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Estimated Effects of Facility Quality on SROTC Recruitment and Retention

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Abstract

This paper summarizes the research that CNA performed to understand how Senior Reserve Officers' Training Corps (SROTC) facility conditions may disproportionately affect SROTC recruitment and retention at Minority-Serving Institutions (MSIs). We used facility quality data, recruitment and retention measures, and institution information to assess whether a relationship exists between SROTC program facility quality and the recruitment and retention of SROTC participants. Using regression analysis and machine learning, we found that, although there is some relationship between SROTC facility related mission impacts and an increase in the two-year dropout rate of SROTC candidates, scholarship rates had a much greater effect on recruitment and retention, specifically for college scholarship recipients compared with national scholarship recipients. We recommend exploring increases in college scholarships at MSIs as a potential way to increase retention of candidates at MSIs. Other recommendations include improved program viability assessment metrics, identification and mitigation strategies for gaps in SROTC program governance, and suggested facilities management practices including targeted facilities spending and facility planning standards for SROTC programs.

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Approved by: **August 2021**

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Executive Summary

The Department of Defense (DOD) and government leaders are greatly interested in improving the representation of racial and ethnic minority groups in the armed forces, as evidenced by the emphasis of previous and current secretaries of defense on the importance of diversity in the military, and the 2018 National Defense Strategy statement that "diversity is essential for warfighting success"[1]. The Senior Reserve Officer Training Corps (SROTC)[1] is the largest commissioning source for officers, and the DOD Board on Diversity and Inclusion found that "racial and ethnic minorities are more likely to take non-academy[2] routes to gain commissions" in the services [3]. SROTC programs at minority-serving institutions (MSIs)[3], therefore, provide an important avenue for students from historically underrepresented racial or ethnic groups to join the services. To this end, in the Senate Armed Services Committee (SASC) report that accompanied the fiscal year 2020 National Defense Authorization Act, Congress called for a report on the condition of facilities that SROTC candidates use at MSIs and an exploration of how these conditions affect SROTC recruiting and retention. To inform its report to Congress, the Office of the Under Secretary of Defense for Personnel and Readiness asked CNA to study these issues.

A body of knowledge on facilities assessments, facilities investment, and (particularly in the civilian sector), research reveals a relationship between the condition of facilities and the recruitment of students in higher education. We relied on the existing literature about facilities investment and recruitment of students in higher education to build the methodology and approach of the current study. Our approach comprises three parts:

- Assessing aggregated SROTC recruitment and retention data

[1] SROTC is one of several options individuals have to achieve an officer commission in the US armed forces. SROTC prepares candidates for potential commission as an officer in the military via programs run by the armed forces at qualifying civilian institutions of higher learning [2].

[2] Non-academy refers to commissioning programs other than attendance at one of the service academies: the US Naval Academy (USNA), US Military Academy (USMA or West Point), or US Air Force Academy (USAFA).

[3] Minority-serving institutions (MSIs) as defined under part F of the Higher Education Act (HEA), 20 U.S. Code § 1067q[4].

- Measuring and assessing SROTC facility quality, including the components of condition, capacity, configuration, and facility-related mission impacts[4]
- Assessing the potential relationship between facilities quality and recruitment and retention using regression analysis and machine learning

The analysis in this report includes only SROTC host programs—that is, programs that provide military training to students at the campus where the students attend school. Because the Army, Air Force, and Navy operate SROTC programs separately, some universities may have more than one host ROTC program on campus. To improve the likelihood of the analysis bearing meaningful statistical results, we focused our analysis on Hispanic-Serving Institutions (HSIs) and Historically Black Colleges and Universities (HBCUs), which make up over 80 percent of MSI designated schools with SROTC host programs. Universities that do not receive any type of MSI designation serve as the source of our "non-MSI" comparison group. As a result, our final sample includes 169 schools and 235 SROTC programs with the following designations:

- 28 HBCUs with 38 SROTC host/consortium programs
- 27 HSIs with 41 SROTC host/consortium programs
- 114 non-MSIs with 156 SROTC host/consortium programs

Our results from the recruitment and retention analysis indicate that four-year commission rates are higher at non-MSI programs—28 percent compared with 21 percent at MSIs. However, we conclude that this difference in commission rates likely is attributable to candidates at non-MSIs being more likely to have scholarships than are candidates at MSIs. When controlling for scholarship status,[5] we find that programs at MSI and non-MSI have similar four-year commission rate distributions, implying that scholarship status may be a significant retention driver (i.e., likelihood of commissioning within four years). Specifically, we show that in our sample, 63 percent of SROTC candidates with scholarships commission within four years, compared to only 10 percent of candidates without scholarships, a result that is consistent across school type. Moreover, the difference in scholarship rates across MSIs and non-MSIs is driven almost entirely by a difference in the presence of national scholarship students, who appear to participate disproportionately in SROTC programs at non-MSIs. To

[4] Condition is the physical status of the facilities used by the SROTC host program. Capacity is the size of the facility in relation to the amount of these facility types needed by the SROTC host program. Configuration is the functionality (or obsolescence) of the facilities to support the missions being performed by the SROTC host program.

[5] Scholarship status includes three categories: In receipt of an SROTC national scholarship, in receipt of an SROTC college scholarship and not receiving an SROTC scholarship, or no scholarship.

understand this scholarship disparity further, it may be beneficial for the Office of the Secretary of Defense (OSD) to explore why national scholarship students are choosing to attend non-MSIs.[6]

Our results from the facility quality assessment indicate that nearly 100 percent of SROTC programs in our sample report at least one facility issue. Based on our data call, the most commonly reported issues relate to capacity and access to facilities that SROTC units share with other campus organizations. Issues related to the availability of indoor training facilities accounted for roughly half of all programs having to cancel or postpone events.

Although most SROTC units experience some facility issues, we find a greater prevalence of issues (related specifically to condition and configuration) at MSI programs (particularly HBCUs) than at non-MSI programs. We also find that overall reporting of mission impact because of facility quality (condition, capacity, and configuration) is greater at MSIs than at non-MSIs, and that MSIs are more likely to have multiple issues that affect mission. In addition, our review of facilities sustainment investment shows that, on average, spending is similar across all schools, but that it varies widely between institutions. As a result, 57 percent of HBCUs spend less than an estimated target of 3 percent of plant value on facilities sustainment, compared to 32 percent of HSIs and 41 percent of non-MSIs.

Our results from relationship analysis between facilities quality and recruitment and retention indicate that, although we did find a weak relationship between some facility quality measures and specific recruitment and retention outcomes, in every instance scholarship rate overwhelms facility quality influence on recruitment and retention. Because this is an observational study and we cannot control fully for all factors that influence both facility quality and recruitment and retention, we cannot determine whether a change in facility quality would cause a change in recruitment and retention. Instead, we apply a pair of analytical techniques to assess whether there is a correlation between facility quality and recruitment and retention. First, we use a standard regression analysis to check for any significant relationships between our measures of facility quality and our measures of recruitment and retention. Second, we apply a machine learning technique using least absolute shrinkage and selection operator (LASSO)[7] to isolate the characteristics of a university and SROTC program that are most useful in predicting recruitment and retention outcomes.

The analyses suggest that our measures of facility quality do not exhibit a consistent, significant correlation with SROTC recruitment and retention. We do find, however, that in nearly every

[6] We note that in all of our analyses we control for differences across universities in the cost of tuition and the percentage of undergraduate students who receive financial aid. In doing so, we ensure that these differences are not driving our results.

[7] LASSO is a shrinkage and selection method for linear regression [5].

estimation, the SROTC scholarship rate exhibits a consistent, significant relationship with candidate retention. Specifically, we find that a 10 percentage point increase in the share of candidates with a SROTC scholarship is associated with a 5 percentage point increase in the percentage of candidates who commission within four years. This relationship appears particularly strong for scholarships that are granted by SROTC staff to students who join SROTC after beginning undergraduate studies at the university—what we refer to as college scholarships. We estimate that a 10 percentage point increase in the share of candidates with a SROTC college scholarship is associated with a 7 percentage point increase in the percentage of candidates who commission within four years. These empirical results suggest that changes to scholarship rates are likely the most effective, and potentially efficient, means of changing recruiting and retention outcomes. Although this is the main finding and the focus of the study, we provide the following additional results from our analyses:

- We found that facility quality and recruitment and retention goals are not included in annual assessments that the services use to assess individual SROTC program success or viability [2]. We suggest that viability assessment measures be reviewed for inclusion of these data.
- We found that, because there is no facility planning standard for SROTC training requirements, each program must negotiate for and maintain access to training and education facilities on a case-by-case basis. We suggest establishing service-level minimum facility support requirements, which would benefit the individual SROTC program by minimizing mission impacts related to the quality of facility quality issues.

The results of this study may help advance DOD's goal to improve the racial and ethnic diversity among the officer corps by identifying significant factors influencing SROTC candidate recruitment and retention and recommending improvements to program governance and facilities management.

Contents

Introduction

The Department of Defense (DOD) and government leaders are greatly interested in improving the representation of racial and ethnic minority groups serving in the armed forces. Former Secretary of Defense Mark Esper and current Secretary of Defense Lloyd Austin have both emphasized the strength and innovation that diversity brings to the military [6-8]. This focus aligns with the National Defense Strategy assertion that recruiting and retaining a high-quality and diverse military and civilian workforce is essential for warfighting success because the "warfighter is our greatest enduring strength" [1]. Recruiting the best and brightest includes making all feel respected and ensuring that all have equal opportunities; this "applies not just to persons of color, but to ethnic differences" to ensure that the force represents the American people [9].

A recent report on diversity, inclusion, and equal opportunity in the armed services documented congressional interest in representation of minority groups among service members and recommended increasing commissions from Minority-Serving Institutions (MSIs) [3]. In alignment with leadership interest and efforts to improve the representation of racial and ethnic minority groups in the DOD, the Senate Armed Services Committee (SASC) directed the secretary of defense to examine Senior Reserve Officers' Training Corps (SROTC) programs at MSIs [10] [3, 11]. Congress is aware that cuts to states' budgets can affect investment in and sustainment of all campus facilities, including those used by SROTC programs [12]. Therefore, the SASC report that accompanied the fiscal year 2020 National Defense Authorization Act [12] called for a report to Congress on the condition of facilities used by SROTC candidates at MSIs and how these conditions affect SROTC recruiting and retention outcomes at these institutions. In response, the Office of the Under Secretary of Defense for Personnel and Readiness asked CNA to study these issues to inform its report to Congress.

The rest of this paper provides background information, followed by sections detailing the methodology, approach, and findings of each of the major efforts within the study. We then present our conclusions and recommendations. The major sections cover the following:

- Recruitment and Retention
- Facilities Quality
- Estimated Effects of Facilities Quality on Recruitment and Retention

Background

In this section, we discuss the following:

- The SROTC commissioning program, including SROTC scholarship information
- MSIs
- Individual SROTC programs included in the analysis
- Recruitment and retention
- Facilities quality

SROTC

SROTC is one of several options for achieving an officer commission in the US armed forces. Individuals can also receive officer commissions by attending a service academy,[8] commissioning after graduating through Officer Candidate School (OCS) or Officer Training School (OTS),[9] commissioning through the US Marine Corps Platoon Leaders Course (PLC),[10] or commissioning by direct commission.[11] Table 1 summarizes the percentage of individuals who commissioned from these sources in FY 18. SROTC is the largest single commissioning source for the military services, accounting for more than 35 percent of total officer commissions.

[8] Service academies provide training and education leading to a four-year bachelor's level degree and an officer commission. The service academies include the USNA for Navy and Marine Corps commissions, USMA for Army commissions, and the USAFA for Air Force commissions.

[9] OCS, or OTS for the Air Force, is a multi-week training program designed to prepare civilians and enlisted personnel for an officer commission. Candidates normally already have an advanced degree prior to attending OCS. Details of each program are dependent on the specific service.

[10] The USMC "Platoon Leaders Class (PLC) undergraduate commissioning program allows college students who are currently enrolled full time in any accredited college or university to pursue a commission in the Marine Corps without interrupting academic careers"[13].

[11] Civilians who have special skills in areas such as law or medicine, for example, may receive a direct commission upon entering service.

Table 1. DOD source of commissioning percentage

Service	Service Academy	SROTC	PLC/OCS/OTS	Direct Appointment	Other/Unknown
Army	15.27	52.46	17.17	13.9	1.2
Navy	19.59	21.23	25.45	20.64	13.09
Marine Corps	15.86	3.71	32.74	4.6	43.09
Air Force	19.33	33.93	27.06	18.49	.58
DOD	17.69	35.34	23.39	15.97	7.61

Source: Office of the Under Secretary of Defense, Personnel and Readiness. Population Representation in the Military Services: Fiscal Year 2018. Appendix B: Historical Data Tables. Table B-322: Active Component Commissioned Officer Gains, FY18: by Source of Commission. Published in 2020. http://www.cna.org/research/pop-rep.

United States Code (U.S.C.)[12] authorizes the establishment of SROTC programs designed to prepare cadets and midshipmen to be commissioned officers in the military services. The programs involve training events that "must include a conceptual awareness of war and armed conflict, an introduction to Service roles and missions, and a basic understanding of joint and combined operations"[2].

SROTC scholarships

As background to our discussion of recruitment and retention metrics, we provide the following overview of SROTC scholarships. We do so because the timing of a scholarship award for a specific SROTC student has implications for the university the student attends, where the student is in their educational career, and, in turn, their experience with and commitment to SROTC.

We characterize SROTC scholarships into two types: national scholarships and college scholarships. National scholarships cover most or all of the cost of tuition and are awarded to prospective SROTC students prior to their attendance at (or commitment to attend) a university. To receive a national scholarship, students must apply to a specific military department, pass the ROTC basic fitness test, and exhibit high academic ability by exceeding a minimum high school GPA and SAT/ACT score. National scholarships are awarded predominantly to high school students who are applying to colleges but have not yet

[12] "For the purpose of preparing selected students for commissioned service in the Army, Navy, Air Force, or Marine Corps, the secretary of each military department, under regulations prescribed by the president, may establish and maintain a Senior Reserve Officers' Training Corps program, organized into one or more units, at any accredited civilian educational institution authorized to grant baccalaureate degrees, and at any school essentially military that does not confer baccalaureate degrees, upon the request of the authorities at that institution"[14].

committed to a specific university. Thus, national scholarship students can use this financial support at whichever university they attend, as long as the service awarding the scholarship has an SROTC program at that university. As a result, these students get to choose what university they attend after they decide to join SROTC. National scholarship students begin their participation in SROTC in the first term of their freshman year, but do not have an explicit commitment to commission into service as an officer unless they continue to use the scholarship after their second year at the university.

College scholarship students choose to attend a university with an SROTC program prior to requesting a scholarship and receive financial support that covers only a fraction of their tuition.[13] These students applied to and chose to attend a college with no official commitment to participate in SROTC, but elected to participate in the university's SROTC program after they began attending the university. In many cases, these students started participating in an SROTC program at their university for one or more academic terms without financial support before receiving a college scholarship. Because these students attended the university prior to joining SROTC, it is likely that they interacted directly with the SROTC staff and facilities prior to participating in SROTC.[14]

Based on these two forms of scholarship, we identify three types of SROTC students: national scholarship students, college scholarship students, and non-scholarship students.[15] From the qualifying conditions associated with each student type, it is clear that students of each type make the decision to join ROTC under different conditions. Because college scholarship students and students without a scholarship are already in attendance at a specific university, their choice to join an SROTC program at that university is potentially more heavily influenced by the SROTC facilities and staff at that program than the choice of a national scholarship student, who faces the additional decision of which university to attend. Moreover, because of the difference in decision timing across these student types, they potentially have different degrees of exposure to the facilities at the SROTC program that they ultimately attend. Specifically, students without a national scholarship likely have repeatedly seen SROTC facilities and spoken directly with the SROTC staff and students at a specific program before joining that program. In contrast, although national scholarship students may have visited the facilities and met with SROTC staff and students, they will also be choosing which program to

[13] The proportion of tuition that is covered by a college scholarship can depend on funding availability and cadet qualifications.

[14] Other financial aid is outside the scope of this study, but we do explore the impact of Pell grants at subject institutions in the estimated effects of facility quality on recruitment and retention section of this paper.

[15] Scholarships other than those provided as a part of SROTC program participation are not within the scope of this study.

attend based on other information about the university that may be unrelated to the SROTC program.

Given the potential differences in a students' exposure to SROTC facilities based on their scholarship type and status, we address our subsequent analysis by scholarship type. In each case, we first present results for all students, regardless of scholarship status.

Minority Serving Institutions

MSIs date back as far as the mid-1800s, when schools such as Lincoln University, Cheyney University of Pennsylvania, and Wilberforce University were established to educate African Americans, who were legally barred from attending white colleges and universities.[16] Even after the Civil War and the abolition of slavery, universities with white students typically prohibited or severely limited attendance by Black students until the passage of the Civil Rights Act of 1964. The Higher Education Act (HEA) of 1965 [4] formally designated schools established before 1964 with the mission of educating Black Americans as Historically Black Colleges and Universities (HBCUs).

The HEA also established formal definitions for other types of MSIs. Title III of the HEA created programs to provide grants and financial support to schools serving mostly high concentrations of students from racial and ethnic minority groups. In creating eligibility rules for these programs, the HEA established formal definitions for different types of MSIs. In addition to being an accredited institution that awards bachelor's or associate's degrees, the school must have the following representation of students from specific minority groups, measured as a percentage of total undergraduate enrollment:

- Hispanic-Serving Institutions (HSIs): At least 25 percent of students are Hispanic.
- Predominantly Black Institutions (PBIs): At least 40 percent of students are Black, at least 50 percent of students are needy,[17] and the school is not listed as an HBCU or HSI.
- Alaska Native and Native Hawaiian-Serving Institutions (ANNHs): At least 20 percent of students are Alaska Native, or at least 10 percent of students are Native Hawaiian.

[16] We use the term "school" as shorthand for college or university.

[17] A student is considered needy if he or she: (1) is a Pell grant recipient; (2) comes from a family that receives benefits under a means-tested federal benefit program; (3) attended a secondary school that was eligible to receive benefits under Title I of the Elementary and Secondary Education Act of 1965; or (4) is a first-generation college student. If the school relies on the definition based on first-generation college students, a majority of such first-generation college students must be low-income.

- Native American-Serving, Nontribal Institutions (NASNTIs): At least 10 percent of students are Native American.
- Asian American and Native American Pacific Islander-Serving Institutions (AANAPISIs): At least 10 percent of students are Asian American or Native American Pacific Islander.

The HEA also provides a definition for Tribal Colleges and Universities (TCUs), which typically do not have enrollment requirements.[18] Any school that fits one of these definitions is considered an MSI. Although Congress has amended and reauthorized the HEA a number of times since 1965 most notably in 2008, with the Higher Education Opportunity Act of 2008 [17]—these definitions have remained unchanged.

Because the racial/ethnic composition of a school's student body determines whether it is considered an MSI, the comprehensive list of MSIs can change each year. To determine MSI status, the US Department of Education (ED) relies on enrollment data in the higher education general information surveys that schools provide to the ED. Each MSI type on the ED website links either to a specific list (HBCUs, for example) or to a resource that provides current enrollment numbers and eligibility (HSIs, for example). The ED website maintains an annually updated list of eligibility [18].

