I N S T I T U T E F O R D E F E N S E A N A L Y S E S

Analysis of DoD Accession Alternatives for Military Physicians: Readiness Value and Cost

Sarah K. John, Project Leader
James M. Bishop
Laura A. Hildreth
Jamie M. Lindly
W. Patrick Luan
Madeline Minneci
George M. Prugh

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4850 Mark Center Drive
Alexandria, Virginia 22311-1882

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For More Information

Sarah K. John, Project Leader
sjohn@ida.org, (703) 575-1407

David E. Hunter, Director, Cost Analysis and Research Division
dhunter@ida.org, (703) 575-4686

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Executive Summary

The Department of Defense (DoD) employs more than 10,000 active duty physicians to support its medical operations. To maintain this force structure, the department operates a large, multi-channeled physician accession pipeline whose programs offer medical education and training in exchange for military service. Today, the pipeline has two primary channels: training students in-house at the Uniformed Services University (USU) F. Edward Hébert School of Medicine, and sending students to civilian medical programs through the Armed Forces Health Professions Scholarship Program (HPSP). The Services also make a small number of physician accessions through the Financial Assistance Program (FAP) which targets individuals who have already completed medical school and who are in the process of completing their Graduate Medical Education (GME) training.

Given that each accession source has its own unique program structure, we expect to see differences in both their costs and benefits. For instance, one would expect the per-student cost to be highest for USU, given that the university bears the fully burdened cost of educating a physician (as opposed to covering only tuition and fees). However, one might also expect educating students in-house to yield additional force structure or readiness benefits (e.g., increased retention, greater knowledge of military-unique medicine, etc.). Past review has confirmed this expectation. A 2003 CNA study found that, while it costs substantially more to put a student through USU relative to HPSP, USU was the most cost effective source for filling O-6 billets (due to increased retention).

The value of maintaining a DoD medical school is again being examined by the Department's Reform Management Group (RMG), which commissioned multiple studies on the topic. The Government Accountability Office (GAO) has also recently raised questions on the cost of providing medical education at USU. To ensure a careful and complete evaluation by the RMG, USU asked the Institute for Defense Analyses (IDA) to perform an independent assessment of the value (benefits relative to costs) of the USU School of Medicine relative to alternative accession options. IDA was also asked to develop a set of options for enhancing the value of USU and the School of Medicine (SOM) to the DoD in two areas: (1) improving cost efficiency and/or value to the MHS (2) enhancing ties to the readiness mission.

Approach

To assess the value provided by the USU SOM relative to alternative accession options, IDA performed a three-part analysis, which included: (1) an accession source cost estimate, (2) an accession source value estimate, and (3) an estimate on the causal impact of USU attendance. These are summarized below.

Accession Source Cost Estimate

The average per-accession cost associated with each source is a required building block for any form of cost comparison or value analysis. Therefore, the first step of our analysis was to develop independent cost estimates for the USU SOM, the Service-run HPSP and FAP programs, and GME. To develop these cost estimates we collected detailed financial data from USU and each Service-run program. We then used the data to construct annual per-student cost estimates. All cost estimates were fully burdened (e.g., they included direct education costs, student compensation, and overhead costs like recruiting and administration). Each program required a different methodology, given their different program structures and cost elements.

Accession Source Value Analysis

Comparing the different accession source cost estimates may be informative. However, such an exercise does not capture the true value of each source; a value analysis must compare costs relative to benefits. To better examine the value USU offers relative to other physician accession sources, we constructed a large database containing observations on all active-duty physicians for the last 19 years (January 2000 through December 2018). We used the data to perform a descriptive analysis that explores multiple dimensions of force structure and readiness benefits (e.g., years served, days deployed, time in grade, specialty leadership roles, etc.). A value-based cost analysis is also performed. In this analysis, we estimate mean accession and total career costs per year of service and year of practice. These costs are estimated by specialty and accession source.

Causal Analysis of USU Attendance

Many acknowledge the value of the higher retention rates observed for USU graduates. However, they often attribute them to selection factors, such as “taste for service.” This argument implies that if the university did not exist, its graduates would have still joined the military (through another accession source) and served just as long. To address this argument, we estimate the share of the observed difference in retention that can be causally attributed to USU versus other observable (prior service, demographics, etc.) and non-observable (“taste for service”) factors using a two-stage instrumental variable econometric approach.

Summary of Findings

On a Per-Student Cost Basis, USU is the Most Expensive Accession Source

We estimate that it costs the DoD approximately $253,000 per year (more than $1 million dollars total) to directly educate a physician though the USU SOM. This is approximately 2.5 times greater than the average annual cost of the HPSP program, which provides education through civilian medical schools ($101,000 per year, or $400,000 for a four-year scholarship).

One-third of the per-student cost difference is explained by student compensation. USU students receive full active-duty pay and benefits (at the grade of O-1), while HPSP participants are largely compensated through monthly stipends. The remaining two-thirds of the cost difference is explained by the fact that USU bears the full overhead cost associated with educating medical students (not just tuition and fees) and the fact that USU provides an extra 700 hours of curriculum that include military-specific field exercises.

On a Value Basis that Factors in Retention, USU is no Longer Significantly more Costly

On average, USU graduates serve significantly longer than physicians from other accession sources, which increases their value to the DoD. We estimate that, in the first 18 years and 11 months of their careers, the mean USU accession serves a mean of 15.23 years on active duty (versus 9.21 years for other accession sources). USU graduates also spend significantly more time deployed—a mean of approximately 700 days, vice 250 for other accession sources.

When these retention differences are factored in, cost differences between USU and other accession channels shrink considerably (and sometimes reverse). The extent to which the cost difference shrinks depends on the provider's specialty, the time-related output explored (e.g., years of service, years of practice, days deployed, etc.), and the cost elements factored into the analysis. For instance, if we consider accession costs only (the investment DoD must make to obtain an attending physician) and take the mean of those costs per year of practice (i.e., years as an attending physician), HPSP is sometimes more costly.

However, accession costs do not tell the full story. Individuals who serve longer earn higher pay and benefits, which increases the total cost of their career to the DoD (i.e., life-cycle costs). When we compute total career costs per years of service, we again observe USU as the more costly accession source. However, the difference for each specialty is between 8 and 25 percent (versus the initial medical education cost difference of 250 percent). We note that this cost difference does not account for later years in a physician's career being more valuable than early years. The table below summarizes these findings by presenting a range of cost metrics for two selected specialties: family practice and general surgery. Results for a greater set of metrics and specialties are contained in the report.

Physician Accession and Career Costs by Periods of Service (in $1000s)

	USU	HPSP	FAP*
Total Accession Cost (with GME):			
Family Practice	1627	1019	252
General Surgery	2061	1453	420
Accession Costs:			
Mean Accession Cost per Year of Service			
Family Practice	101	92	83
General Surgery	124	106	71
Mean Accession Cost per Year of Practice			
Family Practice	127	136	83
General Surgery	185	185	71
Accession Cost per Day Deployed, Given Accession Source Mean Days Deployed**			
Family Practice	2.2	3.8	0.9
General Surgery	2.8	5.5	1.6
Total Career Cost (Life-Cycle Cost):			
Mean Life-Cycle Cost Per Year of Service			
Family Practice	320	257	241
General Surgery	335	287	293
Mean Life-Cycle Cost Per Year of Practice			
Family Practice	388	338	241
General Surgery	475	437	293
Life-Cycle Cost Per Day Deployed, Given Accession Source Mean Days Deployed**			
Family Practice	7.4	12.1	9.3
General Surgery	7.8	15.7	15.3

* We cannot distinguish HPSP from FAP accessions in our manpower data (we only know USU or other). We must assume HPSP and FAP accessions have the same average retention behavior. This should not present a problem for the HPSP estimates as they make up an overwhelming share of other accessions (>95 percent).

** We do not use specialty-specific averages for days deployed in this analysis.

We Estimate that USU Attendance has a Mean Causal Impact on Retention of 4.48 Years of Service

Our causal estimates imply that USU attendance caused the USU graduates in our data to serve a mean of 4.48 additional years on active duty. In other words, if those individuals had been unable to attend USU (and instead joined the military though a different accession source), they would serve an average of 4.48 fewer years. This causal effect accounts for nearly 75 percent of the observed difference in retention across USU and other accession programs. The remaining difference is attributed to selection (i.e., taste for service) and other observable factors.

Relative to the Service Academies, USU compares favorably on value: The dual approach to physician accession is often likened to the model to produce line officers—USU parallels the Service academies, while HPSP parallels the Reserve Officer Training Corps (ROTC) program. Past studies have found that the Service academies are nearly four times as costly as ROTC and only increase retention by less than 10 percent.[1] In contrast, we find that USU costs 2.5 times more than HPSP and significantly increases retention.

Reform Scenarios Did not Offer Significant Savings and Some had Negative Impacts: IDA performed multiple cost excursions on reforms designed to generate savings, including increasing the Doctor of Medicine (M.D.) class size by 30 students, reducing medical student compensation, and closing the SOM (or entire university). Increasing class size was estimated to be roughly cost neutral. Under this scenario, the SOM becomes more cost efficient by spreading fixed overhead across a larger cohort (reducing the cost per student to $239,000 per year). While USU's total cost would still increase, the offset from reduced HPSP accessions would be enough to make the reform approximately cost neutral. Reducing student compensation was expected to generate between $30 million and $50 million in savings per cohort but not without negatively impacting recruiting, retention, and student quality. Finally, closing the SOM was estimated to generate less than $100 million in savings per year. However, the closure was expected to create significant disruption to medical education and training, medical research, and physician accession. We note that closing the SOM would almost surely result in closing the entire university.

Many Opportunities Exist to Increase USU's cost efficiency and value to the Military Health System (MHS): In discussions with USU leadership and faculty, broader MHS leadership, and experts from the civilian trauma community, IDA identified many opportunities for the university to increase its value to the MHS and its ties to the readiness mission. The university routinely receives requests from the Services and the Defense Health Agency (DHA) to expand its degree programs or to provide academic credit for existing education and training programs. There are also opportunities to expand existing military-unique field exercises and leadership curriculum to a larger student base and to accept more students into certain education programs.

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[1] United States Navy, Advanced Management Program, "Comparative Analysis of ROTC, OCS and Service Academies as Commissioning Sources," November 19, 2004, https://cdn.shopify.com/s/files/1/0059/6242/files/tenchfrancisprose.pdf. We note that this study is dated and that relative cost differences may have changed over the last decade.

Summary of Recommendations

- **USU should work to improve its cost efficiency and/or value to the MHS:** IDA identified multiple options that would allow the university to further leverage its resources and capabilities to improve its cost efficiency and/or provide greater value to the MHS. Recommended options are enumerated below.
    - The USU SOM should pursue increasing the M.D. cohort size by 30 students per year to spread fixed overhead costs over a larger cohort, lowering the cost per student.
    - The USU SOM should work with the Services to expand military-unique field exercises and medical leadership courses to HPSP/FAP participants.
    - The USU SOM should work with Service HPSP programs to create a common MHS-wide physician application to streamline the process and increase recruiting success.
    - USU should continue work with the DHA and Services to expand its degree offerings to meet certain MHS educational requirements.
    - USU leadership should work with broader MHS leadership to explore consolidating certain higher-education programs under the university.
    - USU should work with MHS partners to explore building an academic health system (AHS) in the National Capital Region (NCR).

- **USU should work to enhance its readiness value to the MHS:** IDA identified multiple options that would allow the university to enhance its ties to the readiness mission. Recommended options are enumerated below.
    - USU leadership should work to build a military-civilian trauma partnership in the NCR.
    - USU should take a greater leadership role in building the national trauma-care system envisioned in the National Academies of Sciences, Engineering, and Medicine's (NASEM's) 2016 report.
    - USU leadership should ensure that its research centers and new programs remain focused on the readiness mission.

Contents

1. Introduction

A. Background

The Department of Defense (DoD) requires a large, professionally educated medical force to carry out its operational mission. Today, the DoD accesses physicians through two primary channels: training students in house at the Uniformed Services University (USU) F. Edward Hébert School of Medicine (SOM), and sending students to civilian medical programs through the Armed Forces Health Professions Scholarship Program (HPSP). Both programs were established by Congress in 1972 following the formation of the All-Volunteer Force (AVF) and elimination of the draft. The dual approach to physician accessions parallels the model used to access line officers—USU replicates the role of the service academies, while HPSP replicates the role of the Reserve Officer Training Corps (ROTC) programs.[1] The Services also make a small number of physician accessions through the Financial Aid Program (FAP), which targets individuals who have already completed medical school and who are in the process of completing their Graduate Medical Education (GME) training.[2]

The physician accession channels described above each have their own unique program structures. For instance, they differ in terms of the volume of accessions they produce, the service commitments they impose, the compensation packages they provide to participants, and the type of education they provide (medical school versus GME). The degree of military acculturation is also quite different across the programs—USU students enter the university as commissioned officers on active duty status. They train together as a cohort taught by experienced military (and civilian) faculty and receive nearly 700 additional hours of military-focused medical training, including operational field exercises. HPSP and FAP participants, on the other hand, are commissioned as members of the Individual Ready Reserve (IRR) and attend civilian programs in a civilian status. They activate only once a year for short Active Duty for Training (ADT).

These significant differences in program structure naturally produce differences in the costs associated with accessing physicians via the alternative channels. For instance, one would expect the per-student cost to be highest for USU, given that the university bears

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[1] Uniformed Services University, School of Medicine (SOM), "Strengthening Oversight and Organization of Graduate Medical Education in the Military Health System: Analysis and Options," (Bethesda, M.D: USU Defense Health Horizons, June 2018), Pre-decisional.

[2] In some instances, the Services may directly assess a fully trained physician (post residency).

the fully burdened cost of educating a physician (as opposed to covering only tuition and fees).[3] Past reviews have indeed confirmed this to be true—both in the case of USU (direct education) versus HPSP and FAP (scholarship/financial assistant programs), and in the case of the Service Academies (direct education) versus ROTC (scholarship/financial assistance program).[4] However, it should be noted that the initial costs associated with an accession channel and its ultimate value are not the same. The last comprehensive review of USU costs found that the university may actually offer a higher return, due to increased retention rates among its students. Specifically, the 2003 study found that USU was a more cost-effective accession source for obtaining O-6 medical corps officers.[5]

Despite past findings on the high return delivered by USU, the value of maintaining a DoD medical school is again being examined by the Department's Reform Management Group (RMG) which commissioned multiple studies on the topic. To ensure a careful and complete evaluation by the RMG, USU asked the Institute for Defense Analyses (IDA) to perform an independent assessment of the value (benefits relative to costs) of the USU SOM relative to alternative accession options. In the following section, we outline the four main research objectives set for this project.

B. Research Objectives

This paper has four main objectives:

- **Determine the average cost of producing a Doctor of Medicine (M.D.) at USU:** The Army, Navy, and Air Force recently provided the Government Accountability Office (GAO) with the annual average cost of sending a student through their HPSP programs. USU was unable to provide a comparable estimate, as it does not separately track costs for its individual educational programs.[6] Therefore, the first objective of this report was to produce an independent estimate of the average annual cost of M.D. education. IDA was

3 A small body of literature exists on estimating the costs of medical education. A set of four studies was published in the same issue of Academic Medicine in 1997, with a follow up to one of these articles in 2011 and one additional study from 2012. Using the information from these studies, which predominantly look at the average annual cost of educating a medical student, it is possible to estimate the percentage of total costs that are covered by tuition. Estimates for this percentage range from 36.2 percent to 56.2 percent.

4 CNA study found that USU costs nearly three times more that HPSP; "Comparative Analysis of ROTC, OCS and Service Academies as Commissioning Sources" found that the Service Academies cost nearly four times more than ROTC. https://cdn.shopify.com/s/files/1/0059/6242/files/tenchfrancisprose.pdf.

5 Shayne Brannman et al., "Life-Cycle Costs of Selected Uniformed Health Professions," (Alexandria, VA: CNA, April 2003).

6 United States Government Accountability Office, "MILITARY PERSONNEL, Additional Actions Needed to Address Gaps in Military Physician Specialties," GAO-18-77, (Washington, DC: GAO, February 2018). https://www.gao.gov/assets/700/690409.pdf.

also asked to produce independent estimates of the HPSP and FAP program average annual costs for comparison purposes.

- **Perform an accession source value analysis (benefits relative to costs):** While it is important to know the average annual (or per-student) cost associated with each accession source, such a cost may not fully reflect the value of each accession source. The second objective of this report is to perform a value analysis that accounts for retention (costs spread over the career), student quality, performance and career path (e.g., deployments, leadership roles), and other force-management and readiness benefits.
- **Estimate the causal impact of USU attendance on student outcomes:** While many acknowledge the value of the higher retention rates observed for USU graduates, they often attribute them to the longer service obligation and selection factors, such as "taste for service." This argument implies that if the university did not exist, its graduates still would have joined the military (through another accession source) and served just as long. We therefore seek to determine the share of the observed difference in retention that can be causally attributed to USU versus other observable (prior service, service obligations, etc.) and non-observable ("taste for service") factors.
- **Develop a set of options for enhancing the value of USU to DoD:** Options will focus on increasing the university's cost efficiency and increasing the university's focus on the readiness mission.

2. Physician Education and Training

This chapter provides a short primer on physician education and training in the United States, including an overview of the different types of medical schools, medical school curricula, board exams, and the specialty training (known as GME) required after medical school. Chapter 3 will provide additional information specific to the education and training provided at the USU SOM.

A. Types of Medical Schools

Medical school is a requirement for anyone who wants to become a physician. There are two types of medical schools that produce physicians: allopathic and osteopathic medical schools. Students graduating from allopathic medical schools become M.D.s, while students graduating from osteopathic schools become Doctors of Osteopathic Medicine (D.O.s). National educational organizations oversee M.D. and D.O. schools, ensuring that the schools produce experienced and knowledgeable physicians who will be allowed to practice medicine in the United States. The Association of American Medical Colleges (AAMC) oversees M.D. education, while the American Osteopathic Association (AOA) oversees D.O. education.[7,8] Accrediting bodies within both organizations recognize schools in the United States and in Canada who meet standardized criteria to educate a physician. The Liaison Committee on Medical Education (LCME) accredits allopathic medical schools, while the Commission on Osteopathic College Accreditation (COCA) accredits osteopathic medical schools. The AAMC and COCA officially recognize 168 allopathic and 39 osteopathic medical schools in the United States, its territories, and Canada.[9] The number of both M.D. and D.O. schools continues to grow every year. M.D.s and D.O.s have the same career opportunities, but there are some differences in their education.

[7] Association of American Medical Colleges, "Medical Schools: Membership Benefits for Medical Schools," accessed October 24, 2018, https://www.aamc.org/about/membership/378788/medicalschools.html.

[8] American Osteopathic Association, "Commission on Osteopathic College Accreditation," accessed October 24, 2018, https://osteopathic.org/accreditation/.

[9] Association of American Medical Colleges, "About the AAMC," accessed October 24, 2018, https://www.aamc.org/about/.

Applicants to M.D. and D.O. schools have similar educational backgrounds. All students must complete the required pre-med undergraduate science classes, graduate from an undergraduate institution with a Bachelor's degree, and take the Medical College Admission Test (MCAT). Students can apply to both M.D. and D.O. programs, although allopathic and osteopathic programs have different common application systems. On average, D.O. applicants have lower grade point averages (GPAs) and MCAT scores when compared to M.D. applicants; however, this trend has been changing and scores are becoming more similar for M.D. and D.O. applicants. Historically, D.O. schools have placed an emphasis on primary care and rural medicine (many D.O. schools are located in medically underserved areas and 45 percent of D.O. graduates practice primary care).[10] This emphasis attracted and recruited a different student profile than M.D. schools. In 2017, the average total GPA for students applying to D.O. schools was 3.61 (vice 3.7 for M.D. schools) and their average MCAT score was 501.1 (vice 504.7).[11,12,13] Due to the lower average scores, it has been thought that acceptance into D.O. schools is easier. However, with the growing number of applicants, both M.D. and D.O. schools are highly selective and competitive.

B. Medical School Curriculum

Once accepted into a medical school program, M.D. and D.O. students learn the same general information with an emphasis on different approaches to medicine. Allopathic medical programs focus on the diagnosis and treatment of disease with an emphasis on drugs and surgery as treatment. Osteopathic programs on the other hand approach medicine with a holistic view, focusing on prevention, alternative therapies, and connections to other body systems. A D.O. degree requires additional training in Osteopathic Manipulative Medicine (OMM) that goes beyond the traditional medical education.[14] OMM focuses on the musculoskeletal system, teaching students that all of the body's systems are interrelated

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10 Edward Salsberg and Clese Erikson, "Doctor of Osteopathic Medicine: A Growing Share of the Physician Workforce," *Health Affairs Blog*, October 23, 2017, https://www.healthaffairs.org/do/10.1377/hblog20171023.624111/full/.

11 American Association of Colleges of Osteopathic Medicine, "AACOMAS Applicant Pool Profile, Entering Class 2017," accessed October 22, 2018, https://www.aacom.org/docs/default-source/data-and-trends/2017-aacomas-applicant-pool-profile-summary-report.pdf?sfvrsn=886b2b97_4.

12 Note: The AOA and the American Association of Colleges of Osteopathic Medicine (AACOM) have listed different average MCAT and GPA values, and a different total number of D.O. schools. For consistency, this IDA report is using data from the AACOM source directly above.

13 Association of American Medical Colleges, "Table A-16. MCAT Scores and GPAs for Applicants and Matriculants to U.S. Medical Schools, 2016–2017 through 2017-2018," last modified November 22, 2017, accessed October 22, 2018, https://www.aamc.org/download/321494/data/factstablea16.pdf.

14 American Osteopathic Association, "What is a DO?" accessed on October 23, 2018, https://osteopathic.org/what-is-osteopathic-medicine/what-is-a-do/.

and interconnected. Osteopathic education is structured specifically around this holistic approach and integrates OMM throughout the curriculum.

Beyond philosophies, the core curriculum for M.D. and D.O. schools is very similar. All medical schools follow the same general educational structure. First- and second-year courses consist of the basic and core sciences foundational to medicine. These courses include anatomy and physiology, systems of the body, introduction to disease, cardiovascular medicine, endocrinology, etc. The third year of medical school consists of clerkships. Each clerkship rotation is generally four to eight weeks of clinical experience covering specialties such as surgery, family medicine, pediatrics, emergency medicine, and neurology. Students may travel to other medical schools or teaching hospitals for clerkship rotations. During the fourth year of medical school, students will elect to spend additional time training in their chosen specialties from the clerkship rotations. These rotations are longer than the clerkship rotations and informally influence which hospital students attend for GME, the specialty-based education after medical school and before students are considered licensed physicians.

While the scientific foundation of medical education is standardized, medical schools vary in their delivery of the material. Some of the highest ranking medical schools, such as Harvard, Duke, and John's Hopkins, organize core and basic sciences into specific blocks of study. During these blocks, they integrate basic subjects with the practical skills and knowledge needed to practice medicine. This allows for clinical exposure to begin earlier, or in some cases coincide with education in the first and second years. Integration of study can also continue throughout clerkships and electives in the third and fourth years of medical school. More schools are moving to this more integrative style of learning, rather than the traditional classroom to clinical approach. USU embraced curricular reform with its "Molecules to Military Medicine" curriculum in 2011. The class of 2015 was the first to graduate under the new curriculum.

Another recent trend in medical education is the re-emergence of accelerated three-year programs. Three-year medical school programs were initiated during World War II to address physician shortages and have waxed and waned in popularity over time.[15] Between 2010 and 2018, nine allopathic medical schools introduced accelerated programs (80 percent focused on primary care students). According to a 2016 survey of deans and program directors, 7 percent had three year programs, 4 percent were developing one, and 35 percent were considering development.[16] Supporters of these programs cite benefits such as addressing physician shortages and reducing student debt. Opponents argue that

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[15] Christine C. Schwartz et al., "Comprehensive history of 3-year and accelerated US medical school programs: a century in review." *Medical Education Online* 23, no. 1, December 2018.

[16] Cangiarella, Joan et al., "Accelerating medical education: a survey of deans and program directors," *Medical Education Online* 21 31794, June 13, 2016.

they lead to student burnout and reduce the breadth of clinical experience (most schools shorten the curriculum by restricting clinical rotations to a reduced number of pre-determined fields).

C. Board Exams

To advance through the years of medical school, students must pass board exams. The exams are different for M.D.s and D.O.s, but cover the same general information. M.D.s must pass Steps 1, 2, and 3 of the United States Medical Licensing Exam (USMLE), while D.O.s must pass the three steps of the Comprehensive Medical Licensing Examinations (COMLEX).[17,18] The USMLE Step 1 and the COMLEX 1 are taken shortly after a student's second year of medical school. The exams assess if students are able to integrate and apply the foundational science material to patient care.[19,20] All M.D. students must take the USMLE, while some D.O. students take both exams, depending on their school's requirements and their planned specialty. Students must pass the Step 1 or COMLEX 1 exam to begin clinical rotations.

The USMLE Step 2 and COMLEX 2 exams are usually taken either after the third year or during the fourth year of medical school. The scores of the Step 2 and COMLEX 2 exams are very important. The exam scores determine the competitiveness of an applicant to specialty GME programs.[21] Students must pass the first two board exams to graduate from M.D. and D.O. schools.

The last board exam, Step 3 or COMLEX 3, is often taken after the first year of residency. In both exams, students must show competency and the ability to properly obtain and interpret patient data to develop a diagnosis and treatment plan for their patient. Upon passage of Step 3 and COMLEX 3, students can become officially recognized as licensed physicians.

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17 United States Medical Licensing Examination, "What is USMLE?" accessed on October 23, 2018, https://www.usmle.org/.

18 American Osteopathic Association, "Medical School Timeline," accessed on October 23, 2018, https://osteopathic.org/students/medical-school-timeline/.

19 United States Medical Licensing Examination, "Step 1: Overview," accessed on October 23, 2018, https://www.usmle.org/step-1/.

20 National Board of Osteopathic Medical Examiners, "COMLEX-USA Level 1," accessed on October 24, 2018, https://www.nbome.org/exams-assessments/comlex-usa/comlex-usa-level-1/.

21 National Resident Matching Program, "Charting Outcomes in the Match for U.S. Osteopathic Medical Students and Graduates," September 2016, accessed on October 24, 2018, http://www.nrmp.org/wp-content/uploads/2016/09/Charting-Outcomes-US-Osteopathic-2016.pdf.

D. Graduate Medical Education

After graduating from medical school, physicians begin their GME with their residency. Residencies are specialty-specific postgraduate training programs. Fourth-year medical students who want to become a licensed physician must apply to an accredited residency program. The Accreditation Council for Graduate Medical Education (ACGME) is the accrediting body for M.D. residencies, and the AOA is the accrediting body for D.O. residencies. D.O. students can apply to M.D. residency programs, as long as they have taken and passed the USMLE exams; however, M.D. students typically do not apply to D.O. residency programs, because they lack the training in osteopathy and OMM. Upon applying to a residency program, students are entered into either the National Residency Matching Program (NRMP) for M.D.s or the AOA Match for D.O.s. The AOA and American Association of Colleges of Osteopathic Medicine (AACOM) are currently merging with the ACGME to create a single GME match system that will take effect on June 30, 2020, and will allow M.D. and D.O. students to apply to any residency program.[22]

Residency programs can last from three to seven years, depending on a physician's chosen specialty. Primary-care physicians have a three-year residency, while surgical specialty programs can last up to seven years.[23] During the program, students are supervised by senior residents and attending physicians. Residents are given more responsibility and autonomy throughout their residency training. Upon completion of the residency program, some sub-specialties require residents to undergo a fellowship, which is an additional year or two of research, clinical learning, and practice in that specialty.[24] After the completion of their GME, physicians can practice without the direct supervision of an attending physician and are eligible for board certification in their specialty.

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[22] Association of American Medical Colleges, "Roadmap to Residency: Understanding the Process of Getting into Residency," February 20, 2017, accessed September 16, 2019, https://store.aamc.org/downloadable/download/sample/sample_id/201/.

[23] American College of Surgeons, "How Many Years of Postgraduate Training do Surgical Residents Undergo?" accessed on October 23, 2018, https://www.facs.org/education/resources/medical-students/faq/training.

[24] American College of Surgeons, "Post-Residency Fellowships," accessed on October 24, 2018, https://www.facs.org/education/resources/medical-students/postres.

3. DoD Physician Accession Sources

This chapter provides an overview of each accession source, focusing on their structure and student characteristics. The following chapter contains the estimated costs associated with accessing physicians through each program.

A. Uniformed Services University

As previously noted, USU was established by Congress in 1972. While initially founded as a school of medicine, it now includes five different components. These include:

- **The F. Edward Hébert SOM:** The SOM graduates approximately 170 physicians (M.D.s) annually. All medical students are uniformed service members (Army, Navy, Air Force, and Public Health Service). The SOM also offers graduate education programs in biomedical sciences, public health, healthcare administration, and health professions education. Approximately 60 students graduate with PhDs or master's degrees from these programs annually. Non-M.D. students are both military and civilian.
- **The Daniel K. Inouye Graduate School of Nursing (GSN):** The GSN graduates approximately 70 nurse specialists annually. The school began in 1993, offering a family nurse practitioner program, but has since grown in size and scope. Now, the GSN offers a Doctor of Nursing Practice (DNP) in the following five tracks: nurse anesthesia, family nurse practitioner, adult gerontology clinical nurse specialist, women's health nurse practitioner, and psychiatric mental health nurse practitioner. The GSN also offers a Ph.D. in Nursing Science.[25]
- **The Postgraduate Dental College (PDC):** The PDC grants academic credit to uniformed dentists completing select graduate dental education (GDE) residency programs through the three Service postgraduate dental schools.[26] The PDC affiliation permits graduates of residency programs to receive a Master of Science in Oral Biology degree upon the completion of program and degree milestones. Currently, 20 dental residency programs across 7 Military Treatment

[25] Uniformed Services University, Graduate School of Nursing, "Graduate School of Nursing," accessed September 16, 2019, https://www.usuhs.edu/gsn.

[26] The PDC does not directly provide dental education, but rather grants credit through relationships with the existing Service postgraduate dental schools.

Facilities (MTFs) are affiliated with USU's PDC. In addition to its credit-awarding activities, the PDC provides academic support to ten Air Force, ten Navy, and seven Army General Dentistry Certificate Programs. Approximately 80 students are eligible to earn degrees and 165 are eligible to receive certificates from the PDC annually.

- **The College of Allied Health Sciences (CAHS):** In a similar vein to the PDC, the CAHS grants academic credit and degrees to enlisted uniformed service members for the education and training they undergo throughout their careers. The CAHS is closely affiliated with the Medical Education and Training Campus (METC) which provides the majority of initial enlisted medical training. The CAHS is composed of two schools. The School of Undergraduate Studies administers Associate of Science in Health Sciences and Bachelor of Sciences in Health Sciences degrees. The School of Graduate Studies plans to offer a Master of Science degree. Approximately 1,300 students are enrolled each year though the number of eligible students is rapidly increasing.
- **The Armed Forces Radiobiology Research Institute (AFRRI):** AFRRI is a tri-Service radiobiology research institute that has operated continuously since 1962. The institute oversees the DoD Medical Radiological Defense Research Program, collaborating with government agencies, academic institutions, and civilian laboratories to research the biological effects of ionizing radiation. In addition to its research mission, AFRRI administers the Medical Effects of Ionizing Radiation (MEIR) course to more than 1,300 DoD personnel annually.[27]

The focus of this study will be on the F. Edward Hébert SOM. However, the presence of the other USU components will be relevant to the cost analyses performed in following chapters. Below, we provide background on the SOM, including information on the student body and the USU curriculum.

1. SOM Student Background

Each year USU admits approximately 170 new medical students from an applicant pool of nearly 3,000. This corresponds to an admission rate of 5.3 percent. All medical students enter the university as commissioned officers on active duty in the Army, Navy, Air Force, or Public Health Service. Each student, even those with prior service, will hold the rank of O-1 throughout all four years of medical school. At graduation, all graduates

[27] Uniformed Services University, "The Armed Forces Radiobiology Research Institute," accessed September 16, 2019, https://www.usuhs.edu/afrri/.

are promoted to the rank of O-3, or recover their previous rank held prior to matriculation (if higher than O-3).

Table 1 shows summary statistics for USU matriculants compared to civilian M.D. and D.O. program matriculants. The data indicate that the average USU graduate has MCAT and GPA scores consistent with the average for civilian M.D. programs (and higher than average D.O. programs). USU's class size is larger than the average civilian M.D. medical school but smaller than the average D.O. medical school. The average USU class has slightly more female and minority students than the average D.O. school but fewer female and minority students than the average M.D. school. Most notably, USU students are much more likely to have prior military service. Appendix A of this report contains a more detailed comparison of USU to civilian allopathic medical schools. The comparison includes a detailed examination of student characteristics, faculty counts and student to faculty ratios, and financial characteristics (i.e., revenue sources and expenditures).

Table 1. Summary Data for USU and Civilian M.D. and D.O. Programs Matriculants

	USU Matriculants	M.D. Matriculants	D.O. Matriculants
Average MCAT	510	510.4	503.1
Average GPA	3.7	3.7	3.6
Admission Rate	5.3	4.1	4.0
Average Class Size	170	143	185
% out of state	90.2	38.9	N/A
% female	43.9	51.7	42.7
% minority	34.5	46.7	34.3
% prior service	28.0	1.6	1.9

Source: M.D. data from: AAMC Fact Table A-1 (2018–2019 matriculants); D.O. data from: AACOMAS Applicant Pool Profile (2017–2018 matriculants). Note: Prior service statistics do not include service academy graduates nor college ROTC participants.

2. SOM Curriculum

The medical school curriculum at USU follows the general allopathic curriculum augmented with military-focused training. The curriculum is broken into three categories: Pre-Clerkship, Clerkship, and Post-Clerkship. Like many other universities, these three periods categorize the general progression throughout medical school, which involves learning basic sciences and clinical practices, gaining initial exposure to the breadth of medical specialties, and then choosing to emphasize rotations in their desired specialty. Unlike others, USU integrates military training and military medical education throughout their curriculum. Appendix A provides a detailed description of the USU pre-clerkship, clerkship, and post-clerkship education. We also provide a detailed discussion of the military field practicums, including Operation Bushmaster, a large military field exercise that fourth-year students must pass. Below, we provide a short overview of the different ways that USU augments the general allopathic curriculum with military-specific training.

USU offers a year-round curriculum that is approximately 700 hours longer than the curricula of other US allopathic programs. The additional hours cover subjects that are germane to the careers of uniformed physicians, (e.g., emergency war surgery, field exercises and leadership, epidemiology, tropical medicine, leadership and field exercises, disaster medicine and humanitarian operations.) These military-unique courses, which range from one hour lectures to multi-week modules, expose medical students to the breadth of operational environments in which they will be asked to practice. Some courses are offered as electives or supplemental experiences, while others are part of the mandatory curriculum. Table 2 provides some examples of the unique educational experiences offered at USU.

Table 2. Military Unique Training Provided by USU

Category	Sample Courses or Experiences
Military Medical Practice and Leadership	• Summer Service Operational Experience • Bench, Bedside, and Beyond • Military Medical History • Capstone Project
Operational Medicine	• Military Contingency Medicine • Mountain Medicine • Dive Medicine
Operational Field Exercises	• Military Field Practicum 101 • Gunpowder Field Exercise • Operation Bushmaster

B. Armed Forces Health Professions Scholarship Program

The Armed Forces' HPSP is the primary source of DoD physician accessions, accounting for approximately 80 percent of total annual accessions. Each year, 800 to 850 new physicians enter one of the three HPSP programs administered by the Army, Navy, and Air Force.[28] HPSP offers civilian medical students a signing bonus, a full tuition scholarship, payment of fees, and a monthly stipend to attend civilian medical schools. In

[28] GAO, "MILITARY PERSONNEL, Additional Actions Needed to Address Gaps in Military Physician Specialties" reported that the Services recruited 800 to 850 medical students per year through HPSP between FY 2011 and FY 2016. This is consistent with data provided by the Services to IDA, which showed approximately 820 accessions in FY 2017.

exchange, the student incurs a service obligation to practice military medicine upon the completion of their residency training. The length of the service obligation depends on the years of assistance a student receives. The majority of students receive a four-year scholarship (incurring a four-year service obligation) but some receive two- or three-year scholarships (incurring the minimum three-year service obligation). Service obligations can also be affected by specialty choice (due to length of GME training programs).[29]

Unlike USU students, HPSP students are not on active duty while they attend medical school. They are instead commissioned as officers of the Individual Ready Reserve (IRR). However, HPSP students will participate in active duty for training (ADT) while in medical school. These are approximately one-month tours that include officer training, summer medicine training programs, and fourth-year away rotations at military treatment facilities. Students will complete one ADT each fiscal year, unless they request and receive an ADT deferment. HPSP students receive active-duty pay and benefits while on ADT.

Because each Service administers its own HPSP program, applicant requirements can vary but they are generally quite similar.[30] The main requirement is acceptance into an accredited medical school. HPSP participants are allowed to attend any accredited M.D. or D.O. program.

The distribution of schools attended by HPSP students will vary from year to year and across Services. Table 3 lists the top ten medical schools attended by HPSP students for each Service. The Army and Air Force data is based on all enrolled students in FY 2016. The Navy data is only for students in the 2018 graduating cohort.

Only one school, Midwestern University Arizona College of Osteopathic Medicine-Glendale, appears in all three Services' top ten list. Another four schools appear in two of the three Service top ten lists (Rocky Vista College of Osteopathic Medicine, Lake Erie College of Osteopathic Medicine - Erie Campus, Philadelphia College of Osteopathic Medicine, and Des Moines University College of Osteopathic Medicine). The mix of M.D./D.O. students also varies by Service. For 2016 enrollment, the percent of D.O. students was 32 percent (Army), 42 percent (Air Force) and 28 percent (Navy). The current percentage of total US medical students enrolled in D.O. programs is 26 percent.[31]

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[29] If you select a DoD GME program that is five, six, or seven years long, your total service obligation will increase to five, six, or seven years, respectively. Uniformed Services University, "What You Need to Know," April 2018, https://www.usuhs.edu/sites/default/files/media/medschool/pdf/whatyouneedtoknow.pdf.

