, approximately 12 percent of the U.S. military sought or were referred to behavioral health services (Wilson et al. 2009). Of that 12 percent, 38 percent who received a mental disorder diagnoses were unable to continue their service (Wilson et al. 2009).

A follow-on paper entitled “Mental Health Problems, Use of Mental Health Services, and Attrition from Military Service after Returning from Deployment to Iraqi or Afghanistan” by Hoge, Auchterlonie, and Milliken examined the same relationship between the utilization of health services and attrition, but this time for veterans returning from deployment. Compared to the 12 percent of service members utilizing health care in the year 2000, 35 percent of Operation Iraqi Freedom veterans utilized health care (Hoge et al. 2006). Of those 35 percent, twelve percent were diagnosed with a mental health problem (Hoge et al. 2006). In terms of attrition, Hoge, Auchterlonie, and Milliken found that “those who screened positive for a mental health concern were significantly more likely to leave service for any reason during the year after deployment than those who screened negative for all deployment locations” (Hoge et al. 2006). To clarify, a PTSD diagnosis or some sort of other mental condition does not spell discharge from the armed forces. What these papers are stating is that the combination of deployments, specifically to combat zones, and utilization of health care serve as reliable predictors when it comes to whether or not a service member is retained.

7. Region

A 2004 CNA study analyzing retention in the reserve and guard components determined geographic location to be a significant factor in retention. While retention proved to be stable across the seven regions (“Northeast,” “Mid-Atlantic,” “Midwest,” “South,” “Central,” “West,” “Non-U.S”) when evaluating the armed forces as a whole, it

was determined that retention rates differed between enlisted and officer in the Marine Corps Reserve across the various geographic locations (Hansen et al. 2004).

8. Additional Factors

Some additional factors for consideration include those that relate to overall evaluation of an individual Marine. Quantitative in nature, these include the Armed Forces Qualification Test (AFQT) which is administered to recruits to determine enlistment and occupational specialty eligibility. A 2015 CNA study found that Marines with lower AFQT scores were more likely to reenlist, attributing this trend to the fact that said Marines likely have fewer options in the civilian sector with regards to employment (Desrosiers and Bradley 2015). In his 2008 thesis, Hoffman studied the effects of other forms of evaluation, such as annual Marine Corps Physical Fitness Test (PFT) scores, determining that officers with higher PFT scores than their peers were more likely to promote to the rank of major (Hoffman 2008).

These conclusions regarding factors associated with retention were obtained through numerous methods ranging from surveys to retention models. In developing the overall methodology for this study, the following retention models were considered.

Kirby and Naftel developed numerous multivariate models of retention in their 1998 study concerning enlisted reservist retention following Operation Desert Shield/Desert Storm, the first focusing primarily on the differences in retention between enlisted reservists having either four-to-six or seven-to-12 total years of service, or “YOS” (Kirby and Naftel 1998). Utilizing a logistic regression model, they were able to predict the probability of retention for a given reservist. By controlling the “YOS” variable, they came to the following conclusions: reservists falling into the four-to-six “YOS” group tended to have a lower chance of being retained and those reservists falling into the seven-to-12 “YOS” group were much more likely to be retained (Kirby and Naftel 1998). Kirby and Naftel determined the primary reason for this difference in retention behavior is that reservists in the seven-to-12 “YOS” group were more senior which led to high paygrades, closer proximity to retirement, and an increased likelihood of being married and having dependents (Kirby and Naftel 1998).

In the 2005 thesis, Schumacher used a similar logistic regression model aimed at predicting retention for Marines serving in the Marine Corps Reserve, focusing primarily on the effects of mobilization and civilian unemployment rates. Schumacher proposed two distinct models, the first, referred to as Model 1 serving as a baseline without holding any of the predictor variables constant (Schumacher 2005). The second, Model 2, attempts to isolate the primary MOS variable, similar to the approach taken by Kirby and Naftel with total years of service (Kirby and Naftel 1998). Predictor variables common to both models include “gender,” “number of dependents,” “years of service,” “length of time mobilized,” “number of mobilizations,” “months served in a reserve category,” and “home of record unemployment rates” (Schumacher 2005). Schumacher found that each of the predictor variables in Model 1 were significant in determining retention, with “gender,” “number of dependents,” and “total years of service” having a positive impact on retention, while each of the remaining predictor variables had a negative impact (Schumacher 2005). Conversely, Schumacher states Model 2 yielded no significant results, citing lack of significant variance across the various occupational specialties with regards to retention (Schumacher 2005).

In the 2017 thesis, Smith used logistic regression as well as partition tree models to predict the probability of success for a given candidate attempting to complete the Army Ranger Assessment and Selection Program 1 (RASP1). Predictor variables evaluated include “rank,” “age,” “marriage status,” “home of record,” and whether or not candidate had prior military service (Smith 2017). For simplicity’s sake in the logistic regression model, Smith elected to explore only the main effects these variables had on retention. For example, instead of analyzing the effect of being both married and having prior service had on retention, he looked at these variables individually. In his analysis of the two models he developed, Smith determined that the partition tree model was slightly more accurate in predicting retention when compared to the logistic regression model (Smith 2017).

While this literature review is not all-inclusive of the intricacies present when predicting military retention, the predictor variables proven to be historically significant and the methods used to validate them form the basis of this study.

II. DATA AND METHODOLOGY

A. INTRODUCTION

This chapter includes a description of the original data, its compilation for analysis, the procedures used to construct and evaluate the resulting logistic regression models, and the testing regimen to determine effectiveness of the model. This statistical approach leads to logistic regression models with predictor variables that best estimate the overall likelihood of retention for SMCR Marines.

B. DATA

The Retention Analysis Division, M&RA, Headquarters Marine Corps compiled the data required for this study which they obtained from the Marine Corps Total Force System (MCTFS) data warehouse, serving as the source for records pertaining to all active, reserve, and retired Marines. There are over 1,800 data fields specific to each Marine listed in the MCTFS which range from traditional demographics such as age, race, sex to variables specific to the military such as number of deployments, aptitude test scores, and enlistment contract (Simmons 2002).

The provided data includes three distinct groups, or cohorts, of SMCR Marines, defined by the fiscal year they completed their initial service contract in the Marine Corps AC or RC and reenlisted for the first time in the SMCR. The cohort names, periods of observation, and original number of observations are shown in Table 2. Following approval for the release of the data, M&RA provided the data for Cohorts 1, 2, and 3 containing all personnel whose MDPSD fell on the fiscal years 1998, 1999, and 2000, respectively. The data came in the form of 15 separate spreadsheets for each cohort, representing each of the 15 fiscal years in the scope of this study.

The research for this study is limited to the provided variables from M&RA, which do not cover additional factors such as overall job satisfaction, motivations for serving, or other information gained from Marine Corps Retention Surveys.

Table 2. Cohort descriptions. Source: RA, M&RA, HQMC (2017).

Cohort Name	Start Year (FY)	End Year (FY)	Sample Size (n)
Cohort 1	1998	2013	538
Cohort 2	1999	2014	680
Cohort 3	2000	2015	304

Prior to conducting statistical analysis and subsequent predictive model development, exploratory analysis was conducted on the personnel retention throughout the 15 observed years for each cohort in order to identify any trends unique to the cohorts. Figure 7 shows the number of Marines retained in the SMCR by fiscal year. The figure shows similarities between Cohorts 1 and 2, each showing an approximately 63 percent drop in retention within the first four observed fiscal years. Cohort 3, however, only shows a drop of approximately 48 percent. There are two similarities shared by all three cohorts: 1) there is minimal drop in retention during the first observed fiscal year and 2) from the fourth observed year until the fifteenth, all cohorts exhibit between 61 and 65 percent drop in retention. In addition to developing predictive models, this study aims at identifying potential underlying causes for the trends displayed in Figure 7.

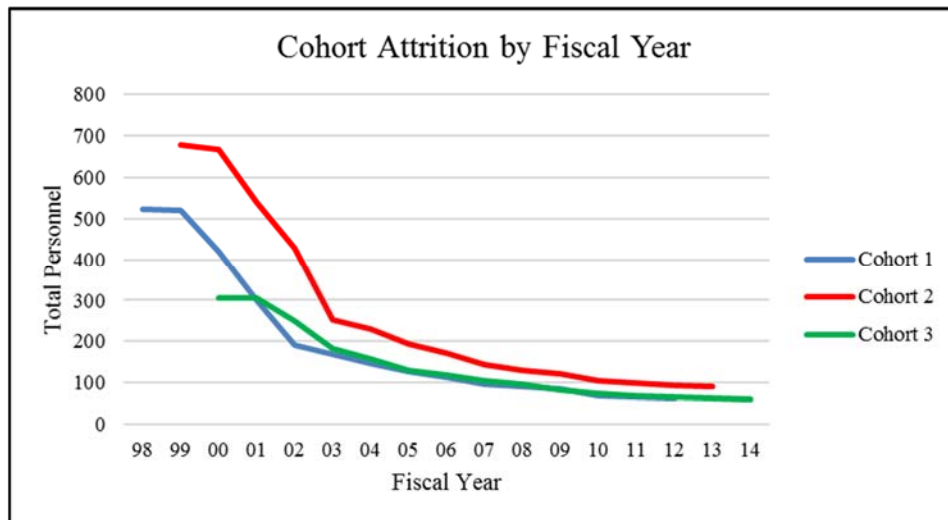


Figure 7. Cohort attrition by fiscal year. Adapted from Retention Analysis Division, M&RA, HQMC (2017).

1. Data Compilation

The original form of the data provided by M&RA consisted of 45 Microsoft Excel (2016) workbook files, 15 for each cohort corresponding to the fiscal years under the scope of this study. Each individual Marine is identified by their unique Electronic Data Interchange Personal Identifier (EDIPI), necessitating secure storage on a protected NPS server. The original data included 56 variables; 30 were removed due to either a substantial number of incomplete entries or missing values, redundancy, or inapplicability to the study. Following conversion to a comma-separated value (csv) format, the data for each cohort were merged using a Marine's unique EDIPI as a reference. In original form, the data were constructed in such a way that in the event a Marine was not retained in the SMCR, their individual data was not included in the subsequent fiscal year data file. Therefore, merging the files produced an "NA" (not applicable) value for each of the variables specific to that Marine for the fiscal years they did not continue service in the SMCR, allowing an easy way to identify retention throughout the scope of the study. The merged, cohort specific data were collapsed into a single spreadsheet per cohort, consisting of 15 rows per Marine, each with the appropriate fiscal year values corresponding to each variable. Upon compilation, there were multiple incomplete cases for each cohort where either the majority or all of the variables took on values of either "UNK" for unknown or "NA." These cases make up for, at most, three percent of each cohort and were therefore dropped from the data sets. A sensitivity analysis was performed with these individuals retained in the analysis which resulted in no significant impact on cohort characteristics.

2. Response Variables

Each Marine included in this study has completed their initial service contract and is eligible to reenlist in the RC at large, not tied to a specific component. For example, a Marine can serve in the SMCR for the first half of his or her four years and then transfer to the IRR until completion of their service contract. Since this study is concerned with continuation solely within the SMCR, milestones were developed to account for various enlistment lengths in the Marine Corps Reserve. These milestones are represented by

three additional variables added to the compiled data set. Each milestone variable is binary and takes the value 0 if a Marine departs the SMCR prior to the milestone and 1 if a Marine remains in the SMCR up to and potentially past the milestone. The names and criteria for each milestone are defined as:

Milestone A: four total years of service from MDPSD

Milestone B: eight total years of service from MDPSD

Milestone C: 12 total years of service from MDPSD

3. Predictor Variables

The 26 predictor variables included in this study fall into two distinct groups: continuous and categorical. For analytical purposes, some predictor variables were evaluated as both continuous and categorical.

a. Categorical Variables

Table 3 lists each categorical variable along with a brief description of the variable itself and its various factor levels. For a more complete list of factor levels and descriptions, see the appendix.

Table 3. Categorical variable descriptions

Categorical Variable	Description	Factor Levels
prior.service	Binary variable indicating whether or not a Marine has prior AC service	0 (No) and 1 (Yes)
enlist.option	Contract upon which a Marine entered the AC or RC, defined by years required in the AC or AR and years in IRR	3x5, 4x4, 6x2 years, or unknown
first.unit.location	State that the Marine's first unit they were assigned to is located	One of seven regions or unknown
home.state	Current home of record (HOR)	One of seven regions or unknown
unit.loc	State that the Marine's current unit they are assigned to is located	One of seven regions or unknown

Categorical Variable	Description	Factor Levels
enlist.bonus	Binary variable indicating whether or not a Marine received a reenlistment bonus	0 (No) and 1 (Yes)
civ.education	Level of civilian education Marine has currently attained	One of two levels signifying high school or post-high school
reenlist.rec	Reenlistment recommendation given by a Marine's command	One of seven levels corresponding to recommendation categories
present.grade	Current pay grade	One of three levels encompassing enlisted rank structure
pmos	Primary MOS	One of three main MOS categories
marital.stat	Current marital status	One of four available status categories
race	Race an individual Marine identifies with	One of six options a Marine can declare as their race
sex	Binary variable indicating whether a Marine is female or male	0 (Male) and 1 (Female)
age	Current age	One of seven age categories
AFQT	Score achieved on the AFQT	One of four categories ranging from scores 0–100
Award	Binary variable indicating whether Marine received a personal award	0 (No) and 1 (Yes)
disciplinary.action	Binary variable indicating whether or not a Marine has at least once service record entry involving disciplinary action	0 (No) and 1 (Yes)
day.combat.deploy	Total number of days deployed to combat zone	One of seven ranges of total days
day.noncombat.deploy	Total number of days deployed to non-combat zone	One of seven ranges of total days
cum_PFT	Cumulative average of scores on the annual Physical Fitness Test (PFT)	One of four test scoring categories
cum_pros	Cumulative average of proficiency marks	One of six evaluation scoring categories
cum_cons	Cumulative average of conduct marks	One of six evaluation scoring categories

b. Numeric Variables

Table 4 lists each numeric variable along with a brief description of the variable itself.

Table 4. Numeric variable descriptions

Numeric Variable	Description
civ.education	Total years of civilian education Marine has currently attained
num.dependents	Total number of dependents to include spouse, children, and or persons that the Marine is designated as the primary caregiver
totsatyrs	Total number of satisfactory years of service credited toward retirement
age	Current age in years
AFQT	Score achieved on the AFQT
num.combat.deploy	Total number of combat deployments
num.noncombat.deploy	Total number of non-combat deployments
day.combat.deploy	Total days deployed to a combat zone
day.noncombat.deploy	Total days deployed to a non-combat zone
cum_PFT	Cumulative average of scores on the annual PFT
cum_pros	Cumulative average of proficiency marks according to enlisted performance evaluation
cum_cons	Cumulative average of conduct marks according to enlisted performance evaluation

C. METHOD

Each of the following analytical methods are applied to Milestones A, B, and C within Cohorts 1, 2, and 3. Cohorts are treated as independent populations when developing predictive models, for the main purpose of identifying reliable predictor variables across the three cohorts, rather than the three cohorts as a whole.

1. Univariate Analysis

Cross tabulation followed by Chi-square testing was used to derive summary statistics, joint frequency distribution, and identify potentially interesting predictors among the categorical variables listed in Table 3. The results from this approach consist

of a contingency table representing joint distribution of each categorical predictor variable level and the response variable and the p-value obtained from the Chi-square test of the null hypothesis that the predictor variable is independent of the response variable and has no effect on the probability of retention. In the event that a p-value is small enough to reject this hypothesis, then there is statistical evidence that the given predictor variable does in fact have a relationship with the response variable. The two-sample t test with unequal variance was used for numeric predictor variables to determine if there was a significant difference in means between those with and without the outcome of interest.

The variables identified from the aforementioned methods of univariate analysis as being significant at the $\alpha = 0.1$ level of significance with regards to predicting retention form the basis for subsequent multivariate analysis.

2. Multivariate Analysis

The models involved in multivariate analysis are developed with the training data, a random subset of 80 percent of the original data set for each milestone, and evaluated with respect to the testing data, the remaining 20 percent of data for each milestone.

a. Logistic Regression

Binomial logistic regression models a response variable, Y_i , for $i = 1, \dots, n$, which is Bernoulli in nature, independent for each member (i) of the total sample population (n), and subjected to the same group of q predictor variables ($x_{i1}, \dots, x_{iq}$) (Faraway 2016). Here Y_i is equal to 1 if the individual is retained, and 0 if otherwise. The aim is now to explain the relationship between these predictor variables and the response, accomplished by a linear predictor, η_i (Faraway 2016),

$$\eta_i = \beta_0 + \beta_1 x_{i1} + \dots + \beta_q x_{iq} . \quad (1)$$

The parameters ($\beta_0, \dots, \beta_q$) are coefficients corresponding to each of the q predictor variables to be estimated by the fitted logistic regression model (Faraway 2016). From this linear predictor value the inverse logit function is applied in order to

map the linear predictor to a probability, in this case probability of retention, where $P(Y = 1)$, within the SMCR based on predictor variable values $x_0, \dots, x_q$ (Faraway 2016),

$$P(Y = 1) = \frac{1}{(1 + e^{-(\beta_0 + \beta_1 x_1 + \dots + \beta_q x_q)})} \quad (2)$$

The base, or full, model for each milestone includes each of the predictive variables previously identified as being significant through univariate analysis. Purposeful selection, a modification of backwards elimination, is then performed to reduce the number of predictor variables (Bursac et al. 2008). With purposeful selection, at each step the predictor with the largest p-value greater than 0.05 is eliminated if it does not exhibit potential confounding with one or more of the remaining predictor variables (Bursac et al. 2008). Confounding is detected when any of the estimated coefficients for the other predictors change by more than 20 percent when the predictor in question is removed. (Bursac et al. 2008) The logistic regression model for each milestone is further evaluated to determine the presence of influential outliers skewing model results. A Hosmer–Lemeshow test then evaluates the goodness of fit by testing a null hypothesis stating that the proposed model sufficiently fits the test data set. Lastly, we compare goodness of fit of the proposed model to the alternate model containing all predictor variables using a large-sample Chi-squared likelihood ratio test.

a. *Random Forest*

Due to logistic regression models being additive with no interaction terms and that only linear functions of numeric predictors are used in computing the linear predictor value, we also fit a class of non-parametric models, referred to as random forests (Faraway 2016). These models are based on an ensemble of classification trees, and naturally accommodate interactions and transformations of numeric predictors (Breiman 2001). Each tree is fit to a bootstrapped sample of the training set where, at each split, the splitting variable is chosen from a randomly selected subset of the original variables (Breiman 2001). Growth, or additional splitting of variables, in the classification tree continues so long as the number of cases per node does not drop below five (Faraway

2016). While random forests are highly effective in accurately predicting the outcome of a response variable, they lack the statistical power of generalized linear models and are not suitable for explaining relationships between the response variable and predictor variables (Faraway 2016).

3. Comparison of Models

Receiver Operator Characteristic (ROC) curves allow for comparison between the predictive capabilities of the logistic regression and random forest models with respect to the test data set. Aimed at evaluating the overall proportion of the population correctly explained by a model, the ROC curve compares the true positive and false positive rates, or, correct classifications of retention versus incorrect classifications of retention using multiple threshold values to classify individuals based on their estimated probability of retention (Faraway 2016). Following the fitting of the logistic regression and random forest models for each milestone, ROC curves constructed for each will allow a visual comparison to further test the accuracy of the resulting logistic regression models. In addition to their respective ROC curves, the models are compared via their percent correct classification, at a threshold of 70 percent, of outcomes with respect to the test data set. This comparison serves as the validation of the proposed logistic regression models for each milestone with respect to the corresponding random forest models.

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III. DESCRIPTIVE STATISTICS

A. INTRODUCTION

The three cohorts analyzed in this study consist of 1,490 enlisted Marines serving in SMCR units, representing a wide range of demographics to include race, sex, and age. In addition to traditional demographics, there are many other variables analyzed that are specific to military service such as occupational specialty, deployment experience, and physical fitness levels.

B. COHORT CHARACTERISTICS BY MILESTONE

Cross tabulation allows for a basic understanding of how each variable relates to successful retention across the milestones. Tables 5–13 show the joint frequency distribution of each predictor variable and the response variables, as well as the conditional distributions of the predictions given the response for Milestones A, B, and C. Also included in these tables is an indicator, denoted by an asterisk, of which predictor variables reject the Chi-square test of independence with a p-value less than 0.10.

1. Cohort 1

Of the 526 Marines represented in Cohort 1, 42.8 percent were retained at Milestone A, 21.4 percent at Milestone B, and 12.6 percent at Milestone C. From the distributions listed in Tables 5–7, we can derive the following statistics. The percentage of post-high school educated Marines retained through Milestones B and C increases by over 10 percent when compared to Milestone A. Non-commissioned officers (E4–E5) account for the largest population retained at Milestone A, but staff non-commissioned officers (E6–E9) emerge as the most retained population for Milestones B and C. The PMOS variable, although insignificant according to the Chi-Square test, shows that the majority of Marines come from Combat Arms and Combat Service Support, with the Aviation and Aviation Support Marines lacking representation—potentially remedied by merging the three cohorts. Marines with a marital status of “single” exhibit the best retention at Milestone A, while those with a marital status of “married” do so at

Milestones B and C. Retention with respect to the age variable behaves as expected, with the largest retained population increasing from 25–29 years, 30–34 years, and 35–39 years from Milestones A, B, and C, respectively. Marines with a home state in the southern region of the United States account for the largest population retained, followed by those from the northeast. Those Marines falling into the lowest category for the AFQT variable with a score of less than 25 show the smallest decrease in retention across milestones when compared to the other three categories. A Marine's present unit location shows an interesting trend. Those Marines stationed in the Midwest show a drastic drop in retention from Milestone A to Milestone C of more than 35 percent, while those stationed in the South make up for more than half of those retained at Milestone C— three times more than they did at Milestone A. Deployment experience, whether combat or non-combat, displays similar trends across milestones. In the event a Marine has less than 90 days of deployment, there is approximately a 50 percent chance they are retained. However, if a Marine's number of days deployed exceed 90 days there is a 99 percent chance they are retained at Milestone A.

The remainder of the predictor variables, all numeric, supplement a number of the conclusions gained from analyzing the categorical predictor variables. Specifically, when the number of days deployed is analyzed as a numeric variable, those retained had an average of 164 more days deployed than those who were not across the three milestones. For total years credited toward retirement, those retained have an average of 5.32 years more than those who were not across the three milestones. PFT scores for those retained were on average 15 points higher than those who were not. Lastly, retained Marines received an average of 4.5 on their proficiency and conduct marks while those not retained receiving an average of 4.4. The only major difference between retained Marines and those who were not occurs at Milestone A, with those Marines failing to be retained having average proficiency and conduct marks of 4.2.

Table 5. Cohort 1 Characteristics for Milestone A (n = 526 [%]).

