



NAVAL POSTGRADUATE SCHOOL

MONTEREY, CALIFORNIA

**THE EFFECT OF THE DIVERSITY ON FIRST-SHIP
ASSIGNMENT ON FIRST-TERM RETENTION DECISIONS**

by

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November 2020

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Prepared for: [21st Century Sailor Office \(OPNAV, N17\)](#)

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REPORT DOCUMENTATION PAGE				Form Approved OMB No. 0704-0188	
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1. REPORT DATE (DD-MM-YYYY) 18-110-2020		2. REPORT TYPE		3. DATES COVERED (From-To)	
4. TITLE AND SUBTITLE THE EFFECT OF THE DIVERSITY ON FIRST-SHIP ASSIGNMENT ON FIRST-TERM RETENTION DECISIONS				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S) Jeremy Arkes Simona Tick Steve Mehay				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) AND ADDRESS(ES) Naval Postgraduate School				8. PERFORMING ORGANIZATION REPORT NUMBER NPS-GSDM-20-004	
9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES) Naval Research Program, Project ID: NPS-20-N338-A, JON: W0A04 21st Century Sailor Office (OPNAV, N17)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION / AVAILABILITY STATEMENT Approved for public release; distribution is unlimited					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT This study uses a sample of Navy personnel data for personnel entering the Navy between FY1995 and FY2012 to examine how higher levels of diversity among peers and role models affect retention. To test for this effect, we estimated fixed-effects models that regressed the first-term retention decision on the proportions of shipmates who were Black, Hispanic, and female. We found some cases of strong evidence that greater diversity positively affects retention for both underrepresented groups, as well as majority groups. In an accompanying qualitative analysis from interviews with first-term sailors on Navy ships, we learned that members of underrepresented groups, compared to others, tend to face greater obstacles resulting from institutional Navy rules, tend to have inferior experiences with mentors, have more communication challenges with peers and superiors, and feel like they have fewer opportunities in the Navy. Greater diversity among peers and superiors might be able to address some of these more challenging experiences.					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			Jeremy Arkes
U	U	U	U	81	19b. TELEPHONE NUMBER (include area code) 831-656-2646

Standard Form 298 (Rev. 8-98)
Prescribed by ANSI Std. Z39.18

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The report entitled “The Effect of the Diversity on First-Ship Assignment on First-Term Retention Decisions” was prepared for N17 and funded by N17.

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EXECUTIVE SUMMARY

The Navy's Inclusion and Diversity (I&D) policies and strategic roadmap have initiated numerous reforms. However, additional efforts may be needed to recruit, train, promote, and retain talented and diverse personnel to address any inequality concerns and to reap the benefits of an all-inclusive force. Such policies must be guided by empirical evidence derived from internally valid and statistically reliable studies. In this study, we investigate how the demographic composition of peer and role-model groups affect the career retention decisions of individual sailors.

This main goal of the project was to better understand how greater diversity could impact retention in the Navy, particularly for members of underrepresented groups. The primary analysis was a quantitative investigation of the effect of diversity of ship crews on retention. In particular, we estimated how having more sailors of underrepresented groups (Blacks, Hispanics, and females) on a sailor's first ship assignment affected the likelihood of reenlistment for first-term enlistees or retention for junior officers (JOs). The retention analysis was conducted for both the members of the underrepresented groups and for the majority groups (Whites and males).

We also developed a basic qualitative analysis to supplement the main quantitative analysis. Whereas the quantitative analysis examined the extent to which greater diversity affected the likelihood of retention, the qualitative analysis, mostly through surveys of and personal interviews with sailors, could speak to how and why diversity might affect individuals' retention decisions. However, more importantly, the qualitative study documented some major challenges that sailors from underrepresented groups face.

The qualitative analysis involved visits to four surface ships and used: (1) surveys on the importance of, and experiences, regarding 20 retention factors (drawn from Maslow's *Hierarchy of Needs*); and (2) semi-structured personal interviews to better understand the retention factors and particularly the factors related to diversity. Unfortunately, despite having a high response rate, the surveys did not have enough observations for different racial/ethnic groups and females to draw robust inferences on differences across these groups.

The real value from the ship visits came from the one-on-one interviews. From the qualitative analysis of those interviews, we identified the following five themes, the first four of which speak to greater challenges for junior personnel from underrepresented groups:

1. Underrepresented groups appear to face greater obstacles linked to Navy policies, culture, and interpersonal communication than the majority groups.
2. Underrepresented group members have inferior experiences with mentors.
3. Underrepresented group members tend to believe there are limited opportunities for them in the Navy.
4. Underrepresented group members are more likely to mention difficulties fitting in with peers.

5. Most junior personnel prefer working under prior-enlisted officers.

The clear conclusion from the interviews was that increasing the diversity among peers and superiors offered one potential solution to the challenges faced by underrepresented junior personnel.

In the quantitative analysis, we focused on the relationship between diversity and retention for sailors on all ships and submarines other than the larger ships (Carriers and Amphibious Assault Ships). The goal was to focus on ships in which crew members, for the most part, knew each other. In particular, personnel from underrepresented groups would be likely to know other members of their demographic group on medium and smaller size ships than on large ships.

In our quantitative statistical analysis, we found some strong positive effects of diversity on the probability of reenlistment of enlisted sailors. The main highlights of the statistical findings are the following:

- Black sailors' retention likelihood is positively impacted by a higher percentage of Blacks among the enlisted crew, with a stronger effect apparently coming from more Blacks among enlisted superiors rather than among enlisted peers.
- There is some evidence that White enlisted sailors' retention is positively affected by having higher percentages of Black peers or Black officers.
- There are no detected positive effects from having a higher percentage of Hispanics (among officers or enlisted) on the retention rates of Hispanics. We suspect that this result may be due to the different sub-groups within Hispanics. In contrast, White and Black sailors appear to be more likely to reenlist if they have a higher percentage of Hispanics among enlisted superiors.
- There is no evidence that female retention is positively affected by having a higher percentage of females in the crew or in any segment of the crew. However, male retention is significantly positively affected by more females among officers and among enlisted peers.

We should note that lack of statistical evidence for any diversity effects does not mean that no effect exists. In some instances, it could be that there is not enough statistical power to detect any effects due to small sample sizes in some of the demographic categories. Another possibility is that there are offsetting positive and negative effects in some cases. For example, given the large diversity within the Hispanic group, some Hispanics might be positively affected by having more Hispanic enlisted peers, while others might be negatively affected. Our estimates only provide the average effect. In addition, another shortcoming could be measurement error in that our measures of the diversity on the ship for the end-of-quarter observations may not be indicative of the true diversity among the most relevant peers and role-models for a sailor. Measurement error, if anything, would likely lead to understated estimated effects.

For officers, unfortunately, there were hardly any significant coefficient estimates on the diversity measures. It is uncertain whether this represents a true lack of diversity effects for officers or is due to the more limited sample size for officers, particularly for

underrepresented groups, preventing the detection of any significant effects. We lean towards the former explanation but certainly cannot rule out the latter.

Regarding the effects of serving under prior-enlisted officers, we found no significant effects for officer retention. However, for enlisted personnel, there were very strong estimated positive retention effects from serving under a higher percentage of prior-enlisted officers. The effects appear to be stronger for Black sailors than for Whites or for Hispanics, and stronger for males than for females. However, the racial/ethnic and gender differences in effects are not statistically significant.

The general implication of our results is that greater diversity would lead to greater retention overall. And, for Black sailors, greater diversity would beget greater diversity. In some cases, the results add to the justification for continuing efforts to encourage greater retention among those in underrepresented groups. Furthermore, expanding opportunities for enlisted sailors to become officers would likely lead to greater retention among first-termers.

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ACKNOWLEDGMENTS

This report benefited from the work of five students, which also served as the basis for three theses. The students, in order of their thesis work and graduation, were LT Alexander (Gee Gee) Greene, LT Jesse Hernandez-Rodriguez, LT Cesar Serna, LCDR Capreece Dunklin, and LT Jeremy Thomas. The three theses were the products of collaborative efforts by the students and ourselves on tasks such as data collection, organization, and coding, as well as developing survey/interview protocols. Greene (2019) presents preliminary estimates of the diversity among role models on retention, while Hernandez-Rodriguez and Cerna (2020) incorporate diversity among peers and superiors using a larger number of observations (from more ships). We extended their preliminary analyses to produce the quantitative results discussed in this technical report. Finally, Thomas and Dunklin, (2020) presents the analysis that formed the basis for the qualitative results discussed in this report.

An understanding of the dynamics of how relationships between social groups and individuals form on Navy ships is a key element of the analysis of peer and leadership effects in this project. We are deeply grateful for the insights gained from discussions with former and current Navy personnel. We would particularly like to thank the five students mentioned above, as well as CDR William Hatch (USN, retired), LT Anthony Caballero and LT Keyeira Jackson.

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I. INTRODUCTION

The U.S. Navy emphasizes continuously improving the training, development, and professional growth of active duty personnel. As part of that effort the Navy's Leader Development Strategy (U.S. Navy, 2015) recognized that mentors can serve as role models and provide training, motivation, and inspiration to mentees, which potentially can improve career attitudes, job attitudes, engagement, and performance.¹ Effective mentoring is considered to be especially important in influencing the career development of junior officers and first-term enlistees.

While the military has attempted to implement numerous formal mentorship programs, most mentoring relationships are informal in nature.² The Navy Supply Corps, for example, is well-known for its networking and mentorship. Junior Supply Corps officers are encouraged to connect with peers and more senior officers for career development, training, and support.³ But, in communities that lack comparable support systems, career guidance and mentoring occurs primarily at the unit level and is driven largely by informal relationships among peers, between leaders and subordinates, and between mentors and mentees. In these informal settings, commonalities shared by peers, by superiors and subordinates, and by mentors and mentees, are likely to be influential in creating bonds within social groups that can impact the career choices of individual group members. These common factors may include occupation, experiences, and demographic background, among others. In this study we explore the impact of the demographic background of social groups on one important career milestone: the voluntary retention decision of Navy officers and enlistees.

We analyze retention, in part because of the inherent importance of retention to manning the force and ensuring operational readiness.⁴ Retention is also an important aspect of the Navy's efforts to improve inclusion and diversity in the force. Informal social interactions and specific social groups -- such as mentors, leaders, and peers -- can play an important role in supporting efforts to improve retention and to achieve the Navy's Inclusion and Diversity goals.

Historical data on retention patterns show that, among males, members of racial and ethnic underrepresented groups have higher cohort retention rates than Whites. On the other hand, women tend to have lower cohort retention rates than men. This lower

¹ A recent survey of mentoring research (Conboy and Kelly, 2016) finds that formal corporate mentoring programs significantly increase promotion and retention of members of underrepresented groups and increase their representation in manager positions when compared to other diversity initiatives.

² In a recent survey of senior enlisted and officers on mentorship 91% reported experiencing at least one important mentoring relationship during their careers, but only 3.7% indicated that the mentoring was part of a formal program (Johnson and Andersen, 2015).

³ Lyle and Smith (2014) find that senior mentors of Army junior officers have a positive effect on the successful early promotion outcomes of the junior officers.

⁴ We focus on voluntary retention in part because of the direct impact of any retention shortfalls on fleet manning and operational readiness.

retention of women holds true in both Navy officer and enlisted communities. Another issue related to retention is that, although the Navy has successfully increased accessions and representation of women, Blacks, and Hispanics, representation of these groups declines in top leadership ranks compared to the lower ranks. The gaps in diversity representation in leadership ranks (by race/ethnicity and gender) are largest in the Navy officer corps.⁵ Retention plays a key role (along with differences in promotion) in explaining the lower diversity in leadership positions (Military Leadership Diversity Commission, 2011).

This study focuses on the following questions:

- What is the effect of increased diversity among specific social groups on the voluntary retention decisions of historically underrepresented-group and majority-group sailors?
- Why could greater diversity impact the retention of sailors?
- What are the major challenges that underrepresented groups face in the Navy?

The study undertakes both qualitative and quantitative assessments of turnover among historically underrepresented groups. The quantitative portion of the study statistically analyzes longitudinal data on cohorts who entered the Navy between FY1995 and June 2012, allowing time for their retention decisions to be realized by the end of our data in June 2019. The statistical analysis focuses on measuring diversity of the crews of Navy ships, and evaluates how the retention of members of underrepresented groups and majority groups is influenced by diversity among the officer and enlisted crews and, within the enlisted crew, by peers versus superiors. Thus, we can examine the effects of diversity among those who are viewed as role models and mentors and those considered peers. The qualitative analysis, with personal interviews, tells us why and how diversity could affect retention.

Ultimately, the findings of this study could help decision makers understand how the diversity of social groups affects retention and what the main challenges are for members of underrepresented groups.

⁵ See Rondeau (2015).

II. DEMOGRAPHIC HIGHLIGHTS: GENDER AND RACE/ETHNICITY

In this section, we describe the trends for the three underrepresented groups we focus on – women, Blacks, and Hispanics. Trends and patterns are drawn from the data base we compiled for this project consisting of the universe of Navy active duty personnel at the end of each fiscal years between 1995 and 2018. The trends and current status can be summarized as follows:

- (1) Females have been a growing percentage of representation in the Navy, but their retention rates among both enlisted sailors and officers are much lower than for males. Thus, the representation of women in senior leadership positions is much lower than that of men.
- (2) Blacks have had relatively high retention rates among enlisted sailors, but their representation among enlisted leadership has been relatively low, compared to Whites.
- (3) Black officers also have low representation relative to the Black share of the U.S. population. They have historically been less likely to stay, but that trend has reversed itself recently. Still, they have disproportionately lower representation in officer leadership ranks than Whites.
- (4) Hispanics are overrepresented among the enlisted ranks, compared to their share of the U.S. population, but underrepresented among officers, especially in the leadership ranks.

A. GENDER DIVERSITY

Figures 1 and 2 show the trends in the percentages of enlisted sailors and officers who are female from FY1995 to FY 2018. There has been a fairly steady increase over time for each enlisted year-of-service (YOS) group and rank group. However, the lower representation of females in higher YOS and rank groups indicates that retention and advancement remain lower for females than males. The story is similar for female officers. However, one peculiar outcome is that the gains made in the higher YOS group is weaker for female officers than female enlisted sailors, but the gains for higher leadership positions for females is relatively higher than that for enlisted sailors.

This demographic shift may indicate that some of the initiatives in the Inclusion and Diversity strategic plan and DoD policy changes that were designed to increase the number of women—such as opening all occupations to women and increasing the number of female recruiters— have been effective (NPC, 2019).

Figure 3 shows a snapshot of the distribution of men and women by pay grade in the Navy in 2018 and highlights the lower representation of women at higher leadership levels among both enlistees and officers.

Figure 1. Trends in enlisted females, by year-of-service (YOS) and rank (Source: authors).

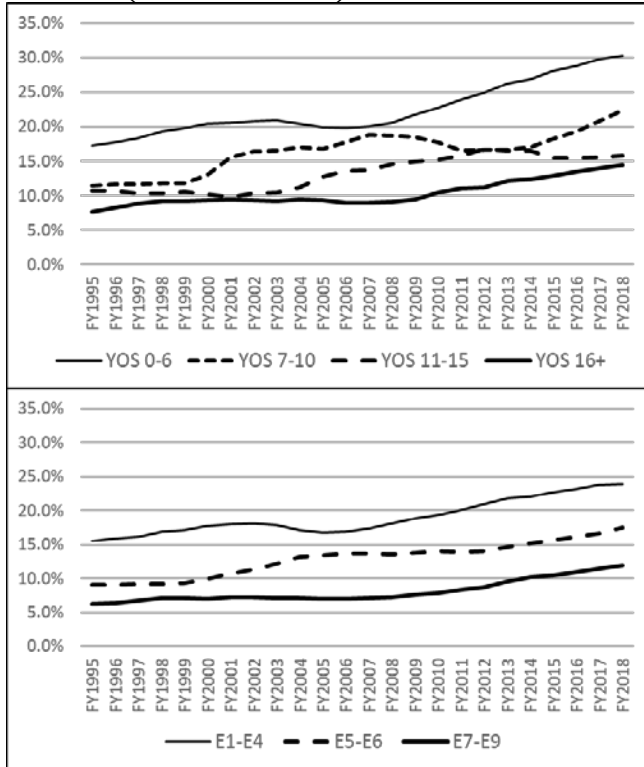


Figure 2. Trends in female officers, by year-of-service (YOS) and rank (Source: authors).