[30] A GAO report showed that GPA requirements ranged from 3.0 (Navy and USU) to 3.2 (Army and Air Force). For MCAT scores, the Navy did not set a minimum requirement, while the Army and Air Force set a requirement of 500. GAO, "Additional Actions Needed to Address Gaps…"

[31] The percentage of D.O. medical students was calculated using data on the 2017/2018 cohorts obtained from the AACOMAS (for D.O. students) and the AAMC (M.D. students).

Table 3. Top Ten HPSP Medical Schools by Service, 2016 Enrollment

Medical School	M.D./D.O.	Students
Army HPSP Enrollment (2016)	68%/32%	885
Rocky Vista University College of Osteopathic Medicine	D.O.	29
Midwestern University Chicago College of Osteopathic Medicine	D.O.	26
Philadelphia College of Osteopathic Medicine	D.O.	25
Kansas City University of Osteopathic Medicine	D.O.	23
Northeast Ohio Medical University College of Medicine	M.D.	22
Midwestern University Arizona College of Osteopathic Medicine-Glendale	D.O.	21
George Washington University School of Medicine and Health Sciences	M.D.	19
University of New England College of Osteopathic Medicine	D.O.	19
Campbell University Jerry M. Wallace School of Osteopathic Medicine	D.O.	17
University of Louisville School of Medicine	M.D.	16
Other Medical Schools	542/126	668
Air Force HPSP Enrollment (2016)	58%/42%	1,059
Rocky Vista University College Of Osteopathic Medicine	D.O.	54
Midwestern University Arizona College of Osteopathic Medicine-Glendale	D.O.	44
Lake Erie College Of Osteopathic Medicine - Erie Campus	D.O.	38
A.T. Still University Kirksville College of Osteopathic Medicine	D.O.	33
Philadelphia College of Osteopathic Medicine	D.O.	28
Kansas City University College of Osteopathic Medicine	D.O.	27
Des Moines University College of Osteopathic Medicine	D.O.	25
The College of Osteopathic Medicine of the Pacific - Pomona Campus	D.O.	24
Michigan State University College of Human Medicine	M.D.	22
Ohio University Heritage College of Osteopathic Medicine	D.O.	22
Other Medical Schools	594/148	742
Navy HPSP Enrollment (2016) for 2018 Graduating Cohort Only	72%/28%	246
Des Moines University College of Osteopathic Medicine	D.O.	7
Lake Erie College Of Osteopathic Medicine – Erie Campus	D.O.	7
Medical University of South Carolina College of Medicine	M.D.	6
Eastern Virginia Medical School – Hampton Roads	M.D.	6
Georgetown University School of Medicine	M.D.	6
Midwestern University Arizona College of Osteopathic Medicine-Glendale	D.O.	5
Creighton University School of Medicine	M.D.	5
Drexel University College of Medicine	M.D.	5
Florida State University College Of Medicine	M.D.	5
New York Medical College School of Medicine	M.D.	5
Other Medical Schools	143/44	187

Table 4 lists the top 25 medical schools attended by all current active-duty physicians (including those who went to USU and those accessed through FAP). USU graduates account for approximately 24 percent of physicians and 32 percent of M.D.s.

Table 4. Active Duty Physicians by Medical School, FY 2018

Medical School	M.D./D.O.	Graduates
Uniformed Services University of the Health Sciences F. Edward Hébert School of Medicine	M.D.	3157
Philadelphia College of Osteopathic Medicine	D.O.	289
Lake Erie College of Osteopathic Medicine	D.O.	248
Georgetown University School of Medicine	M.D.	204
Kansas City University of Medicine and Biosciences College of Osteopathic Medicine	D.O.	185
Tulane University School of Medicine	M.D.	179
A.T. Still University School of Osteopathic Medicine - Kirksville	D.O.	173
Touro University College of Osteopathic Medicine	D.O.	171
Nova Southeastern University Dr. Kiran C. Patel College of Osteopathic Medicine	D.O.	152
College of Osteopathic Medicine - Des Moines University	D.O.	147
College of Osteopathic Medicine of the Pacific	D.O.	143
Lewis Katz School of Medicine at Temple University	M.D.	136
West Virginia School of Osteopathic Medicine	D.O.	128
Edward Via College of Osteopathic Medicine	D.O.	127
Virginia Commonwealth University School of Medicine	M.D.	127
Eastern Virginia Medical School	M.D.	124
Midwestern University	M.D.	116
Sidney Kimmel Medical College at Thomas Jefferson University	M.D.	116
Rocky Vista University College of Osteopathic Medicine	D.O.	114
University of New England College of Osteopathic Medicine	D.O.	113
The University of Texas Health Science Center at San Antonio Joe R. and Teresa Lozano Long School of Medicine	M.D.	112
University of Virginia School of Medicine	M.D.	107
Medical University of South Carolina College of Medicine	M.D.	101
Saint Louis University School of Medicine	M.D.	100
Indiana University School of Medicine	M.D.	98
Other Medical Schools	**5280/853**	**6133**
Grand Total	**9957/2843**	**12800**

Source: Joint Centralized Credentials Quality Assurance System.

C. Financial Assistance Program

The FAP is the smallest of the three physician accession sources (providing approximately 20 to 30 physicians per year). It targets physicians (and dentists) enrolled in accredited civilian residency or fellowship programs. Like HPSP, each Service administers its own FAP program, though payment rules are the same. FAP provides residents with an annual grant of $45,000 and a monthly stipend. In exchange for the financial assistance, the resident will incur an active-duty service obligation. The obligation for FAP is two years for the first year of assistance and then a year's commitment for each additional year of financial support (e.g., one year of assistance requires two years of service, two years requires three years of service, etc.). Like HPSP students, FAP participants become members of the IRR while they complete their education. They also participate in one 14-day ADT per year.[32] While on active duty, they receive full pay and allowances.

Table 5 shows that the number of annual FAP accessions and participants varies year to year and across Services. The residency specialties and years of scholarship assistance also vary. The FAP data IDA received directly from the Services varied in structure and time period covered. The table below lists FY 2017 accession counts, along with total participants.

Table 5. Annual FAP Accessions and Total Participants, FY 2017

	Army*	Navy	Air Force	Total
Accessions	-	5	15	20
Participants	4	29	34	67

* IDA only received total FAP participant counts form Army.

The Navy FAP accession data provided the greatest detail. Specifically, the data provided observations on all FAP participants between FY 2014 and FY 2018. There were 39 unique individuals in the program during this period. From this sample, we observed that the majority of individuals had three- or four-year scholarships (40 and 30 percent, respectively). Two individuals had more than four years of FAP assistances and ten had fewer than three years (though some of these individuals were still in the program as of FY 2018 and could continue to receive assistance). We expect that the majority of Air Force and Army participants would also take three- and four-year scholarships, but we were unable to verify this without more detailed data.

One advantage of FAP accessions is that the Service will know a resident's chosen specialty. This is not necessarily the case with USU and HPSP accessions, as medical students are not expected to select their specialties until their fourth year when they match

[32] GAO, "Additional Actions Needed to Address Gaps…"

into a residency program. The Services indirectly influence student specialty choice by controlling the mix of specialties and the number of available residency slots. Unfortunately, IDA was unable to directly identify FAP accessions and distinguish them from HPSP accessions in the personnel records used for the analysis in Chapter 5.

4. DoD Physician Accession Costs

The objective of this study is to compare the value the USU SOM provides to the DoD relative to other physician accession sources (i.e., HPSP and FAP). While average program costs are not fully reflective of value, they are an essential building block in the value equation. Therefore, the purpose of this chapter is to construct the necessary annual average per-student program costs required for the value analysis.

We chose to focus on annual (rather than total) average per-student program costs because HPSP and FAP provide financial support for varying lengths of time (adjusting the active duty obligation (ADO) accordingly). Because the three accession sources differ significantly in their program and cost structures, we require different methodologies and cost elements for each estimate. To ensure a fair comparison of accession costs, we attempt to construct fully burdened cost estimates for each program. This means we seek to include all program cost elements, including: (1) direct educational expenses, (2) student compensation, and (3) program overhead and recruiting costs. The treatment of GME costs is an important factor to consider when constructing fully burdened cost estimates. Both USU and HPSP graduates will have to complete GME training before they can practice medicine as board-certified physicians. We can therefore think of GME as an additional accession cost for USU and HPSP participants. Table 6 lists all the major cost components we attempt to capture in each program's average annual per-student costs.

Table 6. Cost Components for Different Physician Accession Programs

Cost Component	USU	HPSP	FAP
Accession Costs			
Medical School			
• Program Recruiting and Administrative Costs	✓	✓	
• Active Duty Pay and Benefits (O-1)	✓	✓*	
• Direct Educational Costs (e.g., faculty, staff, facilities, etc.)	✓		
• Tuition/Fees for civilian medical school		✓	
• Monthly Stipend		✓	
• Accession Bonus		✓	
GME (Internship, Residency, Fellowship)			
• Active Duty Pay and Benefits (O-3)	✓	✓	✓*
• Direct Education Costs (e.g., faculty, administrators, etc.)	✓	✓	
• Annual grant			✓
• Monthly Stipend			✓

* For ADT training only (up to 45 days annually for HPSP and 14 days for FAP).

The following sections develop average annual cost estimates for each accession channel (USU, HPSP, and FAP) and GME. Following the presentation of each program's annual cost estimates, we use the estimates to perform simple cost comparisons that explore differences in average annual costs, total accession costs, and average costs per year of obligated service. These comparisons are simplistic and focus on cost as opposed to value. We also compare our estimates to estimates from the past work.

The following chapter will use the average annual cost elements developed in this chapter in a value analysis that factors in retention and other force structure and readiness benefits.

A. Annual USU Cost Estimate

The first major research objective of this study was to generate an estimate of the average cost of producing an M.D. at USU. The average cost of training a medical student is challenging to identify, given that universities and medical schools may not separately track the costs associated with education, research, and service activities.[33] For example, a faculty member in the USU medical school might spend a portion of their time teaching M.D. students, a portion of their time conducting research and teaching Ph.D. students, and a portion of their time providing clinical care. Similarly, the university president and other administrators spend only a portion of their time conducting activities related to the SOM (they also administer the GSN, the PDC, the CAHS, and other programs). For these reasons, USU was unable in the past to provide GAO with an average cost of a USU M.D.[34] Here, we develop a methodology capable of addressing these issues and identify costs specifically attributed to the SOM and M.D. education.

The costs associated with producing a medical student are spread out across the university's budget. The USU budget is comprised of funds appropriated to the university by Congress and by research grants and other external funding sources. The appropriated funds fall into several categories, which include Operations and Maintenance (O&M); Procurement (PROC); Research, Development, Test and Evaluation (RDT&E); military personnel (MILPERS); and military construction (MILCON). For the purpose of this analysis, we split these costs into the three main categories summarized below.

- **O&M, PROC, and RDT&E Costs:** These costs were all captured in the university's "Universe of Financial Transactions" data.[35] USU provided the IDA

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33 R. F. Jones and D. Korn, "On the Cost of Educating a Medical Student," *Academic Medicine* 72, no. 3 (March 1997): 200–10.

34 Noted in GAO, "Additional Actions Needed to Address Gaps…"

35 Uniformed Services University, "USU Financial Transaction Data," 2018. FOUO.

team with this data for FY 2017. O&M includes the operation and maintenance costs incurred by the university (e.g., civilian salaries, travel, training and education, minor construction, facility operations etc.). Funding for the university's capital equipment and research falls into the PROC and RDT&E categories, respectively.

- **MILPERS Cost:** Data on the cost of the university's military personnel and student salaries were not included in the Universe of Financial Transactions data. To capture these costs, IDA was provided with a detailed record of all military personnel (faculty, staff, and students) attached to the university in FY 2017.[36]
- **Facilities Costs:** Operating costs, like maintenance and utilities, are included in O&M. Construction costs (e.g., a new building or a renovation) occur intermittently as MILCON. These "lumpy" capital costs must be converted to a "flow cost" of capital to derive an appropriate annual value to include in our cost estimate.[37] One way to determine the flow cost of capital for USU facilities would be to estimate their opportunity cost (the value of the facility in its next-best alternative use). However, the economic opportunity cost can be challenging to derive for facilities like these. The accounting solution is to compute the annual depreciation of the estimated replacement value of the facilities. While imperfect, this can be used as a proxy for the opportunity cost. USU provided IDA with the annual depreciated data needed to estimate the flow cost of capital.

For FY 2017, USU received more than $521 million in funding belonging to these three categories. Figure 1 illustrates the relative magnitude of each.

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[36] The data included each individual's name, type (faculty/student/staff), rank, service branch, and AOC (e.g., their job type/specialty), as well as the USU school and department in which they work.

[37] It would be inappropriate to count MILCON costs as an annual cost of M.D. education only in the years when they appear in the budget. For example, in years when a facility is built, the annual cost of M.D. education would be dramatically inflated. In years when no facility is built (most years), the cost of facilities would not be reflected at all, which would artificially lower the annual cost of M.D. education.

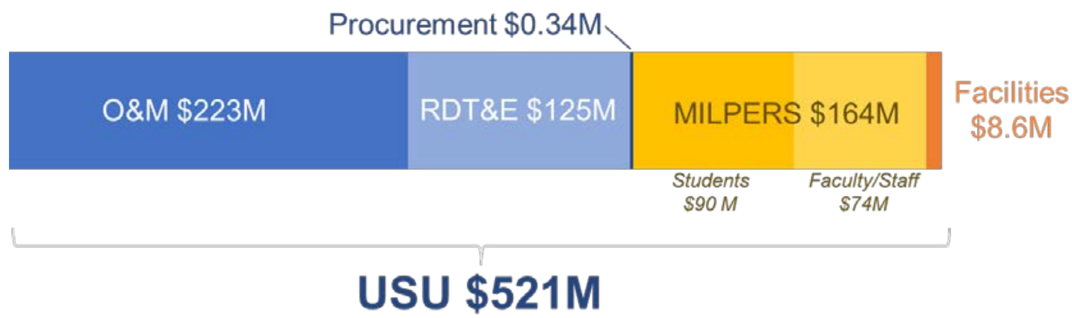

Figure 1. Total USU Funding by Categories, FY 2017

In most cases, the financial data provided was for the entire university (not only the SOM). This meant that costs had to be allocated across each of the USU components. In addition, costs allocated to the SOM had to be split into costs associated with producing M.D. students versus costs associated with other SOM activities (research and other degree programs). Figure 2 shows the final allocation of USU funding to the SOM and M.D. education, along with the final average per-student cost of $253,000.

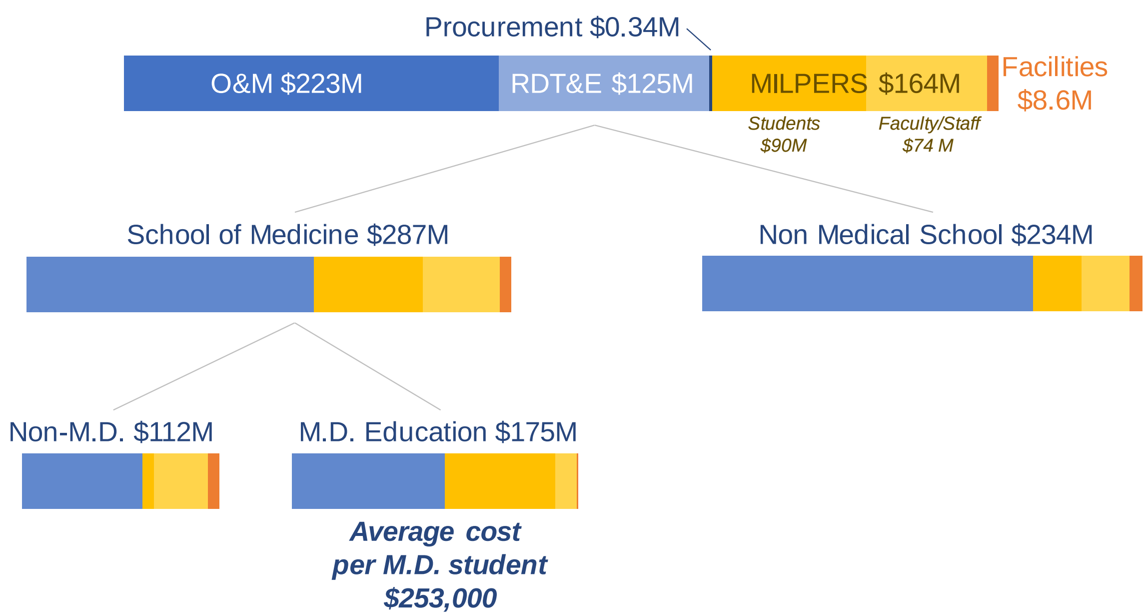

Figure 2. Final Allocation of USU Funding to the SOM and M.D. Education, FY 2017

In the following sections, we discuss the methodology used to perform these allocations. While physician costs are the focus of this report, the method developed for estimating the average cost of producing a physician can easily be extended to estimate the average cost of producing other student types (e.g., nurse specialists). Appendix B provides cost estimates for other USU degree programs in the SOM, GSN, PDC, and CAHS.

1. O&M, PROC, and RDT&E

USU provided the IDA team with their Universe of Financial Transaction data for FY 2017. The data showed transactions totaling just less than $350 million across O&M, PROC, and RDT&E. The IDA team had to apportion these costs to each USU component and ultimately determine the share of these funds that went specifically toward M.D. training and education. The analysis was performed in two primary steps.

The first step of the analysis was to allocate funding to each of the five USU components (e.g., the SOM, CAHS, PDC, GSN, and AFRRI) and four overhead elements, defined as follows:

- **Headquarters (HQ):** Headquarters included offices and activities associated with the university's administration (e.g., the board of regents, the office of the president, vice president, general counsel, external affairs, etc.).
- **Support Services (SS):** Support services included offices and activities providing services to the university and its students, faculty, and staff (e.g., the office of the chief information officer (CIO), the office of the vice president for finance and administration, the help desk, the student health clinic, etc.).
- **Centers (CTR):** Centers include the many research centers and activities run by the university (e.g., the Murtha Cancer Center, the Center for Global Health Engagement, National Center for Disaster Medicine and Public Health, etc.). Appendix A provides an overview of USU's 14 main research centers.
- **Extramural Funding (EXM):** Extramural funding flows into the university from a variety of sources to support research programs and educational activities (e.g., Service Academy Longitudinal MTBI Outcomes Study, Combat and Training Queryable Blast Exposure Repository, etc.).

Figure 3 shows how the $350 million was allocated across USU components and overhead categories. Approximately 40 percent of the O&M, RDT&E, and PROC dollars were allocated directly to one of the five USU components (shown in blue). The remainder of the funding was allocated to the four headquarter elements. It was determined that funding allocated to the other USU components (the GSN, PDC, CAHS, and AFRRI) or to Centers and Extramurals did not directly support the SOM or M.D. education pipeline. However, funding allocated to the HQ and SS headquarter elements does support the SOM and M.D. education, and thus required further allocation.

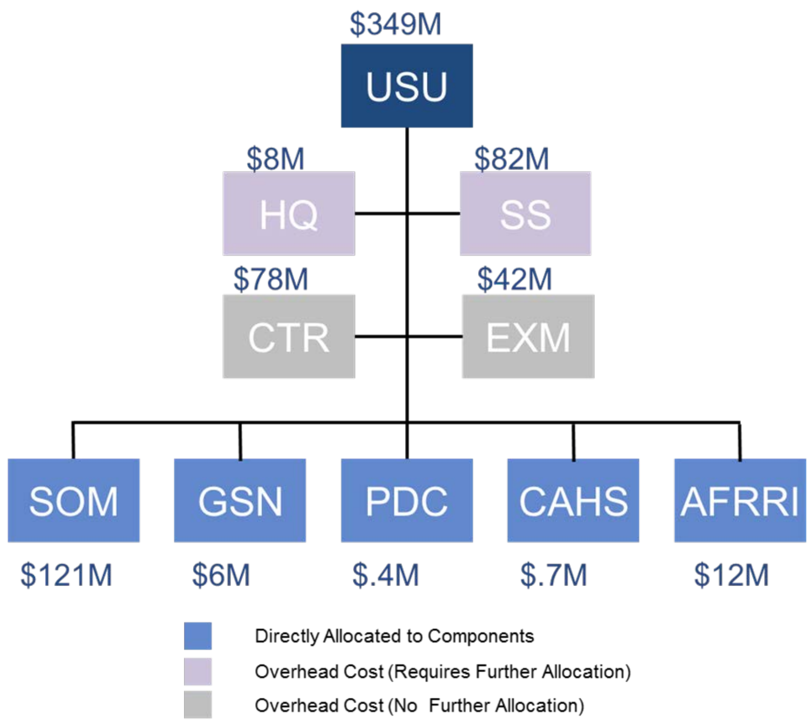

Figure 3. Allocation of O&M, PROC, and RDT&E Funding, FY 2017

The second step of the analysis was to allocate shared overhead costs (shown in purple). To perform the cost allocation, we first classified each overhead cost element into three categories:

- **School of Medicine Cost (M):** Non-shared (unique) cost of the SOM
- **Shared Cost (S):** Shared costs support the SOM and other USU components (e.g., IT support, financial services, the office of the president. etc.)
- **Not a SOM cost (NM):** Non-shared (unique) cost to other USU component

The IDA team worked with subject matter experts (SMEs) from USU to determine which costs fell into each of the three categories outlined above (M, S, and NM). Costs identified as shared had to be allocated among the SOM and the other components. Total SOM costs were then allocated to M.D. education versus other activities (e.g., PhD/MA education, research, and service). Seven allocation rules were used to perform these allocations based on the nature of the shared activity. These rules were based on: share of students, share of faculty, share of students and faculty, share of civilian employees, share of total personnel, share of square footage, and share of total dollars. Table 7 reports the total dollar volume allocated by each rule for shared services and headquarters, respectively. The majority of costs were allocated based on total personnel (faculty, staff, and students). Appendix B of this report contains greater detail on specific budget items and the selected allocation rule. The appendix also explores the robustness of the cost estimate when using only one allocation rule.

Table 7. Shared Service and HQ Costs Allocated by Allocation Rule

Cost Allocation Rule	Amount Allocated	Percent
Share of Students	$5,266,869	6%
Share of Faculty	$6,539,804	7%
Share of Students and Faculty	$3,328,738	4%
Share of Civilian Employees	$2,578,999	3%
Share of Military Personnel	$184,100	<1%
Share of Total Personnel	$39,409,479	44%
Square Footage	$31,164,355	35%
Total Dollars	$589,664	1%
Total	**$89,062,008**	

Figure 4 shows the final allocation of USU's O&M, RDT&E, and PROC dollars between the SOM and all other non-school of medicine activities. Dollars allocated to the SOM are further divided between the M.D. education pipeline and other non-M.D. activities (e.g., other degree programs and research). The allocation shows that the SOM receives approximately half of USU O&M, RDT&E, and PROC dollars. Of this funding, approximately 60 percent goes to the M.D. pipeline. This corresponds to an average O&M, RDT&E, and PROC cost per M.D. student of $141,000 per year.

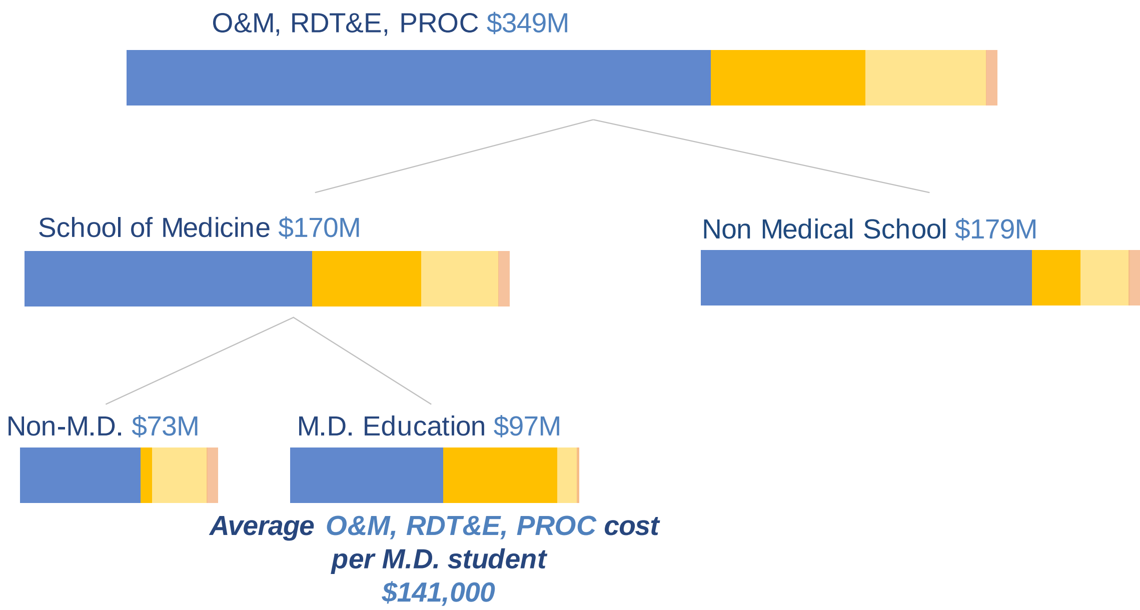

Figure 4. Allocation of O&M, RDT&E, and PROC Funding to the SOM and M.D. Education

a. MILPERS

MILPERS appropriations are used to fund the costs of salaries and compensation for active military personnel. These appropriations contain the funds used for basic pay, subsistence and housing allowances, various types of special and incentive pay, bonuses, and the government's share of contributions to Social Security and Medicare. Data on the cost of the university's uniformed personnel were not included in the Universe of Financial Transactions data. To capture these costs, IDA was provided with a detailed roster of all military personnel (faculty, staff, and students) attached to the university during FY 2017. IDA then used relevant information from this roster to estimate the pay and benefits of the university's uniformed personnel. As education and training costs are of particular interest, the method for costing students differs from that of faculty and staff.

b. Students

In the base case analysis, student personnel costs were assigned based upon the observed rank and Service of the individual from the roster of the university's uniformed personnel. These data were then matched to Service-specific Composite Rates to estimate salary and benefits. Composite Rates are issued annually by the Office of the Under Secretary of Defense (Comptroller) and average the entire annual military personnel budget account across all military personnel by grade. Composite rates capture basic pay, housing and subsistence allowances, retirement pay accrual, health benefits, transportation subsidies, and Medicare/Social Security contributions. They are often used for determining the military personnel appropriations costs for budget studies, but do not reflect the fully burdened cost to the Department. An advantage of using composite rates is that they are readily available and well-documented values. A disadvantage is that they include average special pays, senior personnel within grade, and other factors that may not be relevant to medical students (i.e., transportation subsidies).

Table 8 shows the O-1 composite rates and simple calculation for M.D. student MILPERS costs.[38] Note that the Public Health Service does not publish composite rates, but does offer a compensation calculator instead.

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[38] MILPERS for non-M.D. students are calculated using the same method. Other degree programs have greater variation in their rank distribution. They were costed at the composite rate consistent with their rank.

Table 8. M.D. Student Composite Rates and MILPERS Totals

Service	Composite Rate	Number of Students	MILPERS Total
Army	$87,241	260	$22,682,660
Navy	$96,454	205	$19,773,070
Air Force	$91,138	214	$19,503,532
Public Health Service	$70,830	10	$708,295
Total			**$62,667,562**

Sources: USPHS Pay Calculator https://www.usphs.gov/calculator/
OUSD(C) Green Book FY17
https://comptroller.defense.gov/Portals/45/Documents/defbudget/fy2017/FY17_Green_Book.pdf

MILPERS for non-M.D. students are calculated using the same methodology. Because other degree programs have greater variation in their rank distribution, a large number of composite rates were used. Table 9 reports the total student MILPERS by component.

Table 9. Uniformed Student MILPERS Totals

USU Component	MILPERS Costs
SOM	$66,873,647
GSN	$22,710,567
PDC	$451,672
Total	**$90,035,886**

Note: The SOM total includes non-M.D. students and is therefore higher than the total reported in Table 6.

A sensitivity analysis in Appendix B explores alternative approaches to costing students. Specifically, we perform two bottom-up cost estimates (one that accounts for prior service and one that does not). Results are similar for each method. We use the composite rate as our base case, as it is the simplest to replicate.

c. Faculty and Staff

Most faculty and staff at USUHS are senior officers or enlisted who possess professional or advanced degrees in the health sciences. As such, the use of composite rates alone would significantly understate personnel costs, particularly for clinical specialists who receive a large portion of their compensation through special pay. To obtain more accurate personnel cost estimates, IDA used the methodology outlined in DoD Instruction

(DoDI) 7041.01 for capturing the full cost of military manpower.[39] This method better captures the full cost of uniformed faculty and staff to the DoD.

Replicating and updating previous IDA work analyzing the military medical workforce, we begin with an individual's FY 2017 composite rate according to their rank and Service. The Office of the Under Secretary of Defense (Comptroller) averages the entire MILPERS budget across all military personnel by grade to calculate composite rates used for budget studies. Composite rates, however, should not be considered the fully burdened cost of military personnel. To better capture the burdened cost, we separate personnel into two groups: clinical or non-clinical and enlisted. For non-clinical and enlisted personnel, the composite rate was used without further adjustment. However, due to sizeable differences in compensation between medical specialties, we achieve better estimates of personnel costs by incorporating special pay according to the recorded medical specialty of clinical faculty and staff. Using data provided by USUHS, we match faculty and staff Area of Concentration (AOC) codes to actual medical incentive and special pays provided by the three Services. For both groups of personnel, we use the Full Cost of Manpower Tool (FCoM) to estimate additional loading factors necessary for a fully burdened cost. FCoM provides average loading factors for benefits provided to military personnel, including training, recruitment, and education assistance costs; and child development and family support services costs.[40] Retiree health benefit costs are derived from the DoD actuary and inflated to FY 2017 dollars using the Total DoD Excluding Medical Deflator. Additional health and social benefit program costs come from the 2006 Medical Readiness Review (MRR) and are deflated to FY 2017 dollars using the Total DoD Excluding Medical Deflator. To calculate the fully burdened cost, we add the composite rate, special pay adjustments, and loading factors.

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39 See Department of Defense, "Estimating and Comparing the Full Costs of Civilian and Active Duty Military Manpower and Contract Support," DoD Instruction 7041.04, July 3, 2013, for greater detail on manpower costing.

40 Office of the Secretary of Defense, Cost Assessment Program Evaluation, "Full Cost of Manpower Tool," 2018, https://cade.osd.mil/tools/other-cost-tools.

Table 10 shows the total cost of USU uniformed faculty and staff by component and HQ elements.

Table 10. Uniformed Faculty and Staff MILPERS Totals

USU Component	MILPERS Costs
SOM	$46,175,195
GSN	$7,616,039
AFFRI	$6,919,527
PDC	$386,214
CTR	$810,132
HQ	$12,379,428
Total	**$74,286,535**

Figure 5 shows how total student and faculty MILPERS costs are allocated to the SOM and M.D. education. The allocation was performed using data on the USU Faculty Time Use Survey.[41]

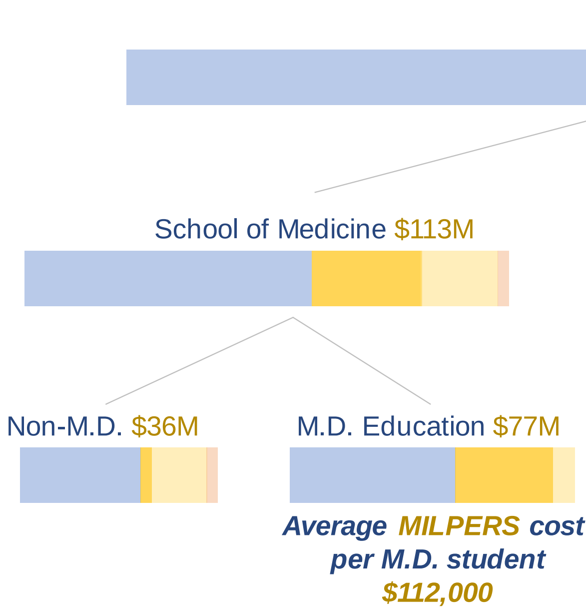

Figure 5. Allocation of MILPERS Dollars, FY 2017

[41] Uniformed Services University, "USU Faculty Time Use Survey," 2018. FOUO.

d. Facilities

As previously discussed, operating costs like maintenance and utilities are included in O&M. However, construction costs (e.g., a new building or a renovation) occur intermittently as MILCON. These "lumpy" capital costs must be converted to a "flow cost" of capital to derive an appropriate annual value to include in our cost estimate.[42] Rather than attempting to estimate the annual opportunity cost (or rent that could be charged for the facilities) we use an accounting solution, which makes use of data on annual depreciation of the estimated replacement value of the facilities.

USU provided IDA with the annual depreciation data needed to estimate the flow cost of capital as previously described. Total costs were just less than $9 million annually. The total facility costs were then allocated to M.D. education in two steps using the USU 2018 Facility Space Survey.[43] The space survey is quite detailed and provides data on the square footage for each building at the room level (e.g., office, classroom, conference room, etc.). Each room is identified as belonging to a school/center and department. Department chairs indicate what percentage of time each space is used for the following activities: clinical instruction, Henry Jackson Foundation (HJF) administration, HJF research, classroom instruction, USU administration, and USU research. The survey was used to determine the total square footage used by the SOM and the total square footage used for M.D. education. Using the square footage data, we assigned the SOM a facilities cost of $4.2 million annually and M.D. education a facilities cost of $500,000. Figure 6 shows the allocation of facility costs to the SOM and M.D. education. Appendix B contains greater detail on these calculations.

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[42] It would be inappropriate to count MILCON costs as an annual cost of M.D. education only in the years when they appear in the budget. For example, in years when a facility is built, the annual cost of M.D. education would be dramatically inflated. In years when no facility is built (most years), the cost of facilities would not be reflected at all, which would artificially lower the annual cost of M.D. education.

[43] Uniformed Services University, "USU Space Survey," 2018. FOUO.

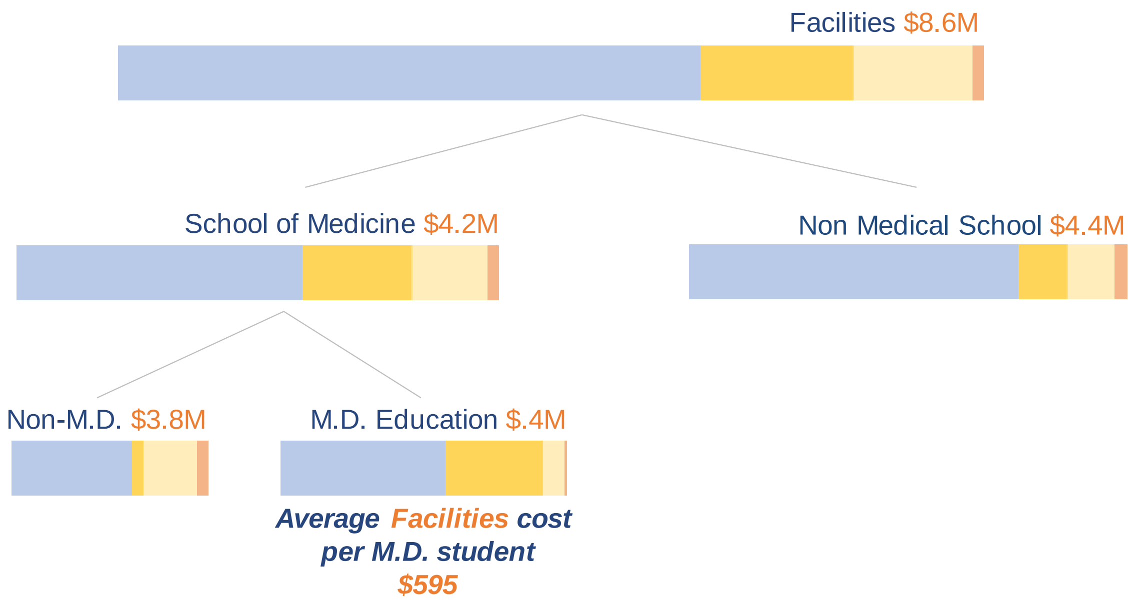

Figure 6. Allocation of Facilities Dollars, FY 2017

B. Annual HPSP Cost Estimate

The cost structure of the HPSP program is different from the cost structure of the USU SOM. Developing an average annual HPSP cost estimate therefore requires a different approach. Because each Service administers a separate HPSP program, Service-specific costs must be estimated. For ease of presentation, we also develop an overall average annual HPSP cost (constructed as a weighted average of the Service-specific estimates).

To develop a cost estimate for Service HPSP programs, we must consider all of the cost elements that should be included. IDA identified three general sets of program costs and requested data from the Services on each:

- **Direct Educational Expenses:** HPSP covers tuition and other direct education expenses (books, equipment, and other fees). These costs vary by medical school, so the average cost will vary across Services and time based on enrollment patterns. These costs will be paid from Service O&M accounts.
- **Payments to Students:** HPSP provides students with a monthly stipend, active duty pay and benefits during ADTs, and often a one-time accession bonus of $20,000.[44] These costs will be paid from Service MILPERS accounts.

[44] All four-year scholarship students will receive the $20,000 bonus. Students on three-year scholarship must increase their service commitment (from three years to four years) to receive the $20,000 bonus.

- **Admin and Recruiting (Other Expenses):** There are several other program costs associated with running the HPSP programs. These include the costs associated with recruiting students and program administration (personnel, travel, IT support, etc.). These costs will also be paid from Service O&M accounts.

Each Service provided IDA with data on the three cost elements discussed above. The data from each Service on the first two elements was assessed to be high quality (though there was some variation in reporting structure and years covered). The data on admin and recruiting costs appeared incomplete for the Army and Air Force. To address this challenge, we estimated these costs for all Services based on the data provided by the Navy. The Navy data produced an annual estimate of approximately $6,000 per student year. We also explored using values from previous studies on HPSP costs. We find that our Navy estimate is lower than the $13,600 per student year cost we obtained by inflating past accession and overhead costs reported in a previous study by CNA.[45] We use our estimate based on Navy data, as it is more recent, but we note that it may understate admin and recruiting expenses.

