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Executive Summary

The Department of Defense (DoD) has an operational requirement for a deployable medical force. A mix of active component (AC) and reserve component (RC) military medical personnel provide these essential capabilities. When they are not deployed, most AC providers work in military hospitals, known as military treatment facilities (MTFs), providing care to DoD beneficiaries. RC medical providers work in civilian jobs when they are not deployed or activated for training.

The wars in Iraq and Afghanistan revealed significant readiness challenges with the current medical force and MTF-based training model. Specifically, the case mix and volume available in MTFs does not support the skill sustainment needs (or "medical readiness") of key AC combat casualty care team (CCCT) personnel who are expected to deploy and perform lifesaving and limb-saving trauma care in austere environments with little back-up. To address these challenges, the *National Defense Authorization Act [NDAA] for Fiscal Year 2017* directed sweeping reforms to the military health system (MHS). Among these provisions was Section 708, which directed the establishment of military civilian partnerships (MCPs) with large civilian trauma centers to provide military providers with greater exposure to a high volume of patients with critical injuries.

Section 757 of the FY 2021 NDAA directed an independent evaluation of progress to date. This report provides this congressionally directed, independent assessment of readiness-enhancing training models (including the use of MCPs), as well as alternative force mix options that would place a higher share of combat casualty care teams in the RC.

Approach

To conduct this independent evaluation, the IDA team completed four analyses:

- **A Review of Medical Readiness Challenges**: To review MCP effectiveness and opportunities for improvement, we began with a detailed examination of the medical readiness challenges MCPs are trying to solve. Through literature review, empirical analyses, and interviews with subject matter experts (SMEs), we identified and examined core medical readiness challenges.
- **An Overview of the Current Medical Force**: Next we conducted a detailed review of the current medical force, including its size, force mix, and specialty composition; how it is utilized in the deployed setting and in garrison; and its cost. We began with an overview of the total force and then narrowed our scope

to focus primarily on CCCT specialties that face the greatest readiness challenges. Forward surgical and resuscitative teams ("forward surgical teams," for short) emerged as a key area of focus.

- **An MCP Analysis**: Next we turned to examining the effectiveness of military civilian partnerships or enhancing readiness and how they might be expanded. We developed a taxonomy for categorizing MCPs; an inventory of existing MCPs; an effectiveness analysis that compares the workload available at MCP sites to MTFs; an analysis of how to optimize and scale MCPs; and an MCP expansion cost analysis.
- **A Force Mix Analysis**: The use of MCPs creates new force mix options. We first examined moving all AC forward surgical teams into MCPs. Under this model, the teams work in civilian trauma centers but remain in the AC with DoD paying their full compensation. We then examined alternative approaches that would move some AC teams to the RC and let the civilian facilities help cover their costs—the primary trade-off being cost versus deployment accessibility. We explored this cost/accessibility trade-off in an analysis that compares AC in MCPs to a traditional RC model, as well as new RC models that look similar to the AC MCPs.

We conclude with a discussion on creating a more integrated trauma and national disaster management system. This discussion includes the role of MCPs in assisting with public health responses to pandemics and other national public health emergencies.

Summary of Key Findings

- **The MTF-based training model does not support the readiness of key CCCT personnel.** Across the MTF system, moderate to severe trauma cases account for less than 1 percent of inpatient dispositions. The cases that do occur are highly concentrated at San Antonio Military Medical Center (SAMMC), DoD's only level I trauma center. The trauma case concentration at SAMMC increases with acuity level—SAMMC had 28 percent of minor traumas, 48 percent of moderate traumas, and 65 percent of severe and greater traumas. Overall, SAMMC had more than 10 times the severe trauma volume than any other large MTF. Even large medical centers like the Naval Medical Center (NMC) San Diego, NMC Portsmouth, and Walter Reed see fewer than 100 severe cases a year (or less than two per week on average). The result is very low trauma workload per provider. SMEs that we interviewed emphasized that high volumes of other case mixes (e.g., elective surgical cases) were a poor substitute for routine trauma experience. Even so, MTF surgical, non-trauma critical care, and emergency medicine cases are also very limited. Current MTF volumes fall significantly below the Department's Knowledge, Skills, and

Abilities (KSA) readiness targets. For instance, only around 10 percent of general surgeons meet their KSA targets.

- **MCP-based training models appear to be highly effective for supporting the readiness of CCCT personnel.** There are three broad MCP models. Short-run rotational models (SRMs) provide quick refresher training. These models do not provide skill sustainment but can be ideal for enlisted providers whose skill sets are relatively narrow and easier to refresh. Embedded sustainment models (ESMs) allow military personnel to sustain critical skills through full-time practice in a civilian trauma center. They are ideal for personnel with a significant requirement for trauma/critical care expertise (e.g., forward surgical teams). Part-time sustainment models (PSMs) allow providers stationed in MTFs to gain some routine trauma experience through periodic trauma call at nearby trauma centers. These models are ideal for specialties that should have routine trauma exposure (e.g., vascular surgeons, cardiothoracic surgeons, etc.) but do not require full-time trauma practice.

  Our in-depth workload analysis on embedded providers found that they experienced a much higher trauma, critical care, and emergency medicine workload volume than MTF-based providers. For instance, on average, embedded trauma and general surgeons performed about five times the daily workload of MTF-based surgeons. We estimated that it would take an embedded surgeon only 23 days to perform the annual workload volume of an MTF-based provider.

- **An MCP expansion targeting key CCCT personnel is feasible and would not impact the majority of the force.** The military force is roughly 193,000 personnel (114,000 in the AC and 79,000 in the RC). However, less than 8,000 military personnel fall into CCCT specialties (4,600 AC and 3,300 RC), or roughly 4 percent of the military medical force. Forward surgical teams, which require the greatest trauma expertise, are less than 1 percent of the military medical force. Our analysis explored embedding all forward surgical teams in MCPs (including SAMMC). We estimated that this would require moving an additional 700 personnel (430 officers, 270 enlisted) to MCPs after accounting for those that are already embedded or working at SAMMC. Building on models already in use by the Services, we estimated between 20 and 30 additional partnerships would be required, a relatively small fraction of the approximately 160 level I ACS-verified trauma centers without DoD partnerships. Furthermore, financial analysis of existing partnerships showed the benefits to civilian partners exceeded the costs. While we focused on embedding surgical teams, we observed that once personnel were embedded, additional short-run rotational models or part-time sustainment models could be added to the MCP

site. For instance, Army places embedded providers at civilian sites through its Army Military-Civilian Trauma Team Training (AMCT3) program (ESM model for Army forward surgical teams). Many of these sites grow to include a Strategic Medical Asset Readiness Training (SMART) program (an SRM model for enlisted personnel). The costs of MCP expansion could vary significantly based on how the military health system chose to adjust the current MTF footprint. For instance, if the MHS chose to maintain the exact footprint and level of service (i.e., backfilling all military personnel reallocated to MCPs with civilians), we estimated costs would increase by $100 million to $130 million per year. However, if the MHS were to right size some clinics and/or small hospitals to match the military workforce available, cost neutrality or savings would be possible.

- **Changing the force mix of key CCCT personnel offers a model for achieving enhanced readiness at lower costs.** Under current MCP models, DoD pays the full cost of AC teams embedded in MCPs. If some teams were moved to the RC, DoD would share their costs with the civilian facilities, reducing costs to taxpayers. In an analysis that holds the number of steady-state deployable teams constant (i.e., requires more RC teams per one AC team given deployment planning factors), we estimate that DoD could save roughly $50 million annually if the Navy and Air Force shifted their forward surgical team force mix to that used by the Army. Savings would be even greater if we did not hold the number of steady-state deployable teams constant. This analysis is based on the traditional RC model where clinical readiness is not monitored as closely as AC readiness. Under an alternative model, where DoD creates MCPs for RC teams, we estimate savings would fall to $40 million, but readiness would match that of the AC teams.

Conclusions and Recommendations

To improve the readiness and, therefore survivability at the start of the next war, we recommend the following changes to policy:

- **The practice of maintaining key CCCT personnel in low-volume MTFs to perform beneficiary care at the expense of readiness should be discontinued.** The MTF-based training model does not support the readiness of key CCCT personnel. This approach cannot sustain the readiness of current providers and creates incentives to reduce requirements for key CCCT members providers whose skills have limited demand in the MTFs.
- **The Services should clearly identify their requirements for trauma surgeons and other key CCCT specialties.** Today, there are approximately 74 fellowship-trained trauma surgeons (58 AC/16 RC) in the military. However, the

official requirements provided by the Services for their deployable trauma surgery platforms were for general surgeons. This contradicts civilian best practices, the academic literature, and SME recommendations. Future medical personnel requirements should determine which billets should be staffed by trauma surgeons versus general surgeons. This recommendation also applies to areas such as emergency medicine and critical care.

