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**THESIS**

**IMPACT OF HIGH SCHOOL QUALITY ON THE  
CONDUCT AND ATTRITION OF ENLISTED MARINES**

by

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**IMPACT OF HIGH SCHOOL QUALITY ON THE CONDUCT AND ATTRITION  
OF ENLISTED MARINES**

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Submitted in partial fulfillment of the  
requirements for the degree of

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## **ABSTRACT**

This study investigates the impact of high school quality and peer group characteristics on the misconduct and attrition of enlisted Marines. Multivariate regression models employ personnel data from the USMC Total Force Data Warehouse on 22,177 enlisted Marines who joined the USMC during fiscal year 2013 and high school identifiers from the Common Core of Data. Misconduct incidents per year of service, propensity to commit misconduct, propensity to attrite within six years, and propensity to attrite under undesirable circumstances are regressed on high school quality, the number of fellow Marines from the same high school, and demographic breakdown of those fellow Marines. The model results show that high school quality, in itself, does not impact misconduct or attrition. Attending a high-quality high school does, however, amplify the negative impact that a higher Armed Forces Qualification Test (AFQT) score has on propensity to attrite within six years. High school enlistment peer group size does not significantly impact misconduct or attrition. The percentage of high school enlistment peer group that consists of female, black, or Hispanic Marines does not impact the misconduct or attrition outcomes for those groups. We recommend that the USMC not invest time or resources toward recruiting Marines specifically from high-quality high schools, recruiting larger peer groups from each school, or achieving a specific demographic breakdown of recruits from each school.

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## LIST OF ACRONYMS AND ABBREVIATIONS

AFADBD	Armed Forces Active-Duty Base Date
AFQT	Armed Forces Qualification Test
AP	Advanced Placement
CCD	Common Core of Data
CNA	Center for Naval Analyses
GED	General Equivalency Diploma
GPA	Grade Point Average
M&RA	Manpower and Reserve Affairs
MCRC	Marine Corps Recruiting Command
NCES	National Center for Education Statistics
NJP	non-judicial punishment
SAT	Scholastic Assessment Test
TAAS	Texas Assessment of Academic Skills
TFDW	Total Force Data Warehouse
USMC	United States Marine Corps

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# I. INTRODUCTION

## A. MOTIVATION AND BACKGROUND

Reducing misconduct and undesirable attrition throughout the U.S. Marine Corps (USMC) is one of the priorities outlined in the 38<sup>th</sup> Commandant of the Marine Corps' Planning Guidance. Undesirable attrition refers specifically to attrition due to “drug and alcohol offenses, and...misconduct,” which cost the USMC more than \$1 billion in personnel turnover costs from Fiscal Year 2009 to Fiscal Year 2019 (Berger, 2019, p. 21). In the same document, the Commandant highlights the need for leaders to take care of Marines by “vigorously enforcing our high standards of performance” (Berger, 2019, p. 22). While it is a leader’s job to help his or her subordinates stay out of trouble and reach their potential, it is also worth exploring the quality of recruit sources to ensure that the USMC is attracting, recruiting, and retaining the best men and women for the job.

One of the requirements to enlist in the USMC is to have earned a high school diploma prior to attending boot camp (U.S. Marine Corps Recruiting Command [MCRC], 2015, p. 7-61). While most enlistment criteria are waivable if an applicant’s favorable qualities outweigh the reason for disqualification (MCRC, 2015, p. 7-91), Marines without high school diplomas are exceptions to the rule. Since most enlisted Marines have graduated from high school, it is worth examining the extent to which the overall quality of the high school attended and the peer effects from that high school have a causal impact on an enlisted Marine’s propensity to commit misconduct or to attrite under undesirable circumstances.

In this paper we answer the following three questions: First, does the quality of a given Marine’s high school have a causal impact on that Marine’s propensity to commit misconduct, to attrite under any circumstance, or to attrite under undesirable circumstances? Second, does the number of Marines who enlist out of a given high school have a causal impact on the misconduct or attrition outcomes for Marines from that school? Finally, does the gender, ethnic, or racial diversity of USMC enlistees from a given high school have a causal impact on the misconduct or attrition of gender, ethnic, or racial

minorities from that high school? The null hypothesis for each of these questions is that there are no statistically significant causal impacts of high school quality, peer group size, or peer group diversity on misconduct or attrition, and the alternative hypothesis is otherwise, that one or more of these pre-enlistment factors has a statistically significant impact on misconduct, attrition, or both.

## **B. RELATION TO EXISTING LITERATURE**

Existing literature that examines military performance and attrition indicators assesses the impact of factors such as high school completion versus non-completion but does not factor in the quality of the high school attended. There is, however, existing literature that examines the impacts of high school quality on civilian labor outcomes. Prior research shows us that a high school's quality does not have a statistically significant impact on the hourly earnings of its graduates (Betts, 1995, pp. 232–236). Furthermore, research has found that servicemembers who earn high school diplomas are less likely to commit misconduct than their counterparts without high school diplomas (Desrosiers & Bradley, 2015, pp. 26–28), and high school graduates are less likely to attrite earlier than their counterparts with GEDs or no education credentials (Marrone, 2020, pp. 32–34).