Table 11 shows the average annual per-student cost for each Service's HPSP program. The estimates are constructed as weighted averages from multiple years of data over FY 2014–2018 for the Army and Navy.[46] Appendix B provides more detail on the data provided by each Service and the method used to impute overhead costs.

Not all three-year students accept the bonus, so the average annual bonus cost is slightly less than $20,000 per student (or $5,000 per student year).

45 Shayne Brannman et al., "Life-Cycle Costs of Selected Uniformed Health Professions." This study reported total cost per recruit and annual overhead costs by service. Inflating their values to 2017 dollars yields a per-recruit cost of approximately $49,000 (or $12,300) per year. Inflating overhead costs yields an annual per student cost of $1,300 per year. Appendix E contains these calculations.

46 The Air Force and Army provided data on the entire HPSP population for several fiscal years (Air Force data covered FY 2007 to FY 2016; Army data covered FY 2013 to FY 2017). The Navy provided data on the FY 2018 graduating cohort (data covered FY 2014 to FY 2018).

Table 11. Average Annual HPSP Cost, FY 2017 Dollars

Cost Element	Army	Navy	Air Force	Weighted Average
Tuition, Books, Equip, Uniform	$51,460	$52,292	$55,462	$53,218
Stipend	$23,579	$23,186	$28,529	$25,323
ADT	$11,567	$10,290	$10,000	$10,591
Accession Bonus	$5,267	$6,758	$5,000	$5,617
Admin and Recruiting*	$6,000	$6,000	$6,000	$6,000
Total	$97,872	$98,526	$104,991	$100,749

* Admin and recruiting expenses are based on Navy data. They include personnel and non-personnel costs (travel, advertising, recruiting events, contract costs, etc.) Costs are prorated to reflect physician accessions using factors provided by the Navy.

C. Annual FAP Cost Estimate

The USU SOM and HPSP program both provide students with the education required to become physicians (i.e., medical school). FAP, on the other hand, targets individuals who have already completed medical school. The costs associated with this program are more straightforward. The program provides an annual grant of $45,000 to program participants (for each year they spend in the program), a monthly stipend of approximately $2,300 (same as the HPSP stipend), and active duty pay during their annual ADT. The Army and Air Force both reported the same ADT average for HPSP and FAP. We expect that these averages likely overstate the FAP ADT, as FAP ADT training is only 14 days versus up to 45 days in HPSP.[47] The Navy data also included small expenditures for books, equipment, and uniforms (about $4,800 a year, or $250 per participant year).

A challenge in calculating FAP costs arose due to the fact that most participants experience partial years in the program where their grants and stipends are prorated. The Navy provided individual-level data on FAP participants, which allowed us to observe the differences in payments over an individual's time in the program. The Army and Air Force, on the other hand, reported only annual stipend and grant amounts. Given our ability to observe actual ADT costs and prorated stipend/grant amounts, we believe the Navy FAP estimate is the most reliable average annual FAP program estimate shown in Table 12.

[47] Given that there are only a handful of FAP participants each year, we expect the averages to be far more representative of the HPSP program. The Navy provided actual FAP ADT costs, which were in fact much lower than the ADT averages reported by the Army and Air Force.

Table 12. Average Annual FAP Costs

Cost Element	Army	Navy	Air Force	Weighted
Annual Grant	$46,132	$43,672	$45,000	$44,493
Stipend	$25,827	$22,987	$28,056	$25,729
ADT	$11,711	$3,668	$10,298	$7,513
Books, Fees, Uniforms		$248		$248**
Admin and Recruiting*	$6,000	$6,000	$6,000	$6,000
Total	**$89,670**	**$76,575**	**$89,354**	**$83,982**

* Admin and recruiting expenses are based on Navy data. They include personnel and non-personnel costs (travel, advertising, recruiting events, contract costs, etc.). Costs are prorated to reflect physician accessions using factors provided by the Navy.

** We use the Navy value for books, fees, and uniforms for all Services.

D. Annual GME Cost Estimates

Medical students accessed through USU and HPSP will be required to complete specialty training (or GME) following their graduation from medical school. These programs typically last three to seven years and can be quite costly to provide. Because GME costs contribute to the total cost of accessing a fully trained and credentialed physician, we construct estimates of average annual GME costs.

An individual's actual GME costs will depend on many factors, including their selected specialty and whether they complete a military "in-service" or a civilian "out-service" program. Today, the majority of DoD physicians complete their GME training in military-run residency programs referred to as Full Time In-Service (FTIS). These programs are housed in the DoD's network of military treatment facilities. Residents are on active-duty status and receive full active-duty pay and benefits. Time spent in a Military Health System (MHS) residency program does not count toward service obligations but it does count toward time in rank (for pay raises and retirement benefits). Students incur an ADO year for year during FTIS programs. However, the GME ADO may be serviced concurrently with the HPSP or USU ADO.

While MHS residencies are the more common route for GME training, a growing number of HPSP accessions are now attending civilian, or "out-service," GME programs. The Air Force sends the largest share of residents to out-service programs (approximately 60 percent) followed by the Navy (approximately 23 percent).[48] There are two options for out-service programs:

[48] Sarah John et al., *Feasibility Study for the Consolidation of Military Medical Education and Training Organizations, Functions, and Activities*, IDA Paper P-10615, (Alexandria, VA: Institute for Defense Analyses, June 2019).

- **Civilian Sponsored, or "Full Time-Out Service" (FTOS):** Under the civilian-sponsored option, individuals selected for sponsored slots may attend a civilian residency of their choice on active duty. The individual will receive full active-duty pay and benefits (and accumulate time in rank). They will not receive any compensation from the civilian program. The individual will also accumulate an additional ADO equal to 1 year per year spent in the program.
- **Civilian Deferred:** Under the civilian deferred option, individuals can attend a civilian residency of their choice. As a resident, the individual will not be on active duty and will not receive military pay, benefits, or time in rank. They will instead be paid the standard resident salary for the program they selected to attend. The individual will not incur any additional service obligation during their residency. Once they complete their residency training, they will return to active duty and serve their HPSP ADO. However, there are concerns that while medical schools have grown enrollment, the number of civilian residency seats have effectively remained constant, leading to unmatched graduates each year.

The cost of providing FTIS GME is highest, given that it includes both resident compensation and overhead (e.g., program administration, faculty and staff, etc.). However, some of these costs are offset by the fact that residents provide patient care (i.e., they contribute to their facilities' productivity and workload.) For FTOS, the majority of the cost will be resident compensation (residents receive full military pay and benefits at the O-3 rank).[49] Civilian-deferred GME costs are minimal, as participants in these programs do not receive military compensation. Table 13 shows the estimated average annual per-resident cost for FTIS and FTOS GME programs. For the in-service programs, we include both the total cost (resident compensation plus overhead costs) and the net cost (resident compensation plus overhead costs less resident productivity), which accounts for the resident's workload. For out-service programs, we used the Army programing rate for an O-3.[50] Appendix B contains details on the methodology and data used to construct the GME estimates. GME cost estimates by specialty are also presented in the appendix.

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49 There may be some minor reimbursable expenses or fees charged by certain programs.

50 We did not have the distribution of FTOS participants by Services needed to construct a weighted average. The Army value fell in the middle. The Air Force and Navy rates were $140,768 and $151,878, respectively.

Table 13. Estimated Average Annual GME Costs

	Student Year	3-year	5-year	7-year
FTIS Total	$202,756	$608,268	$1,013,780	$1,419,292
FTIS Net	$157,126	$471,378	$785,630	$1,099,882
FTOS*	$145,671	$437,013	$728,355	$1,019,697

* FTIS estimates are constructed as weighted averages across specialties. The FTOS estimate is the Army programing rate for an O-3.

Based on these rates, it appears that one year of GME in FTIS or FTOS programs is more costly than one year of HPSP and FAP, but less costly than one year of medical school at USU.

E. Cost Comparisons

In the prior sections of this chapter, we developed the estimated cost of accessing physicians through the USU SOM, the Service-run HPSP programs, and the Service-run FAP program. Estimates were presented both annually and per accession (applying assumptions about how long the student participated in the scholarship program). We also presented estimates of annual average costs of GME, which HPSP and USU accessions must complete before they are fully trained physicians. In this section, we compare these estimates to better understand the relative initial cost differences in each accession source. We also compare our cost estimates to prior estimates.

1. Comparison of Annual USU and HPSP Costs

Our first comparison analysis focuses only on USU and HPSP—the two programs that provide undergraduate medical education (resulting in a M.D. or D.O. medical degree). The detailed cost elements discussed in the previous sections are lumped into two common categories: student compensation (grants, bonuses, stipends and compensation paid to the student) and instruction/program costs (tuition, books and equipment, faculty, administration, and program overhead costs). Table 14 shows the average annual cost comparisons for these categories, as well as a total cost per student (assuming a four-year HPSP scholarship).

Table 14. USU and HPSP Average Annual and Total Cost Per Student, FY 2017

Annual Cost Per Student	USU	HPSP	Difference
Student Compensation	$91,000	$43,000	$48,000
Instruction	$162,000	$58,000	$104,000
Total	$253,000	$101,000	$152,000
Total Cost Per Student	$1,012,000	$404,000	$608,000

From the table, we observe that USU is approximately 2.5 times more costly per student per year than HPSP. This amounts to an average annual cost difference of approximately $150,000 per student (or a total student cost difference of $600,000, assuming a four-year HPSP scholarship). To better understand what drives the cost difference, we examine what percentage of the difference is explained by student compensation versus instruction and program costs. Table 14 shows that USU has higher costs for both categories, but that the larger difference occurs for instruction costs. This is unsurprising, given that USU bears the full overhead costs associated with providing a medical education while HPSP pays only tuition and fees. Two additional factors in the difference in instruction costs include the fact that USU provides a year-round curriculum (an extra 700 hours, or approximately 17.5 weeks) and the fact that USU provides military-specific training (i.e., field exercises). Table 15 presents the difference in average annual student compensation and instruction costs between USU and HPSP and the percentage of the total difference they explain. For instruction costs, we also present estimates of the cost attributed to USU's longer curriculum and USU's military specific training.[51] The table indicates that approximately one-third of the USU-HPSP cost difference can be explained by the difference in student compensation. The remaining two-thirds is explained by the difference in instruction costs. The difference in instruction costs is largely explained by the fact USU bears the full overhead costs of M.D. education versus only tuition and fees. However, about 18 percent of the difference in instruction costs may be attributed to the longer curriculum and military-specific training costs.

Table 15. Decomposition of Annual USU-HPSP Cost Difference

	Difference	Percent Explained
Student Compensation:	$48,000	32%
Instruction Costs:	$104,000	68%
• Military-specific costs	$1,400	1%
• 700 additional hours	$17,200	11%
• Remaining difference	$85,400	56%

[51] We calculated the average USU weekly instruction cost to be $3,940. This suggests that the 17.5 extra weeks increase costs by roughly $69,000 per student total, or $17,200 per student year. Military-specific costs were identified from line items in the USU Universe of Transactions file. We identified just less than $1 million (or $1,400 per student year) of military-specific training costs. These included the Bushmaster field exercise and other field practicums; training in chemical, biological, radiological, nuclear, and explosive (CBRNE); and other military medical operations.

2. Comparison of Annual FAP Accession and GME Costs

USU and HPSP provide individuals with undergraduate medical education in exchange for incurring a service obligation. Once a participants complete their medical school, they still must complete GME. FAP, on the other hand, targets individuals who have already completed medical school and who are in the process of completing their residency training (GME). We therefore believe that it makes more sense to compare the average annual FAP cost to the average annual cost of providing GME to individuals accessed through USU or HPSP. Figure 7 contains estimates of the average annual cost of providing GME through FAP relative to the Service-run FTIS (net cost) and FTOS programs. The figure shows that FAP is by far the least costly option—sending an individual through an FTIS program is expected to cost approximately 2 to 2.5 times more (depending on if you net out productivity). Sending an individual through an FTOS is also more costly that FAP, by about 1.7 times.

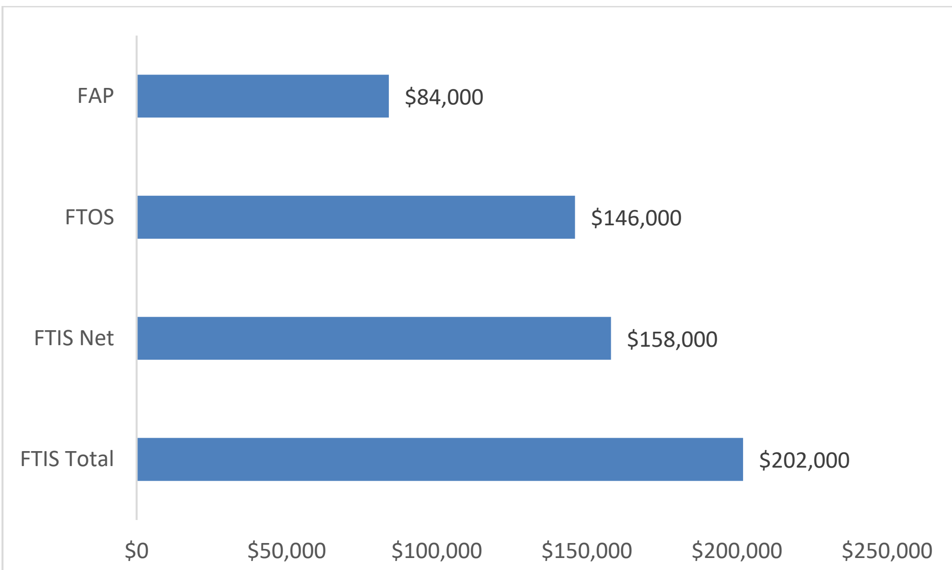

Figure 7. Average Annual GME Costs, FY 2017

3. Comparison of Total Accession Costs for USU, HPSP, and FAP

We now consider the range of total accession costs for individuals accessed through USU, HPSP, and FAP. We consider total accession costs to include both medical school costs (for USU and HPSP) and GME costs. We note that these costs will vary based on the scholarship length for HPSP and FAP students and based on selected specialty (which determines length of GME training). To account for this, we rely on four illustrative cases:

- A USU accession who receives a four-year education at USU and then attends a three-year FTIS GME program

- An HPSP accession who receives a four-year scholarship to attend a civilian medical school and then completes a three-year FTIS GME program
- An HPSP accession who receives a four-year scholarship to attend a civilian medical school and then completes a three-year FTOS GME program
- An FAP accession who receives support for three years while attending a civilian GME program

Table 16 shows the estimated total costs associated with each accession case. To capture differences in service obligations (e.g., the USU accession will face a seven-year ADO while the HPSP and FAP accessions will face four-year ADOs in this scenario), we also calculate the total cost per year of obligated service. This variable is constructed by dividing the total accession cost by the years of obligated service an individual incurs. It represents the per-year accession cost at the minimum return on investment (i.e., the individual leaves the military as soon as their obligation is up). For this scenario, USU and HPSP graduates have very similar costs per year of obligated service ($210,000 to $220,000) while FAP participants cost only $63,000 per year of obligated service.

Of course, many providers serve longer than their minimum ADO. The true value of each accession source will be better measured using actual career-length data. We will explore cost per year of actual service (and actual years of practice post GME) in the following chapter.

Table 16. Estimated Total Accession Cost per Fully Trained Physician

	USU (FTIS)	HPSP (FTIS)	HPSP (FTOS)	FAP
UME	$1,012,000	$404,000	$404,000	
GME	$474,000	$474,000	$438,000	$252,000
Total	$1,486,000	$878,000	$842,000	$252,000
Total Per Obligated Year	$212,286	$219,500	$210,500	$63,000

4. Comparison to Past Work

Several past studies have provided the estimated costs of obtaining DoD physicians from one or more of the accession sources. The most comprehensive study was a 2003 study by CNA.[52] The Boston Consulting Group (BCG) and McKinsey & Company performed more recent analyses for the Department (2017 and 2018).[53] We note that some

[52] See Shayne Brannman et al., "Life-Cycle Costs of Selected Uniformed Health Professions."

[53] Boston Consulting Group, "Initial Analysis of USUHS Costs," briefing, October 2017; and McKinsey & Company, "USU Medical School Preliminary Business Case," briefing, June 20, 2018.

of their estimates are based on inflating the CNA estimates. Different inflation methods and assumptions result in varying estimates.

In Table 17, we show how the IDA annual cost estimates compare to past findings for USU, HPSP, FAP, and GME. The second column shows the original CNA estimates in 2002 dollars. The remainder of the columns are in 2017 dollars. Appendix G provides more detail on the source of the other estimates and our inflation methodology.

In general, our estimates are similar to estimates reported in the literature. Our USU estimate is within 10 percent of the three other estimates.[54] Our estimate for HPSP is at the top end of the literature, but we believe it to be the most accurate and based on the most recent and complete data. The CNA estimate is 16 years old and the BCG and McKinsey estimates appear to be based on inflating it. The GAO HPSP estimate is more recent, but it only covers costs paid by the Defense Health Program (DHP) O&M account (e.g., tuition, books, fees, and other education expenses). A similar story is true for FAP; the IDA estimate is on the high end, but based on the most recent and complete data. We note that the inflated CNA value can no longer be accurate, given that it is lower than the current annual FAP grant of $45,000. For GME, the IDA estimate is on the low end, but generally within range. We note that our GME estimate may not fully reflect the full cost of DoD faculty or the loss in their clinical productivity due to time spent training residents.[55]

It is worth noting that comparing the IDA estimates to the CNA estimates suggests that the cost of USU has declined slightly in real terms, while the cost of HPSP has increased.[56] Specifically, the 2002 CNA estimates imply a compounded average growth rate (CAGR) for USU of 1.98 percent and CAGR for HPSP of 3.99 percent.

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54 We did not include the outlier BCG “bottom up” annual estimate of $420,000, which is considerably larger than all others. The accuracy of the bottom-up estimate has been called into question, given that it would generate a total medical student cost that would consume more than 80 percent of the university’s entire O&M budget.

55 Our GME estimate data is based on the Medical Expense and Performance Reporting System (MEPRS) cost accounting system, which values providers using composite rates. See Appendix F for more detail.

56 The AAMC notes that tuition and fees to attend a public medical school have increased an average of 3.4 percent annually (2.5 percent annually for a private medical school) from 2009–2016, far outpacing the rate of inflation. This cost growth has fluctuated over time, with some periods of rapid growth, particularly among public institutions.

Table 17. Comparison of Past Estimates

		Annual USU Cost Estimates				
	IDA	**CNA (2002)**	**CNA (2017)**	**McKinsey**	**BCG***	**GAO**
USU	$253,000	$185,000	$274,000	$245,000	$274,000	n/a
HPSP	$101,000	$54,000	$74,000	$82,000	$89,000	$49,000*
FAP	$84,000	$23,000	$33,153	n/a	$69,000	n/a
GME	$202,000	$104,000	$162,000	n/a	$218,000	n/a

* We report the "top-down" BCG estimate for USU. The GAO value includes only costs paid by the Defense Health Program (DHP) O&M account (e.g., tuition, books, fees, and other education expenses). Student stipends, bonuses, and ADT are not included. The inflated CNA FAP estimate is clearly too low, given that the annual FAP grant is now $45,000.

5. Accession Source Value Analysis

The previous chapter developed average annual per-student cost estimates for each of the accession sources. While it is important to understand these costs, they may not be the most relevant metric for decision makers considering potential adjustments to the physician accession pipeline, because they do not capture the different force structure benefits associated with the different accession sources (e.g., retention patterns, deployments).

In this chapter, we examine how graduates of the USU SOM and physicians accessed through other sources provide value to the DoD over their careers as active-duty service members. We quantify this value in multiple ways, including time served, time spent deployed, service in operationally focused specialties, and service in special operation units. We recognize that physicians from different accession sources vary in the value they provide to DoD in ways that we do not quantify, and we discuss these ways in a qualitative fashion in addition to our quantitative analyses. We find that, compared to other active-duty physicians, USU graduates serve significantly longer, deploy for more days, and are overrepresented among field-grade officers and in special operations units. They are also more likely than other active-duty physicians to have attained board certification and to have completed various operationally relevant trainings. We emphasize that many of the unique benefits of each accession source are unquantifiable, and that having a variety of physician accession sources is itself valuable to DoD.

Differences in time served across accession sources implies differences in career costs beyond those devoted to education and training. Therefore, we extend our cost analysis for USU and HPSP accessions to the costs to DoD over an entire physician career. Because differences in GME duration, career duration distribution, and bonus and incentive pay vary by specialty, we perform the analysis at the specialty level, though we find similar results across all specialties.

A. Data

We use monthly observations of each active duty physician from January 2000 through December 2018, provided by the Defense Manpower Data Center (DMDC). These data include DoD and service occupation codes, which we crosswalk to obtain physician specialties. Some individuals in the dataset have occupation codes that change over time. For individuals with physician observations, this change in occupation code usually indicates increased specialization or starting or completing a medical internship; however, some individuals shift from non-physician occupations to physician occupations, or viceversa. In the case of switching from a non-physician occupation to a physician occupation, we decided to keep the earliest observation of a physician occupation code and every later observation of the same individual.[57] We also observe unit assignments and dates deployed to each country and body of water.

We merge the DMDC data with physician career data from the DoD and Department of Veterans Affairs Joint Centralized Credentials Quality Assurance System (JCCQAS). These data allow us to observe physician assignments, specialties, education (including degree type, completion date, and institution attended), board certification status, and trainings. For our purposes, we further filtered the JCCQAS data by looking only at physicians who attained degree titles “Doctor of Medicine” and “Doctor of Osteopathy.” Regarding the merge itself, the monthly percentage of DMDC physicians with valid JCCQAS keys varies from a minimum of 72 percent to a maximum of 83 percent (with a mean monthly percentage of 79 percent).

Since we’re conducting a survival analysis on time served as a physician, we need to know the first time period that each individual serves as a physician. However, we cannot know the first time period in which an individual has served as a physician if that time period occurs on or before the first month in our data (January 2000). Therefore, to ensure that we’re only looking at individuals for whom we know their first month of service, for the purposes of generating survival curves, we throw out all individuals who appear in the first month of the data. This solution is reasonable, not only because it solves the problem of not knowing the start date of individuals who appear in the data in January 2000, but also because the people we discard are those with the oldest records in the data, and those whom we expect to be least representative of military physicians of the future.[58]

B. Descriptive Analysis

1. Time Served by Accession Source

DoD offers financial support to medical students and residents in return for a minimum number of years of active duty service. Thus, time served is the sole measure of value that DoD explicitly recognizes in its transactions with future active-duty physicians and an essential metric for the value physicians provide to DoD.

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[57] Some irregularities exist with the DMDC occupation data for the early months of those who accessed in 2000 and 2001. Occupation codes changed nearly every month and sometimes drastically. This may be due to problems in the initial data recording, or due to some preprocessing along the way.

[58] One minor downside of this approach is that we discard the minority of physicians for whom January 2000 was truly their first period of service.

USU SOM graduates incur a longer service obligation than physicians accessed through other sources.[59] Because physicians are generally allowed to serve beyond their obligations, the differences in obligation lengths do not necessitate that USU SOM graduates always serve longer than physicians accessing through other sources. In Figure 8, we compare the service-time distributions of USU SOM-accessing physicians to physicians who access through other sources. Each accession source is associated with a Kaplan-Meier survival curve, which represents, for each number of days on the horizontal axis, the share of physicians who served on active duty at least that many days. For example, 95.6 percent of USU SOM graduates served at least 3,000 days, while only 47.6 percent of graduates accessing from other sources served the same number of days. Thus, we observe empirically that USU SOM graduates tend to serve longer than other military physicians.

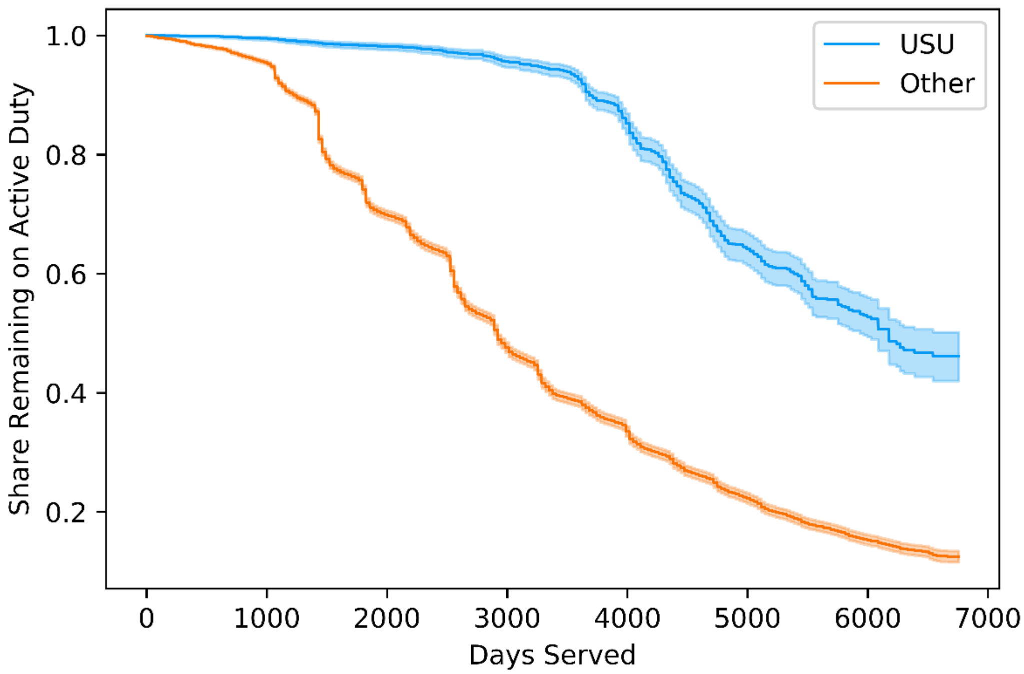

Figure 8. Time Served Survival Curves by Accession Source

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[59] USU SOM graduates incur a seven-year active-duty service obligation post GME; HPSP participants incur one year of active-duty service obligation for every year in the program in medical school or in DoD GME (whichever is greater), for a minimum of three years, post GME; FAP participants incur two years of active-duty service obligation for their first year in FAP and one year for every year covered thereafter, for a minimum of three years. Further details regarding service obligations by accession source can be found in Appendix H.

We can also use the values in Figure 8 to estimate expected time served for a physician accessed through each source in the first 18 years and 11 months of his or her career (since we omitted those who appear in the data in January 2000). Thus, we estimate "restricted mean survival time" (RMST), which is restricted to the time frame of the data, and therefore represents a lower bound on mean career duration. RMST corresponds to the area underneath the survival curves; we estimate RMST of 15.23 years for USU SOM graduates and 9.21 years for other military physicians.

Further, we observe that the difference in time served between USU SOM and other graduates exceeds their differences in obligation lengths (see footnote 59). Therefore, one or more factors other than obligation length must be driving differences in time served.

Figure 9 shows a similar analysis for time served for some of the most common specialties. In each plot, for a given number of days of service, USU physicians are estimated to serve more days on active duty than physicians accessing from other sources. This gap is the largest for emergency medicine and family medicine specialties. The lightly shaded region around the blue and orange lines represents the 95 percent confidence interval on the estimate of the proportion of physicians serving at least that many days, and the confidence interval's growth as days served increases signifies decreasing sample size, which is especially true for the USU graduates, a relatively small subpopulation of all military physicians.

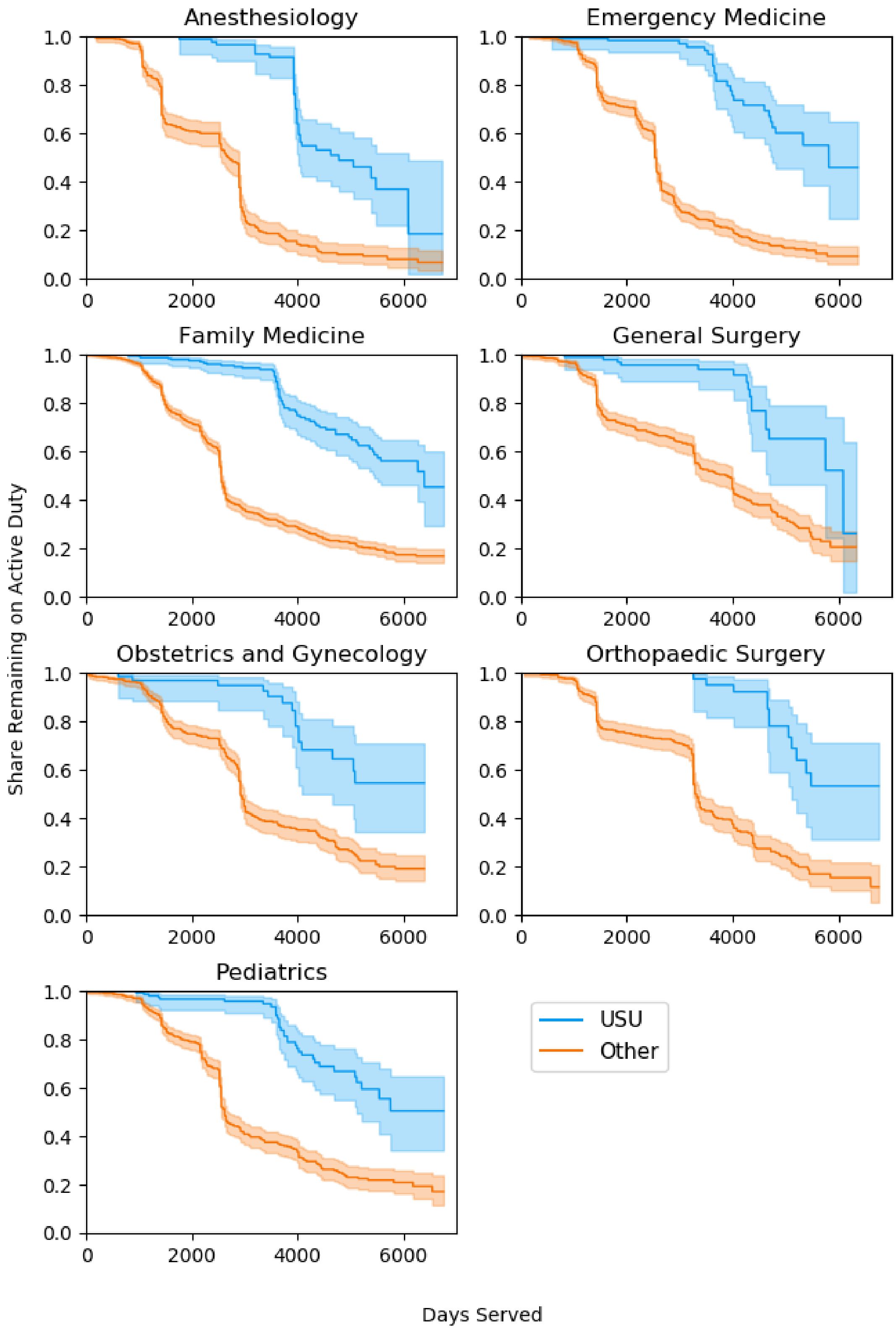


Figure 9. Time Served Survival Curves by Accession Source by Specialty

2. Time Deployed by Accession Source

DoD invests heavily in military physicians because they need a corps of physicians capable of supporting military operations in deployed settings. Maintaining this capability is the central purpose of the active-duty physician education and training pipeline. By measuring time deployed, we can approximate the extents to which different accession sources fulfill that central purpose.

Our analysis is methodologically equivalent to the analysis for time served, except that days deployed are counted here instead of days served. Figure 10 shows that USU SOM graduates spend more time deployed than other physicians.

Because they are in a way analogous to time served, we can use the values in Figure 10 to estimate expected time deployed for a physician accessing through each source in the first 18 years and 11 months of his or her career. Thus, we estimate RMST for time deployed, which is restricted to the time frame of the data, and therefore represents a lower bound on mean time deployed. When we consider the full sample, the RMST for USU graduates is 731 days, versus 266 for other military physicians.

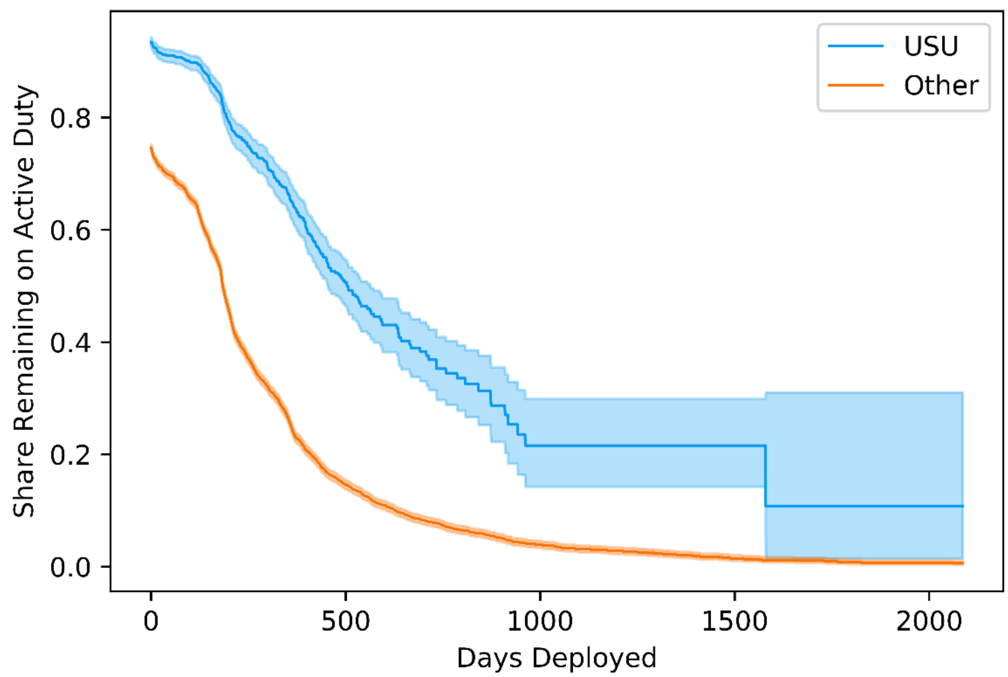


Figure 10. Time Deployed Survival Curves by Accession Source

We note that the confidence intervals are much wider after 1,000 days deployed (due to small samples sizes). For this reason, we also estimate the RMST for only the portion of Figure 10 that is less than 1,001 days. Restricting the sample results in an RMST of 551.72 days for USU SOM graduates and 248.09 days for other military physicians.

Figure 11 shows the same analysis for some of the most common specialties. In each specialty, USU graduates spent more days deployed than physicians accessing from other sources. The large flat parts of the survival curves (most notably for family medicine) were generated from very small samples (only four USU family medicine physicians were deployed more than 1,000 days) and therefore are not very meaningful.

Finally, the blank parts at the end of the curves for emergency medicine, obstetrics and gynecology, orthopaedic surgery, and pediatrics (in Figure 11) do not mean that it is impossible for physicians in those specialties to serve longer than the corresponding value on the horizontal axis, but rather that no one in the data has yet served longer.

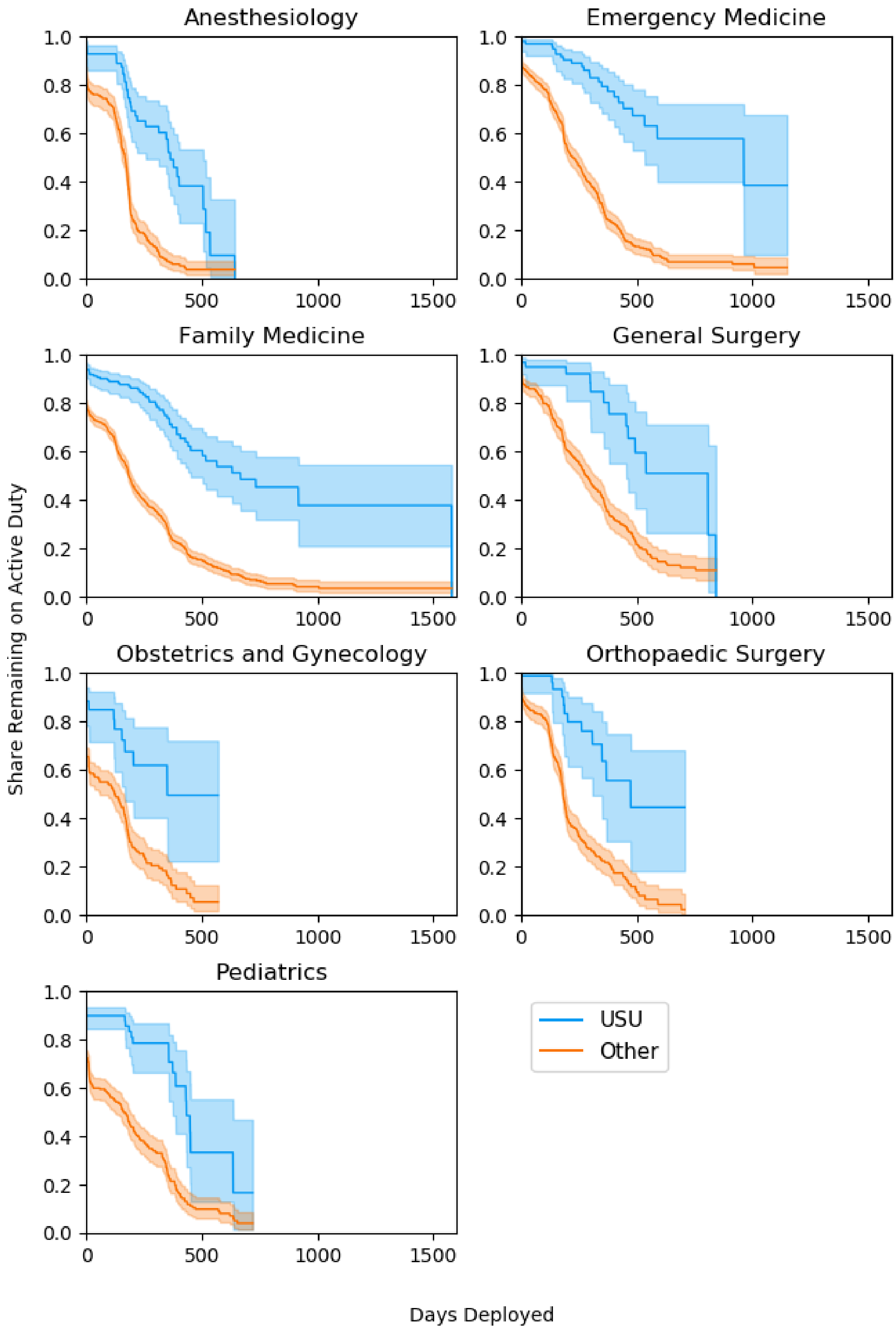


Figure 11. Time Deployed Survival Curves by Accession Source by Specialty

Figure 12 uses number of deployments as an alternative to days deployed and confirms that USU SOM graduates deploy more often than physicians accessed through other sources. Only six USU physicians have more than ten deployments, so estimation after that point on the horizontal axis is not very meaningful.