Milestone A		
Factor Level	Attrite (n,%)	Retain (n,%)
Prior Service*		
No	225 (100)	294 (97.67)
Yes	0 (0)	7 (2.33)
Enlistment Option*		
3x5	0 (0)	1 (0.33)
4x4	2 (0.89)	5 (1.66)
6x2	219 (97.33)	285 (94.68)
Unknown	4 (1.78)	10 (3.32)
First Unit Location		
West	41 (18.22)	68 (22.59)
Midwest	35 (15.56)	53 (17.61)
South	89 (39.56)	104 (34.55)
Northeast	42 (18.67)	60 (19.93)
Pacific	2 (0.89)	1 (0.33)
Unknown	15 (6.67)	15 (4.98)
OCONUS	1 (0.44)	0 (0)
Enlistment Bonus		
No	223 (99.11)	300 (99.67)
Yes	2 (0.89)	1 (0.33)
Civilian Education		
High School Grad	187 (83.11)	225 (74.75)
Post-high school	38 (16.89)	76 (25.25)
Reenlistment Recommendation		
Recommended	86 (38.22)	283 (94.02)
Transfer	0 (0)	0 (0)
Failure	30 (13.33)	1 (0.33)
Extenuating Circumstances	0 (0)	0 (0)
Separated	0 (0)	0 (0)
Denied	104 (46.22)	5 (1.66)
Unassigned	5 (2.22)	12 (3.99)
Present Grade		
E1-E3	104 (46.22)	19 (6.31)
E4-E5	119 (52.89)	254 (84.39)
E6-E9	2 (0.89)	28 (9.3)
PMOS		
Combat Arms	85 (37.78)	133 (44.19)
Combat Service Support	108 (48)	140 (46.51)

Milestone A		
Factor Level	Attrite (n,%)	Retain (n,%)
Aviation and Aviation Support	32 (14.22)	28 (9.3)
Marital Status		
Single	172 (76.44)	174 (57.81)
Married	50 (22.22)	118 (39.2)
Divorced	2 (0.89)	9 (2.99)
Annulled	1 (0.44)	0 (0)
Race		
American Indian/Alaska Native	1 (0.44)	0 (0)
Asian	7 (3.11)	10 (3.32)
Black/African American	37 (16.44)	22 (7.31)
Native Hawaiian/Pacific Islander	0 (0)	0 (0)
White	157 (69.78)	222 (73.75)
Declined to Respond	23 (10.22)	47 (15.61)
Sex		
Male	221 (98.22)	296 (98.34)
Female	4 (1.78)	5 (1.66)
Age*		
Under 20 years	0 (0)	0 (0)
20-24 years	2 (0.89)	0 (0)
25-29 years	196 (87.11)	200 (66.45)
30-34 years	23 (10.22)	88 (29.24)
35-39 years	4 (1.78)	13 (4.32)
40-44 years	0 (0)	0 (0)
45 and Over	0 (0)	0 (0)
Home State		
West	41 (18.22)	59 (19.6)
Midwest	34 (15.11)	53 (17.61)
South	82 (36.44)	88 (29.24)
Northeast	46 (20.44)	69 (22.92)
Pacific	1 (0.44)	1 (0.33)
Unknown	20 (8.89)	30 (9.97)
OCONUS	1 (0.44)	1 (0.33)
AFQT Score*		
<=25	81 (36.99)	137 (45.67)
26-50	102 (46.58)	100 (33.33)
51-75	36 (16.44)	58 (19.33)
76-100	0 (0)	5 (1.67)
Present Unit Location*		

Milestone A		
Factor Level	Attrite (n,%)	Retain (n,%)
West	31 (13.78)	43 (14.29)
Midwest	82 (36.44)	173 (57.48)
South	67 (29.78)	51 (16.94)
Northeast	36 (16)	34 (11.3)
Pacific	3 (1.33)	0 (0)
Unknown	5 (2.22)	0 (0)
OCONUS	1 (0.44)	0 (0)
Personal Award*		
No	160 (71.11)	36 (11.96)
Yes	65 (28.89)	265 (88.04)
Disciplinary Action*		
No	225 (100)	295 (98.01)
Yes	0 (0)	6 (1.99)
Days Combat Deployed*		
Less than or equal to 90 days	225 (100)	218 (72.43)
91-180 days	0 (0)	31 (10.3)
181-270 days	0 (0)	46 (15.28)
271-360 days	0 (0)	6 (1.99)
361-450 days	0 (0)	0 (0)
451-540 days	0 (0)	0 (0)
Greater than 540 days	0 (0)	0 (0)
Days Noncombat Deployed*		
Less than or equal to 90 days	224 (99.56)	199 (66.11)
91-180 days	0 (0)	11 (3.65)
181-270 days	0 (0)	18 (5.98)
271-360 days	0 (0)	28 (9.3)
361-450 days	1 (0.44)	28 (9.3)
451-540 days	0 (0)	7 (2.33)
Greater than 540 days	0 (0)	10 (3.32)
Cumulative Average PFT Score*		
First Class (≥ 235)	77 (34.22)	89 (29.57)
Second Class (200-234)	44 (19.56)	96 (31.89)
Third Class (120-199)	65 (28.89)	98 (32.56)
Failure (< 120)	39 (17.33)	18 (5.98)
Numeric Variables		
Civilian Education (SD)*	12.29 (0.82)	12.62 (1.27)
Number of Dependents (SD)*	0.42 (0.82)	0.81 (1.12)
Retirement Years (SD)*	5.35 (1.76)	8.08 (1.70)

Milestone A		
Factor Level	Attrite (n,%)	Retain (n,%)
Age (SD)*	27.51 (2.15)	29.22 (2.34)
AFQT Score (SD)	67.82 (17.25)	68.12 (20.50)
Number of Combat Deployments (SD)*	0 (0)	0.30 (0.46)
Days Combat Deployed (SD)*	0 (0)	55.17 (90.93)
Number of Noncombat Deployments (SD)*	0.004 (0.067)	0.39 (0.47)
Days Noncombat Deployed (SD)*	1.62 (24.33)	122.89 (207.78)
Cumulative Average PFT Score (SD)*	180.70 (88.89)	204.45 (56.64)
Cumulative Average Proficiency Marks (SD)*	42.94 (3.96)	45.69 (1.22)
Cumulative Average Conduct Marks (SD)*	42.87 (3.94)	45.67 (1.55)

* p-value < 0.1

Table 6. Cohort 1 Characteristics for Milestone B (n = 526 [%]).

Milestone B		
Factor Level	Attrite (n,%)	Retain (n,%)
Prior Service*		
No	408 (100)	105 (94.59)
Yes	0 (0)	6 (5.41)
Enlistment Option*		
3x5	0 (0)	1 (0.9)
4x4	6 (1.47)	1 (0.9)
6x2	394 (96.57)	104 (93.69)
Unknown	8 (1.96)	5 (4.5)
First Unit Location		
West	77 (18.87)	30 (27.03)
Midwest	67 (16.42)	20 (18.02)
South	157 (38.48)	34 (30.63)
Northeast	80 (19.61)	20 (18.02)
Pacific	3 (0.74)	0 (0)
Unknown	23 (5.64)	7 (6.31)
OCONUS	1 (0.25)	0 (0)
Enlistment Bonus		
No	405 (99.26)	111 (100)
Yes	3 (0.74)	0 (0)
Civilian Education		
High School Grad	338 (82.84)	67 (60.36)
Post-high school	70 (17.16)	44 (39.64)
Reenlistment Recommendation		
Recommended	255 (62.5)	104 (93.69)

Milestone B		
Factor Level	Attrite (n,%)	Retain (n,%)
Transfer	0 (0)	0 (0)
Failure	31 (7.6)	2 (1.8)
Extenuating Circumstances	0 (0)	0 (0)
Separated	0 (0)	0 (0)
Denied	109 (26.72)	0 (0)
Unassigned	9 (2.21)	0 (0)
Present Grade		
E1-E3	122 (29.9)	1 (0.9)
E4-E5	277 (67.89)	36 (32.43)
E6-E9	9 (2.21)	74 (66.67)
PMOS		
Combat Arms	159 (38.97)	54 (48.65)
Combat Service Support	200 (49.02)	48 (43.24)
Aviation and Aviation Support	49 (12.01)	9 (8.11)
Marital Status *		
Single	288 (70.59)	28 (25.23)
Married	113 (27.7)	78 (70.27)
Divorced	6 (1.47)	5 (4.5)
Annulled	1 (0.25)	0 (0)
Race		
American Indian/Alaska Native	1 (0.25)	0 (0)
Asian	12 (2.94)	4 (3.6)
Black/African American	53 (12.99)	5 (4.5)
Native Hawaiian/Pacific Islander	0 (0)	1 (0.9)
White	291 (71.32)	84 (75.68)
Declined to Respond	51 (12.5)	17 (15.32)
Sex		
Male	402 (98.53)	109 (98.2)
Female	6 (1.47)	2 (1.8)
Age*		
Under 20 years	0 (0)	0 (0)
20-24 years	2 (0.49)	0 (0)
25-29 years	299 (73.28)	0 (0)
30-34 years	96 (23.53)	76 (68.47)
35-39 years	10 (2.45)	30 (27.03)
40-44 years	1 (0.25)	5 (4.5)
45 and Over	0 (0)	0 (0)
Home State		
West	75 (18.38)	23 (20.72)
Midwest	67 (16.42)	20 (18.02)

Milestone B		
Factor Level	Attrite (n,%)	Retain (n,%)
South	137 (33.58)	31 (27.93)
Northeast	91 (22.3)	22 (19.82)
Pacific	2 (0.49)	1 (0.9)
Unknown	34 (8.33)	14 (12.61)
OCONUS	2 (0.49)	0 (0)
AFQT Score*		
<=25	162 (40.4)	50 (45.05)
26-50	163 (40.65)	31 (27.93)
51-75	74 (18.45)	17 (15.32)
76-100	2 (0.5)	13 (11.71)
Present Unit Location*		
West	45 (11.03)	21 (18.92)
Midwest	226 (55.39)	51 (45.95)
South	82 (20.1)	25 (22.52)
Northeast	47 (11.52)	14 (12.61)
Pacific	2 (0.49)	0 (0)
Unknown	5 (1.23)	0 (0)
OCONUS	1 (0.25)	0 (0)
Personal Award*		
No	195 (47.79)	1 (0.9)
Yes	213 (52.21)	110 (99.1)
Disciplinary Action*		
No	407 (99.75)	106 (95.5)
Yes	1 (0.25)	5 (4.5)
Days Combat Deployed*		
Less than or equal to 90 days	403 (98.77)	39 (35.14)
91-180 days	3 (0.74)	26 (23.42)
181-270 days	1 (0.25)	41 (36.94)
271-360 days	1 (0.25)	5 (4.5)
361-450 days	0 (0)	0 (0)
451-540 days	0 (0)	0 (0)
Greater than 540 days	0 (0)	0 (0)
Days Noncombat Deployed*		
Less than or equal to 90 days	396 (97.06)	26 (23.42)
91-180 days	2 (0.49)	9 (8.11)
181-270 days	4 (0.98)	13 (11.71)
271-360 days	3 (0.74)	23 (20.72)
361-450 days	1 (0.25)	26 (23.42)
451-540 days	1 (0.25)	5 (4.5)
Greater than 540 days	1 (0.25)	9 (8.11)

Milestone B		
Factor Level	Attrite (n,%)	Retain (n,%)
Cumulative Average PFT Score*		
First Class (≥ 235)	129 (31.62)	31 (27.93)
Second Class (200-234)	97 (23.77)	43 (38.74)
Third Class (120-199)	125 (30.64)	35 (31.53)
Failure (<120)	57 (13.97)	2 (1.8)
Numeric Variables		
Civilian Education (SD)*	12.33 (0.89)	13.12 (1.62)
Number of Dependents (SD)*	0.55 (0.93)	1.56 (1.27)
Retirement Years (SD)*	6.28 (2.05)	11.79 (2.76)
Age (SD)*	28.44 (2.52)	33.83 (2.61)
AFQT Score (SD)	67.74 (18.51)	62.74 (28.79)
Number of Combat Deployments (SD)*	0.01 (0.11)	0.72 (0.45)
Days Combat Deployed (SD)*	2.19 (20.98)	131.03 (98.76)
Number of Noncombat Deployments (SD)*	0.03 (0.17)	0.76 (0.42)
Days Noncombat Deployed (SD)*	9.06 (58.34)	290.20 (278.92)
Cumulative Average PFT Score (SD)*	187.77 (79.75)	213.82 (35.47)
Cumulative Average Proficiency Marks (SD)*	44.10 (3.34)	45.77 (1.62)
Cumulative Average Conduct Marks (SD)*	44.026 (3.42)	45.85 (1.58)

* p-value < 0.1

Table 7. Cohort 1 Characteristics for Milestone C (n = 526 [%]).

Milestone C		
Factor Level	Attrite (n,%)	Retain (n,%)
Prior Service*		
No	450 (99.56)	61 (93.85)
Yes	2 (0.44)	4 (6.15)
Enlistment Option*		
3x5	1 (0.22)	0 (0)
4x4	5 (1.11)	2 (3.08)
6x2	435 (96.24)	61 (93.85)
Unknown	11 (2.43)	2 (3.08)
First Unit Location		
West	89 (19.69)	17 (26.15)
Midwest	76 (16.81)	10 (15.38)
South	170 (37.61)	20 (30.77)
Northeast	88 (19.47)	13 (20)
Pacific	3 (0.66)	0 (0)
Unknown	25 (5.53)	5 (7.69)

Milestone C		
Factor Level	Attrite (n,%)	Retain (n,%)
OCONUS	1 (0.22)	0 (0)
Enlistment Bonus		
No	449 (99.34)	65 (100)
Yes	3 (0.66)	0 (0)
Civilian Education		
High School Grad	364 (80.53)	41 (63.08)
Post-high school	88 (19.47)	24 (36.92)
Reenlistment Recommendation		
Recommended	296 (65.49)	60 (92.31)
Transfer	0 (0)	0 (0)
Failure	34 (7.52)	2 (3.08)
Extenuating Circumstances	0 (0)	0 (0)
Separated	0 (0)	0 (0)
Denied	35 (7.52)	1 (1.54)
Unassigned	36 (7.52)	2 (3.08)
Present Grade		
E1-E3	123 (27.21)	0 (0)
E4-E5	301 (66.59)	11 (16.92)
E6-E9	28 (6.19)	54 (83.08)
PMOS		
Combat Arms	181 (40.04)	30 (46.15)
Combat Service Support	218 (48.23)	30 (46.15)
Aviation and Aviation Support	53 (11.73)	5 (7.69)
Marital Status		
Single	299 (66.15)	13 (20)
Married	142 (31.42)	45 (69.23)
Divorced	10 (2.21)	7 (10.77)
Annulled	1 (0.22)	0 (0)
Race		
American Indian/Alaska Native	1 (0.22)	2 (3.08)
Asian	12 (2.65)	4 (6.15)
Black/African American	54 (11.95)	4 (6.15)
Native Hawaiian/Pacific Islander	0 (0)	1 (1.54)
White	326 (72.12)	44 (67.69)
Declined to Respond	59 (13.05)	10 (15.38)
Sex		
Male	446 (98.67)	63 (96.92)
Female	6 (1.33)	2 (3.08)

Milestone C		
Factor Level	Attrite (n,%)	Retain (n,%)
Age*		
Under 20 years	0 (0)	0 (0)
20-24 years	2 (0.44)	0 (0)
25-29 years	296 (65.49)	0 (0)
30-34 years	119 (26.33)	1 (1.54)
35-39 years	33 (7.3)	48 (73.85)
40-44 years	2 (0.44)	14 (21.54)
45 and Over	0 (0)	2 (3.08)
Home State		
West	84 (18.58)	15 (23.08)
Midwest	75 (16.59)	10 (15.38)
South	148 (32.74)	20 (30.77)
Northeast	99 (21.9)	14 (21.54)
Pacific	2 (0.44)	2 (3.08)
Unknown	42 (9.29)	4 (6.15)
OCONUS	2 (0.44)	0 (0)
AFQT Score*		
<=25	182 (40.9)	25 (38.46)
26-50	174 (39.1)	20 (30.77)
51-75	83 (18.65)	8 (12.31)
76-100	6 (1.35)	12 (18.46)
Present Unit Location*		
West	52 (11.5)	8 (12.31)
Midwest	250 (55.31)	14 (21.54)
South	90 (19.91)	34 (52.31)
Northeast	52 (11.5)	9 (13.85)
Pacific	2 (0.44)	0 (0)
Unknown	5 (1.11)	0 (0)
OCONUS	1 (0.22)	0 (0)
Personal Award*		
No	196 (43.36)	0 (0)
Yes	256 (56.64)	65 (100)
Disciplinary Action*		
No	448 (99.12)	63 (96.92)
Yes	4 (0.88)	2 (3.08)
Days Combat Deployed*		
Less than or equal to 90 days	425 (94.03)	17 (26.15)
91-180 days	11 (2.43)	17 (26.15)

Milestone C		
Factor Level	Attrite (n,%)	Retain (n,%)
181-270 days	13 (2.88)	28 (43.08)
271-360 days	3 (0.66)	3 (4.62)
361-450 days	0 (0)	0 (0)
451-540 days	0 (0)	0 (0)
Greater than 540 days	0 (0)	0 (0)
Days Noncombat Deployed*		
Less than or equal to 90 days	412 (91.15)	9 (13.85)
91-180 days	5 (1.11)	6 (9.23)
181-270 days	14 (3.1)	13 (20)
271-360 days	11 (2.43)	16 (24.62)
361-450 days	5 (1.11)	14 (21.54)
451-540 days	3 (0.66)	4 (6.15)
Greater than 540 days	2 (0.44)	3 (4.62)
Cumulative Average PFT Score*		
First Class (≥ 235)	141 (31.19)	20 (30.77)
Second Class (200-234)	110 (24.34)	26 (40)
Third Class (120-199)	143 (31.64)	19 (29.23)
Failure (< 120)	58 (12.83)	0 (0)
Numeric Variables		
Civilian Education (SD)*	12.41 (1.02)	13.05 (1.62)
Number of Dependents (SD)*	0.66 (1.02)	1.77 (1.50)
Retirement Years (SD)*	6.78 (2.58)	14.49 (4.27)
Age (SD)*	29.13 (3.28)	37.89 (2.92)
AFQT Score (SD)	67.33 (19.52)	57 (31.79)
Number of Combat Deployments (SD)*	0.07 (0.25)	0.81 (0.39)
Days Combat Deployed (SD)*	11.90 (47.47)	147.68 (91.66)
Number of Noncombat Deployments (SD)*	0.09 (0.28)	0.86 (0.35)
Days Noncombat Deployed (SD)*	26.75 (93.87)	280.65 (180.58)
Cumulative Average PFT Score (SD)*	189.62 (77.19)	216.07 (30.79)
Cumulative Average Proficiency Marks (SD)*	44.22 (3.36)	45.76 (2.32)
Civilian Education (SD)*	44.16 (3.44)	45.82 (2.32)

* p-value < 0.1

2. Cohort 2

Of the 660 Marines represented in Cohort 2, 61.5 percent were retained at Milestone A, 22 percent at Milestone B, and 11.9 percent at Milestone C. From the distributions listed in Tables 8–10, we can derive the following statistics. Retention

trends for the majority of the significant predictor variables analyzed are similar when compared to Cohort 1. Differences between the cohorts include Marines from Cohort 2 showing much better retention across the milestones when stationed at a unit located in the southern region of the United States. PFT Scores for those Marines retained are an average 35.8 points higher than those who were not, which is approximately 20 points higher than the difference shown by Marines from Cohort 1.

Table 8. Cohort 2 Characteristics for Milestone A (n = 660 [%]).

Milestone A		
Factor Level	Attrite (n,%)	Retain (n,%)
Prior Service*		
No	252 (99.21)	398 (98.03)
Yes	2 (0.79)	8 (1.97)
Enlistment Option		
3x5	0 (0)	2 (0.49)
4x4	4 (1.57)	12 (2.96)
6x2	248 (97.64)	386 (95.07)
Unknown	2 (0.79)	6 (1.48)
First Unit Location		
West	67 (26.38)	87 (21.43)
Midwest	36 (14.17)	74 (18.23)
South	80 (31.5)	138 (33.99)
Northeast	56 (22.05)	80 (19.7)
Pacific	3 (1.18)	0 (0)
Unknown	12 (4.72)	26 (6.4)
OCONUS	0 (0)	1 (0.25)
Enlistment Bonus		
No	253 (99.61)	402 (99.01)
Yes	1 (0.39)	4 (0.99)
Civilian Education		
High School Grad	223 (87.8)	288 (70.94)
Post-high school	31 (12.2)	118 (29.06)
Reenlistment Recommendation		
Recommended	82 (32.28)	358 (88.18)
Transfer	1 (0.39)	0 (0)
Failure	32 (12.6)	1 (0.25)
Extenuating Circumstances		
Separated	1 (0.39)	0 (0)
Denied	121 (47.64)	7 (1.72)
Unassigned	17 (6.69)	40 (9.85)

Milestone A		
Factor Level	Attrite (n,%)	Retain (n,%)
Present Grade		
E1-E3	133 (52.36)	32 (7.88)
E4-E5	121 (47.64)	316 (77.83)
E6-E9	0 (0)	58 (14.29)
PMOS		
Combat Arms	103 (40.55)	172 (42.36)
Combat Service Support	132 (51.97)	204 (50.25)
Aviation and Aviation Support	19 (7.48)	30 (7.39)
Marital Status		
Single	181 (71.26)	218 (53.69)
Married	69 (27.17)	176 (43.35)
Divorced	4 (1.57)	12 (2.96)
Annulled	0 (0)	0 (0)
Race		
American Indian/Alaska Native	1 (0.39)	0 (0)
Asian	9 (3.54)	14 (3.45)
Black/African American	21 (8.27)	45 (11.08)
Native Hawaiian/Pacific Islander	0 (0)	0 (0)
White	180 (70.87)	273 (67.24)
Declined to Respond	43 (16.93)	74 (18.23)
Sex		
Male	253 (99.61)	400 (98.52)
Female	1 (0.39)	6 (1.48)
Age*		
Under 20 years	0 (0)	0 (0)
20-24 years	1 (0.39)	0 (0)
25-29 years	212 (83.46)	260 (64.04)
30-34 years	36 (14.17)	124 (30.54)
35-39 years	5 (1.97)	21 (5.17)
40-44 years	0 (0)	1 (0.25)
45 and Over	0 (0)	0 (0)
Home State		
West	69 (27.17)	101 (24.88)
Midwest	39 (15.35)	74 (18.23)
South	78 (30.71)	134 (33)
Northeast	57 (22.44)	91 (22.41)
Pacific	3 (1.18)	0 (0)
Unknown	7 (2.76)	6 (1.48)
OCONUS	1 (0.39)	0 (0)
AFQT Score*		
<=25	89 (35.89)	154 (37.93)
26-50	100 (40.32)	150 (36.95)

Milestone A		
Factor Level	Attrite (n,%)	Retain (n,%)
51-75	59 (23.79)	91 (22.41)
76-100	0 (0)	11 (2.71)
Present Unit Location*		
West	56 (22.05)	47 (11.58)
Midwest	87 (34.25)	225 (55.42)
South	68 (26.77)	81 (19.95)
Northeast	39 (15.35)	49 (12.07)
Pacific	1 (0.39)	0 (0)
Unknown	3 (1.18)	4 (0.99)
OCONUS	0 (0)	0 (0)
Personal Award*		
No	172 (67.72)	48 (11.82)
Yes	82 (32.28)	358 (88.18)
Disciplinary Action*		
No	253 (99.61)	394 (97.04)
Yes	1 (0.39)	12 (2.96)
Days Combat Deployed*		
Less than or equal to 90 days	253 (99.61)	291 (71.67)
91-180 days	0 (0)	50 (12.32)
181-270 days	1 (0.39)	57 (14.04)
271-360 days	0 (0)	7 (1.72)
361-450 days	0 (0)	0 (0)
451-540 days	0 (0)	1 (0.25)
Greater than 540 days		
Days Noncombat Deployed*		
Less than or equal to 90 days	253 (99.61)	254 (62.56)
91-180 days	0 (0)	26 (6.4)
181-270 days	0 (0)	29 (7.14)
271-360 days	1 (0.39)	38 (9.36)
361-450 days	0 (0)	41 (10.1)
451-540 days	0 (0)	6 (1.48)
Greater than 540 days	0 (0)	12 (2.96)
Cumulative Average PFT Score*		
First Class (≥ 235)	62 (24.41)	112 (27.59)
Second Class (200-234)	60 (23.62)	146 (35.96)
Third Class (120-199)	80 (31.5)	119 (29.31)
Failure (< 120)	52 (20.47)	29 (7.14)
Numeric Variables		
Civilian Education (SD)*	12.23 (0.80)	12.79 (1.47)
Number of Dependents (SD)*	0.50 (0.93)	0.95 (1.17)
Retirement Years (SD)*	5.06 (1.61)	8.12 (1.77)
Age (SD)*	27.66 (2.23)	29.50 (2.48)

Milestone A		
Factor Level	Attrite (n,%)	Retain (n,%)
AFQT Score (SD)	66.19 (18.77)	65.41 (21.29)
Number of Combat Deployments (SD)*	0.003 (0.06)	0.31 (0.46)
Days Combat Deployed (SD)*	0.84 (13.43)	55.48 (91.64)
Number of Noncombat Deployments (SD)*	0.004 (0.06)	0.38 (0.49)
Days Noncombat Deployed (SD)*	1.41 (22.46)	122.34 (188.19)
Cumulative Average PFT Score (SD)*	168.41 (90.60)	202.57 (59.02)
Cumulative Average Proficiency Marks (SD)*	42.74 (4.23)	45.54 (1.84)
Cumulative Average Conduct Marks (SD)*	42.72 (4.21)	45.58 (1.77)

* p-value < 0.1

Table 9. Cohort 2 Characteristics for Milestone B (n = 660 [%]).