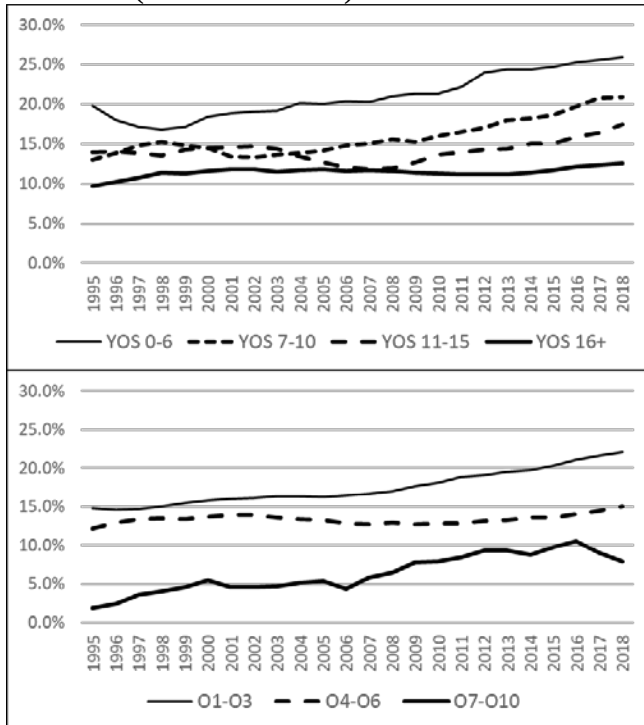
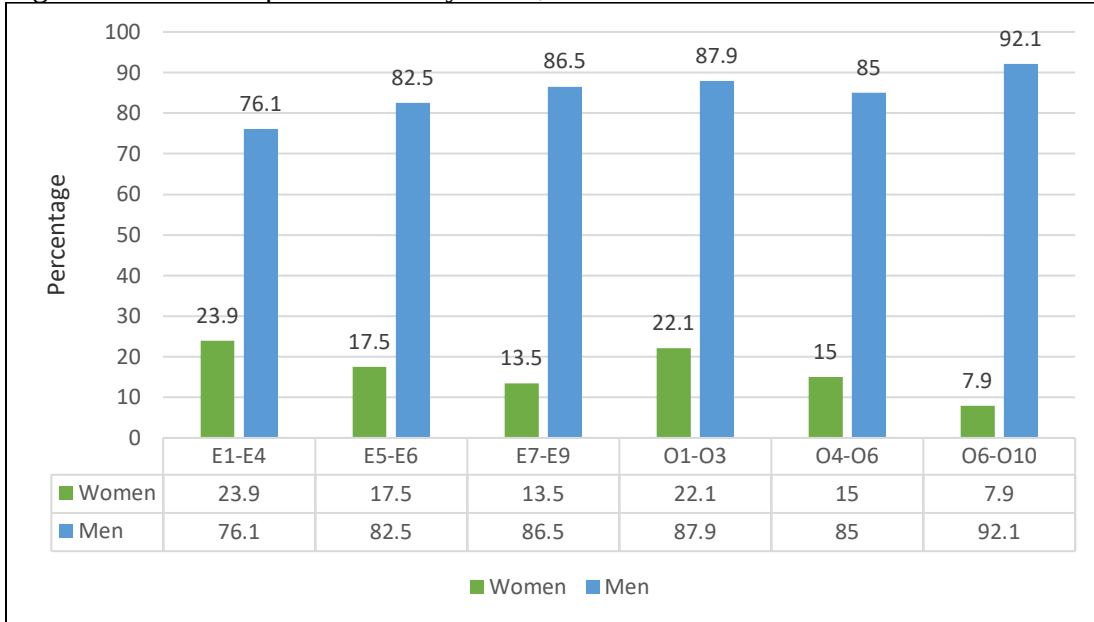


Figure 3. Female representation by ranks, FY2018



B. RACIAL/ETHNIC DIVERSITY

Current representation in the Navy for historically-underrepresented racial and ethnic groups, among enlistees, either meets or exceeds their representation in the U.S. population. Figure 4 shows that in FY2019, enlisted Blacks, Asians, and multiracial individuals accounted for 19%, 6%, and 8%, compared to 13%, 5%, and 3%, respectively, of the civilian population benchmarks (NPC, 2019).

Although Asian demographic representation is rapidly growing in the U.S., they remain a relatively small percentage of the enlisted force (OUSDPR, 2017). Naval officer demographics tell a similar story. In FY2019, Black and Asian officers accounted for 8% and 5%, respectively, of the officer population, compared to 13% and 5%, respectively, in the U.S. population, while multi-racial officers accounted for 4% versus 3% in the U.S. population (NPC, 2019). These percentages point to several potential explanations: (1) differences in measured and unmeasured characteristics among underrepresented groups that could explain the difference in retention and promotion outcomes; (2) lack of opportunity for these personnel to enter the officer ranks; and (3) lack of leadership and role-model influence on same-demographic group and other personnel. It should be noted, however, that the Navy accesses officers from the college-educated population rather than from the general population. Thus, the most appropriate comparison group for officers would be civilians holding college degrees among each race group.

Figures 5 and 6 show trends for Black sailors in our data. Black enlisted sailors have experienced the greatest gains in representation among the higher-YOS group (those in their 16th or higher year of service). Their representation in the other groups has varied a bit over the FY1995 to FY2018 period, but there have not been any major changes. There have been gains in Black representation in both enlisted and officer leadership (E7-E9 and the higher two ranks for officers). Blacks roughly doubled their representation in enlisted leadership, from about 10% to 20%. And, among the middle-rank group for officers, O4-O6, their representation also doubled from under 4% to over 8%. Black representation among Admirals (O7-O10) has generally increased over time, but the percentage has come down a bit since 2013, with a sharp drop in 2018. Randomness cannot be ruled out as a factor for this sharp decline since there are relatively few Admirals.

Figures 7 and 8 show the trends for Hispanic enlisted sailors and officers. Among enlisted sailors, Hispanics have historically been underrepresented at higher experience levels and among enlisted leadership. But, that gap closed, with large gains in Hispanic representation at higher levels of service and higher ranks.

Among officers, in Figure 8, Hispanics in higher YOS groups were underrepresented in FY1995, but became overrepresented, compared to their share of the U.S. population, relative to lower-experience levels by the end of the sample in FY2018. However, while Hispanics have had gains in mid-leadership representation (O4-O6), they have had fewer gains in representation among Admirals.

Figure 9 shows the distribution of Non-Whites and Whites by pay grade in the Navy in 2018 and highlights the overall lower representation of Non-Whites at higher leadership levels among both enlistees and officers.

Figure 4. Racial Diversity of Navy Officer and Enlisted Force.
Source: Population Representation CNA (2019).

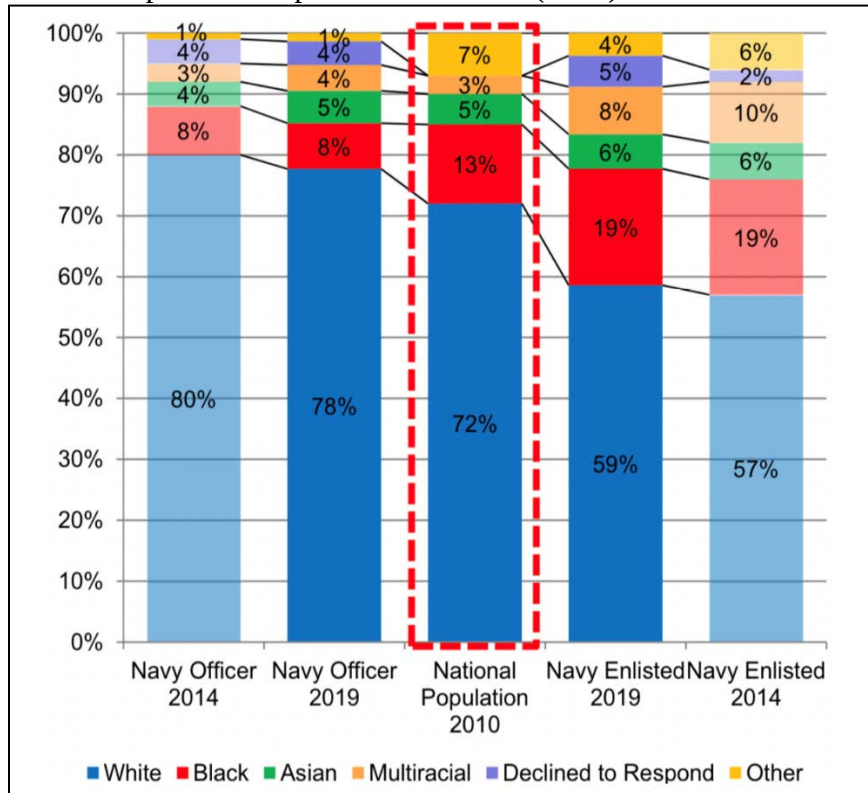


Figure 5. Trends in enlisted Blacks, by year-of-service (YOS) and rank. Source: (authors).

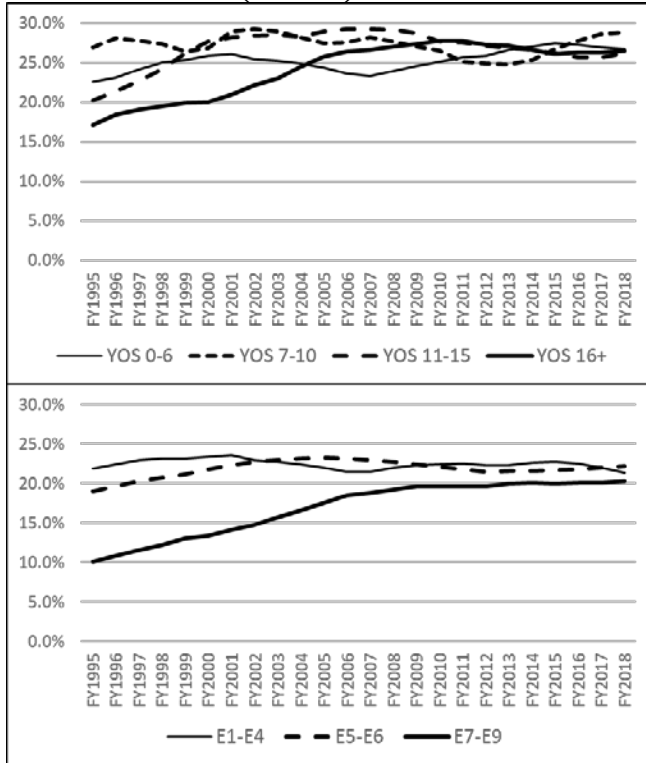


Figure 6. Trends in Black officers, by year-of-service (YOS) and rank. Source: (authors).

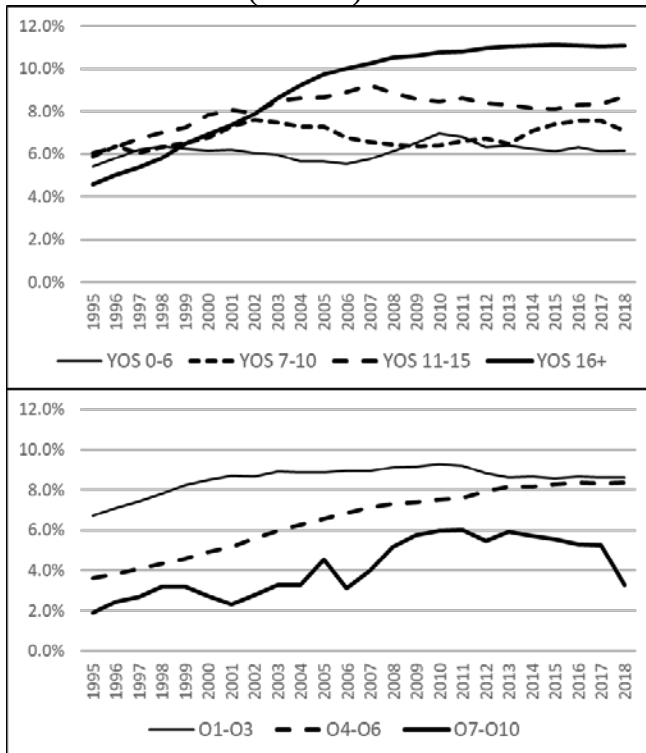


Figure 7. Trends in Hispanic enlisted sailors, by year-of-service (YOS) and rank. Source: (authors).

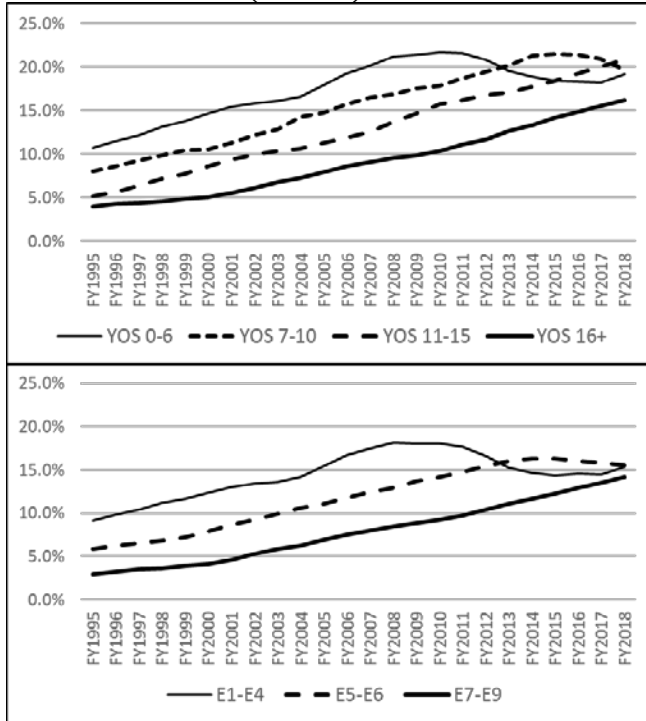


Figure 8. Trends in Hispanic officers, by year-of-service (YOS) and rank. Source (authors).

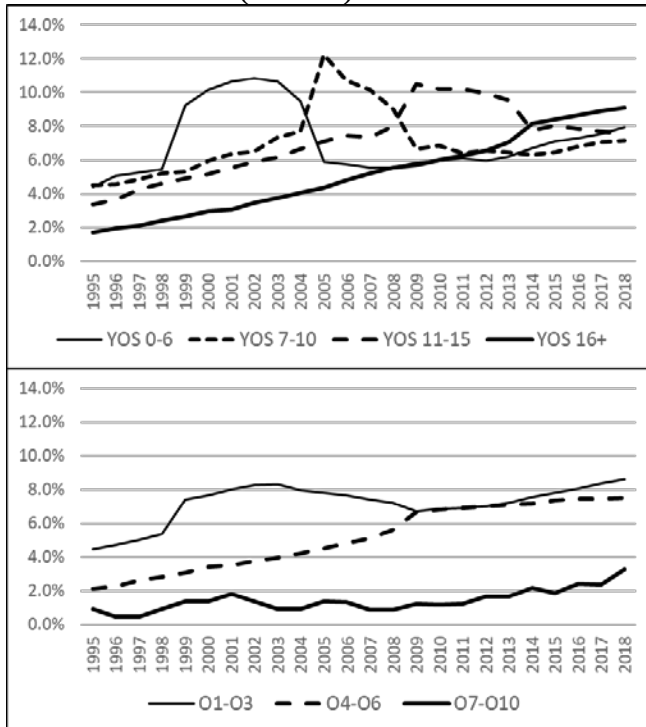
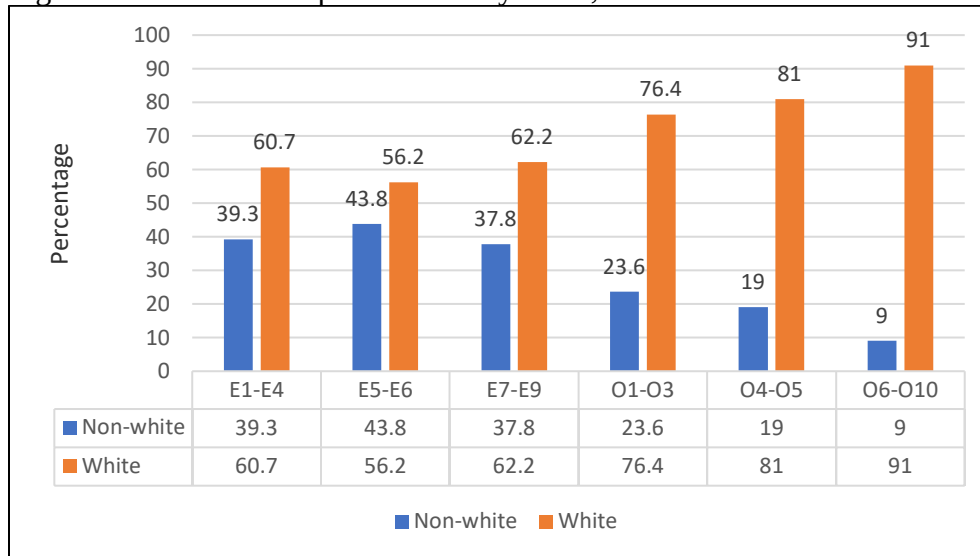


Figure 9. Non-White representation by ranks, FY2018



C. SUMMARY

There have been significant improvements over time in female representation among both enlisted sailors and officers. However, retention remains much lower for females than their male counterparts, as does the representation of females in leadership positions.