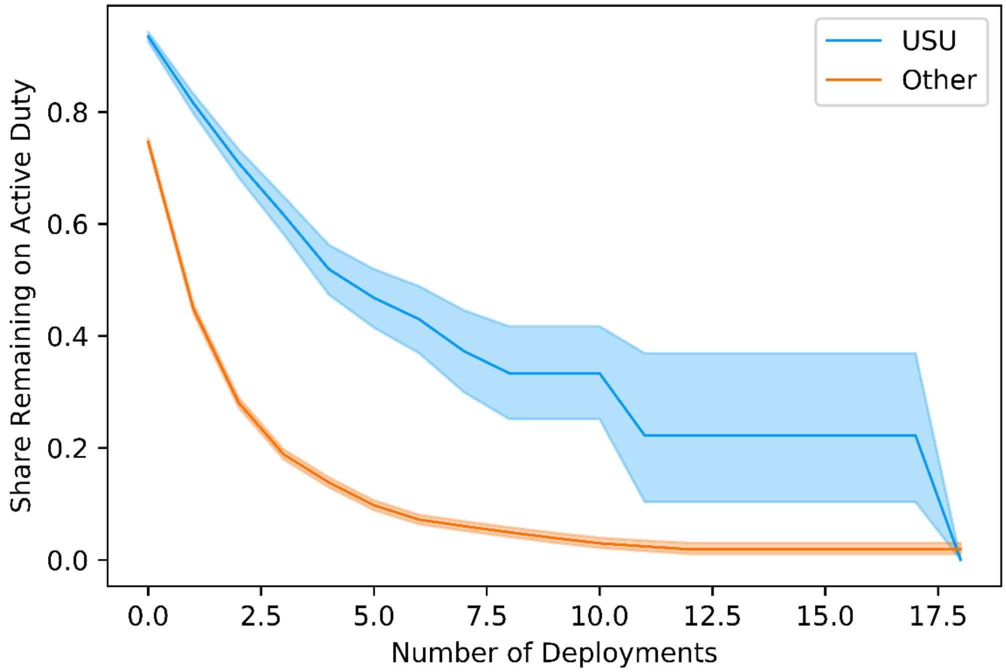


Figure 12. Number of Deployments Survival Curves by Accession Source

3. Shares by Pay Grade

Another metric of an accession source's value to DoD is the proportion of higher ranking officers who access through that source. This metric is another way of measuring the career duration of a military physician. In a December 2018 snapshot, USU graduates were overrepresented in the pay grades O-4, O-5, O-6, and O-7+, accounting for 25.44 percent, 32.66 percent, 25.48 percent, and 25.00 percent of physicians in those pay grades, respectively (see Table 18). In comparison, USU graduates accounted for 23.36 percent of physicians overall in our data. Thus, USU graduates tend to have longer careers characterized by more promotions than physicians accessing from other sources.

Table 18. Shares by Pay Grade, December 2018

Pay Grade	Share USU
Overall	23.36%
O-3	17.53%
O-4	25.44%
O-5	32.66%
O-6	25.48%
O-7+	25.00%

4. Service in Special Operations Units

Service in a special operations unit represents distinctive value to DoD and a signal of a physician's willingness and ability to meet exalted selection and training requirements. IDA obtained a list of unit identification codes for special operations units and merged the list with identification codes for assigned units in the personnel data. USU SOM graduates were overrepresented in special operations units, particularly in the Army and Navy. USU SOM graduates served 36.44 percent, 27.09 percent, and 19.61 percent of months served by physicians in Army, Navy, and Air Force special operations units, respectively (see Table 19). For comparison, USU SOM graduates served 20.56 percent of all months served by physicians in our data.

Table 19. Share of Months Served by USU Graduates

Unit Type	Share USU
Army SOF	36.44%
Navy SOF	27.09%
Air Force SOF	19.61%
All SOF	29.68%
All units	20.56%

SOF = Special Operations Forces

5. Board Certification Status

The share of graduates who have attained board certification at some point in their careers can also be an important metric for evaluating accession sources. Table 20 shows that, in the December 2018 snapshot, a higher percentage of USU graduates have attained board certification at some point in their careers than individuals accessing through other sources. The shares in Table 18 are calculated for the 73.3 percent of physicians in our personnel data in December 2018 with a matching JCCQAS record.

Table 20. Share Having Attained Board Certification, December 2018

Accession Source	Share
Other	55.84%
USU	64.32%

Note: The JCCQAS board certification file presents a cross-sectional snapshot of those who have ever held a board certification in our cohort. Included in the denominator are physicians who are still in the residency pipeline who may be ineligible for board certification, as well as those who have never sat for a board exam. Therefore, it is likely that the figures presented in Table 20 underestimate the true share of uniformed physicians possessing a board certification during their military careers. These figures should not be interpreted as pass rates, as we have no way of identifying from the data who has taken a board exam. The American Board of Medical Specialties notes that approximately 90 percent of USU graduates achieved board certification in a specialty.[60] While similar statistics for HPSP and FAP do not exist, the Federation of State Medical Boards estimates that 79 percent of licensed physicians (MDs and DOs) in the United States are certified by a specialty board.[61] Among eligible MDs, the board certification rate is closer to 88 percent using data from the AMA Masterfile.[62] The approximately eleven percent difference in the reported rates between USU and all medical schools is comparable to what we observe empirically in the JCCQAS data. GAO has noted that military physician data is challenging to monitor as student qualification data and subsequent performance data are managed separately and not always linked or consistently tracked across organizations.[63]

6. Service in Specific Specialties

Table 21 shows the share of person-months for USU and other-accessing individuals who specialize in certain operationally focused specialties, both in the whole dataset as well as in a December 2018 snapshot. Person-months are used instead of simply persons to mitigate problems caused by small sample size (although person-months and number of persons are equivalent for the December 2018 snapshot).

Over the whole time frame of the data, USU graduates represented about 20.56 percent of total person-months in the data (among all specialties). They were thus overrepresented in the fields of anesthesiology, critical care medicine, emergency

[60] American Board of Medical Specialties, "Report of the Special Committee on Military Physicians and Continuing Certification," April 2015, https://www.abms.org/media/93984/militaryreportweb.pdf.

[61] Aaron Young et al., "A Census of Actively Licensed Physicians in the United States, 2016." *Journal of Medical Regulation* 103, no. 2 (2017): 7–21.

[62] Ronald M. Cervero et al., "Staying Power: Does the Uniformed Services University Continue to Meet Its Obligation to the Nation's Health Care Needs?" *Military Medicine* 183, no. 9–10 (2018): e277-e80.

[63] United States Government Accountability Office, "MILITARY PERSONNEL, Additional Actions Needed to Address Gaps in Military Physician Specialties," GAO-18-77, (Washington, DC: GAO, February 2018), https://www.gao.gov/assets/700/690409.pdf.

medicine, neurological surgery, orthopaedic surgery, thoracic surgery, and vascular surgery. They were approximately equally represented in the fields of critical care surgery and general surgery with physicians accessing from other sources.

In December 2018, USU SOM graduates made up about 23.36 percent of physicians over all specialties, and were overrepresented in the fields of anesthesiology and neurological surgery and slightly underrepresented in emergency medicine, general surgery, and orthopaedic surgery.[64]

Table 21. Share in Operationally Focused Specialties

Specialty	Share USU Overall	# Pers.-Mo. Overall	Share USU Dec. 2018	# Pers. Dec. 2018
Anesthesiology	32.44%	58,634	36.58%	298
Critical Care Medicine	28.21%	1,563	26.27%	15
Critical Care Surgery	20.65%	2,479	14.29%	28
Emergency Medicine	23.51%	100,562	23.13%	614
General Surgery	20.67%	110,752	20.38%	476
Neurological Surgery	28.84%	7,243	28.89%	45
Orthopaedic Surgery	23.50%	82,681	22.35%	358
Thoracic Surgery	25.09%	9,684	37.04%	27
Vascular Surgery	28.25%	6,394	21.95%	41
All Specialties	20.56%	2,834,545	23.36%	11,880

Similarly, Table 22 shows the share of USU accessing individuals in the ten most common specialties. Among the ten most common specialties, USU accessors are overrepresented in the fields of family practice, pediatrics, emergency medicine, orthopaedic surgery, radiology, aviation/aerospace medicine, psychiatry, and (to a very small extent) general surgery. They are underrepresented in the field of obstetrics and gynecology and in the population of general internists.

While USU accessors comprise 23.36 percent of all physicians in the December 2018 snapshot, they are underrepresented in the fields of family practice, pediatrics, general surgery, emergency medicine (slightly), obstetrics and gynecology, orthopaedic surgery, aviation/aerospace medicine, psychiatry (very slightly), and in the population of general internists. The only field in which they are overrepresented in December 2018 is radiology.

[64] Due to the small sample size of physicians specializing in critical care medicine, critical care surgery, thoracic surgery, and vascular surgery (fewer than 30), our measurements of the share of USU physicians specializing in these fields should be interpreted with caution.

Table 22. Share of 10 Most Common Specialties by Number of Person-Months

Specialty	Share USU Overall	# Pers.-Mo. Overall	Share USU Dec. 2018	# Pers. Dec. 2018
Family Practice	22.45%	268,754	20.64%	1,221
General Internist	15.59%	147,581	15.58%	659
Pediatrics	24.45%	126,071	22.94%	523
General Surgery	20.67%	110,752	20.38%	476
Emergency Medicine	23.51%	100,562	23.13%	614
Obstetrics and Gynecology	17.17%	88,730	15.29%	399
Orthopaedic Surgery	23.50%	82,681	22.35%	358
Radiology	26.58%	81,576	32.39%	355
Aviation/Aerospace Medicine	20.91%	76,300	21.30%	216
Psychiatry	25.59%	75,364	23.30%	339
All Specialties	20.56%	2,834,545	23.36%	11,880

7. Training Rates

The JCCQAS data contain records of professional trainings, such as short courses and conferences, which allow us to compare the shares of USU graduates and others trained in specific topics. The trainings are recorded in a free-text field. To address variations and errors in entries, we search for case-insensitive tokens.[65] Some trainings, such as Advanced Trauma Life Support, were specifically identifiable, while other trainings were grouped under a thematic topic. For example, we grouped into the CBRNE topic all trainings that contained "CBRN," "CHEMICAL WARFARE," "CHEM WARFARE," or "BIOLOGICAL WARFARE." We selected tokens and topics to capture the most common entries, variations, and errors observed by manual inspection, and operationally relevant trainings. In particular, we created a topic for all trainings containing the token "Emergency" and a topic for all containing "Combat." These keywords appeared in a significant share of trainings, but the names of those trainings varied too much to identify them more specifically. Though our method is unlikely to perfectly capture the trainings relevant to a given topic, we expect that error rates are similar across USU graduates and others, so the relative training rates across the two groups are meaningful.

Table 23 shows the proportion of USU and other accessing physicians who have received either one of the specific, named operationally relevant and common trainings (the top half of Table 23), or who have received training in an operationally relevant and common training area (the bottom half of Table 23). It shows that, for most trainings, USU-accessed physicians have a higher training rate than physicians accessing from other sources.

[65] Keywords were capitalized as part of the text-cleaning process.

Table 23. Operationally Relevant Training Rates by USU, Other

Training	USU	Other
Specific Trainings:		
Advanced Cardiac Life Support (ACLS)	12.40%	9.53%
Advanced Trauma Life Support (ATLS)	12.53%	10.44%
Pediatric Advanced Life Support (PALS)	6.61%	5.29%
Aerospace Medicine (AMP1, AMP2, AMP3)	6.48%	5.82%
Basic Life Support (BLS)	5.57%	4.39%
Expeditionary Medical Support System (EMEDS)	1.84%	1.08%
General Topics:		
Emergency	5.15%	5.45%
Combat	4.05%	4.61%
Aeromedical Evacuation Training	3.57%	3.11%
Mental Health Training	3.36%	2.58%
Chemical, Biological, Radiological, Nuclear, and Explosive (CBRNE)	2.83%	2.72%
Traumatic Brain Injury (TBI)	2.43%	1.19%
Various Disaster Trainings	2.13%	1.63%

8. Unquantified Value by Accession Source

We cannot quantify all of the ways that different physician accession sources provide unique value to DoD. The existence of different accession sources is itself valuable to DoD for multiple reasons, three of which we identify here. First, it offers choice to prospective active-duty physicians. Each accession source attracts to the force those individuals for whom that source was uniquely compelling. For each accession source, there are likely individuals who would not have served if that source was not an option. Second, the existence of different accession sources grants DoD extensive options for shaping the future force and managing the effects of a change in the value of a particular source. For example, FAP allows DoD to recruit physicians training in particular specialties. Third, the existence of different accession sources fosters a diversity of knowledge and experience among active-duty physicians, and thus a greater opportunity for collegial learning.

Consistent with the previous analyses in this chapter and the focus of this paper, we highlight the distinction between USU and other accession sources. Among the DoD physician accession sources, USU offers a unique medical school experience in many unquantifiable ways. The USU SOM curriculum is uniquely designed to prepare future physicians for military service, as we describe in Chapter 3. USU SOM students are active duty officers and many of their professors are current or retired officers. Classmates with whom they build personal bonds will be their fellow service members for years after graduation. USU students are embedded in military culture and build their familiarity with military policies and procedures. That familiarity not only serves USU graduates as their careers progress, but spills over as a benefit to other physicians who can look to USU graduates for guidance.

We do not endeavor to quantify the value of each of these unique elements of a USU medical education; however, in Chapter 6, we endeavor to quantify the total effect of attending USU on years served. Our estimates of the total effect of attending USU on years served capture the sum of all unique elements of a USU medical education, relative to the unique elements of other accession sources, that cause USU graduates to choose to serve longer than other active-duty physicians.

C. Cost Implications

When we think about the value each accession source provides, it makes sense to spread out the initial fixed cost of educating a physician (the total accession costs) over their subsequent years of service (or years of post-GME practice). Doing so provides a better metric for capturing the return on the educational investment required by each program. However, accession costs spread out over years of service do not tell the full story. Once a provider begins their post-education service, DoD also incurs costs that vary with years served, including basic pay, allowances, bonus, special pays, and benefits. Individuals who serve longer will naturally earn higher pay, more bonuses, and benefits that will likely increase the mean costs of their service to DoD. For these reasons, we will also want to consider a physician's total career costs spread out over their years of service (or practice). Doing so provides a better metric for capturing the return on DoD's total investment in providers accessed from different sources. We note that rising pay and benefits with years of service suggests that DoD values later years in a physician's career more highly than early years. The following analysis will capture the greater costs but not the greater benefits of later years of service, as the latter are much less quantifiable.

In the following sections, we present total accession costs and total career costs spread over years of service (and years of practice). Before presenting these estimates, we summarize all cost components captured in our estimates and the assumptions required to derive the estimates.

1. Accession Costs

In Chapter 4, we estimated the medical school and GME costs DoD incurs to obtain attending physicians that can support military operations. These costs are "fixed" in that, unlike pay and benefits over a physician's career, they do not vary with years served (assuming program completion). The longer a physician serves, the more years over which these fixed costs are spread, thus the greater the return on DoD's investment in its physician force. Also in Chapter 4, we found that USU is the most expensive accession source, but in this chapter we found that USU accessions tend to serve much longer careers than other physicians. In this section, we capture those two observations in a single metric—mean accession cost per years served.

We use our 19 years of personnel data to estimate distributions of years served for USU graduates and for all others. Figure 13 and Figure 14 illustrate our estimates for the distributions of years served for USU accessions and all other physicians, respectively. We face a tradeoff in the level of aggregation at which we estimate the distributions. Estimating force-wide, as we did in Figure 8, would not capture differences in years served due to GME duration. Recall that time in DoD GME generally has no net effect on remaining service obligation, so we may expect physicians in specialties requiring more years of GME to tend to serve longer. Estimates at the specialty level would capture differences in GME duration, but would be based on small samples, and therefore imprecise. As a compromise, we group occupations by minimum GME duration and estimate a distribution for each duration.

Because we cannot observe beyond the time frame of our data, we cannot observe distributions of years served for retirement-eligible physicians, so we assume that all physicians observed to have served 19 years serve one additional year and summarize all of those physicians as having "20+" years served. For computing mean costs, we assume that all physicians that serve 20 years retire at 20 years of service.

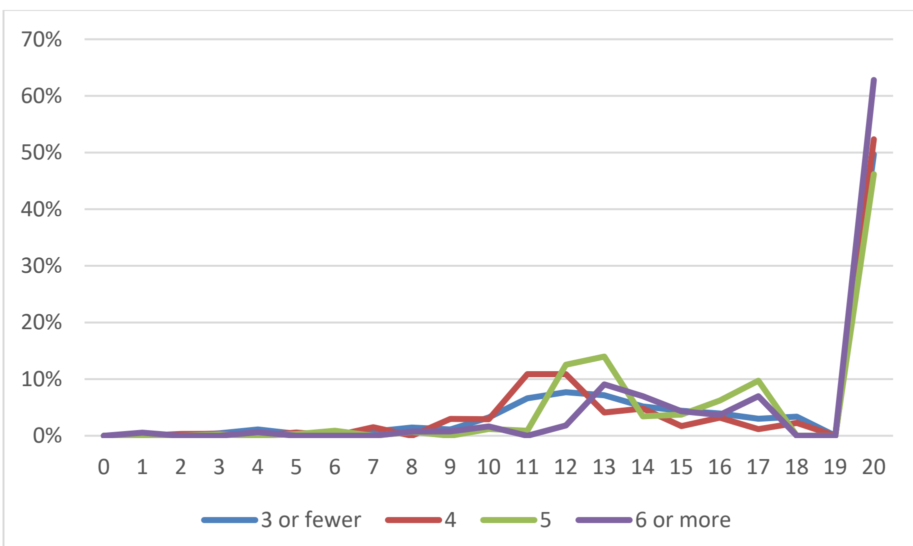


Figure 13. Estimated Distributions of USU Accession Years Served by Minimum GME Duration

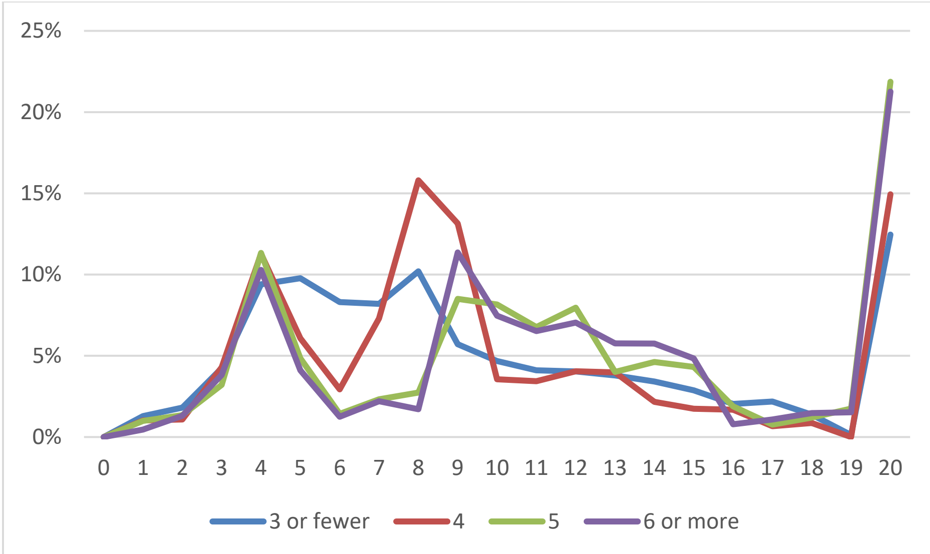


Figure 14. Estimated Distributions of non-USU Accession Years Served by Minimum GME Duration

By taking a weighted mean of costs per years of service (or years of practice), where the weights are the percentages that define a distribution in Figure 13, we can estimate the cost per year of service over the population of USU graduates for a given occupation. Such estimation is not so straightforward for other accession sources, since we do not observe distributions of years served specific to each of them. Because HPSP is the predominant accession source, we are most comfortable using the non-USU distributions in Figure 14 for HPSP accessions. Our estimates will be inaccurate to the extent that FAP accessions differ from HPSP accessions in their distributions of years served and constitute a significant share of the population of non-USU graduates.

We estimate about 10 percent of non-USU accessions serving four years independent of GME duration. To fulfill their service obligation in only four years, an individual must have completed a civilian GME program. Our mean cost estimates for HPSP assume the completion of a DoD GME program. Our mean cost estimates for FAP assume financial support in each year of a civilian GME program, and therefore a minimum obligation of that many years plus one.

Table 24 presents our mean accession cost estimates. USU mean accession costs rise with years of GME, indicating that the greater GME costs outweigh the tendency for longer careers among specialties with greater GME requirements. The same is mostly true for HPSP, but is the opposite for FAP. Mean accession costs are between 3 percent and 18 percent greater for USU than HPSP, while FAP mean accession costs are far below those of the other two sources. Accession costs for direct accessions would primarily be recruiting costs and, given the mixed nature of recruiting across occupations, components, and accession sources, we do not attempt to estimate the recruiting costs specific to direct accessions of active-duty physicians.

Table 24. Mean Accession Costs in Thousands of Dollars per Year of Service by Accession Source and Years of GME

	Years of GME					
Accession Source	**2**	**3**	**4**	**5**	**6**	**7**
USU	89	101	113	124	125	131
HPSP	81	92	110	106	113	120
FAP	66	83	80	71	82	91

Table 25 presents mean accession costs per year of practice. Compared to years of service, years of practice exclude years of GME. Since medical residents and fellows generally do not deploy, years of practice may offer a superior measure of a physician's career contribution to operational capability. Since FAP accessions are not on active duty during their GME, their years of service and practice are identical. For USU and HPSP accessions, however, excluding GME years increases costs. Since GME years tend to be a greater share of HPSP careers than USU careers, excluding those years increases costs more for HPSP than USU, so much so that costs per year of practice are higher for HPSP than USU for all GME durations.

Table 25. Mean Accession Costs in Thousands of Dollars per Year of Practice by Accession Source and Years of GME

	Years of GME					
Accession Source	**2**	**3**	**4**	**5**	**6**	**7**
USU	103	127	156	185	193	214
HPSP	106	136	187	185	213	245
FAP	66	83	80	71	82	91

2. Total Career Costs

To fully compare the costs and benefits of physician accession sources, we must account for fixed and variable costs. In this section, we estimate variable costs for each accession source and compare total costs and benefits for given quantities of years served and over the distributions of years served (estimated earlier in this chapter).

We capture the following annual costs at the occupation level:

- Basic pay, allowances, and all other DoD manpower costs captured by the Full Cost of Manpower tool maintained by the Office of the Secretary of Defense Directorate of Cost Assessment and Program Evaluation
- Retention bonus, paid in each year following the initial obligation and depending on occupation and the duration of the current obligation (two, three, or four years)
- Incentive pay, which varies by occupation, paid in each year following GME completion, and increasing by varying amounts for some occupations if received alongside a retention bonus

We capture the following annual costs that do not vary across occupations:

- Education and GME costs computed in Chapter 4
- Board-certification pay of $6,000 per year, which we assume to be paid each year following GME completion
- Retired pay under the "High 36" retirement system, paid to service members that serve 20 or more years (not including USU attendance)

In estimating variable costs, we face tradeoffs between accuracy and tractability. Tractability requires assumptions, for which counterexamples likely exist. For example, while we assume that physicians never forfeit a retention bonus for failure to complete their contract, some do. Our assumptions also collapse distributions of cost into single estimates. For example, we base all basic allowance for housing (BAH) payment amounts on the San Antonio area. Because we aim to compare accession sources, we are comfortable with assumptions that we do not expect to be violated disproportionately by physicians from one source or another. To continue our example, we expect that USU graduates are not disproportionately likely to be stationed in San Antonio or to receive a disproportionately large or small BAH.

We assume the following to allow tractable comparisons:

- Physicians who become eligible for retirement do so at age 45 and receive 38 years of retired pay. USU graduates must serve 20 years after graduation to be eligible for retirement, but their years attending USU contribute to their retired pay multiplier.
- Physicians do not have prior service.
- Physicians complete GME in the minimum number of years specified for their occupation in the 2013 ACGME Green Book.
- Physicians always complete their service contracts.

- USU and HPSP accessions complete military GME, and are therefore on active duty during their GME.
- Physicians do not serve as a General Medical Officer (GMO) prior to or during their GME. Serving one or more years as a GMO would effectively replace that many years of specialty-specific incentive pay with GMO incentive pay.
- Physicians become board certified in the first year after GME and retain their board certification for the remainder of their careers, and therefore receive board-certification pay in that year and each subsequent year.
- Physicians always sign the maximum-length commitment, given their eventual total years of service. For example, a physician that will serve seven years after their initial obligation will sign a four-year commitment followed by a three-year commitment. This assumption maximizes bonus and incentive pay over a given number of years served.
- All BAH payments are based on San Antonio, Texas, the location of the largest DoD medical facility.
- Pay increases match inflation, so that pay at a given grade remains constant in real (FY 2019) dollars from year to year.
- Basic pay, allowances, and all other manpower costs represent the mean cost over the Army, Navy, and Air Force, weighted by the number of physicians in each as of December 2018.
- HPSP participants receive assistance for four years of medical school, and therefore incur a service obligation of four years.
- FAP participants receive assistance in all years of their GME, and therefore incur a service obligation of that many years plus one.
- Physicians attain the pay grade of O-3 upon graduation and are subsequently promoted every six years.

Under these assumptions we can calculate the total cost to DoD of a physician of a given occupation serving any given number of years. Dividing that cost by the number of years served yields a cost per year of service. For example, Table 26 lists costs per year of service for a general surgeon of each accession source.

Blanks in Table 26 reflect fewer than the minimum number of years served. Five years of GME and seven years of initial service obligation add to 12 minimum years of service for USU graduates (after graduation). Four years of initial service obligation implies nine minimum years of service for HPSP graduates. Five years of FAP support do not count as years of service, but do imply a six-year minimum obligation. The minimum years served by a directly accessed physician is the minimum active-duty contract length of two years.

Table 26 shows that direct accession, followed by HPSP, yields the minimum cost per years of service, given each accession source's minimum years served. For any given number of years served, HPSP exhibits the lowest cost, followed closely by FAP and direct accession and lastly by USU. USU has particularly higher costs for retirees, due to years attending USU contributing to the retired pay multiplier.

Table 26. General Surgeon Cost in Thousands of Dollars per Years of Service by Accession Source and Years Served

Years Served	USU	HPSP	FAP	Direct Accession
1				
2				202
3				216
4				229
5				238
6			259	244
7			249	247
8			247	249
9		248	248	252
10		243	251	255
11		244	254	257
12	288	245	256	259
13	281	248	258	261
14	279	250	259	262
15	278	252	261	263
16	279	255	263	265
17	279	257	265	267
18	280	259	266	268
19	281	261	268	270
20	375	341	347	349
21	374	341	348	349
22	377	345	351	353
23	380	349	355	356
24	379	350	355	357

Table 26 counts GME years as years served for USU and HPSP accessions. Alternatively, years of practice excludes residency years. Table 27 reconstructs Table 22 with cost per years of practice instead of cost per years of service. This substitution necessarily produces higher costs for USU and HPSP, but the same costs for FAP and direct accession. Years served remains in the first column of Table 27 to facilitate comparison with Table 26.

Table 27 shows that direct accession, followed by FAP, yields the minimum cost per years of practice, given each accession source's minimum years served (for each accession source, the first year of practice is the first non-blank cell in the corresponding column). This finding is unsurprising, since these are the two accession sources that do not involve DoD GME. For a given number of years served, FAP and direct accession have similar costs, representing the cost of FAP support roughly offsetting the delay in retention bonus and increased incentive pay associated with FAP participants' fulfillment of their initial obligation. Among the two more common accession sources, USU yields a lower cost per year of practice than HPSP at the respective sources' minimum years served. For any given number of years served, HPSP exhibits a lower cost than USU. Except for the initiation of retired pay eligibility, the difference in cost per year of practice decreases with years served, as the greater USU education cost is spread over a longer career. Retired pay eligibility increases the difference, because years of USU attendance contribute to the retired pay multiplier.

Table 27. General Surgeon Cost in Thousands of Dollars per Years of Practice by Accession Source and Years Served

Years Served	USU	HPSP	FAP	Direct Accession
1				
2				202
3				216
4				229
5				238
6			259	244
7			249	247
8			247	249
9		557	248	252
10		487	251	255
11		447	254	257
12	493	421	256	259
13	457	403	258	261
14	433	389	259	262
15	417	379	261	263

Years Served	USU	HPSP	FAP	Direct Accession
16	405	371	263	265
17	396	364	265	267
18	388	359	266	268
19	381	354	268	270
20	500	454	347	349
21	491	448	348	349
22	488	447	351	353
23	485	446	355	356
24	479	442	355	357

Comparing costs of different accession sources at given numbers of years served is valuable for illustration. However, such comparison does not capture overall differences in the costs of those sources to the extent that distributions of years served differ across sources. For example, comparing the costs per years of practice for USU and HPSP associated with 20 years served is uninformative if USU graduates are more or less likely than HPSP graduates to serve 20 years. As shown in Figure 13 and Figure 14, distributions of years served indeed differ across USU and non-USU accessions. We use those same distributions in this section to compute mean total costs, just as we computed mean accession costs in section 5.C.1.

We estimate that a USU-accessed general surgeon costs a mean of $335,000 per year of service and $475,000 per year of practice. We estimate that an HPSP-accessed general surgeon costs $287,000 per year of service and $437,000 per year of practice. The first two numeric columns of Table 28 tabulate analogous estimates for the ten most common physician occupations. Table 28 also tabulates costs per year of service and year of practice for a physician that serves the minimum obligation and for a physician that serves 20 years. The relative career costs across USU and HPSP accessions are very similar across occupations (including occupations not listed). As shown for general surgery, mean and 20-year costs are lower for HPSP accessions. Minimum obligation costs are lower for HPSP in terms of years of service, but higher for HPSP in terms of years of practice, especially for occupations that require more years of GME.

Table 28. Cost Estimates in Thousands of Dollars by Occupation and Accession Source

Accession Source	Accession Source	Mean Cost per YOS*	Mean Cost per YOP**	Cost per YOS for Minimum Obligation	Cost per YOP for Minimum Obligation	Cost per YOS for 20-year Career	Cost per YOP for 20-year Career
Family Practice	USU	320	388	288	412	351	413
	HPSP	257	338	248	433	310	365
General Internist	USU	318	387	288	412	349	411
	HPSP	256	337	248	433	309	363
Pediatrics	USU	317	385	288	412	347	409
	HPSP	255	335	248	433	306	360
General Surgery	USU	335	475	288	493	375	500
	HPSP	287	437	248	557	341	454
Emergency Medicine	USU	331	433	287	450	358	447
	HPSP	268	394	246	492	318	398
Obstetrics & Gynecology	USU	332	435	290	455	359	448
	HPSP	269	395	249	497	318	397
Orthopedic Surgery	USU	347	517	283	525	373	532
	HPSP	287	472	246	614	338	483
Radiology	USU	332	471	288	493	372	495
	HPSP	284	432	248	557	335	447
Aerospace Medicine	USU	316	384	288	412	346	407
	HPSP	253	333	248	433	303	357
Psychiatry	USU	326	426	283	444	352	440
	HPSP	264	387	243	486	313	391

* YOS = Years of Service

** YOP = Years of Practice

6. Causal Impact of USU Attendance

The preceding descriptive analysis shows how the careers of USU SOM graduates differ from the careers of other active duty physicians. However, that analysis does not show the causal effect of attending USU on physician career outcomes. Medical students sort into medical schools based on preferences that may also influence their career outcomes. We would expect students with a greater "taste for service" to be more likely to choose USU, as they are less likely to be deterred by the extensive service obligation. Students that choose USU would perhaps have served just as long, spent just as much time deployed, or had other similar career outcomes had they accessed through another source. Thus, taste for service confounds the effect of USU attendance on career outcomes. Because we cannot observe taste for service, we must employ an econometric strategy to account for this confounding.

A. Econometric Strategy

1. Causal Identification

We employ an instrumental variable strategy to estimate the causal effect of attending USU on years served, whereby we claim an "instrument"—a source of variation in USU attendance that is not otherwise correlated with years served. That source of variation is therefore not confounded by unobserved features, like taste for service.

We claim that the share of medical students from a physician's home of record state that attended medical school out of state ("out-of-state share") is a valid instrument for the probability of USU attendance. To be valid, an instrument must be a significant source of variation in USU attendance and must not otherwise be correlated with the outcome. We expect that out-of-state share captures a variety of state characteristics that are positively correlated with USU attendance. These characteristics may include the selectivity (or lack of existence) of in-state medical schools, the lack of quality of in-state medical schools, and the paucity of in-state medical school scholarship opportunities. Our first-stage estimates will show that out-of-state share is indeed significantly positively correlated with the probability of USU attendance.

We also expect that the state characteristics captured by out-of-state share do not affect active-duty physicians' career decisions, aside from the decision to attend USU. This expectation is fundamentally unverifiable.

We take multiple precautions to increase our confidence in the validity of our instrument. First, we compute out-of-state share for only the 1998–99 school year. Because this year precedes our data, the computed shares cannot represent responses of incoming medical students to changes in their military career preferences or anything else. Out-of-state shares for the 1998–99 school year yield a 0.97 Pearson's correlation coefficient with out-of-state shares computed over all matriculants from the 1998–99 school year through the 2018–19 school year, so we are not concerned about losing information by selecting only the earliest year.

Second, we assign each physician to an out-of-state share using that physician's home of record state. Home of record state is a service member's state of residence when that member joined the military. Unlike state of legal residence, home of record state is immutable over a military career. We observe home of record state for 97.86 percent of physicians. Home of record state will not always match the member's state of residence when he or she applied to medical school. This mismatch will dilute the predictive strength of our instrument. As our first-stage results will show, our instrument is strong regardless.

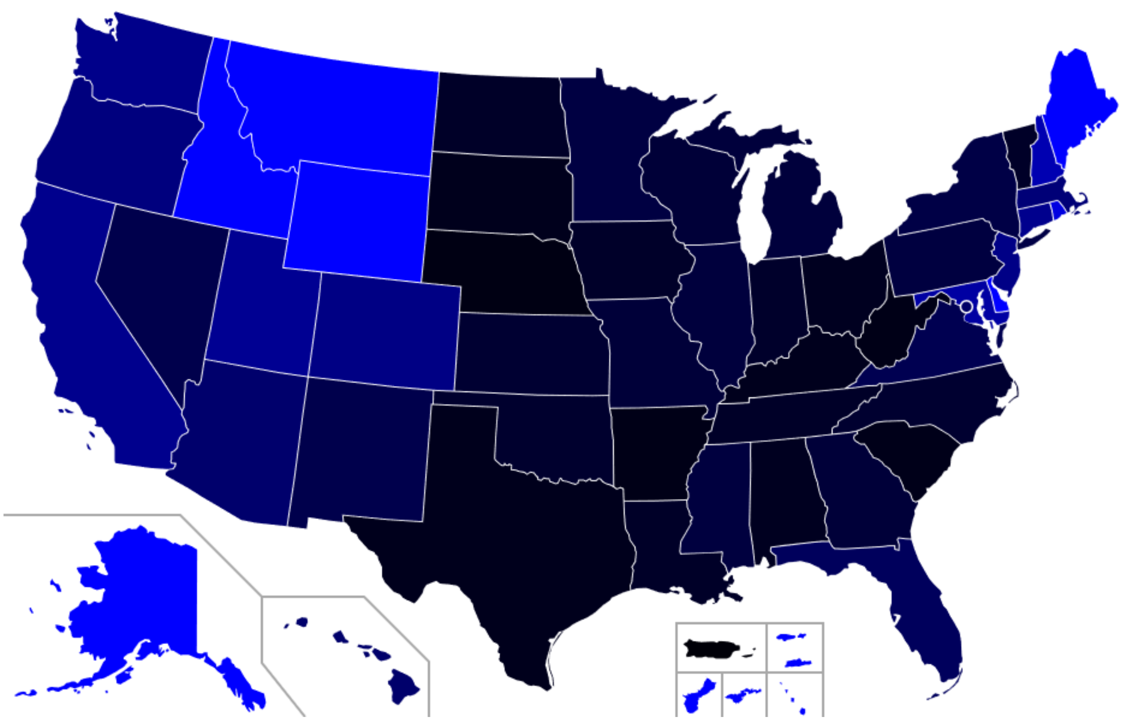
Third, we control for personal features observed in each physician's first month in the data. If personal features are correlated with out-of-state shares and years served they may confound the effect of USU attendance on years served. For example, if individuals who are older when they graduate medical school tend to serve longer careers and also tend to come from states with low out-of-state shares, then our estimates will mistakenly ascribe those longer careers to the low out-of-state shares, biasing our estimate of the effect of USU attendance downward, if we do not control for age. We control for age, prior years of service, and dummy ("one-hot encoded") features for citizenship origin, ethnicity, race, sex, and service branch.