Milestone B		
Factor Level	Attrite (n,%)	Retain (n,%)
Prior Service*		
No	505 (99.02)	140 (97.22)
Yes	5 (0.98)	4 (2.78)
Enlistment Option		
3x5	0 (0)	2 (1.39)
4x4	8 (1.57)	7 (4.86)
6x2	496 (97.25)	133 (92.36)
Unknown	6 (1.18)	2 (1.39)
First Unit Location		
West	126 (24.71)	27 (18.75)
Midwest	73 (14.31)	34 (23.61)
South	168 (32.94)	48 (33.33)
Northeast	107 (20.98)	29 (20.14)
Pacific	3 (0.59)	0 (0)
Unknown	32 (6.27)	6 (4.17)
OCONUS	1 (0.2)	0 (0)
Enlistment Bonus		
No	507 (99.41)	142 (98.61)
Yes	3 (0.59)	2 (1.39)
Civilian Education		
High School Grad	425 (83.33)	86 (59.72)
Post-high school	85 (16.67)	58 (40.28)
Reenlistment Recommendation		
Recommended	314 (61.57)	123 (85.42)
Transfer	1 (0.2)	0 (0)
Failure	32 (6.27)	3 (2.08)
Extenuating Circumstances	0 (0)	0 (0)

Milestone B		
Factor Level	Attrite (n,%)	Retain (n,%)
Separated	1 (0.2)	0 (0)
Denied	129 (25.29)	2 (1.39)
Unassigned	33 (6.47)	16 (11.11)
Present Grade		
E1-E3	164 (32.16)	1 (0.69)
E4-E5	336 (65.88)	38 (26.39)
E6-E9	10 (1.96)	105 (72.92)
PMOS		
Combat Arms	202 (39.61)	67 (46.53)
Combat Service Support	271 (53.14)	66 (45.83)
Aviation and Aviation Support	37 (7.25)	11 (7.64)
Marital Status		
Single	341 (66.86)	37 (25.69)
Married	158 (30.98)	96 (66.67)
Divorced	11 (2.16)	11 (7.64)
Annulled	0 (0)	0 (0)
Race		
American Indian/Alaska Native	1 (0.2)	0 (0)
Asian	19 (3.73)	3 (2.08)
Black/African American	52 (10.2)	14 (9.72)
Native Hawaiian/Pacific Islander	0 (0)	1 (0.69)
White	343 (67.25)	108 (75)
Declined to Respond	95 (18.63)	18 (12.5)
Sex		
Male	506 (99.22)	141 (97.92)
Female	4 (0.78)	3 (2.08)
Age*		
Under 20 years	0 (0)	0 (0)
20-24 years	1 (0.2)	0 (0)
25-29 years	363 (71.18)	0 (0)
30-34 years	128 (25.1)	93 (64.58)
35-39 years	14 (2.75)	44 (30.56)
40-44 years	4 (0.78)	7 (4.86)
45 and Over	0 (0)	0 (0)
Home State		
West	142 (27.84)	28 (19.44)
Midwest	76 (14.9)	33 (22.92)
South	163 (31.96)	46 (31.94)
Northeast	115 (22.55)	34 (23.61)
Pacific	3 (0.59)	0 (0)
Unknown	10 (1.96)	3 (2.08)
OCONUS	1 (0.2)	0 (0)

Milestone B		
Factor Level	Attrite (n,%)	Retain (n,%)
AFQT Score*		
<=25	184 (36.51)	55 (38.19)
26-50	193 (38.29)	53 (36.81)
51-75	122 (24.21)	25 (17.36)
76-100	5 (0.99)	11 (7.64)
Present Unit Location*		
West	77 (15.1)	15 (10.42)
Midwest	265 (51.96)	88 (61.11)
South	101 (19.8)	28 (19.44)
Northeast	59 (11.57)	13 (9.03)
Pacific	1 (0.2)	0 (0)
Unknown	7 (1.37)	0 (0)
OCONUS	0 (0)	0 (0)
Personal Award*		
No	218 (42.75)	2 (1.39)
Yes	292 (57.25)	142 (98.61)
Disciplinary Action*		
No	504 (98.82)	137 (95.14)
Yes	6 (1.18)	7 (4.86)
Days Combat Deployed*		
Less than or equal to 90 days	496 (97.25)	47 (32.64)
91-180 days	10 (1.96)	39 (27.08)
181-270 days	3 (0.59)	51 (35.42)
271-360 days	0 (0)	7 (4.86)
361-450 days	0 (0)	0 (0)
451-540 days	1 (0.2)	0 (0)
Greater than 540 days	0 (0)	0 (0)
Days Noncombat Deployed*		
Less than or equal to 90 days	480 (94.12)	27 (18.75)
91-180 days	9 (1.76)	19 (13.19)
181-270 days	11 (2.16)	18 (12.5)
271-360 days	6 (1.18)	31 (21.53)
361-450 days	1 (0.2)	37 (25.69)
451-540 days	1 (0.2)	5 (3.47)
Greater than 540 days	2 (0.39)	7 (4.86)
Cumulative Average PFT Score*		
First Class (>=235)	125 (24.51)	43 (29.86)
Second Class (200-234)	143 (28.04)	63 (43.75)
Third Class (120-199)	162 (31.76)	35 (24.31)
Failure (<120)	80 (15.69)	3 (2.08)
Numeric Variables		
Civilian Education (SD)*	12.37 (1.01)	13.31 (1.79)

Milestone B		
Factor Level	Attrite (n,%)	Retain (n,%)
Number of Dependents (SD)*	0.64 (1.03)	1.65 (1.45)
Retirement Years (SD)*	6.27 (2.11)	11.81 (2.12)
Age (SD)*	28.70 (2.64)	34.15 (2.64)
AFQT Score (SD)	65.45 (19.86)	64.22 (24.95)
Number of Combat Deployments (SD)*	0.031 (0.17)	0.79 (0.53)
Days Combat Deployed (SD)*	5.09 (33.92)	131.62 (96.29)
Number of Noncombat Deployments (SD)*	0.063 (0.24)	0.83 (0.38)
Days Noncombat Deployed (SD)*	15.49 (68.20)	261.41 (174.81)
Cumulative Average PFT Score (SD)*	180.54 (81.02)	215.75 (36.64)
Cumulative Average Proficiency Marks (SD)*	43.98 (3.56)	45.94 (1.75)
Cumulative Average Conduct Marks (SD)*	43.98 (3.55)	46.01 (1.70)

* p-value < 0.1

Table 10. Cohort 2 Characteristics for Milestone C (n = 660 [%]).

Milestone C		
Factor Level	Attrite (n,%)	Retain (n,%)
Prior Service*		
No	570 (99.13)	74 (94.87)
Yes	5 (0.87)	4 (5.13)
Enlistment Option		
3x5	2 (0.35)	0 (0)
4x4	12 (2.09)	3 (3.85)
6x2	553 (96.17)	75 (96.15)
Unknown	8 (1.39)	0 (0)
First Unit Location		
West	140 (24.35)	13 (16.67)
Midwest	83 (14.43)	24 (30.77)
South	191 (33.22)	25 (32.05)
Northeast	122 (21.22)	13 (16.67)
Pacific	3 (0.52)	0 (0)
Unknown	35 (6.09)	3 (3.85)
OCONUS	1 (0.17)	0 (0)
Enlistment Bonus		
No	571 (99.3)	77 (98.72)
Yes	4 (0.7)	1 (1.28)
Civilian Education		
High School Grad	468 (81.39)	40 (51.28)
Post-high school	107 (18.61)	38 (48.72)
Reenlistment Recommendation		

Milestone C		
Factor Level	Attrite (n,%)	Retain (n,%)
Recommended	369 (64.17)	71 (91.03)
Transfer	1 (0.17)	0 (0)
Failure	35 (6.09)	2 (2.56)
Extenuating Circumstances		
Separated	1 (0.17)	0 (0)
Denied	131 (22.78)	0 (0)
Unassigned	38 (6.61)	5 (6.41)
Present Grade		
E1-E3	165 (28.7)	0 (0)
E4-E5	362 (62.96)	7 (8.97)
E6-E9	48 (8.35)	71 (91.03)
PMOS		
Combat Arms	236 (41.04)	32 (41.03)
Combat Service Support	297 (51.65)	40 (51.28)
Aviation and Aviation Support	42 (7.3)	6 (7.69)
Marital Status		
Single	366 (63.65)	11 (14.1)
Married	194 (33.74)	63 (80.77)
Divorced	15 (2.61)	4 (5.13)
Annulled	0 (0)	0 (0)
Race		
American Indian/Alaska Native	1 (0.17)	0 (0)
Asian	19 (3.3)	3 (3.85)
Black/African American	59 (10.26)	7 (8.97)
Native Hawaiian/Pacific Islander	0 (0)	2 (2.56)
White	394 (68.52)	57 (73.08)
Declined to Respond	102 (17.74)	9 (11.54)
Sex		
Male	570 (99.13)	76 (97.44)
Female	5 (0.87)	2 (2.56)
Age*		
Under 20 years	0 (0)	0 (0)
20-24 years	1 (0.17)	0 (0)
25-29 years	363 (63.13)	0 (0)
30-34 years	157 (27.3)	1 (1.28)
35-39 years	44 (7.65)	58 (74.36)
40-44 years	10 (1.74)	17 (21.79)
45 and Over	0 (0)	2 (2.56)
Home State		
West	155 (26.96)	15 (19.23)
Midwest	86 (14.96)	23 (29.49)
South	186 (32.35)	22 (28.21)

Milestone C		
Factor Level	Attrite (n,%)	Retain (n,%)
Northeast	133 (23.13)	17 (21.79)
Pacific	3 (0.52)	0 (0)
Unknown	11 (1.91)	1 (1.28)
OCONUS	1 (0.17)	0 (0)
AFQT Score*		
<=25	206 (36.2)	31 (39.74)
26-50	216 (37.96)	31 (39.74)
51-75	136 (23.9)	11 (14.1)
76-100	11 (1.93)	5 (6.41)
Present Unit Location*		
West	81 (14.09)	10 (12.82)
Midwest	313 (54.43)	21 (26.92)
South	110 (19.13)	37 (47.44)
Northeast	63 (10.96)	10 (12.82)
Pacific	1 (0.17)	0 (0)
Unknown	7 (1.22)	0 (0)
OCONUS	0 (0)	0 (0)
Personal Award*		
No	220 (38.26)	0 (0)
Yes	355 (61.74)	78 (100)
Disciplinary Action*		
No	565 (98.26)	75 (96.15)
Yes	10 (1.74)	3 (3.85)
Days Combat Deployed*		
Less than or equal to 90 days	528 (91.83)	20 (25.64)
91-180 days	31 (5.39)	25 (32.05)
181-270 days	13 (2.26)	29 (37.18)
271-360 days	2 (0.35)	4 (5.13)
361-450 days	0 (0)	0 (0)
451-540 days	1 (0.17)	0 (0)
Greater than 540 days	0 (0)	0 (0)
Days Noncombat Deployed*		
Less than or equal to 90 days	503 (87.48)	7 (8.97)
91-180 days	21 (3.65)	23 (29.49)
181-270 days	17 (2.96)	12 (15.38)
271-360 days	17 (2.96)	17 (21.79)
361-450 days	11 (1.91)	13 (16.67)
451-540 days	1 (0.17)	2 (2.56)
Greater than 540 days	5 (0.87)	4 (5.13)
Cumulative Average PFT Score*		
First Class (>=235)	141 (24.52)	24 (30.77)
Second Class (200-234)	167 (29.04)	40 (51.28)

Milestone C		
Factor Level	Attrite (n,%)	Retain (n,%)
Third Class (120-199)	185 (32.17)	14 (17.95)
Failure (<120)	82 (14.26)	0 (0)
Numeric Variables		
Civilian Education (SD)*	12.44 (1.10)	13.68 (1.96)
Number of Dependents (SD)*	0.72 (1.09)	2.35 (1.56)
Retirement Years (SD)*	6.79 (2.56)	15.18 (3.39)
Age (SD)*	29.48 (3.47)	37.97 (2.63)
AFQT Score (SD)	65.07 (20.76)	65.70 (23.85)
Number of Combat Deployments (SD)*	0.09 (0.29)	0.86 (0.38)
Days Combat Deployed (SD)*	14.57 (51.21)	142.01 (87.59)
Number of Noncombat Deployments (SD)*	0.13 (0.34)	0.95 (0.22)
Days Noncombat Deployed (SD)*	35.61 (108.75)	271.36 (217.48)
Cumulative Average PFT Score (SD)*	183.61 (77.83)	222.10 (31.76)
Cumulative Average Proficiency Marks (SD)*	44.17 (3.53)	46.14 (0.92)
Cumulative Average Conduct Marks (SD)*	44.18 (3.50)	46.21 (0.87)

* p-value < 0.1

3. Cohort 3

Of the 304 Marines represented in Cohort 3, 59.9 percent were retained at Milestone A, 33.2 percent at Milestone B, and 21.7 percent at Milestone C. From the distributions listed in Tables 11–13, we can derive the following statistics. When compared to Cohorts 1 and 2, Cohort 3 retains a similar percentage of the population at Milestone A. For Milestones B and C, Cohort 3 retains approximately 11.5 and 9.45 percent more Marines, respectively. Retention trends for the majority of the significant predictor variables analyzed are similar when compared to Cohort 1 and 2. Major differences in retention behavior with respect to predictor variables for Cohort 3 include a larger married population making up those Marines retained to Milestones B and C. Cohort 3 also has a much higher average number of dependents for those retained.

Table 11. Cohort 3 Characteristics for Milestone A (n = 304 [%]).

Milestone A		
Factor Level	Attrite (n,%)	Retain (n,%)
Prior Service*		
No	119 (97.54)	177 (97.25)
Yes	3 (2.46)	5 (2.75)
Enlistment Option		
3x5	0 (0)	0 (0)
4x4	1 (0.82)	4 (2.2)
6x2	121 (99.18)	178 (97.8)
Unknown	0 (0)	0 (0)
First Unit Location		
West	21 (17.21)	30 (16.48)
Midwest	27 (22.13)	32 (17.58)
South	56 (45.9)	75 (41.21)
Northeast	15 (12.3)	37 (20.33)
Pacific	0 (0)	2 (1.1)
Unknown	2 (1.64)	6 (3.3)
OCONUS	1 (0.82)	0 (0)
Enlistment Bonus		
No	120 (98.36)	177 (97.25)
Yes	2 (1.64)	5 (2.75)
Civilian Education		
High School Grad	95 (77.87)	124 (68.13)
Post-high school	27 (22.13)	58 (31.87)
Reenlistment Recommendation		
Recommended	55 (45.08)	157 (86.26)
Transfer	0 (0)	0 (0)
Failure	6 (4.92)	0 (0)
Extenuating Circumstances	0 (0)	0 (0)
Separated	0 (0)	0 (0)
Denied	51 (41.8)	2 (1.1)
Unassigned	10 (8.2)	23 (12.64)
Present Grade		
E1-E3	61 (50)	4 (2.2)
E4-E5	60 (49.18)	138 (75.82)
E6-E9	1 (0.82)	40 (21.98)
PMOS		
Combat Arms	42 (34.43)	72 (39.56)
Combat Service Support	72 (59.02)	98 (53.85)
Aviation and Aviation Support	8 (6.56)	12 (6.59)
Marital Status		
Single	85 (69.67)	66 (36.26)

Milestone A		
Factor Level	Attrite (n,%)	Retain (n,%)
Married	35 (28.69)	110 (60.44)
Divorced	2 (1.64)	6 (3.3)
Annulled	0 (0)	0 (0)
Race		
American Indian/Alaska Native	1 (0.82)	4 (2.2)
Asian	1 (0.82)	6 (3.3)
Black/African American	15 (12.3)	16 (8.79)
Native Hawaiian/Pacific Islander	0 (0)	0 (0)
White	91 (74.59)	131 (71.98)
Declined to Respond	14 (11.48)	25 (13.74)
Sex		
Male	121 (99.18)	177 (97.25)
Female	1 (0.82)	5 (2.75)
Age*		
Under 20 years	0 (0)	0 (0)
20-24 years	0 (0)	0 (0)
25-29 years	101 (82.79)	85 (46.7)
30-34 years	19 (15.57)	82 (45.05)
35-39 years	2 (1.64)	14 (7.69)
40-44 years	0 (0)	1 (0.55)
45 and Over	0 (0)	0 (0)
Home State		
West	23 (18.85)	34 (18.68)
Midwest	28 (22.95)	32 (17.58)
South	54 (44.26)	77 (42.31)
Northeast	16 (13.11)	37 (20.33)
Pacific	0 (0)	2 (1.1)
Unknown	0 (0)	0 (0)
OCONUS	1 (0.82)	0 (0)
AFQT Score*		
<=25	43 (35.54)	61 (33.52)
26-50	49 (40.5)	84 (46.15)
51-75	28 (23.14)	36 (19.78)
76-100	1 (0.83)	1 (0.55)
Present Unit Location*		
West	20 (16.39)	25 (13.74)
Midwest	47 (38.52)	75 (41.21)
South	42 (34.43)	55 (30.22)
Northeast	12 (9.84)	26 (14.29)
Pacific	0 (0)	1 (0.55)
Unknown	0 (0)	0 (0)
OCONUS	1 (0.82)	0 (0)

Milestone A		
Factor Level	Attrite (n,%)	Retain (n,%)
Personal Award*		
No	48 (39.34)	3 (1.65)
Yes	74 (60.66)	179 (98.35)
Disciplinary Action*		
No	120 (98.36)	171 (93.96)
Yes	2 (1.64)	11 (6.04)
Days Combat Deployed*		
Less than or equal to 90 days	121 (99.18)	79 (43.41)
91-180 days	0 (0)	42 (23.08)
181-270 days	1 (0.82)	53 (29.12)
271-360 days	0 (0)	8 (4.4)
361-450 days	0 (0)	0 (0)
451-540 days	0 (0)	0 (0)
Greater than 540 days	0 (0)	0 (0)
Days Noncombat Deployed*		
Less than or equal to 90 days	118 (96.72)	60 (32.97)
91-180 days	3 (2.46)	11 (6.04)
181-270 days	1 (0.82)	30 (16.48)
271-360 days	0 (0)	42 (23.08)
361-450 days	0 (0)	25 (13.74)
451-540 days	0 (0)	6 (3.3)
Greater than 540 days	0 (0)	8 (4.4)
Cumulative Average PFT Score*		
First Class (≥ 235)	28 (22.95)	51 (28.02)
Second Class (200-234)	28 (22.95)	69 (37.91)
Third Class (120-199)	41 (33.61)	58 (31.87)
Failure (<120)	25 (20.49)	4 (2.2)
Numeric Variables		
Civilian Education (SD)*	12.38 (0.96)	12.83 (1.45)
Number of Dependents (SD)*	0.63 (1.17)	1.40 (1.39)
Retirement Years (SD)*	5.32 (1.86)	9.12 (1.82)
Age (SD)*	28.12 (2.22)	30.20 (2.59)
AFQT Score (SD)	66.86 (20.59)	65.67 (18.23)
Number of Combat Deployments (SD)*	0.01 (0.09)	0.61 (0.49)
Days Combat Deployed (SD)*	1.70 (18.74)	111.56 (102.31)
Number of Noncombat Deployments (SD)*	0.04 (0.20)	0.69 (0.46)
Days Noncombat Deployed (SD)*	6.11 (31.10)	224.27 (211.99)
Cumulative Average PFT Score (SD)*	167.49 (92.12)	212.27 (43.23)
Cumulative Average Proficiency Marks (SD)*	42.81 (4.53)	46.16 (1.07)
Cumulative Average Conduct Marks (SD)*	42.65 (4.52)	46.14 (1.36)

* p-value < 0.1

Table 12. Cohort 3 Characteristics for Milestone B (n = 304 [%]).

Milestone B		
Factor Level	Attrite (n,%)	Retain (n,%)
Prior Service*		
No	198 (98.51)	97 (97)
Yes	3 (1.49)	3 (3)
Enlistment Option		
3x5	0 (0)	0 (0)
4x4	3 (1.49)	2 (2)
6x2	198 (98.51)	98 (98)
Unknown	0 (0)	0 (0)
First Unit Location		
West	35 (17.41)	14 (14)
Midwest	38 (18.91)	21 (21)
South	85 (42.29)	45 (45)
Northeast	35 (17.41)	17 (17)
Pacific	0 (0)	2 (2)
Unknown	7 (3.48)	1 (1)
OCONUS	1 (0.5)	0 (0)
Enlistment Bonus		
No	198 (98.51)	96 (96)
Yes	3 (1.49)	4 (4)
Civilian Education		
High School Grad	150 (74.63)	62 (62)
Post-high school	51 (25.37)	38 (38)
Reenlistment Recommendation		
Recommended	123 (61.19)	91 (91)
Transfer	0 (0)	0 (0)
Failure	6 (2.99)	1 (1)
Extenuating Circumstances	0 (0)	0 (0)
Separated	0 (0)	0 (0)
Denied	53 (26.37)	0 (0)
Unassigned	19 (9.45)	8 (8)
Present Grade		
E1-E3	65 (32.34)	1 (1)
E4-E5	126 (62.69)	17 (17)
E6-E9	10 (4.98)	82 (82)
PMOS		
Combat Arms	73 (36.32)	35 (35)
Combat Service Support	112 (55.72)	61 (61)
Aviation and Aviation Support	16 (7.96)	4 (4)
Marital Status		
Single	120 (59.7)	23 (23)

Milestone B		
Factor Level	Attrite (n,%)	Retain (n,%)
Married	77 (38.31)	72 (72)
Divorced	4 (1.99)	5 (5)
Annulled	0 (0)	0 (0)
Race		
American Indian/Alaska Native	1 (0.5)	4 (4)
Asian	5 (2.49)	1 (1)
Black/African American	20 (9.95)	11 (11)
Native Hawaiian/Pacific Islander	0 (0)	0 (0)
White	147 (73.13)	75 (75)
Declined to Respond	28 (13.93)	9 (9)
Sex		
Male	197 (98.01)	98 (98)
Female	4 (1.99)	2 (2)
Age*		
Under 20 years	0 (0)	0 (0)
20-24 years	0 (0)	0 (0)
25-29 years	117 (58.21)	3 (3)
30-34 years	72 (35.82)	67 (67)
35-39 years	12 (5.97)	23 (23)
40-44 years	0 (0)	7 (7)
45 and Over	0 (0)	0 (0)
Home State		
West	41 (20.4)	14 (14)
Midwest	39 (19.4)	21 (21)
South	84 (41.79)	47 (47)
Northeast	36 (17.91)	16 (16)
Pacific	0 (0)	2 (2)
Unknown	0 (0)	0 (0)
OCONUS	1 (0.5)	0 (0)
AFQT Score*		
<=25	74 (37)	28 (28)
26-50	80 (40)	51 (51)
51-75	45 (22.5)	19 (19)
76-100	1 (0.5)	2 (2)
Present Unit Location*		
West	33 (16.42)	9 (9)
Midwest	90 (44.78)	49 (49)
South	54 (26.87)	34 (34)
Northeast	23 (11.44)	7 (7)
Pacific	0 (0)	1 (1)
Unknown	0 (0)	0 (0)
OCONUS	1 (0.5)	0 (0)

Milestone B		
Factor Level	Attrite (n,%)	Retain (n,%)
Personal Award*		
No	51 (25.37)	0 (0)
Yes	150 (74.63)	100 (100)
Disciplinary Action*		
No	195 (97.01)	93 (93)
Yes	6 (2.99)	7 (7)
Days Combat Deployed*		
Less than or equal to 90 days	177 (88.06)	22 (22)
91-180 days	14 (6.97)	27 (27)
181-270 days	10 (4.98)	43 (43)
271-360 days	0 (0)	8 (8)
361-450 days	0 (0)	0 (0)
451-540 days	0 (0)	0 (0)
Greater than 540 days	0 (0)	0 (0)
Days Noncombat Deployed*		
Less than or equal to 90 days	168 (83.58)	10 (10)
91-180 days	9 (4.48)	6 (6)
181-270 days	11 (5.47)	20 (20)
271-360 days	8 (3.98)	32 (32)
361-450 days	4 (1.99)	20 (20)
451-540 days	0 (0)	6 (6)
Greater than 540 days	1 (0.5)	6 (6)
Cumulative Average PFT Score*		
First Class (≥ 235)	45 (22.39)	35 (35)
Second Class (200-234)	53 (26.37)	40 (40)
Third Class (120-199)	75 (37.31)	23 (23)
Failure (<120)	28 (13.93)	2 (2)
Numeric Variables		
Civilian Education (SD)*	12.51 (1.12)	13.13 (1.68)
Number of Dependents (SD)*	0.81 (1.21)	2.05 (1.49)
Retirement Years (SD)*	6.49 (2.33)	12.3 (2.5)
Age (SD)*	29.43 (2.88)	33.98 (3.04)
AFQT Score (SD)	66.87 (19.89)	64.13 (18.58)
Number of Combat Deployments (SD)*	0.13 (0.34)	0.84 (0.37)
Days Combat Deployed (SD)*	20.41 (56.68)	159.84 (91.42)
Number of Noncombat Deployments (SD)*	0.17 (0.38)	0.92 (0.27)
Days Noncombat Deployed (SD)*	43.64 (108.31)	312.19 (202.55)
Cumulative Average PFT Score (SD)*	181.80 (79.27)	217.67 (39.36)
Cumulative Average Proficiency Marks (SD)*	44.07 (3.93)	46.23 (0.94)
Cumulative Average Conduct Marks (SD)*	43.92 (4.02)	46.28 (1.04)

* p-value < 0.1

Table 13. Cohort 3 Characteristics for Milestone C (n = 304 [%]).