For Black sailors, retention appears to be just as high as other groups, as their representation in higher YOS groups is about the same as other groups for enlisted personnel and higher at higher-experience levels for officers. And, while Black sailors have made gains in enlisted leadership positions and mid-level officer leadership positions, there have been minimal gains in their representation among higher leadership. High retention rates for Black sailors may be partly attributable to weaker civilian employment opportunities and perhaps weaker stability of employment in the civilian sector, which could make the stability of military employment more valuable to Blacks. And, Black sailors might appreciate more the training they receive in the military.

Hispanics have had growing representation among enlisted personnel, with strong gains in leadership positions. However, for officers, Hispanics have had very low representation in higher leadership positions—lower than for Black officers.

III. CONCEPTUAL FRAMEWORK

The studies we will review below are anchored in theories of demographic similarity, including similarity-attraction, social identity, and Becker's (1972) theory of discrimination (for a survey see Kraus, et al., 2003). Social interaction theory has been applied to develop hypotheses about interactions in the workplace among groups of workers and between workers and superiors (Karaca-Mandic et al., 2013). An underlying assumption is that new employees need information to perform assigned job tasks, which requires interacting with other individuals in the work unit to obtain the required information. Social interaction theory suggests that individuals tend to form bonds with others based on their similarities. Among similar individuals, interpersonal communication is more collegial, and trust is greater, which leads to higher-quality interactions. In addition, there is greater cooperation among similar individuals, which tends to increase performance, enhance job satisfaction, and subsequently increase retention. In social interaction theory, when the group contains relatively few people of an individual's type, the marginal gain in interaction (and information) quality from adding an additional person of that type is high. However, the marginal gain in interaction quality tends to decline as the number of people in the group of the same type rises.

Social interaction theory underlies the hypothesis that the composition of both peer and leadership groups can affect an individual's behavior via their social interactions. The theory also implies that greater diversity can increase total unit performance, so long as the majority group is not affected negatively by the addition of members of the underrepresented groups.

While social interaction theory provides a foundation for the predicted effects of increased diversity in work units, prior studies have explored the concrete pathways via which increased diversity of specific social groups -- role models, mentors, and peers -- may influence the behavior of individual employees, and the likely direction of the effects. For mentors, the effects may operate in a number of different ways (Lyle and Smith, 2014): (1) mentors may improve the protege's learning and skills; (2) mentors may act as role models, which motivates the mentee's engagement and performance; and (3) mentors may encourage the adoption of organizational values by the mentee. The latter effect is potentially important in the case of the Navy where historical traditions and culture are deeply rooted.⁶

The main responsibility of leaders is to act as managers and supervisors, with their main duties involving assigning tasks, ensuring required work is completed, and supervising the conduct and performance of unit members. Thus, the mechanism by which they

⁶ Mentorship can be a formal program, or can be informal among employees, or superiors and subordinates. Social interaction theory suggests that mentoring relationships that are voluntarily formed based on demographic and other similarities will be more effective than those assigned arbitrarily by the organization, a prediction that is upheld by empirical studies (Johnson and Andersen, 2015).

affect subordinates may differ somewhat from that of mentors. Leaders can serve as role models, but do not necessarily act as mentors. Nonetheless, leaders would be knowledgeable of Navy Inclusion and Diversity initiatives and one of their responsibilities would be to implement those policies. A ‘passive leader effect’ would exist for leaders who act as role models for co-demographic employees. In addition, an ‘active role model effect’ may exist if co-demographic leaders are aware of historical career obstacles for underrepresented groups and seek to help these groups to overcome such impediments. The ‘active’ and ‘passive’ leader effects would tend to be reinforcing and thus contribute to a positive impact of greater leadership diversity on the performance and retention of co-demographic subordinates.

Beyond the “leader” and “mentor” effects, there is also the potential for a role-model effect of younger personnel seeing someone “like them” in a leadership position. Similar to the positive effects of underrepresented-group elementary students performing better when they have a same-race teacher (e.g., Dee 2004), having role models of the same race/ethnicity (or gender for females) can give a sailor the belief that they can succeed and advance in the Navy.

The mechanism by which peers impact same-demographic co-workers was suggested above by social interaction theory. The presumption is that same-demographic peers who share interests, experiences, and preferences, will form bonds, which will result in better communication, camaraderie, and support. This personal connection would translate into improved cooperation and collaboration in the workplace. Greater diversity should improve the underrepresented individual’s job satisfaction and job performance so that retention would tend to be higher for those with stronger peer support. As discussed below, peer support also is one of the Social Needs factors in Maslow’s *Hierarchy of Needs* psychological theory (Maslow, 1954)

However, the effect of the peer group on an individual may depend on the group’s characteristics. For example, Mas and Moretti (2009) find that high-productivity peers tend to increase the productivity of an individual worker. This mechanism may be important in predicting military retention. If the peer group for a given service member has a higher average aptitude (e.g., AFQT score), we might expect the member’s performance also to be higher, which would increase his/her promotion chances, and tend to increase the likelihood of staying in the Navy. Of course, a low-productivity peer group may have the opposite effect on an individual worker.

In the quantitative analyses below we explore these different mechanisms in explaining the effects of leaders -- as role models and mentors -- on subordinates, and peer groups on their individual members. We conduct both a qualitative assessment of these relationships as well as a quantitative analysis of personnel data. Section V discusses the results of surveys and personal interviews of junior officers and enlistees, while Sections VI and VII discuss the statistical analyses of the personnel data.

IV. LITERATURE REVIEW

Prior studies in the social sciences – including psychology, organizational behavior, sociology, and economics -- have investigated the effect of social groups, and the diversity of those groups, on the behavior of individuals belonging to or linked to the groups. The studies analyze data from a variety of settings, especially workplace and academic settings. Employment settings are the most pertinent to our study of Navy personnel, but studies of other environments also are valuable. All studies attempt to identify pathways through which social groups may influence individual behavior. They also highlight the modeling issues that confront researchers, especially the necessity of obtaining reliable, unbiased estimates of the effects of role models, mentors and peers

A. EFFECTS OF DIVERSITY IN THE WORKPLACE

Particularly relevant to our study is prior research that analyzes the effects of co-worker similarity (peer effects), or manager-employee similarity (role-model or mentoring effects), on employee turnover in the workplace. This stream of research relies mostly on observational data which requires that researchers develop research designs that attempt to address the non-random nature of such data. We focus on studies with research designs that attempt to address the endogeneity of the diversity measures, along with other issues that may bias statistical estimators.

In one of the few large-scale studies, Leonard and Levine (2006) test peer effects using data drawn from 70,000 employees of a large US retailer. They identify the effect of workforce composition on voluntary turnover across employees in 800 retail stores over 30-months. Their models include workplace fixed effects to control for unobserved factors (e.g., job characteristics, working conditions, and location factors) that could bias the estimates. They find that: (1) there is no consistent evidence that demographic composition of the workplace (along gender and race dimensions) affects employee quits (i.e., workers choosing to voluntarily leave); (2) racial isolation is correlated with higher turnover; (3) there is no retention effect of being what they call a ‘token’ employee (i.e., only one member of a group in a given workplace).

A second large-scale study (Hirsch, Jahn, and Zwick, 2020) uses a sample of 2.6 million workers in all large manufacturing firms in Germany over a long period. To account for unobserved factors, they also use workplace (plant level) fixed effects in Cox duration models of quits. They find that for women, greater co-worker similarity at the plant level is associated with lower voluntary turnover.

Giuliano, Levine, and Leonard (2010) analyze how own-race matches between managers and employees affect voluntary quits, dismissals, and promotions using the data from Leonard and Levine (2006). The models exploit changes in employees’ managers to identify the effect of manager’s race on quits. In particular, they compare quit rates of employees whose managers changed during the 30-month observation period versus the

quits of employees whose managers remained the same. Estimates from hazard models with store-level fixed effects find that quit rates are significantly lower for Whites, Hispanics, and Asian employees who have new own-race managers, but not for Blacks. The effect is strongest among Whites.⁷ Because Giuliano et al.'s results are based on differences between the quit rates of employees who did and did not experience a change in managers, they argue that employee bias is the most likely explanation for the findings.

Another stream of research concentrates on the persistence of women in different organizations and explores the unique pathways via which social groups may influence the organizational commitment of women. In terms of gender peer effects, Elvira and Cohen (2001) find that voluntary turnover of women in a Fortune 500 company is lower when more women are employed at their job level. Gender peer effects on persistence appear to be especially strong in male-dominated fields, such as STEM (Hunt, 2016; Bostwick and Weinberg, 2018) or the military. One military study found that early attrition of female enlistees is lower in occupations with “. . . a higher and more supportive ‘female mix’” (Laurence, Naughton, and Harris, 1996). Huntington-Klein and Rose (2018) found that persistence of female cadets at the U.S. Military Academy is higher in cadet companies with a higher representation of women.

While one pathway for gender peer effects operates via the number of female mentors or role models in the workplace (Matsa and Miller, 2011) -- the effect researchers hope to capture -- another pathway likely operates via workplace culture or climate. These factors can be affected by institutional factors such as organization policies, training, and unit command leadership, which could lead to more females in the workplace and a higher likelihood that a given female would continue working for the organization. This presents a potential source of omitted-variables bias that makes the results of such studies ambiguous, given the multiple explanations for the results.

Workplace climate appears to be particularly important in male-dominated workplaces, where women are more likely to report sexually harassing behavior (Hunt, 2016). In the US military one survey finds that 71 percent of active-duty women reported some type of sexually harassing behavior in the previous year (Antecol and Cobb-Clark, 2006). Surveys of Navy enlisted personnel find that more than one-half of female respondents believe that sexual harassment is a problem, and more than 40 percent report experiencing gender discrimination (U.S. Navy, 2006).

A recent study relied on focus groups to identify the root causes of the higher attrition rates of women in the U.S. Coast Guard (Hall, et al., 2019). One major factor cited by women as a key reason for leaving the Coast Guard was leadership. Participants cited a desire for an increase in female leaders who could act as role models and mentors for junior personnel. Participants also cited gender bias and discrimination as contributors

⁷ The results for dismissals and promotions are similar: Black, Hispanic and Asian employees have lower dismissal rates and higher promotion rates if they have co-race/ethnic managers. However, for White employees, dismissals and promotions are similar or worse when working under new White managers than when working for new non-White managers.

to their decision to leave. These results support our expectation that higher diversity among leaders tends to increase retention of underrepresented groups. Moreover, their results mirror those we obtain from surveys and interviews of women and underrepresented groups in the Navy for this study (cited below).

Other than the studies on the mechanisms for why females could be affected by the lack of leadership, most of these studies pertain to civilian jobs, which poses a problem with the research. Jobs are voluntary and chosen by the workers. A person from an under-represented group, generally, would have a good sense of the diversity of an organization when he/she applies to work for that organization. Hence, it is possible that those from under-represented groups who chose to work for low-diversity organizations were, on average, more likely to believe they could still thrive than those who chose not to work for the organization. This presents a self-selection bias, which would bias results towards diversity having a larger effect than it would for the population.

B. MILITARY STUDIES ON PEER EFFECTS, ROLE-MODEL EFFECTS, AND DIVERSITY

In contrast to the studies from the civilian world, studies on the effects of role models and peers using military data tend to be more valid due to the involuntary and random nature of military assignments.

Similar to studies in civilian university settings that relied on random assignment of dorm roommates to analyze how certain characteristics of roommates (e.g., SAT scores) affect an individual's academic achievement (e.g., Sacerdote, 2001; Kremer and Levy, 2008), Carrell et al. (2009) examine the effects of peers of cadets at the U.S. Air Force Academy. An important contribution of their study is that they also investigate the importance of identifying the relevant peer group. When they define the peer group as dorm roommates, they find only moderate effects of peers on the grades of freshmen Air Force Academy cadets from having roommates with higher SAT scores. However, when they analyze a broader peer group than dorm roommates (Squadron mates), they find large positive effects from high-SAT peers on GPA of freshmen, and that these effects persist into later years of college. The issue of potential measurement error in defining the relevant peer group is applicable to our own empirical analysis below.

The effect of role models or mentors is also examined using data on West Point cadets by two studies. Lyle (2007) analyzes data on West Point cadets who are randomly assigned to cadet 'companies.' For freshmen in each company he defines peers as other freshman in the same company, whereas he defines role models and mentors as the sophomores in the same company. He finds no significant peer effects on academic grades, but that both peers and role models affect the choice of academic major and the decision to remain in the Army (as commissioned officers) past 5 years of service.

Kofoed and McGovney (2019) examine, at West Point, how having "tactical officers" of the same-race/ethnicity (for Black and Hispanic cadets) or same-gender (for female

cadets) affects the likelihood that cadets choose the same occupational field as that of the tactical officer. Tactical officers are randomly assigned to each cadet company and are responsible to train and mentor the cadets, so they also could be considered to be role models.

The authors use a Difference-in-Difference (DD) approach to control for differences between the two groups that exist in the absence of the treatment. In this case, the approach compares how, for example, having a Black tactical officer affects the likelihood that Black cadets choose the same occupational field relative compared to the probability of non-Blacks choosing the same field. Based on the DD approach, the study finds that both female and Black cadets are more likely to pick the same occupational field as their tactical officer when they have a co-gender or co-race tactical officer, respectively.

One major concern with this study is that, due to tendencies of cadets of certain demographic groups to enter certain occupational fields, there would be a natural positive correlation between being of the same demographic group and choosing the same occupational field as the tactical officer. Likewise, there would be a natural negative correlation in occupational fields for a cadet and a tactical officer of an opposite-demographic group. This is certainly true for females, who were restricted from certain branches during the period covered by the data. For example, 27% of male and 0% of female cadets go into Infantry (combat), while 10% of males and 17% of females go into Military Intelligence. And, it is also the case across race/ethnicity—for example, while 25% of White cadets choose the Infantry (combat) branch, only 9% of Black cadets do so. This means that what we observe as a same-group effect might just be a spurious correlation (a positive omitted-variables bias) rather than a role-model effect.

This bias is exacerbated by using the DD approach. The DD approach, again, compares the estimated effect of a female tactical officer on female cadets choosing the tactical officer's branch to the estimated effect of a female tactical officer on male cadets choosing the tactical officer's branch. The former is positively biased for the reasons mentioned above, while the latter (the effect of female officers on male cadets) would be negatively biased for the same reasons. Because the latter effect (for males) that is negatively biased is subtracted from the female effect (that is positively biased), the positive omitted-variables bias would be exacerbated.

This has implications for how we model diversity effects in our study. If greater diversity affects those in the majority groups (i.e., Whites and males), positively or negatively, then a DD approach would not be appropriate for our study. For that reason, as described below, we restrict the samples and estimate separate models by gender or race/ethnicity group.

A study by Karaca-Mandic et al. (2013) is similar to our study in that it attempts to assess the separate effects of both peers and leaders at the unit (company) level on the performance (measured by promotion speed) of Army junior enlisted personnel. Their results show that the demographic composition of peers and leaders have different

effects. In particular, they find that an increase in the percentage of female leaders in the unit decreases the time-to-promote for women relative to males, whereas an increase in the percentage of female peers increases the time-to-promote for women. They find a similar pattern for own-race leaders and peers on the time-to-promote of racial underrepresented groups. The only exception to this pattern was a positive peer effect on time-to-promote for Hispanics.

Kraus et al. (2013) represents the quantitative study that is most similar to ours in that it examines data on the effect of co-worker similarity members on retention of Surface Warfare Officers (SWO). They measure the demographic composition of the crews of all Navy surface ships and investigate whether the percentage of the ship's crew that is same-gender or same-race/ethnicity affects the retention decisions of women or racial/ethnic underrepresented groups (Blacks, Hispanics and Asian-Pacific-Islanders), respectively. The study finds no significant relationships between crew diversity and retention for any of the demographic groups. The authors attribute the lack of statistically significant results to limited variation in ship diversity and the low percentage of crews who are women in their data. This suggests that a diversity effect may exist, but that the lack of variation in their key variable did not allow their models to detect the effect.

That said, other issues in the research design also may contribute to the lack of results in Kraus et al. Retention is defined as remaining in the SWO community until YOS 6. Thus, separations include those who leave the Navy altogether, as well as those who leave the SWO community, but remain in the Navy. Hence, the measured separation rates are higher (and retention rates lower) than in more standard measures of retention. Also, the sample includes both very large ships (e.g., Aircraft Carriers), and small ships (e.g., Frigates). The relevant peer group may differ substantially depending on ship size. On a large ship it is questionable whether the relevant peer group would be the entire crew, or as is more likely, a smaller subset of co-workers, such as a division or department. Also, diversity is measured on the last ship on which the officer is observed at YOS 6, but at YOS 6 most JOs have completed two division officer tours and may be serving ashore rather than on a ship.