It is possible that there exists a variable correlated both with the instrument and with the outcome in question (years served, years deployed, etc.). A strong correlation could mean that our instrument captures less of the causal effect of attending USU than we think, or even none at all. One possible example would be if students in states with higher out-of-state shares tend to have greater taste for service, which causes them to serve longer regardless of their accession source. Omitting taste for service would then cause the model to misattribute those longer career durations to USU attendance, thereby causing our estimates to overstate the effect of USU attendance on career duration.

To address this possible confounder, we include a control variable representing state-level taste for service. This control variable is the state-level percentage of the service-eligible population serving as non-medical officers in January 2000. Since we limit our data to medical officers accessing from February 2000 through December 2018, there is no overlap between the population used to create the control and the population used to train our model. Since the January 2000 records report home of record state codes for only the 50 US states and Washington, DC, we cannot compute values of the control variable for other areas. Of the 19,949 individuals in our data, 118 have a home of record in one of these other areas. For these individuals, we impute with the mean over all other individuals.

To construct our instrument, we obtained counts of matriculants to U.S. medical schools by medical school, state of residence, and matriculation year from the American Association of Medical Colleges. We mapped each medical school to its location state and computed the share of matriculants from each state that chose an out-of-state medical school. We treated Washington, DC, and Puerto Rico no differently than states for the purpose of computing out-of-state share. We imputed an "out-of-state" share of 100 percent for locations outside the 50 US states, Washington, DC, and Puerto Rico.

Figure 15 maps the geographical distribution of out-of-state share. Out-of-state share is naturally highest in states without a medical school, such as Alaska, Delaware, and Montana. While such states are particularly rural, other highly rural states, such as Arkansas, Nebraska, and West Virginia have low out-of-state shares. Out-of-state share also tends to be higher in geographically small states, though it is near zero in Hawaii and Puerto Rico.



Note: Black represents 0 percent attending out-of-state and light blue represents 100 percent.

Figure 15. Share of Medical School Matriculants Attending Out of State, 1998–99 Academic Year

2. Model Specification

We implement two estimation methods proposed by the econometrics literature. Both methods estimate in two stages. In each first stage, we estimate the effect of the instrument on the probability of USU attendance. In each second stage, we estimate the effect of differences in the probability of USU attendance due to the instrument on years served. We begin by describing the simpler, more traditional two-stage least squares (2SLS) method advocated by Angrist and Pischke.[66] Then we describe our more innovative method that combines the control function estimator proposed by Wooldridge with a neural network (CFNN).[67]

The first stage is an ordinary least squares (OLS) regression of USU attendance on out-of-state share and a set of person-level controls observed in each physician's first month in the data. After estimating the first-stage model, we use it to predict for each physician a probability of USU attendance. These predicted probabilities vary due to differences in out-of-state share and the controls, not due to any other sources of variation that may have a confounded relationship with the outcome. We then use the predicted probabilities as a feature in the second stage, along with all of the same controls as in the first stage, but without the actual binary indicators of USU attendance.

Because our outcomes are right-censored, we must employ a survival model in the second stage. Because we expect the USU effect to vary over different time intervals, we fit a separate model for each observable time interval. The model for time interval t takes as input the set of individuals that survived at served at least t-1 years and for which the outcome (continuation or exit) t years later is observed. The dependent variable is an indicator of survival to year t. The predicted values of these models are the additive inverse of the year-specific hazards. The cumulative product of inverse hazards across years is a vector of annual survival probabilities. Whereas a proportional hazards model would assume that the USU effect is constant over any time interval and a parametric hazards model would assume that the survival probabilities lie on a curve from a pre-specified mathematical family, our model does not restrict the relative values of the USU effects nor the survival probabilities over the vector of time intervals.

The CFNN method differs from the 2SLS method in (1) using a probit specification in the first stage instead of OLS; (2) adding controls derived in the first stage to the second stage instead of replacing the actual USU attendance feature with fitted values; and (3) using a flexible specification in the second stage instead of OLS. Unlike OLS, the probit

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[66] Joshua D. Angrist and Jorn-Steffen Pischke, *Mostly Harmless Econometrics: An Empiricist's Companion,* First Edition, (Princeton, NJ: Princeton University Press, January 4, 2009).

[67] Jeffrey M. Wooldridge, "Quasi-maximum likelihood estimation and testing for nonlinear models with endogenous explanatory variables," *Journal of Econometrics* 182, no. 1 (2014): 226-234.

specification is designed for use with a binary outcome such as USU attendance. After estimating the first stage model, we obtain linear predictions (prior to transformation by the probit link function) and generalized residuals, which we include as features in the second stage. Wooldridge emphasizes the importance of a flexible specification (as opposed to OLS, for example) in the second stage,[68] so we use an extraordinarily flexible specification – an artificial neural network. We train the neural network using the survival loss function of Gensheimer and Narasimhan.[69] The survival loss function effectively implements the multi-model second stage of our 2SLS method in a single neural network model, but with a logit regression specification that is grounded in the survival analysis literature and designed for binary outcomes. The neural network consists of a set of parallel embedding layers, one for each categorical feature, followed by three densely connected hidden layers, followed by a densely connected sigmoid output layer. Each embedding layer outputs a one-dimensional array. Thus, each embedding layer acts as a map from the set of category values to the reals and the embedding layers act as memory- and computation-efficient substitutes for sets of dummy features. Each dense hidden layer has 256 nodes and a rectified linear unit ("ReLu") activation function. For a given observation, the output layer produces an 18-length vector of additive inverse hazards.

3. Estimation

Our methods each produce a vector of annual survival probabilities for an individual with given feature values. By imposing a value of 1 for USU attendance, we can obtain survival probabilities given USU attendance. By instead imposing a value of 0, we can obtain survival probabilities given other accession. Our estimated effect of USU attendance on the probability of serving at least a given number of years is the difference in the predicted probability obtained by imposing USU attendance and by imposing other accession. Our estimated effect of USU attendance on years served is the sum of those differences over all values of years served. The estimated causal effects vary across observations, even for the 2SLS specification, due to the nonlinearity of the cumulative product operator. We estimate the mean effect as the mean of the estimated causal effects over the observations in our data. After obtaining point estimates, we perform 200 bootstrap iterations (i.e., re-estimate the effects after resampling the original data with replacement) to estimate the uncertainty in our estimates due to sample variation, and thereby produce confidence intervals.

An important advantage of our CFNN method is that we are able to estimate the effect of USU attendance on the subpopulation comprised of those who actually attended USU.

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[68] Ibid.

[69] Michael. F. Gensheimer and Balasubramanian Narasimhan, "A Scalable Discrete-Time Survival Model for Neural Networks," *PeerJ* 7:e6257, 2019.

This ability is important because an intervention to preclude USU attendance would not necessarily have the same magnitude of effect on career duration as an intervention to compel USU attendance. Thus, we distinguish the effect of the treatment on the treated from the effect of the treatment on the untreated (where the "treatment" is USU attendance). Our 2SLS method does not allow us to distinguish between these two values. In the context of our study, the effect of the treatment on the treated—how much shorter USU graduates' careers would be if they had not attended USU—is of primary importance. This effect is essential to our estimates in section 7.A.3 of the cost of replacing USU accessions with accessions from other sources.

4. Results

a. Two-stage Least Squares

We begin by describing the 2SLS results. In our first stage, we estimate that a one percentage point higher out-of-state share is associated with a 0.27 percentage point increase in the probability of USU attendance. The F-statistic associated with this estimate is more than 500, which validates our instrument as exceedingly strong. In our second stage, we estimate for each annual time interval two probabilities of serving through that interval—one probability given USU attendance and another probability given non-USU attendance. Since we take the mean of these probabilities over all accessions, and under our assumption that out-of-state share is a valid instrument, these means represent the share of individuals that we would expect to serve the given number of years if those individuals were randomly chosen from all accessions. Figure 16 plots these shares in a comparable format to Figure 8. Since most of the gap in time served displayed in Figure 8 persists in Figure 16, Figure 16 indicates that most of the observed gap represents a causal effect of USU attendance, as opposed to self-selection.

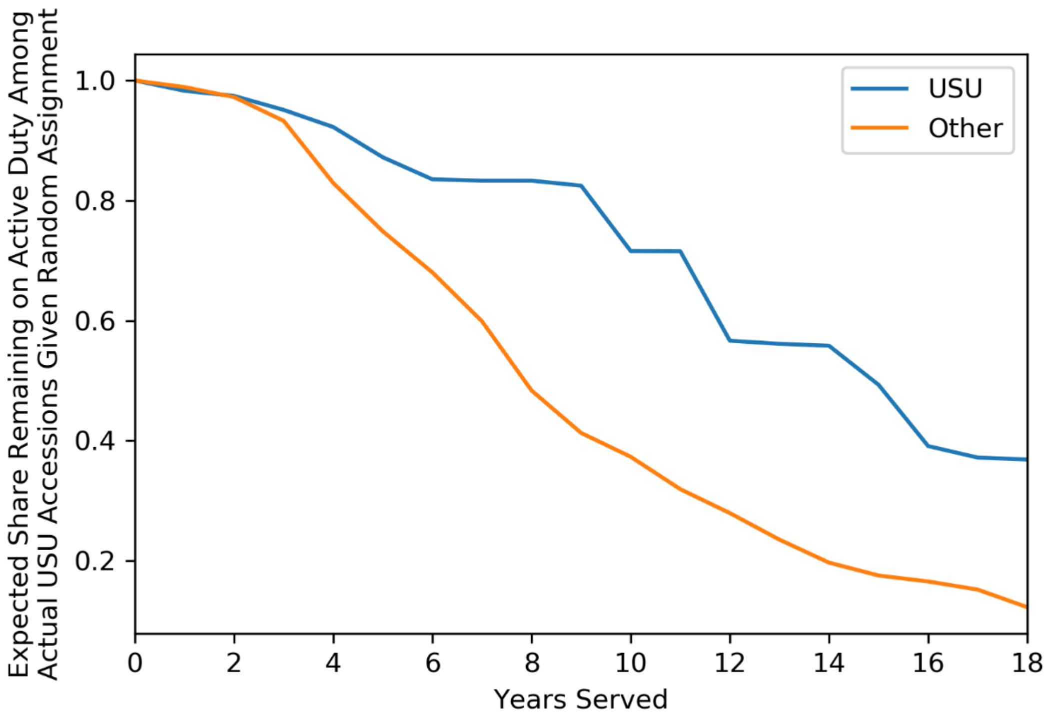

Figure 16. Two-stage Least Squares Estimates of Survival Curves for All Accessions Given Accession through USU versus Otherwise

Figure 17 depicts our point estimates of the mean effects of USU attendance on the probabilities of serving each given number of years, accompanied by 95 percent confidence bounds obtained by bias-corrected bootstrap. The effects rise to a peak of about 40 greater percentage points at the nine-year time interval and noisily trend downward as the intervals increase. The 95 percent confidence intervals lie above zero for all time intervals beyond three years.

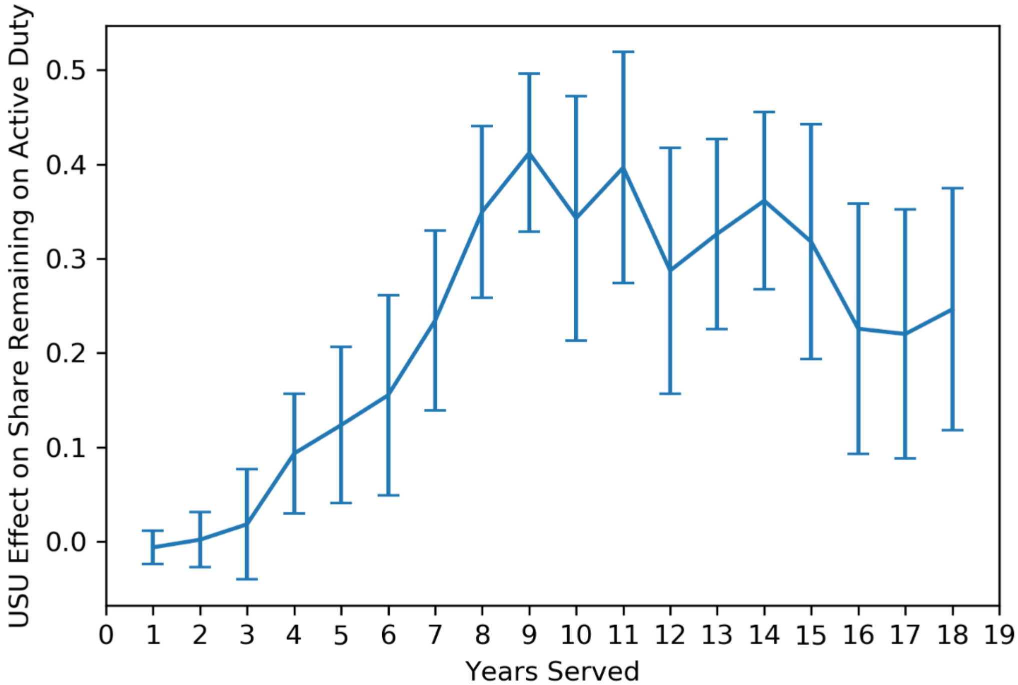

Figure 17. Two-stage Least Squares Estimates of Mean Effects of USU Attendance

The sum of the USU effects over all possible values of years served is the effect of USU attendance on years served. This sum is the area under the curve depicted in Figure 17. Because the effects we estimate are restricted to the first 19 years of a physician's career, we must make an assumption about the effects of USU attendance on the probability of serving any greater amount of years. The most parsimonious assumption we could make is that there are no such effects. With this assumption, we can estimate the effect of USU attendance on years served as the sum of the estimated effects over the 19 years (the entry year plus 18 future years) for which we have estimates. Our estimate understates the effect of USU attendance on years served by the sum of the effects of USU attendance on the probabilities of serving at least t more years for all t greater than 18.

Thus we estimate that USU attendance causes a physician to serve a mean of 4.11 additional years on active duty. We estimate a bias-corrected 95 percent confidence interval on the estimated mean effect of [3.07, 5.91].

b. Control Function Neural Network

In the first stage, we estimate a coefficient of 1.23 on out-of-state share. Due to the probit link function, the estimated additive effect varies with the values of the other features and is not immediately interpretable. Most importantly, and as in the 2SLS first stage, the effect is positive and exceedingly strong, yielding an F-statistic of approximately 484.

Unlike 2SLS, the CFNN method allows us to estimate mean effects specific to those who accessed through USU. Figure 18 plots the mean survival probabilities estimated in the second stage for USU accessions. The upper curve in Figure 18 represents the estimated mean probability of a USU graduate serving at least the given number of years. The lower curve represents the estimated mean probability of a USU graduate serving at least the given number of years if the graduate had accessed otherwise. The CFNN method correctly identifies that USU graduates are very unlikely to serve fewer than ten years (three years of residency plus seven years of minimum service obligation).

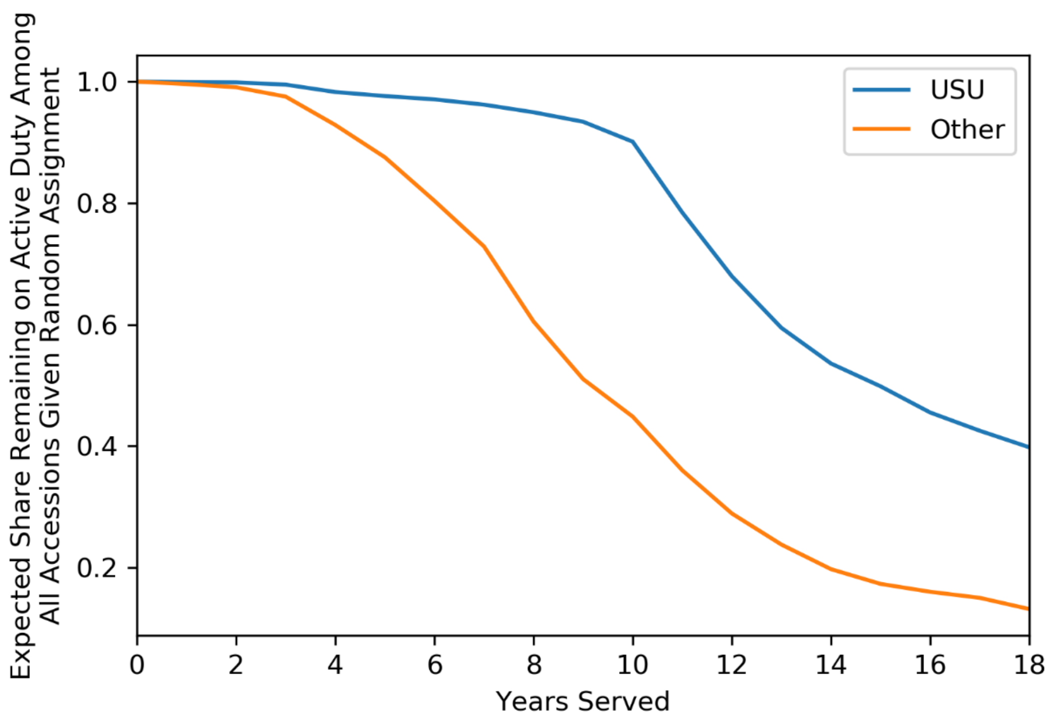

Figure 18. Control Function Neural Network Estimates of Survival Curves for USU Graduates Given Accession through USU versus Otherwise

The gaps between the two curves at each time interval are the estimated effects of USU attendance on the probabilities of serving the given numbers of years. These effects are plotted in Figure 19, along with 95 percent confidence bounds. Similar to the 2SLS estimates depicted in Figure 17, but more smoothly, the effects estimated by CFNN rise through the nine-year time interval and trend downward in later years. All of the 95 percent confidence intervals lie above zero. The sum of the estimated mean effects on USU graduates is 4.48 additional years served and is our estimate of the effect of the treatment on the treated. In other words, if those individuals had been unable to attend USU, they would serve a mean of 4.48 fewer years. The 95 percent confidence interval associated with this estimate is [3.76, 5.15].

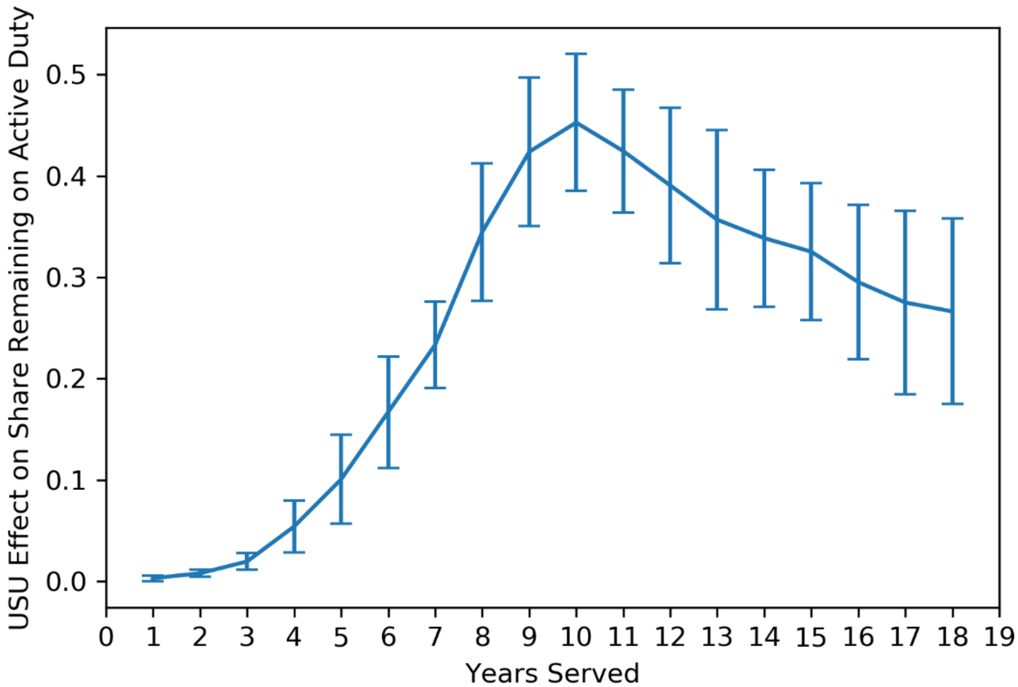

Figure 19. Control Function Neural Network Estimates of Mean Effects of USU Attendance

7. Options for Enhancing the Value of USU and the School of Medicine

As part of this study, USU asked IDA to develop a set of options for enhancing the value of the USU SOM (and the broader university) to the DoD in two areas: (1) improving cost efficiency and (2) enhancing ties to the readiness mission. These options are discussed below.

A. Improving Cost Efficiency and Value to MHS

In this section, we consider scenarios that could improve the cost efficiency of the SOM: increasing the class size and lowering student compensation. We also examine whether closing the SOM would result in large savings (or cost increases) to the DoD. Following our scenario-based cost excursions, we discuss more general ways in which the university might improve its efficiency and provide value to the MHS.

1. Increasing Class Size

Many of the overhead costs associated with operating the school of medicine may be viewed as fixed costs (e.g., faculty, staff, administrators, facilities, etc.). If the SOM's overhead costs are largely fixed, then the marginal cost of adding an additional student may be much lower than the average cost. For instance, if all overhead costs were fixed, the marginal cost of an additional student would be only their student compensation (about one-third of the total average annual cost). In such a situation, increasing class size would lower the average annual cost per student (as the fixed overhead would be spread out over a greater volume of students). While we do not expect all overhead costs to be fixed, many will be in the case of small increases (large class size increases would result in growing overhead costs—hiring more faculty/staff, finding more classroom space, etc.). To explore potential efficiency gains from increasing class size, we estimate the average cost per student if USU increased its class size by 30 students per year (or a total of 120 students). University SMEs felt that the SOM could accommodate this size increase within current staffing and infrastructure constraints without compromising education quality.

To obtain a new average annual cost for the larger student body, we must determine which costs are variable (increasing with the number of students) and which costs would remain fixed. To bound the problem, we considered two scenarios: (1) overhead costs are fixed (represents a lower bound) and (2) overhead costs scale proportionally with the number of students (represents an upper bound). We expect the actual cost to fall somewhere between these bounds. To obtain a best estimate, we sat down with university SMEs and cataloged which costs they believed would increase with each additional student and which would remain fixed (assuming no more than 120 additional students). Examples of costs that were identified as fixed included faculty, staff, and facility costs. Examples of costs that would increase with more students included books, equipment, travel costs for field exercises and rotations, etc. Table 29 shows results of this cost excursion. Our best estimate indicates that the cost per student would drop by approximately $14,000 to $239,000 per year if class size increased by 30 (or 120 students total).

Table 29. Estimated Cost Range Assuming Class Size Increase

	Base Case	OH Remains Constant (Lower Bound)	OH Increases Proportionally (Upper Bound)	OH Increases based on USU SME Estimate
SOM Cost ($1,000,000s)	$287	$300	$323	**$304**
M.D. Education ($1,000,000s)	$175	$186	$203	**$193**
Cost per Student ($1,000s)	**$253**	**$230**	**$252**	**$239**

To understand the net impact on the DoD, we must balance the cost of educating another 120 students against the savings associated with reductions in the required HPSP accessions. Table 30 shows these calculations. By our estimates, adding 30 new students to each cohort would lead to a net increase in USU costs of $20 million. If the increase in USU students was offset by a reduction in HPSP accessions, there could be a net loss or net savings based on the required replacement rate (how many HPSP accessions could be replaced by one USU accession). For example, if HPSP accessions are reduced one for one, we estimate a net increase in cost of $7 million to the DoD.[70] If instead, HPSP accessions were reduced two for one, we estimate a net savings of approximately $5 million. To break even, HPSP accessions would need to be reduced by approximately 48 individuals (a replacement rate of 1.6). This is consistent with a replacement rate based on mean years of service (15 years for USU over 9 years for other accession sources).

70 Calculations are based on four-year HPSP scholarship costs.

Table 30. Total Cost Implications of Increasing USU Class Size

Cost of 30 additional USU Students per year	$28,680,000
Savings for existing students	$ -9,520,000
Net USU increase	**$19,160,000**
Savings from 30 less HPSP Accessions	$ -12,120,000
Net Change	$7,040,000
Savings from 60 less HPSP Accessions	$ -24,240,000
Net Change	$(5,080,000)

Note: Cost and savings are calculated assuming four years at USU or a four-year HPSP scholarship.

One potential concern with this estimate was the assumption that the Services would be able to send additional students to USU or reduce HPSP accessions. If this was not the case, it might make sense for USU to take on civilian students. These students could receive free tuition and a stipend equal to the striped received by GEO students in the SOM, free tuition and no stipend, or could even be charged tuition. In the first two cases, the students would be expected to take on some kind of service obligation. This obligation could be required service in the reserve component or service in federal facilities, such as DoD's MTFs or even VA facilities. Table 31 illustrates how the cost per student would change under the three scenarios outlined above.

Table 31. Estimated Cost Range Assuming Class Size Increase (with Civilians)

	Base Case	**Students at GEO Stipend**	**Students Receive No Stipend**	**Students Charged Tuition**
SOM Cost ($1,000,000s)	$287	$297	$293	**$286**
M.D. Education ($1,000,000s)	$175	$181	$176	**$170**
Cost per Student ($1,000s)	**$253**	**$224**	**$218**	**$210**

Note: All estimates are based on USU SME overhead cost assumptions. We assume a tuition rate of $54,631, the average tuition at non-resident public schools in 2017. *Source: AAMC*

Based on these scenarios, we estimate that admitting civilian students could produce net savings of $3 million (in the charge tuition case) or a net increase of $7 million (in the GEO stipend case). These calculations are based only on changes to USU costs (no HPSP reductions are assumed.)

2. Changing USU Student Compensation

In Chapter 4, we determined that one-third of the annual cost difference between USU students and HPSP participants was explained by student compensation (USU students receive active-duty pay and benefits, while HPSP students are largely compensated with a monthly stipend). Closing this gap could result in annual savings of approximately $48,000 per student year (or $192,000 over a student's education). That's a difference of more than $30 million for a cohort of 170 graduates. While changes in compensation may be worth exploring, we note that they could have considerable impacts on recruitment and retention, depending on their design. The excursions below are only meant to be illustrative of the first-order financial effect of such changes on per-student costs. We note that changing student compensation would require legislative change. USU student compensation is currently governed by 10 U.S. Code 2114, which directs that medical students shall be commissioned officers appointed as regular officers in the grade of second lieutenant or ensign (O-1) and serve on active duty in that grade.

If legislative relief were possible and altering student compensation was determined to be desirable, there are several models that USU could adopt. For instance, USU students could be reclassified as cadets while they are in medical school and receive their commissions upon graduation (paralleling the model used by the Service Academies). Alternatively, they could attend USU as civilians, receiving the stipend received by GEO students. Lastly, they could attend USU on reserve status and be compensated with a stipend (receiving active-duty pay only when activated for ADT, like HPSP participants). Table 32 illustrates these cases. The results indicate that savings would likely fall in the $30 to $50 million range.

Table 32. Potential Savings from Reducing Student Compensation Costs

Scenario	Compensation Costs (1,000,000s)	M.D. Education Costs (1,000,000s)	Cost Per Student Year (1,000s)	Savings Per Cohort (1,000,000)
Base Case	$63	$175	$253	-
Cadet Composite Rate	$13	$125	$181	$49
Cadet Composite Rate with O-1 BAH	$29	$141	$205	$33
GEO Stipend	$26	$138	$201	$36
HPSP Stipend and Active Duty Pay	$25	$136	$198	$38

3. Shutdown Analysis

In this section, we consider the cost implications of two shutdown scenarios: (1) closing the USU SOM and (2) closing the entire university. Closing the SOM (or just the M.D. pipeline) while keeping the remainder of the university open may not be a realistic scenario. However, we believe it has illustrative value—particularly for demonstrating the potential savings range associated with shutting down just M.D. education. The second scenario considers the cost implication of closing the entire university. For this analysis, we focus on estimating the savings of shutting down the university, paying close attention to costs that would transfer to another DoD entity. Many of the activities that would transfer are either driven by a DoD requirement or represent research dollars.

a. SOM Closure

Closing the SOM would reduce USU's operating cost and generate savings to DoD. However, HPSP physician accessions would have to be increased to offset the loss in USU accessions. To estimate the net impact of closing the SOM, we must estimate savings associated with closing and HPSP cost increases.

To estimate the impact of closing the SOM, we consider two scenarios:

- **Complete SOM closure with shared costs adjusting proportionally:** Under this scenario, all research, service, and education in the SOM (M.D. and graduate education) is ended. University shared costs are reduced proportionally to account for the loss of all SOM students. This scenario represents an upper bound on potential savings.
- **Shutdown of M.D. pipeline with shared costs adjusting proportionally:** Under this scenario, SOM research, service and graduate education is maintained. Shared costs are reduced proportionally to account for the loss of M.D. students

Table 33 illustrates the range of SOM shutdown savings for the three scenarios. The first column shows the current USU costs, while columns two and three show the estimated savings for each scenario. The most conservative scenario produces savings of approximately $170 million, while the most optimistic scenario produces savings of $287 million.

Table 33. School of Medicine Shutdown Analysis ($M)

	Baseline USU Cost	SOM Shutdown	M.D. Pipeline with SS
O&M, RDT&E, PROC	349	170	92
MILPERS (Students)	90	67	63
MILPERS (Faculty and Staff)	74	46	14
Facilities	9	4	0.4
Total	**521**	**287**	**169.4**

To estimate the cost impact of increasing HPSP accessions, we must determine the replacement rate. Given that USU graduates have higher than average retention rates, we would not expect a one-for-one replacement rate. Table 34 shows the estimated increase in HPSP costs for a range of replacement rates. The replacement rate consistent with the six-year retention difference is 1.6. However, we estimate that only 4.48 years of the observed retention difference is casually attributed to USU. If we base our replacement rate on this factor, we obtain a rate of 1.45. Based on this range of replacement rates, we estimate that it would cost between $80 and $110 million annually to increase HPSP accessions to make up for the loss of USU graduates. We note that these estimates assume HPSP accessions could be easily increased at the same cost. The may not be a fair assumption. A recent House panel called together senior leadership from the Services to discuss recruiting and retention challenges, particularly in the face of a strong civilian job market. The physician labor market is not immune to these larger economic forces and should be carefully considered when considering changes to accession channels.

Table 34. Estimate Annual Increase in HPSP Costs

Replacement Rate	Additional HPSP Accessions	Total Cost ($M)
1	170	$69
1.2	204	$82
1.3	213	$86
1.45	246.5	$100
1.6	272	$110

Note: The total cost is the cost of funding the given number of additional four-year HPSP scholarships.

These costs will offset a significant share of the expected savings from closing the SOM. In the most optimistic scenario, savings would decrease from $287 million to roughly $200 million. However, this assumes that all SOM costs would be eliminated rather than transferred. In the following section, we discuss which university costs would likely truly be eliminated versus transferred elsewhere to meet remaining DoD research and education requirements.

b. Full Closure and Cost Elimination versus Cost Transfer

Some costs under any of the shutdown scenarios will not be totally eliminated, but rather transferred to another entity within the DoD. Using USU budget data, IDA estimated which costs could likely be eliminated versus transferred. Departmental funds (i.e., Graduate Education Office, Department of Pediatrics, etc.) that directly relate to education were deemed to be costs that would be eliminated in the shutdown scenarios. Similarly, some shared costs would be eliminated by a USU or SOM shutdown. Other costs, particularly research grant funding, if not awarded to USU, would be awarded elsewhere (another DoD or civilian institution). Faculty military billets would not be eliminated outright, but rather transferred back to the Services where they are most needed. Student billets, however, would likely be eliminated. To provide a more comprehensive picture of the shutdown cost savings, Table 35 provides estimates of costs that would be eliminated or costs that would be transferred (or remain) under each of the shutdown scenarios. This analysis shows that shutting down USU would result in only partial savings. Estimates suggest as much as half of the costs would transfer. For these analyses, we exclude any savings or transfer of facility costs.

Table 35. Shutdown Analysis – Estimates of Savings and Cost Transfers

	USU Shutdown	SOM Shutdown	M.D. Pipeline Only
Costs that would be eliminated			
O&M, RDT&E, PROC	$172,527,321	$70,005,171	$36,114,861
MILPERS-Student Costs	$90,035,886.40	$66,873,647.40	$62,667,557.40
Total	**$262,563,207**	**$136,878,818**	**$98,782,418**
Costs that would be transferred or remain			
O&M, RDT&E, PROC	$176,320,598	$99,761,788	$84,372,715
MILPERS-Faculty and Staff	$74,286,535	$46,175,195	$16,161,318
Total	**$250,607,133**	**$145,936,983**	**$100,534,033**

Note: Facilities costs are not included in the above analysis.

This analysis implies that a full closing of the SOM would generate about $140 million in true cost savings. If the lost USU graduates were replaced with HPSP accessions, savings would fall to about $40 million. This estimate ignores the cost of replacing other non-M.D. students in the school of medicine, and may therefore be overstated.

4. Other Options for increasing USU's cost efficiency and value to the MHS

As previously discussed, operating a university is a high-cost business with significant overhead requirements (e.g., maintaining faculty, staff, and administrators; maintaining a campus equipped with state of the art classrooms, research laboratories, and simulation centers; maintaining the institutional and programmatic accreditation required to grant academic credit and degrees, etc.). Over time, USU has leveraged its resources to expand its mission areas into graduate nurse education, dental education, and most recently undergraduate education for enlisted personnel through the CAHS. We believe this growth enhances the university's economic efficiency and value to the MHS, even though it increases the university's total cost. For instance, the CAHS now grants academic credit and degrees to enlisted personnel for training they complete at METC and elsewhere. Prior to the establishment of the CAHS, the Services often paid civilian institutions to grant these degrees.[71] This growth may also help explain how the per-medical-student cost has remained approximately the same in real terms over the past 16 years.

Below, we discuss several options that would allow the university to further leverage its resources and capabilities to provide additional value to the MHS. We note that, while these options would likely increase the university's total operating costs, they could improve its efficiency (i.e., cost per student) and overall value to the MHS. Additional analysis would be required to determine the financial impact of these options.

a. Expand Degree Offerings

One item raised by SMEs was the potential to expand USU degree offerings. Additional educational programs that leverage existing faculty, curriculum, etc., may have relatively low marginal costs and allow the university to spread its fixed overhead costs over a larger student population. Some opportunities we discussed included:

- **Emergency Room Nurse Practitioners:** In discussions with USU GSN leadership, IDA learned that the Army expressed a desire to establish an Emergency Nurse Practitioner (ENP) program at USU. This specialty of advanced practice nursing is a growing field and would fill critical gaps for both the beneficiary and operational missions. These nurses specialize in higher-acuity patient care and management. As ENP programs largely build upon

[71] David DeKunder, "Opportunities Expand for METC Graduates to Further Education," February 22, 2017, https://www.jbsa.mil/News/News/Article/1090279/opportunities-expand-for-metc-graduates-to-further-education/.

Family Nurse Practitioner (FNP) programs, IDA believes USU could meet this need. USU has continuously operated its FNP program since 1993.

- **Physician Assistant (PA) Degrees for Special Forces:** Section 735 of the NDAA for the 2019 NDAA entitled "Pilot Program on Earning by Special Operations Forces Medics of Credit Toward a Physician Assistant Degree" calls for a pilot program to assess the feasibility of a partnership between Special Operations Forces (SOF) and institutes of higher education to allow SOF medics to earn academic credit. Currently, USU has been assigned oversight of the pilot program and discussions between stakeholders have already begun.[72] IDA believes this partnership could be an effective use of degree-granting capacity at CAHS (to award credits toward the requisite bachelor's degree to allow enrollment at a PA school) and potentially an expansion of the degree offerings for the SOM (much of the core coursework is similar across the GSN and SOM). Students in other degree programs at USU could benefit from the operational experience of the SOF students.
- **Additional degrees for enlisted medical personnel training enrolled in METC and other Service-run training programs:** The USU CAHS has a strong ties to the METC, the main provider of initial enlisted medical training. Currently, 38 programs at METC are requested for phase-in over the next three to four years and 11 METC programs currently offer credit.[73] The CAHS has also received requests from each Service to collaborate and award credit. To support this, CAHS has established two additional Other Instructional Sites. These are the US Air Force School of Aerospace Medicine (USAFSAM) in Dayton, OH (Critical Care Air Transport Team), and the Army Medical Department Center of Excellence (AMEDDCoE) in San Antonio, TX (Health Physics). Other areas of support request include the Army/Navy Joint Operations Medical Training Center (JSOMTC) in Fayetteville, NC (Special Operations Combat Medic/Corpsman and Special Forces Medical Sergeant/Corpsman), additional programs at MEDCoE (Licensed Vocational Nurse, Veterinary Technician and Veterinary Food Inspection Specialist), and Navy Medicine Education Training and Logistics Command (NMETLC) in San

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72 Under Secretary of Defense, Personnel and Readiness, "Pilot Program on Earning by Special Operations Forces Medics of Credit toward a Physician Assistant Degree," (Washington, DC: Department of Defense, April 1, 2019), https://www.health.mil/Reference-Center/Congressional-Testimonies/2019/04/01/Pilot-Program-on-Earning-by-Special-Ops-Forces-Medics-of-Credits-Towards-A-PA-Degree.

73 See Sarah John et al., *Feasibility Study for the Consolidation of Military Medical Education and Training Organizations, Functions, and Activities*, for more detail on the CAHS/METC alliance.

Antonio, TX (Independent Duty Corpsman).[74] The provision of transcripts and academic degrees to enlisted medical personnel provides recruitment and retention incentives and benefits; increases readiness-required credentialing; and significantly enhances interdepartmental transition or post-service employment needs and opportunities. USU directly awarding credit also avoids costs associated with paying civilian institutions to grant the degrees. These programs also help the department address challenges associated with "degree creep," the rising degree and certificate requirements for allied health professionals occurring in the civilian sector. USU continues to receive new requests from the Services and METC.