Regarding peer effects, research shows that a student's academic performance can be positively impacted by that of his or her peers at the college level (Winston & Zimmerman, 2004) and the elementary school level (Hanushek et al., 2003). Additionally, analysis of student data from the University of Texas at Austin found that a larger number of fellow college students from the same high school has a significant positive impact on the average college freshman's academic performance and propensity to remain enrolled after four semesters (Fletcher & Tienda, 2009). Finally, research conducted by students at the Naval Postgraduate School found that the diversity of a Sailor's peer group at his or her first duty station can positively impact reenlistment decisions for black Sailors but has no significant impact on the reenlistment decisions of female or Hispanic Sailors (Hernandez Rodriguez & Serna, 2020).

In this paper, we contribute to the existing body of research by looking past the positive effects of earning a high school diploma and determining the impacts of earning

that diploma from a high-quality school versus a low-quality school. Furthermore, we broaden the understanding of peer effects on a Marine's performance by looking at the effects of both the size and the demographic makeup of the cohort of Marine recruits from a given high school.

### **C. DATA AND METHODOLOGY**

The data used herein is a combination of personnel records from the Total Force Data Warehouse (TFDW), public high school data from the Common Core of Data (CCD), and county identification codes from the U.S. Census Bureau. The data from TFDW contains information from the personnel records of the 22,177 enlisted Marines whose Armed Forces Active-Duty Base Dates (AFADBD) occurred during fiscal year 2013, and who graduated from a public high school in the United States. The dataset includes information on each of these Marines from 30 September 2015 up until each Marine's end of active service or 30 September 2019, whichever occurred first. The public high school information includes a letter grade on an A-through-F scale for each school. Each high school is also assigned a "high-quality" variable, which is equal to one if the school's grade is a C or higher, and equal to zero if the school's grade is a D or F.

We use an ordinary least squares (OLS) model as well as various linear probability models (LPM) to assess the impact of high school quality and peer group attributes on conduct and attrition outcomes. Specifically, we regress number of misconduct incidents per year, propensity to commit misconduct, propensity to attrite prior to 30 September 2019, and propensity to attrite under undesirable circumstances on high school quality, high school enlistment cohort size, and percentage of black, Hispanic, and female Marines in each high school's enlistment cohort. Other characteristics such as race, age, Armed Forces Qualification Test (AFQT) score, gender, occupational field, marital status, number of combat deployments, number of dependents, and hometown are held constant.

### **D. RESULTS AND RECOMMENDATIONS**

The quality of a given Marine's high school has no statistically significant impact on that Marine's propensity to commit misconduct, attrite, or attrite under undesirable circumstances. However, a 10-point increase in AFQT score decreases the likelihood that

a Marine from a high-quality school will attrite by 1 percentage point more than a Marine from a low-quality school. The size of the enlistment cohort from a given high school does not have a statistically significant impact on the misconduct or attrition of Marines from that school. Furthermore, the demographic makeup of a given high school's enlistment cohort does not have a statistically significant impact on the misconduct or attrition outcomes of racial, ethnic, or gender minorities from that high school. Based on these results, we recommend that MCRC not invest time or resources toward recruiting Marines from high-quality schools versus low-quality schools, recruiting larger peer groups from each high school compared to smaller peer groups, or achieving a specific demographic breakdown of recruits from each high school. Additionally, as illustrated in Chapter III, certain counties across the United States have significantly higher densities of recruitment compared with other counties. We recommend that MCRC maximize the utility of available resources by focusing larger numbers of recruiters on counties that show higher recruitment density.

#### **E. ORGANIZATION OF THE STUDY**

This paper consists of five chapters, the first of which is this introduction. Chapter II provides a review of existing literature related to this study, and Chapter III includes an explanation of the data and methodology employed to answer the research questions. Chapter IV lists the results of empirical analysis and their implications, and Chapter V provides an explanation of limitations, conclusions, and recommendations.

## **II. LITERATURE REVIEW**

### **A. OVERVIEW**

Existing literature that examines military performance and attrition indicators assesses the impact of factors such as high school completion versus non-completion but does not factor in the quality of the high school attended. There is, however, existing literature that examines the impacts of high school quality on civilian labor outcomes. Prior research shows us that a high school's quality does not have a statistically significant impact on the hourly earnings of its graduates (Betts, 1995, pp. 232–236). Furthermore, research has found that servicemembers who earn high school diplomas are less likely to commit misconduct than their counterparts without high school diplomas (Desrosiers & Bradley, 2015, pp. 26–28), and high school graduates are less likely to attrite earlier than their counterparts with GEDs or no education credentials (Marrone, 2020, pp. 32–34).

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### **B. HIGH SCHOOL EDUCATION**

In 1995, Betts sought to determine the extent to which high school quality impacted the weekly earnings of white males (Betts, 1995). The author used data from the National Longitudinal Survey of Youth (NLSY) on 6,749 individuals and implemented a multivariate model to regress those individuals' average weekly wages from age 24 to 31

on various quality attributes of each individual's high school (p. 232). These attributes included teacher-to-pupil ratio, beginning certified teacher salary (relative to the state's average earnings), and the percentage of teachers at each school with a master's degree or higher (p. 233). The author found that neither of these three attributes had a statistically significant impact on their graduates' weekly earnings (pp. 234–236).