SROTC programs and institution MSI designation

The list of institutions examined in our study is based on the following information provided by the ED on designated MSIs:

- The services have a combined total of 498 SROTC programs that provide host functions (472 designated host programs plus 26 consortium programs that provide host functions) across 317 universities.
- Of these 317 schools, roughly 55 are either HBCUs or HSIs.[19]

[18] To qualify as a TCU, a school must qualify for funding under one of three acts: 1) the Tribally Controlled Colleges and Universities Assistance Act of 1978 (25 U.S.C. §1801)[15], 2) the Navajo Community College Act (25 U.S.C. §640a)[16], or 3) Section 532 of the Equity in Education Land-Grant Status Act of 1994 (7 U.S.C. §301)[14].

[19] The HEA designates the following MSI categories: HBCUs, HSIs, PBIs, ANNHs, NASNTIs, AANAPISIs, and TCUs.

- Twenty-eight schools are MSIs designated as HBCUs[20] with 38 host/consortium programs.
- Twenty-seven schools are MSIs designated as HSIs[21] with 41 host/consortium programs.
- Twenty-one institutions are designated as AANAPISIs,[22] 10 of which are also designated as HSIs.
- Three institutions are designated as ANNHs.[23]
- Two institutions are designated as PBIs.[24]

Recruitment and retention

We define recruitment in a given year at a specific SROTC program as the number of students who begin participating in that SROTC program for the first time that year. Because larger universities have a larger student body from which to recruit new students, we divide an SROTC program's total number of recruits in a year by the number of full-time undergraduate students at that university in that year.

Because a national scholarship student in his or her first term of SROTC participation will be, by definition, in the first term of attendance at the university, the vast majority of national scholarship "recruits" will be freshmen at the university. In contrast, recruits without a national scholarship, by definition, will not be in their first term of attendance at the university. College scholarship and non-scholarship candidates may be in the second term of their freshman year or in their second, third, or fourth year of attendance at the university. Unfortunately, our data do not allow us to decipher how long the student has attended the university before joining SROTC.

[20] The HEA of 1965 formally designated schools established before 1964 with the mission of educating Black Americans as HBCUs.

[21] Title III of the HEA of 1965 defines a school as an HSI if the Hispanic student population as a percentage of total undergraduate enrollment is at least 25 percent.

[22] The HEA of 1965 defines schools as AANAPISIs if at least 10 percent of students are Asian American or Native American Pacific Islander.

[23] The HEA of 1965 defines schools as ANNHs if at least 20 percent of students are Alaska Native or at least 10 percent of students are Native Hawaiian.

[24] The HEA of 1965 defines a school as a PBI if at least 40 percent of students are Black, at least 50 percent of students are needy, and the school is not listed as an HBCU or HSI.

We define retention in two ways: the percentage of students who commission within four years of beginning SROTC, and the percentage of students that leave SROTC within the first two years of beginning SROTC participation (see Table 2).

Table 2. Recruitment and retention definitions and metrics

Factor	Definition	Metric
Recruitment	-Candidates who join ROTC while in high school -Candidates who join once at the university	-Total number of new ROTC students in a program (service-school) in a FY
Retention	-Candidates who remain in the ROTC program through commissioning	-Percentage of a cohort that commissions within four years -Percentage of a cohort that drops out of ROTC within two years

Source: CNA.

Facilities quality

In this section we provide the background for the facilities quality analysis including:

- SROTC facilities governance.
- Types of SROTC programs, including facilities responsibilities.

Facility governance of SROTC programs

Because this study calls for an assessment and understanding of facilities used by SROTC programs, we reviewed and assessed current facilities policies, procedures, and agreements between the services and institutions with SROTC programs.

Although DOD instruction governs SROTC training programs and provides guidance and requirements for establishment and continuation of SROTC programs [2], SROTC programs are established through individual agreements between each institution and each service. In 2018, DOD issued a directive for the services to update their agreements with a 10-year review and renewal requirement added to the DOD instruction [2]. Based on data gathered and conversations with the services, we learned that some of these agreements are still being updated and may not reflect either current unit requirements or requested changes to current agreement language. These agreements should be important to the study as they reflect program commitments and expectations between the service and the institution.

Additionally, DOD Instruction 1215.08 directs [2] that all programs be required to perform an assessment that records compliance with service-established standards and informs service-

level recommendations on the viability of the specific units. These assessments help confirm compliance with the written agreements.

Types of SROTC programs

ROTC units have different levels of responsibility depending on the designation of the relationship between the academic institution and the specific service. These include the following [2]:

1. "Host Unit. A host unit is located at an institution that has an agreement with a Military Department to maintain an ROTC unit on its campus. Cadets and midshipmen at this institution attend ROTC classes and activities on their own campus. A host unit is manned full-time with staff assigned to that institution.
2. Extension Unit. An extension unit is located at an institution that has an agreement with both a host ROTC unit and with the ROTC Command of a Military Department to maintain on its campus an ROTC presence extended from the host unit. Cadets and midshipmen at this institution attend ROTC classes and activities on their own campus.
3. Cross-Town. A cross-town describes an institution that has an agreement with both a host ROTC unit's institution and with the ROTC headquarters of a Military Department that would allow its students to enroll in the ROTC program of the host unit. Cadets and midshipmen at this institution attend ROTC classes and activities on the campuses of the host unit and the cross-town institution if necessary. There is no ROTC staff assigned to this institution.
4. Consortium. A consortium describes an arrangement between multiple ROTC units in order to share resources to maximize efficiency. These resources can include, but are not limited to, facilities, staff, organizational structure, processes, and administrative material. A consortium can consist of host units, extension units, cross-town institutions, or any combination thereof."

Because of the specific nature of this study and the focus on SROTC program facilities, the study sample includes only host programs and Navy consortium programs that provide host functions, which includes providing access to training and education facilities.

In the next sections, we present the methodology and approach, as well as the findings, of the three main sections of this study:

- Recruitment and Retention
- Facilities Quality
- Estimated Effects of Facilities Quality on Recruitment and Retention

We discuss how we developed our sample set of SROTC programs, our SROTC recruitment and retention definitions and measures, and how we performed our review of SROTC governance. We also present a summary discussion of the in-depth facilities quality assessment methodology completed in "SROTC Facilities Condition Assessment" [19] and the details of the regression and machine learning methods used to explore any potential relationship between factors of facilities quality and the outcomes of SROTC candidate recruitment and retention.

Recruitment and Retention

In this section, we discuss the recruitment and retention analysis portion of this study, including how we selected our sample set of SROTC programs.

Methodology and approach

For the first part of this study, we selected our sample set of SROTC programs and then collected recruitment and retention data for these programs from the services to analyze summary statistics and compare recruitment and retention data between programs at MSIs vs non-MSIs.

Selection of SROTC programs included in this study

As the first step in analyzing facility condition effects on recruitment and retention at MSI SROTC units, we required an updated and validated list of MSIs with SROTC relationships. We began with the OSD-provided SROTC program list of schools. We then modified this list based on ED sources. Because of potential changes in designation, we started our review of designations at an ED webpage [18] that reviews the types of minority institution designations; our focus is on those designated as MSIs under part F of the HEA, 20 U.S.C. § 1067q, as described earlier. There is substantial overlap between some MSI designations (10 AANAPISIs are also designated as HSIs) and the very small numbers of other MSI designated schools (3 ANNHs and 2 PBIs). Because these very small numbers prevent us from performing meaningful statistical analysis on these separate categories, we focus our analysis on the largest number of MSI-designated schools with host SROTC programs, which are HBCUs and HSIs. To verify HBCU and HSI designation, we cross-referenced a list from the services with designations from the ED. We corrected and resolved discrepancies, including changes in host institution, corrections or changes in MSI designation, and standardization of institution names among the service programs and with ED naming conventions [19].

Because HBCUs and HSIs have distinct histories and student populations, they can differ dramatically from many non-MSIs. To ensure applicable comparison between MSIs and non-MSIs, we used data from the Integrated Postsecondary Education Data System (IPEDS)[25] and

[25] "IPEDS is a system of interrelated surveys conducted annually by the US Department of Education's National Center for Education Statistics (NCES). IPEDS gathers information from every college, university, and technical and vocational institution that participates in the federal student financial aid programs. These data are made available to researchers and others through the IPEDS Data Center" [20].

College Navigator to compare distributions of full-time undergraduate enrollment and four-year graduation rates between HBCUs, HSIs, and non-MSI schools with SROTC host programs. Using this information, we limited the schools in our analysis to the largest categories of MSI designated schools with SROTC programs, HSIs and HBCUs, and therefore include all HBCUs and all HSIs in the sample. For our non-MSI comparison group, we include only those universities that do not receive any type of MSI designation (or non-MSIs) that also have characteristics similar to the HBCUs and HSIs. Finally, the analysis in this report focuses on SROTC host programs—that is, programs that provide military training to students at the campus where the students attend school. As a result, we examine only MSIs and non-MSIs that have an SROTC host program on campus. Because the Army, Air Force, and Navy operate SROTC programs separately, some universities may have more than one host ROTC program on campus. Our final sample includes 169 select schools with a total of 235 host/consortium programs from which we collected data on facilities quality, recruitment, and retention. The final list of schools is in Appendix A.

Recruitment and retention analysis

We use a four-year commission rate as our measure of retention for two primary reasons. The first is that the SROTC program and curriculum are based on a four-year timeline. While not all students complete the program in four years, national scholarships are intended to cover four years of college attendance, most university degree programs base unit requirements on a four-year timeline, and about 80 percent of students who commission do so within four years of starting SROTC.[26] The second reason relates to the timing of our measurement of SROTC facility quality. As we explain in the following section on facility quality, we measured SROTC facility quality via a data call to each SROTC program during FY 21, and therefore have information only on the current quality of SROTC facilities. To ensure that our observed measurement of facility quality is measuring the same quality experienced by the students in our analysis, we must include recruitment and retention data only for students who are currently participating in SROTC or have participated very recently. However, because completing SROTC requires multiple years of participation, the most recent cohort of students that could have commissioned would have started SROTC in FY 17, four and a half years ago.[27] To include more than one cohort in the commission rate analysis, we also include the cohort of student who began SROTC during FY 16. Although we acknowledge that these students may not have experienced the SROTC facility quality that we measure in FY 21, we identify them as

[26] Based on our data of all commissions in both FY 19 and FY 20.

[27] Note that because FY 21 was ongoing at the time of data collection, we could not include the cohort that began in FY 18 in the commissioning analysis as some of these students have not yet commissioned but may likely do so prior to the end of FY 21.

the most appropriate cohorts for analysis pertaining to commission rates. Examining a five-year commission rate would in turn require analysis of cohorts that began as early as FY 15, which we believed was too long ago to be pertinent to our measure of facility quality.

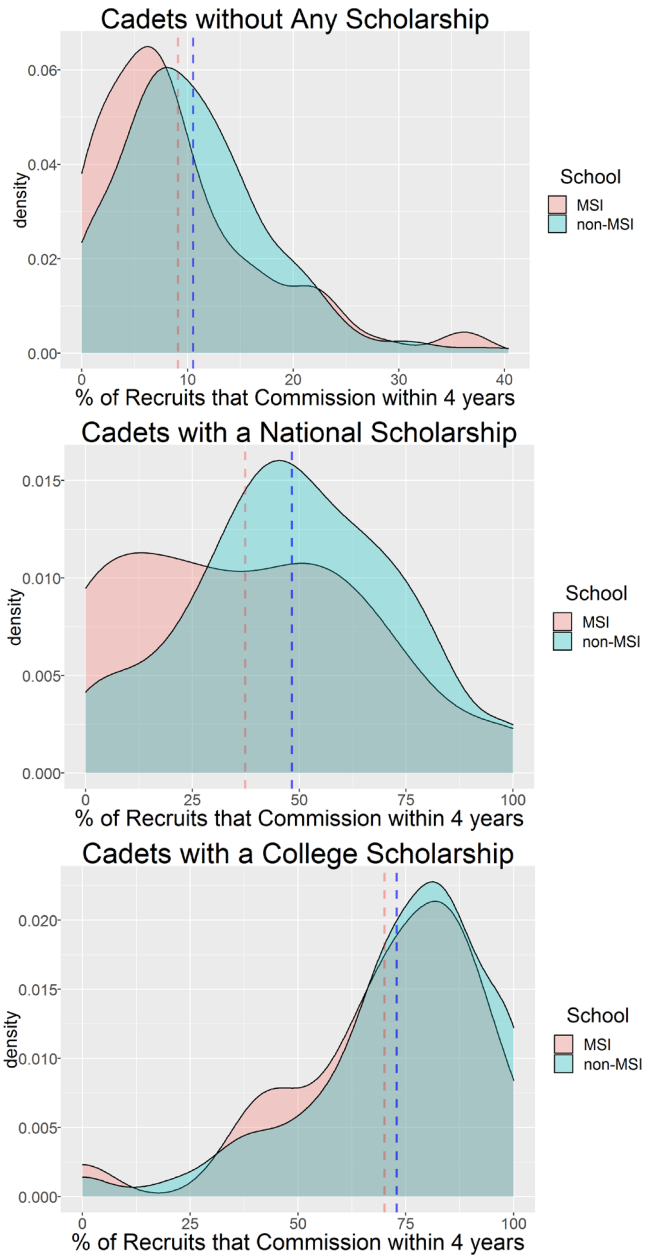
As an alternative measure of retention, we examine the percentage of students who stop participating in SROTC within two years of their initial participation. Focusing on the two-year separation rate allows us to assess an intermediate outcome that is not as restrictive as commissioning into service. In addition, the national scholarship requires a formal commitment to commissioning if the cadet continues participating in SROTC and using the scholarship money past his or her second year. As a result, persistence beyond two years represents an important milestone for the candidate and the service. Moreover, because assessing the two-year dropout rate requires only that we observe a cohort for two years, this measure also allows us to focus on SROTC students who trained at their program's SROTC facilities within the past two or three years. In doing so, we can have more confidence that the students in our analysis experienced SROTC facility quality that mirrors that measured in our FY 21 data call.

Findings

How scholarships relate to commission rates

Figure 1 shows the distribution of four-year commission rates for SROTC programs when we focus on three distinct populations of students: non-scholarship students, national scholarship students, and college scholarship students. In all three graphs, one observation represents a single SROTC program.

Figure 1. Four-year commission rate distributions, by scholarship type



Source: CNA.

Perhaps unsurprisingly, students without a scholarship exhibit the lowest four-year commission rate (roughly 10 percent), which parallels the findings in the previous section that a lower scholarship rate is associated with a lower commission rate. Notably, the distribution of four-year commission rates is very similar for SROTC programs at MSIs and non-MSIs, meaning that students without scholarships commission at a consistently low rate, regardless of school type.

Comparing the distributions for national scholarship students and college scholarship students reveals that college scholarship students are much more likely to commission within four years than are their national scholarship counterparts. The difference in four-year commission rates is stark; less than 60 percent of national scholarship students commission within four years, while over 75 percent of college scholarship students commission within four years. This is particularly striking given that the annual financial support from a college scholarship is much less than that of a national scholarship.

There are a few potential explanations for this difference in commission rate between college scholarship and national scholarship students. First, it is worth noting that, while national scholarship students begin SROTC as freshmen, non-scholarship students likely begin SROTC during the latter half of their first year or during the second or even third year at the university. This means that college scholarship students may have more university coursework completed when they start SROTC and thus may be closer to graduation. Another potentially important difference is that college scholarship students often begin taking SROTC courses before receiving a scholarship. This "trial period" allows SROTC staff to assess these students' ability to succeed in military training and their dedication to commissioning. In contrast, national scholarship students can receive financial support in their first two years and still drop out of SROTC before their third year without incurring a commitment to commissioning. As a result, college scholarships yield a significantly higher commission rate than college scholarships do and at a lower cost.

The potential effect of increasing scholarships

Given the relatively high commissioning rate for scholarship students, in this section we discuss what might happen if the services were to increase the number of scholarships offered to students.

Increasing national scholarships

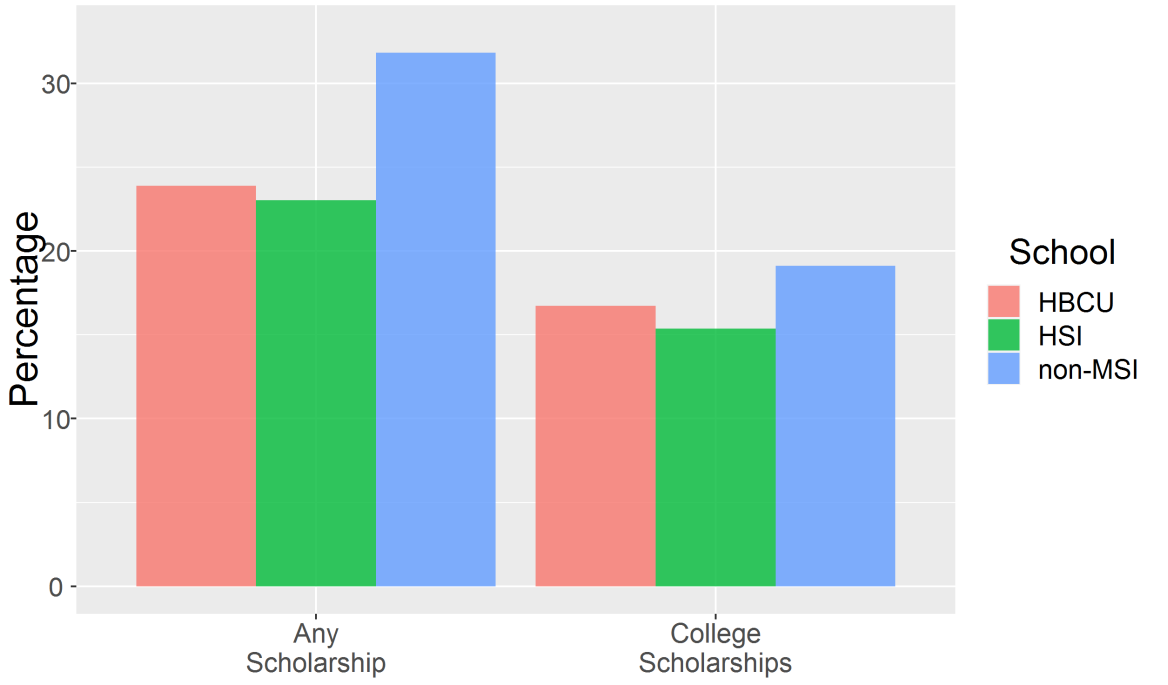
Our analysis suggests that increasing the number of national scholarships is associated with an increase in the four-year commission rate for SROTC programs. However, this does not mean that more national scholarships will translate into higher commission rates from SROTC programs at HBCUs and HSIs. Given the timing and conditions of a national scholarship, these students have the ability to attend any college to which they are granted admission, as long as

that college has an SROTC program affiliated with the service that granted the national scholarship. Thus, students who receive a national scholarship have no obligation to attend an MSI.