C. KEY LESSONS TO AVOID BIASES

Prior research highlights several potential biases that researchers must deal with. First, there is the possibility of omitted-variables bias, in which the key treatment variable is getting blamed for, or credited with, the effects of something correlated with it. Particularly regarding females, the percentage of females in a workplace could be indicative of, and correlated, with a culture that is conducive to females. Further, there could be self-selection bias in that females who choose to work for organizations with fewer females could be more likely to believe they could, despite the lack of diversity, thrive in such an organization more than other females who choose not to work for an organization with low female representation. The same argument could be applied to under-represented racial/ethnic groups. Finally, there is the possibility of measurement

error, highlighted by Carrell et al. (2009) and Kraus et al. (2013), in that the peers (or role models) identified by the researcher might not be the true social groups that a given subject considers when making decisions to stay or leave an organization.

The first two potential problems of omitted-variables bias and self-selection bias are unlikely to be factors in military studies because assignment to units is largely based on where there are openings. Thus, the current members of under-represented groups at a military unit (and a given subject of an analysis) would likely not be able to choose a given unit.

The possibility of measurement error remains a potential issue for our study. However, in this study, we examine small-to-medium-sized ships to ensure that sailors in the sample pretty much know most of the crew members on a ship.

D. OUR STUDY

Our quantitative analysis of diversity described below in Sections VI and VII, is similar in part to the Kraus et al. (2013) study, but we introduce several new features. First, in addition to analyzing officer retention, we focus on enlisted retention. Second, whereas Kraus et al. (2013) combine peers and leaders into a single group, we create separate diversity measures based on diversity among enlisted versus officers. Third, for enlistees, we use the quarterly snapshots for each sailor to create diversity measures of ship crew composition for the whole time a sailor was on a given ship. Finally, we apply estimation techniques that allow for interpretation of our estimates of the key relationships between group characteristics and retention as causal.

V. QUALITATIVE ANALYSES

This section discusses the qualitative assessments of retention determinants, which are intended to complement the quantitative effort discussed below in Section VI. These qualitative methods were used to identify the concerns of sailors that are important in their decisions to leave the Navy. The techniques attempt to discover factors that may explain the existence of any effects of the diversity of peers or superiors on retention among Navy personnel, as well as the possible directions of these effects. As mentioned in Acknowledgements, the analysis discussed here is based off of the student thesis (Thomas and Dunklin, 2020) we guided and participated in with interviews.

Let us qualify this part of the analysis to say that the three of us were not trained in qualitative methods. Someone with formal training in qualitative methods would likely have taken a different approach. Our objective was mostly to discover patterns and note, in particular, what members of underrepresented groups mention as some of their greatest challenges.

The assessment instruments consist of a questionnaire and personal interviews. The instruments were developed based on Maslow's *Hierarchy of Needs Model* (Maslow, 1954) and Herzberg's *Two-Factor Model* (Ozunger and Ozunger, 2014). Both models are derived from psychology and revolve around job satisfaction and motivation as it relates to employee job performance. The surveys and interviews were aimed at identifying factors that affect the retention decisions of JOs and first-term enlistees and comparing factors cited by underrepresented groups versus those cited by majority groups.

The thesis students (Capreece Dunklin and Jeremy Thomas) and two of us authors (Arkes and Tick) visited four Naval Surface ships. The ship's leadership arranged to have us brief all junior personnel (among enlisted sailors and officers) on the study's objectives. We distributed a survey, and although we did not count, it appeared that at least 90% of the first-termers filled out the survey. And, we had a sign-up sheet for voluntary in-person interviews, although many individuals would just check back to see if one of our team members were available.

A. SURVEYS

The surveys collected the views of junior sailors on 20 different retention factors. We asked how important each of the 20 factors was to their retention decision (on a three-point scale) and how their experiences have been with regard to that factor (on a five-point scale from 'very-negative' to 'very-positive'). In addition, we asked about their likelihood of reenlisting or deciding to stay in the Navy. The survey instrument is included in Appendix A.

We developed 20 factors of retention to capture all levels of Maslow's *Hierarchy of Needs*:

- Basic physiological needs
- Safety and security
- Social needs
- Esteem needs
- Self-actualization.

Our focus was on "Social Needs," as this category should be most affected by the degree of diversity for underrepresented groups. And, the four sub-factors we developed for "Social Needs" are:

- Peer support
- Feeling as if you are part of the team; overall camaraderie
- Professional mentorship
- Personal mentorship.

While personal views of sailors are invaluable in providing a framework for understanding retention issues, the value of the survey results were limited due to the limited sample size. Despite the high response rate for the survey, only 143 crew members completed the survey, which is not large enough to be representative of the Navy (officer or enlisted). Also, the size of the separate samples of enlisted and officers, and of racial/ethnic groups were too small to permit comparisons (e.g., of retention intentions and other questions) between racial/ethnic groups or between men and women. Thus, no statistical significance can be established for differences across groups in the survey responses. Because of this, we will focus on the interviews -- see Thomas and Dunklin (2020) for the results of the surveys. In addition, while we might not have had the sample size and statistical power to make strong conclusions from the surveys, the retention survey does serve as a building block for developing future Navy surveys.

B. INTERVIEWS

The thesis students (Capreece Dunklin and Jeremy Thomas) and two of us authors (Arkes and Tick) interviewed 45 first-term enlisted sailors and officers, which is 31% of the 143 interviews (although we believe a few participated in the interviews without doing the survey). One potential issue regarding the interviews is self-selection bias in that the interviewees voluntarily chose to be interviewed. And similarly, the ships that were assigned to us may have had a degree of diversity that diverged from that in the surface community. Nevertheless, there were valuable insights we gained.

The interview responses were used to identify recurring themes around the specific factors that were listed as being important in the stay/leave decisions. We identified five recurring themes from the individual interviews:

1. Underrepresented groups appear to face greater obstacles linked to Navy policies, culture, and interpersonal communication than the majority groups.
2. Underrepresented group members have inferior experiences with mentors.
3. Underrepresented group members tend to believe there are limited opportunities for them in the Navy.
4. Underrepresented group members are more likely to mention difficulties fitting in with peers.
5. Most junior personnel prefer working under prior-enlisted officers.

These themes from the surveys and interviews were informative about the issues that underrepresented groups face in the workplace. The problems appear to be partly rooted in Naval culture and tradition. The issues include oversights in Naval policies that unfairly target Blacks, and perceptions of limited opportunities for people of color and women due to the lack of same-race/ethnicity and same-gender mentors and role models in higher ranks. Problems also arise due to weak interpersonal relationships with peers and superiors stemming from un-relatability and poor communication. During the interviews, both people of color and females mentioned a glass ceiling where diversity and representation is no longer important. The lack of representation at the leadership level means policies often are initiated without the input of underrepresented groups. Any adverse effects of the policies are treated as just another oversight. We now discuss the themes in greater detail and offer some representative narrative responses. Additional relevant responses are provided in the corresponding thesis (Thomas and Dunklin, 2020).

1. Underrepresented groups appear to face greater obstacles linked to Navy policies, culture, and interpersonal communication than the majority groups.

People of underrepresented groups mentioned how certain rules, guidance, and even the administration of such rules work against them. Grooming rules are more difficult to follow (particularly for Black sailors). In addition, smaller things, such as the informal guidance given on port visits, appears to be targeted to underrepresented racial/ethnic groups. Some sailors of underrepresented racial/ethnic groups feel that the rules are applied inequitably, with White sailors given more “rope” to make mistakes. And, even with the military efforts to reduce sexually harassing behavior against women, the impact of such acts and official response can be lasting. We now present some quotes that highlight this theme.

(Underrepresented-group female): “I don't think there's anything that'd make me want to reenlist, other than ... [to] just take care of my family. My family is really what pushes me to deal with all of this. But right now, I don't see anything positive with moving forth and continuing...I'm not comfortable with the environment.

(White female): “Well, I will just tell you -- and I'm allowed to talk about it 'cause it's okay -- but I was stationed on a different ship before this, and my immediate supervisor ... sexually assaulted me. ... [H]e was supposed to be my leader, which made it all the more worse. ... [T]his individual

not only was promoted to [...] ⁸, but [h]e was entrusted with so many things and was supposed to be my leader. And so it's not only like faulty leadership on his part, obviously, but also faulty leadership on the people surrounding him that maybe didn't see some things that they should have. I think that, after that experience, there was a lot of people who, obviously, helped me and a lot of positive female role models, which is huge for me as a female. But even then, I don't think that -- I just think that the culture and the leadership style is pretty widespread, and it's lacking ... And it needs to be better. And somebody like me, it makes me not want to stay in."

(Underrepresented-group male): "As a person of color, I can't shave every day. I can't do it, literally just cannot do it, because if I do...I'm gonna get hair bumps everywhere. | Now you're telling me shave or get out. How fair is that? I'm gonna call it oversight because I think it's just the fact that they want everybody to look one way, but if you want to be diverse, everybody doesn't look the same way."

(White male): "I don't see a lot of like initial racism I do see that sometimes there can be troubles and miscommunication. I had that with a sailor that we had two years back. He was an African American and he spoke kinda in a different dialect sometimes. And so sometimes that made it difficult for me to work with him, and it just made [it] kinda a frustration on me 'cause I wasn't always willing to really work to understand him sometimes 'cause of like I just kinda grew out of patience for it -- which I feel bad about... I think that's the biggest factor I think, is, honestly, is communication. If we just talk to each other and we, like I said, we just learn like where we came from, it makes us better as people and it makes us better as a command to trust each other better."

(Underrepresented-group female): "[sailor's recount of command liberty guidance] And then you go on liberty and they'd be like, "Oh, when you go on liberty, go with somebody you trust...You don't have to go with people that are your color...[J]ust go out with somebody you trust. You don't have to go out with just Black people."...Like I work in a high stress environment...And just having that little thing like that playing in the back of your head only adds to the stress."

(Underrepresented-group male): "I'm very much aware of my surroundings, and I don't believe I have the same amount of rope as my counterparts in general. It's just things, life in general, things I've seen. I try to be a little bit more careful how I go about things because I don't want to be labeled as, "Oh, this guy is aggressive," which is often something people like to label people that look like me...we don't have the

⁸ Content removed to preserve the anonymity of the respondent

same amount of rope, like we don't get that cushion that others get, and that's just the reality, and that sucks.”

2. Underrepresented group members have inferior experiences with mentors.

The following quotes demonstrate how important role models can be and provide an example of an underrepresented-group member who did not have adequate mentorship.

(White female): “I think having a proper role model is better for us. ... [Y]our friends are good ... but you also need to have somebody who's been through it before.”

(Underrepresented-group female): “I feel like leadership has to kinda sit down sometimes with people and say, ‘Hey, what is it that you think you need or what is it that you want for us to do? Even if it's only 5 years or you're gonna do 20 years, what is it we can do to help you on your path, whatever that is?’ And I feel like people need that individualized [attention] sometimes, so that way they know that they're cared for and they're not just another number to another Chief or to another Division Officer.”

(Underrepresented-group female): “I don't feel supported or helped...It's kind of just been me, hitting my head until I get a little bit further...you just push yourself through.”

3. Underrepresented group members tend to believe there are limited opportunities for them in the Navy.

This theme highlights the importance of not having adequate diversity among role-models, which can take away someone's belief that they could have a future in a more advanced position. And, it might give a sense of loneliness if they were to stay in the Navy. Here are some relevant quotes.

(Underrepresented-group female): “Like where's my future? And even my mom was like, ‘You're not really gonna do 20. No one's gonna pick you to be a CO of a command one day or something like that. So that's the uncertainty.’ I'm like, ‘Well, I'll just have to wait and see and do the best I can.’ But that's the uncertainty; like even my mom doesn't think the Navy's gonna pick me to be in command.”

(Underrepresented-group male): “There's no one I can relate to in the wardroom. So, for sure, there are some personalities that I like, but it

would be cool if there was another [person of the same race/ethnicity] in the wardroom...it would be nice if there was somebody I could relate to.”

(Underrepresented-group male): “[If] you go look at other branches, it's not uncommon to see people of color in senior leadership. There's a huge disparity between the Navy and its leadership and what it looks like versus almost all the other branches. Like I've gone to different places and I've seen people of color as a CO, XO, top guy or whatever. And then you see Navy it's usually White. ... I do feel like I have to work harder than my counterparts.”

4. Underrepresented group members are more likely to mention difficulties fitting in with peers.

We include here two quotes that speak to this issue, one from a White sailor and one from a member of an underrepresented group.

(White male): “We're a big melting pot, and we've clashed many times, but at the end of the day I think we all thoroughly love each other and we help each other no matter what, like at work, not at work. I know if I needed help doing whatever tasks, I'd call someone that I know that I work with, and I know that they'd be there for me.”

(Underrepresented-group male): “I don't hang out in the wardroom. I feel like if you say the wrong thing to another officer, they may or may not have your back. We're supposed to be one team, one fight, but just that culture is like -- you know what they say about the SWO pin? They got two swords, one to stab the guy in front of you and one to stab the guy behind you.”

5. Most junior personnel prefer working under prior-enlisted officers.

This issue can speak indirectly to diversity, as commissioning enlisted personnel might be one way to increase diversity among the officer ranks. And, if prior-enlisted officers can elicit higher retention among the personnel serving under them, then encouraging more enlisted Sailors of underrepresented groups to become officers could have a double benefit of eliciting greater retention and increasing diversity among the officer ranks.

We found that nearly everyone, including officers, said that they preferred serving under prior-enlisted officers. Some of the reasons are made clear in the quotes below.

(Underrepresented-group female): “In general, people who are prior enlisted kind of have just like a more down-to-earth way of going about business...I think officers are a little better off on board when they've been

prior-enlisted, because I think they have a better understanding of how both sides work, rather than just having a one-sided approach. Some officers talk to enlisted sometimes gives off the impression of just "I'm more high and mighty than you" kind of thing."

(White male): "So, prior-enlisted definitely are a little bit more grounded. Like they know, 'Okay, this is what's expected. This is what's actually accomplished. Like you can actually do this.' ... [P]eople from the Academy ... seem to come here and they already have it in their head that they know what's going on. ... They did their schooling ... but it doesn't automatically qualify you because there's a lot to learn on a ship And so I believe that Mustangs work better. And I've always been actually kinda curious why we don't encourage that more, because to me it makes more sense to have somebody who's had naval experience first go into ... an officer role, as opposed to bringing somebody who has no naval experience and being in charge of an entire division."

One respondent recommended that all officers spend a few months as an enlisted sailor aboard a ship so that they understand the life of an enlisted sailor. This could include modifications to the summer program for Academy and ROTC members to spend time in an operational and sea-going command to include a longer period on a ship, in which they could perform basic duties and be part of standing watch with junior enlisted sailors. Another respondent suggested that the Navy increase the number of enlisted sailors who become officers.

C. SUMMARY OF INTERVIEWS

The responses suggested that improved diversity in higher ranks may offer a solution to some of the cited issues. Such a change would send a message to underrepresented sailors that their voices are being heard, that there are role models to follow, that there are opportunities for them to succeed, and that, most importantly, they can be themselves. Underrepresented groups often express the need for commonality and relatability in the upper ranks with the belief that more representation will result in more inclusive policies, fairer treatment, and better mentorship. There was a belief that an increase in people of color in leadership positions not only would improve retention of underrepresented groups, but also of all sailors.

We found camaraderie, mentorship, and leadership support to be important to all sailors. However, interpersonal relationships experienced by people of color were not as positive as those experienced by their White counterparts. Sailors discussed the isolation from being treated differently by peers and superiors, which posed additional stress during long underway periods. Over time this practice often leads to a 'fight or flight' response from not having someone to relate to and share experiences. As a result, the retention decisions of underrepresented groups are negatively impacted by their reduced sense of social belonging and social contribution.

One other important result was that nearly all junior personnel mentioned that they preferred serving under prior-enlisted officers than under Naval Academy or ROTC officers. The reason often used to justify this view is that the prior-enlisted officers better understood the pressures they face and the distinction between tasks that truly need to get done versus those that are unnecessary.

VI. QUANTITATIVE ANALYSIS: DATA AND MODELS

For the statistical analyses, we obtained data from DMDC for all Navy enlistees and officers. The files included end-of-quarter snapshots on the universe of active duty personnel from October 1994 to June 2019. We track each individual until they separate or until September 2019. Each quarterly observation for an individual included:

- Active-Duty Base Date (their official start date for active-duty service)
- End of active obligated service (EAOS)--the date their contract ends
- Unit Identification Code (UIC) -- the ship or station they are currently serving on
- Rating
- Race
- Ethnicity
- Gender
- Armed Forces Qualification Test (AFQT) score (for enlistees)
- Commission date (for officers)

The initial file contained 28 million person-quarter records for enlisted personnel, and over 5 million person-quarter records for officers. Below, we describe our sample criteria and the definition of the key variables used in the statistical analyses.