In 2015, Desrosiers and Bradley from the Center for Naval Analyses (CNA) reviewed 25 years' worth of literature to identify valid predictors of success in the USMC, with a focus on identifying differences in predictors of success for male Marines and female Marines (Desrosiers & Bradley, 2015). Tier 1 education credentials are defined by MCRC as possession of a high school diploma (MCRC, 2015, p. 7-61). Desrosiers and Bradley found that Tier 1 Marines are less likely to attrite from boot camp (p. 7), less likely to attrite during their first 24 months on active duty (p. 9), and more likely to successfully complete first 48-month enlistment term (p. 10). Furthermore, Tier 1 Marines are more likely to be eligible and recommended by their superiors for reenlistment upon completion of their first 48-month term of enlistment (p. 12). In addition to favorable attrition outcomes, Desrosiers and Bradley found that Tier 1 enlisted Marines are more likely to be promoted to Corporal than their counterparts, which is the first truly performance-based promotion for an enlisted Marine (p. 20). Tier 1 Marines are also more likely to be meritoriously promoted, which occurs when a Marine is promoted earlier than usual based on exemplary performance (p. 22). Finally, Desrosiers and Bradley found that Marines with high school diplomas are more likely to receive the Good Conduct Medal, which enlisted Marines receive for every three years with no misconduct, less likely to be reduced in rank during their first 48-month enlistment term, and less likely to desert from their unit during their first 48-month enlistment term (pp. 26–28).

In 2020, a study by the RAND Corporation corroborated Desrosiers and Bradley's findings (Marrone, 2020). By conducting an empirical study of more than 2 million enlisted servicemembers across all four military branches to identify predictors of early attrition, Marrone found that enlisted servicemembers with no high school diploma or equivalent are more likely to attrite within 36 months than their counterparts with high school diplomas or General Equivalency Diplomas (GED) (pp. 32–33). Furthermore, enlisted

servicemembers with GEDs are more likely than their high school graduate counterparts to attrite within 36 months (pp. 32–34).

### **C. PEER EFFECTS**

Peer effects are the impacts of an individual’s interaction with his or her peers on his or her own behavior (Winston & Zimmerman, 2004, p. 396). In 2004, Winston and Zimmerman determined the extent to which a college freshman’s grade point average (GPA) is impacted by their roommate’s Scholastic Assessment Test (SAT) scores (p. 405). The authors’ use of college freshmen roommates to represent peers is prudent in that it mitigates selection bias, since college freshmen do not typically get to pick their roommates (p. 402). Additionally, the authors’ models include additional independent variables such as the individual student’s SAT scores, race, and gender in order to ensure that any variance in student GPA is solely due to variance in the roommate’s SAT score (p. 405). After running their model on a sample of 5,437 students who began college across a five-year period at three separate universities, the authors found that roommate SAT scores have a statistically significant, positive impact on certain students’ college GPA (pp. 407–416). Specifically, at the first school, a 100-point increase in roommate SAT scores caused an increase in GPA of .032 points, but only for students whose own SAT scores were in the bottom 15 percent (p. 410). At the second school, a 100-point increase in roommate SAT scores caused an increase in GPA of .020 points for students whose own SAT scores were in the middle 70 percent (p. 411). Finally, at the third school, a student whose own SAT scores were in the top 15 percent saw a decrease in GPA of .127 points if their roommate’s SAT scores were in the middle 70 percent, and a decrease of .175 points if their roommate’s SAT scores were in the bottom 15 percent (p. 412). Likewise, a student whose own SAT scores were in the middle 70 percent saw a decrease in GPA of .092 points if their roommate’s SAT scores were in the bottom 15 percent (pp. 407–412).

The results found by Winston and Zimmerman corroborate those found in 2003, when Hanushek, Kain, Markman, and Rivkin examined the causal impact of peer group characteristics on the academic achievement of public elementary school students (Hanushek et al., 2003). Specifically, the authors used a fixed effects model to determine

the impact of peer group characteristics, such as average Texas Assessment of Academic Skills (TAAS) math grades and the proportion of students eligible for free lunch, on students' performance on the math section of the TAAS (pp. 536–537). In order to address the issue of reverse causality, that an individual student's achievement affects those of his or her peers, rather than vice versa, the authors employ G-2 TAAS math scores, or a given peer group's average TAAS math scores from two grades prior, as the key explanatory variable (p. 537). Such a variable mitigates the reverse causality bias by measuring a given peer group's lagged achievement rather than concurrent achievement (pp. 534–535). Using indicator variables to control for individual student demographics, interaction terms to control for interaction of peer group diversity with individual race and ethnicity, and fixed effects to control for school-by-grade characteristics, the authors determined that a one-point increase in average TAAS math scores causes a statistically significant increase in a given student's TAAS math scores of between .15 and .24 points, depending on the type of fixed effects model employed (p. 538). Hanushek and others also found that this positive causal impact is smallest in magnitude for the first quartile of a given class, at .08 points, while the estimated causal impact for the other four quartiles is .12 points (p. 539).

Existing research also suggests that the size and diversity of an individual's peer group may impact his or her performance as well as perseverance. In 2009, Fletcher and Tienda assessed the causal impact of peer group size on a college student's performance and perseverance, using multivariate regression models to determine the extent to which the number of fellow college freshmen from the same high school impact a college student's cumulative GPA as well as the student's propensity to remain enrolled for at least four semesters (Fletcher & Tienda, 2009, pp. 292–294). The authors' empirical analysis show that a 30-person increase in a college freshman's high school peer group size has a statistically significant positive impact on both the student's freshman year GPA, and the student's propensity to remain enrolled for at least four semesters, regardless of race, gender, maternal education, high school class rank, and SAT/ACT scores (pp. 294, 296). While the authors used data covering more than 10 years to control for any fixed effects over time (p. 293), the data only included graduates of Texas public high schools who attended the University of Texas at Austin (pp. 292–293), and so it is unclear whether the

sample is truly representative of the national population, or if the empirical results are unique to in-state attendees at this particular campus.