Figure 2 shows the percentage of SROTC students from each type of university who receive a scholarship. The left-hand side of the figure shows that SROTC students at non-MSIs are much more likely to have a SROTC scholarship of any kind. Given national scholarship students' ability to choose their university, it may be that these students disproportionately sort into non-MSIs. The right-hand side of the figure mostly confirms this. When excluding national scholarship students, students at MSIs and non-MSIs have relatively similar scholarship rates.

Although only descriptive, this discussion suggests that increasing the number of national scholarships will likely not increase the recruitment and retention at MSIs because national scholarship students are much more likely to attend non-MSIs.

Figure 2. Percentage of recruits with a scholarship



Source: CNA.

Facilities Quality

In a separate document, *"SROTC Facilities Condition Assessment"* [21], the study team performed an extensive facility condition assessment of facilities used by SROTC candidates at MSI and non-MSI host program locations. We summarize this assessment below.

Methodology and approach

In this section, we present the methodology and approach of the facilities quality assessment that we performed on SROTC program facilities.

Governance review

Our policy review of MSI and non-MSI agreements focuses on types of facilities committed to the SROTC unit; sharing agreements; condition expectation; assessment of adequacy of facilities; and other facility related specifics. We reviewed available documents from the service SROTC program offices that related to the agreements between the services and the colleges, looking specifically for any information on college-provided facilities used by the programs. Our review also included annual evaluations of the host programs performed by the services. We supplemented our document review with phone conferences with each of the services to capture additional information on the facilities provided, as well as facilities expectations, issues, and resourcing. Appendix B discusses our facility governance review in more detail.

Facility quality definition

Based on facility assessment research [22-25] and the researchers' extensive experience with the Navy's facility evaluation process, we determined that a facility's condition is not the sole factor in assessing facility quality. Other aspects—including size, location, and layout—are important to understand the quality of a facility. Therefore, a broader definition of the facility status provides a more useful way to evaluate the SROTC facilities and we adapted three factors that the Navy uses to evaluate its facilities to assess the broader concept of facility quality; together they provide a facility quality picture [26]:

1. Condition is the physical status of the facilities used by the SROTC host program.
2. Capacity is the size of the facility in relation to the amount of these facility types needed by the SROTC host program.

3. Configuration is the functionality (or obsolescence) of the facilities to support the missions being performed by the SROTC host program.

To understand further the severity of identified facility condition issues, we also looked at SROTC training mission impact attributable to facility quality issues. The mission of the SROTC unit is to train candidates to be commissioned officers in the services. If the unit cannot hold classes or perform training because of facility issues, it can be assumed that identified facility condition issues are severe.

Using the same list of SROTC programs used for the subject analysis in Appendix A, we applied a three-pronged approach to evaluate overall facility quality:

- Assessment of facility condition through a data call to SROTC programs
- Assessment of institution infrastructure investment and spending through a sustainment modeling effort
- Assessment of institution facility management strategies through subject matter expert (SME) discussions with college facility managers

Data call

Our primary source of SROTC facility condition and quality data is a CNA-developed formal data call sent to each of the host SROTC units. We used a web-based data call to collect responses. To elicit the highest response rate, the data call went to SROTC programs via the chain of command (i.e., military service SROTC lead organization to individual SROTC programs at host colleges). Table 3 summarizes the number of questions in the data call by facility quality factor and facility type assessed. [21]. SROTC mission impact was assessed through several questions associated with each facility category, along the lines of the following selection of questions associated with SROTC classrooms:

- "Over the past two years, has the ROTC unit had to cancel, postpone, reschedule, or relocate any classes due to a lack of classroom availability?"
- "Over the past two years, has the ROTC unit had to cancel, postpone, reschedule, or relocate any classes due to classroom condition?"
- "Over the past two years, has the ROTC unit had to cancel, postpone, reschedule, or relocate any classes due to a lack of classroom equipment or furnishings?"

Table 3. Data call questions by facility quality factors and facility type

Facility Quality	Condition	Capacity	Configuration	Free Response	Total
Facility Type					
Offices	14	1	3	1	19
Classrooms	15	2	6	1	24
Storage	13	1	2	1	17
Indoor Training	15	2	1	1	19
Field Training	1	2	2	1	6
Assembly	15	2	1	1	19
Other	0	0	0	2	2
Number of Questions	73	10	15	8	106

Source: CNA[21].

Because we collected responses from staff members at each SROTC program at each university, we generated questions that could be answered by people without facility expertise and that would elicit objective responses. The questions included in the data call met the following criteria:

- Yes/no, or simple response with drop-down menu options for response
- Facility expertise not needed to answer the questions

Of 235 units that received the data call, 211 responded—a 90 percent response rate. Table 4 and Table 5 reflect response rates by service and school type, respectively.

Table 4. Number of programs that responded, by service

	Received	Sent	Percentage
Army	140	146	96%
Air Force	53	68	78%
Navy	18	20	90%
Total	211	235	90%

Source: CNA [21].

Table 5. Number of programs that responded, by school type

	Received	Sent	Percentage
HBCU	36	38	95%
HSI	38	41	93%
Non-MSI	137	155	88%
Total	211	235	90%

Source: CNA [21].

Alternative facility condition and quality measures

Although the data call was our primary source of data on facility condition and quality, we also used the ED Integrated Postsecondary Education Data System (ED IPEDS) infrastructure investment data to explore facility investment and any potential relationships between spending and school designation. These data helped us compare colleges' spending levels to the standard used by DOD to determine needed facility investment spending for similar facilities using the DOD Facility Sustainment Model (FSM).[28] DOD has been using the FSM since 2003 to determine the required annual facility sustainment requirement for each of the military services. The FSM has been reviewed extensively, and a Government Accountability Office (GAO) evaluation found that the "FSM provided a consistent and reasonable framework for establishing DOD's annual facilities sustainment[29] requirements"[27].

ED IPEDS data include the annual spending on facilities and the total plant value of the facilities for 142 of the 169 colleges in our sample. We used these data to calculate facility investment spending as a percentage of plant value. To minimize potential year-to-year variations, we calculated this value based on an average of the 2016, 2017, and 2018 school year spending (2018 was the most recent year available).

We then evaluated spending per plant value against the FSM spending standard used by DOD and other organizations for their facilities, roughly 3 percent of facility plant value for a defense educational facility.

Understanding the negative impact on facility condition because of lower sustainment investment [26], we compared the institutions' facility spending per facility plant value to the standard using the ED IPEDS data for each of the colleges on our selected list.

Subject matter expert discussions

The third part of our facility quality assessment included discussions with facility management professionals at a sample of MSI and non-MSI institutions. Because of COVID-19 restrictions, our original planned campus visits were replaced by telephone and teleconference calls. Many of the campuses were closed to students and personnel during the period of the scheduled

[28] "The DoD facilities sustainment model (FSM) is used as the standardized model for forecasting facilities sustainment resource requirements" [27].

[29] "Sustainment means the maintenance and repair activities necessary to keep an inventory of facilities in good working order. It includes regularly scheduled adjustments and inspections, preventive maintenance tasks, and emergency response and service calls for minor repairs. It also includes major repairs or replacement of facility components (usually accomplished by contract) that are expected to occur periodically throughout the life cycle of facilities. This work includes regular roof replacement, refinishing of wall surfaces, repairing and replacement of heating and cooling systems, replacing tile and carpeting, and similar types of work" [27].

discussions, limiting our ability to arrange virtual meetings. We contacted a representative sample of facility management SMEs at MSI and non-MSI institutions to understand the SROTC facility maintenance and management processes as part of the overall institution facility management program. Although quality information was gleaned from these discussions, there may be limitations in the widespread applicability across all institutions because of the small sample size. To facilitate an open discussion, we conducted these on a voluntary and non-attribution basis.

Findings

Complete results of the analysis are included in *"SROTC Facilities Condition Assessment"* [21]. In this section, we summarize the findings of the facility quality analysis.

Governance review

From the governance review, detailed in Appendix B, we found that facilities were not mentioned often in any of the documents we studied. When they were mentioned, for example in the agreements, they were not considered in future program reviews. All the services have informally delegated responsibility for facility issue resolution with their host colleges to the individual programs.

We also found in our review of SROTC program governance that facility quality, recruitment goals, and retention statistics are not included in required annual program assessments to measure program success or viability.[30] Therefore, the annual assessments do not reflect facility-related mission impact and influence on program viability. Without recruitment goals by commissioning source, it seems impossible to assess the success of the recruitment effort or the contribution of any one program to the overall service recruitment goal.

We also found that the supporting institution and the local SROTC program staff handle SROTC program facility issues at their local level. There is no formal process to elevate facilities issues. We did find that several units highlighted facilities issues in our data call free response questions, and we also found that facility issues were reported by the SROTC program staff in correspondence with institution leadership. However, there is no way to raise those issues above the institution level or to the DOD level.

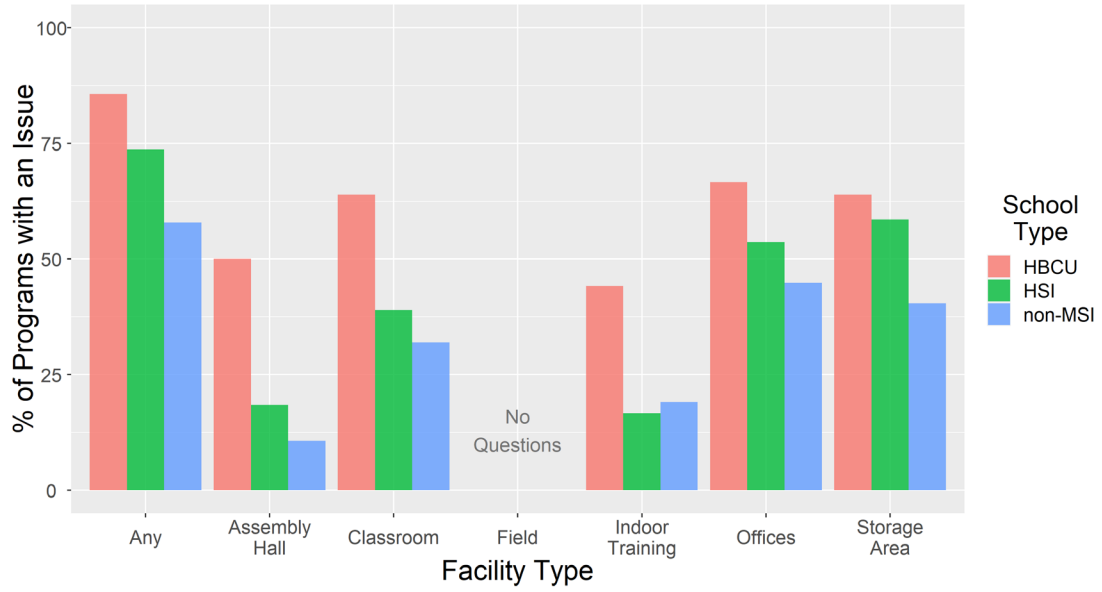
[30] Although not associated with program success or viability, the Army does ask second-year SROTC cadets if there are improvements in library materials, equipment, computers, and classroom space that could benefit the program experience as part of their larger cadet annual survey [28]. They also ask third-year cadets if campus facilities or overall facility appearance influenced their decision to select their current institution [29].

In our review of the SROTC program establishment agreements between the services and the universities, we found that they are not used to manage program-level facility requirements or to address facility issues. Initial agreements, sometimes decades old, did outline facility support requirements, but subsequent updates did not update these specifics. Therefore, original documented program requirements may not reflect current program needs. As mentioned previously, facility issues are not a formal part of the annual assessments; without a formal feedback mechanism to ensure that institutions comply with SROTC agreements with regard to facilities, improvements to these agreements may not lead to measurable changes to the programs' facilities or contribute to viability of programs.

Data call

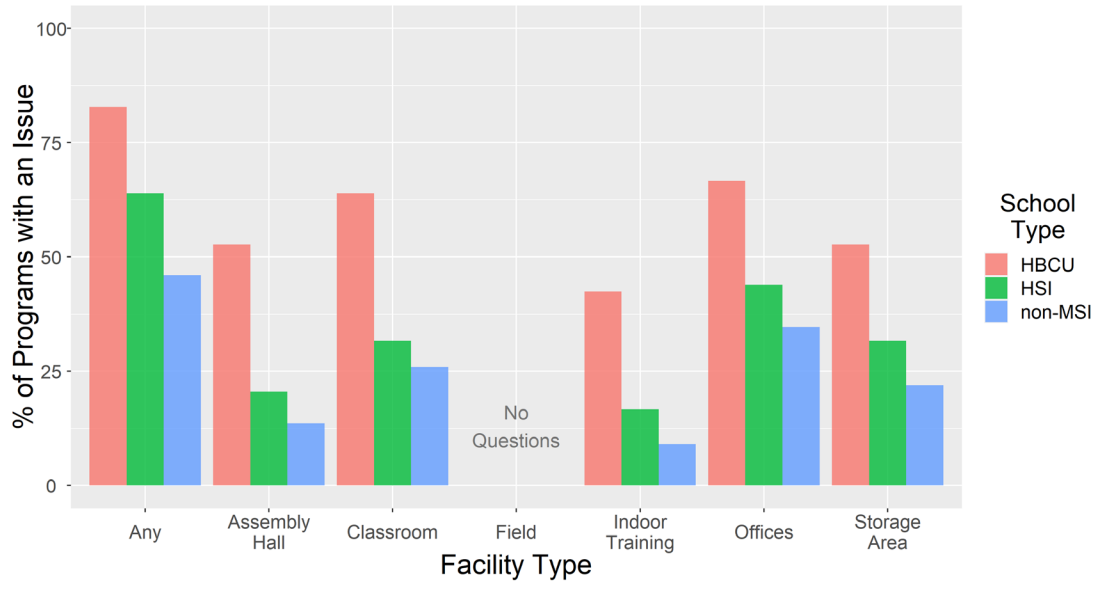
Overall we find that all SROTC programs—at both MSIs and non-MSIs—have at least some facility quality issues. However, we find that programs at MSIs report more instances of facility quality issues than do programs at non-MSIs. Programs at MSIs are more likely to report visible condition issues, such as peeling paint (see Figure 3) and potentially serious issues (see Figure 4), such as difficulty maintaining comfortable temperatures or ceiling damage potentially indicating plumbing or roof leaks. Issues with facility configuration, such as shared office space that may not support required counseling and mentorship events or lack of classroom equipment, are more common at MSIs than they are at non-MSIs (see Figure 5).

Figure 3. Facility issues—cosmetic



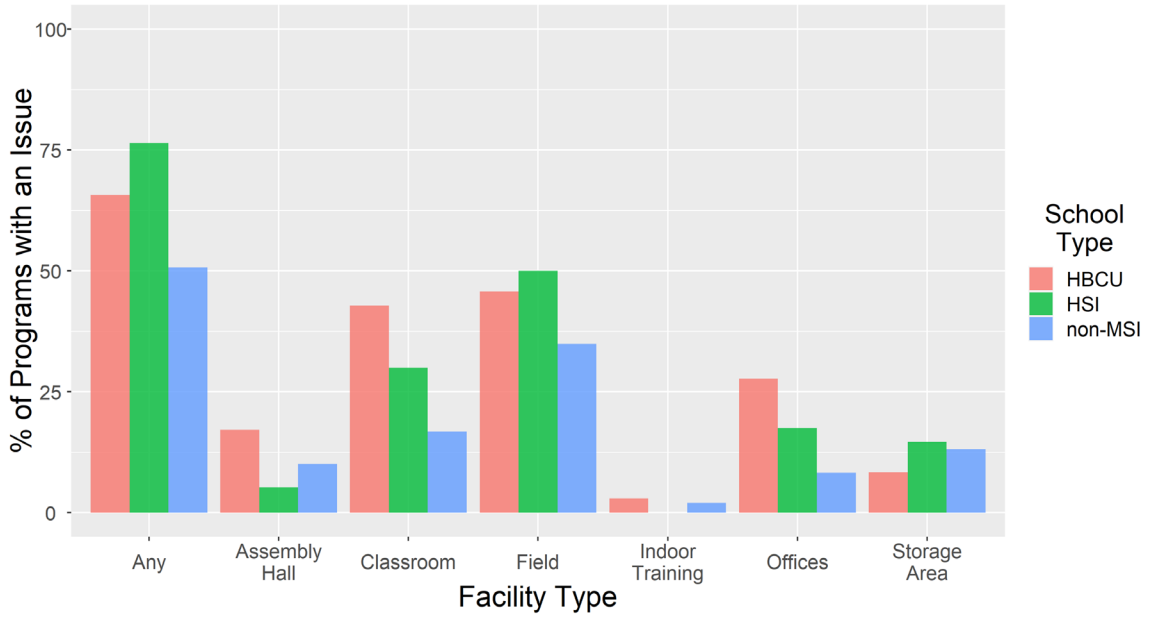
Source: CNA.

Figure 4. Facility condition issues—potentially serious



Source: CNA.

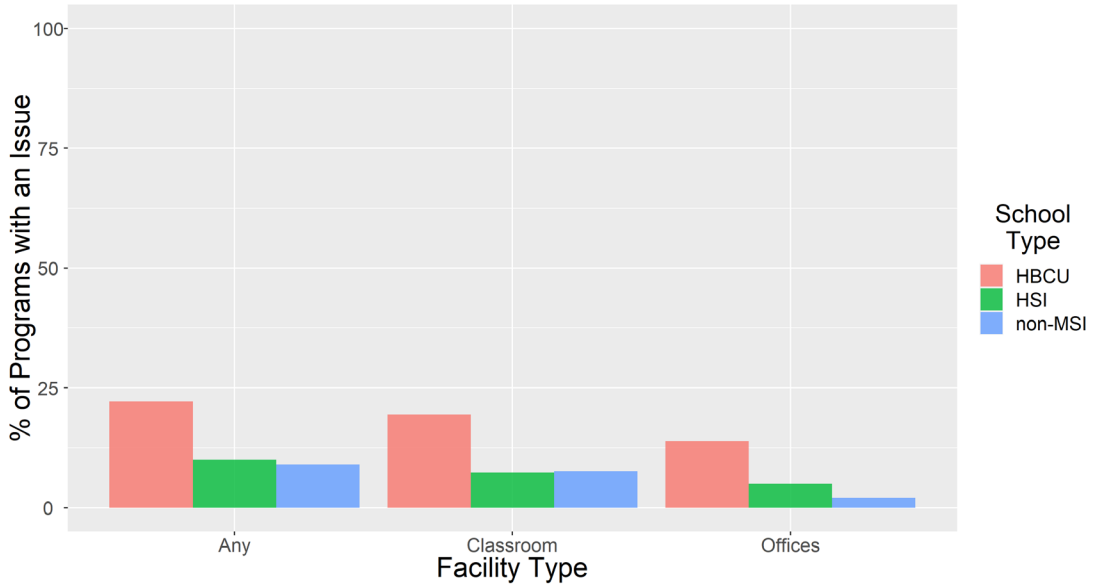
Figure 5. Configuration issues



Source: CNA.