- **The DoD should expand MCPs to place all forward surgical teams in busy trauma centers full time.** Each Service appears to be moving forward with MCP expansion. At this point, the end state for MCP expansion is unclear and appears to be constrained by beneficiary care requirements and bureaucratic considerations. The DoD should have each Service develop an official MCP requirement to facilitate the process. A strategic roadmap for expanding this requirement should then be developed. Key considerations should include civilian partner identification, resourcing, and a strategy for absorbing the loss of CCCT personnel from the MTFs (e.g., optimal mix of backfilling, infrastructure changes, increased use of purchased care, and so on).
- **The DoD should consider increasing the use of RC forces for CCCT specialties, including expanded RC force mix options.** Placing AC providers in civilian trauma centers is similar to placing them in a reserve status. The difference is AC providers are more accessible for deployments, and DoD pays their full costs. Moving some share of these providers to an RC status would lower costs while maintaining similar levels of readiness. Expanding RC force mix options to include RC MCPs could provide further readiness and training benefits.

Implementation Challenges to Fulfilling These Recommendations

The IDA team conducted extensive interviews to identify implementation challenges associated with fulfilling these recommendations. From these interviews, we identified three primary categories of challenges: (1) barriers to establishing MCPs; (2) barriers related to the beneficiary care mission (e.g., having difficulty reallocating personnel from MTFs to MCPs); and (3) barriers related to expanding use of RC personnel (e.g., new contracts, recruiting, and so on).

The main body of this report addresses these challenges and provides implementation level recommendations.

Contents

1. Introduction

The Department of Defense (DoD) has an operational requirement for a deployable medical force. This force has two primary missions: (1) delivering combat casualty care (saving life, limb, and eyesight on the battlefield) and (2) providing force health protection (maintaining the health of warfighters in the field). A mix of active component (AC) and reserve component (RC) military medical providers deliver these essential capabilities.

AC medical providers are full-time employees of the DoD. When they are not deployed, most work in military hospitals, known as military treatment facilities (MTFs), to provide care to DoD beneficiaries and to maintain their medical readiness (i.e., clinical skills). In contrast, RC medical providers are not full-time employees of the DoD. When they are not deployed or activated for training, they work in civilian jobs. Civilian jobs for military medical reservists vary, but many, particularly in higher-level credentialed specialties, work in civilian hospitals and clinics.

The wars in Iraq and Afghanistan revealed significant readiness challenges with the current medical force mix and MTF-based training model.[1] To address these challenges, the *National Defense Authorization Act [NDAA] for Fiscal Year 2017* directed sweeping reforms to the military health system (MHS). Key provisions directed major changes to force structure, MTF infrastructure, and training methods. Among these provisions was Section 708, which directed the establishment of partnerships with large civilian trauma centers to provide military combat casualty care teams with greater exposure to a high volume of patients with critical injuries. Specifically, the provision stated:

> The Secretary may enter into partnerships with civilian academic medical centers and large metropolitan teaching hospitals that have level I civilian trauma centers to provide integrated combat trauma teams, including forward surgical teams, with maximum exposure to a high volume of patients with critical injuries. Under the partnerships entered into with civilian academic medical centers and large metropolitan teaching hospitals under paragraph (1), trauma teams of the Armed Forces led by traumatologists of the Armed Forces shall embed within the trauma centers of the medical centers and hospitals on an enduring basis.[2]

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1 This literature is summarized in Chapter 2.

2 *National Defense Authorization Act for Fiscal Year 2017*, Section 708, "Joint Trauma Education and Training Directorate."

To assess progress to date and identify areas for improvement, Section 757 of the FY 2021 NDAA directed:

> Not later than 30 days after the date of the enactment of this Act, the Secretary of Defense shall seek to enter into an agreement with a federally funded research and development center or other independent entity to conduct a study on force mix options and service models (including traditional and nontraditional active and reserve models) to enhance the readiness of the medical force of the Armed Forces to deliver combat care on the battlefield and assist public health responses to pandemics or other national public health emergencies.[3]

Further language directed a strong focus on military civilian partnerships (MCPs). The provisions specifically called for:

> (1) a review of existing models for such members who are medical professionals to improve clinical readiness skills by serving in civilian trauma centers, Federal agencies, or other organizations determined appropriate by the Secretary;
>
> (2) an assessment of the extent to which such existing models can be optimized, standardized, and scaled to address readiness shortfalls; and
>
> (3) an evaluation of the cost and effectiveness of alternative models for such members who are medical professionals to serve in the centers, agencies, and organizations specified in subparagraph (A).

The full language can be found in Appendix A.

The Institute for Defense Analyses (IDA) was selected to conduct this study, and this report provides our results; it is organized as follows:

- Chapter 2 provides a detailed review of medical readiness challenges.
- Chapter 3 provides a detailed overview of the military medical force.
- Chapter 4 reviews the current MCP approach.
- Chapter 5 examines how MCPs can be optimized and expanded.
- Chapter 6 examines the cost of MCP expansion.
- Chapter 7 examines the mix of AC and RC forces, how MCP expansion likely impacts the optimal force mix, and actions DoD can take to achieve an optimal force mix.

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[3] *National Defense Authorization Act for Fiscal Year 2021,* Section 757, "Study on Force Mix Options and Service Models to Enhance Readiness of Medical Force of the Armed Forces."

- Chapter 8 provides discussion on creating a more integrated trauma and national disaster management system.
- Chapter 9 offers concluding remarks.

2. Medical Readiness Challenges

> We are going to repeat the same mistakes we have made before. We are going to think our doctors are trained. They are not going to be trained. You have just got to pray your son or daughter, or granddaughter is not the first casualty of the next war. Pray they come in at about the year five mark. (General Peter Chiarelli, 2016)[4]
>
> We recognize that current training and practice do not fully prepare expeditionary surgeons and their teams to perform vital life, limb, and eyesight-saving procedures. (Military Medicine, 2021)[5]

Military healthcare has long experienced a harmful "peacetime effect." Military medical forces make dramatic gains in the quality of lifesaving care on the battlefield during wars, but then see these gains erode after the wars end. The medical force is left unready at the start of the next war. Cannon et al. (2020)[6] estimates that this readiness loss may have contributed to over 100,000 combat fatalities (almost 40 percent of all combat deaths) from World War II to present.

This chapter reviews the causes of the peacetime effect. These causes afford the motivation for section 757 of the FY 2021 NDAA and provide the criteria used by the IDA team to assess MCPs in this report. The chapter concludes with a case study of one of the most dramatic lifesaving operations performed in combat and its implications for MCPs.

A. Medical Readiness Challenges in the Military Health System

A key measure of military healthcare readiness is survival on the battlefield. During the wars in Iraq and Afghanistan, researchers evaluated each combat death to determine whether the injuries were potentially survivable or non-survivable. Death from potentially survivable injuries means that it is likely the service member could have survived if optimal

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4 National Academies of Sciences, Engineering, and Medicine (NASEM), "A National Trauma Care System: Integrating Military and Civilian Trauma Systems to Achieve Zero Preventable Deaths after Injury," Washington, DC: *The National Academies Press* (2016): 15.

5 Kyle N. Remick, Pamela B. Andreatta, and Mark W. Bowyer, "Sustaining Clinical Readiness for Combat Casualty Care," *Military Medicine* 186(5-6), May–June 2021, 152–154, https://doi.org/10.1093/milmed/usaa475.

6 J. W. Cannon, K. R. Gross, and T. E. Rasmussen, "Combating the Peacetime Effect in Military Medicine" *JAMA Surgery* 2021;156(1): 5–6, https://doi.org//10.1001/jamasurg.2020.1930.

healthcare had been delivered in a timely manner. Eastridge et al. (2012)[7] estimate that 976 of the 4,016 pre-hospital deaths from 2001 to 2011 were from potentially survivable injuries. In a separate paper, Eastridge et al. (2011)[8] estimated that 287 of the 558 in hospital deaths from 2001 to 2009 were from potentially survivable injuries.[9] In some cases, failure to provide optimal healthcare was caused by the tactical situation. Unfortunately, in other cases, the death resulted from not having a ready medical force: the right provider with the right training with the right equipment was not deployed. This section examines the causes of inadequate medical readiness.