A. DEFINING RACE/ETHNICITY

There were three issues with the coding of race in the DMDC data files. First, the coding changed in September 2000, and the categories were expanded in 2003. Instead of single-race categories, individuals were classified into one of 30 different categories of combinations of races. (The Hispanic categorization is straightforward, as there are categories that are specific to being Hispanic.) Second, race or ethnicity was missing for some individuals. And, third, some individuals were classified with a different race over time.

We addressed the third problem by using the last reported race in the file, and we believe this is sufficiently minor to not have any major impact on the analysis. For the second problem, we counted those with race/ethnicity missing as not being in our race-ethnic categories, Black, Hispanic, and White. The first problem required more investigation. We compared those who were under both schemes: they had an observation from just before the categories were expanded and after the expansion of categories. We found that those who identified being Black and one other race in their last observation were more likely to identify as Black when they had to choose. In contrast, those who identified as Black and at least two other races were far less likely to be classified as Black before the categories were expanded. Thus, our classification of individuals into race/ethnic groups, based on the last observation we have for a given individual, is the following:

- Black: they would need to be classified as solely Black, or Black plus one other race.
- Hispanic: they would need to be classified as Mexican, Puerto Rican, Cuban, “Latin American with Hispanic descent,” or “Other Hispanic descent.”
- (Non-Hispanic) White: they would need to be White and no other race, and for ethnicity be coded as “None” or “Non-Hispanic.”

B. THE REENLISTMENT OUTCOME FOR ENLISTED SAILORS

Our goal was to determine whether a service member chose to stay in the Navy or leave. For enlistees, we based retention on whether they reenlisted, which is committing to the Navy for an additional three years or more. For this purpose, we used their End-of-Active-Obligated-Service (EAOS) dates. This date changes only when a sailor reenlists or extends his/her service. An extension involves agreeing to no more than 24 months of additional service. Extensions are often used to allow a sailor to finish an assignment, or to delay a decision to reenlist for 3-4 years in the hope that a larger selective reenlistment bonus (SRB) will be offered.

We identify a formal reenlistment based on whether a sailor’s EAOS date advanced at least 36 months from a baseline EAOS date (see Arkes, 2018). Sailors who left the Navy before their initial obligation ended (attrited) were counted as not reenlisting (if they were observed at least 5 quarters on a ship). We excluded from the analysis those who had not left the Navy and did not have an EAOS extension of at least 36 months by the 84-month point of their career.

Sailors originally have an initial obligation that is 4, 5, or 6 years (some sailors in our sample had a 3-year initial obligation, but those are no longer offered). Those with a 5- or 6-year initial obligation officially have a 4-year enlistment and a required 1- or 2-year extension.

There are actually two official EAOS dates: a “soft EAOS date” and “hard EAOS date.” The soft EAOS indicates when the obligation actually expires, after any extensions. In contrast, the hard EAOS for those with the 5- or 6-year obligations is just 4 years. Unfortunately, the DMDC data only identifies the “hard EAOS,” which means we cannot distinguish between those with 4-, 5-, or 6-year initial obligations. Consequently, there are two reasons for why an individual stayed for 7 years: (1) she had an obligation of 4 years and reenlisted for 3 years; or (2) she had an obligation of 5 or 6 years and extended for 2 years or 1 year, respectively. We treat both cases as a reenlistment. While we might incorrectly classify some extensions as reenlistments for those with 5- or 6-year initial obligations, this will not introduce a large error since an extension signals that the sailor was not so dissatisfied with the Navy to attempt to leave as soon as possible.

What might be more problematic is that some sailors with longer initial obligations are offered an option to reenlist early, at around the two-year (24-month) point (generally in

exchange for an SRB). This means that the measured crew diversity they experience on their first ship assignment would actually occur after their decision to reenlist.

This situation should not create an omitted-variables bias, as the eventual diversity measured for them should not be systematically correlated with the factor that caused them to reenlist. However, it could contribute to measurement-error bias in that the diversity we measure for the sailor is not what was considered when the sailor made the decision whether to reenlist. The likely direction of the bias from measurement error would be towards zero, meaning that any estimated effect we find would understate the true effects. We attempted to address this issue by excluding the three ratings (EM, ET, and MM) that have 5% or more sailors with an EAOS date of at least 8 YOS by the 34-36-month point. Note that we only observe a sailor one time in the 34-36-month point, based on our having quarterly data.⁹

C. THE RETENTION OUTCOME FOR OFFICERS

For officers, the EAOS date is rarely used. Thus, our retention measure is based on whether the officer was still in the Navy at the 7-year point. Initial obligations are five years for most officers. Thus, being present at 84 months is indicative of some commitment to stay in the Navy.

D. DIVERSITY MEASURES

The measures of diversity are based on the proportions of various components of the crew who are Black, Hispanic, or female. These proportions are calculated for two different groupings of shipmates: (1) for each ship's enlisted crew and officer crew, and (2) separately among first-term peers (those with 72 months of service or less) and leaders (those in ranks E5 or above for enlisted leaders and in ranks O3 or above for officer leaders, with at least 85 months of service). We did not consider other racial/ethnic groups or more narrowly-defined ethnicities within the Hispanic group, as there were insufficient observations to generate enough power to obtain precise estimates.

The details of the construction of the diversity measures are described in Appendix B. As a quick summary, our methods involved the following steps:

- We identify the ship on which a sailor served the most time (based on quarterly observations); to be included in the sample the individual needed to be observed on that ship for at least 5 quarters.

⁹ An enlistee with a 4-year obligation would not have the option to reenlist so early, so their EAOS date should not advance by the 36-month point. As expected, the results from unreported models that include these ratings have lower standard errors (due to the larger sample size) but also lower coefficient estimates, which is likely due to the bias towards zero due to measurement error.

- For the sailor's time on that ship, we summed the total number of person-quarters falling into a given category and summed the total number of person-quarters who are female, Black, and Hispanic.
- We calculate the proportions of total personnel who are female, Black, and Hispanic. (So, people serving 6 quarters on a ship with the subject will be counted 6 times in the denominator and 6 times in the numerator if they fall into one of the groups of Black, Hispanic, and/or female.)

E. MEASURES OF THE PROPORTION OF OFFICERS WHO ARE PRIOR-ENLISTED

One other key explanatory variable we added is the proportion of a ship's officers who were prior enlisted. Prior-enlisted officers may serve as role models and/or mentors, especially to the enlisted crew. They have different backgrounds, experience, and skill training than officers who access directly from the standard commissioning programs (USNA, NROTC, OCS). These differences could affect the quality of their mentorship of first-term enlistees, as well as new division officers. This mentoring effect was mentioned by the interviewees for this study, many of whom stated they preferred to work with, or under, prior-enlisted officers (see Section V).

For enlistees, the prior-enlisted officer variable is based on their proportion in the entire officer crew. For JOs, we use the proportion of prior-enlisted officers who are in grade O-3 or above, and who have at least 85 months of service. The construction of the prior-enlisted variable follows the same procedure (just described above) as in calculating the proportions of various underrepresented groups.

F. SAMPLE REQUIREMENTS

Our main sample criteria were that the subjects entered the Navy between October 1994 and June 2012 and were observed to serve on a medium or small ship (defined below) or a submarine for at least five end-of-quarter observations.¹⁰ Our data go from October 1994 to June 2019, thus we set the latest date for entry at June 2012 to allow enough time for the sailor to make a reenlistment/retention decision.

Table 1 shows the various ship classes, along with their normal crew size and the number of ships currently in the fleet in each class. We focus on small- and medium-size ships, including submarines, because sailors tend to know everyone on those ships and thus the identification of peer and leader groups is likely to be more accurate. In contrast, on

¹⁰ Almost all junior personnel in the Surface Warfare (SW) community serve on a ship for at least 5 quarters.

larger ships it is difficult to identify the true peers and leaders for a given sailor, which could introduce measurement error in our diversity measures.¹¹

Ships are identified based on Unit Identification Codes (UICs). The list of current ships came from various sources within the Navy’s intranet site, including the “Navy Vessel Register,” which we cross-referenced with a register of UICs from DMDC. Unfortunately, decommissioned ships are not part of the current list, and given that our data extends back as early as FY1995, many currently-decommissioned ships would have been active during much of the period of analysis. To identify decommissioned ships, we searched the data for UICs that were not part of our current list of ships and that had at least 20 first-term enlisted sailors (i.e., in length-of-service up to 48 months) in at least one of four periods covering our 25-year period. We identified 625 such UICs. If the UIC was one of the ship classes we use (or a retired class of ship similar to a current one), then we kept observations for those ships.

Table 1. Ship class, crew size, number of ships

Ship class	Estimated crew size	Number of ships in fleet, 2020
Large ships		
Aircraft Carrier (CVN)	5200	11
Amphibious Assault Ships (LHD)	1070	9
Medium ships		
Amphibious Command Ships (LCC)	598	2
Dock Landing Ship (LSD)	413	12
Amphibious Transport Dock (LPD)	383	11
Cruisers (CG)	330	22
Destroyers (DDG)	329	69
Guided Missile Subs (SSGN)	159	14
Ballistic Missile Subs (SSBN)	159	4
Attack submarines (SSN)	132-143	66
Small ships		
Mine Sweeper (MCM)	84	11
Littoral Combat Ships (LCS)	75	18
Patrol Coastal (PC)	28	13

We list in Appendix B the other sample restrictions we used and how that resulted in the final sample for both the enlisted and officer samples. The final samples were 105,427 for enlisted sailors and 7986 for officers. However, the sample for each model will be smaller since it will be based on one demographic group.

¹¹ We did explore an analysis by identifying peers and leaders in the same occupation on the larger ships, but nearly all estimates were insignificant, which was likely due to measurement error from not identifying the correct peers and role models.

G. OBJECTIVE OF MODELS AND PRIMARY THREATS TO VALIDITY

The primary goal of the models is to estimate the effects of crew diversity on the retention of individuals in various demographic categories. One concern in estimating causal effects is that the key explanatory (treatment) variables might be assigned non-randomly. If there were a systematic factor that causes certain people to be assigned to a value of the treatment variable (the diversity measures) and that factor also affects the outcome (retention), then there could be omitted-variables bias. In such a case, the estimated diversity effects on retention would partly reflect the effects of these other factors, causing the estimated diversity effects to be biased.

The treatment variables are the diversity measures, based on the proportions of sailors among certain groups (enlisted vs. officer, and peers vs. leaders) on a ship who are in one of the underrepresented groups. Assignment of sailors to ships is mostly random and is based on what ships and billets are available when new recruits have completed their initial training. At the very least, ship assignment should be random with respect to the diversity composition of a ship.

However, there may be instances which could provide threats to the assumption of random assignment. For example, certain demographic groups might be more (or less) likely to choose certain occupations, which are more likely to be assigned to certain ships, and which could affect retention. For example, with females still having a small role on submarines, there would be little gender diversity for those in occupations that are concentrated on submarines. And, serving on submarines could certainly affect retention rates.

Another potentially confounding factor is that certain ships may have higher diversity than other ships, just from natural variation, and those ships may, for other reasons, have good, or poor leadership, which can affect retention. A final factor is the possibility that, during the period covered by this study, as diversity has changed (e.g., more females), retention rates also may have changed systematically in a certain direction for other reasons.

H. DESIGNING THE MODEL TO ADDRESS THREATS TO VALIDITY

Without controlling for these potential confounding factors (the rating/occupation, the ship, and the year), the estimated effects of diversity could capture these other effects (rather than the effect of diversity of role models and leaders). To address the confounding factors of occupation (rating), ships, and years, we designed a fixed-effects model that accounts for these time-invariant factors. The basic model specification (which we will build on below) is:

$$R_{iosy} = \beta_1 \times D_{iosy} + \beta_2 \times PE_{iosy} + \mu_o + \mu_s + \mu_y + \varepsilon_{iosy} \quad (1)$$

where

- R = a 0/1 retention indicator
- D = a set of the diversity measures
- PE = the share of officers on the ship who were prior-enlisted
- μ_o = fixed effects for the occupation
- μ_s = fixed effects for the ship
- μ_y = fixed effects for the fiscal year of entry
- subscripts refer to the individual sailor (i), the occupation/rating (o), the ship (s), and the cohort year (y).

We estimate the model as a Linear Probability Model, which is usually the more appropriate model (instead of a probit or logit model) in the presence of fixed effects (Arkes, 2019). The best way to interpret the set of coefficient estimates for β_1 is that it represents how within-ship variation over time in the likelihood of retention moves with greater diversity, after factoring out rating and fiscal-year effects. That is, each ship will have variation over time in diversity due to sailors rotating off and on the ship. Behind the scenes, the model calculates how the first-term retention decision for sailors serving on a given ship is related to the diversity sailors experience on that ship during their tenure, factoring out rating and fiscal-year effects. Effectively, the model produces a β_1 for each ship and then calculates an average of those ship-specific β_1 's, weighted mostly by the number of observations on the ship. This method of having these three sets of fixed effects (ship, rating, and fiscal year) makes it so that the estimated diversity effects are not capturing the effects of these potential confounding factors.

I. TWO DIFFERENT APPROACHES

There are two different approaches for estimating these models: A Difference-in-Difference (DD) approach, or estimating separate models using samples for each demographic groups.

The DD general approach would include all sailors in the sample and have indicators in the model for whether the person was in the particular peer or leader group for which the diversity measures are available. For example, we might estimate the following model:

$$R_{iosy} = \beta_1 \times D_{iosy} + \beta_2 \times B_i + \beta_3 \times B_i \times D_{iosy} + \mu_o + \mu_s + \mu_y + \varepsilon_{iosy} \quad (2)$$

where B is an indicator for the subject being Black (1,0) and the diversity variables (D) measure the proportions of Blacks among peers and leaders.

The estimated treatment effect would be the estimate for β_3 , which indicates how the reenlistment probability for Blacks is affected by an increase in the percentage of Blacks among a given group, relative to how non-Blacks were affected. This would have the advantage of controlling for any inherent differences in the effectiveness of Black peers

and leaders for, say, making others feel comfortable to work with them. However, similar to our critique of Kofoed and McGovney (2019) in the *Literature Review* (see Section III), this approach is not appropriate because the control group (non-Blacks) also could be affected by an increase in the number of Blacks in a given group. This effect on non-Blacks could be negative due to potential discrimination, or it could be positive if non-Blacks appreciate the greater diversity.

Given that the control group potentially could be affected by the treatment, the most appropriate method is to estimate the effects of diversity separately for the underrepresented group as well as for the majority group. Thus, our approach is to model the reenlistment decision separately for each demographic group, using equation (1) above. This would simply estimate, for Black sailors for example, how much an increase in Blacks among their shipmates would affect their probability of reenlisting.

One potential problem is that those in the given underrepresented group being examined, say Blacks, might have stronger leaders. That is, sailors (both Blacks and non-Blacks) might enjoy serving with, and under, other Black sailors for various reasons. For example, Dunklin and Thomas (2020) report that first-term sailors prefer to serve under officers who are prior-enlisted; and prior-enlisted officers are more likely to be Black than other officers.

If it were true that Black sailors are better peers, role models, and/or leaders, then what we observe as a diversity effect might actually be due to the quality of the peer, role model, or leader. This might not create a bias in the estimated diversity effect if this is a general pattern that comes with greater diversity rather than something peculiar to the data. And, given that our data span such a long period of time, there is no reason to think that our data period is different from what we would expect going forward.

J. REMAINING POTENTIAL THREATS TO VALIDITY

As described above, the internal validity of the model (in terms of avoiding bias) relies on the diversity measures being random with respect to each sailor. For enlistees, this is probably the case, as they have little role in choosing their ship assignments. For officers, it might be different. Based on our discussions with Navy personnel, in some circumstances, officers may choose the ship or home port of their next assignment. And, with the online group forums now available to officers from underrepresented groups, they may be able to identify ships with cultures more favorable to diverse personnel, or determine the demographic diversity on some ships.¹² However, personnel rotate on and off a given ship frequently, which would mitigate any threat to validity from this source.

¹² Counter-intuitively, officers may sometimes choose to go to a ship with fewer of their group on the ship. The reason is that underrepresented-group officers perceive that, when the number of underrepresented-group officers is greater, they are more likely to be judged based on the group rather than individually.

It is not known how often officers can choose their ship or home port. And, it is uncertain whether the information officers garner from online forums was available for much of the period covered by our data. Another mitigating factor is that personnel rotate on and off ships frequently, which would make it difficult for an individual to identify in advance the precise current climate on a ship. Overall, we do not perceive this to be a major threat to internal validity (particularly for enlisted sailors), although it cannot be ruled out.

K. SUMMARY OF METHODS

Table 2 summarizes the statistical methods, including the design of the sample, the estimating models, and the key variables in the models.