- **Expand degree programs for other federal partners:** The Public Health Service currently sends several students to the USU SOM and GSN. These students then go on to work in health positions in other federal health systems, like the National Institutes of Health (NIH), Indian Health Service (IHS), Coast Guard, etc. Some of these systems, particularly the IHS, face difficulty in attracting providers.[75] It may be possible for these federal agencies to sponsor a few select students to attend USU in exchange for service commitments.

b. Expand Field Exercise Training to non-USU students

The USU SOM has a well-developed series of field exercises that it offers to its medical and nursing students. Operation Bushmaster is the most well-known of these, and students and graduates routinely discuss its value. In coordination with Service HPSP leaders, USU could provide military medical training opportunities similar to Operation Bushmaster for HPSP students during ADT periods. For instance, USU could set up several regional events that would bring together a large groups of HPSP students for one week over the summer to participate in realistic medical field exercises.

This would increase the exposure of HPSP students to military medical training and leadership. Residents in the FAP program could also participate in field exercise events. Expanding the availability of existing military training opportunities would further leverage the expertly developed curriculum more widely across the MHS. These courses could improve medical readiness and military acculturation for HPSP students who have little connection to the military during their civilian education. Such events could also have recruiting and retention benefits.

[74] Department of the Army, Special Warfare Medical Group (Airborne), "Request for Academic Collaboration," memorandum, March 26, 2018.

[75] GAO, "Additional Actions Needed to Address Gaps…"

c. Leverage existing Distributed Learning Capabilities

USU has existing distributed learning (DL) capabilities. Some of these resources could be leveraged more widely across the MHS education and training enterprise. For instance, the Dean of the SOM discussed the opportunity of strengthening HPSP education with a DL program in Military Medicine and Leadership. Similar opportunities could be offered to reserve component providers or to forward deployed personnel at the combatant commands.

d. Explore Consolidating MHS education programs at USU

There may also be options for consolidating certain MHS education programs with existing USU programs to gain economies of scale and standardize the curriculum. A recent study on consolidating MHS education and training explored this topic and found several opportunities.[76] For example, USU and the Army Medical Department Center and School both run a doctoral-level nurse anesthesia program. Consolidating these programs under USU could reduce overhead costs and standardize training. The report also discussed the possibility of merging the METC with the USU CAHS and merging Service-run graduate degree programs under a USU Graduate School of Public Health. Additional analysis would be required to develop estimates of the full financial impact of these consolidations.

e. Create a Common MHS Physician Application Process

The need for a standardized military physician application process came up several times in discussions with university and HPSP personnel. Most prospective medical students (USU and HPSP) begin the application process through the American Medical College Application Service (AMCAS) common application that allows them to apply to numerous schools with just one application. While USU is included in AMCAS, students wishing to attend must also submit a secondary application to the university. Students wishing to participate in HPSP must apply to each Service's scholarship program separately. As many students apply to multiple service HPSP programs concurrently, scholarships often go unfilled, due to the same student being selected across multiple Service or USU programs. If program withdrawal notification is made late in the cycle, Service recruiters may not be able to fill newly available scholarships. In addition, applicants that are not admitted to USU are not automatically considered for HPSP. Currently USU receives nearly 3,000 applications per year and has an acceptance rate of approximately 5 percent. Applicants who were willing to consider a seven-year service obligation at USU should automatically be considered for an HPSP scholarship. By

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[76] Sarah John et al., *Feasibility Study for the Consolidation of Military Medical Education and Training Organizations, Functions, and Activities*.

consolidating the HPSP and USU processes into a single application where students indicate Service preference, fewer scholarships could potentially go unfilled while improving the efficiency and transparency of student selection. USU faculty and staff have begun developing a joint application process concept, which could prove beneficial to the MHS.

f. Establish an Academic Health System (AHS)

Section 724 of the proposed 2020 NDAA directly calls for "The Establishment of an Academic Health System in the National Capital Region." This provision would drive the creation of a formal system to integrate health care, health professions education, and health research of the MHS in the National Capital Region (NCR).[77] While such a health system has been in the works since at least 2016, inclusion in the NDAA could catalyze real progress toward its establishment.[78]

AHSs represent partnerships between accredited higher education institutions, health professions schools, and health care providers. They also play a key role in the education and training of the future health workforce by bridging research and clinical practice. The most transformational opportunities for innovation come at the nexus of translational research, where bench meets bedside. AHSs therefore offer an ideal environment to foster research, education, and training, while bringing together interdisciplinary teams of scientists, clinicians, and administrators to improve population health.

Building an AHS would allow USU to play a more central role in the broader MHS. An AHS in the NCR would formally integrate education and research into clinical care; educate, train, and professionally develop the medical force across the continuum of service members' careers; provide opportunities for academic and professional career progression; more easily allow for partnerships with civilian hospitals, VA health care facilities, and national research centers; and leverage shared resources and best business practices, such as shared learning and research resources, distance learning, faculty development, and academic pricing.

For USU, closer partnerships with both NCR MTFs, as well as other federal health care and civilian facilities, would provide valuable opportunities for students and faculty. Under an AHS model, overarching affiliations and agreements could streamline student training experiences and practicums, research approval processes, and faculty dual

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[77] United States Senate, "National Defense Authorization Act for Fiscal Year 2020," S. 1790, Report no. 116-48, 2019, https://www.congress.gov/116/bills/s1790/BILLS-116s1790rs.pdf.

[78] Uniformed Services University and Defense Health Agency, "Memorandum of Agreement to Establish the National Capital Region Academic Health System between the Uniformed Services University of the Health Sciences and the Defense Health Agency National Capital Region Medical Directorate," memorandum, April 8, 2016.

appointments. The greater degree of integration and flexibility would encourage interdisciplinary and interagency cooperation, enabling the university to widen its impact and attract a diverse, world-class faculty. The AHS could also augment MHS analytic capacity to the benefit of both education and training at USU and in the GME programs, as well as DHA leadership. While we believe the creation of an AHS could offer many benefits to the MHS, we believe it would be necessary to include a clear plan for increasing access to a sufficient case mix to support readiness with a particular emphasis on trauma patients. This could be achieved by establishing Walter Reed National Military Medical Center as a state level II trauma center (allowing it to receive civilian trauma patients) or by forming strategic partnerships with regional civilian trauma centers.

B. Enhancing USU's Value to the Readiness Mission

The MHS is currently undergoing a large, congressionally directed transformation.[79] One of the central themes of the transformation has been increasing the focus on the medical-readiness mission and medical-readiness training. This direction stems from a growing body of evidence that highlighted: (1) the misalignment of the medical force toward beneficiary care specialties (e.g., pediatricians, OB/GYNs) and shortages in key operational specialties (e.g., general surgeons, anesthesiologists) and (2) a critical gap in the case mix and volume required for peacetime-readiness training and maintenance of provider clinical currency and the workload available in the MHS. This literature includes: the 2008 Medical Readiness Review, 2015 Final Report of the Military Compensation and Retirement Modernization Commission, the National Academies of Sciences, Engineering, and Medicine (NASEM) 2016 report titled "A National Trauma Care System: Integrating Military and Civilian Trauma Systems to Achieve Zero Preventable Deaths After Injury" and a series of other reports by IDA, GAO, and CNA.[80]

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[79] See Sarah John et al., *Feasibility Study for the Consolidation of Military Medical Education and Training Organizations, Functions, and Activities* for a detailed discussion of congressionally directed MHS reforms.

[80] See reports: Department of Defense, *DoD Force Health Protection and Readiness—A Summary of the Medical Readiness Review, 2004–2007,* Force Health Protection and Readiness Policy and Programs, June 2008, FOUO; Military Compensation and Retirement Modernization Commission, "Report of the Military Compensation and Retirement Modernization Commission," January 2015; National Academies of Sciences, Engineering, and Medicine, "A National Trauma Care System: Integrating Military and Civilian Trauma Systems to Achieve Zero Preventable Deaths after Injury," June 17, 2016; John E. Whitley et al., *Essential Medical Capabilities and Medical Readiness,* IDA Paper NS P-5305, (Alexandria, VA: Institute for Defense Analyses, July 2016); Philip Lurie et al, *Medical Readiness within Inpatient Platforms,* IDA Paper P-8464 (Alexandria, VA: Institute for Defense Analyses, August 2017); John E. Whitley et al., *Medical Total Force Management,* IDA Paper P-5047, (Alexandria, VA: Institute for Defense Analyses, May 2014); John E. Whitley et al., *Medical Total Force Management: Assessing Readiness and Cost*, IDA Paper P-8805, (Alexandria, VA: Institute for Defense Analyses,

Chapter 3 of this report identified several readiness-focused activities conducted by the SOM and broader university, including military-specific curriculum, military-focused research, and military medical-training exercises. In addition, in Chapter 6 we found that USU graduates deploy at higher rates than non-USU graduates and that USU graduates are overrepresented in special operation units. Both findings highlight USU's contribution to the readiness mission. However, we also found that USU students do not appear to select into critical readiness (or wartime) focused specialties at a higher rate than HPSP graduates.[81] This is partially due to the fact that USU and DoD GME programs are constrained by the case mix available in the MTFs, which is more heavily weighted toward beneficiary care specialties like family practice and OB/GYN. Finally, upon examination of the USU research portfolio and centers, we found military-focused research topics (e.g., traumatic brain injury (TBI), post-traumatic stress disorder (PTSD), infectious disease) but also topics that are less relevant to operational requirements (e.g., breast cancer, prostate cancer, lung cancer, diabetes, pediatrics, etc.) To increase USU's ties to the readiness mission, the university could consider the following options:

a. Build a Military-Civilian Trauma Partnership in the NCR Region

The lack of access to a readiness-relevant case mix, particularly in trauma and emergency medicine, presents challenges for accessing physicians into these critical specialties. IDA spoke with SMEs from the MHS and civilian trauma sector who described how a medical student's residency specialty choices are shaped. SMEs discussed how a student's experiences in clinical rotations, their faculty mentors, their test scores, and the GME positions available greatly influence their choices. This implies that USU students will be more likely to select critical readiness specialties if they are exposed to the right clinical rotations, have experienced faculty mentors, and are provided with sufficient GME opportunities in these fields.

USU could take a leadership role in addressing this challenge in the NCR by forming trauma partnerships with regional high-volume trauma centers.[82] Military-civilian trauma partnerships have been growing over the last decade and currently include several types of arrangements, including:

May 2018); and Kara Mandell et al., "Measuring and Improving Currency in the Navy Emergency Medicine Enterprise," (Alexandria, VA: CNA, September 2016) for in-depth treatment of this subject.

[81] GAO, "Additional Actions Needed to Address Gaps..."

[82] Level I and II trauma centers are the highest volume trauma facilities. Hospitals may be designated as level I or II facilities by the state in which they operate or the American College of Surgeons. Only state designation ensures that the facility will receive civilian trauma patients through the civilian trauma-regulating system.

- **Just-in-time Arrangements with Civilian Trauma Facilities:** Each Service currently operates just-in-time training for medical personnel at level I civilian trauma facilities. These courses are generally several weeks and trainees rotate through on temporary duty assignment (TDY) assignments (often pre-deployment). Military teaching staff are assigned to these locations for two- or three-year PCS orders. See *Medical Readiness within Inpatient Platforms* for a detailed discussion of each Service's program.[83] We note that one of the Air Force's Centers for the Sustainment of Trauma Readiness Skills (C-STARS) programs is located at the R Adams Cowley Shock Trauma Center, a regional trauma facility in Baltimore, MD.
- **Full-Time Arrangements with Civilian Trauma Facilities:** Military providers (or teams of providers) may also be stationed at civilian facilities on a more permanent basis. For example, the Air Force Special Operations Surgical Team –Special Operations Critical Care Evacuation Team (SOST-SOCCET) is currently stationed at the University of Alabama at Birmingham's (UAB's) level I trauma center, where they work as fully privileged staff members.[84] The Army has also begun stationing small teams of providers in civilian trauma centers at multiple sites, including Cooper University Health Care in New Jersey and the Oregon Health and Science University.[85]
- **Civilian Trauma Patients in Military Facilities:** Military facilities may work with regulators to become state-designated trauma centers (a requirement for joining the state trauma-regulating system and receiving patients). Currently, the San Antonio Military Medical Center (SAMMC) in Texas is the only MTF that is a state-designated level I trauma center. Camp Lejeune in North Carolina recently became a state-designated level III trauma center.[86]

These arrangements have received strong Congressional support. The 2017 NDAA contained several provisions promoting the formation of such partnerships. These included Section 706, which directed the establishment of high-performance military-civilian integrated health delivery systems, and Section 717, which directed the department to begin

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[83] Philip M. Lurie et al., *Medical Readiness within Inpatient Platforms*.

[84] Bob Shepard, "Air Force Special Ops Medical Team Calls UAB Home," November 2, 2011, https://www.uab.edu/news/health/item/1794-air-force-special-ops-medical-team-calls-uab-home.

[85] Elizabeth Hayes, "Why military trauma specialists are integrated into OHSU medical teams," *Portland Business Journal*, January 22, 2019, https://www.bizjournals.com/portland/news/2019/01/22/why-military-trauma-specialists-are-integrated.html.

[86] Naval Medical Center Camp Lejeune, "Naval Medical Center Camp Lejeune Becomes First Level III Trauma Center in the Navy," January 24, 2019, https://health.mil/News/Articles/2019/01/24/Naval-Medical-Center-Camp-Lejeune-becomes-first-Level-III-Trauma-Center-in-the-Navy.

treating civilian patients for the purpose of obtaining a readiness case mix. The 2018 "Mission Zero Act" also supported military-civilian partnerships by providing grants to trauma centers that would allow military trauma-care providers and trauma teams to train in their facilities.[87]

To date, the NCR does not have a military-civilian trauma partnership in place. Walter Reed is not a state-designated trauma center, though it is designated as a level II trauma center by the American College of Surgeons (ACS). Though attempts have been made to integrate Walter Reed into the civilian trauma system, the DoD and the state of Maryland have not reached an agreement that would allow Walter Reed to accept civilian trauma patients from the MedStar Washington Hospital Center, which serves the DC area, or the nearby Suburban Hospital. This is largely due to the number of civilian trauma centers already serving the area and their need to maintain patient volumes.[88] Despite the area's extensive coverage of trauma centers, there may still be opportunities for partnerships. For instance, MedStar Washington Hospital Center has had continued challenges with safety, budget cuts, and emergency room overcrowding.[89] In fact, MedStar Washington Hospital was the only hospital in the DC/Northern Virginia region to receive a safety grade of D in the LeapFrog Group's 2018 Bi-Annual Hospital Safety Ratings.[90]

If an agreement cannot be reached to allow Walter Reed to receive civilian patients from the area, there are still opportunities for partnerships. Leadership from USU and the NCR could develop arrangements like the just-in-time and full-time military-civilian trauma training programs discussed above. For instance, USU should explore developing programs in which USU faculty teach clinical rotations in the busy regional trauma centers like Washington Hospital Center or Baltimore's R Adams Cowley Shock Trauma Center. USU may also consider partnerships with local medical schools that already have arrangements with these facilities (e.g., Georgetown University, George Washington University, and the University of Maryland). These arrangements could help increase USU student exposure to the fields of trauma and emergency medicine and create better clinical

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87 United States House of Representatives, "Military Injury Surgical Systems Integrated Operationally Nationwide to Achieve Zero Presentable Deaths Act," H.R. 880, Report no. 115-330, 2017, https://www.congress.gov/bill/115th-congress/house-bill/880.

88 For a detailed discussion of the Maryland/DC/Northern Virginia Trauma System, see Philip M. Lurie et al., *Medical Readiness within Inpatient Platforms*.

89 Jayne O'Donnell, "Official trauma hospital for D.C. power brokers cuts costs amid sewage leaks, safety problems," *USA Today*, September 13, 2017, https://www.usatoday.com/story/news/politics/2017/09/13/official-trauma-hospital-dc-powerbrokers-cuts-costs-amid-sewage-leaks-safety-problems/608083001/.

90 Leapfrog Group, "Hospital Safety Grade, MedStar Washington Hospital," Spring 2019, https://www.hospitalsafetygrade.org/search?findBy=hospital&zip_code=&city=&state_prov=&hospital=MedStar+Washington+Hospital.

practice opportunities for faculty in these fields. Such partnerships will likely be required to expand USU's degree offerings in readiness-focused fields, such as emergency room nurse practitioners. Finally, building more partnerships will also support the National Academy of Sciences, Engineering, and Medicine's vision for building an integrated military and civilian trauma system. While there are many bureaucratic and legal constraints to work through, there are also many existing partnership models to learn from, as well as strong Congressional support.[91]

In addition to forming military-civilian trauma partnerships in the NCR, USU could create a research or innovation center focused on the strategic implementation and evaluation of military-civilian trauma partnerships across the broader MHS. The center could track and evaluate existing partnerships and explore opportunities for new partnerships. It could also help to standardize and streamline the processes currently being used by the Services to form partnerships.

b. Take a Leadership Role in the National Trauma-Care System

The 2016 NASEM report on building a national trauma-care system has gained a great deal of support from the trauma community. Faculty and leadership from USU have played a role in promoting this effort and continue to do so.[92] A 2017 paper[93] co-authored by USU faculty discussed some of the obstacles with establishing a national trauma-care system and possible implementation strategies. Two of the most significant barriers cited were the lack of long-term federal funding and the absences of a federal home for and commitment to trauma research. Specifically, the authors argue, "to address one of the major barriers to securing a consistent, sustainable federal appropriation for trauma research, the stakeholders believe that a federal home for trauma research needs to be identified, created, and supported." They also describe a debate over whether the federal home for trauma and injury research should reside with the NIH or DoD. While the consensus of the experts ruled that the NIH would be the optimal home, we believe USU seeks to play a more dominant role. For instance, USU could form a partnership with the NIH Institute for Trauma Research and work to build the nation's preeminent trauma research center of excellence and the federal home for trauma research. In a leadership role, USU could help set the research agenda and priorities for the national trauma-care system and ensure that they represent DoD's priorities. The military-civilian trauma partnerships discussed above

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91 The 2017 NDAA directed the treatment of civilians in DoD MTFs.

92 Todd E. Rasmussen, "A National Trauma Care System: From Call to Action," *Journal of Trauma and Acute Care Surgery* 81, no. 5 (2016): 813–15; and Todd E. Rasmussen and Arthur L. Kellermann, "Wartime Lessons — Shaping a National Trauma Action Plan," *New England Journal of Medicine* 375, no. 17 (2016): 1612–15.

93 Philip M. Lurie et al., *Medical Readiness within Inpatient Platforms.*

would help further promote the national trauma system vision and better enable the university to expand their trauma research capabilities.

c. Ensure that USU Research Centers and Programs Support the Readiness Mission

Research drives the future of clinical care and medical practice. As previously discussed, USU is home to numerous research centers and programs (see Appendix A for summary). Today, the research portfolio supports both the readiness mission (e.g., infectious disease, TBI/PTSD, bleeding control, etc.) and the beneficiary care mission (cancer, diabetes, pediatrics etc.). USU should work with MHS leadership to ensure that the university's research portfolio prioritizes the most essential military-unique research requirements. USU could work with the Department to develop a taxonomy for the military-unique medical research agenda and priorities. The university could improve transparency on its contribution to the research agenda by reporting on the share of research dollars that go to projects in different research areas (e.g., combat casualty care, prolonged field care, TBI/PTSD, infectious disease) and into other topics. Data on the number of patents, products, and lessons learned could also be tracked.

By increasing the share of research that is military unique or operationally focused, the university can provide greater readiness value to the MHS and also attract students and faculty most interested in working in these fields. USU has a competitive advantage, in that many faculty have valuable operational experience in both clinical and command positions. This unique human capital does not exist at similar medical schools or research institutions. USU should encourage collaboration across centers and academic departments to advance research in combat casualty care, trauma, and emergency research to further the university's prominence in these fields and the national trauma-care system vision.

8. Findings and Recommendations

A. Summary of Findings

Below, we summarize key findings from the cost and value assessments and the options for enhancing USU's value to the DoD.

1. Cost and Value Assessment Findings

- **On a per student cost basis, USU is the most expensive accession source:** We estimate that it costs the DoD approximately $253,000 per year (or more than $1 million total) to directly educate an M.D. though the USU SOM. This is approximately 2.5 times greater than the average annual cost of the HPSP program, which provides education through civilian medical schools ($101,000 per year, or $400,000 for a four-year scholarship). Finally, both USU and HPSP are more costly than the FAP program, which targets residents who have already completed their medical school training (by 3 and 1.2 times, respectively).
- **One-third of the per-student cost difference is explained by student compensation:** USU students receive full active-duty pay and benefits (at the grade of O-1), while HPSP participants are largely compensated through monthly stipends. The remaining two-thirds cost difference is explained by the fact that USU bears the full overhead cost associated with educating medical students (not just tuition and fees) and the fact that USU provides an extra 700 hours of curriculum that include military-specific field exercises.
- **Comparing the IDA estimate to the 2003 CNA estimate suggests that the USU cost per student has decreased slightly in real terms:** Many recent analyses have inflated the previous CNA estimate using various price indices or assumptions on annualized growth rates. Most of these inflated estimates were slightly higher than the IDA estimate of $253,000 per student year, suggesting that USU cost growth has not exceed the general inflation. Specifically, the 2002 CNA estimates imply a compounded annual growth rate (CAGR) for USU of 1.98 percent and CAGR for HPSP of 3.99 percent.
- **On a value basis that factors in retention, USU may offer the highest return on physician education and training investments:** The value analysis presented in Chapter 6 spread out total accession costs over years of service and practice. The results indicated that USU graduates are often less costly than

HPSP accessions (but still more costly than FAP) when their total fixed accession costs are spread over years of service.

- **On a value basis that factors in retention, USU graduates still have higher average career costs:** The value analysis presented in Chapter 6 also spread out total career costs over years of service and practice. Individuals who serve longer earn higher pay and more bonuses and benefits, which increases their total average annual career cost to the DoD. Because USU graduates serve longer on average, they cost the department 10 to 30 percent more per year of service. However, we note that this cost difference is at least partially driven by the fact that the DoD values later years in a physician's career more highly than early years.
- **Relative to the service academies, USU compares favorably on value:** The dual approach to physician accession is often likened to the model to produce line officers – USU parallels the service academies while HPSP parallels the ROTC program. Past studies have found that the service academies are nearly four times as costly as ROTC and only increase retention by less than 10 percent.[94] In contrast, we find that USU costs 2.5 times more than HPSP and has significant impacts on retention. Furthermore, just less than half of the retention difference is causally attributed to USU attendance, as opposed to selection factors (i.e., taste for service).
- **In terms of meeting force requirements, HPSP contributes the largest volume of physicians:** On average, the HPSP program contributes approximately 80 percent of new physician accessions (800 to 850 annually) while USU contributes 15 to 17 percent (170 annually). The smaller FAP program contributes another 20 to 30 physician accessions (generally less than 5 percent). While USU students account for 15 to 17 percent of annual accessions, USU graduates make up 25 percent of the active-duty medical force, due to higher retention rates.
- **In terms of contributing to readiness or critical wartime specialty requirements, there are not clear differences between USU and HPSP:** Our data showed that, on average, USU graduates made up 21 percent of physician man months. They were overrepresented in the fields of anesthesiology and neurological surgery, and slightly underrepresented in emergency medicine, general surgery, and orthopedic surgery. We note that individuals accessed as

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94 United States Navy, Advanced Management Program, "Comparative Analysis of ROTC, OCS and Service Academies as Commissioning Sources," November 19, 2004, https://cdn.shopify.com/s/files/1/0059/6242/files/tenchfrancisprose.pdf. Note that this study is dated and relative cost differences may have changed over the last decade.

medical students through USU or HPSP are free to exercise choice in their specialty selection (i.e., neither program can direct students to fill needed specialty gaps). Furthermore, the ability to select certain critical readiness specialties may be constrained by GME slots available in the MHS, which are weighted more heavily toward beneficiary care requirements.

- **GME costs are a significant component of physician accession costs:** The average annual cost of putting a newly trained physician through GME starts at nearly $500,000 (for a three-year program) and can exceed $1 million (for the longest programs). The average annual cost of providing GME exceeds the average annual cost of HPSP and FAP, but not USU.
- **FAP accessions offer great value to the DoD:** The FAP program has the lowest average annual student costs among the three accession sources. This program also has the shortest pipeline and the added advantage that DoD knows a participant's specialty when they access (this is not the case for USU and HPSP). While the program offers great value to the DoD, its accession volume is very low. The department could explore growing the use of the FAP program by testing the impact of offering higher FAP annual grants on total accessions.
- **The multi-channeled approach to physician accession offers many benefits:** These include choice for students, flexibility in the shaping the future force and managing the effects of a change in the value of a particular source, and fostering a diversity of knowledge and experience.

2. Option Assessment Findings

- **Increasing USU's class size by 30 students would lower the average USU cost per student year to $239,000; the net impact on total DoD accession costs would be roughly neutral:** We estimate that adding an additional 30 students to each USU cohort would cost USU an additional $30 million. However, because the marginal cost is much lower than the average cost, taking on more students would result in a per-student cost savings of $70,000 (or $14,000 per student year) which would partially offset the cost increase required to train 30 additional students. The remaining cost increase would be offset through savings generated from reduced HPSP accessions.
- **Reducing USU student compensation would generate modest savings, but not without consequences:** We determined that one-third of the USU/HPSP cost gap is attributed to the higher compensation and benefits received by USU students (who are commissioned O-1s). We estimated that USU could save between $30 and $50 million per cohort if the student compensation were reduced through the adoption of a new model (e.g., USU students treated like

cadets, reservists, or compensated through stipends). However, such a change would be expected to have negative impacts on recruiting, retention, and graduate quality.

- **Closing the Uniformed Services University is not expected to generate substantial savings:** IDA explored several scenarios in which the USU (or the SOM) were closed. Under these theoretical scenarios, the university could have its budget reduced by up to $520 million (for full closing) or up to $287 million (for SOM closure). However, we note that this amount does not represent true cost savings to the DoD, as we expect that many of the university's military personnel and research activities would transfer to other agencies. We estimate that the costs that could truly be eliminated (e.g., student salaries, department funding, and administration) account for approximately half of the current budget. Furthermore, to maintain force structure, HPSP accessions would also need to increase. We estimate HPSP physician expenditure alone would need to increase by approximately $100 million annually. Based on these considerations, closing the SOM would be expected to generate less than $100 million in true net savings, while closing the university would be expected to generate less than $200 million.
- **There are opportunities to further leverage existing university resources and capabilities and provide value to the broader MHS:** USU receives many requests from the Services and the DHA-run Medical Education and Training Campus to offer certain degree programs or to provide academic credit/degrees through its CAHS. Leveraging its status as an accredited university, USU can work with these programs to provide degrees, removing the need to pay civilian institutions for these services. There are also opportunities for USU to expand many courses (e.g., field exercises, distributed learning, etc.) to a broader MHS student population. The formation of the academic health system directed in the 2020 NDAA could also increase USU's value to the broader MHS.
- **There are opportunities to enhance USU's readiness value to the DoD:** USU provides readiness value to the DoD by producing graduates who serve longer, deploy more often, and have more military and leadership specific education. However, there are opportunities to further enhance the university's readiness value. By forming military-civilian partnerships, students and faculty could gain better access to trauma and emergency medicine patients, which could help increase the number of graduates selecting into these fields. There are also opportunities to hone the USU research portfolio to better support the operational mission and to help the university become the federal home for trauma research.

B. Summary of Recommendations

In Chapter 7, we explored a series of options for enhancing the USU's value to the MHS. These options covered two main areas: (1) improving USU's cost efficiency and/or value, and (2) enhancing the university's ties to the readiness mission.

- **The USU SOM should pursue increasing the M.D. cohort size by 30 students per year to spread fixed overhead costs over a larger cohort, lowering the cost per student.** While this option is expected to be approximately cost neutral, it would lower the average cost per student and increase USU's contribution to force requirements. This option would require working with each Service to secure additional billets. Additional billets could also come from the Public Health Service.
- **The USU SOM should work with Service HPSP programs and education and training commands to explore expanding USU military unique field exercises to HPSP and FAP participants.** The curriculum previously developed for the USU Bushmaster training event could be re-deployed for HPSP/FAP participants in new regional training events. These events would serve as part of the HPSP/FAP participants' ADT requirement. This would leverage existing university curriculum to help improve the military acculturation and medical readiness of students being trained in the civilian sector. This option would require working with each Service to gain support. This option would also enhance USU's ties to the readiness mission.
- **The USU SOM should work with Service HPSP programs and education and training commands to explore using USU distributed learning capabilities to offer courses in military medicine and leadership to HPSP/FAP participants**. These courses would re-deploy existing USU curriculum and use existing capabilities to increase military-unique learning opportunities for HPSP/FAP participants. Courses could also be developed for reservists and other providers who receive less exposure to military-specific medical training. This option would also require working with each Service to gain support/approval.
- **The USU SOM should continue efforts to develop a joint application process:** A joint application process for all medical students interested in military service would improve information sharing between the university and the Service HPSP programs, reduce overhead, and streamline recruiting.
- **USU leadership should work with the broader MHS leadership to explore expanding degree offering.** As an accredited university, USU has the capability to help the Services provide academic credit and degrees for the medical education and training they provide. Currently, the Services have

many arrangements with civilian institutions for providing degrees. These can be more costly for the Services and the students. For these reasons, USU continues to receive many requests to expand its degree programs, especially for enlisted personnel. Further analysis should examine the business case for providing different degrees at USU.

- **USU leadership should work with the broader MHS leadership to explore consolidating higher education programs under the university.** The MHS has a very large, decentralized education and training enterprise. In previous work, IDA found that there was duplication in education programs across the enterprise and opportunities for consolidation that could reduce overhead and improve standardization. That report recommended that DoD consider realigning all MHS higher medical education programs to USU. This would entail a merger of the U.S. Army Graduate Program in Anesthesia Nursing (USAGPAN) with the USU GSN, a merger of the CAHS with METC, and the formation of a USU graduate school of public health to house a handful of other graduate degree programs offered across the MHS. Additional analysis would be required to develop estimates of the full financial and readiness impact of these consolidations.
- **USU should work with MHS partners to explore building an academic health system (AHS) in the NCR.** MHS partners have been exploring the opportunity to build an AHS in the NCR since at least 2016. Section 724 of the proposed 2020 NDAA directly calls for "The Establishment of an Academic Health System in the NCR." The formation of an AHS could help to formalize the integration of health care, health education, and health research.
- **Savings from closing the SOM may not be worth the programmatic risks.** Our analysis found that the savings from closing the university would be smaller than one may initially expect—less than $200 million from closing USU or less than $100 million for closing the just SOM. This was due to the need to replace USU graduates with HPSP accessions and the expectation that many costs would be transferred rather than eliminated. These expected net savings are likely not enough to justify the disruption and uncertainty that closing the university would cause for the medical education and training pipeline and medical research programs.

To enhance the university's ties to the readiness mission, we make the following recommendations:

- **USU leadership should work to build military-civilian trauma partnerships in the NCR.** By partnering with one or more busy civilian trauma centers, USU could expand opportunities for students and faculty interested in trauma, critical care, and emergency medicine. The partnership would enhance USU's prominence in trauma care, benefit civilian partners, and further the NASEM's national trauma care system vision.
- **USU leadership should take a greater leadership role in building the national trauma-care system envisioned in the 2016 report.** USU faculty have worked to support NASEM's national trauma-care system. The university should prioritize taking a greater leadership role in furthering this initiative. USU should partner with the NIH to create the nation's preeminent center for trauma care research. This center could serve as the federal home for trauma-care research and work to further the national trauma-care system vision.
- **USU leadership should ensure that its research centers and programs prioritize the readiness mission.** USU leadership should work with MHS leadership and the combatant commands to ensure that its research centers and programs prioritize the most essential military-unique research requirements. USU should work with the department to build a research taxonomy capturing the military-unique/readiness research agenda and priorities and track research dollars supporting each priority area.

Appendix A.
Uniformed Services University Overview

Comparing the Uniformed Services University (USU) to Civilian Allopathic Medical Schools

To compare USU to civilian medical schools, several sources of data and metrics were used. We first use data from the Association of American Medical Colleges (AAMC) to compare school, student, and financial characteristics of USU to all fully accredited medical schools in the US. Table A-1 compares characteristics of USU to the average of accredited medical schools in the United States.

Table A-1. Comparison of USU to Civilian Medical Schools

	USU	All Fully Accredited Medical Schools
Average Number of Applicants	3288	5627
Average Number of Matriculants	173	143
Average Total Enrollment	698	605
Percent Out-of-State	90.2	38.9
Percent Women	43.9	51.7
Race/Ethnicity		
American Indian or Alaska Native	0.10%	0.20%
Asian	13.00%	22.00%
Black or African American	4.30%	7.20%
Hispanic, Latino, or other Spanish origin	3.30%	6.50%
Native Hawaiian or other Pacific Islander	0.30%	0.10%
White	65.50%	50.90%
Other	1.20%	2.10%
Multiple Race/Ethnicity	12.10%	8.60%
Unknown	0.10%	1.00%
Non US Citizen or Permanent Resident	0.10%	1.50%
Student to Faculty Ratio	2.57	1.24

School Characteristics

Number of Applicants, Matriculants, and Total Enrollment

We first compare the number of applicants, matriculants, and total enrollment at USU to all fully accredited medical schools in for academic year 2018–2019. As indicated by Table A-1, the number of applicants to USU (3,288) is lower than the average at all medical schools (5,627) and, in fact, is in the 23rd percentile of all fully accredited medical schools. Though the number of applicants is comparatively low, the number of matriculants to USU (173) is higher than average (143), with the number of matriculants at USU in the 72nd percentile.

Faculty Full-time Equivalents (FTEs) and Student to Faculty Ratio

The number of faculty FTEs associated with Doctor of Medicine (M.D.) education are reported to AAMC. As schools self-report data, there is considerable variation in FTEs across schools. For example, USU includes affiliated faculty, such as residency directors and clerkship preceptors, in their report to the AAMC. Though these individuals are part of M.D. education, they do not provide classroom-based education. For USU's data, we use figures directly provided by the university instead of the data reported to the AAMC. We also present a student-to-faculty ratio, a common metric within education.

Sex

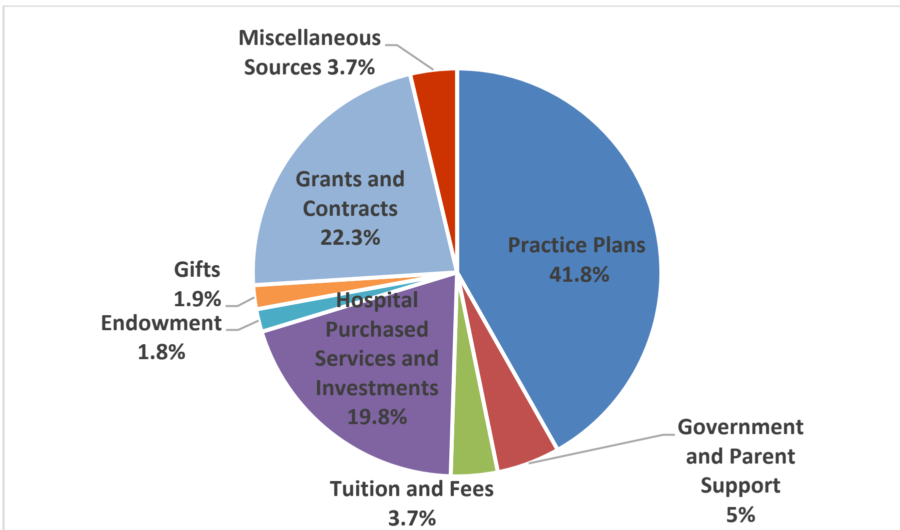
As indicated in Table A-1, the percentages of women applicants, matriculants, and total enrollment at USU (38.9 percent, 43.9 percent, and 42.6 percent, respectively) is considerably lower than the average at fully accredited medical schools (49.5 percent, 51.7 percent, and 49.7 percent, respectively). The percentages of women applicants, matriculants, and total enrollment at USU are in the 1st, 8th, and 4th percentiles, respectively.

Race and Ethnicity

Table A-1 provides the number and percentage of students identifying as each race or ethnicity for USU and civilian medical schools. USU has a higher percentage of white students (65.5 percent) than civilian medical schools (50.9 percent) and, in general, a lower percentage of students that are not white. These data suggest that the students at USU are less racially and ethnically diverse than at civilian medical schools.

Financial Characteristics

AAMC provides an overview of revenue sources for all fully accredited medical schools as reported in the Liaison Committee on Medical Education (LCME): Part 1-A Annual Financial Questionnaire. Values reported are the average over all schools, as information for individual schools is not publicly available. Figure A-1 provides the average percentage of total revenue attributed to eight different revenue sources. This figure indicates that the largest revenue source for medical schools (41.8 percent) is derived from practice plans, which are the fees for medical services provided by university faculty at affiliated hospitals and clinics. Revenue from hospital purchased services and investments, and from grants and contracts are the next largest revenue sources, accounting for 19.8 percent and 22.3 percent, respectively. The remaining sources (government and institutional support, tuition and fees, endowment, gifts, and miscellaneous sources) collectively account for about 20 percent of total revenue.



Source: https://www.aamc.org/data/finance/2017-tables/.

Figure A-1. Percent of Total Revenue by Revenue Source

Because USU is primarily federally funded, their revenue sources differ considerably from other medical schools. Based on information provided by USU to the AAMC on revenue sources for 2017–2019, there are two revenue sources: federal appropriations, and grants and contracts. Federal appropriations account for 75 percent of total revenue. Grants and contracts account for the remaining 25 percent. Although USU is primarily federally funded, its revenue from grants and contracts is similar to the average percentage at all medical schools.

All of USU's grant and contract revenue is from federal sources, while for all other medical schools, 60.5 percent of grants and contracts are from federal sources.[1] This may be attributed to the type of research that USU is conducting, which has a heavy focus on military-specific areas. The proportion of revenue derived from direct costs and indirect

[1] Association of American Medical Colleges, "FY 2017 Medical School Financing Highlights," accessed September 16, 2019, https://www.aamc.org/data/finance/2017-tables/.

costs also differs at USU, with 34.1 percent of federal grants and contracts from direct costs and the remaining 65.9 percent from indirect (facilities and administrative) costs. At the national level, the opposite is observed, as 71.4 percent of revenue from federal grants and contracts is from direct costs and 28.6 percent is from indirect costs.