In 2020, Hernandez Rodriguez and Serna conducted an empirical study to assess the causal impact of peer group diversity on retention outcomes for first term Sailors and Officers in the United States Navy (Hernandez Rodriguez & Serna, 2020). The authors found that a 10-percentage point increase in female peers at a sailor's first duty station did not have a statistically significant impact on female sailors' propensity to reenlist (pp. 40–41). Similarly, a 10-percentage point increase in Hispanic peers at a sailor's first duty station did not have a statistically significant impact on Hispanic sailors' propensity to reenlist (p. 45). Hernandez Rodriguez and Serna did find, however, that a 10-percentage point increase in black peers at a sailor's first duty station was estimated to have a statistically significant, positive impact of 2.1 percentage points on a black sailor's propensity to reenlist (pp. 43–44). The linear probability model employed by Hernandez Rodriguez and Serna to estimate these impacts uses fixed effects to control for variations caused by fiscal year, rating/designator, and duty station (pp. 36–37).

#### **D. SUMMARY**

We conclude from existing research that earning a high school diploma is beneficial for servicemember performance outcomes (Marrone, 2020) and (Desrosiers & Bradley, 2015), and that high school quality has no significant impact on success in the civilian labor market (Betts, 1995). What the literature does not show, however, is the extent to which high school quality impacts the attrition and misconduct of enlisted Marines. The literature also shows that the academic performance of students from elementary school through college is positively impacted by that of their peers (Hanushek et al., 2003) and (Winston & Zimmerman, 2004), that college students, at least at certain campuses, have higher academic performance and perseverance when more students from their high school are at the same campus (Fletcher & Tienda, 2009), and that black Sailors may be more likely to reenlist when there is a larger percentage of black Sailors at their first duty station (Hernandez Rodriguez & Serna, 2020).

In this paper, we contribute to the existing body of research by looking past the positive effects of earning a high school diploma and determining the impacts of earning that diploma from a high-quality school versus a low-quality school. Furthermore, we broaden the understanding of peer effects on a Marine's performance by looking at the effects of both the size and the demographic makeup of the cohort of Marine recruits from a given high school.

### **III. DATA AND METHODOLOGY**

#### **A. DATA**

The data used herein consists of demographic, military, and education-related variables obtained from TFDW, CCD, and the U.S. Census Bureau. The TFDW data contains information from the personnel records of 22,177 enlisted Marines whose AFADBD occurred during fiscal year 2013 and have graduated from a public high school in the United States. The information in the dataset was gathered from each Marine from 30 September 2015 until the Marine's end of active service or 30 September 2019, whichever occurred first. The data from the CCD provides the National Center for Education Statistics (NCES) identification number associated with each Marine's high school and the state in which each school is located, and the U.S. Census Bureau data provides identification codes for each U.S. county that existed in 2013.

##### **1. Descriptive Statistics**

Table 1 provides a summary of the information in the dataset. Of note, the average number of misconduct incidents per Marine per year was .014, 17 percent of Marines in the sample received at least one non-judicial punishment (NJP) or court-martial during their first six years on active duty, 13 percent left active duty within the first six years of service, and 5.8 percent left active duty under undesirable circumstances. With regard to high school quality, 90 percent of Marines graduated from a high school that was rated as average or above average. High school quality in this case is a function of graduation rates, advanced placement (AP) exam participation and passing rates, and SAT participation and passing rates, while holding middle school success rates constant. A high school is listed as high-quality if it received a quality letter grade of C or better on a scale of A through F. With regard to peer group size, the average individual in the sample enlisted in the Marine Corps with 3.2 other enlistees from his or her high school. Furthermore, 11 percent of Marines in the sample were black, 21 percent were Hispanic, and 7.5 percent were female, which is roughly representative of USMC-wide demographics.

Table 1. Summary Statistics

Variable	Mean	Std. Dev.	Min	Max
<b>Key Explanatory Variables</b>				
High-Quality School	.9	.3	-	-
Other Marines from Same School	3.223	2.68	0	16
Percentage of Black Marines per School	9.469	21.974	-	-
Percentage of Hispanic Marines per School	19.159	30.788	-	-
Percentage of Female Marines per School	6.579	16.296	-	-
<b>Outcome Variables</b>				
Misconduct Incidents per Year Committed	.014	.048	0	.857
Attrite	.171	.377	-	-
Poor Attrite	.13	.336	-	-
	.057	.233	-	-
<b>Demographic Variables</b>				
Age as of 30 September 2015	21.424	1.676	19	32
Number of Dependents	.634	.881	0	7
Female	.075	.263	-	-
Married	.462	.499	-	-
Single	.72	.449	-	-
Widowed	0	.018	-	-
Divorced	.001	.024	-	-
Black	.11	.312	-	-
Pacific Islander	.012	.108	-	-
Native American	.012	.108	-	-
Asian	.03	.171	-	-
White	.831	.374	-	-
Other Race	.017	.128	-	-
Hispanic	.21	.407	-	-
<b>Career Variables</b>				
AFQT Score	62.189	17.374	21	99
Combat Deployments	.265	.552	0	4

Summary statistics are based on the personnel records of 22,177 Marines obtained from the Total Force Data Warehouse. The individuals in the dataset are enlisted Marines who possess an AFADBD during Fiscal Year 2013 and who graduated from a public high school in the United States.