Table 2. Summary of methods

	Enlisted	Officers
Sample criteria	• Reenlisted or left by 84 months • Active Duty Base Date prior to July 2012 • Not in ratings EM, ET, or MM	• Active Duty Base Date prior to July 2012
Dependent variable	Reenlisted (their EAOS date moved forward 36 months) by 84 months	Stayed at least 84 months
Key explanatory variables	• Proportions in demographic groups among members of the crew (overall and differentiated by enlisted vs. officer and peers vs. superiors) • Proportion of officers (or superiors for officer sample) who are prior-enlisted	
Important control variables	Fixed effects for ship, occupation, fiscal year	
Model type	Linear probability model	
Potential pitfall	Measurement error from not correctly identifying peers and superiors would create a bias towards zero (i.e., an underestimate of true diversity effect).	

VII. QUANTITATIVE ANALYSIS: RESULTS

A. RESULTS FOR ENLISTED MODELS

Table 3 shows the descriptive statistics for the analysis sample of individual enlistees. The average reenlistment rate was 0.45. And, as seen in the bottom part of the table, reenlistment rates are higher among Blacks and Hispanics than Whites, and lower for women than for men. Enlisted sailors had, on average 10% of their officer shipmates and 23% of their enlisted shipmates who were Black. There were lower percentages of Hispanics among these shipmates. Note that the standard deviation for the variables on proportions of the crew who are Hispanic is lower than the other similar variables. This would lead to higher standard errors in the coefficient estimates on these variables in the models.

Table 3. Descriptive statistics for enlisted sailors (n = 105,427)

Variable	Mean	Std. Dev.
Reenlist	0.449	0.497
% officers who are prior-enlisted	0.203	0.121
Proportion who are <u>Black</u> among:		
Officer crew	0.100	0.060
Enlisted crew	0.233	0.078
Enlisted crew peers	0.224	0.074
Enlisted crew superiors	0.246	0.098
Proportion who are <u>Hispanic</u> among:		
Officer crew	0.069	0.041
Enlisted crew	0.135	0.046
Enlisted crew peers	0.155	0.050
Enlisted crew superiors	0.093	0.049
Proportion who are <u>Black or Hispanic</u> among:		
Officer crew	0.166	0.073
Enlisted crew	0.353	0.081
Enlisted crew peers	0.362	0.079
Enlisted crew superiors	0.331	0.100
Proportion who are <u>Female</u> among:		
Officer crew	0.145	0.094
Enlisted crew	0.090	0.093
Enlisted crew peers	0.104	0.109
Enlisted crew superiors	0.060	0.064
Characteristics of sailor		
Female	0.114	0.317
Black	0.230	0.421
Hispanic	0.162	0.369
Black and Hispanic	0.019	0.138
White	0.565	0.496
Serving on a sub	0.108	0.310
Serving on a small ship	0.007	0.083
Mean of “reenlist” by sample		
Black sailors	0.512	0.500
Hispanic sailors	0.447	0.497
Black or Hispanic sailors	0.485	0.500
White sailors	0.407	0.491
Female sailors	0.433	0.498
Male sailors	0.450	0.496

Tables 4 to 7 show the results of the models for enlisted sailors. While we include demographic variables in the models, (e.g., we include the racial/ethnic variables for the male and female samples and vice-versa), we do not report them in the tables, as any differences in the retention outcome based on race/ethnicity and gender should be represented well in the descriptive statistics of Table 3.

Table 4 shows the results for the effects of having a higher proportion of Black sailors among the crew. We estimate separate models for samples consisting of: (a) Black, (b) Black-or-Hispanic, and (c) Non-Hispanic White. For each sample, we estimate one model (in columns 1, 3, 5) with a variable for the whole enlisted crew and one model (in columns 2, 4, 6) with separate variables for enlisted peers (fellow Zone A sailors) and enlisted leaders (E-5 or higher with at least 85 months of service). We focus on coefficient estimates that are significant at least at the 5% level ($p < 0.05$).

For Blacks, the evidence in columns (1) and (2) of Table 4 suggests that having more Blacks among the enlisted crew -- particularly among enlisted superiors -- on one's first ship assignment leads to a higher reenlistment rate. To give a sense of the magnitude of the coefficient estimate on the "proportion who are Black among enlisted superiors" in column (2), if there were a 10-percentage-point increase in Blacks among enlisted superiors (which is about one standard deviation in this variable from Table 3), a Black sailor would have an estimated increase in the probability of reenlisting of approximately 2.0 percentage points). The 95% confidence interval, which is a range of likely values of the true coefficient, would be (0.4 to 3.6 percentage points).

The effects of more blacks among peers and superiors on the likelihood of reenlistment appear to be just as strong for a combined sample of Blacks and Hispanics (columns (3) and (4)). For Whites, in columns (5) and (6), having more Blacks among the officer crew and enlisted peers also appear to have positive reenlistment effects.

The results in Table 4 also indicate that more prior-enlisted officers on the ship are associated with a significantly higher reenlistment rate among all samples.¹³ These results are consistent with the hypothesis that prior-enlisted officers serve as role models and/or mentors for Black first-term enlisted sailors. The results are also consistent with the responses from our in-person interviews where many interviewees stated a preference to work with prior-enlisted officers. The point estimates suggest that a 10-percentage-point increase in the share of officers who are prior-enlisted is associated with a 1.4- to 2.1-percentage-point increase in the reenlistment rate for Blacks; and even the lower bound of the 95% confidence interval on the estimates for the three samples indicates a 0.5- to 1.2-percentage-point increase in reenlistment from a 10-percentage-point increase in prior-enlisted officers.

¹³ Because prior-enlisted officers have longer time-in-service than their peers in the same grade, they often do not have the same careers as other officers. For example, it is possible for prior-enlisted officers to retire as O-3's, and many retire as O-4's. We tend to prefer the mentoring explanation over the role model explanation for the observed reenlistment effect.

Table 4. Effects of more **Black** crew members on retention

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Black sailors	Black sailors	Black or Hispanic sailors	Black or Hispanic sailors	White sailors	White sailors
% officers who are prior-enlisted	0.207*** (0.060)	0.209*** (0.060)	0.148*** (0.047)	0.149*** (0.047)	0.145*** (0.040)	0.144*** (0.040)
Proportion who are <u>Black</u> among:						
Officer crew	-0.010 (0.077)	-0.000 (0.077)	-0.002 (0.061)	0.002 (0.061)	0.150*** (0.053)	0.147*** (0.053)
Enlisted crew	0.252* (0.132)		0.274*** (0.103)		0.110 (0.094)	
Enlisted crew peers		0.035 (0.118)		0.142 (0.092)		0.183** (0.083)
Enlisted crew superiors		0.202** (0.082)		0.143** (0.064)		-0.057 (0.057)
Observations	24,289	24,289	39,378	39,378	48,381	48,381
R-squared	0.042	0.043	0.038	0.038	0.058	0.058
The model also includes a constant, gender, racial/ethnic variables (Black, Hispanic, Black and Hispanic) where appropriate, and fixed effects for the ship, rating, and fiscal year. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.10						

Figure 10. 95% confidence intervals for the estimated retention effects of 10-percentage-point increase in Blacks among various groups.

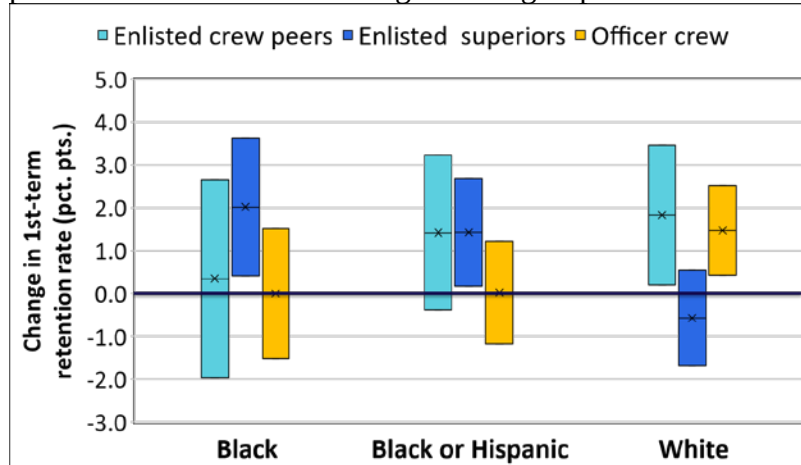


Figure 10 shows a graphical version of the main results from columns 2, 4, and 6 of Table 4. For the three samples listed at the bottom of the chart (Black, Black or Hispanic, and White), which corresponds to those in Table 4, we show the estimated effects of a

10-percentage-point increase in the proportion of Blacks among the three social groups listed at the top (enlisted peers, enlisted superiors, and officers). The vertical, colored bars for the estimated coefficient for a given social group (light blue for enlisted peers, dark blue for enlisted supervisors, and orange for officers) shows the 95% confidence interval for the likely range of values for the *true coefficient*, based on the estimated coefficient and its standard error. This is not necessarily the 95% confidence interval for the *true effect*, as the whole confidence interval might be biased downwards (moving with the coefficient estimate) due to measurement error from failing to capture the relevant peers and superiors. What the confidence intervals do tell us is how far the lower bound is from zero (no effect) and how high the true coefficient might be. The estimated effects that are significantly greater than zero would have bars that are fully above the horizontal (black) zero line. The estimates with bars close to the zero line are just marginally significant. Given that many estimates are statistically significant strongly suggests positive effects on retention from having more Blacks among enlisted peers and superiors. Corresponding figures for the results for the subsequent tables are in Appendix C.

Table 5 shows the effects of greater Hispanic diversity among peers and leaders. For Hispanic sailors, although all coefficient estimates are generally positive, there is only one statistically-significant coefficient estimate on the proportion of the crews who are Hispanic: White sailors are more likely to reenlist if they have more Hispanic enlisted superiors. The lack of many significant estimates is likely explained by the weaker power due to relatively small sample sizes. For the sample of Hispanics and Black-or-Hispanics, it also could be the result of Hispanics being a heterogeneous group. For example, for Puerto Ricans, having more Mexican-Americans on the crew might not be as beneficial as having more Puerto Ricans.

Table 6 examines the effect of a combined group of Blacks and Hispanics. It may be the case that when there are few Blacks and Hispanics on a crew, the two groups tend to band together because they have similar experiences. We have results for four groups: Blacks (columns 1 and 2), Hispanics (columns 3 and 4), Black or Hispanics (columns 5 and 6), and Whites (columns 7 and 8).

There is no evidence of a reenlistment effect of an increase in Black-or-Hispanic officers, except for Whites, whose reenlistment appears to be positively affected by more Blacks-or-Hispanics among the officer crew. This is consistent with Table 4 and might just be an effect of more Blacks among the officers. But, the estimated effect of more Black-or-Hispanics among the enlisted crew is large for each sample, with significant estimates for the Black and Black-or-Hispanic samples. For these two, a 10-percentage-point increase in the proportion of the enlisted crew who are Black-or-Hispanic is associated with about a 3.6-percentage-point increase in the likelihood of reenlisting for these two groups. For the latter group, there is evidence of a positive effect of more Blacks-or-Hispanics among both enlisted peers and enlisted superiors.

Table 5. Effects of more **Hispanic** crew members on retention

VARIABLES	(1) Hispanic sailors	(2) Hispanic sailors	(3) Black or Hispanic sailors	(4) Black or Hispanic sailors	(5) White sailors	(6) White sailors
% officers who are prior-enlisted	0.058 (0.069)	0.059 (0.069)	0.147*** (0.047)	0.148*** (0.047)	0.156*** (0.040)	0.159*** (0.040)
Proportion who are <u>Hispanic</u> among:						
Officer crew	0.019 (0.114)	0.022 (0.114)	0.015 (0.076)	0.018 (0.076)	-0.019 (0.066)	-0.016 (0.066)
Enlisted crew	0.114 (0.197)		0.239* (0.133)		0.101 (0.120)	
Enlisted crew Peers		0.031 (0.160)		0.088 (0.107)		-0.035 (0.095)
Enlisted crew Superiors		0.118 (0.143)		0.169* (0.099)		0.201** (0.089)
Observations	17,122	17,122	39,378	39,378	48,381	48,381
R-squared	0.046	0.046	0.038	0.038	0.058	0.058
The model also includes a constant, gender, racial/ethnic variables (Black, Hispanic, Black and Hispanic) where appropriate, and fixed effects for the ship, rating, and fiscal year. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.10						

Table 6. Effects of more (**Black or Hispanic**) crew members on retention

	(1) Black sailors	(2) Black sailors	(3) Hispanic sailors	(4) Hispanic sailors	(5) Black or Hispanic sailors	(6) Black or Hispanic sailors	(7) White sailors	(8) White sailors
% officers who are prior-enlisted	0.200*** (0.061)	0.205*** (0.061)	0.058 (0.070)	0.056 (0.070)	0.143*** (0.047)	0.146*** (0.047)	0.142*** (0.040)	0.141*** (0.040)
Proportion who are <u>Black or Hispanic</u> among:								
Officer crew	0.012 (0.063)	0.012 (0.063)	-0.008 (0.077)	-0.008 (0.077)	0.009 (0.049)	0.010 (0.049)	0.098** (0.043)	0.098** (0.043)
Enlisted crew	0.359*** (0.134)		0.247 (0.158)		0.357*** (0.104)		0.103 (0.092)	
Enlisted crew Peers		0.113 (0.114)		0.217 (0.133)		0.178** (0.088)		0.111 (0.076)
Enlisted crew Superiors		0.239*** (0.082)		0.063 (0.095)		0.198*** (0.064)		0.004 (0.056)
Observations	24,289	24,289	17,122	17,122	39,378	39,378	48,381	48,381
R-squared	0.043	0.043	0.046	0.046	0.038	0.038	0.058	0.058

The model also includes a constant, gender, racial/ethnic variables (Black, Hispanic, Black and Hispanic) where appropriate, and fixed effects for the ship, rating, and fiscal year.

Robust standard errors are in parentheses.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

Table 7 shows the effects of greater female diversity among the crew. The results are interesting. For females, in columns (1) and (2), although most coefficient estimates are positive, none are statistically significant. However, for males (columns 3 and 4), more females among the officer crew and the enlisted-crew peers is associated with significantly higher probabilities of reenlistment. The coefficient estimate on the proportion female among the officer crew is significant despite being about half of the magnitude for the insignificant estimate for females. One other interesting result is that having more prior-enlisted officers appears to have a large positive effect on the reenlistment of for males, but no significant effect for females. Even the lower bound of the estimate for males would indicate that a 10-percentage-point increase in the share of officers who are prior-enlisted would elicit a 1.2-percentage-point increase in the likelihood of reenlisting.

As alluded to above, Appendix C shows the figures, similar to Figure 10 for the effects of more Blacks, that correspond to the effects of more of the other groups. These correspond to Tables 5 to 7. In addition, the last figure in Appendix C shows the effects of more prior-enlisted officers for the various demographic groups.

Table 7. Effects of more **Female** crew members on retention
(sample of those serving on medium ships; not subs or small ships)

	(1) Female	(2) Female	(3) Male	(4) Male
% officers who are prior-enlisted	0.097 (0.087)	0.097 (0.087)	0.195*** (0.035)	0.195*** (0.035)
Proportion who are <u>Female</u> among:				
Officer crew	0.130 (0.093)	0.135 (0.093)	0.064** (0.031)	0.063** (0.031)
Enlisted crew	0.013 (0.180)		0.316*** (0.061)	
Enlisted crew peers		-0.041 (0.136)		0.263*** (0.058)
Enlisted crew superiors		0.052 (0.174)		0.026 (0.079)
Observations	11,982	11,976	81,366	81,361
R-squared	0.056	0.056	0.037	0.037
The model also includes a constant, racial/ethnic variables (Black, Hispanic, Black and Hispanic), and fixed effects for the ship, rating, and fiscal year. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.10				

B. WHY COULD GREATER DIVERSITY IMPACT RETENTION?

One of the original research questions we posed in the Introduction was: “Why could greater diversity impact the retention of sailors?” With the quantitative analyses, we could not analyze *why* greater diversity leads, at least in some cases, to higher retention. However, we can draw on the qualitative analysis, along with other information from the interviews, to provide educated guesses on why there could be such effects.

Regarding how having more co-race/ethnic peers affects retention, this could be due members of underrepresented groups fitting in better with co-race/ethnic peers and communicating better with them. In addition, having others of your demographic group to commiserate with when feeling “targeted” could be somewhat comforting. An interesting story comes from a Black enlisted Sailor, who had been successful and had recently reenlisted. She related an incident in which the ship was about to have a port visit. Someone in the ship’s leadership announced to the crew that they did not have to just hang out with their own kind when they leave the ship. Believing this was directed to directed at racial/ethnic underrepresented groups, she made eye contact with another Black sailor, getting a small bit of comfort in knowing she was not alone in feeling

singled out. (This sailor also said she was going to leave the Navy if they made her do another sea tour.)

Having more of one's own group among superiors could provide role models and a greater sense of having the opportunity for a successful career in the Navy. Furthermore, more co-race/ethnic superiors could make for better mentoring experiences.