Milestone C		
Factor Level	Attrite (n,%)	Retain (n,%)
Prior Service*		
No	232 (98.72)	62 (95.38)
Yes	3 (1.28)	3 (4.62)
Enlistment Option		
3x5	0 (0)	0 (0)
4x4	3 (1.28)	2 (3.08)
6x2	232 (98.72)	63 (96.92)
Unknown	0 (0)	0 (0)
First Unit Location		
West	40 (17.02)	9 (13.85)
Midwest	46 (19.57)	12 (18.46)
South	99 (42.13)	31 (47.69)
Northeast	42 (17.87)	10 (15.38)
Pacific	0 (0)	2 (3.08)
Unknown	7 (2.98)	1 (1.54)
OCONUS	1 (0.43)	0 (0)
Enlistment Bonus		
No	229 (97.45)	64 (98.46)
Yes	6 (2.55)	1 (1.54)
Civilian Education		
High School Grad	173 (73.62)	35 (53.85)
Post-high school	62 (26.38)	30 (46.15)
Reenlistment Recommendation		
Recommended	155 (65.96)	55 (84.62)
Transfer	0 (0)	0 (0)
Failure	6 (2.55)	3 (4.62)
Extenuating Circumstances	0 (0)	0 (0)
Separated	0 (0)	0 (0)
Denied	53 (22.55)	2 (3.08)
Unassigned	21 (8.94)	5 (7.69)
Present Grade		
E1-E3	65 (27.66)	1 (1.54)
E4-E5	138 (58.72)	3 (4.62)
E6-E9	32 (13.62)	61 (93.85)
PMOS		
Combat Arms	88 (37.45)	18 (27.69)
Combat Service Support	129 (54.89)	44 (67.69)
Aviation and Aviation Support	18 (7.66)	2 (3.08)
Marital Status		
Single	131 (55.74)	11 (16.92)

Milestone C		
Factor Level	Attrite (n,%)	Retain (n,%)
Married	98 (41.7)	49 (75.38)
Divorced	6 (2.55)	5 (7.69)
Annulled	0 (0)	0 (0)
Race		
American Indian/Alaska Native	2 (0.85)	3 (4.62)
Asian	6 (2.55)	0 (0)
Black/African American	26 (11.06)	5 (7.69)
Native Hawaiian/Pacific Islander	0 (0)	0 (0)
White	169 (71.91)	53 (81.54)
Declined to Respond	32 (13.62)	4 (6.15)
Sex		
Male	230 (97.87)	64 (98.46)
Female	5 (2.13)	1 (1.54)
Age*		
Under 20 years	0 (0)	0 (0)
20-24 years	0 (0)	0 (0)
25-29 years	117 (49.79)	2 (3.08)
30-34 years	86 (36.6)	2 (3.08)
35-39 years	31 (13.19)	43 (66.15)
40-44 years	1 (0.43)	14 (21.54)
45 and Over	0 (0)	4 (6.15)
Home State		
West	46 (19.57)	9 (13.85)
Midwest	46 (19.57)	13 (20)
South	100 (42.55)	31 (47.69)
Northeast	42 (17.87)	10 (15.38)
Pacific	0 (0)	2 (3.08)
Unknown	0 (0)	0 (0)
OCONUS	1 (0.43)	0 (0)
AFQT Score*		
<=25	84 (35.9)	19 (29.23)
26-50	97 (41.45)	35 (53.85)
51-75	51 (21.79)	11 (16.92)
76-100	2 (0.85)	0 (0)
Present Unit Location*		
West	34 (14.47)	4 (6.15)
Midwest	118 (50.21)	10 (15.38)
South	58 (24.68)	46 (70.77)
Northeast	24 (10.21)	5 (7.69)
Pacific	0 (0)	0 (0)
Unknown	0 (0)	0 (0)
OCONUS	1 (0.43)	0 (0)

Milestone C		
Factor Level	Attrite (n,%)	Retain (n,%)
Personal Award*		
No	51 (21.7)	0 (0)
Yes	184 (78.3)	65 (100)
Disciplinary Action*		
No	227 (96.6)	60 (92.31)
Yes	8 (3.4)	5 (7.69)
Days Combat Deployed*		
Less than or equal to 90 days	187 (79.57)	14 (21.54)
91-180 days	22 (9.36)	19 (29.23)
181-270 days	23 (9.79)	27 (41.54)
271-360 days	3 (1.28)	5 (7.69)
361-450 days	0 (0)	0 (0)
451-540 days	0 (0)	0 (0)
Greater than 540 days	0 (0)	0 (0)
Days Noncombat Deployed*		
Less than or equal to 90 days	170 (72.34)	8 (12.31)
91-180 days	13 (5.53)	3 (4.62)
181-270 days	19 (8.09)	10 (15.38)
271-360 days	18 (7.66)	23 (35.38)
361-450 days	13 (5.53)	8 (12.31)
451-540 days	0 (0)	7 (10.77)
Greater than 540 days	2 (0.85)	6 (9.23)
Cumulative Average PFT Score*		
First Class (≥ 235)	61 (25.96)	18 (27.69)
Second Class (200-234)	64 (27.23)	27 (41.54)
Third Class (120-199)	81 (34.47)	18 (27.69)
Failure (<120)	29 (12.34)	2 (3.08)
Numeric Variables		
Civilian Education (SD)*	12.57 (1.21)	13.46 (1.82)
Number of Dependents (SD)*	0.92 (1.28)	2.37 (1.49)
Retirement Years (SD)*	7.12 (2.69)	16.11 (3.04)
Age (SD)*	30.2 (3.36)	37.92 (3.81)
AFQT Score (SD)	66.38 (19.93)	66.37 (15.70)
Number of Combat Deployments (SD)*	0.23 (0.42)	0.86 (0.39)
Days Combat Deployed (SD)*	39.26 (78.76)	157.4 (88.63)
Number of Noncombat Deployments (SD)*	0.28 (0.45)	0.91 (0.29)
Days Noncombat Deployed (SD)*	78.09 (139.65)	337.52 (241.04)
Cumulative Average PFT Score (SD)*	187.58 (76.87)	212.73 (38.06)
Cumulative Average Proficiency Marks (SD)*	44.36 (3.72)	46.14 (2.19)
Cumulative Average Conduct Marks (SD)*	44.23 (3.81)	46.20 (2.30)

* p-value < 0.1

C. MERGING COHORTS 1–3

From the previous analysis of the individual cohorts, there were two categorical variables levels present that lack sufficient representation allowing for meaningful statistical analysis. Female Marines and Marines with prior AC service made up, at most, two percent of each individual cohort with individual numbers never exceeding nine Marines. A potential solution for these small numbers is combining the three cohorts. Of the predictor variables evaluated through univariate analysis for each milestone and each cohort, 85 percent of these variables were common to all. The similarities in predictor variables which exhibit dependence with the response variable across cohorts suggests combining the three cohorts. Two of the main benefits of this approach are 1) larger total sample size increasing the statistical power of the resulting regression models for each milestone and 2) larger individual sizes for demographics that are underrepresented when analyzing the cohorts individually. In order to still have the means to analyze any differences in retention between cohorts, a new categorical variable dictating which cohort an individual Marine is from is included in the merged cohort data set.

1. Traditional Demographics

These demographics refer to those predictor variables not specifically related to military service. These include the following variables: civilian education, marital status, race, sex, age, home state, and number of dependents. In this section we explore the marginal distributions of these demographic variables for the merged cohort.

a. Civilian Education

As depicted in Figure 8, over 75 percent of the Marines in the cohort have not elected to pursue any education past high school. Even though the Marines with a post-high school education will likely have more employment options in the civilian sector, the population retained at Milestone A, for example, is 72.4 percent compared to 55.7 percent from those with only a high school education.

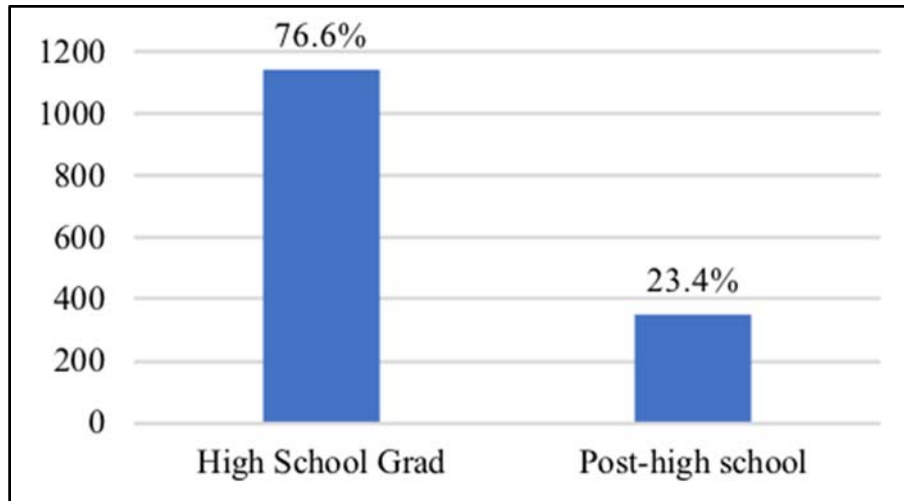


Figure 8. Education demographics for merged cohort (n=1,490).

b. Marital Status

The merged cohort consists predominantly of single Marines at 60.1 percent, while married Marines have less representation at 37.4 percent as depicted in Figure 9. Only 2.3 percent of the population were listed as divorced, which showed little change throughout each milestone.

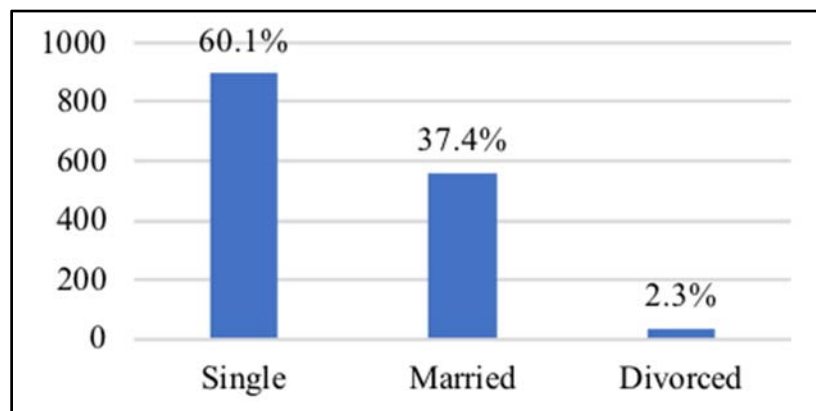


Figure 9. Marital status demographics for merged cohort (n=1,490).

c. Race

As depicted in Figure 10, the sample population predominantly identifies as white at over 70 percent, which due to the categories established by the Marine Corps could include those who are Hispanic as well. A substantial number of Marines, totaling 15.2 percent, declined to respond to this entry into their personnel file.

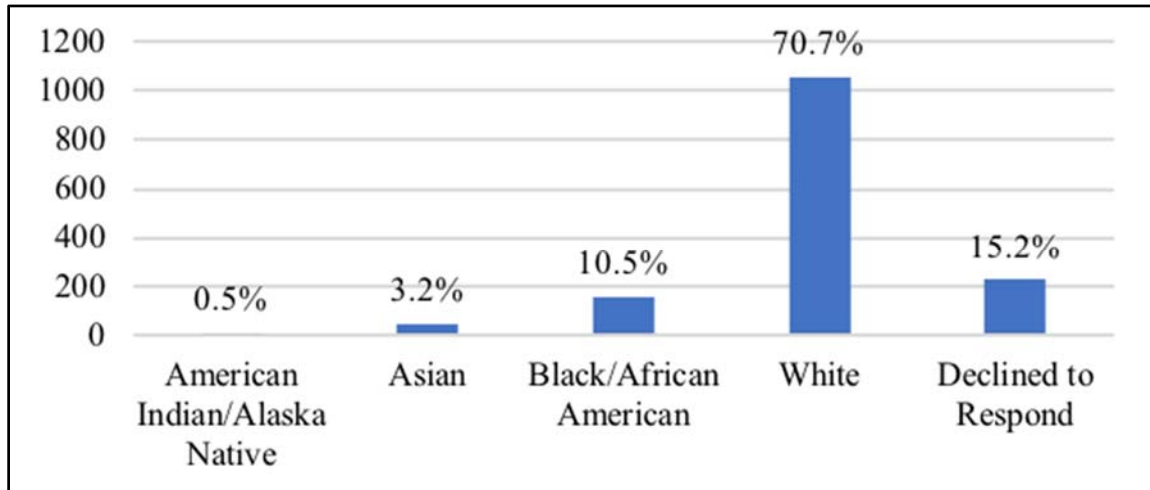


Figure 10. Race demographics for merged cohort (n=1,490).

d. Age

As depicted in Figure 11, the majority of Marines at Milestone A fall into the 25–29 year range, as they are only four years past their initial service contract. Those in the 30–34 and 35–39 year range are those Marines with a significant amount of prior service in the AC and have chosen to spend the remainder of their career in the SMCR.

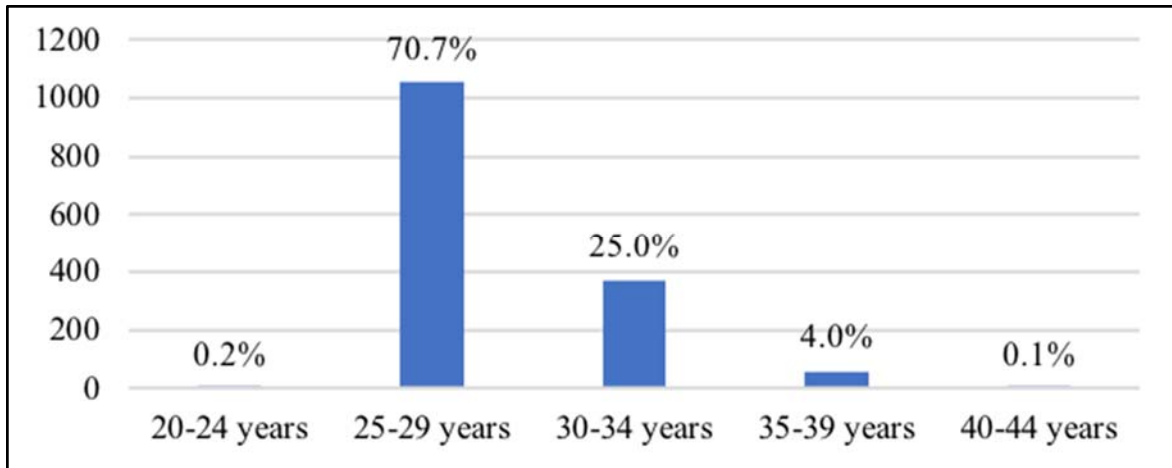


Figure 11. Age demographics for merged cohort (n=1,490).

e. Home State

The majority of SMCR Marines list their home state within the southern portion of the United States totaling more than 34 percent of the population as depicted in Figure 12. For this study, the state of Texas is included in this region which explains the high degree of representation. The most densely population of the United States, the Northeast, and the Western region, to include California, are the next highest represented regions at approximately 21 percent.

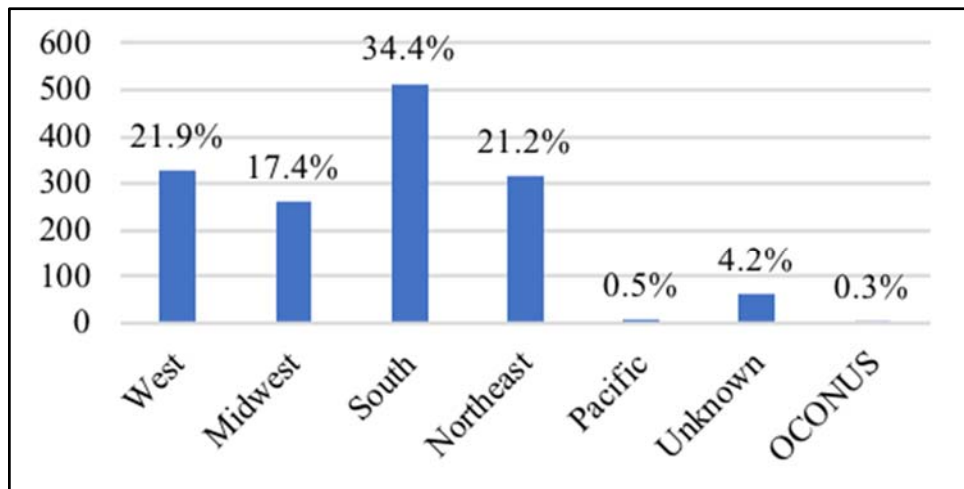


Figure 12. Home state demographics for merged cohort (n=1,490).

f. Number of Dependents

As depicted in Figure 12, the majority of Marines list no dependents in their personnel file at 58 percent. Marines with one dependent listed account for 19.9 percent of the population, which normally corresponds to the Marine's spouse. The remaining 22.1 percent of the population have two or more dependents.

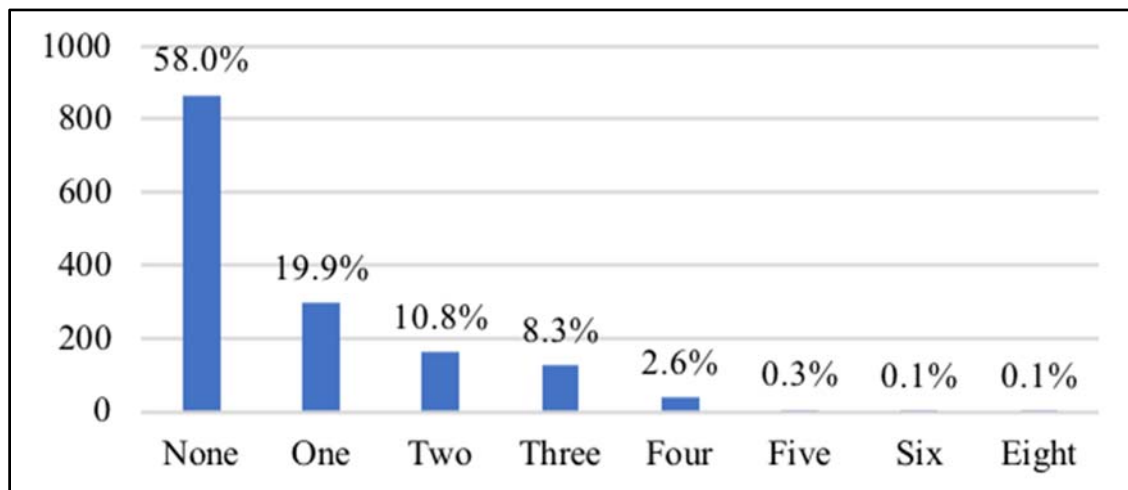


Figure 13. Dependent demographics for merged cohort (n=1,490).

2. Military Demographics

These demographics refer to the remainder of predictor variables analyzed in this study— those related specifically to military service to include the cohort from where the Marines originated.

a. Cohort

Figure 14 depicts that the majority of the Marines making up the merged cohort come from Cohort 2 at 44.3 percent. The next-largest representation comes from Cohort 1 at 35.3 percent. Cohort 3 is the minority making up only 20.4 percent of the population.

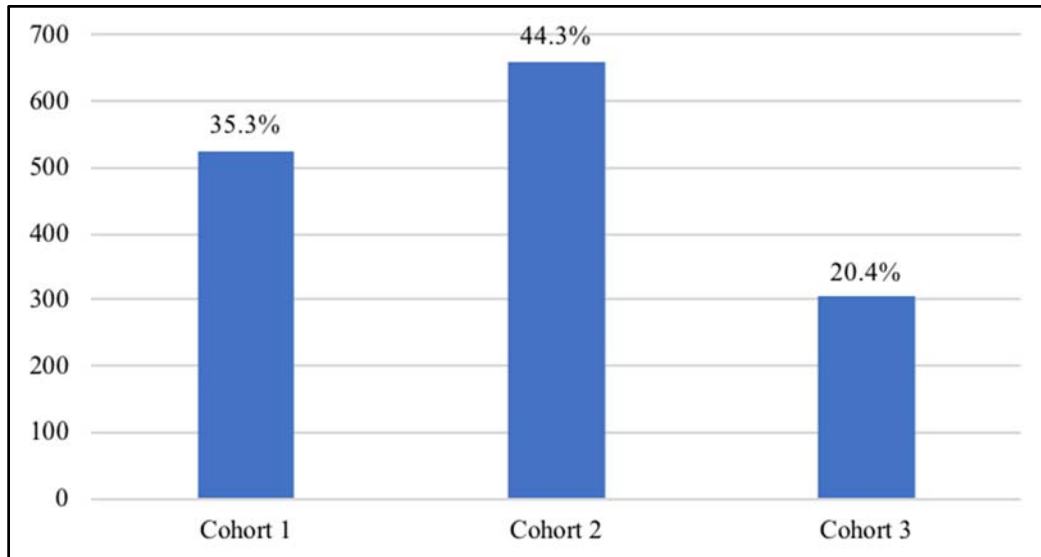


Figure 14. Cohort demographics for merged cohort (n=1,490).

b. Reenlistment Recommendation

An individual Marine's reenlistment recommendation is an excellent and obvious predictor in retention. If a Marine falls into the "denied" category, they simply will not be retained in the SMCR. This variable is included in the study only to provide a summary of exactly how many Marines from the cohort are even eligible for reenlistment in the SMCR, in this case 68.5 percent as depicted in Figure 15.

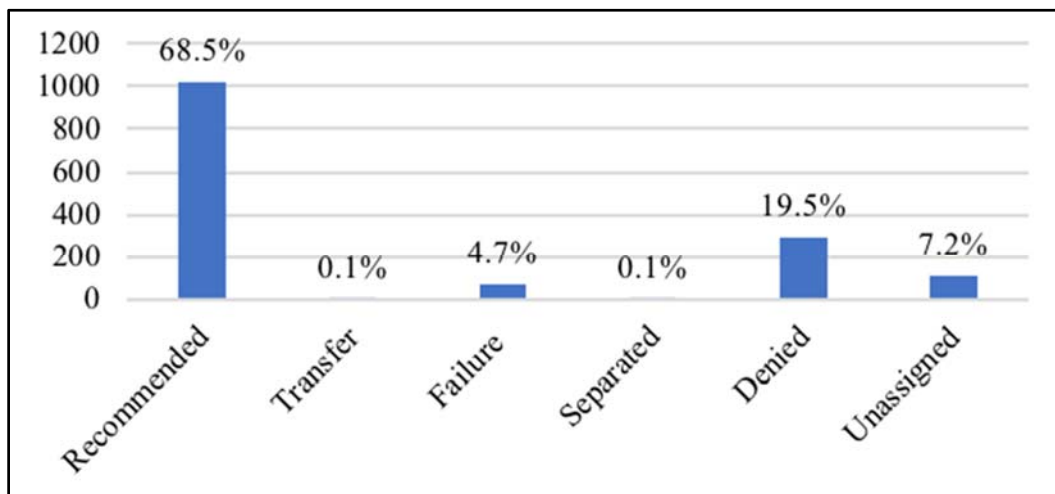


Figure 15. Reenlistment recommendation demographics for merged cohort (n=1,490).

c. Present Grade

As depicted in Figure 16, The majority of the Marines have achieved a rank of either Corporal (E-4) or Sergeant (E-5). This is to be expected, as the Marines included in this study have completed their initial service contract in the AC or RC. The 8.7 percent in the Staff Sergeant (E-6) to Master Gunnery Sergeant/Sergeant Major (E-9) are those who either 1) exhibited performance warranting meritorious promotion or 2) have prior AC service.

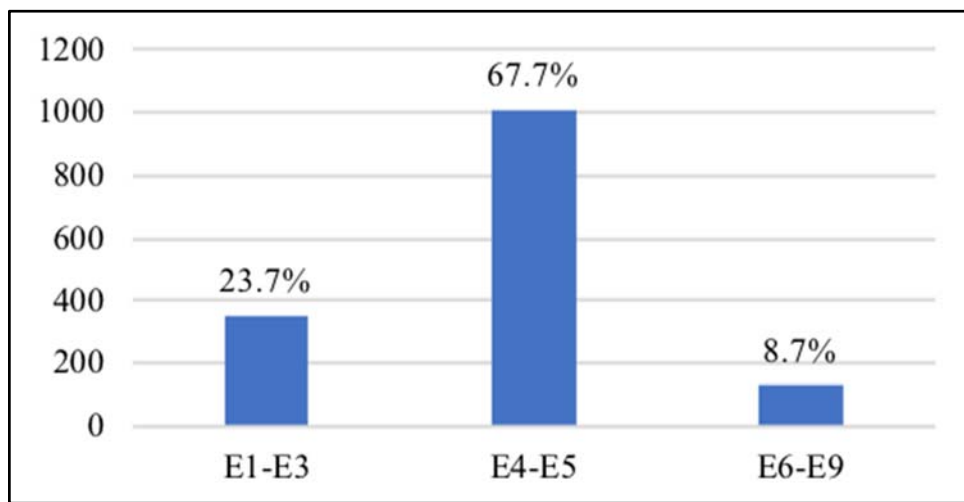


Figure 16. Rank demographics for merged cohort (n=1,490).

d. PMOS

Figure 17 depicts that just over half the Marines have a PMOS in the combat service support category which includes logistics, communications, and administration centric specialties. Marines in the combat arms category make up the next highest represented category at 40.7 percent including those in infantry, armor, engineer, artillery specialties. The least represented category is that of aviation and aviation support Marines at 8.7 percent including aircraft crewmen, maintainers, and air control specialties.

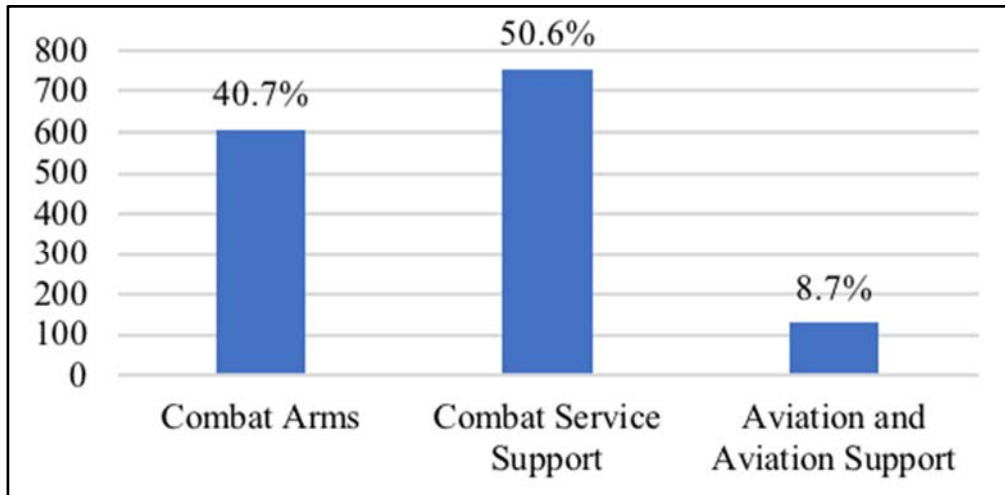


Figure 17. PMOS demographics for merged cohort (n=1,490).

e. AFQT Score

As depicted in Figure 18, over 77 percent of Marines achieved a score of 50 or less on the AFQT. Only 21.9 percent were able to achieve a score above 50.