As evinced in Table 2, the preponderance of Marines in the sample graduated from high schools that received an A, B, or C grade. Specifically, 31.04 percent, 29.58 percent, and 29.39 percent of Marines graduated from A-, B-, and C-graded high schools, respectively. The Marines who graduated from D- and F-graded schools make up 8.64 percent and 1.35 percent of the sample, respectively. We also see in Table 2 that there is

no apparent correlation between high school quality and average AFQT score, gender breakdown, racial breakdown, or ethnic breakdown.

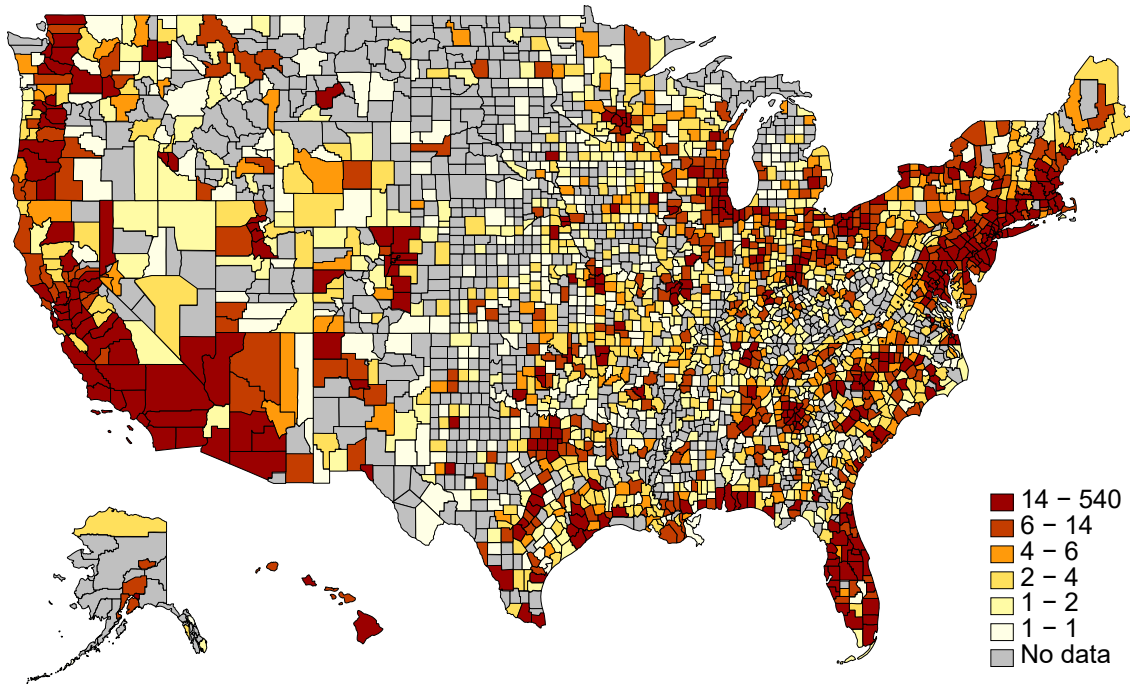
Table 2. School Quality Breakdown

School Quality Grade	Number of Marine Graduates	Percentage of Total Sample	Mean AFQT Score	Percentage of Marine Graduates Who Are Female	Percentage Of Marine Graduates Who Are Black	Percentage of Marine Graduates Who Are Hispanic
A	6,884	31.04	61.964	7.365	12.493	31.784
B	6,560	29.58	62.568	7.088	9.726	15.960
C	6,518	29.39	62.573	7.625	9.880	14.774
D	1,915	8.64	60.295	9.086	13.107	20.731
F	300	1.35	62.817	6.000	12.667	18.000

Statistics are based on the personnel records of 22,177 Marines obtained from the Total Force Data Warehouse. The individuals in the dataset are enlisted Marines who possess an AFADBD during Fiscal Year 2013 and who graduated from a public high school in the United States.

Figure 1 illustrates the number of Marines in the data set who attended high school in each county. It makes sense that the regions where larger numbers of Marines attended high school exist in the denser population centers, such as coastal regions and larger cities. It is also worth noting, however, that the Southeast region of the country, despite its relatively low population density compared to the Northeast and Pacific regions, serves as the home region for a large number of Marines in this particular data set.

Figure 1. Number of Marines Who Attended High School in Each County



Distribution of the number of Marines who attended high school in each county is based on the personnel records of 22,177 Marines obtained from the Total Force Data Warehouse as well as public high school data from the Common Core of Data and county identification codes from the Census Bureau. The individuals in the dataset are enlisted Marines who possess an AFADBD during Fiscal Year 2013 and who graduated from a public high school in the United States.

## 2. Dependent Variables

The following dependent variables are used to represent the outcomes being considered in each of the research questions:

- Misconduct per year: A continuous variable equal to the total number of NJPs and courts-martial each Marine received divided by each Marine's total years of service.
- Committed Misconduct: A binary variable that equals one if the Marine received a nonjudicial punishment or a trial by court-martial at any time during the observed period, and zero otherwise.
- Attrition: A binary variable that equals one if the Marine left active service within his or her first six years of service, and zero otherwise.