1. Combining Readiness and Benefit Missions Poses Challenges

The root cause of the peacetime effect is a long-standing misalignment of DoD business practices. Instead of focusing on its readiness requirement to provide combat casualty care in times of war, DoD optimizes its structure to deliver beneficiary healthcare during peacetime. In 2015, the *Final Report of the Military Compensation and Retirement Modernization Commission (MCRMC)* highlighted the mismatch between prevalent injuries and wounds sustained during operations in Iraq and Afghanistan (predominantly penetrating trauma and blast trauma) and MTF inpatient cases (predominantly labor and delivery, newborn care, and pediatrics).[10] Subsequent work by IDA and RAND further highlighted this mismatch with in-depth analyses of theater and MTF medical workload concluding that "inpatient workload performed in the direct care system bears little resemblance to that encountered in theater" and "trauma care in theater is often being delivered by people who do not see trauma at home."[11,12]

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7 Brian J. Eastridge et al., "Death on the battlefield (2001–2011): Implications for the future of combat casualty care," *Journal of Trauma and Acute Care Surgery* 73(6), (December 2012): S431–S437.

8 Brian J. Eastridge et al., "Died of Wounds on the Battlefield: Causation and Implications for Improving Combat Casualty Care," *Journal of TRUAMA Injury, Infection, and Critical Care* 71(1), (July Supplemental 2011): S4–S8, https://apps.dtic.mil/sti/pdfs/ADA618943.pdf.

9 Martin Similarly et al., (2009) studied in-hospital deaths at the Combat Support Hospital in Baghdad and found opportunities for improvement, which the researchers defined as "significant deviation from optimal care" in 49 percent of the cases.

10 *Report of the Military Compensation and Retirement Modernization Commission-Final Report*, January 2015, https://docs.house.gov/meetings/AS/AS00/20150204/102859/HHRG-114-AS00-20150204-SD001.pdf.

11 Edward W. Chan et al., "Options for Maintaining Clinical Proficiency During Peacetime," RAND Publication, 2020, https://www.rand.org/pubs/research_reports/RR2543.html. This report compares the most common medical diagnoses and surgical procedures performed in a combat setting to those performed during peacetime in MTFs.

12 Chan et al., "Options for Maintaining Clinical Proficiency During Peacetime."

The MCRMC report went on to discuss several consequences created by this misalignment. One consequence was the tendency for understaffing key combat casualty care specialties during peacetime (e.g., surgeons and anesthesiologists) and overstaffing beneficiary care mission specialties (i.e., pediatrics and obstetricians). A previous DoD report identified that, in 2004, the military medical force contained 359 more pediatricians and 179 more obstetricians than required for military missions and was understaffed for its military mission by 59 anesthesiologists and 242 general surgeons.[13]

Another consequence highlighted by the commission report was that many surgeons felt ill-prepared to deliver combat casualty care in theater. Citing a survey of over 200 general surgeons who deployed between 2002 and 2012, the report found that 80 percent of participants desired additional pre-deployment training in certain surgical disciplines and injuries.[14] Many reported experiencing difficulties with complex cases while deployed (particularly vascular surgeries, neurosurgical procedures, burns, and thoracic cases) because they had not performed them in regular clinical practice.

The MCRMC concluded that medical readiness "suffers during peacetime" and made multiple recommendations to help sustain the level of medical readiness gained over the past 2 decades. Among the recommendations was the direction to define and measure essential medical capabilities (EMCs). A 2016 IDA report developed a preliminary EMC concept.[15] In the years following the final report of the MCRMC, the DoD developed its own metric for measuring medical readiness known as "Knowledge Skills and Abilities (KSAs)." These are now available for several specialties including general surgery, trauma surgery, and emergency medicine.

2. MTF Trauma and Combat Casualty Care Relevant Cases Are Limited

Multiple studies have examined the volume of trauma and combat casualty care relevant workload available in MTFs. A 2017 IDA study examined the workload available

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[13] Department of Defense, *DoD Force Health Protection and Readiness—A Summary of the Medical Readiness Review, 2004–2007*, June 2008. The misalignment of the medical force to the operational mission at the start of the OIFO/EF conflicts was also highlighted in John E. Whitley, Brandon R. Gould, Nancy M. Huff, and Linda Wu, "Medical Total Force Management, " IDA Paper P-5047 (Alexandria, VA: Institute for Defense Analyses, May 2014).

[14] The most commonly requested types of training were extremity vascular repairs, neurosurgery, orthopedics, and abdominal vascular repairs. Surgeons overwhelmingly cited vascular surgeries as the most difficult cases, followed by neurosurgical procedures, burns, and thoracic cases. See Joshua A. Tyler MD et al., "Combat Readiness for the Modern Military Surgeon: Data from a Decade of Combat Operations," *Journal of Trauma and Acute Care Surgery* 73 no. 2, supp 1 (August 2012): S64–S79, https://doi.org/ 10.1097/TA.0b013e3182625ebb.

[15] John E. Whitley et al., "Essential Medical Capabilities and Medical Readiness," IDA Paper P-5305 (Alexandria, VA: Institute for Defense Analyses, July 2016).

in MTFs for the purpose of identifying the size of the readiness-related workload gap facing surgical providers.[16] The analysis used two different definitions of readiness workload. The first was based on IDA's EMCs (a list of roughly 100 procedures commonly used to treat combat casualties in Iraq). The second was major trauma (cases with an injury severity score (ISS) greater than 15). Using volume benchmarks based on DoD's only level I trauma center (SAMMC, the IDA team found only enough major trauma workload across the MHS to support 28 percent of providers (or only 14 percent of providers using the stricter EMC metric). The study concluded that, by either metric, workload gaps were substantial and needed to be addressed by tapping into a larger population of trauma patients.

A more recent study in the *Journal of Trauma and Acute Care Surgery* developed a metric for CCC-RCs and analyzed the volume of such cases performed by surgeons at four MTFs with surgical residency programs.[17] Over a 2-year period, only 30 CCC-RCs were performed (less than 1 percent of over 10,500 cases analyzed). The study also looked at SAMMC, and found that its surgeons saw a significantly higher portion of CCC-RCs (35 percent). The study concluded that MTFs that care primarily for DoD beneficiaries should not be considered a meaningful source of CCC-RCs for general and vascular surgeons.

To further illustrate this point, Table 1 shows all MHS trauma cases for FY 2019.[18] To identify trauma cases from healthcare claims, we use the case definition from the American College of Surgeons-Committee on Trauma. We also classify trauma by severity level (minor, moderate, and severe) using ISSs derived from injury diagnosis codes. Appendix B provides detail on the trauma definition and ISS methodology. We use these metrics throughout this report for evaluating trauma workload available from MCPs.

Across the MHS, moderate to severe trauma cases account for just over 1 percent of all inpatient admissions. Nearly 40 percent of trauma cases were concentrated at SAMMC. This concentration increases with acuity level: SAMMC had 28 percent of minor traumas, 48 percent of moderate traumas, and 65 percent of severe and greater traumas. Overall, SAMMC had more than 10 times the severe trauma volume than any other large MTF. Even large medical centers like NMC San Diego, NMC Portsmouth, and Walter Reed see fewer than 100 severe cases per year (or less than 2 per week on average).

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16 Philip M. Lurie, Sarah K. Burns, John E. Whitley, James M. Bishop, and Dylan J. Carrington-Fair, "Medical Readiness within Inpatient Platforms," IDA Paper P-8464 (Alexandria, VA: Institute for Defense Analyses, 2017).

17 Andrew B. Hall et al., "Current Challenges in Military Trauma Readiness: Insufficient Relevant Surgical Case Volumes in Military Treatment Facilities," *Journal of Trauma and Acute Care Surgery*, 89(6) (December 2020): 1054–1060, https://doi.org/10.1097/TA.0000000000002871. The studied MTFs were the 96th Medical Group Hospital, the William Beaumont Army Medical Center (level III trauma center), Naval Hospital Camp Pendleton, and Naval Medical Center San Diego.