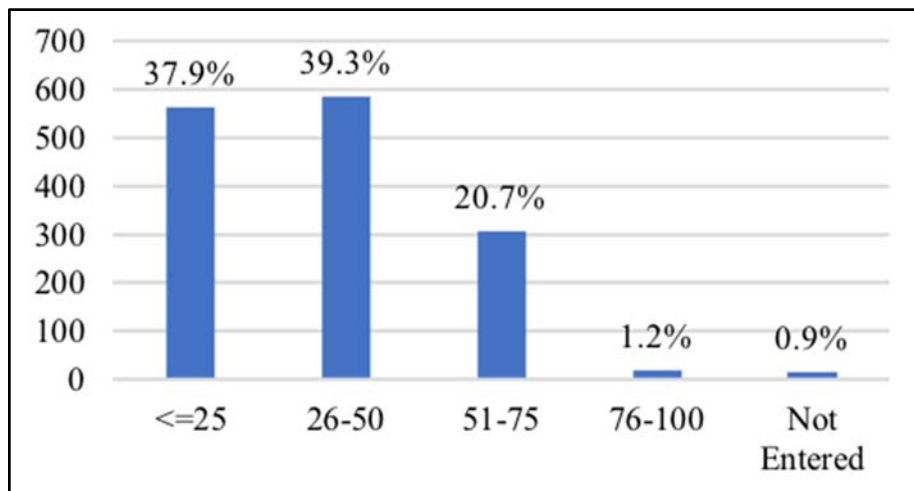


Figure 18. AFQT score demographics for merged cohort (n=1,490).

f. Present Unit Location

Marines serving in the Midwest region of the United States comprise 46.2 percent of the population, as depicted in Figure 19. The next highest represented region is the Southern region at 24.4 percent followed by the West at 14.9 percent.

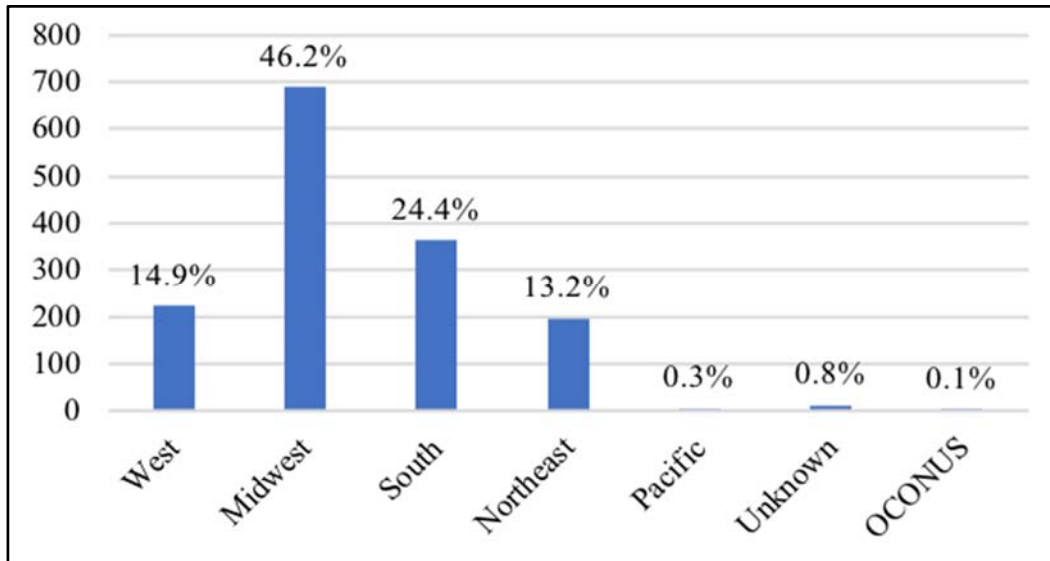


Figure 19. Present unit location demographics for merged cohort (n=1,490).

g. Personal Award

Figure 20 depicts that the majority of the Marines in the population have received at least one personal award, to include the Good Conduct Medal denoting all around satisfactory performance.

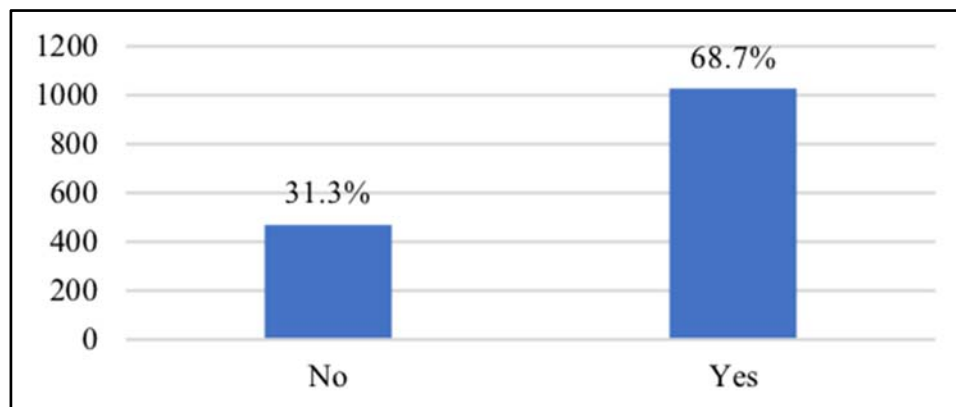


Figure 20. Personal award demographics for merged cohort (n=1,490).

h. Days Combat Deployed

There is a large subset of the population with little to no combat deployment experience, totaling 79.7 percent depicted in Figure 21. However, 20.3 percent show experience in at least one combat deployment. Omitted from Figure 21 are the variable levels corresponding to 361–450 days and greater than 540 days combat deployed due to zero observations falling into these categories.

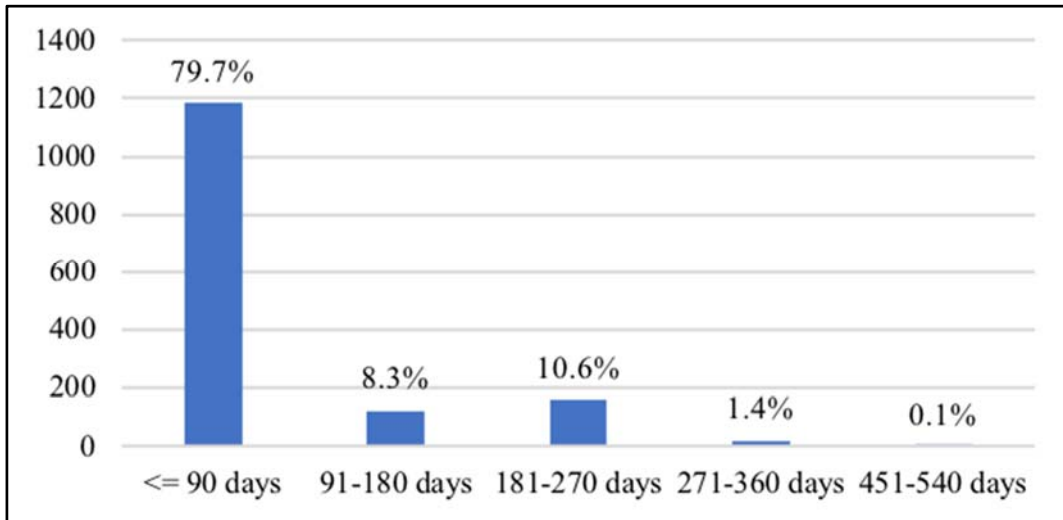


Figure 21. Days of combat deployment demographics for merged cohort (n=1,490).

i. Days Non-combat Deployed

As depicted in Figure 22, this demographic follows a similar trend of days combat deployed, but this time showing a larger percentage of Marines who have at least one deployment at 25.6 percent.

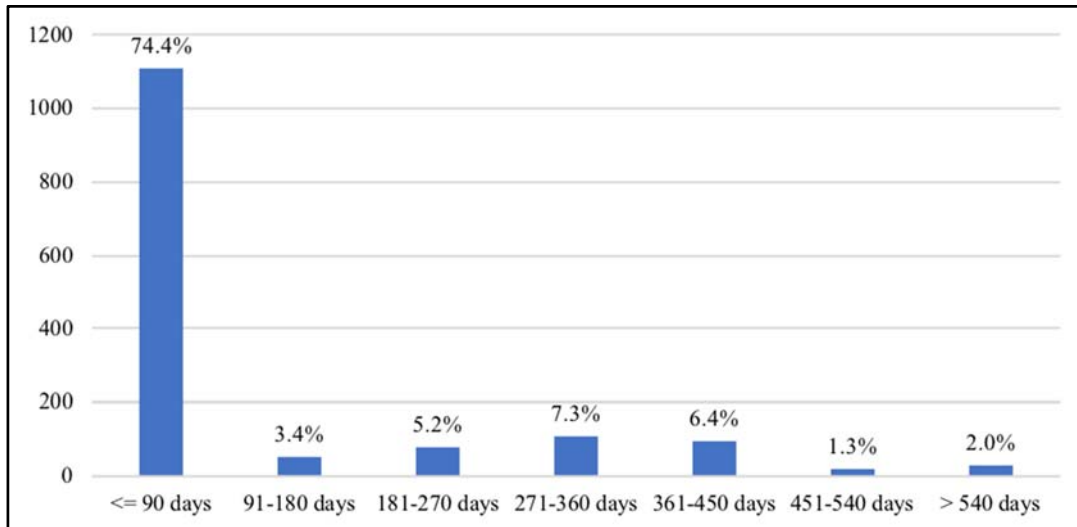


Figure 22. Days of non-combat deployment demographics for merged cohort (n=1,490).

j. Cumulative Average PFT Score

Marines in this population have achieved mostly first through third class scores, accounting for 88.7 percent as depicted in Figure 23. Only 11.2 percent show a failing score which is grounds for denial of a reenlistment recommendation.

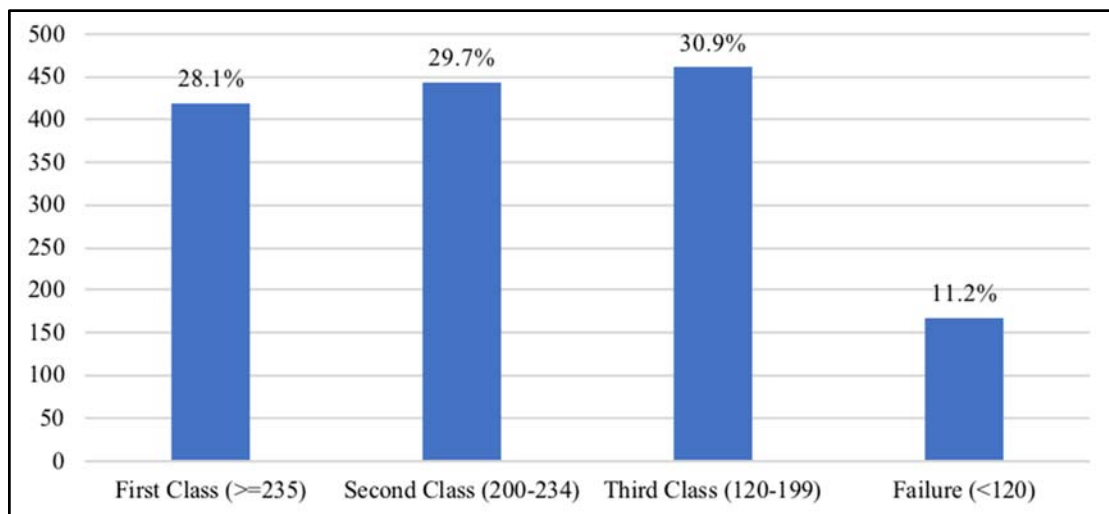


Figure 23. PFT score demographics for merged cohort (n=1,490).

k. Total Retirement Years

As depicted in Figure 24, There are very few Marines having less than five credited years toward retirement at 14.9 percent. The majority of the cohort, at 84.5 percent, have earned between five and 10 total years toward retirement.

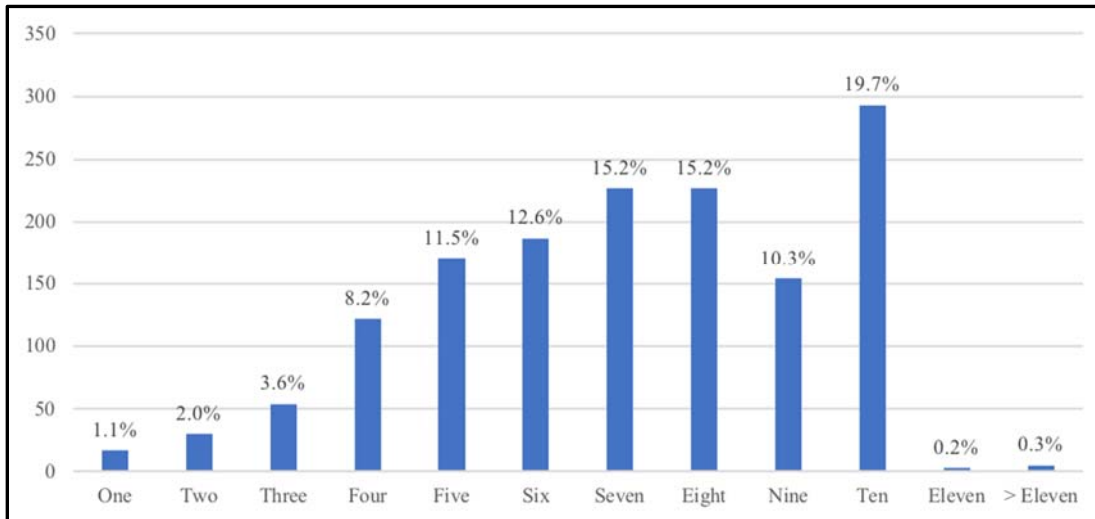


Figure 24. Retirement credited years demographics for merged cohort (n=1,490).

3. Characteristics by Milestones

Of the 1,490 Marines represented in the merged cohort, 51.7 percent were retained at Milestone A, 24.1 percent at Milestone B, and 14.2 percent at Milestone C. From the distributions listed in Tables 14–16, we can derive the following statistics. As expected, many of the retention trends previously identified when analyzing the individual cohorts are present in the merged cohort. By merging cohorts there is, however, an emergence of significant variables previously identified as insignificant. These include prior service Marines, who show substantially better retention than their counterparts with 80 percent retention at Milestone A, 60 percent at Milestone B, and 48 percent at Milestone C— an average of 31.5 percent greater than those Marines without prior service. The predictor corresponding to PMOS, now identified as significant, confirms previous conclusions of Aviation and Aviation Support Marines exhibiting the worst retention across the milestones. The race variable shows Black/African–American

Marines and those Marines who declined to respond exhibiting the worst retention across milestones.

Table 14. Merged Characteristics for Milestone A (n = 1,490 [%]).

Milestone A		
Factor Level	Attrite (n,%)	Retain (n,%)
Cohort*		
Cohort 1 (FY98 - FY12)	225 (37.44)	301 (33.86)
Cohort 2 (FY99 - FY13)	254 (42.26)	406 (45.67)
Cohort 3 (FY00 - FY14)	122 (20.3)	182 (20.47)
Prior Service*		
No	596 (99.17)	869 (97.75)
Yes	5 (0.83)	20 (2.25)
Enlistment Option *		
3x5	0 (0)	3 (0.34)
4x4	7 (1.16)	21 (2.36)
6x2	588 (97.84)	849 (95.5)
Unknown	6 (1)	16 (1.8)
First Unit Location		
West	129 (21.46)	185 (20.81)
Midwest	98 (16.31)	159 (17.89)
South	225 (37.44)	317 (35.66)
Northeast	113 (18.8)	177 (19.91)
Pacific	5 (0.83)	3 (0.34)
Unknown	29 (4.83)	47 (5.29)
OCONUS	2 (0.33)	1 (0.11)
Enlistment Bonus		
No	596 (99.17)	879 (98.88)
Yes	5 (0.83)	10 (1.12)
Civilian Education *		
High School Grad	505 (84.03)	637 (71.65)
Post-high school	96 (15.97)	252 (28.35)
Reenlistment Recommendation *		
Recommended	223 (37.1)	798 (89.76)
Transfer	1 (0.17)	0 (0)
Failure	68 (11.31)	2 (0.22)
Separated	1 (0.17)	0 (0)
Denied	276 (45.92)	14 (1.57)
Unassigned	32 (5.32)	75 (8.44)
Present Grade *		
E1-E3	298 (49.58)	55 (6.19)

Milestone A		
Factor Level	Attrite (n,%)	Retain (n,%)
E4-E5	300 (49.92)	708 (79.64)
E6-E9	3 (0.5)	126 (14.17)
PMOS *		
Combat Arms	230 (38.27)	377 (42.41)
Combat Service Support	312 (51.91)	442 (49.72)
Aviation and Aviation Support	59 (9.82)	70 (7.87)
Marital Status *		
Single	438 (72.88)	458 (51.52)
Married	154 (25.62)	404 (45.44)
Divorced	8 (1.33)	27 (3.04)
Race*		
American Indian/Alaska Native	3 (0.5)	4 (0.45)
Asian	17 (2.83)	30 (3.37)
Black/African American	73 (12.15)	83 (9.34)
Native Hawaiian/Pacific Islander	0 (0)	0 (0)
White	428 (71.21)	626 (70.42)
Declined to Respond	80 (13.31)	146 (16.42)
Sex		
Male	595 (99)	873 (98.2)
Female	6 (1)	16 (1.8)
Age*		
Under 20 years	0 (0)	0 (0)
20-24 years	3 (0.5)	0 (0)
25-29 years	509 (84.69)	545 (61.3)
30-34 years	78 (12.98)	294 (33.07)
35-39 years	11 (1.83)	48 (5.4)
40-44 years	0 (0)	2 (0.22)
45 and Over	0 (0)	0 (0)
Home State		
West	133 (22.13)	194 (21.82)
Midwest	101 (16.81)	159 (17.89)
South	214 (35.61)	299 (33.63)
Northeast	119 (19.8)	197 (22.16)
Pacific	4 (0.67)	3 (0.34)
Unknown	27 (4.49)	36 (4.05)
OCONUS	3 (0.5)	1 (0.11)
AFQT Score		
<=25	213 (36.22)	352 (39.64)
26-50	251 (42.69)	334 (37.61)
51-75	123 (20.92)	185 (20.83)
76-100	1 (0.17)	17 (1.91)
Present Unit Location *		

Milestone A		
Factor Level	Attrite (n,%)	Retain (n,%)
West	107 (17.8)	115 (12.94)
Midwest	216 (35.94)	473 (53.21)
South	177 (29.45)	187 (21.03)
Northeast	87 (14.48)	109 (12.26)
Pacific	4 (0.67)	1 (0.11)
Unknown	8 (1.33)	4 (0.45)
OCONUS	2 (0.33)	0 (0)
Personal Award *		
No	380 (63.23)	87 (9.79)
Yes	221 (36.77)	802 (90.21)
Disciplinary Action *		
No	598 (99.5)	860 (96.74)
Yes	3 (0.5)	29 (3.26)
Days Combat Deployed*		
Less than or equal to 90 days	599 (99.67)	588 (66.14)
91-180 days	0 (0)	123 (13.84)
181-270 days	2 (0.33)	156 (17.55)
271-360 days	0 (0)	21 (2.36)
451-540 days	0 (0)	1 (0.11)
Days Noncombat Deployed*		
Less than or equal to 90 days	595 (99)	513 (57.71)
91-180 days	3 (0.5)	48 (5.4)
181-270 days	1 (0.17)	77 (8.66)
271-360 days	1 (0.17)	108 (12.15)
361-450 days	1 (0.17)	94 (10.57)
451-540 days	0 (0)	19 (2.14)
Greater than 540 days	0 (0)	30 (3.37)
Cumulative Average PFT Score*		
First Class (≥ 235)	167 (27.79)	252 (28.35)
Second Class (200-234)	132 (21.96)	311 (34.98)
Third Class (120-199)	186 (30.95)	275 (30.93)
Failure (< 120)	116 (19.3)	51 (5.74)
Numeric Variables		
Civilian Education (SD)*	12.29 (0.84)	12.74 (1.40)
Number of Dependents (SD)*	0.49 (0.95)	0.99 (1.22)
Retirement Years (SD)*	5.22 (1.72)	8.31 (1.80)
Age (SD)*	27.69 (2.21)	29.55 (2.48)
AFQT Score (SD)	66.93 (18.60)	66.38 (20.44)
Number of Combat Deployments (SD)*	0.003 (0.06)	0.37 (0.48)
Days Combat Deployed (SD)*	0.70 (12.13)	66.86 (96.30)
Number of Noncombat Deployments (SD)*	0.01 (0.11)	0.43 (0.49)
Days Noncombat Deployed (SD)*	2.44 (25.15)	143.40 (203.92)

Milestone A		
Factor Level	Attrite (n,%)	Retain (n,%)
Cumulative Average PFT Score (SD)*	172.83 (90.33)	205.19 (55.38)
Cumulative Average Proficiency Marks (SD)*	42.83 (4.19)	45.72 (1.53)
Cumulative Average Conduct Marks (SD)*	42.76 (4.17)	45.72 (1.63)

* p-value < 0.1

Table 15. Merged Characteristics for Milestone B (n = 1,490 [%]).

Milestone B		
Factor Level	Attrite (n,%)	Retain (n,%)
Cohort*		
Cohort 1 (FY98 - FY12)	408 (36.46)	111 (31.27)
Cohort 2 (FY99 - FY13)	510 (45.58)	144 (40.56)
Cohort 3 (FY00 - FY14)	201 (17.96)	100 (28.17)
Prior Service*		
No	1111 (99.29)	342 (96.34)
Yes	10 (0.71)	15 (3.66)
Enlistment Option*		
3x5	0 (0)	3 (0.85)
4x4	17 (1.52)	10 (2.82)
6x2	1088 (97.23)	335 (94.37)
Unknown	14 (1.25)	7 (1.97)
First Unit Location		
West	238 (21.27)	71 (20)
Midwest	178 (15.91)	75 (21.13)
South	410 (36.64)	127 (35.77)
Northeast	222 (19.84)	66 (18.59)
Pacific	6 (0.54)	2 (0.56)
Unknown	62 (5.54)	14 (3.94)
OCONUS	3 (0.27)	0 (0)
Enlistment Bonus		
No	1110 (99.2)	349 (98.31)
Yes	9 (0.8)	6 (1.69)
Civilian Education*		
High School Grad	913 (81.59)	215 (60.56)
Post-high school	206 (18.41)	140 (39.44)
Reenlistment Recommendation*		
Recommended	692 (61.84)	318 (89.58)
Transfer	1 (0.09)	0 (0)
Failure	69 (6.17)	6 (1.69)
Separated	1 (0.09)	0 (0)
Denied	291 (26.01)	2 (0.56)

Milestone B		
Factor Level	Attrite (n,%)	Retain (n,%)
Unassigned	61 (5.45)	24 (6.76)
Present Grade*		
E1-E3	351 (31.37)	3 (0.85)
E4-E5	739 (66.04)	91 (25.63)
E6-E9	29 (2.59)	261 (73.52)
PMOS*		
Combat Arms	434 (38.78)	156 (43.94)
Combat Service Support	583 (52.1)	175 (49.3)
Aviation and Aviation Support	102 (9.12)	24 (6.76)
Marital Status*		
Single	749 (66.93)	88 (24.79)
Married	348 (31.1)	246 (69.3)
Divorced	21 (1.88)	21 (5.92)
Race*		
American Indian/Alaska Native	3 (0.27)	4 (1.13)
Asian	36 (3.22)	8 (2.25)
Black/African American	125 (11.17)	30 (8.45)
Native Hawaiian/Pacific Islander	0 (0)	2 (0.56)
White	781 (69.79)	267 (75.21)
Declined to Respond	174 (15.55)	44 (12.39)
Sex		
Male	1105 (98.75)	348 (98.03)
Female	14 (1.25)	8 (1.97)
Age*		
Under 20 years	0 (0)	0 (0)
20-24 years	3 (0.27)	0 (0)
25-29 years	779 (69.62)	3 (0.85)
30-34 years	296 (26.45)	236 (66.48)
35-39 years	36 (3.22)	97 (27.32)
40-44 years	5 (0.45)	19 (5.35)
45 and Over	0 (0)	0 (0)
Home State		
West	258 (23.06)	65 (18.31)
Midwest	182 (16.26)	74 (20.85)
South	384 (34.32)	124 (34.93)
Northeast	242 (21.63)	72 (20.28)
Pacific	5 (0.45)	3 (0.85)
Unknown	44 (3.93)	17 (4.79)
OCONUS	4 (0.36)	0 (0)
AFQT Score		
<=25	420 (38.01)	133 (37.46)
26-50	436 (39.46)	135 (38.03)

Milestone B		
Factor Level	Attrite (n,%)	Retain (n,%)
51-75	241 (21.81)	61 (17.18)
76-100	8 (0.72)	26 (7.32)
Present Unit Location*		
West	155 (13.85)	45 (12.68)
Midwest	581 (51.92)	188 (52.96)
South	237 (21.18)	87 (24.51)
Northeast	129 (11.53)	34 (9.58)
Pacific	3 (0.27)	1 (0.28)
Unknown	12 (1.07)	0 (0)
OCONUS	2 (0.18)	0 (0)
Personal Award*		
No	464 (41.47)	3 (0.85)
Yes	655 (58.53)	352 (99.15)
Disciplinary Action*		
No	1106 (98.84)	336 (94.65)
Yes	13 (1.16)	19 (5.35)
Days Combat Deployed*		
Less than or equal to 90 days	1076 (96.16)	108 (30.42)
91-180 days	27 (2.41)	92 (25.92)
181-270 days	14 (1.25)	135 (38.03)
271-360 days	1 (0.09)	20 (5.63)
451-540 days	1 (0.09)	0 (0)
Days Noncombat Deployed*		
Less than or equal to 90 days	1044 (93.3)	63 (17.75)
91-180 days	20 (1.79)	34 (9.58)
181-270 days	26 (2.32)	51 (14.37)
271-360 days	17 (1.52)	86 (24.23)
361-450 days	6 (0.54)	83 (23.38)
451-540 days	2 (0.18)	16 (4.51)
Greater than 540 days	4 (0.36)	22 (6.2)
Cumulative Average PFT Score*		
First Class (≥ 235)	299 (26.72)	109 (30.7)
Second Class (200-234)	293 (26.18)	146 (41.13)
Third Class (120-199)	362 (32.35)	93 (26.2)
Failure (<120)	165 (14.75)	7 (1.97)
Numeric Variables		
Civilian Education (SD)*	12.39 (1.00)	13.18 (1.70)
Number of Dependents (SD)*	0.64 (1.03)	1.74 (1.42)
Retirement Years (SD)*	6.33 (2.15)	11.93 (2.45)
Age (SD)*	28.74 (2.67)	34.01 (2.74)
AFQT Score (SD)	66.56 (19.39)	63.64 (24.65)
Number of Combat Deployments (SD)*	0.04 (0.20)	0.78 (0.47)

Milestone B		
Factor Level	Attrite (n,%)	Retain (n,%)
Days Combat Deployed (SD)*	7.01 (36.70)	139.39 (96.25)
Number of Noncombat Deployments (SD)*	0.07 (0.26)	0.83 (0.37)
Days Noncombat Deployed (SD)*	18.68 (75.71)	284.6 (220.41)
Cumulative Average PFT Score (SD)*	183.56 (80.25)	215.39 (36.86)
Cumulative Average Proficiency Marks (SD)*	44.04 (3.56)	45.96 (1.53)
Cumulative Average Conduct Marks (SD)*	43.99 (3.59)	46.03 (1.51)

* p-value < 0.1

Table 16. Merged Characteristics for Milestone C (n = 1,490 [%]).