Regarding how whites are, in some cases, positively impacted by more Hispanic or Black peers or superiors, it could be due to sailors enjoying a greater diversity of backgrounds. As a few sailors related to us in the interviews, they actually somewhat enjoy "standing watch" (which involves staying up all night), as it is a chance to hear the stories and backgrounds of their shipmates. And, it could be more interesting to hear stories from people with backgrounds different from their own. (In a similar vein, males might appreciate having more females on board to make for a more diverse set of shipmates.) The greater retention of whites with more Black or Hispanic superiors also could be due to management styles of Hispanics and Blacks that are perceived to be better.

C. OFFICER MODELS

Due to the small samples, there were no coefficient estimates on the diversity measures that were significant at least at the 5% level. And, the coefficient estimate on the proportion of superior officers who were prior-enlisted was significant just for Hispanics, with a large estimated effect but also a very high standard error. Generally, the standard errors are very large, which means that there could be sizable effects that would not be detected as being statistically significant. Given the lack of any results that are informative, we relegate the descriptive statistics and results to Appendix D (Tables D1-D5).

D. OTHER MODELS

The original research objectives for this project also included two additional analyses: (a) estimating separate analyses by ship class; and, (b) estimating models separately for large ships.

For separate analyses by ship class, the models had very little power and wide standard errors, particularly the models for under-represented groups, which had small sample sizes. While some of these had significant coefficient estimates, the wide standard errors made the results inconclusive in terms of identifying which ships had the greatest and the lowest reenlistment effects from crew diversity.

For models for large ships (Amphibious Assault Ships and Aircraft Carriers), the ships were too large to use diversity measures for the entire crew, as we did for the small and medium-size ships. And, while randomness of assignments can create good variation over time for the diversity measures for small- and medium-sized ships, there should be

much less variation in whole-ship diversity measures for large ships -- i.e., the randomness on the large ships averages out to minimal overall variation in diversity measures over time. Thus, for this effort we decided to create the diversity measures for members (peers and leaders) of each sailor's rating for each ship.

These results are not reported, as nearly all coefficient estimates were statistically insignificant. This is likely due to measurement error from restricting the definition of peers and leaders to those within a sailor's rating. The error arises from not identifying the true peers or social groups for a sailor on large ships. In the setting of a large ship, a sailor's peers could easily be coming from sailors outside of the specific rating, such as from work mates within a division or within a department, or from other sailors met in informal settings onboard the ship. Unfortunately, accurately identifying one's peers is very difficult in such large work units. But, we imagine that the same diversity effects we observe for sailors on small- and medium-sized ships would translate to sailors on large ships.

E. OVERALL SYNTHESIS OF THE MODELS

As with any statistical analysis, the strength of the evidence should be based on how well alternative explanations for the statistical relationships could be ruled out and whether random variation could explain any statistical significance. Furthermore, the estimated effects should be judged not just for statistical significance, but also practical significance, or how meaningful vs. trivial the estimated effect is.

As described in the prior section, the treatment (the extent of diversity on a sailor's first ship assignment) should be random to a sailor with respect to other factors that could affect his/her retention decision. And so, there are unlikely to be any biases in the direction of showing a positive effect of greater diversity. The one bias that could exist is measurement error in that, by measuring the diversity for everyone in certain experience and peer or leadership groups on a ship, we might not be focusing on the relevant set of shipmates. The fortunate thing is that any measurement error should bias the estimate towards zero, in which case, the strong effects we do estimate could understate the true effects of diversity.

There is also the possibility of a Type I error (or "false positive"). We doubt that this would be the case for most of our results, given the strong tendency for the coefficient estimates on the diversity variables to be positive and given how many of the estimates of diversity are statistically significant. (We must also point out that insignificance is just indicative of there being no evidence for any effect, not that there is no effect, as is a common misinterpretation.) And so, we are reasonably confident in our results.

The practical significance of the estimated effects is uncertain, and we will leave it to others to judge. What must be kept in mind is the downward bias from measurement error mentioned above. Thus, the true effects are likely greater than what we estimate in

this study. And, some cases of not finding a statistically significant effect might actually have a true effect that we are unable to detect in this data set.

VIII. CONCLUSIONS AND RECOMMENDATIONS

This project examined the role of diversity in sailors' retention decisions, using both qualitative and quantitative analyses. The main qualitative analysis consisted of interviews of first-term enlisted sailors and JOs aboard surface ships. We identified several themes from the interviews:

1. Underrepresented groups appear to face greater obstacles linked to Navy policies, culture, and interpersonal communication than the majority groups.
2. Underrepresented group members have inferior experiences with mentors.
3. Underrepresented group members tend to believe there are limited opportunities for them in the Navy.
4. Underrepresented group members are more likely to mention difficulties fitting in with peers.
5. Most junior personnel prefer working under prior-enlisted officers.

Perhaps most importantly, sailors from underrepresented racial/ethnic groups believe that they are treated differently, with rules (such as grooming) and informal guidance (such as for port visits) that appear to be targeted to them or inconsiderate of their differences. The inferior experiences with mentors could be due to fewer people from underrepresented groups in leadership positions. This factor was mentioned often by participants in our in-person interviews. Many from underrepresented groups also believe that they are given less latitude (e.g., shorter rope for mistakes) and that they have less opportunity for advancement and promotion.

In the quantitative analyses, we aimed to examine how the diversity on a sailor's first ship assignment affected his/her retention likelihood. Normally, with observational studies (rather than randomized control trials), there are issues with the validity of the model due to the treatment being non-random. In our situation, the primary factors that could determine the "treatment" of diversity a sailor experiences on ship assignments (the ship, the fiscal year, and the sailor's occupation) can be controlled for in the models. Therefore, the diversity of a ship's crew that a sailor experiences is effectively random, and the model can be viewed as reasonably valid to represent any causal effects there are. If anything, there was potential measurement error in that our diversity measures may not correctly identify the most important peers and superiors for individual sailors. However, this potential error would cause our estimated diversity effects to be biased towards zero, which suggests that the effects we do estimate understate the true effects. One limitation was having small sample sizes with regards to the underrepresented groups and officers, which resulted in imprecisely estimated effects (i.e., wide confidence intervals from large standard errors).

The main results are:

- Black enlisted sailors are more likely to reenlist if they have a higher proportion of enlisted crew members who are Black or Hispanic. The evidence suggests that the reenlistment effects stem more from greater diversity among enlisted superiors rather than among peers.

- White enlisted sailors are more likely to reenlist if they serve under more officers who are Black.
- Whereas the estimated effects of Hispanics are insignificant, that could be due to weak power. Indeed, when Hispanics are combined with Blacks, the effect of diversity on retention appear to be stronger than just the effects of more Blacks on the crew.
- Male sailors are more likely to reenlist if they have more females on their crew; unfortunately, there is not enough power to determine how females are affected by crews with a higher proportion of females
- Having more prior-enlisted officers on one's crew strongly increases the likelihood of reenlisting for enlisted sailors.

Some of these results, particularly those for the effects of enlisted superiors and officers of underrepresented groups, suggest that these sailors and officers have certain leadership characteristics that promote greater retention. This could be from role-model effects, mentoring effects, or both. And, it could be that leaders from underrepresented groups contribute more to a healthier command environment.

The Navy defines inclusion as having 'no barriers to opportunity' (Kraus, et al., 2015). Thus, improving the representation of women and members of race/ethnic underrepresented groups at all ranks is an important aspect of inclusion. Sailors from underrepresented racial/ethnic groups have experienced a pattern of increasing retention and representation in higher-experience groups. However, their representation in leadership positions generally lags that of Whites, as does that for females relative to males. This suggests that the Navy may not be keeping the best and most talented among those from underrepresented groups. And, it could be that institutional norms or established practices are limiting advancement opportunities for those from underrepresented groups, including women.

One lesson that might be useful comes from the National Basketball Association. Price and Wolfers (2010) found that, for 2003-2006, the more White referees that were officiating a game, the more fouls were called on Black players relative to White players. The reverse was true as well—that more Black referees was associated with more foul calls on White relative to Black players—and so, it was not clear whether this was bias from White referees, Black referees, or both. A subsequent study (Pope, Price, and Wolfers, 2018) found, with data on games from 2007-2010, that the racial differences in foul calls based on the races of the referees had disappeared. The *Washington Post* (Ingraham, 2014) reported that the NBA denied taking any action after the first study, which if true, the *Washington Post* argued, would suggest that the referees self-corrected after being made aware of what could be unconscious biases.

The implication of this study is that just being made aware of the possibility of unconscious biases could go a long way towards addressing these biases.

With that in mind, along with the results of our analyses, we developed several recommendations for the Navy. We must qualify these in that we do not know the

mechanisms behind why retention for enlisted personnel tends to be higher for those serving under more officers and enlisted leaders from underrepresented groups. And so, our recommendations presume that all major mechanisms we mentioned above (a mentoring effect, a role-model effect, and contributing to a healthier command environment) are at play. Our recommendations are:

- Gain a better understanding of the challenges faced by underrepresented groups.
- Continue to expand efforts to make the whole fleet aware of unconscious biases.
- Explore whether increasing the number of enlisted sailors who can enter commissioning programs would be cost-effective, taking into account the increased enlisted retention resulting from having more prior-enlisted officers.
- Gain a better understanding of the characteristics and leadership qualities of prior-enlisted officers that make them preferred officers to work with.
- Increase efforts to ensure underrepresented-group sailors are receiving adequate mentoring from superiors.

All the above have the potential for increasing retention among the most talented of the underrepresented groups and, ultimately of increasing representation of these groups in leadership positions.

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APPENDIX A: SURVEY INSTRUMENT



NAVAL
POSTGRADUATE
SCHOOL

First-Term Sailor Retention Survey (Enlisted and Officer)

This is a survey for first-term sailors attached to sea-going surface ships. This survey is intended to assist researchers at the Naval Postgraduate School in improving retention throughout the United States Navy. This survey is to be answered anonymously. All efforts, within reason, will be made to keep your personal information in your research record confidential but total confidentiality cannot be guaranteed. However, it is possible that the researcher may be required to divulge information obtained in the course of this research to the subject's chain of command or other legal body. Disclosure of professional misconduct or where criminal acts took place, will require reporting to command leadership. As a volunteer in this study, you do not have to answer any question you prefer not to answer and can stop further participation at any time.

Demographic Information:									
Please fill in the demographic information below to further assist researchers in data analysis with current and future studies. Demographic information is <u>optional</u> , but appreciated. Please select from each of the following categories.									
Community:	Enlisted	Officer							
Gender:	Female	Male	Race/Ethnicity:	Asian	Black / African-American	Hispanic	Native Hawaiian/ Other Pac. Islander	White	Other

Survey Ratings:

Please give your honest assessment pertaining to your decision to continue or separate from the Navy by circling one of the numbers below each question based on the factors listed to the left of the page.

Factors	How important will this factor be for your eventual decision to continue or separate from the Navy?			Has your experience with this factor been positive or negative?				
	Not Important	Somewhat Important	Important	Very Negative	Somewhat Negative	Neutral	Somewhat Positive	Very Positive
1 Job Duties	1	2	3	1	2	3	4	5
2 Skill Development	1	2	3	1	2	3	4	5
3 Fulfillment in Job Accomplishment	1	2	3	1	2	3	4	5
4 Peer Support	1	2	3	1	2	3	4	5
5 Feeling as if you're part of the team, overall comraderie	1	2	3	1	2	3	4	5
6 Resourced to do your job	1	2	3	1	2	3	4	5
7 Earning Qualifications and Awards	1	2	3	1	2	3	4	5
8 Potential Leadership Opportunities	1	2	3	1	2	3	4	5
9 Command Leadership	1	2	3	1	2	3	4	5
10 Navy Rules and Regulations	1	2	3	1	2	3	4	5
11 *Appropriate respect by superiors, free of bias due to your gender/race/identity	1	2	3	1	2	3	4	5
12 Recognition of Hard Work	1	2	3	1	2	3	4	5
13 Professional Mentorship	1	2	3	1	2	3	4	5
14 Personal Mentorship	1	2	3	1	2	3	4	5
15 Working Conditions	1	2	3	1	2	3	4	5
16 Living Conditions	1	2	3	1	2	3	4	5
17 Command Operational Tempo	1	2	3	1	2	3	4	5
18 Salary and Bonus Pay	1	2	3	1	2	3	4	5
19 Perceived Future Opportunities in the Navy	1	2	3	1	2	3	4	5
20 Evaluation Feedback/Process	1	2	3	1	2	3	4	5

*The term "Appropriate" partly means proper respect and not experiencing bias due to your gender/race/identity.

On a scale of 1 to 5, what are your intentions to separate from the Navy? (Circle One)

Separating from the Navy	Leaning towards Separation	Neutral	Possibly continuing Active Duty	Continuing on Active Duty
1	2	3	4	5

APPENDIX B: DETAILS ON METHODS

Creation of the diversity variables

We first identified each subject's first (major) ship. Enlistees typically serve on one ship during their first term of service. However, officers (and a small percentage of enlistees) serve on two different ships in their first term. For those, we determine their ship where they served the longest (at the end-of-quarter dates), and for at least 5 quarters (meaning they were on the ship at least 12 months and one day). For the few cases in which they were on two different ships for the same number of quarters, we used the first ship.

For each end-of-quarter point a Sailor was observed on the ship, we counted the total number of personnel, and the number of personnel in each demographic group (black, Hispanic, and female), separately for enlisted vs. officer, and peers vs. superiors. We subtracted out the subject for these counts.

For each subject, we calculated the proportion of their peers or leaders belonging to a demographic group. The diversity a Sailor experiences on a ship, of course, can change as various shipmates rotate out (finish their 3-5-year tour or leave the Navy) and new shipmates rotate in. So, we calculated the average proportion for each demographic group for the 5 quarters.

For each ship and year-quarter, we counted the number in each demographic category (all, female, black, and Hispanic) and in each sub-category (enlistees, officers, and junior members and superiors for both enlistees and officers). We then merged that count with the ship a given individual served on for a given quarter. Then, we summed the counts for each group across the 5 quarters the Sailor served on the ship (making sure to subtract out the given Sailor).

For each Sailor, from these sums, we calculated the proportions of Sailors in each group who were in one of the under-represented categories. Suppose, for example, a Sailor served on a ship for 6 quarters. The ship had the following counts of blacks among the enlisted crew:

<u>Quarter</u>	<u>Enlisted crew</u>	<u>Blacks among enlisted crew</u>
1	80	10
2	90	15
3	90	15
4	100	15
5	90	20
6	100	15
	550	90

In this example, the black diversity measure for the enlisted crew on this ship is 0.164 (= 90/550).

How the sample restrictions gave us the final sample

For enlisted sailors, our sample restrictions were as follows:

- We started with 679,849 sailors who entered the Navy in the timeframe listed above who did not leave to become officers, as far as we could identify, and had an initial obligation of 4 years (which could include those with automatic 1- or 2-year extensions).
- We kept the 540,850 of them who remained in service at least 24 months, which we used to establish a common standard for having at least 5 end-of-quarter observations on a ship.
- We kept the 160,438 who served on one of the medium or small ships, and submarines we identified.
- We kept the 142,436 of those who had at least 5 end-of-quarter observations on one of those ships.
- We dropped 6,883 who had a missing rating.
- We dropped 91 who were in a rating with fewer than 10 subjects in the rating.
- We dropped 154 for being on ships with fewer than 15 subjects.
- We dropped 29,871 from the EM, ET, and MM ratings (which eliminates those who could reenlist early).
- We dropped 11 observations who had inconsistency in the gender code.
- The resulting file included 105,427 enlisted sailors.

For officers,

- We started with 43,400 officers who were commissioned in the timeframe listed above and who were not prior-enlisted, as far as we could identify.
- We kept the 11,991 who served on one of the medium or and small ships and on submarines we identified.
- We kept the 8,971 of those who had at least 5 end-of-quarter observations on one of those ships.
- We dropped 440 who had a missing occupation code.
- We dropped 11 who had an occupation code with fewer than 10 subjects.
- We dropped 534 for being on ships with fewer than 15 subjects.
- The resulting file contained 7,986 officers.

APPENDIX C: FIGURES SHOWING 95% CONFIDENCE INTERVALS OF KEY ESTIMATES

Figure C1. 95% confidence intervals for the estimated retention effects of 10-percentage-point increase in Hispanics among various groups (corresponding to Table 5).