18 We use data to 2019 to avoid the impact of the COVID-19 pandemic.

Table 1. Trauma Volume and Inpatient Admissions at Top 25 MTFs, FY 2019

MTF Name	Minor	Moderate	Severe or Higher	All Trauma	Total Dispositions	Trauma Share of Dispositions
SAMMC	1,997	649	1,101	3,747	24,211	15%
NMC San Diego	499	87	83	669	16,124	4%
NMC Portsmouth	352	30	39	421	13,607	3%
Walter Reed NMMC	333	77	64	474	13,183	4%
AMC Madigan-Lewis	393	96	68	557	12,235	5%
AMC Tripler-Shafter	371	53	51	475	11,686	4%
AMC Womack-Bragg	259	36	15	310	10,049	3%
AMC Willian Beaumont-Bliss	242	39	42	323	8,514	4%
AMC Darnall-Hood	119	7	9	135	7,975	2%
Ft. Belvoir Community Hospital	115	20	15	150	7,183	2%
NMC Camp Lejeune	265	50	34	349	7,044	5%
ACH Evans-Carson	63	7	7	77	6,255	1%
AF-MC-60th MEDGRP-Travis	113	26	29	168	5,337	3%
ACH Blanchfield-Campbell	71	12	4	87	5,028	2%
AMC Eisenhower-Gordon	165	23	10	198	4,757	4%
Landstuhl Regional MMC	255	29	38	322	4,495	7%
NH Camp Pendleton	118	9	7	134	4,263	3%
AF-MC-99th MEDGRP-Nellis	87	13	7	107	4,213	3%
ACH Martin-Benning	144	15	5	164	3,838	4%
AF-H-96th MEDGRP-Eglin	43	5	2	50	3,399	1%
NH Okinawa	129	16	10	155	3,368	5%
NH Jacksonville	43	5	1	49	3,319	1%
AF-H-673rd MEDGRP-Elmendorf	76	4	11	91	3,097	3%
AF-MC-88th MEDGRP-Wright Patt	56	4	10	70	2,996	2%
ACH Winn-Stewart	13	2	1	16	2,893	1%
All Other Inpatient MTFs	711	43	38	792	23,455	3%
Total	7,032	1,357	1,701	10,090	212,524	5%
SAMMC Share	28%	48%	65%	37%	11%	

Source: M2; NMC=Naval Medical Center; AMC=Army Medical Center; ACH=Army Community Hospital; NH=Naval Hospital

3. MTF Surgical, Non-trauma Critical Care, and Emergency Care Is Also Limited

Some have argued that military surgeons can maintain their readiness without seeing routine trauma cases, as long as they see a sufficient volume of surgical cases. This is the premise behind the Department's KSA metric, which assigns points to most workloads using a scoring algorithm that factors in case acuity, complexity, and diversity.[19] However, recent studies have shown that MTFs have low volumes in most surgical areas and that volume has been falling. For instance, Dalten et al. (2021)[20] found that only 10 percent of general surgeons met their KSA point thresholds in 2019.[21] Levy et al. (2021)[22] also documented a very low proportion of general surgeons meeting KSA targets (approximately 8.5 percent in 2019). KSA findings were better for orthopedic surgeons but still showed significant gaps (roughly 60 percent of orthopedic surgeons met KSA targets in 2019). Haag et al. (2021)[23] also examined surgical volume in MTFs. Focusing on procedures with high KSA value, they found low volumes in the vast majority of MTFs. To our knowledge, KSA data for surgical subspecialties other than trauma (e.g., vascular, neuro, cardiothoracic, etc.) have not been reported. Two additional studies by CNA have examined the MTF volume of procedures and the relationship between this volume and quality of care. These are described below.

Brevig et al. (2014)[24] examined the clinical literature on volume quality and identified a number of volume standards used in civilian healthcare for both providers and facilities. For example, the literature finds that orthopedic surgeons that perform at least 50 knee

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19 Daniel B. Holt et al., "Clinical Readiness Program: Refocusing the Military Health System," *Military Medicine* 186, supp 1 (2021): 32–39, https://doi.org/10.1093/milmed/usaa385.

20 Michael K. Dalton et al., "Analysis of Surgical Volume in Military Medical Treatment Facilities and Clinical Combat Readiness of U.S. Military Surgeons," *JAMA Surgery* 157(1), (2022): 43–50, https://doi.org//10.1001/jamasurg.2021.5331.

21 The authors also found a 26 percent decline in the number of surgical procedures generating KSA points, and a 19 percent decrease in the total number of KSA points for general surgeons over the same period.

22 Robert A. Levy, Shing Lai (Angie) Cheng, and Patricia Netzer, "Feasibility and Risks Associated with Providing Trauma Skills Sustainment and Training in the USSOUTHCOM AOR," *CNA Research Memorandum*, October 2021.

23 Austin Haag et al., "Trends in Surgical Volume in the Military Health System–A Potential Threat to Mission Readiness," *Military Medicine* 186 (July–August 2021): 646–650, https://doi.org/10.1093/milmed/usaa543.

24 Holly Brevig, Christina Colosimo, Ted Jaditz, Ramona Krauss, Kara Mandell, Robert Morrow, Jessica Oi, and Wilhelmina Tsang, "The Quality-Volume Relationship: Comparing Civilian and MHS Practice," CNA Research Paper, January 2015. https://www.cna.org/CNA_files/PDF/DIM-2014-U-009221-Final.pdf.

arthroplasties per year have the best outcomes for this surgery, but in DoD only 10 of the 292 orthopedic surgeons performing these surgeries met this standard. An example at the facility level is open heart surgeries. The literature finds that the best chance of a good outcome is in a facility that performs at least 250 of these surgeries per year. No MTF met this standard. For the year studied, the highest volume MTF was Eisenhower Army Medical Center with 64 procedures. Brevig et al. found that very few MTFs or providers meet civilian volume standards for a wide range of procedures.

Mandell et al. (2016)[25] examined the volume of procedures performed by Navy emergency medicine physicians. Similar to other studies, few MTFs met foundational volume standards. For example, Mandell et al. reviewed literature finding that emergency medicine physicians should perform at least 50 central line insertions per year for the best patient outcomes, and that emergency departments should have at least 3 percent of their patients critically ill or injured to provide adequate training for residency programs. In the year studied, Navy emergency medicine physicians averaged four central line insertions. Four out of 13 Navy MTFs met the standard of at least 3 percent critically ill or injured patients.

In addition to reviewing past studies, the IDA team interviewed several SMEs. Many interviewees emphasized the lack of non-trauma critical care patients in the MTFs stemming from the low volume of high-acuity medical/surgical patients. They discussed that maintaining the currency of critical care specialists, such as intensivists and critical care nurses, is also a critical readiness function because these providers must keep trauma patients alive following surgical interventions. These specialists also play a central role in transporting critically injured patients to higher levels of care.

To examine the critical care workload available in the MTFs, the IDA team examined the count of all inpatient, outpatient, and emergency room professional encounters containing procedure codes (current procedural terminology (CPT) codes) that indicate the patient required critical care. Specifically, we counted CPT codes of 99291 (critical care, first hour) and 99292 (critical care, additional 30 minutes) within the first three evaluation and management codes for all records across the entire MHS. The results are shown in Table 2. About one-third of the total MHS critical care encounters occurred at SAMMC.

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[25] Kara Mandell, Shing Lai (Angie) Cheng, Greg Schell, Elliot Lee, and Pat Netzer, "Measuring and Improving Currency in the Navy Emergency Medicine Enterprise" (Alexandria, VA: CNA, September 2016).

Table 2. Critical Care Professional Encounters (CPT: 99291,99292)

MTF Name	Emergency Room	Inpatient	Outpatient Support - Other	Total
SAMMC	1,410	3,906	319	5,635
AMC TRIPLER-SHAFTER	358	878	108	1,344
AMC EISENHOWER-FT GORDON	391	670	150	1,211
AMC MADIGAN-FT LEWIS	38	1,137		1,175
AMC WILLIAM BEAUMONT-FT BLISS	270	753	18	1,041
FT BELVOIR COMMUNITY HOSP-FBCH	312	466	63	841
WALTER REED NATL MIL MED CNTR	143	612	1	756
AF-MC-60th MEDGRP-TRAVIS	271	468		739
NMC PORTSMOUTH	92	471	7	570
NMC SAN DIEGO	494	15		509
LANDSTUHL REGIONAL MEDCEN	110	164	89	363
AMC WOMACK-BRAGG	118	184	36	338
NMC CAMP LEJEUNE	284	4	6	294
NH GUAM-AGANA	96	168		264
AMC DARNALL-FT HOOD	237	23	2	262
AF-MC-81st MEDGRP-KEESLER	155	74	1	230
AF-MC-99th MEDGRP-NELLIS	84	1	88	173
ACH EVANS-CARSON	150	1	14	165
ACH BLANCHFIELD-FT CAMPBELL	133	15	1	149
AF-H-96th MEDGRP-EGLIN	44	67	19	130
ACH LEONARD WOOD	88		3	91
NH OKINAWA	86	1	0	87
AF-MC-88th MEDGRP-WRIGHT-PAT	25	0	47	72
ACH WINN-FT STEWART	61	0	1	62
NH CAMP PENDLETON	38	0	13	51
All Others	260	3	50	313
Total	5,748	10,081	1,036	16,865
SAMMC Share	25%	39%	31%	33%