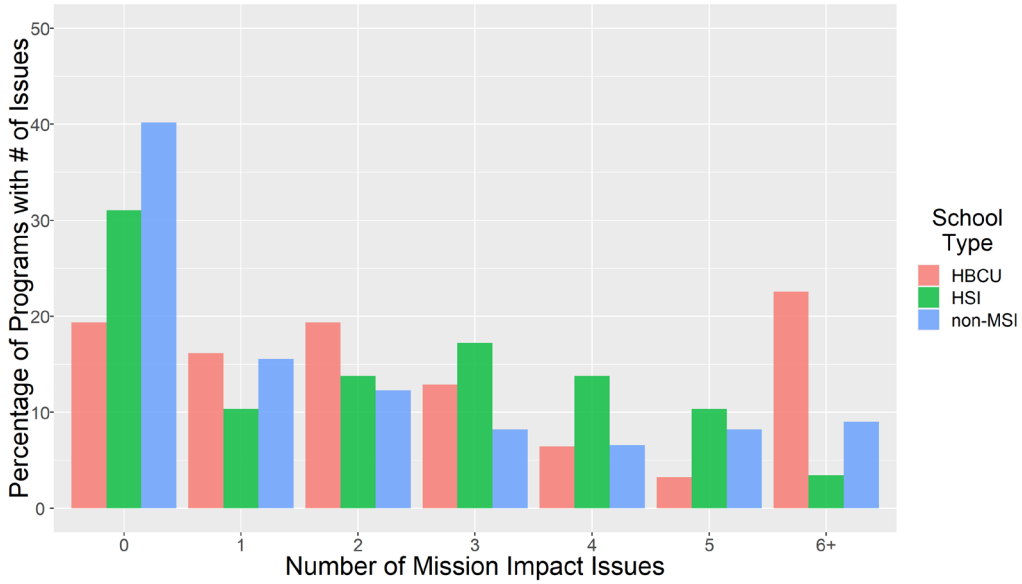
Facility issues are particularly acute among SROTC programs at HBCUs. These programs were more than twice as likely to have unsuitable internet in classrooms and offices as were programs at non-MSIs (22 percent versus 9 percent) (Figure 6). In addition, overall, MSIs report greater numbers of facility-related mission impact events than do non-MSIs (Figure 7).

Figure 6. Internet suitability



Source: CNA.

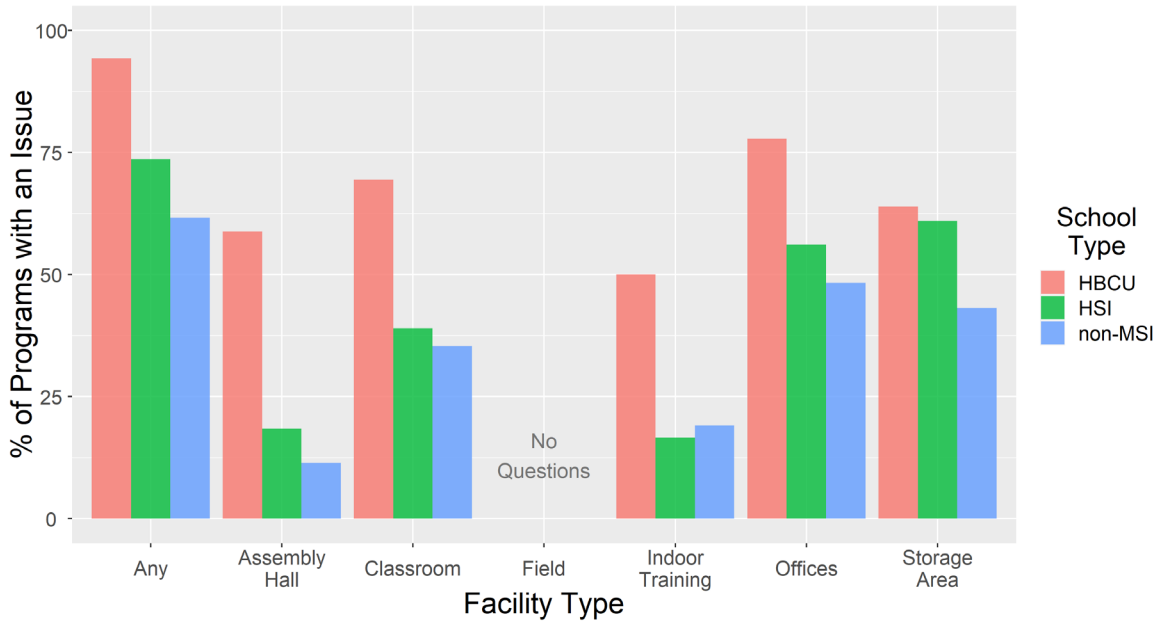
Figure 7. Distribution of mission impact issues



Source: CNA.

These findings, as well as facility quality measures by facility type (Figure 8) were used in the estimated effects of facilities quality on recruitment and retention analysis section later in this report.

Figure 8. Visible facility issues



Source: CNA.

Alternative facility condition and quality measures

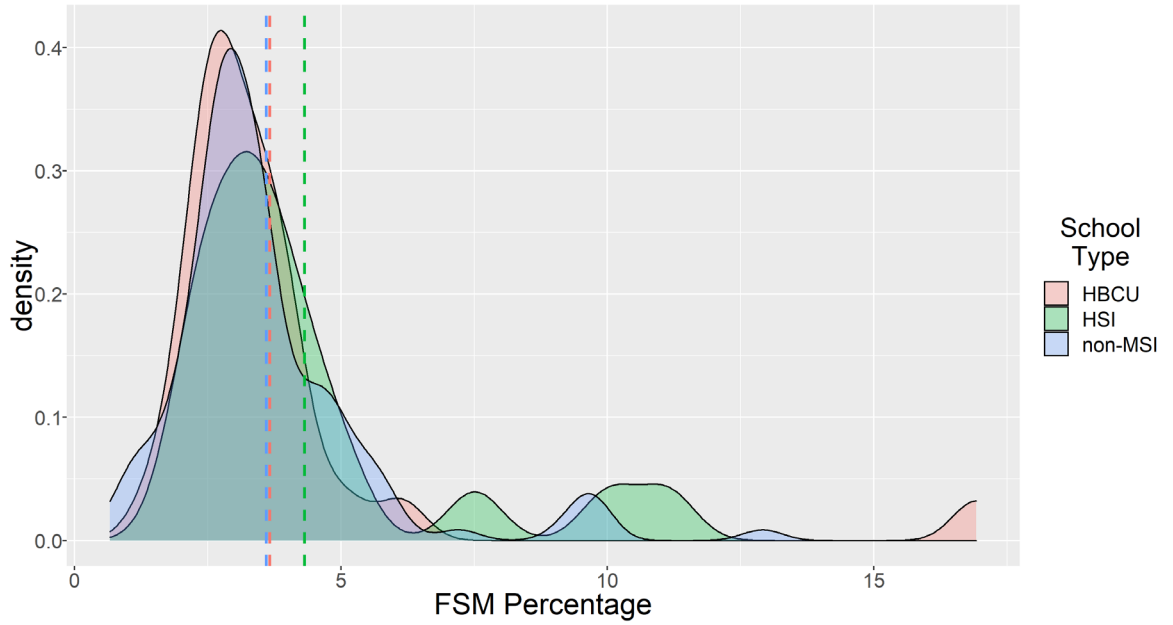
From our calculation of facility investment spending as a percentage of plant value, we found that, using overall averages, all college types in our analysis spend similar percentages of their plant value on their facilities (3.74 percent to 3.93 percent); HBCUs, however, generally have the lowest ratio. Table 6 summarizes these results by school designation. These averages mask a tremendous variation in the amount spent on facilities across colleges (individual college spending ratios range from 0.7 percent to 16.9 percent). Figure 9 illustrates the percentage of plant value spending.

Table 6. Facility spending by school type

Designation	FY16	FY17	FY18	Summary Average
HBCU	3.77	3.74	3.88	3.80
HIS	3.85	3.81	3.91	3.86
Non-MSI	3.83	3.79	3.93	3.85

Source: CNA [21].

Figure 9. Average facility spending, 2016–2018

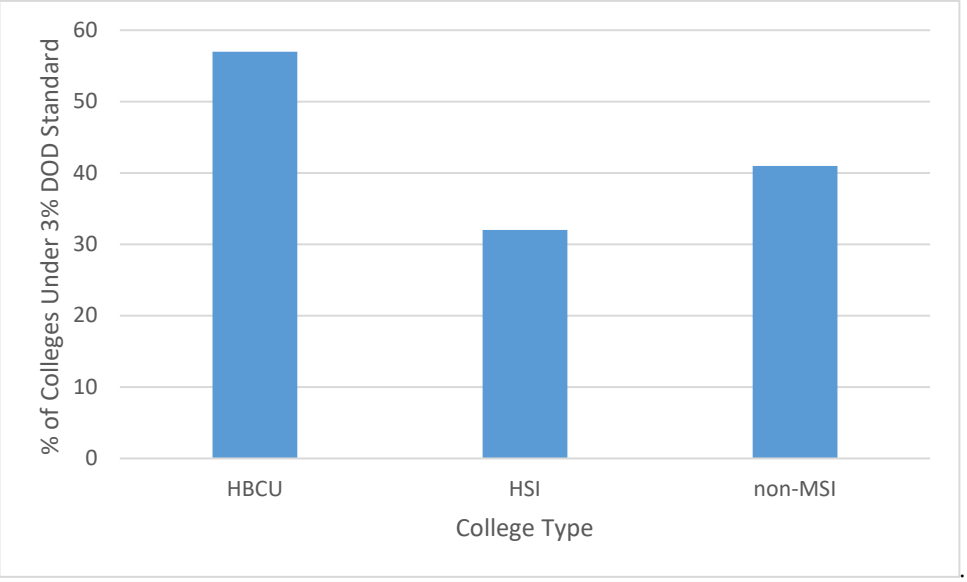


Source: CNA from IPEDs [21].

The result of the review of DOD standards showed that 3 percent of a facility plant value was the standard spending for a defense educational facility. The amount is consistent with "the National Research Council's generic estimate for sustainment of 2–4 percent of a facility's" plant value [30] and the Building Research Board's "conclusion that an appropriate annual total budget allocation for routine maintenance and capital renewal is in the range of 2 to 4 percent of the aggregate current replacement value of those facilities" [31]. The exploration

into facility investment spending is important because spending less than the targeted amount results in accelerated degradation of the condition of facilities. For DOD facilities, the GAO found that chronic failure to meet the goal of FSM spending "increases the risk of facility deterioration in the future," and, therefore, potentially mission capability [32].[31] As shown in Figure 10, 57 percent of the HBCUs had facility spending levels below the 3 percent spending standard. Lower percentages were seen for HSIs (32 percent) and non-MSIs (41 percent).

Figure 10. Percentage of spending below 3% standard



Source: CNA from FY 16-18 average spending ED IPEDS.[21]

Subject matter expert discussions

We found the following common themes in our SME discussions:

- All institutions we spoke with said that they treat the SROTC facilities the same as they do any other facility on their campuses. Some admitted that there may be competing priorities with athletics and other campus entities when scheduling shared facilities.
- Almost all colleges said that they were unfamiliar with the SROTC facility requirements included in the formal agreements between the military service and the

[31] From FY 2009 through FY 2014, the services have reported annually spending, in operation and maintenance funding, approximately 80 percent of the funds needed to meet estimated facilities sustainment requirements[32].

college. Those who were familiar with their agreements stated that they did not use that document to determine facility allocation or facility investment.

- Not all institutions have annual condition assessments. Many of the colleges use contractors to perform the condition assessments using a variety of different procedures to document the condition of their facilities, which inhibits the ability to collect comparable and consistent data. This supports our decision to use a data call and not to depend on data from the colleges for our condition and quality assessments.
- Only some of the colleges held regular, sometimes annual, meetings with the SROTC program staff to discuss facility issues. Many depended on routine interaction with the program staff to expose any facility problems.
- All the colleges had a form of automated work order processing system for facility requests, such as maintenance and repair work.
- Some of the colleges had dedicated building representatives who took the lead on presenting facility requests. Several of the colleges said that they provided college-paid administrative staff to the SROTC program as they did for all their academic programs. These staff members usually served as primary liaisons with the college facility staffs on any facilities issues.
- Only some of the colleges said that they had sufficient funds to fulfill all routine maintenance in a timely manner. They maintained lists of maintenance backlogs and prioritized them using a criticality process, such as prioritizing roof repairs. Most institutions are responsible for providing their governing organizations with informational reports on facilities and spending.
- Most of the colleges indicated that they had a formal capital investment plan covering new and replacement facilities. A few said they did not have a formal capital plan because of very limited funds for new facilities.
- Public colleges explained that most of their facility spending came from state funding. Private colleges said that they depend on tuition and other school fees for facility spending.

Summary conclusions

Through a combination of facility data analysis, spending analysis, and SME discussions, we found that the data indicate that all SROTC programs have some level of facility quality issues. We also found more instances of facility quality issues, reduced facility spending levels, and greater mission impact at MSIs than we did at non-MSIs, especially at HBCUs. MSI-designated schools showed greater mission impact issues in each of the facility type categories, with nearly 25 percent of HBCUs indicating six or more mission impact events. In addition, 57 percent of

HBCUs are not investing a suggested target level on facilities to prevent accelerated degradation and loss of service life of their facilities. We do not assess the reasons for the disparity in facility quality between MSIs and non-MSIs outside the alternative facility condition quality measure, which does show greater percentages of MSIs spending less on facilities investment than non-MSIs. Reasons for the lower spending rates are outside the scope of this study but could include the age of the campus, investment prioritization, or lack of funds. Detailed findings are published in *"SROTC Facilities Condition" [21]*. Facilities quality results, including condition, capacity, configuration, and mission impact are carried into the estimated effects on recruitment and retention analysis in the next section.

Estimated Effects of Facilities Quality on Recruitment and Retention

In this section, we examine whether the condition, configuration, and capacity of the facilities that SROTC programs use correlate with the available measures of recruitment and retention of candidates at these programs. We begin the methodology and approach section with a discussion of the potential limitations of this analysis, then discuss some noteworthy observations about retention and scholarships before discussing the results of our analysis.

Methodology and approach

In this section, we present the methodology and approach from the estimated effect of facilities quality on recruitment and retention including:

- Limitations of the analysis.
- Regression analysis approach.
- Machine learning approach.

Limitations of the analysis

As we present this analysis, we stress that our findings represent correlation and in no way imply that a change in one measure will cause a change in outcome. Assessing causality requires that differences in SROTC facility qualities across programs are uncorrelated with other observable and unobservable characteristics at the program and university that might also affect recruitment and retention. Because facility quality is not randomly determined, our measures of facility quality likely are correlated with university traits, such as the university's age, size, and financial health. Moreover, because we observe only a singular, present value of facility quality at each program, we cannot observe changes in facility quality within a program over time while holding the university constant, which could help to alleviate some of these concerns.

Although we can control for some observed information about each program and university—such as the SROTC scholarship rate, the four-year graduation rate, or the cost of tuition—there are other factors that potentially influence both SROTC commission rates and SROTC facility quality that we do not observe and therefore cannot control for. For example, previous research indicates that an institution with a strong major in the student's field of interest

influences institution selection [33]. Therefore, an interest in a particular major may influence a student's decision to stay and graduate and, therefore, commission. In such a case, a higher commission rate may be attributed erroneously to better facility quality when, in fact, it may be because of educational interest.

As noted earlier, the concept of recruitment has a very different meaning for national scholarship students than it does for students without a national scholarship. Because national scholarship students apply to SROTC before college admission, they show a desire to participate in SROTC prior to choosing a university and associated SROTC program. Therefore, the influence of facilities may be between competing institutions and associated SROTC programs but not directly associated to recruitment into SROTC overall. In contrast, students without a national scholarship may not have had interest in SROTC participation prior to attendance at their university and therefore may be directly influenced to join by the staff and the condition of facilities and at the SROTC program at their university. Recognizing the different conditions under which each type of student participates in SROTC, we include analyses that exclude students with a national scholarship.

Approach 1: Regression analysis

To assess the relationship between facilities and recruitment and retention, we first use a multiple linear regression approach. In this approach, we regress our three measures of recruitment and retention against various measures of facility quality and a collection of controls related to the SROTC program and the university. The general regression equation is as follows:

$$Outcome_p = \beta_0 + \beta_1 FacilityQuality_p + X_p + \varepsilon_p$$

Here, $Outcome_p$ represents the number of SROTC recruits per institution undergraduate student, the two-year dropout rate, or the four-year commission rate for a given program, p. $FacilityQuality_p$ is a vector of variables based on our facility data call that measures facility quality. In the first set of estimated equations, this vector includes the number of responses in which a program indicated facility condition issues, capacity issues, configuration issues, or issues that affected the execution of the SROTC mission. We then interact these four variables with an indicator for whether the program is at an MSI to assess any differential relationships between facilities and recruitment and retention at MSIs. This allows us to determine whether the relationship between facility quality and our outcomes is stronger at MSIs than at non-MSIs. This would be the case if facility issues do not reduce retention at non-MSIs but have a significant impact on retention at MSIs.

In a second collection of specifications, $FacilityQuality_p$ includes a collection of 17 binary variables indicating issues related to specific facility types. Finally, the vector of covariates, X_p,

includes variables that indicate whether the program is at an HBCU or HSI, whether the program is operated by the Army, Navy, or Air Force, and variables that control for the ROTC scholarship rate, the cost of tuition, the percentage of students at the university who receive a Pell grant, the university retention rate, the percentage of university students who receive any aid, the admission rate, and the test scores of students admitted to the university. These variables allow us to control for any observed differences across the universities and programs that may contribute to differences in recruitment and retention.

Approach 2: Machine learning variable selection

As an alternative method of identifying which variables help predict recruitment and retention at SROTC programs, we employ the least absolute shrinkage and selection operator (LASSO) regression model. The LASSO method uses an iterative optimization process to select the most relevant predictors of an outcome from a list of possible explanatory variables. The result of this method is an equation that includes only the explanatory variables that help produce the "best" estimate of our outcome, where "best" is determined by a specified test statistic.[32]

To apply the LASSO method to our current setting, we include all of our measures of facility quality and all of our observed characteristics about the university and SROTC program as potential predictors of recruitment and retention. We execute this model selection six times: separately for our three measures of recruitment and retention, across two different populations (all students and the population of students without a national scholarship). For each of the six iterations of LASSO, we consider "relevant predictors" to be the explanatory variables that LASSO includes in the final model.

Findings

The results of our analysis of facility quality and SROTC student outcomes suggest that visible facility condition issues have a moderate, inconsistent relationship with lower SROTC cadet retention, and we find that in some cases this relationship is slightly stronger at MSIs. However, our results conclude that the most significant and consistent relationship is between retention

[32] LASSO regression uses a tuning parameter to penalize the sum of the absolute value of regression coefficients. In doing so, LASSO will down-weight coefficients to zero for variables that do not provide sufficient predictive power, causing those variables to be excluded from the final prediction model. While the coefficients on the variables selected by LASSO are of little practical meaning, the approach can provide insight into which variables are most useful in predicting the outcome of interest. We use LASSO to select a tuning parameter based on the extended Bayes information criterion, re-run the LASSO estimation with the resulting tuning parameter, then examine the list of variables included in the final model.

and the percentage of SROTC students who have a scholarship. Although we stress that none of the results of this analysis can be interpreted as causal, we use this section to examine this relationship further and discuss how changes in scholarship rates may affect recruitment and retention.