Milestone C		
Factor Level	Attrite (n,%)	Retain (n,%)
Cohort*		
Cohort 1 (FY98 - FY12)	452 (35.82)	65 (31.25)
Cohort 2 (FY99 - FY13)	575 (45.56)	78 (37.5)
Cohort 3 (FY00 - FY14)	235 (18.62)	65 (31.25)
Prior Service*		
No	1252 (99.21)	197 (94.71)
Yes	13 (0.79)	12 (5.29)
Enlistment Option*		
3x5	3 (0.24)	0 (0)
4x4	20 (1.58)	7 (3.37)
6x2	1220 (96.67)	199 (95.67)
Unknown	19 (1.51)	2 (0.96)
First Unit Location		
West	269 (21.32)	39 (18.75)
Midwest	205 (16.24)	46 (22.12)
South	460 (36.45)	76 (36.54)
Northeast	252 (19.97)	36 (17.31)
Pacific	6 (0.48)	2 (0.96)
Unknown	67 (5.31)	9 (4.33)
OCONUS	3 (0.24)	0 (0)
Enlistment Bonus		
No	1249 (98.97)	206 (99.04)
Yes	13 (1.03)	2 (0.96)
Civilian Education*		
High School Grad	1005 (79.64)	116 (55.77)
Post-high school	257 (20.36)	92 (44.23)
Reenlistment Recommendation*		
Recommended	820 (64.98)	186 (89.42)
Transfer	1 (0.08)	0 (0)

Milestone C		
Factor Level	Attrite (n,%)	Retain (n,%)
Failure	75 (5.94)	7 (3.37)
Separated	1 (0.08)	0 (0)
Denied	293 (23.22)	3 (1.44)
Unassigned	72 (5.71)	12 (5.77)
Present Grade*		
E1-E3	353 (27.97)	1 (0.48)
E4-E5	801 (63.47)	21 (10.1)
E6-E9	108 (8.56)	186 (89.42)
PMOS*		
Combat Arms	505 (40.02)	80 (38.46)
Combat Service Support	644 (51.03)	114 (54.81)
Aviation and Aviation Support	113 (8.95)	13 (6.25)
Marital Status*		
Single	796 (63.07)	35 (16.83)
Married	434 (34.39)	157 (75.48)
Divorced	31 (2.46)	16 (7.69)
Race*		
American Indian/Alaska Native	4 (0.32)	5 (2.4)
Asian	37 (2.93)	7 (3.37)
Black/African American	139 (11.01)	16 (7.69)
Native Hawaiian/Pacific Islander	0 (0)	3 (1.44)
White	889 (70.44)	154 (74.04)
Declined to Respond	193 (15.29)	23 (11.06)
Sex		
Male	1246 (98.73)	203 (97.6)
Female	16 (1.27)	6 (2.4)
Age*		
Under 20 years	0 (0)	0 (0)
20-24 years	3 (0.24)	0 (0)
25-29 years	776 (61.49)	2 (0.96)
30-34 years	362 (28.68)	4 (1.92)
35-39 years	108 (8.56)	149 (71.63)
40-44 years	13 (1.03)	45 (21.63)
45 and Over	0 (0)	8 (3.85)
Home State		
West	285 (22.58)	39 (18.75)
Midwest	207 (16.4)	46 (22.12)
South	434 (34.39)	73 (35.1)
Northeast	274 (21.71)	41 (19.71)
Pacific	5 (0.4)	4 (1.92)
Unknown	53 (4.2)	5 (2.4)
OCONUS	4 (0.32)	0 (0)

Milestone C		
Factor Level	Attrite (n,%)	Retain (n,%)
AFQT Score		
<=25	472 (37.82)	75 (36.06)
26-50	487 (39.02)	86 (41.35)
51-75	270 (21.63)	30 (14.42)
76-100	19 (1.52)	17 (8.17)
Present Unit Location*		
West	167 (13.23)	22 (10.58)
Midwest	681 (53.96)	45 (21.63)
South	258 (20.44)	117 (56.25)
Northeast	139 (11.01)	24 (11.54)
Pacific	3 (0.24)	0 (0)
Unknown	12 (0.95)	0 (0)
OCONUS	2 (0.16)	0 (0)
Personal Award*		
No	467 (37)	0 (0)
Yes	795 (63)	208 (100)
Disciplinary Action*		
No	1240 (98.26)	198 (95.19)
Yes	22 (1.74)	10 (4.81)
Days Combat Deployed*		
Less than or equal to 90 days	1140 (90.33)	51 (24.52)
91-180 days	64 (5.07)	61 (29.33)
181-270 days	49 (3.88)	84 (40.38)
271-360 days	8 (0.63)	12 (5.77)
451-540 days	1 (0.08)	0 (0)
Days Noncombat Deployed*		
Less than or equal to 90 days	1085 (85.97)	24 (11.54)
91-180 days	39 (3.09)	32 (15.38)
181-270 days	50 (3.96)	35 (16.83)
271-360 days	46 (3.65)	56 (26.92)
361-450 days	29 (2.3)	35 (16.83)
451-540 days	4 (0.32)	13 (6.25)
Greater than 540 days	9 (0.71)	13 (6.25)
Cumulative Average PFT Score*		
First Class (>=235)	343 (27.18)	62 (29.81)
Second Class (200-234)	341 (27.02)	93 (44.71)
Third Class (120-199)	409 (32.41)	51 (24.52)
Failure (<120)	169 (13.39)	2 (0.96)
Numeric Variables		
Civilian Education (SD)*	12.45 (1.10)	13.41 (1.83)
Number of Dependents (SD)*	0.73 (1.11)	2.17 (1.54)
Retirement Years (SD)*	6.85 (2.60)	15.26 (3.63)

Milestone C		
Factor Level	Attrite (n,%)	Retain (n,%)
Age (SD)*	29.49 (3.38)	37.93 (3.11)
AFQT Score (SD)	66.12 (20.18)	63.19 (24.86)
Number of Combat Deployments (SD)*	0.11 (0.31)	0.85 (0.39)
Days Combat Deployed (SD)*	18.21 (57.04)	148.59 (89.00)
Number of Noncombat Deployments (SD)*	0.14 (0.35)	0.91 (0.29)
Days Noncombat Deployed (SD)*	40.35 (111.78)	294.94 (215.60)
Cumulative Average PFT Score (SD)*	186.50 (77.41)	217.29 (33.64)
Cumulative Average Proficiency Marks (SD)*	44.22 (3.50)	46.02 (1.87)
Cumulative Average Conduct Marks (SD)*	44.18 (3.53)	46.09 (1.90)

* p-value < 0.1

D. UNIVARIATE EXPLORATION

To further explore effects of the predictor variables on retention, generalized linear models allow for independent univariate tests on each predictor variable as it relates to each milestone variable. Although previous statistical testing allowed for identification of a preliminary set of significant predictor variables to be used as a basis for further modeling, the univariate exploration conducted in this section presents an opportunity to examine in more detail the effect predictor variables and their respective levels have on the response variable for each milestone. From the coefficients listed in the form of log odds in Tables 17–19, we can derive statistics for each milestone presented in the form of percent likelihood of retention.

1. Milestone A

From Table 17, the univariate logistic regression models show 12 independent categorical variables deemed significant at the alpha level of 0.1. Marines with prior service, when compared to those without prior service, have a 73.3 percent higher chance of being retained at Milestone A. Those with any amount of post-high school education have a 67.4 percent higher chance of retention when compared to those with only a high school education. When compared to Marines whose present grade falls between E–1 and E–3, those with a present grade of E–4 to E–5 and E–6 to E–9 have a 92.7 and 99.5 percent higher chance of retention, respectively. Aviation and Aviation Support Marines have a 42.1 percent lower chance of retention when compared to those in the Combat

Arms communities. Married Marines, when compared to those who are single, have a 71.5 percent higher chance of retention. Although the sex variable is not significant at the $\alpha = 0.1$ level, the model shows that females have a 64.6 percent higher chance of retention than their male counterparts. Those Marines who score in the highest echelon on their AFQT (76–100 points), show a 91.1 percent higher chance of retention when compared to those scoring in the lowest echelon (less than 25 points). The major difference in retention is exhibited with respect to unit location exists between Marines stationed in the West and Midwest regions, with those in the Midwest region showing a 67 percent higher chance of retention. Marines who have received at least one personal award show a 94 percent higher chance of retention than those who have received none, which is expected due to likelihood of high performance warranting the personal award. Conversely, a Marine who has at least one entry in their service record of disciplinary action, possibly denoting sub-standard performance, show a 87.1 percent higher chance of retention when compared to those with no disciplinary action. The two categorical variables with respect to deployment experience exhibit a similar trend: the more days a Marine has deployed increase the likelihood of retention by 94.8 to 99 percent for each individual category. The last categorical variable examined, cumulative PFT score, shows that when compared to Marines with first class scores (greater than 235), Marines with second class scores (200–234) have a 61 percent higher chance of retention, while those with a failing score (less than 120) have a 22.6 percent lower chance of retention.

The univariate logistic regression models show 11 independent numeric variables deemed significant at the alpha level of 0.1. As the amount of civilian education increases by one year, there is a 59.1 percent higher chance of retention. As the amount of dependents a Marine has increases by one individual, there is a 60.8 percent higher chance of retention. As the total years a Marine has credited toward retirement increases by one year, there is a 71.7 percent higher chance of retention. This statistic is likely due to the fact that most Marines in this study have between six and eight years credited toward retirement placing them in close proximity to the 10-year mark, or halfway toward retirement and all the benefits it entails. As a Marine's current age increases by 1 year, there is a 60.1 percent higher chance of retention. As the number of deployments,

whether combat or non-combat, increases by one, there is over a 98 percent higher chance of retention. As a Marine's cumulative average proficiency and conduct marks increase, for example, from 4.2 to 4.3, there is an approximately 62 percent higher chance of retention.

Table 17. Univariate Model Results from merged cohort: Milestone A.

Milestone A			
Independent Variable	Coefficient	p-Value	p-Value < 0.1
Cohort			
Cohort 1 (FY98 - FY12)	<i>Ref</i>	<i>Ref</i>	
Cohort 2 (FY99 - FY13)	0.18	0.135	
Cohort 3 (FY00 - FY14)	0.11	0.457	
Prior Service			
No	<i>Ref</i>	<i>Ref</i>	
Yes	1.01	0.045	*
First Unit Location			
West	<i>Ref</i>	<i>Ref</i>	
Midwest	0.12	0.474	
South	-0.02	0.902	
Northeast	0.09	0.596	
Pacific	-0.87	0.239	
Unknown	0.12	0.641	
OCONUS	-1.05	0.392	
Enlistment Bonus			
No	<i>Ref</i>	<i>Ref</i>	
Yes	0.30	0.580	
Civilian Education			
High School Grad	<i>Ref</i>	<i>Ref</i>	
Post-high school	0.73	<0.001	*
Present Grade			
E1-E3	<i>Ref</i>	<i>Ref</i>	
E4-E5	2.55	<0.001	*
E6-E9	5.43	<0.001	*
PMOS			
Combat Arms	<i>Ref</i>	<i>Ref</i>	
Combat Service Support	-0.15	0.191	
Aviation and Aviation Support	-0.32	0.098	*
Marital Status			
Single	<i>Ref</i>	<i>Ref</i>	

Milestone A			
Independent Variable	Coefficient	p-Value	p-Value < 0.1
Married	0.92	<0.001	*
Divorced	1.17	0.004	*
Race			
American Indian/Alaska Native	<i>Ref</i>	<i>Ref</i>	
Asian	0.28	0.733	
Black/African American	-0.16	0.838	
White	0.09	0.904	
Declined to Respond	0.31	0.686	
Sex			
Male	<i>Ref</i>	<i>Ref</i>	
Female	0.60	0.215	
Home State			
West	<i>Ref</i>	<i>Ref</i>	
Midwest	0.08	0.653	
South	-0.04	0.765	
Northeast	0.13	0.434	
Pacific	-0.67	0.389	
Unknown	-0.09	0.747	
OCONUS	-1.48	0.203	
AFQT Score			
<=25	<i>Ref</i>	<i>Ref</i>	
26-50	-0.22	0.072	*
51-75	-0.09	0.517	
76-100	2.33	0.024	*
Present Unit Location			
West	<i>Ref</i>	<i>Ref</i>	
Midwest	0.71	<0.001	*
South	-0.02	0.920	
Northeast	0.15	0.436	
Pacific	-1.46	0.195	
Unknown	-0.77	0.222	
OCONUS	-13.64	0.971	
Personal Award			
No	<i>Ref</i>	<i>Ref</i>	
Yes	2.76	<0.001	*
Disciplinary Action			
No	<i>Ref</i>	<i>Ref</i>	
Yes	1.91	0.002	*
Days Combat Deployed			
Less than or equal to 90 days	<i>Ref</i>	<i>Ref</i>	

Milestone A			
Independent Variable	Coefficient	p-Value	p-Value < 0.1
91-180 days	17.58	0.961	
181-270 days	4.38	<0.001	*
271-360 days	17.58	0.984	
451-540 days	17.58	0.996	
Days Noncombat Deployed			
Less than or equal to 90 days	<i>Ref</i>	<i>Ref</i>	
91-180 days	2.92	<0.001	*
181-270 days	4.49	<0.001	*
271-360 days	4.83	<0.001	*
361-450 days	4.69	<0.001	*
451-540 days	16.71	0.976	
Greater than 540 days	16.71	0.970	
Cumulative Average PFT Score			
First Class (≥ 235)	<i>Ref</i>	<i>Ref</i>	
Second Class (200-234)	0.45	0.002	*
Third Class (120-199)	-0.02	0.882	
Failure (< 120)	-1.23	<0.001	*
Numeric Variables			
Civilian Education	0.37	<0.001	*
Number of Dependents	0.44	<0.001	*
Retirement Years	0.93	<0.001	*
Age	0.41	<0.001	*
AFQT Score	0.00	0.599	
Number of Combat Deployments	5.17	<0.001	*
Days Combat Deployed	0.03	<0.001	*
Number of Noncombat Deployments	4.16	<0.001	*
Days Noncombat Deployed	0.02	<0.001	*
Cumulative Average PFT Score	0.01	<0.001	*
Cumulative Average Proficiency Marks	0.49	<0.001	*
Cumulative Average Conduct Marks	0.46	<0.001	*

2. Milestone B

From Table 18, the univariate logistic regression models show 15 independent categorical variables deemed significant at the alpha level of 0.1. Models from this response variable show the first instance in which there is a significant difference in retention between cohorts. Marines from Cohort 3, when compared to those from Cohort 1, show a 64.6 percent higher chance of retention. Prior service Marines have an even

higher percent chance of retention at Milestone B when compared to those without prior service than at Milestone A, with an 84 percent higher percent chance in this case. The same trend applies when comparing education levels of Marines, with those having any form of post-high school education showing a 74.3 percent higher chance of retention. Retention likelihood when comparing E-4 through E-9 to E-1 through E-3 is similar when compared to the trend present at Milestone A. Aviation and Aviation Support Marines have a 39.7 percent lower chance of retention when compared to those in the Combat Arms communities. Female Marines continue to show better retention than their male counterparts, with a similar likelihood at Milestone A. Marines with at least one personal award again have a much higher likelihood of retention than those without, increasing to 98.8 percent at Milestone B. The likelihood of retention for Marines with disciplinary action on their records decreases from Milestone A, but only slightly coming down to 82.8 percent at Milestone B when compared to those without. Trends for number of days combat and non-combat deployed are nearly identical at when compared to those from Milestone A. A Marine's PFT score again has a significant effect on retention, with those achieving a second-class score showing a 57.7 percent higher chance of retention than those with a first-class score. The major difference from Milestone A with respect to PFT score is that, when compared to Marines with a first-class score, those with a third-class score or failing score show a 41.3 and 10.4 percent less likely chance of retention, respectively.

The univariate logistic regression models show 12 independent numeric variables deemed significant at the alpha level of 0.1. The major differences when comparing the effects of these variables on retention to those at Milestone A are found in number of dependents and age. As the number of dependents increases by one, there is now a 66.4 percent higher chance of retention at Milestone B, more than 6 percent higher than at Milestone A. As age increases by one year, there is now a 64.8 percent higher chance of retention at Milestone B, approximately five percent higher than at Milestone A.

Table 18. Univariate Model Results from merged cohort: Milestone B.

Milestone B			
Independent Variable	Coefficient	p-Value	p-Value < 0.1
Cohort			
Cohort 1 (FY98 - FY12)	<i>Ref</i>	<i>Ref</i>	
Cohort 2 (FY99 - FY13)	0.04	0.795	
Cohort 3 (FY00 - FY14)	0.60	<0.001	*
Prior Service			
No	<i>Ref</i>	<i>Ref</i>	
Yes	1.66	<0.001	*
First Unit Location			
West	<i>Ref</i>	<i>Ref</i>	
Midwest	0.35	0.074	*
South	0.04	0.824	
Northeast	0.00	0.986	
Pacific	0.11	0.893	
Unknown	-0.28	0.392	
OCONUS	-12.36	0.968	
Enlistment Bonus			
No	<i>Ref</i>	<i>Ref</i>	
Yes	0.75	0.157	
Civilian Education			
High School Grad	<i>Ref</i>	<i>Ref</i>	
Post-high school	1.06	<0.001	*
Present Grade			
E1-E3	<i>Ref</i>	<i>Ref</i>	
E4-E5	2.67	<0.001	*
E6-E9	6.96	<0.001	*
PMOS			
Combat Arms	<i>Ref</i>	<i>Ref</i>	
Combat Service Support	-0.18	0.156	
Aviation and Aviation Support	-0.42	0.084	*
Marital Status			
Single	<i>Ref</i>	<i>Ref</i>	
Married	1.79	<0.001	*
Divorced	2.14	<0.001	*
Race			
American Indian/Alaska Native	<i>Ref</i>	<i>Ref</i>	
Asian	-1.79	0.037	*
Black/African American	-1.71	0.030	*
Native Hawaiian/Pacific Islander	13.28	0.972	

Milestone B			
Independent Variable	Coefficient	p-Value	p-Value < 0.1
White	-1.36	0.076	*
Declined to Respond	-1.66	0.034	*
Sex			
Male	<i>Ref</i>	<i>Ref</i>	
Female	0.46	0.322	
Home State			
West	<i>Ref</i>	<i>Ref</i>	
Midwest	0.48	0.014	*
South	0.25	0.151	
Northeast	0.17	0.389	
Pacific	0.87	0.243	
Unknown	0.43	0.178	
OCONUS	-13.19	0.976	
AFQT Score			
<=25	<i>Ref</i>	<i>Ref</i>	
26-50	-0.02	0.873	
51-75	-0.22	0.199	
76-100	2.33	<0.001	*
Present Unit Location			
West	<i>Ref</i>	<i>Ref</i>	
Midwest	0.11	0.566	
South	0.23	0.265	
Northeast	-0.10	0.706	
Pacific	0.14	0.906	
Unknown	-14.33	0.973	
OCONUS	-14.33	0.989	
Personal Award			
No	<i>Ref</i>	<i>Ref</i>	
Yes	4.42	<0.001	*
Disciplinary Action			
No	<i>Ref</i>	<i>Ref</i>	
Yes	1.57	<0.001	*
Days Combat Deployed			
Less than or equal to 90 days	<i>Ref</i>	<i>Ref</i>	
91-180 days	3.52	<0.001	*
181-270 days	4.57	<0.001	*
271-360 days	5.29	<0.001	*
451-540 days	-11.27	0.983	
Days Noncombat Deployed			
Less than or equal to 90 days	<i>Ref</i>	<i>Ref</i>	

Milestone B			
Independent Variable	Coefficient	p-Value	p-Value < 0.1
91-180 days	3.34	<0.001	*
181-270 days	3.48	<0.001	*
271-360 days	4.43	<0.001	*
361-450 days	5.43	<0.001	*
451-540 days	4.89	<0.001	*
Greater than 540 days	4.51	<0.001	*
Cumulative Average PFT Score			
First Class (≥ 235)	<i>Ref</i>	<i>Ref</i>	
Second Class (200-234)	0.31	0.038	*
Third Class (120-199)	-0.35	0.030	*
Failure (< 120)	-2.15	<0.001	*
Numeric Variables			
Civilian Education	0.43	<0.001	*
Number of Dependents	0.68	<0.001	*
Retirement Years	1.00	<0.001	*
Age	0.61	<0.001	*
AFQT Score	-0.01	0.021	*
Number of Combat Deployments	4.22	<0.001	*
Days Combat Deployed	0.02	<0.001	*
Number of Noncombat Deployments	4.16	<0.001	*
Days Noncombat Deployed	0.01	<0.001	*
Cumulative Average PFT Score	0.01	<0.001	*
Cumulative Average Proficiency Marks	0.45	<0.001	*
Cumulative Average Conduct Marks	0.47	<0.001	*

3. Milestone C

From Table 19, the univariate logistic regression models show 14 independent categorical variables deemed significant at the alpha level of 0.1. Marines from Cohort 3 again show the highest likelihood of retention, with a 65.7 percent higher chance when compared to Cohort 1. Marines with prior service continue to show higher likelihood of retention with compared to those Marine without, with a 87.4 percent higher likelihood of retention at Milestone C. Marine with post-high school education show a similar likelihood of retention when compared to those with only high school education, increasing slightly to 75.6 percent from the likelihood at Milestone B. As expected, those Marines whose current rank falls between E-6 and E-9 show the highest likelihood of

retention at 99.8 percent when compared to those in the E–1 through E–3 range. This spike when compared to Milestone B is due to service limits by grade established by the Marine Corps Reserve taking effect on those who fail to promote or who have been demoted to E–3 and below. Married Marines continue to have a higher likelihood of retention, this time showing a 89.2 percent higher chance of retention than those who are single. Retention with respect to the remainder of categorical variables exhibits similar trends when compared to Milestone B.

The univariate logistic regression models show 12 independent numeric variables deemed significant at the alpha level of 0.1. The only numeric variable exhibiting a different trend in retention likelihood when compared to Milestone B is total credited years toward retirement. For Milestone C, as the number of retirement years increases by one, there is now only a 67 percent higher chance of retention which is down almost ten percent from Milestone B. This is potentially due to the majority of Marines retained at Milestone C having a mean number of retirement years of 15.26. This decrease in retention likelihood is due to a Marine likely not choosing to leave service given their close proximity to the 20–year retirement mark.

Table 19. Univariate Model Results from merged cohort: Milestone C.