4. Specialization in Trauma and Critical Care Decreases Mortality

The clinical literature from Iraq and Afghanistan found that providers who specialized in trauma, emergency medicine, and critical care reduced mortality across a variety of deployed settings, including combat support hospitals (Lettieri, Shah, and Greenburg,

2009);[26] battalion aide stations (Gerhardt et al., 2009);[27] and aeromedical evacuation platforms (Mabry et al., 2012).[28] In the civilian setting, patients with similar characteristics and injuries were found to be 25 percent more likely to die while being treated in a non-trauma center as opposed to a level I trauma center (Makenzie et al., 2006).[29]

The civilian literature has also established that a structured trauma program led by an experienced trauma surgeon[30] can augment with non-trauma-trained surgeons who have ongoing trauma experience to assist in trauma cases without increasing mortality. Specifically, Haut et al. (2009) found, using data from Johns Hopkins Hospital, that once such a program was established, patients managed by novice surgeons[31] were more likely to survive, and that mortality was comparable regardless of a surgeon's experience. Important elements of this structured program include: in-house trauma surgeon presence 24 hours a day; evidence-based protocols for trauma patient management; dedicated trauma admitting with use and triage solely under the control of the trauma team; and a daily morning report in which all new trauma contacts and inpatient management decisions for the previous 24 hours were discussed in a learning forum. It is important to note that these novice surgeons "spent most of their time in trauma and emergency surgical patient care" (Haut et al.).

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[26] Christopher J Lettieri, Anita A. Sha, and David L. Greenburg, "An Intensivist-Directed Intensive Care Unit Improves Clinical Outcomes in a Combat Zone," *Critical Care Medicine* 37(4) (April 2009): 1256–1260, https://doi.org/10.1097/ccm.0b013e31819c167f.

[27] Robert T. Gehardt et al., "Out-of-Hospital Casualty Care in the Current War in Iraq," *Annals of Emergency Medicine* 53 no. 2 (February 2009): 169–174, https://apps.dtic.mil/sti/pdfs/ADA513489.pdf.

[28] Robert L. Mabry et al., "Impact of Critical Care-Trained Flight Paramedics on Casualty Survival during Helicopter Evacuations in the Current War in Afghanistan," *Journal of Trauma and Acute Care Surgery* 73, no. 2 (August 2012): S32–S37.

[29] Ellen J. MacKenzie et al., "A National Evaluation of the Effect of Trauma-Center Care on Mortality," *New England Journal of Medicine* 354(4) (January 2006): 366–378, https://doi.org/10.1056/nejmsa052049.

[30] Defined in Haut, et al., (2009) as having "completed a two-year trauma/critical care fellowship and 10 additional years as a full-time trauma clinical surgeon." See Elliott R. Haut et al., "Surgeon- and System-Based Influences on Trauma Mortality," *Journal of the American Medical Association* 144(8) (August 2009): 759–764, https://doi.org/10.1001/archsurg.2009.100.

[31] Defined in Haut et al., (2009) as "junior first-year surgical attending surgeons… [who have completed] their general surgical residency."

Louras et al. (2016)[32] and Kilen et al. (2017)[33] confirm this finding. Louras et al. (2016) examined a rural level I trauma center in Vermont that, during the study period, had seven full-time trauma surgeons and used five experienced general and thoracic surgeons on a part-time basis to supplement the call schedule. The study found no excess mortality for patients treated by the non-trauma surgeons operating under the leadership of and with the protocols and systems emplaced by the trauma specialists. Kilen et al. (2017) examined a level I trauma center in New Mexico that uses experienced general surgeons to supplement the on-call schedule. They examined a specific, complex procedure injury category (hepatopancreatobiliary injuries) and found no increase in mortality for patients treated by general surgeons with ongoing trauma experience working under the supervision of experienced trauma surgeons.

These findings have important implications for specialty requirements and clinical currency for military medical personnel. The clinical literature indicates that the lead surgeon in a trauma unit should be an experienced trauma surgeon, defined as completing a 2-year trauma fellowship and having 10 years of full-time experience at a busy trauma center. For units that have supporting surgeons (see discussion in the next chapter for descriptions of specific units), the supporting surgeons do not have to be fellowship-trained in trauma surgery but should have active and ongoing trauma experience.

B. Input from Trauma Subject Matter Experts and MCP Participants

To supplement the clinical literature, the IDA team conducted extensive interviews and discussions with trauma/critical care subject matter experts, including trauma surgeons, critical care and ER physicians, critical care nurses, and respiratory therapists. These individuals included active duty, retired active duty, reservists, and civilian experts. The IDA team also held discussions with MCP participates at each site we visited:

- University Medical Center (UMC) of Southern Nevada (Air Force);
- University Alabama Birmingham (UAB) Medical Center (Air Force);
- Cooper University Hospital, New Jersey (Army);
- Penn Presbyterian Medical Center (Navy); and
- Vanderbilt University Medical Center (Army).

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[32] Nathan Louras et al., "Nontrauma Surgeons Can Safely Take Call at an Academic, Rural Level 1 Trauma Center," *American Journal of Surgery* 211(1) (January 2016): 129–132, https://doi.org/10.1016/j.amjsurg.2015.05.020.

[33] Peter Kilen, Alissa Greenbaum, Richard Miskimins, Manuel Rojo, Razvan Preda, Thomas Howdieshell, Stephen Lu, and Sonlee West, "General Surgeon Management of Complex Hepatopancreatobiliary Trauma at a Level 1 Trauma Center," *Journal of Surgical Research* 217 (September 2017): 226–231, https://doi.org/10.1016/j.jss.2017.05.019.

Next, we provide a summary of the common themes that arose in discussions with MCP participants. This section is followed by an interview discussion with a reservist who talked to the IDA team about the importance of trauma expertise in providing lifesaving care on the battlefield and the importance of fellowship trauma training.

1. Common Themes for MCP Participant Discussions

MCP participants emphasized that immersion into a busy trauma/critical care environment was essential to being prepared to treat combat casualties. Much emphasis was placed on how immersion can improve providers' cognitive abilities to quickly assess injuries and make lifesaving treatment decisions. Some of the most common recurring statements the IDA team heard are paraphrased below:

- When you see a dozen trauma cases a day, you develop a decision make algorithm that allows you to quickly assess a critical patient and start the appropriate intervention.
- Treating critically injured patients needs to be second nature. You can't only do it 2 weeks a year and then be expected to provide care to the most severely injured patients in austere environments with less support than you would have in the MTF.
- I got to do more of procedure X (e.g., chest tubes, intubations, etc.) in one day at this MCP that I did in 6 months at the MTF.
- I had never seen a patient injured that severely in the MTF, when you first see it you panic or go into shock.
- The concept that elective surgical cases can substitute for routine high-volume trauma goes against the civilian trauma system experience and standard of care.
- A trauma surgeon is very different from a general surgeon; the Department needs to be clearer about the requirement for trauma surgeons versus general surgeons.

2. A Discussion of the Importance of Trauma Fellowship Training

The IDA team spoke with many SMEs during the course of this study. One was a leading civilian trauma surgeon who also serves in the reserve component. The IDA team reached out to him after hearing and reading about an incredible casualty save he was involved in. The interview below covers that scenario and then turns to an in-depth discussion on trauma fellowship training, which he credited with his success. The exchange has been edited for clarity.

Scenario: During an assault on an extremely remote target, a U.S. Special Operations Soldier sustained multiple gunshot wounds to the chest, resulting in a traumatic arrest.

Owing to expertly delivered pre-hospital field care, the use of innovative military medical products, and an incredible early far-forward surgical intervention by a reserve trauma surgeon, the patient survived. His story has been called "The Most Impressive Casualty Save in a Combat Theater."

Q: Can you tell us a little about the conditions on the ground when the patient received his injuries and required field care?

> It was dark, everything was done under Night Observation Devices (NODs), it was very windy, very cold—I think the ambient temperature was like 13 degrees but with the wind chill it was about 20 below. So cold, in fact, I encountered a problem that I don't think anyone had ever encountered before. When I started operating on him, it was so cold that when I made the incision on his chest and put the retractor in, the humidity that came from his organs fogged up my [eye protection] and I couldn't see. I had to lift my NODs, throw my [eye protection] away, and put my NODs back on to be able to continue. Generally, you don't do surgery in conditions that cold.