Effect of facility quality by type of issue

Table 7 in Appendix C shows the results of using mission impact issues, condition issues, capacity issues, and configuration issues as the measures of SROTC facility quality. The estimates in Table 7 show that none of these measures of facility quality exhibits a statistically significant relationship with our measures of recruitment and retention. Furthermore, columns (3) through (6) indicate that no relationship exists between these measures at MSIs (that otherwise does not exist at non-MSIs), with one exception: an increase in the number of condition issues is associated with a very slight, marginally significant, increase in the two-year dropout rate. This relationship is not strong enough to definitively link facility quality directly to recruitment and retention effects for the population of SROTC students as a whole.

Table 8 show these same estimated equations when we exclude students with national scholarships. The results are similar to those found for all students. When included without interactions, none of the facility quality variables exhibits a statistically significant relationship with our measures of recruitment and retention. In the last three columns, we allow these relationships to depend on the MSI status of the university where the SROTC program resides. In these specifications, we find that the number of mission impact issues and the number of condition issues have a slight negative relationship with recruitment and the four-year commission rate, respectively, at MSIs. However, we note that the positive coefficient on the non-interacted values tempers these modest relationships. This variation in the estimated relationship confirms our main finding that we cannot confidently conclude that mission impact and condition issues exhibit a consistent, reliable relationship with recruitment and retention.

Also in Appendix C, we repeat these analyses separately for the Army and the Air Force SROTC programs in our sample.[33] Overall, we find that the results closely resemble those shown in the estimates for all services. Table 9 (including all Army SROTC candidates) and Table 10 (excluding national scholarship Army candidates) presents the analysis for only Army SROTC programs. Table 9 indicates that, for the most part, facility quality does not have a significant effect on recruitment and retention for Army SROTC programs. However, column (1) suggests

[33] We do not conduct separate analysis for only Navy programs because of the insufficient number of Navy programs (18) in our sample.

that a higher number of configuration issues is associated with a lower number of recruits per student, though the statistical significance of this estimate is marginal. Columns (5) and (6) of Table 9 and columns (5) and (6) of Table 10 show that condition issues may have a small differential effect on retention of Army cadets at MSIs. Whether we include all students or only those who do not have a national scholarship, these estimates suggest that facility condition issues negatively affect retention for students at MSIs in a way that they do not for students at non-MSIs. However, we again note that these estimated effects are tempered by the coefficients on the non-interacted terms, which are opposite in sign. This means that for Army units, the total effect of capacity issues on recruitment at MSIs is minimal. Table 11 and Table 12 repeat the analysis for Air Force SROTC programs, with similar results.

Across all specifications and student populations, only the number of condition issues exhibits a significant relationship with any of our recruitment and retention outcomes. Whether we include all students or only those who do not have a national scholarship, more condition issues are associated with a higher two-year dropout rate. The coefficients on condition issues in these equations suggest that an additional condition issue is associated with a 0.1 percentage point increase in the two-year dropout rate.

Effect of facility quality by type of facility

To examine whether a specific type of facility has an impact on SROTC student outcomes, we break our measures of facility quality out by facility type. Table 13 shows the results of this analysis for SROTC programs from all services. The first three columns estimate the relationships between facilities and outcomes for all students, while the final three columns include only students without a national scholarship. Columns (2), (3), (5), and (6) show that none of our measures of facility quality exhibits any significant relationship with either measure of retention. However, column (1) indicates that, when including all students, the existence of condition and configuration issues is associated with a lower number of recruits per undergraduate student. To examine whether this is driven by students with national scholarships—who may see classrooms before choosing to attend the school—we look to the results in column (4), which remove national scholarship students from the analysis. We find that even when excluding national scholarship students, the existence of classroom condition issues is associated with a decrease in the number of recruits per undergraduate student. Interestingly, for this population, the existence of an indoor training configuration issue is associated with an *increase* in the number of recruits per student. We note that in all four cases, these coefficients are only marginally significant, meaning that they do not exhibit a particularly strong relationship with the number of recruits per student.

We elect not to break this analysis out by service because of the limited number of observations in our sample. Although we broke out the analysis of facility issue type by service, the additional variables that result from the analysis by facility type make it such that the total number of variables in the model is nearly equivalent to the number of observations we have for the Air Force. In that case, we begin to lose the ability to measure accurately the statistical significance of any correlations, making it difficult to draw meaningful conclusions from our analysis. Therefore, in this analysis, we examine only the relationship between facility type and recruitment and retention for all of the SROTC programs from all of the services.

Effect of scholarships on retention

The results of the regression analysis show little evidence of a relationship between facility quality and our measures of recruitment and retention. We do find, however, that across all specifications, both measures of retention exhibit a strong, consistent, and significant relationship with the prevalence of SROTC scholarships in the unit.

In analyses that include all students, this prevalence is measured as the sum of national scholarship cadets and college scholarship cadets divided by the sum of all cadets. Across all specifications, we estimate that a 10 percentage point increase in the scholarship rate decreases the two-year dropout rate by about 5 percentage points and increases the four-year graduation rate by about 4 percentage points.[34]

In analyses that exclude national scholarship students, the prevalence of scholarships is measured as the number of cadets with a college scholarship divided by the sum of students with either a college scholarship or no scholarship. Across all specifications, we estimate that a 10 percentage point increase in the scholarship rate (that excludes national scholarship students) decreases the two-year dropout rate by about 7 percentage points and increases the four-year commission rate by about 7 percentage points.[35]

In all estimated specifications where we allow the effect of facility quality to differ by MSI status, we also allow the effect of scholarship prevalence to differ by MSI status. This allows us to assess whether the effect of scholarships is stronger (or weaker) in SROTC programs that reside at MSIs. In all estimated specifications where we include this variable effect, we find no

[34] See the estimated coefficients on the variable *% of Cadets with Scholarship* in tables 7, 9, 11, and 13 in Appendix C.

[35] See the estimated coefficients on the variable *% of Cadets with Scholarship (no NS)* in tables 8, 10, 12, and 13 in Appendix C.

evidence to suggest that SROTC scholarships have a stronger or weaker effect on retention at MSIs.[36]

The results of the machine learning LASSO regression approach also provide evidence that the percentage of cadets with a scholarship is the strongest predictor of retention at an SROTC unit. Table 14 in Appendix C shows which variables LASSO selects as significant predictors of our three measures of recruitment and retention. Panel A of Table 14 shows the results of this analysis when including all students. Columns 2 and 3 of Panel A of Table 14 indicate that, out of all the measures of facility quality and university characteristics, the service, the four- year graduation rate, and the percentage of students with a scholarship (of any kind) are the best variables for predicting both measures of retention. We note that in all three cases, LASSO does not select any of the measures of facility quality, suggesting that none of our measures of facility quality is a relevant predictor of recruitment and retention.

Panel B of Table 14 shows the results of the same LASSO analysis when the population is limited to students without a national scholarship. The results in Panel B resemble very closely those shown in Panel A. In Panel B of Table 14, the variables selected for inclusion for predicting retention are service and the percentage of students with a scholarship (in this case, the percentage with a college scholarship). This again indicates that the percentage of students with a scholarship is a more relevant predictor of SROTC retention than is any of our measures of facility quality.

Although this approach is a non-traditional usage of the LASSO method, we note that the results of this approach reiterate the pattern seen in the results from approach 1; while facility quality may have little to no relationship with recruitment and retention at SROTC programs, the percentage of students who have a scholarship appears to have a strong, consistent relationship with our measures of retention. We discuss this finding further in the next section.

[36] See the estimated coefficients on the variables *Impact Count x MSI, Visible Count x MSI, Capacity Count x MSI* in columns 5 and 6 of tables 7-13.

Conclusions and Recommendations

In conclusion, we found some indication of a relationship between some facility quality measures and specific recruitment and retention outcomes. Specifically, higher numbers of mission impact issues and the total number of facility condition issues at an institution are correlated with fewer recruits per student and lower four-year commission rates at those institutions. This finding is more pronounced at MSIs than it is at non-MSIs. In addition, we found that facility-related mission impact events showed a correlation with higher two-year dropout rates. These findings are more pronounced in Army programs at MSIs than other service results. However, these findings are only marginally statistically significant, and we found that scholarship rate overwhelms facility quality influence on recruitment and retention in every instance—particularly when looking at college scholarship SROTC students compared to national scholarship SROTC students. With these findings, there may be increased benefit to recruitment and retention of SROTC candidates at MSIs by exploring college scholarship influence in more detail for possible increases in college scholarship availability at MSIs. However, this must be tempered with the understanding that we did not assess demographic information about SROTC candidates, and although MSIs, by definition, may have higher populations of students from historically underrepresented racial or ethnic minority groups available to participate in SROTC, any increase in commission at MSIs may not result in increases in commissions of candidates from those groups.

Although the main finding of the study is that scholarship influences overwhelm any correlation between facility quality and recruitment and retention outcomes, we provide the following additional other findings and observations. These findings are detailed in each of the three main sections of this paper: Recruitment and Retention, Facility Quality, and Estimated Effects of Facilities Quality on Recruitment and Retention. We present a summary of these findings below.

- Facility quality: We found that facility-related mission impact [37] is significant. Mission impact related to facilities condition issues is reported in significantly greater numbers at MSIs than at non-MSIs, particularly at HBCUs. Because the SROTC program goal is to prepare candidates for commission through physical and non-physical training and education, the delay or cancellation of training events because of facility issues is a problem that needs to be explored for mitigation and resolution.

[37] Mission impact is defined in this study as if the ROTC unit had to cancel, postpone, reschedule, or relocate any training or educational event due to issues of facility availability, condition, or configuration.

- SROTC governance: We found that facility quality, recruitment goals, and retention statistics are not included in annual assessments that the services use to assess individual SROTC program success or viability [2]. Thus, we suggest a review of these measures and the inclusion of additional measures to broaden the definition and measure of program viability. These could include measures of institution support of the program, such as facilities quality, facilities spending, and facility-related mission impact events.
- SME discussions: We found that institutions currently track facilities issues submitted by all departments into facilities management systems. We recommend including an annual summary of facilities issues and resolutions to the service level, either as part of the annual assessments or as a separate submission for a more complete picture of the operational status of the SROTC program.
- Recruitment and retention: Although outside the scope of this study, annual assessments for viability could benefit from service-level common measures of recruitment and retention.

We also offer observations and recommendations on facilities conditions that are not related to recruitment and retention outcomes.

First, we found tremendous variation in institution spending on facility sustainment and facility sustainment spending, which is lower than the 3 percent of plant value discussed in the Alternative Facility Condition and Quality Measures section of this paper, particularly at HBCUs. Facility spending goals should meet or exceed the target 3 percent of plant value to minimize accelerated degradation of facilities. This target number, as described earlier in this paper and in more detail in *"SROTC Facilities Condition Assessment" [21],* depends on the current condition and the age of the facility or facilities. We recommend that the services suggest to supporting institutions that they review facilities investment levels overall as they affect SROTC facilities.

Second, we found that no service-level documented facilities standards or planning standards exist for SROTC training facilities. (For example, there is no standard for the type and size of spaces required for specific training and development for the service program.) The result is that each program must negotiate for and maintain access to training and education facilities on a case-by-case basis. We recommend that the services explore potential benefits to having at least a rough planning standard to ensure that SROTC programs have and maintain access to the required facilities to mitigate facility-related mission impact events.

This study sought to explore facility factors that may influence SROTC candidate recruitment and retention, particularly at MSIs. Although we did not determine a robust relationship between facility quality and recruitment and retention, we were able to assess, for the first

time, the facility quality of 169 select schools with a total of 235 host/consortium programs across all services. As a result of this assessment, we did find that there is room for improvement in MSI facility quality, particularly at HBCUs. We also discovered a significant relationship between scholarship rates, particularly at HBCUs, and improvement in recruitment and retention measures. These findings suggest that the services may improve SROTC program four-year commission rates at MSIs through additional scholarship access, particularly college scholarships, which may then contribute to increased commissioning rates at MSIs.[38]

[38] As stated previously, increased commissions at MSIs may not result in increases in racial and ethnic diversity of commissions; student demographic information was outside the scope of this study.

Appendix A: List of Schools

Institution Name	City	State	School Type
Alabama A&M University	Normal	AL	HBCU
Alabama State University	Montgomery	AL	HBCU
Alcorn State University	Alcorn State	MS	HBCU
Angelo State University	San Angelo	TX	HSI
Arizona State University-Tempe	Tempe	AZ	non-MSI
Arkansas State University	Jonesboro	AR	non-MSI
Augusta University	Augusta	GA	non-MSI
Austin Peay State University	Clarksville	TN	non-MSI
Boise State University	Boise	ID	non-MSI
Bowie State University	Bowie	MD	HBCU
Brigham Young University-Provo	Provo	UT	non-MSI
CUNY City College	New York	NY	HSI
California State University-Fresno	Fresno	CA	HSI
California State University-Fullerton	Fullerton	CA	HSI
California State University-Sacramento	Sacramento	CA	HSI
California State University-San Bernardino	San Bernardino	CA	HSI
Cameron University	Lawton	OK	non-MSI
Campbell University	Buies Creek	NC	non-MSI
Capital University	Columbus	OH	non-MSI
Carson-Newman College	Jefferson City	TN	non-MSI
Central Michigan University	Mount Pleasant	MI	non-MSI
Central State University	Wilberforce	OH	HBCU
Central Washington University	Ellensburg	WA	non-MSI
Charleston Southern University	Charleston	SC	non-MSI
Columbus State University	Columbus	GA	non-MSI
Drexel University	Philadelphia	PA	non-MSI
East Tennessee State University	Johnson City	TN	non-MSI
Eastern Illinois University	Charleston	IL	non-MSI
Eastern Kentucky University	Richmond	KY	non-MSI
Eastern Michigan University	Ypsilanti	MI	non-MSI
Eastern Washington University	Cheney	WA	non-MSI
Edinboro University of Pennsylvania	Edinboro	PA	non-MSI

Institution Name	City	State	School Type
Elizabeth City State University	Elizabeth City	NC	HBCU
Embry-Riddle Aeronautical University-Daytona Beach	Daytona Beach	FL	non-MSI
Embry-Riddle Aeronautical University-Prescott	Prescott	AZ	non-MSI
Fayetteville State University	Fayetteville	NC	HBCU
Florida A&M University	Tallahassee	FL	HBCU
Florida Institute of Technology	Melbourne	FL	non-MSI
Florida International University	Miami	FL	HSI
Fort Valley State University	Fort Valley	GA	HBCU
Georgia Southern University	Statesboro	GA	non-MSI
Grambling State University	Grambling	LA	HBCU
Hampton University	Hampton	VA	HBCU
Howard University	Washington	DC	HBCU
Illinois Institute of Technology	Chicago	IL	non-MSI
Indiana State University	Terre Haute	IN	non-MSI
Indiana University-Purdue University-Indianapolis	Indianapolis	IN	non-MSI
Iowa State University	Ames	IA	non-MSI
Jackson State University	Jackson	MS	HBCU
Jacksonville State University	Jacksonville	AL	non-MSI
Jacksonville University	Jacksonville	FL	non-MSI
James Madison University	Harrisonburg	VA	non-MSI
Kansas State University	Manhattan	KS	non-MSI
Kent State University at Kent	Kent	OH	non-MSI
Lincoln University	Jefferson City	MO	HBCU
Lock Haven University	Lock Haven	PA	non-MSI
Louisiana State University-Baton Rouge	Baton Rouge	LA	non-MSI
Marshall University	Huntington	WV	non-MSI
Michigan Technological University	Houghton	MI	non-MSI
Middle Tennessee State University	Murfreesboro	TN	non-MSI
Minnesota State University-Mankato	Mankato	MN	non-MSI
Mississippi State University	Mississippi State	MS	non-MSI
Missouri State University-Springfield	Springfield	MO	non-MSI
Missouri University of Science and Technology	Rolla	MO	non-MSI
Missouri Western State University	Saint Joseph	MO	non-MSI
Montana State University	Bozeman	MT	non-MSI

Institution Name	City	State	School Type
Morehead State University	Morehead	KY	non-MSI
Morehouse College	Atlanta	GA	HBCU
Morgan State University	Baltimore	MD	HBCU
New Jersey Institute of Technology	Newark	NJ	non-MSI
Norfolk State University	Norfolk	VA	HBCU
North Carolina A&T State University	Greensboro	NC	HBCU
Northeastern University	Boston	MA	non-MSI
Northern Arizona University	Flagstaff	AZ	non-MSI
Northern Illinois University	Dekalb	IL	non-MSI
Northern Michigan University	Marquette	MI	non-MSI
Northwestern State University of Louisiana	Natchitoches	LA	non-MSI
Oklahoma State University	Stillwater	OK	non-MSI
Old Dominion University	Norfolk	VA	non-MSI
Oregon State University	Corvallis	OR	non-MSI
Pittsburg State University	Pittsburg	KS	non-MSI
Prairie View A&M University	Prairie View	TX	HBCU
Rochester Institute of Technology	Rochester	NY	non-MSI
SUNY College at Brockport	Brockport	NY	non-MSI
SUNY Maritime College	Throggs Neck	NY	non-MSI
Saint Augustine's University	Raleigh	NC	HBCU
Saint Mary's University-Texas	San Antonio	TX	HSI
Sam Houston State University	Huntsville	TX	non-MSI
San Diego State University	San Diego	CA	HSI
San Jose State University	San Jose	CA	HSI
Savannah State University	Savannah	GA	HBCU
Shippensburg University of Pennsylvania	Shippensburg	PA	non-MSI
Slippery Rock University of Pennsylvania	Slippery Rock	PA	non-MSI
South Carolina State University	Orangeburg	SC	HBCU
South Dakota School of Mines and Technology	Rapid City	SD	non-MSI
Southern Illinois University-Carbondale	Carbondale	IL	non-MSI
Southern Illinois University-Edwardsville	Edwardsville	IL	non-MSI
Southern University and A&M College	Baton Rouge	LA	HBCU
Stephen F. Austin State University	Nacogdoches	TX	non-MSI
Tarleton State University	Stephenville	TX	non-MSI
Temple University	Philadelphia	PA	non-MSI
Tennessee State University	Nashville	TN	HBCU