- Undesirable Attrition: A binary variable that equals one if the Marine was discharged from the USMC due to alcohol rehabilitation failure, any condition other than a disability, drug abuse, guilty findings at a trial by court martial, in lieu of a trial by court martial, conviction in a civilian court, desertion, drug-related misconduct, sexual perversion, unsatisfactory job performance, failure to meet physical performance standards, failure to maintain weight standards, or any other single incident or pattern of misconduct; and zero otherwise.

### 3. Key Explanatory Variables

The following factors are the key explanatory variables:

- High Quality: A binary variable that equals one if a given Marine attended a high school rated as average or above average, and zero otherwise. The quality of a given high school is a function of that high school's graduation rate, SAT participation and passing rate, and AP exam participation and passing rate, while holding middle school success rates constant.
- High Quality\*AFQT: An interaction term equal to the product of a given Marine's high school quality indicator and that same Marine's AFQT score.
- Peer Count: A continuous variable that equals the number of Marines who graduated from a given high school in addition to a given Marine. This number equals zero if only one Marine came from a given high school, one if two Marines came from a given high school, and so on.
- Peer Count\*AFQT: An interaction term equal to the product of a given Marine's peer count and that same Marine's AFQT score.

- Female\*Female Percentage: An interaction term equal to the product of an indicator variable for female and a continuous variable that represents the percentage of female Marines from a given high school.
- Black\*Black Percentage: An interaction term equal to the product of an indicator variable for black and a continuous variable that represents the percentage of black Marines from a given high school.
- Hispanic\*Hispanic Percentage: An interaction term equal to the product of an indicator variable for Hispanic and a continuous variable that represents the percentage of Hispanic Marines from a given high school.

#### **4. Control Variables**

- AFQT Score: A continuous variable equal to each Marine's AFQT score.
- Age: A continuous variable equal to each Marine's age in years as of 30 September 2015.
- Marital Status: A series of binary variables to indicate whether each Marine is single, married, divorced, or widowed.
- Number of Dependents: A continuous variable equal to the total number of dependent family members each Marine has on record.
- Female: A binary variable equal to one if a given Marine is female and zero if a given Marine is male.
- Race: A series of binary variables that indicate whether each Marine is Black, White, Asian, Native American, Pacific Islander, or other.
- Hispanic: A binary variable that equals one if a Marine's ethnicity is Hispanic and zero if a Marine's ethnicity is non-Hispanic.
- Number of Combat Deployments: A continuous variable equal to the total number of combat deployments in which each Marine has participated.

- Occupational Fields: A series of binary variables for each of the enlisted occupational fields represented in the dataset.
- State: A set of binary variables to indicate the state in which each Marine attended high school.

## **B. METHODOLOGY**

### **1. Multivariate Regression Model**

In order to estimate the impact of each key explanatory variable on the continuous dependent variable, misconduct per year, we employ a multivariate regression OLS model. OLS models treat the relationship between the dependent and independent variables as linear and assign an estimated coefficient to each independent variable that results in the smallest total difference between actual observed values of the dependent variable and the predicted values thereof (Wooldridge, 2016, p. 27). In order to ensure the estimated coefficient is as close as possible to the true causal impact of the key explanatory variable on the dependent variable, multivariate regression models hold constant other factors, called control variables, that may impact the dependent variable (Wooldridge, 2016, p. 60). We also employ a multivariate regression LPM to estimate the impacts of each key explanatory variable on the binary dependent variables. An LPM works much the same as an OLS model, but in this case the outcome of interest is binary and so the dependent variable represents the probability that the outcome of interest will be successful, or equal to 1, given the values of the explanatory variables (Wooldridge, 2016, pp. 224–225).

In this paper, we employ variations of the following models to estimate the causal impact of the designated explanatory variables on selected outcomes:

$$\text{OLS: } y_i = \beta_0 + \beta_1 x_{1i} + \beta_2 x_{2i} + \varepsilon_i$$

$$\text{LPM: } P(y_i = 1 | x) = \beta_0 + \beta_1 x_{1i} + \beta_2 x_{2i} + \varepsilon_i$$

In these models,  $y_i$  represents each of the misconduct and attrition dependent variables. The key explanatory variable  $x_{1i}$  represents the quality score of a given Marine's high school, the size of the enlistment cohort from a given Marine's high school, the

Marine's AFQT score interacted with the high school's quality, the Marine's AFQT score interacted with the size of the cohort, or the diversity of the enlistment cohort from a given Marine's high school interacted with the Marine's race or gender. The control variables represented by  $x_{2i}$  include each Marine's age, gender, race, ethnicity, AFQT score, occupational field, marital status, number of dependents, number of combat deployments, and home state.

## **2. Potential Biases**

The methodology employed herein mitigates the potential for various pitfalls. First and foremost, there is no potential for reverse causality, because our dependent variables occur at a point in time after our key explanatory variables. Furthermore, there is limited potential for self-selection bias because, typically, teenagers do not get to choose the quality of the high school they attend. Additionally, they have no control over how many other students from their school enlist in the Marine Corps, or the gender, race, and ethnicity of those students. One potential limitation of our regression model is the potential for omitted-variables bias. According to *Regression Analysis: A Practical Introduction* by Dr. Jeremy Arkes, omitted-variables bias occurs when an unobserved factor impacts the dependent variable and is correlated with the key explanatory variable (2019, p. 123). In the case of our research, if a Marine has parents who are heavily invested in raising their child, they may be more likely to live in an area with better high schools, and so the unobserved factor of parental investment would have a positive impact on our dependent variable, high school quality. Additionally, heavily invested parents may also reduce a Marine's propensity to commit misconduct, and so parental investment is likely negatively correlated with misconduct outcomes. Therefore, any significant causal impact of high-school quality on misconduct is likely to be negatively biased due to the unobserved factor, parental investment.