Curriculum

Pre-Clerkship

During the 16-month pre-clerkship phase, students take fundamental and introductory courses consistent with the allopathic curriculum. Students begin with a course in the foundations of medicine, learning the fundamental basic science and clinical skills necessary to become a physician. The rest of the pre-clerkship period is divided into six organ system-based modules including: Musculoskeletal Integument; Cardiopulmonary-Renal; Neuroscience and Behavior; GI, Hepatobiliary, Nutrition, and Metabolism; Reproduction and Endocrinology; and Multi-System and Complex Diseases.[2] In each module, students learn how to present patients and administer patient exams. They also learn about the pathology, microbiology, and pharmacology associated with each system and diseases associated with the organ system. Each module is supplemented with a corresponding anatomy lab, small group case-based learning, and clinical skills exercises, which reinforce concepts. The last module during the pre-clerkship period is called Multi-System and Complex Diseases. USU uses this module to help students prepare for their clinical experiences during clerkship. As students move to the clinical setting, this final module helps them to not only treat patients, but also to contextualize medicine by understanding the social and environmental impacts of disease.

In addition to their general first- and second-year medical curriculum, medical students at USU take part in a unique Military Medical Curriculum. The curriculum is anchored by three pillars of military medicine: Military Emergency Medicine, Military Medical Practice, and Military Medical Leadership. During the pre-clerkship phase, students attend 31 lectures and activities that integrate the core pillars, including topics such as the roles of a medical officer, maneuvering, leadership, military problem solving, malaria case studies, shock, and effective team building.

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[2] Uniformed Services University, School of Medicine, "Medical Program by Year: Pre-Clerkship Period—the First 16 Months," accessed October 30, 2018. https://www.usuhs.edu/medschool/med-program-by-year.

Students without prior service are required to attend a basic officer training course the summer before they start medical school at USU.[3] In addition, USU requires students to participate in the Summer Operational Experience (SOE), which exposes them to the unique cultures of the Army, Navy, Air Force, and Public Health Service.[4] The SOE and supplemental learning through military lectures and exercises help students understand the organization and protocol of each Service and its medical corps. Students leave the university with a deep understanding of their Service culture and informal experience in a joint environment.

Clerkship

The second phase of a medical student's education at USU is the clerkship period, beginning halfway through a student's second year of medical school and spanning one year. The clerkship period begins with a one-week Transition to Clerkship course introducing students to their roles and responsibilities in a clinical setting before students begin their clinical rotations. There are three 16-week blocks of clinical rotations, called Formative Core Clerkship Blocks. During each block, students take three five-week clinical clerkships. Topics covered include Family Medicine, Pediatrics, Internal Medicine, Psychiatry, Surgery, Obstetrics & Gynecology, and a Third-Year Selective. Core clerkships occur at 22 different teaching sites across the United States. Clerkship rotations are not Service-specific and are determined through a lottery system.

Post-Clerkship

The post-clerkship period is the final phase of a medical student's education at USU. The period begins with six weeks of USMLE Step-1 Exam preparation leading up to the exam. Step-1 preparation is followed by a course called Bench to Bedside & Beyond (B^3). This small group medicine exercise ties together the basic sciences learned in pre-clerkship and clinical experiences learned during clerkship. Students engage in extra emergency medicine techniques, such as advanced cardiothoracic training, triage, forward surgery, and medical evacuation and en-route care. B^3 also focuses on contingency planning, ethical decision-making, care of military working dogs, team dynamics and problem solving, large-team leadership, and internal & external communications.

The remaining 52 weeks of medical school at USU consist of Advanced Clinical Rotations, Step-2 exams, and Capstone Projects. Each Advanced Clinical Rotation is broken into four-week blocks consisting of specialties chosen by students. All students are

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3 Uniformed Services University, School of Medicine, "SOM Admissions FAQs: Commissioning," accessed on November 2, 2018, https://www.usuhs.edu/medschool/somfaq.

4 Uniformed Services University, "Summer Operational Experience," accessed September 16, 2019, https://www.usuhs.edu/sites/default/files/media/curriculum/pdf/soexperience2015.pdf.

required to complete a rotation in Military Contingency Medicine and Military Emergency Medicine. Capstone projects are individual, elective research projects completed by USU medical students under the supervision of a faculty mentor and last about one to three months during the post-clerkship period. Students choose a faculty mentor and design a scholarly project. Fourth-year medical students are required to pass the Step-2 exams prior to graduation.

Medical Field Practicums

Throughout a student's time at USU, Medical Field Practicums (MFPs) complement classroom-based learning and offer students the opportunity to apply their knowledge in an operational setting. Leadership development is also emphasized across MFPs.[5]

Medical Field Practicum 101

Medical Field Practicum 101 is a five-day field exercise that takes place two months into a student's first year of medical school. Students play the roles of patients for fourth-year students completing Medical Field Practicum 202 "Operation Bushmaster." Concurrently, students in MFP 101 are introduced to their roles and responsibilities as physicians in operational settings while gaining exposure to fundamental elements of deployed medicine.

Medical Field Practicum 102

Medical Field Practicum 102 focuses on advanced military medical skills and is an extension of the Combat Medical Skills course. The experience spans two weeks of combined didactics and field exercises, which occur at the end of the pre-clerkship period. Topics covered include immediate care, Tactical Combat Casualty Care (TC3), and battlefield pain management; military decision making process, perspectives from a wounded warrior, and medically austere trauma care; and interpersonal communications, small-team leadership, and communications under stress.

Medical Field Practicum 201 – "Gunpowder"

Medical Field Practicum 201 is a one-and-a-half day field course conducted on USU's campus. The course covers TC3, small unit leadership, and medical platoon drills. Students learn patient assessment, patient decontamination, troop leading, and essential TC3 clinical skills. Students also are presented with scenario-driven challenges in small teams to emphasize leadership, problem solving, and interpersonal communication.

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[5] Francis G. O'Connor et al., "Leadership Education and Development at the Uniformed Services University," *Military Medicine* 180, no. suppl_4 (2015): 147–52.

Medical Field Practicum 202 – Operation Bushmaster

Military Contingency Medicine (MCM) is the capstone course of the military medical curriculum at USU. Operation Bushmaster is the course's accompanying four-day intensive field training, which occurs at Fort Indian Gap, Pennsylvania. Bushmaster brings together fourth-year medical students, some international students, and Graduate School of Nursing (GSN) students to evaluate their medical knowledge and leadership abilities in a simulated, forward tactical field setting. Students assume various roles within a battalion-aid station where they are presented with operationally relevant missions and operational challenges while simultaneously managing the medical care of simulated patients. Students must medically manage a variety of cases, ranging from disease and non-battle injuries to combat stress and trauma casualties. Mission briefs are dynamic and change throughout the course of the exercise to challenge students to operate effectively in uncertain or resource-constrained environments. Faculty observers evaluate a student's leadership, clinical skills, and medical management. Scenarios in Bushmaster challenge students in a variety of topics, including military environmental medicine, applied field medicine, mass casualty events, health service support planning, military decision making, stability operations, medical intelligence, and TC3.

Leadership Development and Training

USU's Leadership Education and Development (LEAD) Program is integrated throughout the four years of medical school curriculum. Based on USU LEAD's conceptual framework, the program teaches and develops knowledge, skills, and attitudes to help students become effective uniformed healthcare leaders and followers. Topics of study include crisis communication, effective communication, effective feedback, followership, individual and team performance under stress, emotional intelligence, self-assessment, and team building. Sessions are designed to be integrated with concurrent topics presented in other courses.[6]

Operational Training

The GSN hosts three operational elective courses which are delivered across the country to both GSN and SOM students. The Dive Medicine, Military Mountain Medicine, and Cold Weather Medicine courses are all offered annually to provide relevant operational training in unique clinical environments. The Dive Medicine course provides 14 days of didactic and practical experience in undersea medicine. Students become open water, advanced open water, and water rescue dive certified upon the completion of the course.

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[6] Erin S. Barry et al., "A four-year medical school leader and leadership education and development program," *International Journal of Medical Education*, (2018), 9:99; and Neil E. Grunberg et al., "A conceptual framework for leader and leadership education and development," *International Journal of Leadership in Education* 22, no. 5, (2019): 644–650.

The Military Mountain Medicine course is a 14-day integrated didactic and practical experience incorporating medicine with tactical mountaineering, avalanche basics, and patient transport. The Cold Weather Medicine course provides 10 days of didactics, which provides advanced cold weather and mountain training emphasizing casualty care and evacuation in extreme, austere environments. Completing the Military Mountain Medicine, Cold Weather Medicine, and Avalanche Course (not offered by USU) qualifies students for a Diploma of Mountain Medicine. As of January 2019, 137 students have received a Diploma of Mountain Medicine from USU.

Centers

USU houses 14 distinct centers that advance the research and education missions of the Military Health System (MHS). These interdisciplinary centers address current and future threats to the health of the force and are directly aligned to Department of Defense (DoD) priorities and requirements. The following section will provide a brief description of each of the centers and their relevance to the military. Detail on each of the centers, including their funding and research output, can be found in the 2018 USU Centers Report.[7]

Center for Deployment Psychology

The Center for Deployment Psychology (CDP) was established in 2006 to lead the development of a community of culturally mindful and clinically competent providers through the delivery of high-quality training and education, the convening of experts, and the dissemination of research-based treatment and the latest topics in military behavioral health. CDP trains existing and new behavioral health providers to effectively care for the needs of service members and their families while focusing on the needs of the population, such as posttraumatic stress disorder, depression, suicide, sleep disorders, chronic pain, and other consequences of deployment stress. In 2017, CDP trained more than 9,000 behavioral health providers through training workshops, seminars, and distance learning.

Center for Global Health Engagement

The Center for Global Health Engagement (CGHE) was established in 2016 to provide operational support to DoD global health engagement in fulfillment of national security objectives. In 2017, CGHE supported 112 requests for assistance from stakeholders across the DoD, conducted 14 courses across the globe, and trained more than 800 military personnel. The center provides several training courses across the world while maintaining reach-back global health expertise to combatant commands. The center

7 Uniformed Services University, "2018 Annual Centers Report," August 2018, https://www.usuhs.edu/sites/default/files/media/vpe/pdf/centers_report_august_2018.pdf.

directly supports DoD Instructions 6000.16 and 2000.13 to support DoD end states and U.S. national security objectives.

Consortium for Health and Military Performance

The Consortium for Health and Military Performance (CHAMP) was established as a center of excellence in 2012 to be the premier DoD translational resource in the range of disciplines associated with military-unique human performance optimization and total force fitness for maximizing readiness, performance, and resilience of military service members. In addition, CHAMP has many active partnerships with federal agencies, international partners, and academia.

Collaborative Health Initiative Research Program

The Collaborative Health Initiative Research Program (CHIRP) is a strategic partnership between the National Institutes of Health's (NIH's) National Heart, Lung, and Blood Institute (NHLBI) and USU formed in 2014. The interagency partnership seeks to transform patient care by harnessing genomics, bioinformatics, and high-performance computing to predict and pre-empt disease, mitigate traumatic injury, optimize human performance, and generate novel personalized therapies. CHIRP is the home for DoD's genomic expertise and provides critical support to Defense Health Agency's (DHA) precision care advisory panel.

Center for Neuroscience and Regenerative Medicine

The Center for Neuroscience and Regenerative Medicine (CNRM) was established by Congress in 2008 to study blast-related concussive traumatic brain injury (TBI). CRNM has expanded its scope to focus on interventional trials addressing concussive TBI. CRNM has 12 clinical trials at various stages of development producing critical evidence for medical practitioners.

Center for Rehabilitation Sciences Research

The Center for Rehabilitation Sciences Research (CRSR) was established in 2011 to advance rehabilitative care for service members suffering from combat-related injuries, particularly those with blast-rated orthopedic trauma, limb loss, and neurological complications. CRSR has produced more than 100 publications engaging clinical scientists across the MHS. CRSR disseminates findings through state-of-the-sciences gatherings with stakeholders and practitioners across the MHS.

Center for the Study of Traumatic Stress

The Center for the Study of Traumatic Stress (CSTS) was established in 1987 and is one of the nation's oldest and most highly regarded academic-based organizations dedicated to addressing the medical and psychiatric consequences of a wide scope of trauma exposure, including combat operations, operations other than war, terrorism, disasters, and public health threats. CSTS develops knowledge to understand the principles and practices for dealing with individuals and groups exposed to extreme environments. These include post-traumatic stress disorder, traumatic brain injury depression, wounded families, and disaster mental health.

Defense and Veterans Center for Integrative Pain Management

The Defense and Veterans Center for Integrative Pain Management (DVCIPM) was aligned to USU in 2014 to leverage evidence, clinical expertise, and collaboration to develop and communicate consensus recommendations in support of Service and Veterans Health Administration (VHA) pain management practice, education, and research. DVCIPM is the sole DoD organization focused exclusively on pain management and has adapted to changes in healthcare delivery across the continuum of care.

Infectious Disease Clinical Research Program

The Infectious Disease Clinical Research Program (IDCRP) was founded in 2005 as an interagency agreement between the NIH's National Institute of Allergy and Infectious Diseases (NIAID) and USU to conduct multicenter infectious disease clinical research focusing on high-impact cohort and interventional trials. IDCRP leverages the global reach of the MHS's clinical research network to ultimately advance clinical practice, force readiness, and health policy to protect the health of military personnel.

John P. Murtha Cancer Center

The John P. Murtha Cancer Center was established in 2011 and chartered at USU in 2016 to improve the diagnosis and interdisciplinary treatment of cancer for DoD beneficiary patients through innovative clinical care, research, and education. The Murtha Cancer Center focuses research on cancers prevalent among the population of military beneficiaries. The center also conducts genomic studies at USU labs and has many active partnerships with federal and civilian entities.

National Center for Disaster Medicine and Public Health

The National Center for Disaster Medicine and Public Health (NCDMPH) was founded in 2008 to improve the nation's disaster health readiness through critical education and science. NCDMPH provides important readiness expertise to the Services and the National Guard Bureau, consulting on disaster preparedness exercises, TC3 applications in civilian environments, and bridging lessons learned on the battlefield to the American public.

Surgical Critical Care Initiative

The Surgical Critical Care Initiative (SC2i) was established in 2013 to develop biomarker-drive clinical decision support tools for the critically ill with the goal of improving outcomes and reducing treatment costs. SC2i predictive models aim to support readiness by accelerating return to duty through more effective treatment and by curbing logistical burdens in forward-deployed settings.

Tri-Service Center for Oral Health Studies

The Tri-Service Center for Oral Health Studies (TSCOHS) was established in 1997 to advance oral health care in the Military Health System. TSCOHS supports the development of oral health policies and programs, fosters understanding of military oral health care issues, and advances oral public health within the military. The center provides data-drive clinical and population health research to maximize dental readiness.

Tri-Service Nursing Research Program

The Tri-Service Nursing Research Program (TSNRP) was established in 1992 to facilitate nursing research to optimize the health of military members and their beneficiaries. To date, TSNRP has awarded 420 grants totaling more than $100 million, resulting in research published in more than 60 peer-reviewed journals. It is the only program that specifically funds and supports rigorous scientific research in the field of military nursing.

Center Budgets

It is challenging to estimate the financial resources of the various research centers at USU using budget data provided by the university, due to the relationship between USU and the Henry M. Jackson Foundation for the Advancement of Military Medicine (HJF). Many of the centers use HJF for contract support, personnel staffing, and research support. Therefore, data in the Universe of Transactions does not capture the full financial resources of the centers. IDA used financial data reported in the 2018 Centers Annual Report to better understand the 14 research centers housed under the USU umbrella. Table A-2 shows that these funds come from a variety of sources, including the DoD budget, the Services, and other government agencies.

Table A-2. USU Center Budgets

Center	Approximate FY2017 Budget ($ Millions)
Center for Deployment Psychology	7.2
Center for Global Health Engagement	17.2
Consortium for Health and Military Performance	1.9
Collaborative Health Initiative Research Program	1.0
Center for Neuroscience and Regenerative Medicine	15.0
Center for Rehabilitation Sciences Research	2.0
Center for the Study of Traumatic Stress	11.0
Defense and Veterans Center for Integrative Pain Management	2.4
Infectious Disease Clinical Research Program	23.0
John P. Murtha Cancer Center	4.0*
National Center for Disaster Medicine and Public Health	1.2
Surgical Critical Care Initiative	9.0
Tri-Service Center for Oral Health Studies	0.4
Tri-Service Nursing Research Program	7.0
Total	**102.3**

* The Annual Centers Report did not contain financials for the John P. Murtha Cancer Center. The Universe of Transactions data did, however, show $4 million in funding for FY 2017.

While all 14 centers relate to an aspect of military health, some place a greater emphasis on the operational mission than others. This could become an area of differentiation for the university as it leverages its unique faculty and competitive advantage as the nation's only military medical school to become a leader in research and education. IDA estimates that $71.3 million of center funding focuses directly on the operational mission, while $31 million is allocated to other research germane to military health. While this dichotomy is subjective and imperfect, it is nevertheless illustrative of the center's funding dollars and how USU could potentially realign its priorities.

USU's Role in Graduate Medical Education (GME)

USU is a founding member of the National Capital Consortium (NCC) representing 23 residency specialties and 37 fellowship programs across the National Capital Region

(NCR).[8] The NCC was formed in 1995 to provide joint, centralized institutional and administrative oversight of all GME internship, residency, and fellowship programs located within the NCR. It consists of Walter Reed National Military Medical Center, the 11th Medical Group, Fort Belvoir Community Hospital, and USU. Through the consortium, the individual GME programs can pool resources and increase efficiency, while ensuring the fulfillment of Accreditation Council for Graduate Medical Education (ACGME) requirements.

USU provides value to GME and shares otherwise inaccessible resources in several ways. Program directors and clinical faculty can receive adjunct or instructor appointments at the university, providing them access to academic resources such as the university's Library and Learning Resource Center. Residents and faculty can also hone clinical skills at the university's simulation center or anatomic teaching labs. USU has basic science labs, which can host research projects and initiatives through collaboration with USU faculty. More directly, the university houses key administrative functions essential to ACGME accreditation. Every accredited residency or fellowship program must be overseen and supported by an ACGME-accredited Sponsoring Institution capable of meeting a set of stringent requirements. In addition, each Sponsoring Institution must identify a Designated Institutional Official who is responsible for the oversight and administration of its programs. Many of the administrative functions of the NCC (i.e., legal counsel, compliance, program support, agreement management, financial management, oversight) are centrally housed at USU. USU also supports GME beyond the NCC through the development and delivery of faculty development. These one-week courses are delivered twice per year. An additional weeklong course is offered for new residency program directors. For clinical faculty interested in advanced study in medical education, USU also offers a Master's degree in Health Professions Education.

[8] Uniformed Services University, "Graduate Medical Education," accessed September 16, 2019, https://www.usuhs.edu/gme/.

Appendix B.
Uniformed Services University Cost Estimates: Detailed Methodology

Operations and Maintenance (O&M), Research, Development, Test, and Evaluation (RDT&E), and Procurement (PROC) Costs

Partitioning O&M, RDT&E, and PROC costs to the School of Medicine (SOM) and Doctor of Medicine (M.D.) education is challenging. A significant degree of institutional knowledge is necessary to assign these costs. Institute for Defense Analyses (IDA) analysts had to work closely with Uniformed Services University (USU) subject matter experts (SMEs) to make these determinations. Most costs could be directly attributed to components, based on the assigned cost centers (SOM, Graduate School of Nursing (GSN), Postgraduate Dental College (PDC), etc.). However, determining if cost items relate to education, necessary for calculating the cost per student, requires an understanding of the university's structure and operations. Table B-1 presents the O&M, RDT&E, and PROC costs from the Universe of Transactions budget, which were directly mapped to each component. These were all costs that were not considered shared services.

Table B-1. Directly Allocated O&M, RDT&E, and PROC Costs by Component

Component	Allocated O&M, RDT&E, PROC
SOM	$120,487,575.45
GSN	$5,466,100.04
AFFRI	$12,285,043.59
PDC	$519,060.45
CTR	$77,668,927.54
HQ	$8,262,069.20
CAHS	$684,066.18
Total	**$225,372,842.44**

Shared Service Costs

IDA consulted with administrators and SMEs from USU to accurately attribute shared service costs across the university's components. SMEs reviewed the Universe of Financial Transactions data, which contain O&M, RDT&E, and Procurement costs line by line, and suggested the best method to assign costs. Shared service costs were attributed to components based on two general categories: the number of personnel (students, faculty, civilian employees, total personnel) or space based (square footage). This method ensures that all shared service costs are fully attributed to each of the USU components.

Once costs had been attributed to each of the university's components IDA could then focus on valuing the individual degree programs. For estimating the cost of M.D. education, IDA broke out the share of SOM shared service costs and subtracted shared costs that SMEs deemed did not relate to education (largely research administration costs). As there are multiple education programs within the SOM, the proportion of M.D. students relative to all SOM students was applied against the education-specific shared services costs. This same method can be applied to the other schools and components within USU.

Shared Service – Summary by Component

In FY 2017, USU had a total of $81.3 million in shared services, which were allocated across the components. Table B-2 presents the breakout of shared service costs by each of USU's components.

Table B-2. Shared Service Costs by Component

Component	Allocated Shared Services
School of Medicine	$49,279,383.73
Graduate School of Nursing	$6,312,939.05
AFFRI	$5,823,150.85
Postgraduate Dental College/ College of Allied Health Sciences	$312,050.15
Centers	$325,514.32
Headquarters	$19,273,636.27
Total	**$81,326,674.36**

Shared Service – Summary by Allocation Rule and Budget Item

Table B-3 shows the different allocation rules used to attribute shared services to each of the components, as well as the budget items and costs associated with each rule.

Table B-3. Shared Service Costs by Allocation Rule and Budget Item

Cost Application Rule	Budget Item	Budget Item Detail	Budgeted Amount
Share of Students			
	Office Of The Registrar	Civilian Pay	$457,800.00
		Other	$45,679.68
		Travel	$4,520.59
	Multidiscipline Laboratory Services	Civilian Pay	$856,443.69
		Other	$6,057.61
		Travel	$1,476,121.00
	Instructional Design	Civilian Pay	$487,311.05
		Other	$80,621.09
		Travel	$5,319.88
	Student Health Clinic	Civilian Pay	$121,817.30
		Other	$338,183.00
		PCA	$957,000.00
	Mental Health Center	Other	$247,998.29
	O&M Bag 101 Reserves	Civilian Pay	$2,000.00
		Reserves	$10,139.14
Share of Students Total			$5,097,012.32
Share of Faculty			
	Office Of CIO - Academic Computing Division	Civilian Pay	$171,100.00
		Other	$689,646.25
	Office Of VP For Research (VPR)	Civilian Pay	$2,300,844.68
		Other	$233,247.23
	Office Of VPR - Research Day Support	Other	$18,100.55
	Office Of VPR - Institutional Review Board	Other	$57,398.90
	Office Of VPR - IACUC	Other	$70,078.99
	Biomedical Instrumentation Center (BIC)	Civilian Pay	$487,398.09
	President's Research Support	Other	$1,610,465.00
		Travel	$110,000.00

Cost Application Rule	Budget Item	Budget Item Detail	Budgeted Amount
	Biomedical Instrumentation Center (BIC)	Other	$122,000.00
	VPR Public Health Service Staff	Other	$208,000.00
	Acquisition Public Health Service Staff	Other	$168,000.00
	Procurement Reserves	Reserves	$98,000.00
Share of Faculty Total			$6,344,279.69
Share of Students and Faculty			
	University Media Services	Civilian Pay	$759,289.65
		Other	$-
	Learning Resource Center (LRC)	Civilian Pay	$867,600.46
		Other	$576,048.46
		Travel	$6,133.80
	LRC - Journals	Other	$1,119,665.71
Share of Students and Faculty Total			$3,328,738.08
Share of Civilian Employees			
	Office Of Workers Compensation Program	Civilian Pay	$162,904.00
	Office of Civilian Human Resources (CHR)	Civilian Pay	$1,456,264.48
		Other	$749,902.82
		Travel	$5,346.47
	CHR - Training	Other	$187,646.55
	CHR - Advertising	Other	$16,934.55
Share of Civilian Employees Total			$2,578,998.87
Share of Total Personnel			
	Office Of Information Services Management	Civilian Pay	$4,048,697.38
		Other	$1,009,509.81
	CIO - Arcs Helpdesk	Other	$351,309.40
	Office Of Chief Information Officer	Civilian Pay	$649,049.05
		Other	$254,322.00

Cost Application Rule	Budget Item	Budget Item Detail	Budgeted Amount
	Academic Support & Operations (ASO)	Other	$361,686.41
	Business Processes Improvement/Project Management	Other	$171,485.20
	O&M Bag 104 Reserves	Civilian Pay	$20,353.57
		Reserves	$5,587.18
	Crossbill And Effort Certification Bag 104	EURRC	$-
		Other	$-
	Office Of The VP For Finance And Administration	Civilian Pay	$789,500.00
		Other	$157,564.70
		Travel	$29,365.57
	Office Of Asst. VP For Resource Mgmt	Civilian Pay	$244,106.73
		Other	$109.95
		Travel	$31,651.00
	Network Operations & Communication (NOC)	Other	$2,292,000.00
		Travel	$4,100.00
	Customer Support Division (CSD) Service Desk	Other	$1,654,729.25
	Academic Support & Operations (ASO)	Other	$420,650.00
		Travel	$2,604.38
	Business Processes Improvement/Project Management	Other	$821,934.66
		Travel	$3,227.51
	Financial And Manpower Management	Civilian Pay	$2,340,933.49
		Other	$1,202,292.43
		SCR	$351,000.00
	Bag 6 EURRC Account	EURRC	$746,000.00
	Resource Management Information	Civilian Pay	$298,213.52
		Other	$430,128.35
	Assistant VP For Support Services	Civilian Pay	$208,135.98

Cost Application Rule	Budget Item	Budget Item Detail	Budgeted Amount
		Travel	$1,925.89
	Security Division	Civilian Pay	$593,827.32
		Other	$306,193.07
	Sec Division - Guards	Other	$1,799,465.44
	Administrative Services Dept. (ASD)	Civilian Pay	$863,300.00
		Other	$697,612.83
		Travel	$98,000.00
	ASD - Duplicating	Other	$(535.31)
	ASD - Employee Equal Opportunity Office	Other	$10,284.90
	Contracting Division	Civilian Pay	$1,483,995.28
		Other	$37,384.90
	Logistics	Civilian Pay	$1,105,407.50
		Other	$977,154.32
	Logistics - Furniture	Other	$1,604,308.25
	Logistics - Technical Services	Other	$137,126.48
	Logistics - TSB Service & Maintenance Contracts	Other	$450,000.00
	Logistics - Replacement Equipment Account	Other	$877,580.00
	Crossbill And Effort Certification- CIO	Other	$-
	Office Of The Asst VP For Health & Safety	Civilian Pay	$811,041.06
		Other	$385,020.94
		Travel	$4,000.00
	Office Of CIO - Communications - Telephones	Other	$1,037,304.00
	Office Of CIO - Pager And Cell Phones	Other	$84,246.39
	CIO Telephones And Communication - EURRC	EURRC	$-
	ASD - Postal Services	Other	$19,000.00
	Logistics- Dry Ice	Other	$32,000.00
	Logistics Liquid Nitrogen	Other	$50,500.00
	Logistics Specialty Gasses	Other	$20,000.00
	Logistics Airgas	Other	$35,500.00

Cost Application Rule	Budget Item	Budget Item Detail	Budgeted Amount
	AMSUS Meeting Registration	Other	$25,000.00
Share of Total Personnel Total			$32,446,890.78
Square Footage			
	Facilities - Restoration & Modernization	Other	$17,147,167.89
	O&M Bag 107 Reserves	Reserves	$265,632.41
	Facilities Sustainment	Civilian Pay	$2,088,300.00
		Other	$2,914,707.30
	Facilities - Utilities, Pub Works, Custodial	Other	$8,748,547.00
Square Footage Total			$31,164,354.60
Total Dollars			
	Interest 1885	Other	$29.00
	FMG - Defense Finance and Accounting Service	Other	$589,635.00
Total Dollars Total			$589,664.00

Headquarter (HQ) Costs – HQ Costs by Component

Table B-4 shows the distribution of HQ costs that are attributable to each USU component using the established allocation rules. USU budget SMEs determined which allocation rules should be used for each HQ budget item.

Table B-4. HQ Costs by USU Component

Component	Allocated HQ Costs
School of Medicine	$5,494,468.80
Graduate School of Nursing	$853,675.17
Armed Forces Radiobiology Research Institute	$361,022.30
Postgraduate Dental College	$14,127.05
Centers	$48,720.40
Headquarters	$1,475,928.44
College of Allied Health Sciences	$14,127.05
Total	**$8,262,069.20**

Headquarter Costs – HQ Costs by Allocation Rule

Table B-5 shows the different allocation rules used to attribute headquarter costs to each of the components, as well as the budget items and costs associated with each rule.

Table B-5. HQ Costs by Allocation Rule

Cost Application Rule	Budget Item	Budget Item Detail	Budgeted Amount
Share of Students			
	Board of Regents	Civilian Pay	$149,425.88
		Other	$1,110.68
		Travel	$19,320.04
Total Share of Students			**$169,856.60**
Share of Faculty	Center for Laboratory Animal Medicine	Civilian Pay	$195,523.92
Total Share of Faculty			**$195,523.92**
Share of Military Personnel	Office of the Brigade Commander	Civilian Pay	$102,100.00
		Other	$77,555.10
		Travel	$4,445.14
Total Share of Military Personnel			**$184,100.24**
Total Personnel	Office of the President	Civilian Pay	$1,983,000.00
		Other	$799,264.64
		Travel	$114,103.97
	Faculty Senate	Other	$7,475.17
		Travel	$2,139.28
	Office of the General Counsel	Civilian Pay	$1,252,737.04
		Other	$178,377.46
		Travel	$1,916.34
	Center for Technology Transfer	Other	$11,525.00
	Office of External Affairs	Civilian Pay	$992,017.93
		Other	$272,784.67
		Travel	$6,889.52
	USU Graduation	Other	$368,244.84
	VP Western Region	Civilian Pay	$200,600.00

Cost Application Rule	Budget Item	Budget Item Detail	Budgeted Amount
		Other	$19,000.00
	Office of Accreditation	Civilian Pay	$295,900.00
		Other	$290,985.66
		Travel	$4,920.17
	Office of the Senior Vice President	Civilian Pay	$160,500.00
		Other	$206.75
Total of Total Personnel			**$6,962,588.44**

Student Cost Estimates for Other USU Components

Table B-6 presents estimates of the cost per student for other USU degree-granting components. Graduate Education Office (GEO) students within the School of Medicine are not pursuing M.D. degrees, but rather receiving advanced degrees in health and the biomedical sciences. Some of these students are mid-career officers receiving additional graduate-level training in conjunction with a residency program. Others receive doctorates in psychology, public health, or the biomedical sciences. The GSN provides advanced practice nursing degrees at the doctoral level to uniformed and federal nurses. They offer a three-year curriculum with a variety of specializations. The Post-Graduate Dental School and College of Allied Health Sciences differ in that they are largely credit-granting organizations that do not incur the direct costs of educating students.

Table B-6. Annual Cost per Student for Other USU Components

Component	Component Cost	Component Education Costs	Cost Per Student
School of Medicine – M.D.	$287,030,855	$174,573,852	$253,373
School of Medicine - GEO		$23,033,657	$267,833
Graduate School of Nursing	$42,314,742	$38,143,697	$249,305
Post-Graduate Dental School	$1,398,069	$1,398,069	$17,260
College of Allied Health Sciences	$854,351	$854,351	$944

Student Cost Estimates for GSN Specialty Programs

In addition to an average cost per student for each USU component, IDA calculated an estimated cost per student for each nurse specialist doctoral program. Using the

Universe of Transaction data, student rosters, and faculty rosters, IDA mapped budget items and personnel costs to the various graduate nursing programs. Students and faculty were matched to programs according to their recorded specialties in the USU rosters. Shared costs assigned to the GSN were allocated to individual programs based on the proportion of students in each program.

Table B-7. Estimated Annual Cost per Student by GSN Specialty Program

Specialty Program	Degree Conferred	Estimated Program Costs	Estimated Cost per Student
Family NP/Women's Health NP	DNP	$7,167,632	$247,160
Nurse Anesthesia (CRNA)	DNP	$14,587,906	$251,516
Adult-Gerontology CNS	DNP	$12,866,363	$247,430
Psychiatric Mental Health NP	DNP	$2,377,286	$264,143
Nursing Science	PhD	$1,144,537	$286,134
Total		**$38,143,697**	**$249,305**

Appendix C.
Institutionalizing Uniformed Services University's Cost Estimate

Here, we discuss how the methodology can be institutionalized and used to recreate the cost per medical student for subsequent years. While we focus on Doctor of Medicine (M.D.) education within the School of Medicine (SOM), the methodology could be similarly applied to other education programs at the Uniformed Services University (USU) (as shown in Appendix B). In FY 2017, USU used the Defense Agencies Initiative (DAI) to manage budgeting and finance. However, beginning with FY 2018, USU began its transition to using the General Fund Enterprise Business Systems (GFEBS) for financial, asset, and accounting management. FY 2018 financial data use both systems. The methods and rules for attributing costs would not change, irrespective of the accounting system. We replicate our base case cost estimate of USU M.D. education for FY2018 in Appendix D.

Operations and Maintenance (O&M), Research, Development, Test, and Evaluation (RDT&E), and Procurement (PROC)

Partitioning O&M, RDT&E, and PROC costs to the SOM and M.D. education is challenging. A significant degree of institutional knowledge is necessary to assign these costs. IDA analysts had to work closely with USU SMEs to make these determinations.

We can think of O&M, RDT&E, and PROC costs as falling into two general groups: (1) costs that can be directly allocated to the SOM (or other USU components) and (2) shared costs (of which a portion of costs can be attributed to the SOM). Most budget items are directly attributed to a department within a particular USU school. However, a challenge with the directly attributable costs is determining whether costs are related to instruction or to some other category of the university's mission (e.g., research, service, etc.) Again, this requires institutional understanding of university operations and curriculum.

For shared costs, the accuracy with which these costs can be attributed to a particular program or school depends in part upon the completeness of the line item description provided in the budget. Once a budget item is determined to be a shared service cost, an appropriate allocation rule for determining the SOM's share must be applied. Most of these costs are split according to personnel-based rules (the share of students, share of faculty, share of total personnel, etc.), while some others are based on other factors (square footage, total budgeted dollars, etc.). The choice of which rule to apply is somewhat subjective, which could lead to some variability. A detailed explanation of the allocation rules applied to each cost category is included in Appendix B.

One way to simplify the allocation of O&M, RDT&E, and PROC costs is to use a common rule for allocating shared costs. The results indicate that using one allocation rule based on total personnel (students, faculty, and staff) to allocate all shared costs to components results in very small differences. Table C-1 shows the differences between the base case allocation method and a personnel-based approach.

Table C-1. Comparison of Shared Costs Using Different Allocation Methods

	Base Case Allocation		Personnel Based Allocation	
	Shared Services	**HQ Costs**	**Shared Services**	**HQ Costs**
SOM	$49,279,384	$5,494,469	$51,379,924	$5,418,010
GSN	$6,379,237	$853,675	$8,960,105	$844,649
AFFRI	$5,852,937	$361,022	$4,025,554	$379,480
PDC	$157,146	$14,127	$151,499	$14,282
CTR	$329,358	$48,720	$519,426	$48,965
HQ	$19,394,702	$1,475,928	$16,361,930	$1,542,402
CAHS	$157,146	$14,127	$151,470	$14,282
Total	**$81,549,909**	**$8,262,069**	**$81,549,909**	**$8,262,069**

The final difference in the cost per medical student is about $2,300 (less than a 1 percent difference). The robustness of the results from using a simplified approach suggests that this simplified approach to allocating shared costs is sufficient for future estimates.

Table C-2 shows the differences in the cost per student for each of the USU components. Note that the cost per GSN student changes the most under a personnel-based costing approach.

Table C-2. Comparison of Cost per Student Estimates Using Different Allocation Methods

	Base Case Analysis			Personnel-Based Analysis			
	Component Cost	Education Cost	Cost Per Student	Component Cost	Education Cost	Cost Per Student	% Difference
School of Medicine	$287,030,855	$174,573,852	$253,373	$289,131,395	$176,159,952	$255,675	0.91%
Graduate School of Nursing	$42,314,742	$38,143,697	$249,305	$44,895,610	$40,715,539	$266,115	6.74%
Post-Graduate Dental School	$1,398,069	$1,412,196	$17,435	$1,392,423	$1,406,704	$17,367	-0.39%
College of Allied Health Sciences	$854,350	$868,478	$960	$848,704	$862,985	$954	-0.63%

Military Personnel (MILPERS)

University MILPERS costs fall into two categories: student costs or faculty and staff costs. Student costs are straightforward and easily calculated. Composite rates are published annually by the Office of the Undersecretary of Defense (Comptroller) OUSD(C) and can be simply multiplied by the number of medical students in each Service. The Public Health Service has an online compensation calculator, which can be used for estimating salary and benefits for their students.[1]

Estimating uniformed faculty and staff costs requires additional steps, making them more difficult to calculate. First, physicians (and other highly skilled clinicians) receive higher-than-average special pays, which means their true cost is not well represented by composite rates. The IDA costing methodology backs out the average special pay included in the composite rate and adds back each individuals' specialty-specific special pay. We do this only for officers in clinical professions. The composite rate is used for non-clinical professions and enlisted personnel. Second, after adjusting composite rates for clinical officer professions, we must apply several loading factors to obtain the full cost of the personnel to the Department of Defense (DoD). Most factors are calculated directly by the full cost of manpower (FCoM) tool, which can be accessed with a common access card (CAC). Other factors (derived from previous manpower studies) should be inflated to present year dollars.[2] To calculate the cost to the DoD, we add the following loading factors to composite rates and special pay: the cost of the health benefit; training costs, recruitment and advertising, and education assistance; child development, family support service, and discounted groceries; retiree health benefit costs; and other health benefit costs, retiree, separation pay and travel, unemployment benefits, death gratuities and survivor benefits.