Institution Name	City	State	School Type
Tennessee Technological University	Cookeville	TN	non-MSI
Texas A&M University-Corpus Christi	Corpus Christi	TX	HSI
Texas A&M University-Kingsville	Kingsville	TX	HSI
Texas State University	San Marcos	TX	HSI
Texas Tech University	Lubbock	TX	HSI
The University of Alabama	Tuscaloosa	AL	non-MSI
The University of Montana	Missoula	MT	non-MSI
The University of Tennessee-Martin	Martin	TN	non-MSI
The University of Texas Rio Grande Valley	Edinburg	TX	HSI
The University of Texas at Arlington	Arlington	TX	HSI
The University of Texas at El Paso	El Paso	TX	HSI
The University of Texas at San Antonio	San Antonio	TX	HSI
Troy University	Troy	AL	non-MSI
Tuskegee University	Tuskegee	AL	HBCU
University of Akron	Akron	OH	non-MSI
University of Alaska Anchorage	Anchorage	AK	non-MSI
University of Arizona	Tucson	AZ	HSI
University of Arkansas at Pine Bluff	Pine Bluff	AR	HBCU
University of California-Santa Barbara	Santa Barbara	CA	HSI
University of Central Arkansas	Conway	AR	non-MSI
University of Central Florida	Orlando	FL	HSI
University of Central Missouri	Warrensburg	MO	non-MSI
University of Central Oklahoma	Edmond	OK	non-MSI
University of Cincinnati	Cincinnati	OH	non-MSI
University of Colorado Boulder	Boulder	CO	non-MSI
University of Colorado Springs	Colorado Springs	CO	non-MSI
University of Connecticut	Storrs	CT	non-MSI
University of Delaware	Newark	DE	non-MSI
University of Hawaii, Manoa	Honolulu	HI	non-MSI
University of Houston	Houston	TX	HSI
University of Idaho	Moscow	ID	non-MSI
University of Illinois at Chicago	Chicago	IL	HSI
University of Maine	Orono	ME	non-MSI
University of Massachusetts-Amherst	Amherst	MA	non-MSI
University of Memphis	Memphis	TN	non-MSI
University of Nebraska at Omaha	Omaha	NE	non-MSI

Institution Name	City	State	School Type
University of Nevada-Reno	Reno	NV	non-MSI
University of New Mexico	Albuquerque	NM	HSI
University of North Alabama	Florence	AL	non-MSI
University of North Carolina at Charlotte	Charlotte	NC	non-MSI
University of North Dakota	Grand Forks	ND	non-MSI
University of North Texas	Denton	TX	HSI
University of Pittsburgh	Pittsburgh	PA	non-MSI
University of Puerto Rico-Mayaguez	Mayaguez	PR	HSI
University of Puerto Rico-Rio Piedras	San Juan	PR	HSI
University of South Alabama	Mobile	AL	non-MSI
University of South Dakota	Vermillion	SD	non-MSI
University of Southern Mississippi	Hattiesburg	MS	non-MSI
University of Tampa	Tampa	FL	non-MSI
University of Toledo	Toledo	OH	non-MSI
University of Utah	Salt Lake City	UT	non-MSI
University of West Florida	Pensacola	FL	non-MSI
University of Wisconsin-La Crosse	La Crosse	WI	non-MSI
University of Wisconsin-Oshkosh	Oshkosh	WI	non-MSI
University of Wisconsin-Stevens Point	Stevens Point	WI	non-MSI
University of Wyoming	Laramie	WY	non-MSI
Utah State University-Logan	Logan	UT	non-MSI
Virginia State University	Petersburg	VA	HBCU
Washington State University	Pullman	WA	non-MSI
Weber State University	Ogden	UT	non-MSI
West Virginia State University	Institute	WV	HBCU
West Virginia University	Morgantown	WV	non-MSI
Western Illinois University	Macomb	IL	non-MSI
Western Michigan University	Kalamazoo	MI	non-MSI
Widener University	Chester	PA	non-MSI
Wilkes University	Wilkes-Barre	PA	non-MSI
Wright State University	Dayton	OH	non-MSI

Appendix B: SROTC Program Facilities Governance

This study included a review and assessment of the governance process used by DOD and the services related to the facilities used by the SROTC programs. The study began with a review of policies that direct this process and the documents created by the services as they manage the programs. This review led to a set of key points we observed that are related to facilities governance by DOD and the services.

Key points

The documentation related to facilities in the policies and the implementing documents used for the SROTC programs is hampered by the lack of a definition of adequate SROTC facilities. As we discuss in the section on facility condition and quality, DOD and the services have standards that relate to facility condition, capacity, and configuration that facilitate the identification of inadequate facilities. Because the facilities used by SROTC units lack these measures, they are unable to identify facility problems consistently.

The required annual program assessments often do not mention issues related to facilities. This reflects the services' existing governance processes related to SROTC facilities—facility issues are informally delegated by the services to the individual SROTC units. Because these assessments are transmitted to the leadership of the host institutions, including significant facility issues in the annual assessments would support the unit's efforts to improve inadequate facilities.

Document review

We began our work by reviewing DOD and service policies, instructions, and regulations that discuss the management of the SROTC programs. The focus of this review was on identifying where facilities are discussed and how the policies affect the facilities used by the SROTC programs.

The primary DOD policy source is DoDI 1215.08 Senior Reserve Officers' Training Corps (ROTC) Programs, which "establishes policy, assigns responsibilities, and prescribes procedures for DOD oversight of the Military Departments' Senior ROTC programs" [2]. The instruction references facilities only in a general sense and delegates the facility specifics to

the services. It does state that the host universities "agree to provide adequate physical facilities as specified by the respective Military Department" [2].

The instruction also provides for the annual assessment of the SROTC units. The assessment seeks to evaluate the program's efficiency, effectiveness, and production rates, which results in a determination of SROTC program viability. There is no specific requirement or direction to assess any facility issues such as facility condition or availability. The instruction does allow the services to consider "service-specific measures," including facility investments and improvements.

We also reviewed individual service policies related to their SROTC programs.

Army Regulation 145-1: Army Advisory Panel on Reserve Officers' Training Corps Affairs [34] includes guidance on the facility requirements that the host universities must follow:

- The universities provide adequate facilities for conducting a SROTC program.
- Facilities should be equal to the facilities provided to other departments or other elements of the school.
- Janitorial and grounds services are provided in the same manner as they are to other departments.

Other facility references include discussion of and requirements for scheduling of classes, adequate storage, and facilities required to issue gear and equipment. For these specific facilities, the instruction defines as "adequate" those that are "safe, well-lighted, dry, heated, ventilated areas" with "office space, shelving, bins, clothing racks, and cabinets."

The Army agreement forms with the universities (DA Form 918, 918A and 918B) contain the most detail about facilities compared with other service agreements. For example, DA Form 918 includes specific facility requirements for different types of facilities including the required size of specific facilities.

The Navy NSTC M-1533.2D [35] is a manual prepared by the Naval Service Training Command that provides administrative and managerial regulations related to the Navy's SROTC programs. It discusses the responsibilities of the NROTC unit and the host institution, "including that facilities, equipment, and services provided by the institution, shall be per the terms of the Agreement to Establish and Maintain an NROTC Unit."

The Navy performs annual NROTC host unit assessments based on the DODI. Educational institution support is evaluated based on "quality of life, unit morale and esprit de corps, facilities and environment, and security."

The Air Force Policy Directive 36-20, Accession of Air Force Military Personnel [36] and AFROTC Instruction 36-2011 [37] provide guidance on the Air Force SROTC program but do not include any specific mention of facility requirements.

The Air Force performs annual program assessments that do not consistently include facility issues. Some of the program assessments mention specific facility issues. Assessments for non-viable programs, at both MSI and non-MSI universities, often mention facility issues that could affect program performance.

For example, the 2019 Air Force evaluation of the program at Tuskegee University includes the following statement in the Air Force letter to the university:

"… we ask that you also consider improving the appearance and maintenance of the facilities. These enhancements will assist in improving the detachment's viability as well as increase our ability to recruit and retain top quality cadets for both AFROTC and university programs"[38].

Similar statements are in other letters to the MSI and non-MSI universities with non-viable AFROTC programs.

Appendix C: Estimated Relationship Analysis

This appendix includes the tables of results for both the Approach 1 Regression analysis (Tables 7-13) and the Approach 2 Machine learning variable selection (Table 14) discussed in the Estimated Effects of Facilities Quality on Recruitment and Retention section of this paper.

Table 7. Facility quality versus recruitment and retention, all services, all SROTC students

VARIABLES	(1) Recruits per Student	(2) 2-year Dropout Rate	(3) 4-year Commission Rate	(4) Recruits per Student	(5) 2-year Dropout Rate	(6) 4-year Commission Rate
Impact Count	-0.0001	0.0007	-0.0083	0.0008	0.0016	-0.0096
	0.0010	0.0060	0.0050	0.0010	0.0060	0.0060
Impact Count x MSI				-0.0029	-0.0079	0.0096
				0.0020	0.0110	0.0100
Visible Count	-0.0001	0.0009	-0.0004	0.0000	-0.0002	0.0005
	0.0000	0.0010	0.0010	0.0000	0.0010	0.0010
Visible Count x MSI				-0.0001	0.0024	-0.0021
				0.0000	0.0010	0.0020
Capacity Count	0.0006	-0.0018	0.0089	0.0000	0.0016	0.0050
	0.0010	0.0060	0.0060	0.0010	0.0060	0.0060
Capacity Count x MSI				0.0007	-0.0091	0.0114
				0.0020	0.0110	0.0120
Configuration Count	-0.0008	0.0021	0.0037	-0.0012	0.0083	0.0022
	0.0010	0.0050	0.0050	0.0010	0.0070	0.0070
Configuration Count x MSI				0.0017	-0.0102	-0.0041
				0.0020	0.0130	0.0110
% Cadets with Scholarship[a]	-0.0047	-0.52939***	0.45357***	-0.0031	-0.49696***	0.43211***
	0.0140	0.0610	0.0620	0.0140	0.0630	0.0650
H.B.C.U.	-0.0072	0.0267	-0.0510			
	0.0090	0.0350	0.0330			
H.S.I.	0.0027	-0.0024	-0.0208			
	0.0030	0.0220	0.0210			
M.S.I. (HBCU or HSI)				0.0018	0.0582	-0.07828*
				0.0060	0.0390	0.0420
Air Force	0.01713***	0.05164***	-0.03147**	0.01848***	0.05880***	-0.04051**
	0.0050	0.0140	0.0150	0.0050	0.0160	0.0160
Navy	0.01011*	-0.09032***	-0.37694***	0.0086	-0.09677***	-0.37475***

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VARIABLES	(1) Recruits per Student	(2) 2-year Dropout Rate	(3) 4-year Commission Rate	(4) Recruits per Student	(5) 2-year Dropout Rate	(6) 4-year Commission Rate
	0.0050	0.0280	0.0310	0.0050	0.0250	0.0300
Average FSM Spending	-0.0362	0.3376	-0.0688	-0.0305	0.3000	0.0047
	0.0620	0.3610	0.3820	0.0630	0.3490	0.3800
Full Time Undergraduates	-0.00000**	0.0000	0.0000	-0.00000**	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
4yr Graduation Rate	-0.0001	-0.00183***	0.00350***	-0.0001	-0.00188***	0.00353***
	0.0000	0.0010	0.0010	0.0000	0.0010	0.0010
Private School	0.0058	-0.0074	-0.06053**	0.0067	-0.0023	-0.06281**
	0.0070	0.0340	0.0280	0.0070	0.0360	0.0310
vet1	-0.0004	0.0187	-0.0006	-0.0019	0.0254	-0.0083
	0.0030	0.0180	0.0180	0.0030	0.0170	0.0170
vet2	-0.0067	0.0178	0.0095	-0.0087	0.0037	0.0219
	0.0110	0.0220	0.0220	0.0110	0.0240	0.0240
vet3	0.0057	-0.08673*	0.12288***	0.0106	-0.08304*	0.11281**
	0.0090	0.0440	0.0420	0.0110	0.0460	0.0470
vet4	-0.0051	0.04651*	-0.0375	-0.0038	0.04331*	-0.0360
	0.0060	0.0270	0.0270	0.0060	0.0240	0.0260
vet5	-0.0062	-0.0032	0.0012	-0.0064	-0.0059	0.0004
	0.0090	0.0230	0.0270	0.0090	0.0230	0.0270
Day Care Available	-0.0011	-0.03151*	0.0187	-0.0020	-0.03376**	0.0224
	0.0020	0.0170	0.0170	0.0030	0.0170	0.0180
Cost of Instate Tuition	0.0000	0.0000	0.00000***	0.0000	0.0000	0.00000***
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
% of Students with Pell Grant	0.0000	0.0005	0.0004	-0.0001	0.0007	0.0002
	0.0000	0.0010	0.0010	0.0000	0.0010	0.0010
Average Cost (after aid)	0.0000	0.0000	-0.00001***	0.0000	0.0000	-0.00001***
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
University Retention Rate	0.0005	0.0018	-0.00341**	0.0005	0.0021	-0.00370**
	0.0000	0.0010	0.0020	0.0000	0.0010	0.0020

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VARIABLES	(1) Recruits per Student	(2) 2-year Dropout Rate	(3) 4-year Commission Rate	(4) Recruits per Student	(5) 2-year Dropout Rate	(6) 4-year Commission Rate
% Students with Any Aid	-0.0001	-0.0005	-0.0002	-0.0001	-0.0003	-0.0003
	0.0000	0.0010	0.0010	0.0000	0.0010	0.0010
Admission Rate	0.0001	0.0007	-0.00124**	0.0001	0.0008	-0.00133**
	0.0000	0.0010	0.0010	0.0000	0.0010	0.0010
SAT Verbal 75th Percentile	0.0000	0.0001	0.0000	0.0000	0.0001	-0.0001
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SAT Math 75th Percentile	-0.0001	-0.0001	-0.0001	-0.0001	-0.0003	0.0001
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ACT 75th Percentile	-0.0009	0.0016	-0.0037	-0.0010	0.0031	-0.0052
	0.0010	0.0050	0.0050	0.0010	0.0050	0.0050
Constant	0.0411	0.62531***	0.44211**	0.0446	0.61999***	0.43674**
	0.0440	0.2050	0.2220	0.0440	0.2030	0.2190
Observations	158	158	158	158	158	158
Adjusted R-squared	0.313	0.746	0.67	0.303	0.759	0.676

Source: CNA.

[a] Total number of students with a national scholarship or college scholarship, divided by the total number of students.

Table 8. Facility quality versus recruitment and retention, all services, students without a national scholarship

VARIABLES	(1) Recruits per Student	(2) 2-year Dropout Rate	(3) 4-year Commission Rate	(4) Recruits per Student	(5) 2-year Dropout Rate	(6) 4-year Commission Rate
Impact Count	-0.0004	0.0011	-0.0050	0.0005	0.0033	-0.0067
	0.0010	0.0050	0.0040	0.0010	0.0060	0.0060
Impact Count x MSI				-0.00309*	-0.0135	0.0106
				0.0020	0.0100	0.0090

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VARIABLES	(1) Recruits per Student	(2) 2-year Dropout Rate	(3) 4-year Commission Rate	(4) Recruits per Student	(5) 2-year Dropout Rate	(6) 4-year Commission Rate
Visible Count	0.0000	0.0010	-0.0006	0.0000	0.0001	0.0006
	0.0000	0.0010	0.0010	0.0000	0.0010	0.0010
Visible Count x MSI				0.0000	0.0024	-0.00264**
				0.0000	0.0010	0.0010
Capacity Count	0.0009	-0.0026	0.0054	0.0003	0.0007	0.0029
	0.0010	0.0060	0.0050	0.0010	0.0060	0.0060
Capacity Count x MSI				0.0008	-0.0101	0.0064
				0.0020	0.0110	0.0090
Configuration Count	-0.0004	0.0021	0.0048	-0.0006	0.0057	0.0058
	0.0010	0.0050	0.0050	0.0010	0.0070	0.0070
Configuration Count x MSI				0.0011	-0.0011	-0.0108
				0.0020	0.0140	0.0120
% Cadets with Scholarship (no NS)[a]	0.0142	-0.77162***	0.76583***	0.0181	-0.71928***	0.73413***
	0.0160	0.0920	0.0740	0.0170	0.0880	0.0760
H.B.C.U.	-0.0065	0.0168	-0.0467			
	0.0080	0.0380	0.0290			
H.S.I.	0.0023	-0.0130	-0.0167			
	0.0030	0.0240	0.0200			
M.S.I. (HBCU or HSI)				0.0019	0.0535	-0.0440
				0.0060	0.0420	0.0310
Air Force	0.01735***	0.04884***	-0.0193	0.01875***	0.05855***	-0.02793*
	0.0040	0.0140	0.0130	0.0050	0.0160	0.0150
Navy	0.0056	-0.10597***	-0.20587***	0.0048	-0.10463***	-0.21031***
	0.0050	0.0340	0.0260	0.0050	0.0320	0.0260
Average FSM Spending	-0.0556	0.73107**	-0.51741**	-0.0499	0.63719*	-0.44478*
	0.0590	0.3490	0.2530	0.0580	0.3370	0.2450
Full Time Undergraduates	-0.00000**	0.0000	0.00000**	-0.00000**	0.0000	0.00000**
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
4yr Graduation Rate	-0.0001	-0.0008	0.00137**	-0.0002	-0.0009	0.00147***

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VARIABLES	(1) Recruits per Student	(2) 2-year Dropout Rate	(3) 4-year Commission Rate	(4) Recruits per Student	(5) 2-year Dropout Rate	(6) 4-year Commission Rate
	0.0000	0.0010	0.0010	0.0000	0.0010	0.0010
Private School	0.0052	-0.0069	-0.0396	0.0060	0.0034	-0.0346
	0.0060	0.0360	0.0320	0.0060	0.0400	0.0330
vet1	-0.0002	0.0123	0.0004	-0.0014	0.0207	-0.0078
	0.0020	0.0200	0.0160	0.0030	0.0190	0.0150
vet2	-0.0053	0.0353	0.0051	-0.0077	0.0191	0.0137
	0.0090	0.0260	0.0210	0.0100	0.0270	0.0230
vet3	0.0052	-0.05506*	0.06808**	0.0096	-0.0447	0.06293*
	0.0080	0.0330	0.0310	0.0100	0.0330	0.0330
vet4	-0.0037	0.0332	-0.0195	-0.0023	0.0325	-0.0217
	0.0050	0.0260	0.0230	0.0050	0.0240	0.0230
vet5	-0.0075	0.0041	-0.0016	-0.0078	0.0034	-0.0015
	0.0070	0.0220	0.0220	0.0070	0.0220	0.0220
Day Care Available	-0.0018	-0.0221	0.0043	-0.0026	-0.0259	0.0068
	0.0020	0.0170	0.0140	0.0030	0.0170	0.0140
Cost of Instate Tuition	0.0000	0.0000	0.00000**	0.0000	0.0000	0.00000**
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
% of Students with Pell Grant	0.0000	0.0010	0.0003	-0.0001	0.0012	0.0002
	0.0000	0.0010	0.0010	0.0000	0.0010	0.0010
Average Cost (after aid)	0.0000	0.0000	-0.00000*	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
University Retention Rate	0.0003	0.0011	-0.00234*	0.0004	0.0015	-0.00249*
	0.0000	0.0010	0.0010	0.0000	0.0010	0.0010
% Students with Any Aid	-0.0001	-0.0014	-0.0003	-0.0001	-0.0013	-0.0002
	0.0000	0.0010	0.0010	0.0000	0.0010	0.0010
Admission Rate	0.0001	0.0003	-0.00095*	0.0001	0.0004	-0.00104**
	0.0000	0.0010	0.0010	0.0000	0.0010	0.0000
SAT Verbal 75th Percentile	0.0000	0.0002	-0.0001	0.0000	0.0002	-0.0002
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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VARIABLES	(1) Recruits per Student	(2) 2-year Dropout Rate	(3) 4-year Commission Rate	(4) Recruits per Student	(5) 2-year Dropout Rate	(6) 4-year Commission Rate
SAT Math 75th Percentile	-0.0001	0.0001	-0.0002	-0.0001	-0.0002	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ACT 75th Percentile	-0.0009	0.0007	-0.0008	-0.0009	0.0024	-0.0022
	0.0010	0.0050	0.0050	0.0010	0.0050	0.0050
Constant	0.0512	0.58989***	0.42344**	0.0540	0.59647***	0.40550**
	0.0380	0.2090	0.1840	0.0370	0.2060	0.1860
Observations	158	155	155	158	155	155
Adjusted R-squared	0.309	0.627	0.702	0.307	0.645	0.704

Source: CNA.