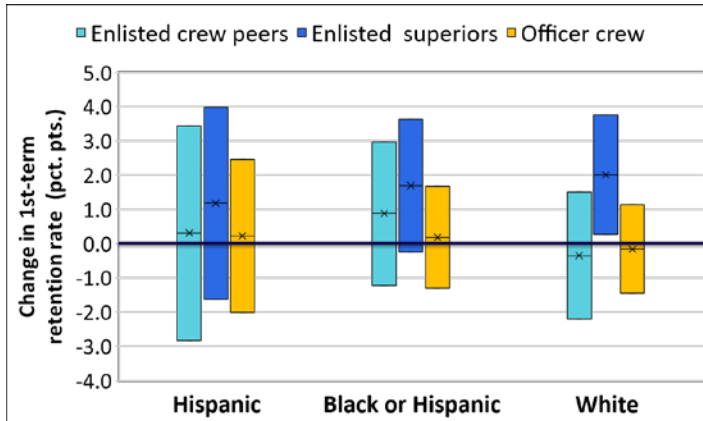


Figure C2. 95% confidence intervals for the estimated retention effects of 10-percentage-point increase in (Black or Hispanics) among various groups (corresponding to Table 6).

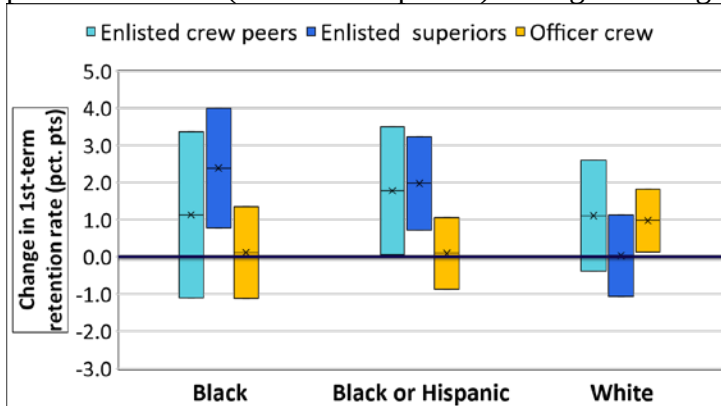


Figure C3. 95% confidence intervals for the estimated retention effects of 10-percentage-point increase in females among various groups (corresponding to Table 7).

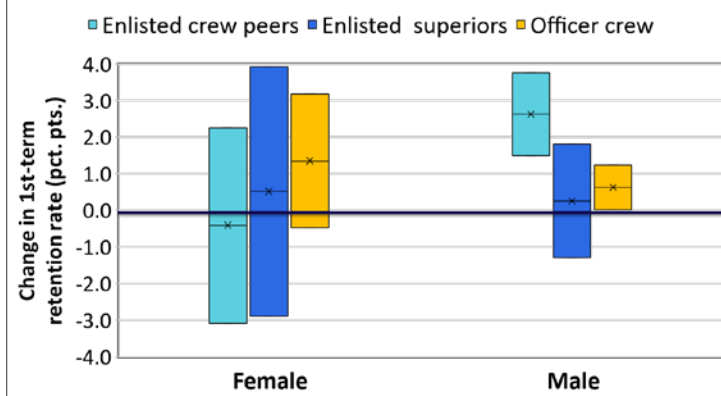
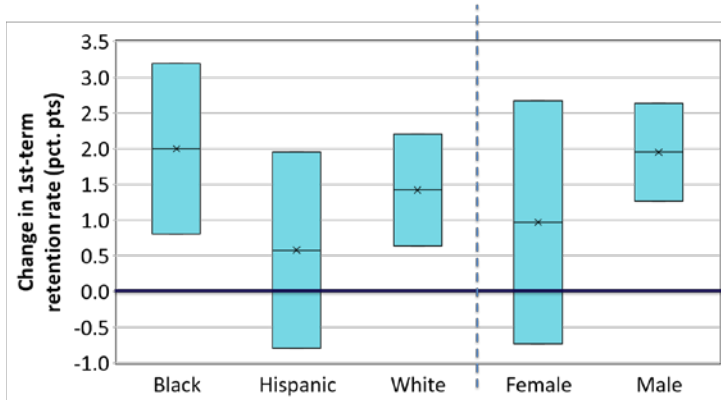


Figure C4. 95% confidence intervals for the estimated retention effects of 10-percentage-point increase in prior-enlisted among officers (corresponding to Tables 4-7).



APPENDIX D: RESULTS FROM OFFICER MODELS

Table D1. Descriptive statistics for Officers (n = 7986)

Variable	Mean	Std. Dev.
Reenlist	0.561	0.496
% superior Officers who are prior-enlisted	0.061	0.122
Proportion who are <u>Black</u> among:		
Officer crew	0.085	0.062
Officer crew peers	0.074	0.080
Officer crew superiors	0.063	0.116
Proportion who are <u>Hispanic</u> among:		
Officer crew	0.065	0.044
Officer crew peers	0.066	0.068
Officer crew superiors	0.049	0.101
Proportion who are <u>Black or Hispanic</u> among:		
Officer crew	0.147	0.078
Officer crew peers	0.137	0.105
Officer crew superiors	0.110	0.151
Proportion who are <u>Female</u> among:		
Officer crew	0.122	0.106
Officer crew peers	0.161	0.151
Officer crew superiors	0.033	0.084
Characteristics of Sailor		
Female	0.171	0.376
Black	0.053	0.224
Hispanic	0.059	0.236
Black and Hispanic	0.002	0.049
White	0.565	0.496
Serving on a sub	0.281	0.450
Mean of “reenlist” by sample		
Black Sailors	0.645	0.479
Hispanic Sailors	0.570	0.496
Black or Hispanic Sailors	0.605	0.489
White Sailors	0.549	0.498
Female Sailors	0.578	0.494
Male Sailors	0.481	0.500

Note: Higher retention rates for females might be due to the different distribution of males vs. females on different ship classes.

Table D2. Effects of more **Black** crew members on retention

	(1)	(2)	(3)	(4)	(5)	(6)
	Black Sailors	Black Sailors	Black or Hispanic Sailors	Black or Hispanic Sailors	White Sailors	White Sailors
% Officer-crew superiors who are prior-enlisted	0.207 (0.397)	0.155 (0.393)	0.425* (0.219)	0.425* (0.219)	-0.121 (0.081)	-0.120 (0.081)
Proportion who are <u>Black</u> among:						
Officer crew	-0.185 (0.659)		0.074 (0.456)		0.222 (0.180)	
Officer crew peers		-0.759 (0.560)		-0.155 (0.360)		0.035 (0.116)
Officer crew superiors		0.056 (0.290)		-0.082 (0.192)		-0.019 (0.076)
Observations	338	338	696	696	4,515	4,515
R-squared	0.420	0.426	0.364	0.364	0.102	0.102

The model also includes a constant, gender and racial/ethnic variables (Black, Hispanic, Black and Hispanic) where appropriate, and fixed effects for the ship, rating, and fiscal year.

Robust standard errors are in parentheses.

*** p<0.01, ** p<0.05, * p<0.10

Table D3. Effects of more **Hispanic** crew members on retention

	(1)	(2)	(3)	(4)	(5)	(6)
	Black Sailors	Black Sailors	Black or Hispanic Sailors	Black or Hispanic Sailors	White Sailors	White Sailors
% Officer-crew superiors who are prior-enlisted	0.207 (0.397)	0.155 (0.393)	0.425* (0.219)	0.425* (0.219)	-0.121 (0.081)	-0.120 (0.081)
Proportion who are <u>Black</u> among:						
Officer crew	-1.746 (1.091)		-0.901 (0.596)		0.046 (0.208)	
Officer crew peers		-1.241* (0.696)		-0.567 (0.353)		0.120 (0.122)
Officer crew superiors		-0.094 (0.357)		-0.264 (0.237)		0.081 (0.085)
Observations	263	263	696	696	4,515	4,515
R-squared	0.593	0.595	0.367	0.369	0.102	0.102

The model also includes a constant, gender and racial/ethnic variables (Black, Hispanic, Black and Hispanic) where appropriate, and fixed effects for the ship, rating, and fiscal year.

Robust standard errors are in parentheses.

*** p<0.01, ** p<0.05, * p<0.10

Table D4. Effects of more **Black or Hispanic** crew members on retention

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Black	Black	Hisp.	Hisp.	Black or Hisp.	Black or Hisp.	White	White
% Officer-crew superiors who are prior-enlisted	0.223 (0.402)	0.222 (0.404)	0.900** (0.378)	0.942** (0.374)	0.422* (0.219)	0.443** (0.221)	-0.120 (0.081)	-0.123 (0.081)
Proportion who are <u>Black</u> among:								
Officer crew	0.105 (0.570)		-0.436 (0.869)		-0.172 (0.410)		0.157 (0.142)	
Officer crew peers		-0.151 (0.407)		-0.444 (0.454)		-0.318 (0.269)		0.072 (0.088)
Officer crew superiors		-0.081 (0.244)		-0.106 (0.276)		-0.119 (0.153)		0.020 (0.060)
Observations	338	338	263	263	696	696	4,515	4,515
R-squared	0.420	0.421	0.586	0.588	0.364	0.367	0.102	0.102

The model also includes a constant, gender and racial/ethnic variables (Black, Hispanic, Black and Hispanic) where appropriate, and fixed effects for the ship, rating, and fiscal year.

Robust standard errors are in parentheses.

*** p<0.01, ** p<0.05, * p<0.10

Table D5. Effects of more **Female** crew members
(sample of those serving on medium ships; not subs or small ships)

	(1) Female	(2) Female	(3) Male	(4) Male
% officers prior-enlisted	-0.029 (0.186)	-0.057 (0.186)	-0.032 (0.070)	-0.030 (0.070)
Proportion who are <u>Female</u> among:				
Officer crew	-0.076 (0.290)		-0.014 (0.120)	
Officer crew Peers		0.193 (0.169)		-0.001 (0.074)
Officer crew superiors		-0.230 (0.154)		0.037 (0.097)
Observations	1,241	1,241	6,168	6,168
R-squared	0.220	0.222	0.078	0.078

The model also includes a constant, gender and racial/ethnic variables (Black, Hispanic, Black and Hispanic) where appropriate, and fixed effects for the ship, rating, and fiscal year.

Robust standard errors are in parentheses.

*** p<0.01, ** p<0.05, * p<0.10

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LIST OF REFERENCES

- Antecol H. and D. Cobb-Clark (2006). The Sexual Harassment of Female Active-Duty Personnel: Effects on Job Satisfaction and Intentions to Remain in the Military. *Journal of Economic Behavior and Organization*, 61(1): 55-80.
- Arkes, J. (2019). *Regression analysis: A practical introduction*. Oxford: Routledge.
- Arkes, J. and S. Mehay (2014). The Impact of the Unemployment Rate on Attrition of First-Term Enlistees, *Defence and Peace Economics*, 25(2), 125-138.
- Asch, B. and J. Hosek (2007). The New Economics of Manpower in the Post-Cold War Era. In *Handbook of Defense Economics*, Vol. 2. Amsterdam: Elsevier.
- Carrell, S., M. Page, & J. West. (2010). Sex and science: How professor gender perpetuates the gender gap. *The Quarterly Journal of Economics*, 125(3), 1101-1144.
- Carrell, S. E., Fullerton, R. L., & West, J. E. (2009). Does your cohort matter? Measuring peer effects in college achievement. *Journal of Labor Economics*, 27(3), 439-464.
- Chen, T. (2018). A Corporate Ladder of Attrition for Women. *Wall Street Journal*, October 23, 2018, p. R5.
- Cox, G., T. Jaditz and D. Reese (2003). *The Effect of Enlistment Bonuses on First-Term Attrition among Navy Enlistees*. Alexandria, VA: Center for Naval Analyses.
- Dee, T. S. (2004). Teachers, race, and student achievement in a randomized experiment. *Review of economics and statistics*, 86(1), 195-210.
- Elvira, M. and L. Cohen (2001). Location Matters: A Cross-Level Analysis of the Effects of Organizational Sex Composition on Individual Turnover,” *Academy of Management Journal*, 44: 591-605.
- Fairlie, R., F. Hoffmann, & P. Oreopoulos. (2014). A community college instructor like me: Race and ethnicity interactions in the classroom. *American Economic Review*, 104(8), 2567-91.
- Faram, M. (2015). Better Benefits Aim to Persuade More Women to Stay In. *Navy Times* (May 30).
- Fletcher, J., J. McMahon, and A. Quester (1994). *Women in the Navy: The Past, Present, and the Future*. Arlington, VA: Center for Naval Analyses.
- Giuliano, L., D. Levine, and J. Leonard (2011). Racial Bias in the Manager-Employee Relationship. *Journal of Human Resources*, 46(1): 26-52.

Golding, H., J. Gasch, D. Gregory, A. Hattiangadi, T. Husted, C. Moore, R. Shuford, and D. Seiver (2001). *Fleet Attrition: What Causes It and What to Do About It?* Arlington, VA: Center for Naval Analyses.

Hall, K., K. Keller, D. Schulker, S. Weiland, K. Kidder, N. Lim (2019). *Improving Gender Diversity in the U.S. Coast Guard: Identifying Barriers to Female Retention*. Santa Monica, CA: Rand Corporation.

Harrell, M. Beckett, S. Chien, and J. Sollinger (2002). *The Status of Gender Integration in the Military*. Santa Monica, CA: Rand Corporation.

Hernandez Rodriguez, J. M., & Serna, C. (2020). *The effects of diversity among peers and role models on US Navy retention*. Master's Thesis, Monterey, CA; Naval Postgraduate School.

Hirsch, B., J. Jahn, T. Zwick (2020). Birds, Birds, Birds: Co-worker Similarity and Workplace Diversity and Voluntary Turnover. *British Journal of Industrial Relations*, 58(3): 690-718.

Hunt, J. (2016). Why Do Women Leave Science and Engineering? *Industrial and Labor Relations Review*, 69(1): 199-226.

Huntington-Klein, N. and E. Rose (2018). Gender Peer Effects in a Predominantly Male Environment: Evidence from West Point. *AER Papers and Proceedings*, 108: 329-395.

Ingraham, C. (2014). What the NBA can teach us about eliminating racial bias. Washington Post, Feb. 25, 2014.
<https://www.washingtonpost.com/news/wonk/wp/2014/02/25/what-the-nba-can-teach-us-about-eliminating-racial-bias/>, accessed 10-8-2020.

Johnson, B. and G. Andersen (2015). Mentoring in the U.S. Navy: Experiences and Attitudes of Senior Navy Personnel. *Naval War College Review*, 68(3): Article 6.

Karaca-Mandic, P., N. Maestas, and D. Powell (2013). *Peer Groups and Employment Outcomes: Evidence Based on Conditional Random Assignment in the U.S. Army*. Santa Monica, CA: Rand Corporation.

Kofoed, M. and E. McGovney (2017). The Effect of Same-Gender and Same-Race Role Models on Occupation Choice: Evidence from Randomly Assigned Mentors at West Point. *Journal of Human Resources* (forthcoming).

Kraus, A., A. Parcell, D. Reese, and R. Shuford (2013) *Navy Officer Diversity and the Retention of Women and Minorities*. Arlington, VA: Center for Naval Analyses.

- Laurence, J., J. Naughton, and D. Harris (1996). *Attrition Revisited: Identifying the Problem and its Solutions*. Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.
- Leonard, J. and D. Levine (2006). The Effect of Diversity on Turnover. *Industrial and Labor Relations Review*, 59(4): 547-572.
- Lyle, D. (2007). Estimating and Interpreting Peer and Role Model Effects from Randomly Assigned Social Groups at West Point. *Review of Economics and Statistics*, 89(2): 289-299.
- Lyle, D. and J. Smith(2014). The Effect of High-Performing Mentors on Junior Officer Promotion in the U.S. Army. *Journal of Labor Economics*, 32(2): 229-258.
- Matsa, D. and A. Miller (2011). Chipping Away at the Glass Ceiling: Gender Spillovers in Corporate Leadership. *American Economic Review*, 101(3): 635-639
- Pope, D. G., Price, J., & Wolfers, J. (2018). Awareness reduces racial bias. *Management Science*, 64(11), 4988-4995.
- Price, J., & Wolfers, J. (2010). Racial discrimination among NBA referees. *The Quarterly Journal of Economics*, 125(4), 1859-1887.
- Rondeau, A. (2015). Tackling Troubling Trend of Women Leaving Military. *San Diego Union-Tribune*, June 11, 2015.
- Thomas, J. and C. Dunklin (2020). *An Analysis of Factors Impacting Retention Decisions of First-Term Sailors*. Master's Thesis. Monterey, CA: Naval Postgraduate School.
- Tilghmann, A. (2015). All Combat Jobs Open to Women in the Military, *Military Times*, December 3, 2015.
- U.S. Defense Department (2018). *Profile of the Military Community: 2018 Demographics*. Washington, DC: Office of the Deputy Assistant Secretary of Defense for Military Community and Family Policy.
- U.S. Department of Navy (2006). *Navy Climate Survey, 2006*. Millington, TN: Bureau of Naval Personnel, Navy Personnel Research, Studies, and Technology (NPRST).
- U.S. Department of Navy (2015). *The Navy Leader Development Strategy*. Washington, DC: author.
- Warner, J. and B. Asch (1995). The Economics of Military Manpower. In *Handbook of Defense Economics*, Vol. 1. Amsterdam: Elsevier.

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