One way to more easily estimate faculty and staff MILPERS costs would be through using average costs. Assuming that the composition of SOM faculty and staff do not vary drastically from year to year, the administration could multiply the number of faculty and staff by an average cost adjusted for inflation to quickly arrive at a total cost. Table C-3 presents the SOM's average faculty and staff cost for FY 2017. Should the specialty mix or seniority of USU faculty and staff change over time, however, this method could lead to significant imprecision. For example, consider that an O-6 plastic surgeon has a fully burdened cost of approximately $534,000 per year, as compared to O-4 pediatrician, who has a fully burdened cost of $386,000 per year. Changes in university strategy, such as increased focus on operational medicine, would likely be accompanied by changes in the composition and cost of the supporting clinical faculty.

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1 Public Health Service, "Pay Calculator," https://www.usphs.gov/calculator/.

2 John E. Whitley et al., *Medical Total Force Management*, IDA Paper P-5047, (Alexandria, VA: Institute for Defense Analyses, May 2014).

Table C-3. Average SOM MILPERS Cost by Faculty and Staff ($FY17)

	Average Composite Rate	Average Fully-Burdened Cost
Faculty	$203,042	$371,907
Staff	$95,640	$141,299
Overall Average	$179,175	$320,661

Facilities

Facilities costs are easily calculated by replicating the depreciation calculation for each subsequent year. This depreciation cost is already calculated by USU Finance for routine budgeting and operations. Their figure can be used for estimating the costs of the schools while avoiding any large one-time capital expenditures, which would unduly bias estimates. Note that USU is currently in the process of constructing a new building on the Bethesda campus. The multi-story building will provide an additional 477,966 square feet of space for education and research, as well as parking and support services.[3]

[3] National Capital Planning Commission, "Executive Director's Recommendation," NCPC file number 7987, commission meeting, June 7, 2018, https://www.ncpc.gov/docs/actions/2018June/7987_Naval_Support_Activity_Bethesda_Uniformed_Services_University_of_the_Health_Sciences_Education_and_Research_Building_Staff_Report_Jun2018.pdf.

Appendix D.
Cost Estimates for FY 2018

In 2018, the Uniformed Services University (USU) began a transition to using the General Fund Enterprise Business Systems (GFEBS) for financial management and accounting. For FY 2018, USU used a combination of GFEBS and Defense Agencies Initiative (DAI) systems. While the systems differ slightly, they perform the same essential functions. To validate and ensure that the Institute for Defense Analyses' (IDA's) cost analysis is replicable under the new system, we re-estimate USU's component costs and the cost per student for FY 2018.

We follow the same methodology used in the main body of this report to assign costs to USU components and estimate each component's education costs. USU provided updated operations and maintenance (O&M) cost data from both DAI ($127.2 million) and GFEBS ($105.5 million), which IDA reconciled and combined. They also provided research, development, test and evaluation (RDT&E) and procurement (PROC) cost data for FY 2018. Using the previous year's personnel rosters, we updated military personnel costs using the FY 2018 rates published by OUSD(C). We inflated facilities costs using Department of Defense (DoD) deflators, also from OUSD(C)'s Green Book. In Table D-1, we summarize our estimate of USU's total costs. Our estimate shows that USU's FY 2018 total cost increased approximately 4.9 percent from the previous year.

Table D-1. USU Total Cost Estimate – Fiscal Year 2018

Element	Cost
MILPERS – Faculty & Staff	$78,293,692
MILPERS - Student	$95,448,875
O&M	$136,528,357
O&M - Shared Services	$96,533,550
Facilities	$8,808,078
RDT&E	$125,354,000
PROC	$5,898,000
USU Total	**$546,864,551**

To assign shared costs to USU components, we used the same apportioning rules as used for FY 2017. Other O&M costs were directly assigned to components using the assigned cost codes. Personnel rosters were used to allocate uniformed personnel costs (faculty, staff, and students) to each component. The facility space survey was again used to assign facility costs to the individual USU components. We assume that the faculty and student composition, as well as the facility use, did not change meaningfully from the previous year. Table D-2 summarizes the costs of each USU component.

Table D-2. USU Component Costs – Fiscal Year 2018 ($Ms)

Element	SOM	GSN	AFFRI	PDC	CAHS	HQ	CTR
MILPERS - Faculty and Staff	48.2	8	7.4	0.4	0	13.3	0.8
MILPERS - Students	70.9	24.1	0	0.5	0	0	0
O&M	93.8	6.3	11.6	0.5	1	13.6	9.8
Facilities	4.3	0.1	1.1	0	0	3.2	0
Shared Services	56.6	8.2	6.9	0.2	0.2	24	0.5
RDT&E	48.2	0	0	0	0	3.5	73.7
PROC	0	0	0	0	0	5.9	0
Total	**322**	**46.8**	**27.1**	**1.6**	**1.2**	**63.4**	**84.9**

Using the previous year's student rosters, faculty time survey, and facility use survey, IDA was able to also estimate a cost per student. Using the same methodology to estimate education costs, we extract education related expenses to calculate the cost per student for FY 2018. Table D-3 and Table D-4 summarize these findings.

Table D-3. Education Program Costs – Fiscal Year 2018 ($Ms)

Element	M.D. Costs	GEO Costs	GSN Costs	PDC	CAHS
MILPERS - Faculty and Staff	15.0	1.9	2.8	0.4	0.0
MILPERS - Students	64.8	6.1	24.1	0.5	0.0
O&M	59.0	10.4	6.3	0.5	1.0
Facilities	0.4	0.1	0.1	0.0	0.0
Shared Services	39.1	4.9	5.7	0.2	0.2
Total	**178.3**	**23.3**	**38.9**	**1.6**	**1.2**

Table D-4 shows that the estimated annual cost per USU physician grew a modest 2.1 percent between FY 2017 and FY 2018. The higher cost growth rates for the Postgraduate Dental College and the College of Allied Health Sciences (CAHS) can be explained by the rapid expansion of USU's South Campus in San Antonio. CAHS, in particular, has seen its mission and operations expand rapidly through tighter coordination with the co-located Medical and Education Training Campus (METC) run by the Defense Health Agency

(DHA) and the three Services. Therefore, using the previous year's student counts may overstate the cost per student for USU's San Antonio campus programs.

Table D-4. Costs per Student – Fiscal Year 2018 ($Ms)

	M.D.	GEO	GSN	PDC	CAHS
Program Cost ($Ms)	178.3	23.3	38.9	1.6	1.2
Number of Students	689	86	152	81	905
Annual Cost per Student ($Ks)	258.7	270.8	256.2	19.3	1.3
Annual Cost Growth	2.1%	1.1%	2.8%	11.0%	40.3%

Appendix E.
Service Health Professions Scholarship Program and Financial Aid Program Costs

This appendix contains a detailed description of the Health Professions Scholarship Program (HPSP) and Financial Aid Program (FAP) data provided by each Service. Service data was provided in various formats and covered slightly different time periods. The Institute for Defense Analyses (IDA) team used the data provided to construct Service-specific average annual per student costs for HPSP and FAP.

Army Data

The Army provided data on the HPSP program for FY 2013 through FY 2017. The data contained tuition and other reimbursable expenses, such as books and equipment, stratified by school. The Army also provided stipends, active duty for training (ADT), and critical skills accession bonus (CSAB) amounts.

The data covered all students enrolled in the program each year (multiple graduating cohorts). We restricted our analysis to the FY 2014–2017 window for consistency with the other Services. Table E-1 shows the estimated average annual cost per student by the different cost elements reported. IDA received data on Army HPSP staffing and estimated a per-student cost of $565. However, IDA did not receive data on non-personnel costs or recruiting costs. We therefore relied on the Navy annual per-student other expense estimate, as the Navy provided the most comprehensive data. All data were converted to constant 2017 dollars.[1]

[1] The O&M deflator was used for books, equipment, and tuition. The MILPERs deflator was used for stipends, ADT, and bonuses. *Source: Greenbook.*

Table E-1. Average Annual Cost per Army HPSP Enrollee, 2017 Dollars

Year	Students	Books	Equipment	Tuition	Stipend	ADT	Bonus	Total
2014	1024	$155	$1,011	$47,355	$23,714	$11,616	$5,378	$89,230
2015	1035	$138	$961	$50,034	$23,656	$12,656	$5,375	$92,820
2016	1018	$110	$948	$52,434	$23,529	$11,628	$5,002	$93,651
2017	979	$76	$1,080	$51,610	$23,408	$10,298	$5,312	$91,784
Weighted Average		$120	$999	$50,341	$23,579	$11,567	$5,267	$91,872
Est. Other expense*								$6,000
Cost per Student Year								$97,872

* Other expenses are an estimate of recruiting and program administrative costs based on data provided by the Navy. The following section discusses how they were calculated.

The Army also provided data on the FAP program. The data included the average annual FAP grant amount, stipend amount, and ADT amount. The number of FAP participants was also provided. The data was provided as aggregate averages, rather than individual level data. All data covered FY 2013–2017. Table E-2 shows the data. As before, all dollar amounts were converted to 2017 dollars.

Table E-2. Annual Average Cost for Army FAP Participant, 2017 Dollars

	Students	ADT*	FAP Stipend	Annual Grant	Total
2014	4	$11,616	$25,973	$47,111	$84,700
2015	7	$12,656	$25,910	$46,531	$85,097
2016	7	$11,628	$25,770	$45,820	$83,218
2017	4	$10,298	$25,637	$45,000	$80,935
Weighted Average		$11,711	$25,827	$46,132	$83,670
Est. Other Expense*					$6,000
Cost per Participant Year					**$89,670**

* The Army reported the average annual ADT as a HPSP/FAP average. We use the same per-accession recruiting/overhead cost estimate used for the HPSP program.

The average annual grant and stipend amounts provided by the Army appear most representative of a full residency year. Individual-level data provided by the Navy shows individuals receiving prorated grants and stipends for partial years. In some instances, it appears that individuals do not receive a grant for their final year in the program. This results in a much lower annual average cost for the FAP program. We note this difference and suggest that the Army estimate can be viewed as an upper bound on annual FAP cost estimates. The same is true for the Air Force, which also provided aggregate summary data for the FAP program.

Navy Data

The Navy provided data on the HPSP program for FY 2014–2018. Rather than covering the total HPSP enrolled population, the Navy data covered the 2018 graduating cohort. This allows us to observe how the costs for one cohort vary over time. The 2018 cohort contained 247 unique individuals. The majority of the cohort received four-year scholarships (188 individuals, or roughly 75 percent). Another 47 individuals received three-year scholarships, while 12 received two-year scholarships.

Table E-3 shows the average annual expenditures for the 2018 graduating cohort over time. Because the academic calendar begins in the fall and ends in spring, the first and last years are partial years. To obtain the annual cost per student year, we divide the average per-student costs by 3.71 (the weighted average number of scholarship years). The other costs will be discussed in detail in the following section.

Table E-3. Average Annual Cost for 2018 Navy HPSP Cohort, FY 2017 Dollars

Year	Books & Equipment	Tuition	Other	Stipend	ADT	Bonus	Total
2014	$155	$25,999	$6,242	$4,264	$272	$20,832	$57,764
2015	$1,416	$49,091	$6,173	$23,189	$7,448	$3,911	$91,227
2016	$1,145	$47,503	$6,094	$22,635	$9,552	$331	$87,259
2017	$1,889	$47,417	$6,000	$22,895	$12,768	$-	$90,969
2018	$794	$18,597	$5,899	$13,037	$8,135	$-	$46,462
Per Student	$5,399	$188,606	$30,408	$86,020	$38,175	$25,074	$373,681
Cost Per Student Year (Weighted average of 3.71 yrs.)							$100,723

Note: 2014 and 2018 are partial years.

The Navy also provided individual-level data on all FAP participants for FY 2014–2018, shown in Table E-4. There were 39 unique individuals in the data. The data covered all participants (as opposed to one cohort). From the individual-level data, it was possible to observe that participants did not receive the full $45,000 annual grant or the full annual stipend (due to prorating for partial years). Because this data was more detailed and allowed us to observe partial years, we believe the Navy FAP cost estimate to be the most accurate.

Table E-4. Average Annual Cost for Navy FAP Participants, FY 2017 Dollars

Year	Participants	Grant	Stipend	ADT	Books, Equipment, and Uniform	Total
2014	11	$38,545	$8,694	$1,574	$365	$49,178
2015	21	$41,927	$18,674	$2,514	$542	$63,657
2016	30	$38,990	$20,877	$4,343	$152	$64,362
2017	30	$34,721	$21,274	$2,490	$91	$58,575
2018	27	8,616	$18,619	$3,144	$58	$50,436
Weighted Average		$36,037	$18,950	$3,025	$204	$58,216
Other Expenses						$6,000
Cost Per Participant Year						**$64,216**

Other Expenses: Recruiting and Overhead Costs

The Navy provided the detailed data required to estimate the costs associated with recruiting HPSP and FAP participants and the costs associated with program administration. The data was provided for FY 2014–2018 and covered several offices, including:

- **Commander Navy Recruit Command (CNRC):** The Navy provided personnel data for the CNRC and estimated that HPSP and FAP accounted for approximately 28 percent of the total command workload. The Navy asked IDA to prorate per-student cost estimates using this factor. The Navy also provided non-personnel data for the CNRC. Non-personnel costs included lodging, food, and other travel expenses, events/job fairs, advertising, etc. The Navy asked IDA to apply the same 28-percent prorating factor to non-personnel costs.
- **Medical Department Accessions Department (MDAD) and M85 Director Headquarters Resource Management (BUMED – M85):** The Navy provided personnel data on the staff supporting the HPSP, FAP and Nurse Candidate Program. The Navy estimated that the HPSP and FAP physician accessions accounted for 69 percent of the overall program management workload. The Navy asked IDA to prorate MDAD and M85 personnel costs using this factor. MDAD non-personnel costs were also provided. These costs were specific to the medical corps and did not require prorating.

IDA costed all personnel according to the Full Cost of Manpower (FCoM) tool published annually by Office of the Secretary of Defense (OSD) Cost Assessment and

Program Evaluation (CAPE).[2] We then applied the appropriate prorating factors provided by the Navy, shown in Table E-5.

Table E-5. Annual HPSP/FAP Recruiting and Administration Costs, FY 2017Dollars

	Personnel	Non-Personnel	Total
MDAD/ M85	$2,190,705	$359,561	$2,550,267
NCRC	$4,231,577	$129,471	$4,361,048
Total	$6,422,282	$489,033	$6,911,315
Cost Per Participant			$5,813

IDA also explored inflating recruiting and administrative costs reported in a 2003 CNA study. The data was pulled from Table 6 and Table 7 in Chapter 4. Table E-6 and Table E-7 show these values inflated to 2017 dollars. We used the military personnel (MILPERS) deflator for personnel costs and the Operations and Maintenance (O&M) deflator for all other costs.

Table E-6. Average Health Professions Recruiting Costs, FY 2017 Dollars

	Army	Navy	Air Force
Total Cost	$34,931,180	$27,980,553	$38,279,541
Accessions	695	746	981
Cost per Accession	$50,261	$40,260	$55,078
Cost per student year	$12,565	$10,065	$13,770
Weighted Average			$12,283

Table E-7. Average Annual per Student HPSP Overhead Cost, FY 2017 Dollars

	Army	Navy	Air Force
Overhead	$1,058	$1,941	$1,058
Weighted Average			**$1,330**

Air Force Data

The Air Force provided IDA with a summary document dated October 24, 2018, reporting that the Air Force Medical Service (AFMS) sees approximately 300 new physicians enter active duty each year from HPSP (and another 50 from USU). The Air Force also reported that historic data shows 35–50 physician participants in FAP per year.

2 Office of the Secretary of Defense, Cost Assessment Program Evaluation, "Full Cost of Manpower Tool," 2018, https://cade.osd.mil/tools/other-cost-tools.

The Air Force reported the average annual medical school cost per HPSP student (includes tuitions, books, equipment), annual average stipends, and the annual average FAP grant amount. Data on ADT costs and accession bonuses were not provided. We estimate these costs using data provided by the Army and Navy. The averages reported by the Air Force are shown in Table E-8, along with the assumed ADT and bonus amounts. The Air Force did provide some data on physician recruiting costs, but these were only for advertising. Because personnel and other non-personnel costs (e.g., admin and recruiting personnel, travel, etc.) were not included, we chose to rely on the Navy data for this category of expenses.

Table E-8. Average Annual Cost for Air Force HPSP and FAP, 2017 Dollars

	2018	2017*	HPSP	FAP
Average Total Medical School Cost	$55,462	$54,530	$54,530	$-
Average annual HPSP/FAP stipend	$28,592	$28,056	$28,056	$28,056
Annual FAP Grant*	$45,000	$45,000	$-	$45,000
ADT (Navy Value)		$10,298	$10,298	$10,298
Bonus*	$5,000	$5,000	$5,000	$-
Other Expenses*	$5,899	$6,000	$6,000	$6,000
Average Annual Cost			**$103,884**	**$89,354**

* We converted 2018 dollars to 2017 for consistency. The fixed annual FAP grant and $20,000 bonus ($5,000 per year) were not adjusted for inflation. Navy data was used for other expenses.

The Air Force also provide some school-level data on tuition and enrollment for FY 2007–2016. This data was used in Chapter 3 to discuss school enrollment. Financial data was not used, as it did not match the final HPSP figures reported by AFMS.

Appendix F.
Graduate Medical Education Costs

Full Time In-Service (FTIS) Graduate Medical Education (GME) and Graduate Dental Education (GDE) occurs, for the most part, at various military treatment facilities (MTFs) throughout the Military Health System (MHS). To capture and estimate FY 2017 expenses for these graduate education programs conducted inside MTFs, the team extracted data reported in the Medical Expense and Performance Reporting System (MEPRS) under the following codes: FAN, FAO, FAP, FAQ, EBE, and EBI. These codes represent special programs to capture GME/GDE expenses for interns, residents, or fellows at MTFs. Table F-1 summarizes GME and GDE expenses across the MHS.

Table F-1. FY 2017 MHS MTF GME/GDE Expense ($000s)

Program	O&M Expense	MILPERS Expense	Other Support Expense	Total Expense	Students	Cost/Student/ Year
GME	$72,417	$311,110	$125,186	**$508,714**	**2,509**	**$202,756**
GDE	$6,203	$41,862	$21,023	**$69,088**	**365**	**$189,282**
Total	**$78,620**	**$352,972**	**$146,209**	**$577,802**	**2,874**	**$201,045**

As part of their training, GME/GDE students see patients and provide care, which contributes to the overall productivity of the sponsoring MTF. This workload is captured as direct-care encounters reported with Provider Skill Type equal to '1R' (Intern/Residents with License—eligible for relative value unit (RVU) credit). The contributions of this workload to the overall productivity of the MHS lowers the overall cost of GME/GDE programs, as the cost of these services would otherwise be borne in MTFs (without training programs) for care delivery. Table F-2 displays the offset to direct GME/GDE expenses for a net cost per student year.

Table F-2. FY 2017 MHS GME/GDE Net Expense ($000s) Per Student

Program	Total Expense	Student Workload	Net Total Expense	Students	Net Cost/Stu/Yr
GME	**$508,714**	**$114,484**	**$394,229**	**2,509**	**$157,126**
GDE	**$69,088**	**$15,548**	**$53,540**	**365**	**$146,685**
Total	**$577,802**	**$130,032**	**$447,769**	**2,874**	**$155,800**

In addition to the average GME/GDE student costs captured in the MEPRS system above, the team also examined the average cost by specialty across the MHS. As the MEPRS system does not differentiate residency type in the special program codes for interns, residents, or fellows, the team relied on specialty counts by MTF reported in the Department of Defense (DoD) response to section 749 of the FY 2017 National Defense Authorization Act (NDAA), "Oversight of Graduate Medical Education Programs of Military Departments."[1] The counts presented in the Section 749 report did not include dental residency programs, nor the costs and workload of the GME programs considered. From a total-expense point of view, the team attempted to join MEPRS expenses captured in Table F-2 to the distribution of residency programs captured in the Section 749 report to different GME programs by cost. Table F-3 provides an aggregate cost by GME product line.

Table F-3. FY 2017 MHS GME Expense by Product Line

Product Line	Annual Cost / Student
Primary Care	$201,744
IM Subspecialty	$185,035
Emergency Room	$210,208
Obstetrics/Gynecology	$202,840
Orthopedic Surgery	$178,152
General Surgery	$168,076
Surgical Subspecialty	$171,795
Mental Health	$174,120
Ancillary Services	$179,625
Other	$191,608
Average	**$187,344**

The student counts presented by specialty provided in the Sec 749 report did not fully match the aggregate student counts and expenses reported by MEPRS for the same sites. So while the average annual cost per GME student in Table F-3 appears approximately 8 percent lower than the totals in Table F-1, both approaches yielded average annual student costs comparable with prior MHS GME studies. Table F-4 provides the complete list of residencies stratified by the same product lines as above.

[1] Under Secretary of Defense, Personnel and Readiness, "Report on Oversight of Graduate Medical Education Programs of Military Departments," (Washington, DC: Department of Defense, July 13, 2018), https://www.health.mil/Reference-Center/Congressional-Testimonies/2018/07/13/Oversight-of-GME-Programs-of-Military-Departments.

Table F-4. FY 2017 MHS Expense by Residency Program

Product Line	Residency Program	Annual Cost / Student
PC	Family Medicine	$201,683
PC	Internal Medicine	$179,659
PC	Pediatrics	$170,423
PC	Pediatrics - Neonatology	$192,876
PC	Adolescent Medicine	$203,233
PC	Family Medicine Sports Medicine	$169,079
PC	Pediatrics - Developmental	$245,479
PC	Pediatrics Hematology / Oncology	$174,363
PC	Pediatrics - Infectious Disease	$174,363
PC	Family Medicine - OB	$333,661
PC	Pediatrics - Endocrinology	$174,363
IMSub	IM - Gastroenterology	$177,688
IMSub	IM - Critical Care	$175,276
IMSub	Neurology	$197,889
IMSub	IM - Cardiology	$183,591
IMSub	IM Hematology /Oncology	$188,798
IMSub	IM - Infectious Disease	$182,436
IMSub	IM - Nephrology	$188,798
IMSub	Allergy And Immunology	$186,736
IMSub	IM - Infectious Disease	$203,233
IMSub	IM - Rheumatology	$190,402
IMSub	IM - Endocrinology	$188,798
IMSub	Child Neurology	$174,363
IMSub	IM - Critical Care	$174,363
IMSub	Nuclear Medicine	$188,798
IMSub	Neurology - Clinical Neurophysiology	$174,363
ER	Emergency Medicine	$181,911
ER	Emergency Medicine - EMS	$203,233
ER	Emergency Medicine Wilderness	$245,479
OBGYN	Obstetrics Gynecology	$202,993
OBGYN	OB - Gynecologic Oncology	$174,363
OBGYN	OB/GYN - Pelvic Med - Reconstr.	$174,363
OBGYN	OB/GYN - Mat. / Fet. Medicine	$245,479
OBGYN	OB/GYN - Reproductive Endocrin.	$245,479
OBGYN	OB - Minimally Invasive Surgery	$174,363
Ortho	Orthopaedics	$181,942
Ortho	Orthopaedics - Hand Surg.	$174,363

Product Line	Residency Program	Annual Cost / Student
Surg	General Surgery	$167,930
Surg	General Surgery - Research	$168,222
SurgSub	Anesthesiology	$171,517
SurgSub	ENT	$182,259
SurgSub	Dermatology	$171,903
SurgSub	Ophthalmology	$184,726
SurgSub	Urology	$177,157
SurgSub	Neurosurgery	$174,363
SurgSub	General Surgery - Trauma/Critical Care	$203,233
SurgSub	General Surgery - Vascular	$162,457
SurgSub	Anesthesiology - Pain Mgmt	$113,402
SurgSub	Pediatrics - Gastroenterology	$174,363
SurgSub	Dermatology - Dermatopathology	$174,363
MH	Psychiatry	$160,547
MH	Psychiatry - Child/Adolescent	$187,206
MH	IM - Psychiatry	$174,363
MH	Psychiatry - Forensic	$174,363
Ancillary	Radiology	$175,689
Ancillary	Pathology	$186,354
Ancillary	Radiation Oncology	$174,363
Ancillary	Pathology - Cytopathology	$203,233
Ancillary	Radiology - Musculoskeletal	$158,485
Other	Transition Year	$181,246
Other	Physical Medicine and Rehabilitation	$174,363
Other	Preventive Medicine	$187,293
Other	Occupational Medicine	$185,304
Other	Sleep Medicine	$188,798
Other	Preventive Medicine - WRAIR	$174,363
Other	Clinical Informatics	$245,479
Other	Pain Medicine	$196,015
Average		**$187,344**

Appendix G.
Past Cost Estimates

In this section, we provide a brief overview of other estimates of the cost of physician accession. It is important to note that each study differed in various aspects, including data availability, assumptions, or methodological approach, that impact the estimates of physician education costs. They are nevertheless useful as points of reference.

Center for Naval Analysis

In 2003, the Center for Naval Analysis (CNA) published a comprehensive report on the life-cycle costs of various uniformed health professionals.[1] As part of the report, physician accession costs for the different accession sources (Uniformed Services University (USU), Health Professions Scholarship Program (HPSP), and Financial Aid Program (FAP)) were estimated. The education and training costs were presented both in an average annual education cost per student and as life-cycle costs over the student's military career (cost per year of service (YOS) and year of practice (YOP)). The innovation of studying life-cycle costs was important. Even though CNA found it was three times more expensive to put someone through USU as compared to HPSP, they found it was the most cost-effective accession source for filling O-6 billets, due to higher retention rates among USU graduates.

Table G-1 shows CNA's average annual education costs for USU and the service HPSP and FAP programs, and full-time in-service (FTIS) graduate medical education (GME). The values are inflated to 2017 dollars.[2] We note that the inflated FAP value is clearly underestimated, as the FAP annual grant alone is now $45,000.

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[1] Eric Christensen et al., "Impact of Increasing Obligated Service for Physician Scholarships," (Arlington, VA: CNA, 2003).

[2] We used the O&M deflator for the operational costs associated with training and education and the MILPERS deflator for personnel costs (student salaries and military faculty and staff). We used a 3-percent annual growth rate for GME (because we couldn't break out O&M versus MILPERS).

Table G-1. CNA Average Annual Education Costs in 2002 and 2017 Dollars

	USU	HPSP	FAP	GME
2002	$185,059	$53,492	$23,410	$103,909
2017	$273,611	$74,388	$33,153	$161,887

Note: The CNA estimates were inflated using the O&M deflator (for education and training costs) and the MILPERS deflator for personnel costs (student salaries and military faculty and staff).

Government Accountability Office

In 2018, the Government Accountability Office (GAO) published a report titled "Additional Actions Needed to Address Gaps in Military Physician Specialties." As part of this analysis, GAO explored the costs associated with educating medical students through the Army, Navy, and Air Force HPSP programs. They were unable to obtain a comparison cost for USU.[3]

Table G-2 shows an average annual cost per student produced by IDA from the data reported by GAO.[4] It should be noted that these data only include the costs for educating medical students funded by the Defense Health Program (DHP) O&M account (e.g., tuition, books, fees and other education expenses). Based on the O&M data included in the GAO report, we estimate an average annual HPSP cost of approximately $50,000 per student. This is consistent with our estimate tuition, fees, and other direct expenses (approximately $53,000). Overhead costs and costs funded by the Services MILPERS accounts (e.g., stipends, allowances, and bonus) are not included in the GAO estimate.

[3] United States Government Accountability Office, "MILITARY PERSONNEL, Additional Actions Needed to Address Gaps in Military Physician Specialties," GAO-18-77, (Washington, DC: GAO, February 2018), https://www.gao.gov/assets/700/690409.pdf.

[4] GAO reported total HPSP costs and student volume ranges between FY 2011 and 2016 by Service (e.g., Army HPSP costs ranged from $50.9 million to $59.2 million between 2011 and 2016; Army medical students per year fluctuated between 1,018 and 1,128 over the same period). We used this data to construct the per-student-year estimates shown in Table G-2.

Table G-2. Estimated Annual HPSP O&M Cost per Student

	Cost Range (M)		Student Vol Range	
	Low	High	Low	High
Army	50.9	59.2	1,018	1,128
Navy	44.2	47.3	884	931
Air Force	44.7	51	1,029	1,127
Average cost per year*			$47,679	$49,435

* Average costs were calculated as the weighted average of each Services average cost. Average costs were constructed by dividing each Service's low range cost by the low student volume range (and high cost ranges by high cost volume).

Reform Management Group

In October 2017, the Deputy Secretary of Defense established nine cross-functional teams to improve DoD's business operations in nine different topic areas including healthcare management. A Reform Management Group (RMG) was also established to identify opportunities for reform and to provide support to each of the nine cross-functional teams. The reform management team had two different analyses performed on the costs of physician accession in the DoD. One was performed by Boston Consulting Group (BCG) and the other by McKinsey & Company. Both used the past work by CNA in some capacity.

Boston Consulting Group Analysis

An analysis by BCG estimated the average annual cost per USU using several different methodologies—including a bottom-up approach, a ratio-driven approach, and a top-down approach. Their average annual cost per student ranged from $274,000 to $422,000, depending on the methodology used.[5] The BCG analysis also examined how USU's costs compared to four civilian medical schools. Results indicated that USU was from 48 to 113 percent more costly than civilian peers. However, BCG noted that their conclusions were sensitive to key assumptions on labor costs that required further validation.

McKinsey & Company Analysis

An analysis by McKinsey considered the cost differentials between USU and HPSP and modeled several scenarios where USU accessions were replaced by HPSP students.[6]

5 Boston Consulting Group, "Initial Analysis of USUHS Costs," briefing, October 2017.

6 McKinsey & Company, "USU Medical School Preliminary Business Case," briefing, June 20, 2018. This analysis used past USU and HPSP cost estimates from the 2003 CNA study.

The estimated annual financial impact ranged from losses of $86 million to savings of $104 million, depending on retention behavior of HPSP graduates. The most-likely estimates suggested a savings range of $43million to $82 million. In this scenario, 50 to 160 additional physician accessions would be required annually to account for the lower retention of HPSP graduates.

Appendix H.
Service Obligation Lengths by Accession Source

This section provides information on active duty and reserve service obligation lengths for various military physician accession sources. Table H-1 shows that the Uniformed Services University (USU) has the longest service obligation of the different military physician accession sources, both in terms of its active-duty service obligation, as well as its military service obligation. Physicians may fulfill their military service obligation with a combination of service on active duty, in the selected reserve, or in the individual ready reserve (IRR). Unless currently being subsidized for Health Professions Scholarship Program (HPSP) or Financial Aid Program (FAP), the IRR has no weekend or annual required active-duty drill, but IRR physicians are eligible to be called into active service in times of emergency.

Table H-1. Service Obligation Lengths by Accession Source for Military Physicians

Accession Source	Active Duty Service Obligation (ADSO)	Military Service Obligation - (MSO)
Uniformed Services University School of Medicine (USU SOM)	7 years (minimum)*	13 years
	8 years*	12 years
	9 years*	11 years
	10 or more years*	10 years
Health Professions Scholarship Program (HPSP)[a]**	1 year for every year in the program in medical school or in GME (whichever is greater) (3 year minimum)*	8 years
Financial Assistance Program (FAP) for Medical Residents***	2 years for first year in FAP, 1 year for every year covered thereafter (3 year minimum)*	8 years
Direct Accession	2 year (minimum)	8 years

[a] Army HPSP Handbook (sections 2-2 through 2-4 in particular), http://com.msu.edu/Students/Academic_Career_Guidance/Military%20Resources/Army%20Student%20Handbook.pdf.

* Time spent in military residency or fellowship program does not affect total service obligation length (not applicable for direct accessions).

** HPSP students are required to serve 45 days of active duty for training (ADT) for each year of scholarship awarded. Students who do military First Year Graduate Medical Education (FYGME) will be counted as being on active duty during that year, but they will not repay any of their active-duty service obligation. Instead, they reduce their IRR requirement by one year.

***FAP students are required to serve 14 days of ADT for each year of scholarship awarded.

Illustrations

Figures

Tables

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Abbreviations

AACOM	American Association of Colleges of Osteopathic Medicine
AAMC	Association of American Medical Colleges
ACGME	Accreditation Council for Graduate Medical Education
ADO	Active Duty Obligation
ADT	Active Duty for Training
AFMS	Air Force Medical Service
AFRRI	Armed Forces Radiobiology Research Institute
AHS	Academic Health System
AOA	American Osteopathic Association
AOC	Area of Concentration
ASD	Administrative Service Dept.
ASO	Academic Support & Operations
AVF	All-Volunteer Force
BAH	Basic Allowance for Housing
BCG	Boston Consulting Group
BIC	Biomedical Instrumentation Center
BUMED	Bureau of Medicine and Surgery
CAC	Common Access Card
CAHS	College of Allied Health Sciences
CAPE	Cost Assessment and Program Evaluation
CBRNE	Chemical, Biological, Radiological, Nuclear, and Explosive
CDP	Center for Deployment Psychology
CE	Cognitive Evaluation
CGHE	Center for Global Health Engagement
CHAMP	Consortium for Health and Military Performance
CHIRP	Collaborative Health Initiative Research Program
CHR	Civilian Human Resources
CK	Clinical Knowledge
CNA	Center for Naval Analyses
CNRC	Commander Navy Recruit Command
CNRM	Center for Neuroscience and Regenerative Medicine

COCA	Commission on Osteopathic College Accreditation
COMLEX	Comprehensive Medical Licensing Examinations
CRSR	Center for Rehabilitation Sciences Research
CS	Clinical Skills
CSAB	Critical Skills Accession Bonus
CSD	Customer Support Division
CSTS	Center for the Study of Traumatic Stress
CTR	Centers
DAI	Defense Agencies Initiative
DHA	Defense Health Agency
DHP	Defense Health Program
DMDC	Defense Manpower Data Center
DNP	Doctor of Nursing Practice
DO	Doctors of Osteopathic Medicine
DoD	Department of Defense
DVCIPM	Defense and Veterans Center for Integrative Pain Management
ENP	Emergency Nurse Practitioner
EXM	Extramural Funding
FAP	Financial Aid Program
FCoM	Full Cost of Manpower
FNP	Family Nurse Practitioner
FTE	Full Time Equivalents
FTIS	Full Time In-Service
FTOS	Full Time-Out Service
GAO	Government Accountability Office
GDE	Graduate Dental Education
GEO	Graduate Education Office
GFEBS	General Fund Enterprise Business Systems
GME	Graduate Medical Education
GMO	General Medical Officer
GSN	Graduate School of Nursing
HJF	Henry M. Jackson Foundation for the Advancement of Military Medicine
HPSP	Health Professions Scholarship Program
HQ	Headquarters
IDA	Institute for Defense Analyses

IDCRP	Infectious Disease Clinical Research Program
IRR	Individual Ready Reserve
JCCQAS	Joint Centralized Credentials Quality Assurance System
LCME	Liaison Committee on Medical Education
LEAD	Leadership Education and Development
LRC	Learning Resource Center
MCAT	Medical College Admission Test
MCM	Military Contingency Medicine
M.D.	Doctor of Medicine
MDAD	Medical Department Accessions Department
MEIR	Medical Effects of Ionizing Radiation
MEPRS	Medical Expense and Performance Reporting System
METC	Medical Education and Training Campus
MFP	Medical Field Practicum
MHS	Military Health System
MILCON	Military Construction
MILPERS	Military Personnel
MRR	Medical Readiness Review
MSN	M.S. in Nursing
MTF	Military Treatment Facility
NCC	National Capital Consortium
NCDMPH	National Center for Disaster Medicine and Public Health
NCR	National Capital Region
NDAA	National Defense Authorization Act
NIAID	National Institute of Allergy and Infectious Diseases
NOC	Network Operations & Communication
NRMP	National Residency Matching Program
O&M	Operations and Maintenance
OH	Overhead
OMM	Osteopathic Manipulative Medicine
OUSD(C)	Office of the Undersecretary of Defense (Comptroller)
PDC	Postgraduate Dental College
PE	Performance Evaluation
PROC	Procurement
RDT&E	Research, Development, Test and Evaluation
RMG	Reform Management Group

RMST	Restricted Mean Survival Time
ROTC	Reserve Officer Training Corp
RVU	Relative Value Unit
SC2i	Surgical Critical Care Initiative
SME	Subject Matter Expert
SOE	Summer Operational Experience
SOF	Special Operations Forces
SOM	School of Medicine
SS	Support Services
TC3	Tactical Combat Casualty Care
TDY	Temporary Duty Assignment
TSCOHS	Tri-Service Center for Oral Health Studies
TSNRP	Tri-Service Nursing Research Program
USMLE	United States Medical Licensing Exam
USU	Uniformed Services University
USUHS	Uniformed Services University of the Health Sciences
VA	Veterans Affairs
VHA	Veterans Health Administration
VPR	Vice President for Research
YOP	Year of Practice
YOS	Year of Service

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6. AUTHOR(S)
John, Sarah, K.
Bishop, James, M.
Hildreth, Laura, A.
Lindly, Jamie, M.
Luan, W., Patrick
Minneci, Madeline
Prugh, George, M.

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Institute for Defense Analyses
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14. ABSTRACT
The Department of Defense accesses physicians through two primary channels: the Uniformed Services University (USU) F. Edward Hébert School of Medicine and the Armed Forces Health Professions Scholarship Program (HPSP). From time to time, questions arise regarding the cost and value associated with each accession source. We estimate it costs approximately $1 million to access a new physician through USU (vice $400,000 for HPSP). However, when costs are spread over years of service to reflect value, the cost difference is greatly diminished or reversed depending on the time unit and cost definition. Finally, we estimate that 4.48 years, or about 75 percent, of the higher retention observed for USU graduates can be causally attributed to the university. The remaining difference is explained by individual student characteristics like "taste for service."

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