## IV. RESULTS AND IMPLICATIONS

### A. EFFECTS OF HIGH SCHOOL QUALITY

A high school’s quality does not have a statistically significant impact on the number of misconduct incidents per Marine per year, or on a given Marine’s propensity to commit misconduct, to attrite in general within the first six years of service, or to attrite under undesirable circumstances. Furthermore, the causal impact of change in AFQT score on a Marine’s misconduct outcomes or propensity to attrite under undesirable circumstances is not impacted by the quality of that Marine’s high school. These results corroborate existing literature which suggests that high school quality has no significant impact on job performance (Betts, 1995). The quality of a Marine’s high school, however, does cause the impact of that Marine’s AFQT score on propensity to attrite in general to vary. Specifically, as shown in Table 3, a one-point increase in AFQT score causes a .1 percentage-point decrease in propensity to attrite for a Marine from a high-quality school. This implies, specifically regarding general attrition, that Marines from high-quality schools tend to benefit more from a higher AFQT score than Marines from low-quality schools.

Table 3. Impact of H.S. Quality and AFQT Score on Misconduct and Attrition

	Misconduct per Year	Committed Misconduct	Attrition	Undesirable Attrition
High Quality School	0.00371 (0.00395)	0.01391 (0.03076)	0.05107 (0.02739)	0.02604 (0.01902)
AFQT	-0.00001 (0.00006)	-0.00035 (0.00047)	0.00068 (0.00042)	0.00024 (0.00029)
High Quality School*AFQT	-0.00009 (0.00006)	-0.00049 (0.00049)	-0.00095* (0.00043)	-0.00044 (0.00030)
Observations	22,177	22,177	22,177	22,177

Standard errors in parentheses

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

## B. EFFECTS OF PEER GROUP SIZE

As illustrated in Table 4, the number of individuals who enlist in the Marine Corps from a given high school does not have a statistically significant impact on the misconduct, general attrition, or undesirable attrition outcomes of Marines from that high school. Furthermore, a one-point increase in AFQT score does have a statistically significant impact on average misconduct incidents per year of service and propensity to commit misconduct by -.008 percentage points and -.078 percentage points, respectively. The size of a given high school's enlistment cohort, however, does not change the extent to which an individual's AFQT score impacts his or her misconduct or attrition outcomes. These results imply that a higher AFQT score is expected to have a negative impact on the average Marine's misconduct outcomes regardless of the size of that Marine's high school enlistment cohort. These results are contrary to existing research, which shows that a larger high school peer group positively impacts performance and persistence of freshmen at the University of Texas at Austin (Fletcher & Tienda, 2009). A likely reason for the difference in findings is the fact that, unlike students attending classes at the same campus, enlisted Marines are assigned to bases throughout the world, and so they may spend their entire enlistment without seeing another Marine from their high school.

Table 4. Impact of H.S. Enlistment Cohort Size and AFQT Score on Misconduct and Attrition

	Misconduct per Year	Committed Misconduct	Attrition	Undesirable Attrition
Peer-Count	-0.00008 (0.00046)	-0.00114 (0.00356)	-0.00034 (0.00317)	-0.00155 (0.00220)
AFQT	-0.00008** (0.00003)	-0.00078** (0.00024)	-0.00013 (0.00021)	-0.00022 (0.00015)
Peer-count*AFQT score	-0.00000 (0.00001)	-0.00000 (0.00006)	-0.00001 (0.00005)	0.00002 (0.00003)
Observations	22,177	22,177	22,177	22,177

Standard errors in parentheses

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

### C. EFFECTS OF PEER GROUP DEMOGRAPHICS

The misconduct and attrition outcomes of black, Hispanic, and female Marines are not significantly impacted by changes in the percentage of the enlistment cohort from their high school that shares their gender, race, or ethnicity. Specifically, as illustrated in Table 5, the average black Marine does not have a significantly different rate of misconduct incidents per year when compared to the average non-black Marine. The propensity of the average black Marine to receive a court-martial or NJP, attrite in general, or attrite under undesirable circumstances is higher than that of the average non-black Marine by 6.01 percentage points, 2.63 percentage points, and 3.409 percentage points, respectively. However, the percentage of a Marine’s high school enlistment peer group made up of black Marines does not have a statistically significant impact on any of these outcomes for black Marines or for non-black Marines.

Table 5. Impact of Black Marines in H.S. Enlistment Cohort on Misconduct and Attrition of Black Marines

	Misconduct per Year	Committed Misconduct	Attrition	Undesirable Attrition
Black	0.00053 (0.00134)	0.06005*** (0.01048)	0.02631** (0.00933)	0.03409*** (0.00648)
Percentage of black Marines in H.S. cohort	-0.00002 (0.00002)	-0.00014 (0.00015)	-0.00006 (0.00013)	-0.00005 (0.00009)
Black*Percentage of black Marines in H.S. cohort	0.00006 (0.00003)	0.00031 (0.00026)	-0.00005 (0.00023)	0.00003 (0.00016)
Observations	22,177	22,177	22,177	22,177

Standard errors in parentheses

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

As illustrated in Table 5, there is no significant difference between Hispanic and non-Hispanic Marines in misconduct or the propensity to attrite under undesirable circumstances. Furthermore, the average Hispanic Marine is 2.339 percentage points less likely to attrite in general than the average non-Hispanic Marine. None of these outcomes,

however, are significantly impacted by the percentage of a Marine’s high school enlistment peer group made up of Hispanic Marines.