Milestone C			
Independent Variable	Coefficient	p-Value	p-Value < 0.1
Cohort			
Cohort 1 (FY98 - FY12)	<i>Ref</i>	<i>Ref</i>	
Cohort 2 (FY99 - FY13)	-0.06	0.745	
Cohort 3 (FY00 - FY14)	0.65	0.001	*
Prior Service			
No	<i>Ref</i>	<i>Ref</i>	
Yes	1.94	<0.001	*
First Unit Location			
West	<i>Ref</i>	<i>Ref</i>	
Midwest	0.44	0.065	*
South	0.13	0.537	
Northeast	-0.01	0.952	
Pacific	0.83	0.318	
Unknown	-0.08	0.846	

Milestone C			
Independent Variable	Coefficient	p-Value	p-Value < 0.1
OCONUS	-12.63	0.980	
Enlistment Bonus			
No	<i>Ref</i>	<i>Ref</i>	
Yes	-0.07	0.927	
Civilian Education			
High School Grad	<i>Ref</i>	<i>Ref</i>	
Post-high school	1.13	<0.001	*
Present Grade			
E1-E3	<i>Ref</i>	<i>Ref</i>	
E4-E5	2.23	0.030	*
E6-E9	6.41	<0.001	*
PMOS			
Combat Arms	<i>Ref</i>	<i>Ref</i>	
Combat Service Support	0.10	0.530	
Aviation and Aviation Support	-0.33	0.294	
Marital Status			
Single	<i>Ref</i>	<i>Ref</i>	
Married	2.11	<0.001	*
Divorced	2.46	<0.001	*
Race			
American Indian/Alaska Native	<i>Ref</i>	<i>Ref</i>	
Asian	-1.89	0.016	*
Black/African American	-2.39	0.001	*
Native Hawaiian/Pacific Islander	14.34	0.978	
White	-1.98	0.003	*
Declined to Respond	-2.35	0.001	*
Sex			
Male	<i>Ref</i>	<i>Ref</i>	
Female	0.65	0.209	
Home State			
West	<i>Ref</i>	<i>Ref</i>	
Midwest	0.48	0.040	*
South	0.21	0.332	
Northeast	0.09	0.709	
Pacific	1.77	0.011	*
Unknown	-0.37	0.455	
OCONUS	-12.58	0.977	
AFQT Score			
<=25	<i>Ref</i>	<i>Ref</i>	
26-50	0.11	0.536	

Milestone C			
Independent Variable	Coefficient	p-Value	p-Value < 0.1
51-75	-0.36	0.118	
76-100	1.73	<0.001	*
Present Unit Location			
West	<i>Ref</i>	<i>Ref</i>	
Midwest	-0.69	0.012	*
South	1.24	<0.001	*
Northeast	0.27	0.393	
Pacific	-13.54	0.987	
Unknown	-13.54	0.974	
OCONUS	-13.54	0.990	
Personal Award			
No	<i>Ref</i>	<i>Ref</i>	
Yes	18.23	0.971	
Disciplinary Action			
No	<i>Ref</i>	<i>Ref</i>	
Yes	1.05	0.007	*
Days Combat Deployed			
Less than or equal to 90 days	<i>Ref</i>	<i>Ref</i>	
91-180 days	3.06	<0.001	*
181-270 days	3.65	<0.001	*
271-360 days	3.51	<0.001	*
451-540 days	-10.46	0.984	
Days Noncombat Deployed			
Less than or equal to 90 days	<i>Ref</i>	<i>Ref</i>	
91-180 days	3.61	<0.001	*
181-270 days	3.45	<0.001	*
271-360 days	4.01	<0.001	*
361-450 days	4.00	<0.001	*
451-540 days	4.99	<0.001	*
Greater than 540 days	4.18	<0.001	*
Cumulative Average PFT Score			
First Class (≥ 235)	<i>Ref</i>	<i>Ref</i>	
Second Class (200-234)	0.41	0.023	*
Third Class (120-199)	-0.37	0.067	*
Failure (< 120)	-2.73	<0.001	*
Numeric Variables			
Civilian Education	0.44	<0.001	*
Number of Dependents	0.73	<0.001	*
Retirement Years	0.71	<0.001	*
Age	0.59	<0.001	*

Milestone C			
Independent Variable	Coefficient	p-Value	p-Value < 0.1
AFQT Score	-0.01	0.062	*
Number of Combat Deployments	3.70	<0.001	*
Days Combat Deployed	0.02	<0.001	*
Number of Noncombat Deployments	4.07	<0.001	*
Days Noncombat Deployed	0.01	<0.001	*
Cumulative Average PFT Score	0.01	<0.001	*
Cumulative Average Proficiency Marks	0.45	<0.001	*
Cumulative Average Conduct Marks	0.46	<0.001	*

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IV. RESULTS AND ANALYSIS

A. INTRODUCTION

Predictor variables previously identified as being related to the response variables through univariate analysis form the basis of the logistic regression models created for Milestones A, B, and C. This chapter includes model descriptions, model comparison, model evaluation, and analysis and additional considerations.

B. DESCRIPTION

Following the selection of previously identified predictor variables, the logistic regression models for each milestone are fit and variables selected using purposeful selection in R programming software (R Core Team 2016). Predictor variables identified as confounding are not eliminated. Tables 20–22 include predictor variable coefficient estimates, the 95 percent confidence interval for the estimates, and the Wald test p-values of the null hypothesis that the corresponding coefficients are zero. Conclusions for each milestone are derived from the coefficients listed in the form of log odds in Tables 20–22, presented in the form of percent likelihood of retention.

1. Milestone A

Table 20 displays the summary of the model fit for Milestone A. Categorical predictor variables significant retained with p-values less than 0.05 following purposeful selection include, cohort, present unit location, and personal award. Numeric variables include age, total retirement years, and number of combat deployments. Present grade, significant at the $\alpha = 0.1$ level, is included due to confounding with the present unit location variable. Holding all other variables constant, there are multiple significant trends exhibited by the model. When compared to Cohort 1, Cohort 3 shows a 26.1 percent less likelihood chance of retention. Marines serving at an SMCR unit in the mid-western region of the United States show a 69.8 percent greater likelihood of retention than those in the western region. Those with at least one personal award show a 75.9 percent greater likelihood of retention than those who do not. As total retirement years

and age increase by an increment of one year, there is a 63.4 and 57.7 greater likelihood of retention, respectively. The number of combat deployments variable shows the greatest impact on the response; as it increases by an increment of one deployment there is a 96.8 percent greater likelihood of retention.

Table 20. Coefficient estimates and p-values, Milestone A model.

Milestone A Model		
Independent Variable	Coefficient (95% C.I.)	p-Value
Cohort		
Cohort 1 (FY98 - FY12)	<i>Ref</i>	<i>Ref</i>
Cohort 2 (FY99 - FY13)	0.28 (-0.10, 0.66)	0.152
Cohort 3 (FY00 - FY14)	-1.04 (-1.58, -0.51)	<0.001*
Present Grade		
E1-E3	<i>Ref</i>	<i>Ref</i>
E4-E5	0.13 (-0.39, 0.64)	0.629
E6-E9	1.96 (0.23, 4.90)	0.069
Present Unit Location		
West	<i>Ref</i>	<i>Ref</i>
Midwest	0.84 (0.29, 1.42)	0.003*
South	0.07 (-0.58, 0.74)	0.831
Northeast	-0.22 (-0.98, 0.54)	0.568
Pacific, OCONUS, Unknown	-0.34 (-2.13, 1.31)	0.687
Personal Award		
No	<i>Ref</i>	<i>Ref</i>
Yes	1.15 (0.74, 1.56)	<0.001*
Total Retirement Years		
Numeric	0.55 (0.43, 0.69)	<0.001*
Age		
Numeric	0.31 (0.22, 0.40)	<0.001*
Number of Combat Deployments		
Numeric	3.40, (2.18, 5.24)	<0.001*

* p-value < 0.05

2. Milestone B

Table 21 displays the summary of the model for Milestone B. Categorical predictor variables retained with p-values less than 0.05 following purposeful selection include prior service, PMOS, race, AFQT score, present unit location, and days noncombat deployed. Numeric variables include age and number of retirement years. Present grade, significant at the $\alpha = 0.1$ level, is included due to confounding with the race variable. Holding all other variables constant, there are multiple significant trends exhibited by the model. When compared to Marines without prior AC service, prior service Marines show a 95.9 percent greater likelihood of retention. Combat arms Marines exhibit the best retention, with those falling into the combat service support category for the PMOS variable showing a 26.9 percent less likelihood of retention. Marines who identify as Asian show a 11.7 percent less likelihood of retention when compared to those in the “other” category that includes American Indians, Alaskan Natives, Pacific Islanders, and those who choose not to declare their race. High performers in the AFQT with a score of 76 or greater show a 97.8 percent greater likelihood of retention when compared to those scoring in the lowest echelon. Present unit location has a similar effect as in Milestone A. Deployment experience is highly significant at this milestone, with those Marines having 271 days or more showing at least a 85.3 percent higher likelihood of retention than those with less than 90 days. The variables total retirement years and age exhibit similar trends as in Milestone A.

Table 21. Coefficient estimates and p-values, Milestone B model.

Milestone B Model		
Independent Variable	Coefficient (95% C.I.)	p-Value
Prior Service		
No	<i>Ref</i>	<i>Ref</i>
Yes	3.15 (1.37, 5.27)	0.001*
PMOS		
Combat Arms	<i>Ref</i>	<i>Ref</i>
Combat Service Support	-1.00 (-1.71, -0.34)	0.004*
Aviation and Aviation Support	-1.05 (-2.32, 0.14)	0.092
Present Grade		
E1-E3	<i>Ref</i>	<i>Ref</i>

Milestone B Model		
Independent Variable	Coefficient (95% C.I.)	p-Value
E4-E5	1.22 (-1.14, 4.37)	0.413
E6-E9	2.97 (0.48, 6.15)	0.052
Race		
Other	<i>Ref</i>	<i>Ref</i>
Asian	-2.02 (-3.74, -0.27)	0.021*
Black/African American	-0.93 (-2.29, 0.38)	0.171
White	-0.64 (-1.55, 0.28)	0.168
AFQT Score		
<=25	<i>Ref</i>	<i>Ref</i>
26-50	0.18 (-0.54, 0.91)	0.622
51-75	-0.18 (-0.99, 0.62)	0.664
76-100	3.82 (2.34, 5.39)	<0.001*
Present Unit Location		
West	<i>Ref</i>	<i>Ref</i>
Midwest	1.08 (0.02, 2.16)	0.048*
South	1.11 (-0.14, 2.37)	0.083
Northeast	0.55 (-0.78, 1.89)	0.416
Pacific, OCONUS, Unknown	0.27 (-3.05, 3.86)	0.882
Days Noncombat Deployed		
< 90 Days	<i>Ref</i>	<i>Ref</i>
91-180 Days	0.57 (-0.52, 1.66)	0.304
181-270 Days	0.83 (-0.09, 1.75)	0.074
271-360 Days	1.76 (0.87, 2.67)	<0.001*
> 360 Days	2.51 (1.54, 3.54)	<0.001*
Total Retirement Years		
Numeric	0.56 (0.40, 0.72)	<0.001*
Age		
Numeric	0.34 (0.23, 0.45)	<0.001*

* p-value < 0.05

3. Milestone C

Table 22 displays the summary of the model for Milestone C. Categorical predictor variables retained with p-values less than 0.05 following purposeful selection include prior service, first unit location, home state, present unit location, and AFQT score. Numeric variables include age and number of retirement years. Days noncombat deployed, significant at the alpha = 0.1 level, is included due to confounding with the

AFQT score variable. Holding all other variables constant, there are multiple significant trends exhibited by the model. Marines with prior AC service show an increased likelihood in retention when compared to Milestone B, this time with a 98.4 percent greater likelihood of retention when compared to those Marines without. Location-based predictor variables are highly influential for this Milestone C model. First unit location shows high significance, with those Marines first serving in the southern and northeast regions having at least a 79 percent greater likelihood of retention when compared to those first serving in the western region. Marines with home states in the southern and northeast regions show a 17.7 and 13.3 percent less likelihood of retention when compared to those from the western region. The last location-based variable, present unit location, shows Marines stationed in the southern region having a 86.9 percent greater likelihood of retention when compared to those stationed in the western region. The variables total retirement years and age exhibit similar trends as in Milestones A and B.

Table 22. Coefficient estimates and p-values, Milestone C model.

Milestone C Model		
Independent Variable	Coefficient (95% C.I.)	p-Value
Prior Service		
No	<i>Ref</i>	<i>Ref</i>
Yes	4.13 (2.29, 6.04)	<0.001*
First Unit Location		
West	<i>Ref</i>	<i>Ref</i>
Midwest	0.28 (-0.98, 1.52)	0.664
South	1.37 (-0.21, 2.55)	0.022*
Northeast	1.65 (-0.20, 3.16)	0.029*
Pacific, OCONUS, Unknown	1.58 (0.01, 3.17)	0.051
Home State		
West	<i>Ref</i>	<i>Ref</i>
Midwest	0.38 (-0.98, 1.79)	0.591
South	-1.54 (-2.97, -0.15)	0.032*
Northeast	-1.87 (-3.65, -0.18)	0.034*
Pacific, OCONUS, Unknown	-0.57 (-2.49, 1.18)	0.530
Present Unit Location		
West	<i>Ref</i>	<i>Ref</i>
Midwest	-0.52 (-1.90, 0.82)	0.454
South	1.89 (0.36, 3.46)	0.016*

Milestone C Model		
Independent Variable	Coefficient (95% C.I.)	p-Value
Northeast	1.35 (-0.58, 3.33)	0.173
Pacific, OCONUS, Unknown	-11.24 (-31.33, 29.50)	0.990
AFQT Score		
<=25	<i>Ref</i>	<i>Ref</i>
26-50	-0.33 (-1.15, 0.48)	0.427
51-75	-0.88 (-2.01, 0.19)	0.116
76-100	2.21 (0.79, 3.67)	0.002*
Days Noncombat Deployed		
< 90 Days	<i>Ref</i>	<i>Ref</i>
91-180 Days	0.45 (-0.71, 1.61)	0.442
181-270 Days	-0.71 (-1.98, 0.51)	0.263
271-360 Days	0.62 (-0.52, 1.74)	0.279
> 360 Days	1.10 (-0.01, 2.22)	0.055
Total Retirement Years		
Numeric	0.51 (0.38, 0.66)	<0.001*
Age		
Numeric	0.34 (0.23, 0.47)	<0.001*

* p-value < 0.05

C. MODEL DIAGNOSTICS

Plotting the residuals and Cook's distances for each logistic regression model aids in identification of influential observations that could potentially affect the coefficient estimates of various predictor variables. In the event the Cook's Distance value for a single observation exceeds 0.10, it is classified as potentially influential and is removed from the training data set (Faraway 2016). In order to assess the effect of the outlier(s), the model is re-evaluated with the new training data set to identify any predictor variable coefficient estimates that increase or decrease by more than 20 percent. Each model is also subjected to the Hosmer-Lemeshow test of the null hypothesis that retention rates predicted by the models match observed retention rates. Lastly, we check to ensure that no important predictors were overlooked in the initial screening with a large-sample Chi-squared likelihood ratio test of the final model against the alternative additive logistic regression model with all predictors.

1. Milestone A

Although some standardized Pearson residuals in Figure 25 are quite large, with magnitudes exceeding five, none appear to be unduly influential. Figure 26 shows that while there are five observations with relatively high Cook's distances, none exceed 0.10 (Faraway 2016). The Hosmer–Lemeshow goodness of fit test returned a p-value of 0.890 and does not provide sufficient evidence to reject the null hypothesis at the $\alpha = 0.05$ level. The likelihood ratio test of the model against the alternative with all predictor variables returned a p-value of 0.282, which also does not provide sufficient evidence to reject the null hypothesis at the $\alpha = 0.05$ level.

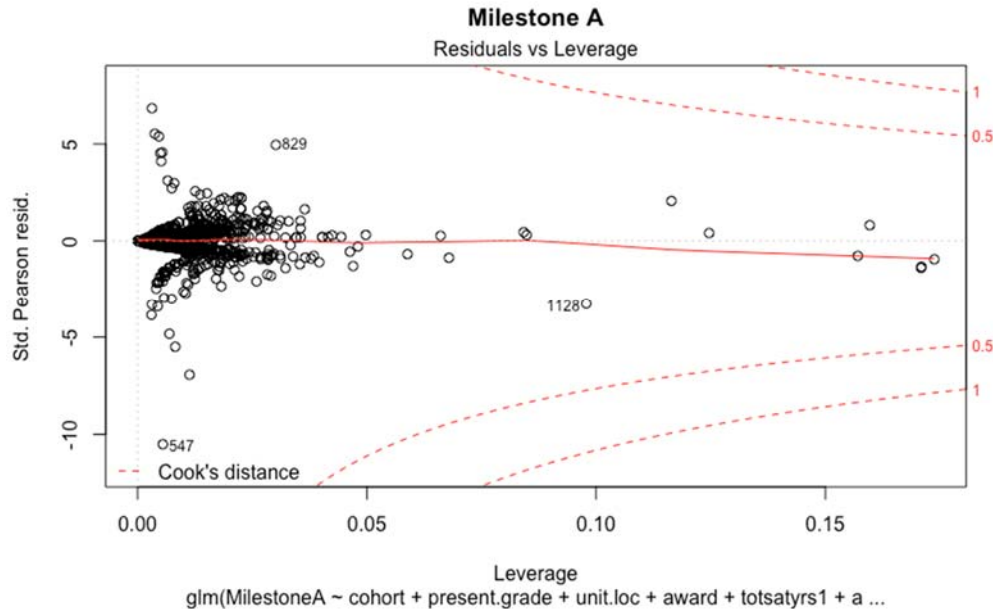


Figure 25. Pearson standardized residuals, leverage and Cook's distances, Milestone A model.

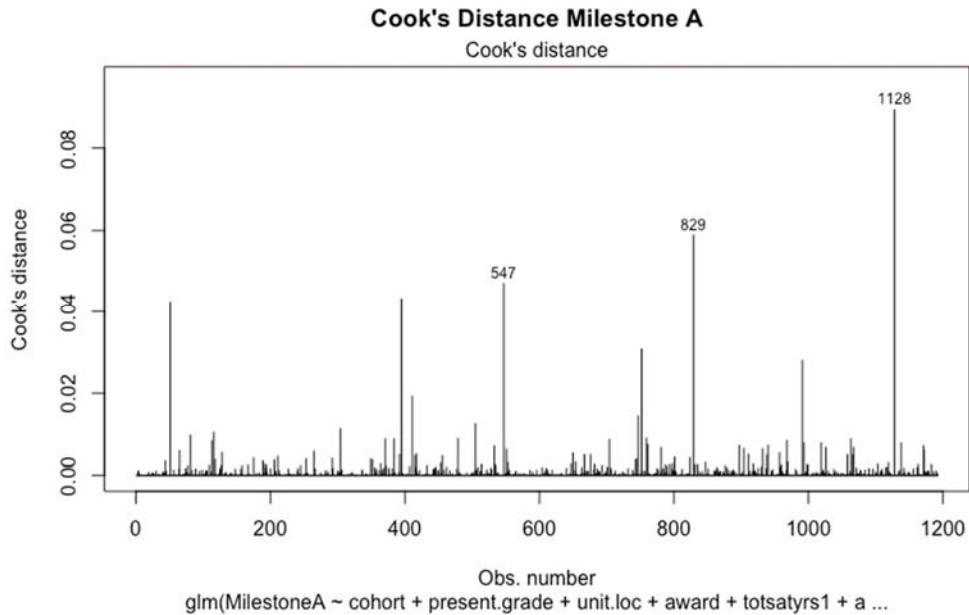


Figure 26. Cook's Distance values per observation, Milestone A model.

2. Milestone B

Some standardized Pearson residuals in Figure 27 are quite large, with magnitudes exceeding five, and there appear to be some outliers exerting a concerning amount of influence. Figure 28 confirms that two observations have Cook's distances larger than 0.10 (Faraway 2016). Upon removal of the observations and re-evaluation of the model, there is not any appreciable change in predictor variable coefficient estimates. The Hosmer–Lemeshow goodness of fit test returned a p-value of 0.802 and does not provide sufficient evidence to reject the null hypothesis at the $\alpha = 0.05$ level. The likelihood ratio test of the model against the alternative with all predictor variables returned a p-value of 0.631, which also does not provide sufficient evidence to reject the null hypothesis at the $\alpha = 0.05$ level.

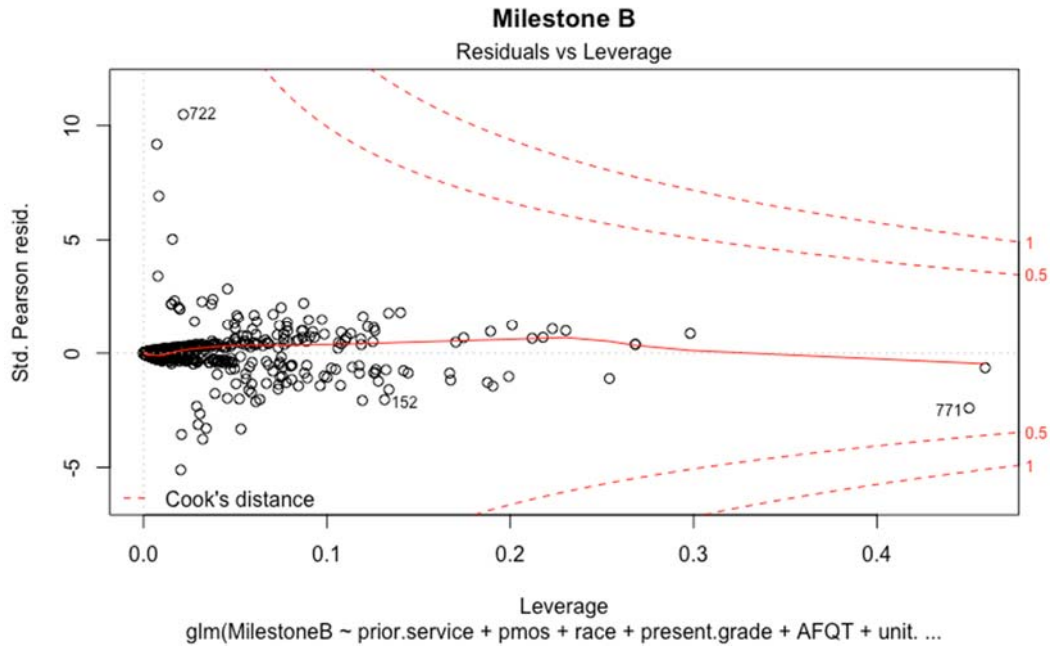


Figure 27. Pearson standardized residuals, leverage and Cook's distances, Milestone B model.

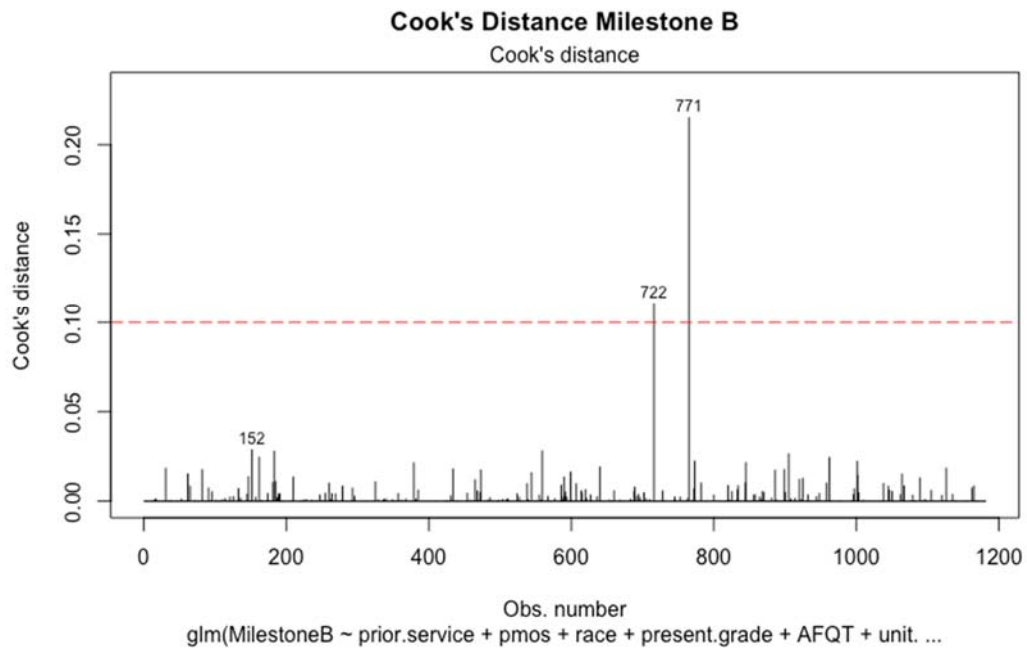


Figure 28. Cook's Distance values per observation, Milestone B model.

3. Milestone C

Some standardized Pearson residuals in Figure 29 are quite large, with magnitudes exceeding five, and there appears to be at least one outlier exerting a concerning amount of influence. Figure 30 confirms that this observation has a Cook's distance larger than 0.10 (Faraway 2016). Upon removal of the observation and re-evaluation of the model, there is not any appreciable change in predictor variable coefficient estimates. The Hosmer–Lemeshow goodness of fit test returned a p-value of 0.826 and does not provide sufficient evidence to reject the null hypothesis at the $\alpha = 0.05$ level. The likelihood ratio test of the model against the alternative with all predictor variables returned a p-value of 0.143, which also does not provide sufficient evidence to reject the null hypothesis at the $\alpha = 0.05$ level.