Q: Can you describe the surgical intervention you performed in layman terms for a non-clinical audience?[34]

> In laymen's terms, it's pretty simple—it was basically open-heart surgery in the field. That's what we did. In a place and under a set of circumstances where it is downright absurd to even contemplate the undertaking of doing such a thing. If you had asked a Vietnam or Korea era surgeon if they would do this they would say "absolutely not, that's insanity." And there are a lot of reasons for that, but as they say, we stand on the shoulders of giants. So, in 1955 in Korea, they were right in that it would have been certain death for that patient, but we've had a variety of medical advancements and innovations since Korea and Vietnam that allowed us to safely operate on him in that way.

Q: You were able to quickly assess the patient's condition and act to perform lifesaving damage control surgery in conditions far more austere than what you must be used to from working in a busy level I trauma center. How were you able to do this?

> There were actually four casualties and we operated on all of them. You are asking, how did I know it was time for what we call in trauma surgery a "varsity move." This is when you say, I'm going to accept all the risk and whack into this guy's chest even though its freezing and I'm in the dark in the back of a helicopter and under most circumstances the patient would

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[34] For a detailed clinical description see: Myles R. McKenzie, Ernest W. Parrish et al., "A Case of Prehospital Traumatic Arrest in a U.S. Special Operations Soldier: Care from Point of Injury to Full Recovery," *Journal of Special Operations Medicine* 16(3) (2016): 93–96.

face certain death. How do you know when it's time to make the varsity move? The answer to that I would say is training and I don't mean military training. I mean fellowship training in trauma surgery. You don't typically get that in an MTF and you certainly don't get it at the VA.

Q: So being able to do something like that required a lot of clinical training, education, and experience in those trauma scenarios that you don't get from the military health system. How do we define the true population that needs this level of training? How do we craft MCPs to help that population get the training we need? How do we articulate the training requirement back to the Department so that we make sure they are maximizing opportunities to get those folks trained to be able to succeed and save lives in the field?

Let me tell you something very broad for a minute and then move out into something very granular. I strongly feel that the only way to put competent surgeons in these forward surgical teams is to have fellowship-trained trauma surgeons in that role. Let me clear up one detail that you must get people to understand. A general surgeon is not a trauma surgeon—they are not the same. Just because your MOS is 61J (Army general surgeon) doesn't mean you know how to treat a gunshot wound to the heart. They are not the same—if you could communicate anything, you need to make that go away. There needs to be a separate requirement for a trauma surgeon because those are the people that you want to put at the role 2 (forward care units). They don't have to be there by themselves. You can put a fellowship-trained trauma surgeon at a role 2 with a 61J because that guy can get coached up pretty darn fast and get pretty darn good if he is standing shoulder to shoulder with a guy who has all the right training. I'm not saying forget about the 61Js—not at all. What I am saying, though, is that you need someone with real bona fides at a role 2 if your goal is to have best possible outcomes at all times.

On the granular scale, I did something recently as the fellowship director at Mass General. Last year, I made a point to recruit a military general surgery trainee. So, I have a guy who is a military trainee, who I brought to our trauma fellowship and he is training with us. When he graduates this summer, he will have the chops to make the right decisions for very, very sick and injured patients under the worst of circumstances.

A trauma fellowship in not just about incisions and instruments and that kind of stuff. Trauma training is learning how to make good decisions with imperfect information under suboptimal circumstances in the absence of all the things that you are used to having. A trauma surgeon says give me whatever you have and I will figure it out, I will figure out how to use it. That doesn't come over night. That requires a year or two of additional training to develop that kind of confidence in yourself where you say you know what, I don't care what the circumstances are, I'm going to figure this out.

Can I have a carotid shunt? No, we don't have a carotid shunt. Ok, give me IV tubing, I will cut one myself and bevel the edges and stick that in instead. Oh, you ran out of chest tubes, I will use a nasal gastric tube. Let me put that in the chest. That kind of problem-solving only comes from a trauma fellowship.

Q: Can surgeons who perform a high volume of elective surgical procedures but who don't work in trauma centers be expected to perform lifesaving damage control surgery down range?

No. No way. It is not [the same]. The guy that is doing 4 gallbladders and 6 hernias a day is not equipped to adequately deal with a stab wound. No way. Or worse yet, the bilateral lower extremity blast injury with above the knee amputation and trans pelvic transplantation. That surgeon is going to be lost and the casualty will be lost too.

Q: To follow that up, we've heard some say that fellowship training might be too specialized and that those fellows will learn to rely on equipment sets and support that aren't going to be available to them down range. What is your response to that?

I trained at one of the busiest trauma centers in the country, Ryder Trauma in Miami. I graduated in June and was in Iraq by July and not once did I struggle for equipment. The reason for that is, as I explained earlier, is the whole point of trauma training is to figure out how to do a lot with a little. Yes, Ryder is a huge trauma center, but when I'm operating there as a fellow and I say we need interventional radiology, and they say that's an hour and a half away, well guess what? You don't have an hour and a half. What do you do? You figure it out yourself.

These centers are well equipped but there are still real challenges. Even at Mass General, I can't get an interventional radiologist in 5 minutes at 2:00 in the morning. I have to figure that out for myself. The trauma surgeon is the person who will never stutter when somebody hands them an instrument that is not the one they asked for. They will say, "OK, I will figure out how to make it work." That is the training program. How do you do a lot with a little? Any good trauma training fellowship program emphasizes that. We do it every day.

I took my fellow through a very, very bad colectomy today. He wanted to use this device called a LigaSure, it's an electronic device that you can just chomp across tissue and it cauterizes and seals—it's like magic. I call it surgical cheating. So, we asked for the LigaSure but it was not readily accessible and the colon needed to be out before it could be retrieved. I turned to our fellow and said, "We are going to do this the old school way with silk ties." And we did. To heck with the technology. Those are the type of hurdles that come up every day even at the places with so called "infinite resources." We don't have infinite resources—nobody does. When a patient is bleeding so bad that it is audible and you say, "I want X" and they hand you Y, you say "OK, I will figure that out." That is trauma.

So, the argument that training at a big center means you won't be able to adapt to limitations at a forward surgical team is nonsense, and we can easily train with what we are most likely to have down range. I will do that with my fellow this week. I'm going to get the instrument list for the FST and have our processors rack it up. The next time we do a trauma laparotomy, I will have him open it up and tell him, this is what we've got —figure it out.

Q: The last topic we wanted to explore with you is how military civilian partnering can enhance the sharing of battlefield medicine innovations with the civilian trauma community. The case study you shared mentioned combat gauze and freeze-dried plasma. We understand these are military innovations. Have many been adopted in civilian trauma centers?

Almost all of them have been widely adopted by civilian hospitals and pre-hospital providers. To give you another example, the same thing with tourniquets. The modern tourniquet was adopted by Bob Miller, a former ranger—his wife was sewing them at their kitchen table. That was developed out of necessity. He formed a company around it—that was a military innovation that was spread everywhere. Every military on Earth carries these.

As you probably know, I played a role at the Boston Marathon bombing. I took care of 243 patients that were blown up that day and I wrote a paper about this. One of the problems that I learned was our pre-hospital providers in Boston were not carrying tourniquets or advanced topical hemostatic agents and that probably resulted in excess blood loss and morbidity. To me, that was a shame because that was in 2013—12 years into the GWOT so we knew better. The pressure that I put on them worked because now every medic in Boston EMS carries a tourniquet and an advanced topical hemostatic agent. Most advanced pre-hospital medical agencies around the country do the same now. Those are all the result of direct military translation. As they say, the only victor of war is medicine.

Q: With the end of the wars in Iraq and Afghanistan, are you concerned about the "peacetime effect" that has historically been a challenge?

We know the next is coming. It might not be this year or next year. It could be 5 years or 10 years, but it is coming. The worst thing we can do is put our heads in the sand and say it is not happening now so readiness doesn't matter. Our go-to war posture can never go away. The tip of the spear always has to be sharp and in medical, that means keeping competent trauma surgeons ready to go to Role 2.

The IDA team felt this discussion clearly demonstrated the importance of having high levels of trauma expertise in certain units such as the Role 2 forward surgical teams. It also demonstrated the role RC providers can play in both the military mission and providing valuable integration between the military and civilian trauma systems. We will return to this topic in Chapter 7 when we examine force mix options.

3. An Overview of the Total Medical Force

This chapter provides an overview of the military medical force. The first section covers the size and composition of the current medical force (e.g., end strength, force mix, occupation mix, etc.). The second section covers how the medical force is utilized (e.g., deployments, providing care in MTFs, RC members civilian occupations, etc.). The third and final section covers the cost of the medical force.