[a] Total number of students with a college scholarship, divided by the total number of students with either a college scholarship or no scholarship.

Table 9. Facility quality versus recruitment and retention, Army programs, all SROTC students

VARIABLES	(1) Recruits per Student	(2) 2-year Dropout Rate	(3) 4-year Commission Rate	(4) Recruits per Student	(5) 2-year Dropout Rate	(6) 4-year Commission Rate
Impact Count	-0.0002	0.0027	-0.0041	0.0000	0.0004	-0.0005
	0.0000	0.0080	0.0080	0.0000	0.0100	0.0100
Impact Count x MSI				-0.0002	-0.0104	0.0039
				0.0010	0.0140	0.0140
Visible Count	0.0000	0.0013	-0.0004	-0.0001	-0.0003	0.0017
	0.0000	0.0010	0.0010	0.0000	0.0010	0.0020
Visible Count x MSI				0.0001	0.00286*	-0.00401*
				0.0000	0.0020	0.0020
Capacity Count	0.00080*	-0.0056	0.0064	0.0004	-0.0002	-0.0013
	0.0000	0.0070	0.0080	0.0000	0.0090	0.0090
Capacity Count x MSI				0.0015	-0.0120	0.0191

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VARIABLES	(1) Recruits per Student	(2) 2-year Dropout Rate	(3) 4-year Commission Rate	(4) Recruits per Student	(5) 2-year Dropout Rate	(6) 4-year Commission Rate
				0.0010	0.0140	0.0170
Configuration Count	-0.00073*	0.0024	-0.0007	-0.0004	0.0166	-0.0081
	0.0000	0.0090	0.0090	0.0000	0.0120	0.0130
Configuration Count x MSI				-0.0014	-0.0118	-0.0033
				0.0010	0.0200	0.0180
% Cadets with Scholarship[a]	-0.0038	-0.56798***	0.53448***	-0.0025	-0.51931***	0.51137***
	0.0030	0.0990	0.0810	0.0030	0.1010	0.0860
H.B.C.U.	0.0026	-0.0117	-0.0469			
	0.0020	0.0420	0.0440			
H.S.I.	0.0021	0.0089	-0.0265			
	0.0010	0.0290	0.0300			
M.S.I. (HBCU or HSI)				-0.0013	0.0632	-0.0826
				0.0030	0.0520	0.0570
Average FSM Spending	0.0091	0.5809	-0.0584	0.0076	0.6668	-0.0100
	0.0210	0.4630	0.4760	0.0190	0.4620	0.4440
Full Time Undergraduates	-0.00000***	0.0000	0.00000*	-0.00000***	0.0000	0.00000*
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
4yr Graduation Rate	0.0000	-0.00185*	0.00326***	0.0000	-0.00177*	0.00324***
	0.0000	0.0010	0.0010	0.0000	0.0010	0.0010
Private School	0.0001	-0.0169	0.0202	-0.0005	-0.0005	0.0202
	0.0030	0.0420	0.0490	0.0030	0.0410	0.0490
vet1	-0.0003	0.0157	-0.0020	-0.0005	0.0157	-0.0088
	0.0010	0.0210	0.0220	0.0010	0.0190	0.0210
vet2	0.0030	0.0128	-0.0021	0.0030	-0.0086	0.0041
	0.0020	0.0250	0.0330	0.0020	0.0250	0.0320
vet3	-0.0016	-0.0547	0.08493*	-0.0023	-0.0403	0.0732
	0.0020	0.0440	0.0500	0.0020	0.0510	0.0550
vet4	-0.0005	0.0266	-0.0487	-0.0004	0.0234	-0.0452
	0.0020	0.0300	0.0360	0.0020	0.0260	0.0340

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VARIABLES	(1) Recruits per Student	(2) 2-year Dropout Rate	(3) 4-year Commission Rate	(4) Recruits per Student	(5) 2-year Dropout Rate	(6) 4-year Commission Rate
vet5	0.0008	-0.0231	0.0209	-0.0001	-0.0274	0.0199
	0.0020	0.0310	0.0410	0.0020	0.0320	0.0430
Day Care Available	0.0003	-0.04070*	0.0374	0.0008	-0.03811*	0.03813*
	0.0010	0.0230	0.0230	0.0010	0.0220	0.0230
% of Students with Pell Grant	0.00014**	0.0002	0.0006	0.00012*	0.0000	0.0008
	0.0000	0.0010	0.0010	0.0000	0.0010	0.0010
Average Cost (after aid)	0.0000	0.0000	-0.00001**	0.0000	0.0000	-0.00001**
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
University Retention Rate	0.0001	0.0010	-0.0029	0.0001	0.0007	-0.0023
	0.0000	0.0020	0.0020	0.0000	0.0020	0.0020
% Students with Any Aid	0.0000	-0.0009	-0.0006	0.0000	-0.0008	-0.0006
	0.0000	0.0010	0.0010	0.0000	0.0010	0.0010
Admission Rate	0.0000	0.0008	-0.00131*	0.0000	0.0008	-0.00129*
	0.0000	0.0010	0.0010	0.0000	0.0010	0.0010
ACT 75th Percentile	-0.0002	0.0016	-0.0073	-0.0003	0.0011	-0.0076
	0.0000	0.0060	0.0060	0.0000	0.0060	0.0060
Constant	0.0015	0.72293**	0.52598*	0.0032	0.72329**	0.50732*
	0.0110	0.3050	0.3020	0.0110	0.3050	0.3030
Observations	100	100	100	100	100	100
Adjusted R-squared	0.507	0.589	0.553	0.522	0.624	0.569

Source: CNA.

[a] Total number of students with a national scholarship or college scholarship, divided by the total number of students.

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Table 10. Facility quality versus recruitment and retention, Army programs, students without a national scholarship

VARIABLES	(1) Recruits per Student	(2) 2-year Dropout Rate	(3) 4-year Commission Rate	(4) Recruits per Student	(5) 2-year Dropout Rate	(6) 4-year Commission Rate
Impact Count	-0.0001	0.0052	-0.0033	0.0002	0.0052	-0.0025
	0.0000	0.0080	0.0070	0.0000	0.0100	0.0090
Impact Count x MSI				-0.0004	-0.0172	0.0085
				0.0010	0.0140	0.0120
Visible Count	0.0000	0.0009	-0.0002	0.0000	-0.0008	0.0014
	0.0000	0.0010	0.0010	0.0000	0.0010	0.0020
Visible Count x MSI				0.0001	0.00322**	-0.00330*
				0.0000	0.0010	0.0020
Capacity Count	0.0007	-0.0070	0.0046	0.0002	-0.0026	-0.0014
	0.0000	0.0070	0.0070	0.0000	0.0080	0.0080
Capacity Count x MSI				0.00161*	-0.0104	0.0178
				0.0010	0.0130	0.0140
Configuration Count	-0.0006	-0.0005	0.0023	-0.0004	0.0114	0.0019
	0.0000	0.0090	0.0080	0.0000	0.0120	0.0110
Configuration Count x MSI				-0.0013	-0.0047	-0.0182
				0.0010	0.0220	0.0180
% Cadets with Scholarship (no NS)[a]	-0.00705**	-0.76228***	0.79822***	-0.00595*	-0.70086***	0.78011***
	0.0030	0.1270	0.0870	0.0030	0.1270	0.0890
H.B.C.U.	0.0024	-0.0001	-0.0546			
	0.0020	0.0410	0.0370			
H.S.I.	0.00236*	0.0157	-0.0307			
	0.0010	0.0310	0.0280			
M.S.I. (HBCU or HSI)				-0.0015	0.0664	-0.0757
				0.0030	0.0490	0.0470
Average FSM Spending	0.0119	0.97752**	-0.63394**	0.0115	1.01730**	-0.55261**
	0.0190	0.4130	0.3040	0.0190	0.4010	0.2760
Full Time Undergraduates	-0.00000***	0.0000	0.00000*	-0.00000***	0.0000	0.00000**

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VARIABLES	(1) Recruits per Student	(2) 2-year Dropout Rate	(3) 4-year Commission Rate	(4) Recruits per Student	(5) 2-year Dropout Rate	(6) 4-year Commission Rate
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
4yr Graduation Rate	0.0000	-0.0011	0.0011	0.0000	-0.0010	0.0012
	0.0000	0.0010	0.0010	0.0000	0.0010	0.0010
Private School	-0.0024	-0.0208	0.0369	-0.0029	-0.0045	0.0407
	0.0030	0.0520	0.0470	0.0030	0.0570	0.0500
vet1	-0.0009	0.0015	0.0046	-0.0011	0.0052	-0.0044
	0.0010	0.0210	0.0190	0.0010	0.0210	0.0180
vet2	0.0029	0.0133	0.0046	0.0028	-0.0131	0.0102
	0.0020	0.0270	0.0240	0.0020	0.0250	0.0230
vet3	-0.0019	-0.0173	0.0263	-0.0026	0.0019	0.0112
	0.0020	0.0360	0.0340	0.0020	0.0390	0.0380
vet4	-0.0008	0.0222	-0.0280	-0.0006	0.0193	-0.0256
	0.0020	0.0280	0.0260	0.0020	0.0240	0.0260
vet5	-0.0002	-0.0308	0.0224	-0.0010	-0.0321	0.0163
	0.0020	0.0280	0.0290	0.0020	0.0280	0.0300
Day Care Available	0.0006	-0.0372	0.0251	0.0011	-0.0339	0.0275
	0.0010	0.0230	0.0190	0.0010	0.0210	0.0180
% of Students with Pell Grant	0.00013**	0.0003	0.0002	0.00011*	0.0002	0.0002
	0.0000	0.0010	0.0010	0.0000	0.0010	0.0010
Average Cost (after aid)	0.00000*	0.0000	-0.00000*	0.00000**	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
University Retention Rate	0.0000	0.0005	-0.0015	0.0001	0.0004	-0.0011
	0.0000	0.0020	0.0020	0.0000	0.0020	0.0020
% Students with Any Aid	-0.0001	-0.0006	-0.0005	0.0000	-0.0005	-0.0004
	0.0000	0.0010	0.0010	0.0000	0.0010	0.0010
Admission Rate	0.0001	0.0006	-0.0009	0.0001	0.0007	-0.00100*
	0.0000	0.0010	0.0010	0.0000	0.0010	0.0010
ACT 75th Percentile	-0.0003	0.0028	-0.0065	-0.0003	0.0026	-0.0070
	0.0000	0.0060	0.0040	0.0000	0.0060	0.0050

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VARIABLES	(1) Recruits per Student	(2) 2-year Dropout Rate	(3) 4-year Commission Rate	(4) Recruits per Student	(5) 2-year Dropout Rate	(6) 4-year Commission Rate
Constant	0.0042	0.68810**	0.44004*	0.0048	0.66458**	0.43847*
	0.0110	0.2900	0.2400	0.0100	0.2900	0.2360
Observations	100	100	100	100	100	100
Adjusted R-squared	0.534	0.593	0.656	0.559	0.636	0.667

Source: CNA.

[a] Total number of students with a college scholarship, divided by the total number of students with either a college scholarship or no scholarship.

Table 11. Facility quality versus recruitment and retention, Air Force programs, all SROTC students

VARIABLES	(1) Recruits per Student	(2) 2-year Dropout Rate	(3) 4-year Commission Rate	(4) Recruits per Student	(5) 2-year Dropout Rate	(6) 4-year Commission Rate
Impact Count	-0.0012	-0.0130	0.0012	-0.0011	-0.0114	0.0030
	0.0040	0.0080	0.0060	0.0040	0.0080	0.0080
Impact Count x MSI				-0.0030	-0.0022	0.0177
				0.0190	0.0360	0.0370
Visible Count	-0.0002	0.00145*	-0.0011	0.0001	0.0031	-0.00344**
	0.0000	0.0010	0.0010	0.0010	0.0020	0.0010
Visible Count x MSI				-0.0008	-0.0010	0.0023
				0.0010	0.0030	0.0030
Capacity Count	0.0020	0.0052	0.0030	0.0024	0.0002	0.0036
	0.0040	0.0080	0.0080	0.0040	0.0110	0.0100
Capacity Count x MSI				0.0049	-0.0116	0.0042
				0.0160	0.0280	0.0280
Configuration Count	0.0028	0.0062	0.0052	0.0027	-0.0001	0.0045
	0.0040	0.0090	0.0070	0.0030	0.0080	0.0080
Configuration Count x MSI				0.0075	-0.0020	-0.0332

VARIABLES	(1) Recruits per Student	(2) 2-year Dropout Rate	(3) 4-year Commission Rate	(4) Recruits per Student	(5) 2-year Dropout Rate	(6) 4-year Commission Rate
				0.0180	0.0520	0.0470
% Cadets with Scholarship[a]	0.1042	-0.55063***	0.36035***	0.08433*	-0.49339***	0.22668*
	0.0610	0.0930	0.0980	0.0460	0.1600	0.1230
H.B.C.U.	0.0138	0.20770***	-0.09987**			
	0.0360	0.0530	0.0380			
H.S.I.	0.0215	0.0334	0.0339			
	0.0220	0.0490	0.0470			
M.S.I. (HBCU or HSI)				0.0083	0.13446*	-0.1024
				0.0280	0.0700	0.0630
Average FSM Spending	-0.1372	-0.3939	0.1551	-0.1931	-1.01842*	0.8686
	0.1560	0.4910	0.3240	0.2400	0.5370	0.5900
Full Time Undergraduates	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
4yr Graduation Rate	-0.0004	-0.0012	0.00279***	-0.0003	0.0003	0.0010
	0.0010	0.0010	0.0010	0.0010	0.0020	0.0010
Private School	0.06370*	-0.0671	-0.0785	0.05335*	0.0512	-0.22697**
	0.0330	0.0510	0.0510	0.0290	0.0830	0.0780
vet1	0.0035	0.0113	-0.0052	0.0009	0.0635	-0.0419
	0.0150	0.0270	0.0240	0.0160	0.0370	0.0280
vet2	-0.0426	0.13948*	-0.0128	-0.0310	0.0699	0.0121
	0.0310	0.0670	0.0460	0.0330	0.0810	0.0640
vet4	0.0384	0.0779	-0.1013	0.0379	0.1078	-0.17217**
	0.0350	0.0590	0.0610	0.0320	0.0810	0.0720
vet5	0.0146	-0.0435	-0.0341	0.0086	0.0302	-0.0679
	0.0230	0.0430	0.0290	0.0260	0.0760	0.0550
Day Care Available	0.0052	-0.0073	0.0042	0.0039	-0.0052	0.0012
	0.0120	0.0230	0.0230	0.0120	0.0300	0.0350
Cost of Instate Tuition	0.0000	0.0000	0.0000			
	0.0000	0.0000	0.0000			

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VARIABLES	(1) Recruits per Student	(2) 2-year Dropout Rate	(3) 4-year Commission Rate	(4) Recruits per Student	(5) 2-year Dropout Rate	(6) 4-year Commission Rate
% of Students with Pell Grant	0.0008	-0.0009	0.0016	0.0006	0.0008	0.0010
	0.0010	0.0020	0.0010	0.0010	0.0020	0.0020
Average Cost (after aid)	0.0000	0.0000	0.0000	0.00000*	-0.00001*	0.00001***
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
University Retention Rate	-0.0007	-0.0006	-0.00374*	-0.0012	0.0007	-0.0020
	0.0010	0.0020	0.0020	0.0010	0.0020	0.0030
% Students with Any Aid	0.0005	0.00247**	-0.0009	0.0005	0.0016	-0.0010
	0.0010	0.0010	0.0010	0.0010	0.0020	0.0010
Admission Rate	0.0004	0.0000	0.0002	0.0002	-0.0001	-0.0003
	0.0000	0.0010	0.0010	0.0000	0.0010	0.0010
SAT Verbal 75th Percentile	-0.0004	0.0005	-0.00111*			
	0.0010	0.0010	0.0010			
SAT Math 75th Percentile	0.0000	0.0003	0.0007			
	0.0000	0.0010	0.0000			
ACT 75th Percentile	0.0062	-0.0096	0.0046	0.0005	0.0028	-0.0066
	0.0060	0.0130	0.0110	0.0040	0.0120	0.0120
Constant	-0.0073	0.2179	0.57289**	-0.0914	0.3843	0.6019
	0.1280	0.2640	0.2540	0.1340	0.5070	0.4100
Observations	43	43	43	43	43	43
Adjusted R-squared	0.499	0.829	0.714	0.5	0.678	0.563

Source: CNA.

[a] Total number of students with a national scholarship or college scholarship, divided by the total number of students.