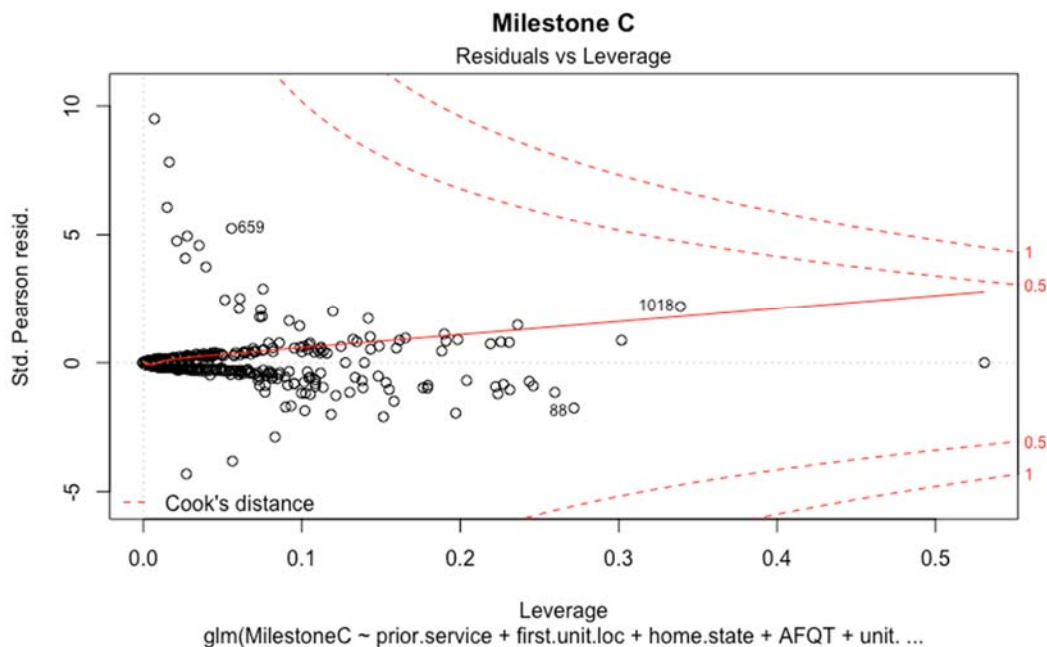


Figure 29. Pearson standardized residuals, leverage and Cook's distances, Milestone C model.

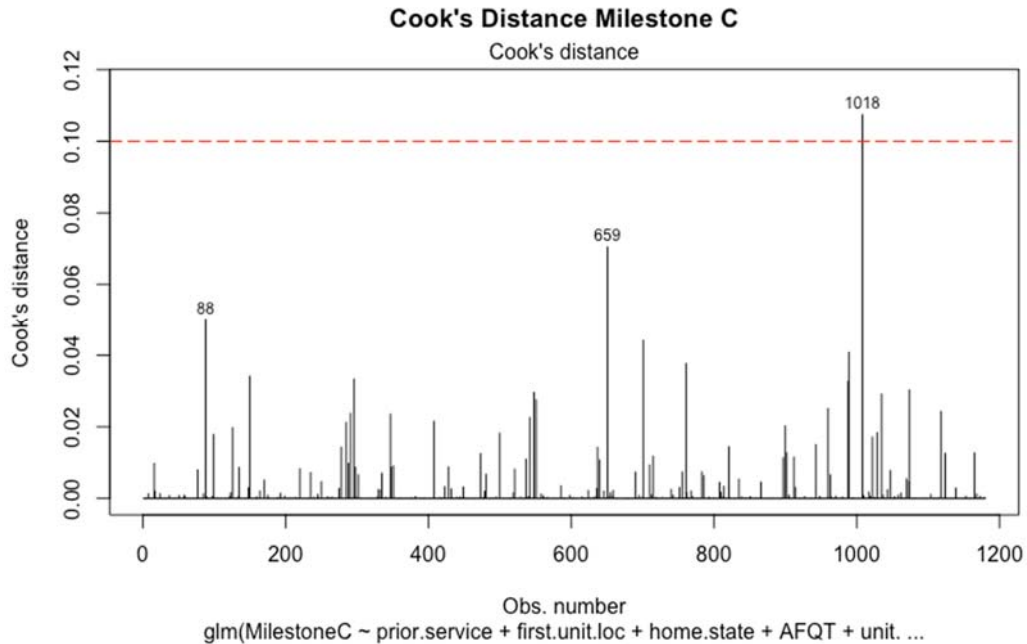


Figure 30. Cook's Distance values per observation, Milestone C model.

D. COMPARISON

The logistic regression models are compared against random forest models with respect to the following: ROC curves, commonality of variables identified as important by the random forest model, and percent correct classification of outcomes with respect to retention. For random forests, the importance of each individual variable is measured with respect to the overall increase in misclassification rate upon removal of said variable from the classification tree (Breiman 2001). To get unbiased estimates of classification rates, the independent test sets are used for all computations.

1. Milestone A

Figure 31 shows very favorable curves in terms of sensitivity and specificity for the logistic regression model and random forest for Milestone A. Correct classification rates with respect to the test set are 83.2 percent for the logistic regression model and 90.6 percent for the random forest model. Although the correct classification rate of the logistic regression model is favorable, Milestone A presents the only situation that the classification tree performs considerably better. This suggests a need to explore variable

interactions and transformations of numeric variables in the logistic regression model. However, following the incorporation of meaningful interaction terms and various methods of numeric variable transformation, the logistic regression model still performed less effectively than the classification tree. In conclusion, the logistic regression model fails to account for some measure of variability in the response variable for Milestone A.

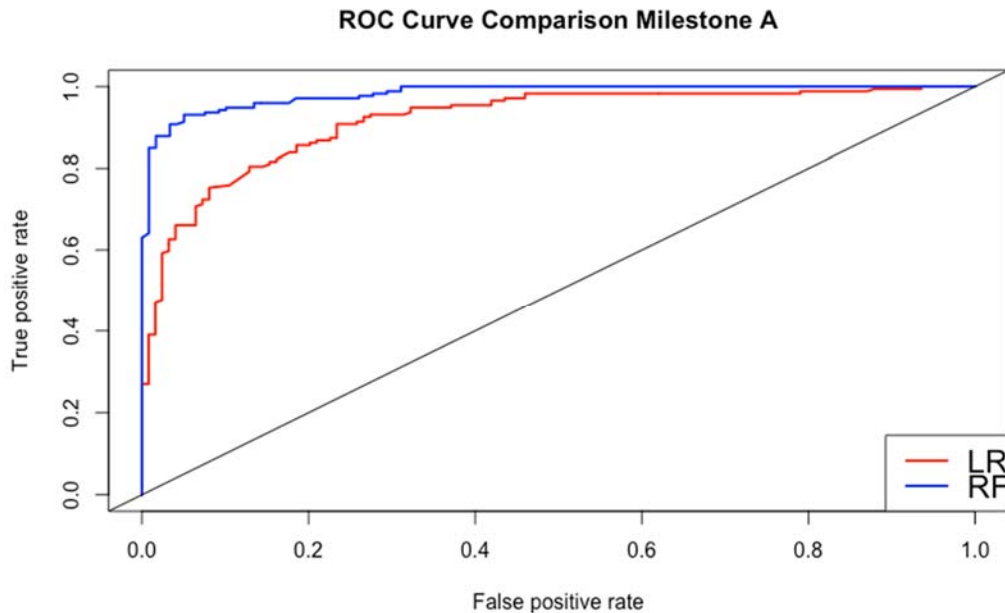


Figure 31. ROC curve comparison between logistic regression (LR) and random forest (RF) models, Milestone A.

Figure 32 shows that the top 50 percent of variables identified as important by the random forest include total retirement years, age, each of the combat and noncombat deployment-related variables, present unit location, number of dependents, and cumulative PFT average. Of the variables included in the logistic regression model for Milestone A, four were identified as having high importance comprising 66.7 percent of variables in the model.

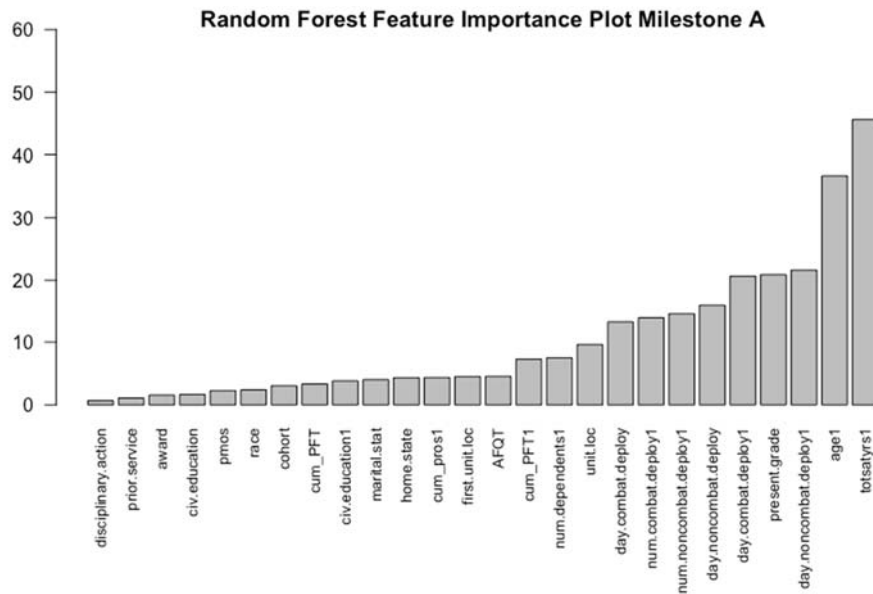


Figure 32. Importance values by predictor variable, Milestone A.

2. Milestone B

Figure 33 shows a near-perfect curve for the random forest in terms of sensitivity and specificity, with the curve for the logistic regression model showing at minimum 80 percent specificity and 60 percent sensitivity. Correct classification rates with respect to the test set are 91.3 percent for the logistic regression model and 95.6 percent for the random forest model.

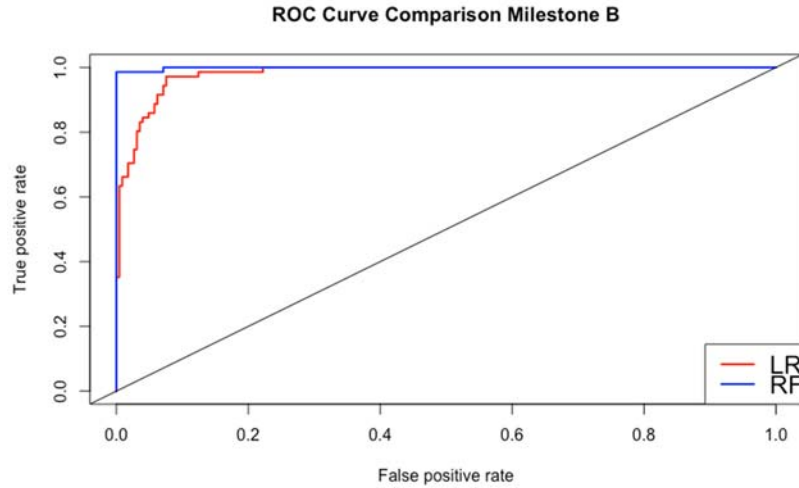


Figure 33. ROC curve comparison between logistic regression (LR) and random forest (RF) models, Milestone B.

Figure 34 shows that the top 50 percent of variables identified as important by the random forest include total retirement years, age, each of the combat and noncombat deployment-related variables, present grade, cumulative average PFT score, AFQT score, number of dependents, and civilian education. Of the variables included in the logistic regression model for Milestone B, five were identified as having high importance comprising 55.6 percent of variables in the model.

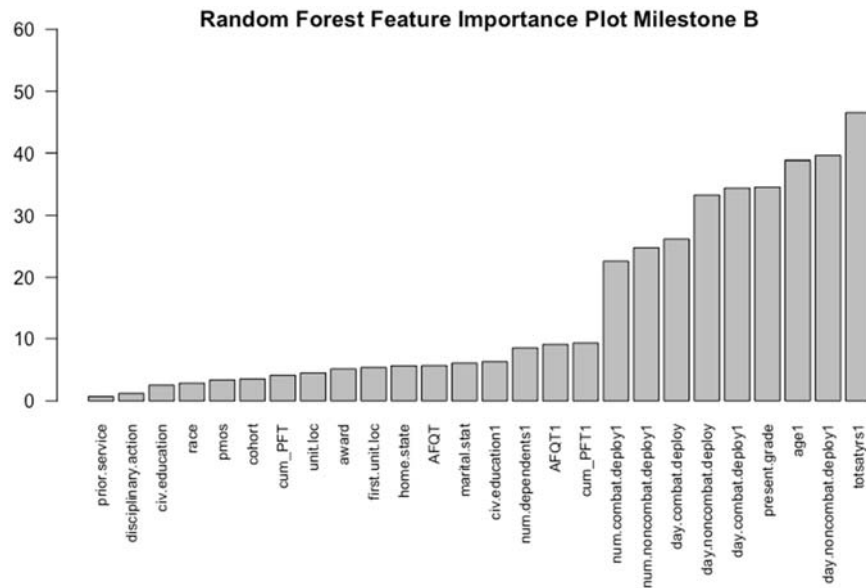


Figure 34. Importance values by predictor variable, Milestone B.

3. Milestone C

Figure 35 shows a near-perfect curve for the random forest in terms of sensitivity and specificity, with the curve for the logistic regression model showing at minimum 80 percent specificity and 75 percent sensitivity. Correct classification rates with respect to the test set are 96.6 percent for the logistic regression model and 96.9 percent for the random forest model.

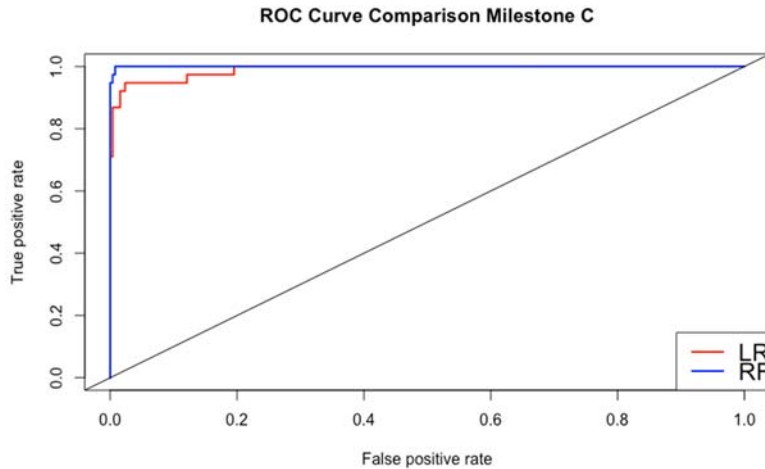


Figure 35. ROC curve comparison between logistic regression (LR) and random forest (RF) models, Milestone C.

Figure 36 shows that the top 50 percent of variables identified as important by the random forest include total retirement years, age, each of the combat and noncombat deployment-related variables, present grade, present unit location, number of dependents, cumulative average PFT score, and AFQT score. Of the variables included in the logistic regression model for Milestone B, five were identified as having high importance comprising 62.5 percent of variables in the model.

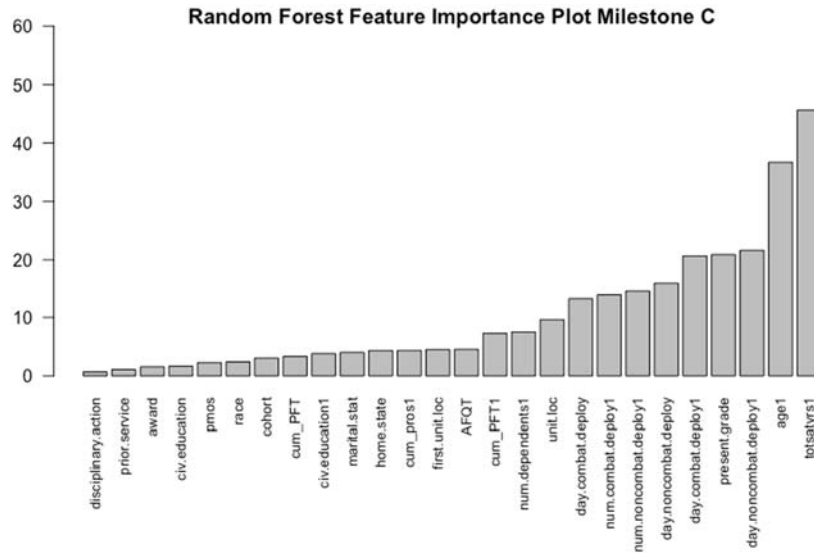


Figure 36. Importance values by predictor variable, Milestone C.

E. ANALYSIS AND ADDITIONAL CONSIDERATIONS

Each of the logistic regression models developed for Milestones A, B, and C show excellent performance in sensitivity, specificity, and predictive quality when compared to the corresponding random forest models. Corresponding ROC curves show very similar behavior, and the average difference in predictive quality is minimal at only four percent. Predictor variables with importance values in the upper 50 percent as identified by the random forest models make up on average 61.6 of the predictor variables included in the multivariate regression models. Considering performance and variable selection alone, results from the comparison between the logistic regression and random forest models are highly favorable.

Evaluation of the multivariate regression models with respect to leverage, Cook's Distance values, and goodness of fit also yields very positive results. Although several observations had large standardized residuals, none were unduly influential. Goodness of fit for each model was validated by the Hosmer Lemeshow Test at the $\alpha = 0.05$ level.

While performance of the logistic regression models is overall very favorable, there are limitations associated with the purposeful selection method used here, where elimination of predictor variables was based on hypothesis testing criteria. An alternate

approach would be to use a R programming software (R Core Team 2016) function that performs stepwise selection governed by minimizing the model's Akaike Information Criterion (AIC) value, which is another variable selection criteria taking into account a penalty term aimed at reducing collinearity or confounding among the predictor variables (Faraway 2015). While this method is statistically sound, when applied to the testing data sets for each milestone it introduced multiple insignificant variables at the $\alpha = 0.10$ level increasing the potential for over-fitting. Purposeful selection used by the author allowed for a systematic analysis of each variable and the effects generated upon its removal, which has the potential to be lost when simply subjecting a base model to an automated stepwise selection procedure.

V. CONCLUSIONS AND RECOMMENDATIONS

A. INTRODUCTION

This study developed logistic regression models aimed at predicting the likelihood of retention for Marines serving in SMCR units. The goal was to determine which variables had the most significant effect, whether positive or negative, on retention over a period of 15 years. Additional motivations for this study include identifying significant predictor variables unique to each established career milestone, the relationship between contractual reenlistment options and sustained continuation, and differences in retention between prior service and non-prior service Marines. The models developed and the information they provide allows planners at M&RA, HQMC the ability to forecast retention and make informed decisions concerning establishment of goals in recruiting and retention.

B. CONCLUSIONS

The logistic regression models developed for each milestone performed exceptionally well, achieving an average correct classification rate of 90.4 percent for the observations included in this study. Findings from the statistical testing regimen applied to each model suggest sufficient 1) overall fit of the data and 2) ability to explain variability of the response variable.

At Milestone A, or four years of service from a Marine's MDPSD, an increase in rank, total years credited toward retirement, number of combat deployments, and age show a positive effect on retention. Earning at least one personal award also shows a positive effect on retention, which suggests these Marines are high performers, likely displaying attributes allowing for continued service. Present unit location, depending on region, shows both a positive and negative effect on retention. In the event a Marine is serving at a SMCR unit in the Western, Midwestern, or Southern regions of the United States, retention is positively affected while serving in the Northeastern or Pacific region shows a negative effect.

The logistic regression model for Milestone B, or eight years of service from a Marine's MDPSD, has similarities when compared to the Milestone A model in that an increase in rank, total years credited toward retirement, days noncombat deployed, and age show a positive effect on retention. Prior service in the AC component shows a positive effect on retention, as does scoring in the highest echelon (76–100 points) on the AFQT. The Milestone B model also allows for a comparison of retention between PMOS categories, with combat service support and aviation and aviation support PMOS designation showing a negative effect on retention when compared to combat arms. Race also appears to be a factor, with a race designation of "Other" to include Hispanics, Pacific Islanders, and Native Americans showing a positive effect on retention when compared to designations of Asian, African American, and Caucasian.

The logistic regression model for Milestone C, or 12 years of service from a Marine's MDPSD, yields similar findings from the previous two models with respect to total years credited toward retirement and age. A major driving factor in reaching this milestone appears to be prior service in the AC, showing a highly positive effect on retention. For the first time, home state is significant in predicting retention, with HORs in the Southern, Northeastern, and Pacific regions showing a considerably negative effect on retention when compared to HORs in the Western and Midwestern regions.

Significant predictor variables common to each of the logistic regression models for the three milestones include total years credited toward retirement and age. These more senior individuals have likely made a career decision in continuing their military service, which explains the consistently positive effect. Marines with prior service in the AC, often correlating to an increase in age and total years credited toward retirement, exhibit significantly better retention than their counterparts for Milestones B and C. Deployment experience, whether combat or noncombat, shows consistently positive effect on retention across milestones. This suggests that Marines serving in SelRes units view deployment opportunities as favorable, and even upon completion of only single deployment, they are much more likely to continue their military service.

Though development of logistic regression models for each milestone yielded results that are both meaningful and applicable, there are limitations associated with this

study. One of the main goals concerning the relationship between contractual reenlistment options and sustained continuation was unattainable due to the majority of Marines reenlistment under the 6x2 option. This led to lack of observations from the other reenlistment contract options, making any kind of statistical analysis infeasible. This same scenario of underrepresentation also applies to female Marines included in the original data set.

C. RECOMMENDATIONS FOR FUTURE STUDIES

The major limitation associated with the study is lack of sufficient data, with respect to key demographics, to enable meaningful statistical analysis. These demographics include SelRes Marines who entered under the 3x5 and 4x4 enlistment contract options and female Marines. A viable solution is to conduct a study with similar methodology, but with respect to a larger sample that includes additional cohorts. If conditions again warrant merging the cohorts, there is potential for increased representation from these demographics.

The next logical step for follow-on studies is to take the findings presented here and incorporate them into an easy-to-use GUI that can be placed in the hands of future force level planners at M&RA, HQMC. Applying the equations obtained from the logistic regression models to a database of readily accessible variables associated with Marines currently serving in SMCR unit will provide a means to forecast retention for four, eight, and twelve years from each Marine's MDPSD.

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APPENDIX

Table 23. Data dictionary for categorical variables.

Variable	Description	Level	Level Description
prior.service	Binary variable indicating whether or not a Marine has prior AC service	0 1	No Yes
enlist.option	Contract upon which a Marine entered the active or reserve component	1 2 3 4	3x5 4x4 6x2 Unknown
first.unit.location home.state unit.loc	State in which the Marine's first unit they were assigned to is located Current home of record (HOR) State in which the Marine's current unit they are assigned to is located	1 2 3 4 5	West Midwest South Northeast Pacific, Unknown, OCONUS
enlist.bonus	Binary variable indicating whether or not a Marine received a reenlistment bonus	0 1	No Yes
civ.education	Level of civilian education Marine has currently attained	1 2	High School Post-High School
reenlist.rec	Reenlistment recommendation given by a Marine's command	1 2 3 4 5 6 7	Recommended (1A, 1B, 1C) Transfer (2A, 2B, 2C) Failure (3A, 3B, 3C, 3E, 3F, 3P) Extenuating Circumstances (3H, 3N, 3O) Separated (3S, 3V) Denied (4,04, 4B) Unassigned (00)
present.grade	Current pay grade	1 2 3	Private-Lance Corporal Corporal-Sergeant Staff Sergeant-Master Gunnery Sergeant/Sergeant Major
pmos	Primary military occupational specialty	1 2 3	Combat Arms Combat Service Support Aviation and Aviation Support
marital.stat	Current marital status	0 1 2	Single Married Divorced/Annulled
race	Race an individual Marine identifies with	1 2 3 5	American Indian/Alaska Native, Native Hawaiian/Pacific Islander, Declined to Respond Asian Black/African American White

Variable	Description	Level	Level Description
sex	Binary variable indicating whether Marine is a male or female	0	Male
		1	Female
age	Current age in years	1	Under 20 years
		2	20-24 years
		3	25-29 years
		4	30-34 years
		5	35-39 years
		6	40-44 years
		7	45 and Over
AFQT	Score achieved on the AFQT	1	<=25
		2	26-50
		3	51-75
		4	76-100
award	Binary variable indicating whether or not a Marine is the recipient of a personal award	0	No
		1	Yes
disciplinary.action	Binary variable indicating whether or not a Marine has at least once service record entry involving disciplinary action	0	No
		1	Yes
day.combat.deploy	Number of days deployed to a combat zone	1	Less than or equal to 90 days
		2	91-180 days
		3	181-270 days
		4	Greater than 271 days
day.noncombat.deploy	Number of days deployed to a non combat zone	1	Less than or equal to 90 days
		2	91-180 days
		3	181-270 days
		4	271-360 days
		5	Greater than 361 days
cum_PFT	Cumulative average of scores on the annual Physical Fitness Test (PFT)	1	First Class (>=235)
		2	Second Class (200-234)
		3	Third Class (120-199)
		4	Failure (<120)

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