A. Size and Composition

The total medical force includes the military medical force—both AC Service members and RC Service members—and civilian providers who deliver beneficiary care. The size and composition of the military medical force is supposed to be driven by the operational mission requirement. There is no operational requirement for civilian medical providers. These providers are hired to support the beneficiary care mission by working alongside AC providers in MTFs. Demand for civilian providers is a function of each Service's MTF footprint (how many hospitals and clinics they operate), the volume of care delivered at these facilities, and the number of AC providers available to provide care.

Table 3 shows the size of the total medical force as of January 2021. Including civilians, the total medical force is just over 236,000 personnel. The military medical force end strength was 192,579—just over 80 percent of the total medical force. Force mix varies considerably across services. The Army has the most balanced force mix, while the Navy has nearly 70 percent of medical personnel in the active component. The Air Force has the smallest number and share of civilian personnel.

Table 3. Total Medical Force, January 2021

	Active	Reserve	Civilian	Total	AC/RC/Civ Mix
Army	47,582	49,423	27,275	124,280	38/40/22
Navy*	35,961	11,033	7,474	54,468	66/20/14
Air Force	30,541	18,039	4,802	53,382	57/34/9
DoD	-	-	4,203	-	
Total	**114,084**	**78,495**	**43,754**	**236,333**	**48/33/19**

Source: DMDC.

Note: *The Marine Corps do not have their own medical force. Navy medical personnel provide medical care to Marines.

Table 4 shows only the military medical force broken out by officer and enlisted for both the AC and RC. The AC/RC mix is approximately 60/40 across the total military medical force. The Navy has the highest AC share (nearly 80 percent), while the Army has the lowest (just under 50 percent). Enlisted personnel account for 67 percent of the total military medical force (roughly two-thirds) though there is some variation by Service, with the Air Force having a lower share of enlisted and the Navy having the highest.

Table 4. Total Military Medical Force, January 2021

Service	Enlisted/Officer	Active	Reserve	Total	AC Share
Army	Enlisted	32,465	33,244	65,709	49%
	Officer	15,117	16,179	31,296	48%
	Total	47,582	49,423	97,005	49%
	Enlisted Share	68%	67%	68%	
Navy	Enlisted	25,630	7,679	33,309	77%
	Officer	10,331	3,354	13,685	75%
	Total	35,961	11,033	46,994	77%
	Enlisted Share	71%	70%	71%	
Air Force	Enlisted	19,494	11,265	30,759	63%
	Officer	11,047	6,774	17,821	62%
	Total	30,541	18,039	48,580	63%
	Enlisted Share	64%	62%	63%	
Grand Total		114,084	78,495	192,579	59%

Source: DMDC, January 2021.

The military medical force can also be broken out into several broad medical occupation-based groups. For officers, each Service maintains a medical corps (physicians), a dental corps (dentists), and a nurse corps (nurses). The Services vary in the way they organize their remaining medical officer personnel.[35] For ease of presentation, we group these providers into an "Other Medical Specialist" category. Table 5 shows the AC share by officer occupation groups. We observe a wide variation in the AC/RC mix across occupation groups. It appears all Services have the highest AC share for physicians (72 percent on average) followed by dentists (59 percent on average). Nurses have the lowest AC share at 50 percent.

[35] For instance, the Army has a medical specialist corps, a veterinary corps, and warrant officers, while the Air Force has a Biomedical Science Corps.

Table 5. Total Military Medical Officers by Occupation Groups, 2021

Officer Corps	Service	Active	Reserve	Total	AC share
Medical	Army	4,245	2,240	6,485	65%
	Navy	3,685	864	4,549	81%
	Air Force	3,643	1,473	5,116	71%
	Total Medical	**11,573**	**4,577**	**16,150**	**72%**
Dental	Army	984	1,281	2,265	43%
	Navy	1,149	344	1,493	77%
	Air Force	900	477	1,377	65%
	Total Dental	**3,033**	**2,102**	**5,135**	**59%**
Nurse	Army	3,217	4,716	7,933	41%
	Navy	2,791	1,601	4,392	64%
	Air Force	3,116	2,763	5,879	53%
	Total Nurse	**9,124**	**9,080**	**18,204**	**50%**
Other Medical Specialist	Army	6,671	7,942	14,613	46%
	Navy	2,706	545	3,251	83%
	Air Force	3,388	2,061	5,449	62%
	Total Other	**12,765**	**10,548**	**23,313**	**55%**

Source: DMDC, January 2021.

The readiness challenges discussed in Chapter 2 do not apply evenly to all military medical occupations. These challenges primarily affect personnel who are in combat casualty care (CCC) specialties. Providers of primary care (i.e., family practice, general medicine, internal medicine, pediatrics, and obstetrics/gynecology) have ample workload in the MTFs given the beneficiary population has a high demand for this type of care. Many other subspecialists providing beneficiary care (i.e., allergists, cardiologists, oncologists, gastroenterologists, endocrinologists, etc.) are less impacted by this problem given they would not typically be involved in treating critically injured patients in a deployed setting.[36] The remainder of this study will, therefore, focus on CCC specialties.

The IDA team was unable to obtain an official DoD list of CCC specialties. Each Service organizes medical personnel and units to treat combat casualties differently. In the following section, we discuss the make-up of each Service's medical units that deliver care to combat casualties across different roles of care. The IDA team did obtain a list of combat

[36] It was noted that these specialists do deploy to theater as internists and sometimes substitute for intensivists (critical care experts) which makes their readiness more important. SMEs recommended against this type of substitution.

casualty care team (CCCT) specialties created by a DoD Working Group and published in the American College of Surgeons Bluebook, "Military-Civilian Partnerships for Trauma Training, Sustainment, and Readiness." The list contained 16 officer specialties, subdivided into specialties that are core (C) members of small surgical trauma teams (CCCT-core (C)) and subspecialties that augment the smaller trauma teams at higher levels of care (CCCT+).[37] We highlight these provider specialties (see Table 6) because they are a target population for trauma sustainment MCPs. We added nurse anesthetists to the list given we observed these providers, instead of anesthesiologists, being utilized on many small teams.

Table 6. CCCT Specialty End Strength, FY 2021

	Specialty	Active	Reserve	Grand Total	AC Share
CCCT-C	Anesthesiology	308	190	498	62%
CCCT-C	Nurse Anesthetist*	474	680	1,154	41%
CCCT-C	Critical Care Nurse	1,172	999	2,171	54%
CCCT-C	Critical Care/Trauma, Surgery	58	16	74	78%
CCCT-C	Emergency Medicine	542	413	955	57%
CCCT-C	Emergency/Trauma Nurse	694	374	1,068	65%
CCCT-C	General Surgery	308	256	564	55%
CCCT-C	Orthopedic Surgery	322	126	448	72%
CCCT+	Cardiac/Thoracic Surgery	26	18	44	59%
CCCT+	Critical Care/Trauma, Medicine*	49	67	116	42%
CCCT+	Neurological Surgery	46	29	75	61%
CCCT+	Ophthalmology	133	30	163	82%
CCCT+	Oral Maxillofacial Surgery	175	50	225	78%
CCCT+	Otorhinolaryngology	133	33	166	80%
CCCT+	Peripheral Vascular Surgery	42	12	54	78%
CCCT+	Plastic Surgery	33	13	46	72%
CCCT+	Urology	102	35	137	74%
	Total	4,617	3,341	7,958	58%
	Share of Military Medical Force	4%	4%	4%	

Source: DMDC, 2020 HMPDS Reports.

Note: *Residents are not included in the specialty-specific counts.

[37] This specialty list is drawn from Table 1, page 9, in the "Military-Civilian Partnerships for Trauma Training, Sustainment, and Readiness," also known as the "Bluebook." In the following section, we will discuss the size and make-up of each Service's small surgical teams, which contain some, but not all of, these specialists along with enlisted personnel.

From the table we can see that CCCT specialties make up a fairly small portion of the military medical force—about 4 percent for all active duty medical personnel.

Enlisted personnel also play a key role in the combat casualty care mission. The largest category of enlisted medical personnel are first responders (Army medics, Navy Corpsmen, and Air Force technicians). Other enlisted personnel work on surgical teams with the CCCT specialists discussed above; these specialties include surgical and/or operating room technicians, respiratory therapists, and independent duty corpsmen.

While these personnel play a key role in the combat casualty care mission, their trauma sustainment needs are not as great as the credentialed providers listed in Table 5, who take 8 or more years to train (medical school plus residencies and sometimes fellowships). These personnel will be discussed in more detail in the next section.