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Table 12. Facility quality versus recruitment and retention, Air Force programs, students without a national scholarship

VARIABLES	(1) Recruits per Student	(2) 2-year Dropout Rate	(3) 4-year Commission Rate	(4) Recruits per Student	(5) 2-year Dropout Rate	(6) 4-year Commission Rate
Impact Count	-0.0016	-0.0118	0.0014	-0.0017	-0.0099	0.0035
	0.0040	0.0070	0.0050	0.0030	0.0090	0.0090
Impact Count x MSI				-0.0020	-0.0177	0.0255
				0.0170	0.0410	0.0430
Visible Count	-0.0001	0.00144*	-0.0010	0.0001	0.0027	-0.0017
	0.0000	0.0010	0.0010	0.0010	0.0020	0.0020
Visible Count x MSI				-0.0006	0.0006	-0.0007
				0.0010	0.0030	0.0030
Capacity Count	0.0016	0.0060	0.0007	0.0021	-0.0003	0.0034
	0.0040	0.0080	0.0060	0.0040	0.0120	0.0110
Capacity Count x MSI				0.0040	-0.0048	-0.0047
				0.0140	0.0310	0.0320
Configuration Count	0.0023	0.0048	0.0038	0.0026	-0.0001	0.0018
	0.0030	0.0080	0.0050	0.0030	0.0080	0.0070
Configuration Count x MSI				0.0061	0.0144	-0.0446
				0.0180	0.0570	0.0510
% Cadets with Scholarship (no NS)[a]	0.1180	-0.52182***	0.34471**	0.1011	-0.44306*	0.2194
	0.0800	0.1340	0.1400	0.0740	0.2340	0.2110
H.B.C.U.	0.0117	0.19645***	-0.11239**			
	0.0340	0.0540	0.0380			
H.S.I.	0.0196	0.0132	0.0210			
	0.0210	0.0510	0.0350			
M.S.I. (HBCU or HSI)				0.0088	0.1213	-0.0733
				0.0240	0.0730	0.0640
Average FSM Spending	-0.0800	-0.2918	0.3703	-0.1216	-0.7764	0.5857
	0.1470	0.4340	0.2750	0.2180	0.6660	0.6140
Full Time Undergraduates	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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VARIABLES	(1) Recruits per Student	(2) 2-year Dropout Rate	(3) 4-year Commission Rate	(4) Recruits per Student	(5) 2-year Dropout Rate	(6) 4-year Commission Rate
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
4yr Graduation Rate	-0.0004	-0.0006	0.00243**	-0.0003	0.0007	0.0013
	0.0000	0.0010	0.0010	0.0000	0.0020	0.0010
Private School	0.06096*	-0.0194	-0.0798	0.05193*	0.1117	-0.20736**
	0.0300	0.0550	0.0630	0.0260	0.0870	0.0810
vet1	0.0047	0.0004	-0.0137	0.0021	0.0534	-0.0485
	0.0140	0.0240	0.0200	0.0140	0.0350	0.0280
vet2	-0.0327	0.15380**	-0.0330	-0.0220	0.0799	0.0055
	0.0280	0.0670	0.0520	0.0290	0.0850	0.0730
vet4	0.0306	0.0860	-0.12377**	0.0323	0.1179	-0.16871**
	0.0300	0.0540	0.0560	0.0300	0.0820	0.0770
vet5	0.0174	-0.0389	-0.0112	0.0102	0.0313	-0.0507
	0.0230	0.0450	0.0360	0.0250	0.0780	0.0640
Day Care Available	0.0044	-0.0136	0.0059	0.0039	-0.0041	-0.0151
	0.0110	0.0230	0.0150	0.0110	0.0330	0.0290
Cost of Instate Tuition	0.0000	0.0000	0.0000			
	0.0000	0.0000	0.0000			
% of Students with Pell Grant	0.0006	-0.0017	0.0017	0.0005	-0.0006	0.0017
	0.0010	0.0020	0.0010	0.0000	0.0020	0.0020
Average Cost (after aid)	0.0000	0.0000	0.0000	0.00000*	-0.00001*	0.00001*
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
University Retention Rate	-0.0003	-0.0001	-0.0019	-0.0008	0.0011	-0.0011
	0.0010	0.0020	0.0020	0.0010	0.0020	0.0030
% Students with Any Aid	0.0004	0.00203**	-0.0010	0.0004	0.0015	-0.0012
	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010
Admission Rate	0.0004	0.0002	0.0003	0.0003	0.0003	-0.0004
	0.0000	0.0010	0.0010	0.0000	0.0020	0.0010
SAT Verbal 75th Percentile	-0.0003	0.00103**	-0.00123**			
	0.0010	0.0000	0.0010			

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VARIABLES	(1) Recruits per Student	(2) 2-year Dropout Rate	(3) 4-year Commission Rate	(4) Recruits per Student	(5) 2-year Dropout Rate	(6) 4-year Commission Rate
SAT Math 75th Percentile	0.0000	0.0003	0.0002			
	0.0000	0.0000	0.0000			
ACT 75th Percentile	0.0050	-0.02305*	0.01767*	0.0004	-0.0009	-0.0052
	0.0060	0.0120	0.0080	0.0030	0.0130	0.0110
Constant	-0.0163	0.2216	0.56408**	-0.0929	0.4686	0.5405
	0.1210	0.3070	0.2540	0.1240	0.5770	0.4340
Observations	43	43	43	43	43	43
Adjusted R-squared	0.46	0.787	0.767	0.458	0.536	0.5

Source: CNA.

[a] Total number of students with a college scholarship, divided by the total number of students with either a college scholarship or no scholarship.

Table 13. Facility quality versus recruitment and retention, by facility type, all services

VARIABLES	(1) Recruits per Student	(2) 2-year Dropout Rate	(3) 4-year Commission Rate	(4) Recruits per Student	(5) 2-year Dropout Rate	(6) 4-year Commission Rate
Staff Offices						
Condition	-0.0003	0.0001	-0.0027	-0.0009	-0.0034	-0.0021
	0.0030	0.0180	0.0200	0.0030	0.0180	0.0180
Capacity	0.0007	-0.0182	0.0145	0.0012	-0.0213	0.0105
	0.0030	0.0170	0.0200	0.0020	0.0160	0.0170
Configuration	0.0009	-0.0126	0.0288	0.0000	0.0118	0.0158
	0.0030	0.0260	0.0260	0.0030	0.0260	0.0240
Classrooms						
Mission Impact	0.0024	-0.0005	-0.0184	0.0015	0.0046	-0.0129
	0.0040	0.0160	0.0180	0.0040	0.0170	0.0160
Condition	-0.00909*	-0.0047	0.0021	-0.00736*	-0.0026	0.0061

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VARIABLES	(1) Recruits per Student	(2) 2-year Dropout Rate	(3) 4-year Commission Rate	(4) Recruits per Student	(5) 2-year Dropout Rate	(6) 4-year Commission Rate
	0.0050	0.0200	0.0210	0.0040	0.0210	0.0190
Capacity	-0.0020	0.0184	-0.0147	-0.0017	0.0189	-0.0171
	0.0030	0.0160	0.0160	0.0030	0.0160	0.0150
Configuration	-0.00773*	0.0079	-0.0038	-0.0060	0.0114	-0.0043
	0.0040	0.0190	0.0190	0.0040	0.0190	0.0170
Indoor Training						
Mission Impact	0.0009	0.0091	-0.0190	0.0012	0.0203	-0.0176
	0.0030	0.0160	0.0180	0.0020	0.0170	0.0160
Condition	-0.0006	0.0275	-0.0111	0.0002	0.0198	-0.0075
	0.0030	0.0180	0.0160	0.0030	0.0180	0.0150
Capacity	-0.0006	-0.0073	0.0305	0.0002	-0.0109	0.0215
	0.0040	0.0240	0.0240	0.0040	0.0240	0.0190
Configuration	0.0057	0.0544	-0.0433	0.01198*	-0.0149	0.0378
	0.0070	0.0430	0.0450	0.0060	0.0420	0.0350
Outdoor Training						
Mission Impact	0.0021	-0.0034	0.0132	0.0011	-0.0108	0.0165
	0.0030	0.0160	0.0170	0.0030	0.0170	0.0170
Capacity	-0.0006	-0.0096	0.0342	0.0000	-0.0314	0.0194
	0.0030	0.0240	0.0310	0.0030	0.0280	0.0230
Configuration	0.0006	0.0045	0.0028	0.0010	0.0010	0.0198
	0.0020	0.0140	0.0170	0.0020	0.0150	0.0150
Storage Areas						
Condition	0.0037	0.0045	0.0093	0.0032	0.0079	-0.0063
	0.0030	0.0160	0.0170	0.0030	0.0160	0.0150
Capacity	0.0023	-0.0127	-0.0024	0.0046	-0.0175	-0.0010
	0.0040	0.0230	0.0230	0.0030	0.0220	0.0260
Configuration	0.0051	0.0073	-0.0023	0.0040	-0.0067	0.0112
	0.0050	0.0180	0.0190	0.0050	0.0210	0.0170
% Cadets with Scholarship[a]	-0.0045	-0.53147***	0.44015***			

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VARIABLES	(1) Recruits per Student	(2) 2-year Dropout Rate	(3) 4-year Commission Rate	(4) Recruits per Student	(5) 2-year Dropout Rate	(6) 4-year Commission Rate
	0.0130	0.0680	0.0700			
% Cadets with Scholarship (no NS)[b]				0.0157	-0.77131***	0.75253***
				0.0150	0.1010	0.0820
H.B.C.U.	-0.0022	0.0271	-0.06121*	-0.0022	0.0174	-0.0428
	0.0080	0.0350	0.0330	0.0070	0.0380	0.0300
H.S.I.	0.0015	0.0099	-0.0376	0.0018	-0.0016	-0.0279
	0.0040	0.0230	0.0230	0.0030	0.0250	0.0220
Air Force	0.01897***	0.03991***	-0.02862*	0.01955***	0.03628**	-0.0142
	0.0050	0.0150	0.0160	0.0040	0.0160	0.0140
Navy	0.0082	-0.09188***	-0.37414***	0.0039	-0.10634***	-0.20833***
	0.0050	0.0290	0.0330	0.0040	0.0320	0.0280
Average FSM Spending	-0.0891	0.2992	-0.0707	-0.1134	0.81917**	-0.63303**
	0.0760	0.3930	0.4210	0.0700	0.3700	0.2840
Full Time Undergraduates	-0.00000***	0.0000	0.0000	-0.00000***	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
4yr Graduation Rate	-0.0001	-0.00178**	0.00343***	-0.0001	-0.0007	0.00135**
	0.0000	0.0010	0.0010	0.0000	0.0010	0.0010
Private School	0.0024	0.0106	-0.06337*	0.0022	0.0053	-0.0502
	0.0070	0.0390	0.0340	0.0060	0.0410	0.0360
vet1	-0.0005	0.0261	-0.0002	-0.0005	0.0178	-0.0007
	0.0030	0.0170	0.0180	0.0030	0.0190	0.0160
vet2	-0.0018	0.0238	0.0066	-0.0015	0.0412	-0.0010
	0.0090	0.0230	0.0250	0.0080	0.0280	0.0230
vet3	0.0078	-0.08240**	0.10473**	0.0062	-0.05055*	0.07019**
	0.0090	0.0400	0.0480	0.0080	0.0290	0.0330
vet4	-0.0028	0.04564*	-0.0280	-0.0016	0.0301	-0.0058
	0.0070	0.0240	0.0250	0.0060	0.0260	0.0230
vet5	-0.0096	-0.0065	-0.0031	-0.0102	-0.0025	-0.0011
	0.0080	0.0230	0.0280	0.0070	0.0230	0.0210

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VARIABLES	(1) Recruits per Student	(2) 2-year Dropout Rate	(3) 4-year Commission Rate	(4) Recruits per Student	(5) 2-year Dropout Rate	(6) 4-year Commission Rate
Day Care Available	-0.0014	-0.03184*	0.0137	-0.0025	-0.0177	-0.0019
	0.0030	0.0170	0.0180	0.0020	0.0180	0.0150
Cost of Instate Tuition	0.0000	0.0000	0.00000***	0.0000	0.0000	0.00000***
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
% of Students with Pell Grant	-0.0001	0.0006	0.0007	-0.0001	0.0008	0.0004
	0.0000	0.0010	0.0010	0.0000	0.0010	0.0010
Average Cost (after aid)	0.0000	0.0000	-0.00001***	0.0000	0.0000	-0.00000*
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
University Retention Rate	0.0005	0.0018	-0.00309*	0.0004	0.0004	-0.0020
	0.0000	0.0020	0.0020	0.0000	0.0020	0.0020
% Students with Any Aid	0.0000	-0.0004	-0.0006	0.0000	-0.0013	-0.0004
	0.0000	0.0010	0.0010	0.0000	0.0010	0.0010
Admission Rate	0.0001	0.0006	-0.00119**	0.0001	0.0002	-0.00088*
	0.0000	0.0010	0.0010	0.0000	0.0010	0.0010
SAT Verbal 75th Percentile	0.0000	0.0001	-0.0001	0.0000	0.0003	-0.0002
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SAT Math 75th Percentile	-0.0001	0.0000	-0.0001	-0.0001	0.0002	-0.0003
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ACT 75th Percentile	-0.0006	-0.0002	-0.0020	-0.0006	-0.0028	0.0019
	0.0010	0.0050	0.0060	0.0010	0.0060	0.0060
Constant	0.0190	0.62626***	0.43759**	0.0306	0.63300***	0.39595**
	0.0390	0.1990	0.2210	0.0340	0.2050	0.1900
Observations	166	166	166	166	163	163
Adjusted R-squared	0.333	0.736	0.649	0.327	0.615	0.68

Source: CNA.

[a] Total number of students with a national scholarship or college scholarship, divided by the total number of students.

[b] Total number of students with a college scholarship, divided by the total number of students with either a college scholarship or no scholarship.

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Table 14. Variables selected for prediction model by LASSO regression

Outcome	Variables Selected
Panel A: All students	
Recruits per Student	Service, Private School
2-year Dropout Rate	Service, Scholarship Rate, 4-year Graduation Rate
4-year Commission Rate	Service, Scholarship Rate, 4-year Graduation Rate
Panel B: Students without a national scholarship	
Recruits per Student	Service, Private School
2-year Dropout Rate	Service, Scholarship Rate
4-year Commission Rate	Service, Scholarship Rate

Source: CNA.

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Figures

Tables

References

[1] US Department of Defense. 2018. *Summary of the 2018 National Defense Strategy of the United States of America: Sharpening the American Military's Competitive Edge.* https://dod.defense.gov/Portals/1/Documents/pubs/2018-National-Defense-Strategy-Summary.pdf.

[2] DOD Instruction 1215.08, Change 1. 2018. *Senior Reserve Officers' Training Corps (ROTC) Programs*.

[3] DOD Board on Diversity and Inclusion (D&I). 2020. *Recommendations to Improve Racial and Ethnic Diversity and Inclusion in the U.S. Military.*

[4] *Higher Education Act of 1965*. Nov. 8, 1965. Public Law 89-329.

[5] Trevor Hastie, Robert Tibshirani, Jerome Friedman. 2017. *The Elements of Statistical Learning Data Mining, Inference, and Prediction, second addition*, Springer Series in Statistics. Springer.

[6] US Secretary of Defense. 2020. SecDef Memo D&I 2020. Subject: Actions for Improving Diversity and Inclusion in the Department of Defense.

[7] Cronk, Terri Moon. 2020. "Esper Discusses COVID-19, Inclusion, National Defense Strategy." DoD News. Aug. 5. https://www.defense.gov/Explore/News/Article/Article/2301113/esper-discusses-covid-19-inclusion-national-defense-strategy/.

[8] Secretary of Defense. 2021. Memorandum for All Department of Defense Employees. Subject: Secretary of Defense Lloyd Austin's Message to the Force.

[9] Cronk, Terri Moon. 2020. "Esper Discusses COVID-19, Inclusion, National Defense Strategy." *DoD News*. Aug. 5. Accessed Apr. 10, 2021. https://www.defense.gov/Explore/News/Article/Article/2301113/esper-discusses-covid-19-inclusion-national-defense-strategy/.

[10] Pennamon, Tiffany. 2018. "ROTC Programs Bring Access to Education and Careers for HBCU Students." Diverse Education. Sept. 12. https://diverseeducation.com/article/125932/.

[11] Office of the Under Secretary of Defense, Personnel and Readiness. 2020. *Population Representation in the Military Services: Fiscal Year 2018.* https://www.cna.org/pop-rep/2018/.

[12] Budget Document. FY20. *FY20 SASC NDAA*.

[13] How to Commission as a Marine Officer. 2021. https://www.marines.com/become-a-marine/process-to-join/become-an-officer.html.

[14] *Equity In Educational Land-Grant Status Act Of 1994*. Oct. 1, 2014. Public Law 103–382; 108 Stat. 4048; 7 U.S.C. 301 note.

[15] *Tribally Controlled Colleges and Universities Assistance Act of 1978*. August 14, 2008. P.L. 95–471.

[16] *Navajo Community College Act*. Dec.15, 1971. Public Law 92-189.

[17] *Higher Education Opportunity Act*. Jan. 3, 2008. H. R. 4137.

[18] Eligibility Matrix 2020. 2020. Department of Education. https://www2.ed.gov/about/offices/list/ope/idues/eligibility.html.

[19] LaDuca, Michelle, Kyle Neering, and Alex Yellin. Sept. 15, 2020. Task 1 School List Memo. Subject: Senior Reserve Officer Training Corps (SROTC) Facility Condition at Minority-Serving Institutions (MSIs) and Its Effects on Unit Recruiting and Retention-Task 1 School List.

[20] Eckert, Erica. 2012. "Examining the Environment: The Development of a Survey Instrument to Assess Student Perceptions of the University Outdoor Physical Campus." Doctor of Philosophy, Kent State University.
[21] La Duca, Michelle, Alex Yellin, Kyle Neering, and Robert Shuford. 2021. *SROTC Facility Condition Assessment.* DRM-2021-U-029678.
[22] Facilities Performance Indicators Report. 2019-20. APPA.
[23] Williams, June Audrey. 2006. "Facilities Play a Key Role in Students' Enrollment Decisions, Study Finds." *The Chronical of Higher Education* 52 (40).
[24] Quirk, Robert. 2006. "The Facilities Condition Index as a Measure of the Conditions of Public Universities as Perceived by the End Users." *APPA CFaR Facilities Manager* September/October 2006: 62-69.
[25] Mayo, Glenda, and Pauline Karanja. 2017. *Current State of Practice for Condition Assessment Methods and the Facility Condition Index as a Measure.* APPA CFaR.
[26] Streicher, Burton, Daniel D. Steeples, Samuel Yellin, Kyle J. Kretschman, Lauren R. Malone, and Dorothy L. Morgan. 2012. *Reducing Shore Infrastructure Cost: Allocation of Shore Burden to Individual Units.* CNA. DRM-2012-U-001748-Final.
[27] DOD Financial Management Regulation 7000.14R, Volume 2B, Chapter 8. Dec. 2016. *Facilities Sustainment and Restoration/Modernization*.
[28] Huggins, Bert. 2020. *2020 MS 2 Survey Results.*
[29] Huggins, Bert. 2019. *2019 MS 3 Survey Results.*
[30] Streicher, Burton L., Daniel D. Steeples, Glenn H. Ackerman, Kyle J. Kretschman, and Zachary T. Miller. 2012. *Long-Term Effects of 80-Percent Facility Sustainment.* CNA. DRM-2012-U-001430-1Rev.
[31] Kaiser, Harvey. "Capital Renewal and Deferred Maintenance." APPA Body of Knowledge. Accessed Mar. 16, 2021. https://www.appa.org/bok/capital-renewal-and-deferred-maintenance.
[32] Government Accountability Office. 2016. *Defense Facility Condition Revised Guidance Needed to Improve Oversight of Assessments and Ratings.* GAO-16-662. https://www.gao.gov/products/gao-16-662.
[33] McDonald, Lucinnda Sue. 2019. "The Impact of Campus Facilities on the Recruitment of Students in Hugher Education." Doctor of Education, Western Kentucky University. https://digitalcommons.wku.edu/diss/170.
[34] Department of the Army. 2011. *Senior Reserve Officers' Training Corps Program: Organization, Administration, and Training.*
[35] Naval Service Training Command Regulations for Officer Development (ROD). 2021. https://www.netc.navy.mil/Commands/Naval-Service-Training-Command/ROD_and_Appendices/.
[36] AIR FORCE POLICY DIRECTIVE 36-20. 2019. *Recruiting Programs and Accession of Air Force Military Personnel*.
[37] AFROTC INSTRUCTION 36-2011. 2015. *Cadet Operations*.
[38] Cotton, Anthony J. Department of the Air Force, Letter from LTGEN Cotton to Dr. Lilly D. McNair, 2019.

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