Table 6. Impact of Hispanic Marines in H.S. Enlistment Cohort on Misconduct and Attrition of Hispanic Marines

	Misconduct per Year	Committed Misconduct	Attrition	Undesirable Attrition
Hispanic	-0.00121 (0.00122)	-0.00465 (0.00949)	-0.02339** (0.00845)	-0.00149 (0.00587)
Percentage of Hispanic Marines in H.S. cohort	-0.00002 (0.00002)	-0.00006 (0.00013)	-0.00016 (0.00011)	-0.00006 (0.00008)
Hispanic*Percentage of Hispanic Marines in H.S. cohort	-0.00001 (0.00002)	0.00004 (0.00019)	0.00017 (0.00017)	0.00009 (0.00012)
Observations	22,177	22,177	22,177	22,177

Standard errors in parentheses

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

Female Marines, as illustrated in Table 6, display annual misconduct rates that are statistically similar to those of male Marines. When compared with male Marines, female Marines are 2.638 percentage points less likely to ever receive a court-martial or NJP, 3.85 percentage points more likely to leave active service within six years of the start of their enlistment, and 2.998 percentage points less likely to attrite under undesirable circumstances. The misconduct and attrition outcomes for both male and female Marines are not significantly impacted by the percentage of a given Marine’s high school enlistment cohort that is made up of females.

Table 7. Impact of Female Marines in H.S. Enlistment Cohort on Misconduct and Attrition of Female Marines

	Misconduct per Year	Committed Misconduct	Attrition	Undesirable Attrition
Female	0.00158 (0.00139)	-0.02638* (0.01080)	0.03850*** (0.00962)	-0.02998*** (0.00668)
Percentage of female Marines in H.S. cohort	-0.00003 (0.00002)	-0.00032 (0.00016)	-0.00003 (0.00015)	-0.00002 (0.00010)
Female*Percentage of female Marines in H.S. cohort	-0.00005 (0.00006)	-0.00004 (0.00050)	0.00003 (0.00044)	0.00020 (0.00031)
Observations	22,177	22,177	22,177	22,177

Standard errors in parentheses

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

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## **V. CONCLUSIONS AND RECOMMENDATIONS**

### **A. LIMITATIONS AND FURTHER RESEARCH**

Due to the data used herein being limited in scope to the fiscal year 2013 enlistment cohort, we recommend this study be expanded to include at least three fiscal year enlistment cohorts in order to control for variance in recruit quality and performance outcomes over time. Furthermore, we recommend that any future iterations of this study be expanded to address causal impacts of each high school's attributes, such as average graduating class size, Junior Reserve Officer Training Corps (JROTC) affiliation, and demographic makeup of the student body, on misconduct and attrition.

Any future iterations of this study will require an accurate accounting of which high school each Marine attended, which is made difficult by the manner in which high schools are recorded. For example, two Marines from the same high school may have had their high school name recorded differently, such as "Jefferson High School" instead of "TJHS," and the CCD may list the same high school as "Thomas Jefferson H.S." Every public high school in the United States does possess an NCES code that serves as a unique identifier, however these codes are not recorded or maintained in USMC databases. Should the USMC wish to expand the scope of this study in the future, we recommend that the NCES identification code unique to each high school be recorded by MCRC or Manpower and Reserve Affairs (M&RA) and maintained by TFDW.

### **B. CONCLUSIONS**

Based on the results of empirical analysis, we conclude that high school enlistment cohort size and diversity have no statistically significant impact on misconduct, general attrition, and undesirable attrition. Furthermore, we conclude that high school quality has no statistically significant impact on misconduct or undesirable attrition. We do, however, find that high school quality has a statistically significant impact on the extent to which an increase in AFQT score decreases a Marine's propensity to attrite under general circumstances within their first six years of active service.

### **C. POLICY RECOMMENDATIONS**

As stated in Chapter I, misconduct and undesirable attrition are significant problems in the Marine Corps that must be dealt with (Berger, 2019). Existing research, cited in detail throughout Chapter II, has shown that various pre-enlistment factors, most notably the possession of a high school diploma versus a GED or lack of education credentials, can be taken advantage of to improve performance, misconduct, and attrition outcomes amongst enlisted Marines (Desrosiers & Bradley, 2015) and (Marrone, 2020). However, as a result of the conclusions drawn from this study, we recommend that the Marine Corps not invest time or resources toward the recruitment of Marines specifically from high-quality schools versus low-quality schools, the recruitment of larger peer groups from each high school versus smaller peer groups, or the achievement of a specific demographic breakdown of recruits from each high school.

Additionally, as illustrated in Chapter III, certain counties across the United States have significantly higher densities of recruitment compared with other counties. A detailed breakdown of recruitment density across the United States is provided in Chapter III as Figure 1. We recommend that MCRC maximize the utility of available resources by focusing larger numbers of recruiters on those counties that show the highest recruitment density.

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