B. Medical Force Utilization

In this section we explore how the medical force is utilized for deployed missions as well as in non-deployed "in garrison" settings (i.e., providing care in MTFs).

1. Medical Force Deployment

U.S. military medical doctrine uses "roles of care" to categorize deployed medical capabilities. The first role of care, first responder care, begins at the point of injury. Each successive role of care offers an increased medical capability, with the fourth and final role of care being definitive care (e.g., large MTFs out of theater, civilian hospitals, or VA hospitals). Below we provide a short summary of each role of care, followed by Table 7, which provides specific examples of the medical units that provide each role of care, unit personnel, and unit critical skills/capabilities.

- **Role 1 – First Responder Care**: Role 1 provides primary healthcare (routine sick call and management of minor illness/injuries) for troops in the field and specialized first aid, triage, resuscitation, and stabilization for casualties and non-combat injuries (preparing the patient for transfer to a higher role of care).
- **Role 2- Forward Resuscitative/Surgical Care**: Role 2 provides advanced trauma management and emergency care. This includes greater resuscitation capability and the ability to perform damage control surgery.
- **Role 3 – Theater Hospitalization**: Role 3 is staffed and equipped to initiate definitive care for all categories of patients and to provide postoperative treatment including intensive care.
- **Role 4 – Definitive Care**: Role 4 represents the most definitive (or comprehensive) medical care available within the medical care system.

Table 7. Medical Unit Personnel and Capabilities by Roles of Care

Role	Unit Examples	Personnel/Manning	Critical Skills/Capabilities
1	First responders or small teams led by physician or mid-level provider • Army BAS • Marine BAS	• Army Medic, Navy Corpsman, Air Force Technician • Mid-level providers (e.g., PAs, NPs, independent duty corpsman) • EM physicians • Other primary care physicians	• Control massive hemorrhage • Manage airway, respiration, and circulation • Prevent/treat hypothermia and shock • Protect wounds • Immobilize fractures • Emergency measures
2	Light Maneuver and Enhance Forward Care • Army FRSD (LM) • Navy ERSS (LM) • AF EMED GST(LM) • AF EMED+10 (E)	• Trauma, general, and ortho surgeons • EM Physician • Anesthesiologist or Nurse Anesthetist • Nurses (ER/OR/and critical care) • Technicians (surgical and or respiratory)	• Role 1 capabilities • Trauma resuscitation (e.g., through use of blood and blood products, parenteral fluids and medications) • Damage control surgery (e.g., laparotomy, abbreviated thoracotomy, placement of external fixators, vascular shunts, amputation, fasciotomy, decompression of cardiac tamponade, and emergency decompressive craniotomy)
3	Modular Fixed Facilities (Field Hospitals) • Army Combat Support Hospital • Navy Hospital Ship • Air Force Theater Hospital	• All Role 2 providers • Surgical specialties (e.g., vascular, cardio thoracic, OFMS, neuro, etc.) • Critical care/ICU specialists • Specialized lab/rad/ancillary personnel	• Roles 1 and 2 capabilities • Inpatient and intensive care (ICU) • Laboratory, radiology, and microbiology • Blood banking • Outpatient primary and specialty care (e.g., dental care, ophthalmology, nutrition care, behavioral health, OBGYN, urology, pediatrics, orthopedics, etc.)
4	Definitive Care Facilities • MTFs • Civilian hospitals • VA hospitals	• All Role 3 providers • All surgical/critical care specialties • All lab/rad/ancillary specialists • All recovery/long-term care	• Roles 1, 2, and 3 capabilities • Comprehensive care for the full spectrum of injuries and recovery phase

Source: JP 4-02; ATP 4-02.10.

Lifesaving care occurs at all roles, and providers must maintain clinical currency for the care that is delivered by the unit they are likely to deploy with. But the types of providers and specific readiness requirements vary by role and by unit. Roles 1 to 3 occur in the combat theater and, thus, constitute the key military-essential requirements for the medical force.

2. Role 1

Role 1 is pre-hospital care from non-medical personnel (self and buddy aid), enlisted medical personnel, physician extenders like Physician Assistants, and emergency medicine physicians. As seen in Chapter 2, most deaths from potentially survivable injuries occurred pre-hospital, making this is a key area for improvement.

MCPs are an important element of readiness improvements for Role 1 care, but are different in nature than the MCPs for embedding surgeons in trauma centers. MCPs for Role 1 providers are addressed in this report, but were not the primary focus of our study.

3. Role 2

Role 2 can be subdivided into Role 2 light maneuver (LM) surgical teams and Role 2 enhanced (E). The composition of Role 2 LM units varies by Service but are generally small and/or modular to enhance their mobility. For instance, the Army's forward resuscitative surgical detachment (FRSD) is a 20-man unit that can split into two 10-man teams. The Navy's expeditionary resuscitative surgery system (ERSS) that supports the Marine Corps is a 7-man team. Finally, the Air Force's expeditionary medical support (EMEDs) ground surgical teams have only 6 members. These units can deploy forward on their own or augment a larger medical unit. When deployed forward, they have a limited capability to hold casualties. They evacuate postsurgical patients to Role 2 E units or Role 3. Role 2E units are still small (i.e., typically 6 to 10 beds) but have more capabilities than the LM units including ICU beds, ward beds, and basic laboratory/radiology capabilities. Role 2E can stabilize postsurgical patients for evacuation straight to Role 4.[38]

These teams are expected to perform trauma resuscitations and damage control surgery for severely injured patients in austere environments with minimal personnel, equipment, and supplies.[39] Table 8 shows the structure of each Service's forward surgical

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[38] Lt. Col. Michael F. LaBrecque and Capt. Michael A. Honsberger, *Army Field Hospitals and Expeditionary Hospitalization*, 2018, https://alu.army.mil/alog/2018/SEPOCT18/PDF/210113.pdf.

[39] Capt. Scott A. Cota, "Redefining SOF Surgical Support to Meet Joint Force Demand," *Combat and Casualty Care*, 2018, https://tacticaldefensemedia.com/redefining-sof-surgical-support-to-meet-joint-force-demand/; and Andrew B. Hall et al., "Current Challenges in Military Trauma Readiness: Insufficient Relevant Surgical Case Volumes in Military Treatment Facilities," *The Journal of Trauma and Acute Care Surgery* 89(6) (December 2020): 1054–1060, https://doi.org/10.1097/TA.0000000000002871.

teams and the total number of teams required. Because some forward surgical units split into multiple teams, we standardize the team size to the smallest unit—one operating table team. With the exception of the Army FRSD and the Marine Corps forward resuscitative surgical system (FRSS), the smallest units are single-surgeon teams.

Table 8. Forward Surgical and Resuscitative Teams

Specialty	Army FRSD*	Navy ERSS	Marine Corps FRSS*	Marine Corps Stabilization Sect.	Air Force GST	Air Force SOST	USASOC FRSD
General Surgeon	1	1	1	0	1	1	1
Orthopedic Surgeon	1	0	1	0	0	0	0
Emergency Physician	1	1	0	2	1	1	1
Anesthesiologist	0	0	1	0	1	0	0
PA/IDC	0	1	1	2	0	0	1
Critical Care Nurse	1	1	1	0	1	1	1
Emergency/Trauma Nurse	1	0	0	0	0	0	1
Nurse Anesthetist	1	1	0	0	0	1	1
Medic	1.5	0	1	6	0	0	2
OR/Surg Tech	1	1	2	0	1	1	1
Resp Therapist	0	1	0	0	0	1	0
LPN	1	0	0	0	0	0	0
Health Services Admin	0.5	0	0	0	1	0	1
Team Members	10	7	8	10	6	6	10
Total AD Teams	36	24	35	35	18	8	4
Total RC Teams	44	0	10	10	8	0	0

Source: Service Medical Unit Data. We have standardized modular teams to the operating table unit.
Note: *We show ½ an Army FRSD as a team. Sometimes a Marine Corp FRSS will have 2 general surgeons instead of 1 general surgeon and 1 orthopedic surgeon. GST = ground surgical team; SOST = special operation surgical team; USASOC = United States Army Special Operation Command.

The teams listed above range from 6 to 10 people. The units share several similarities but there are also differences. For instance, all surgical teams include a general surgeon (which may be a trauma surgeon, but this is not the listed requirement); a critical care nurse; and an enlisted surgical technician. All teams also include an anesthesia provider, though some use an anesthesiologist (physician) and the other units rely on certified registered

nurse anesthetists (CNRAs). All teams except the Marine Corps FRSS have an emergency medicine provider.[40]

The remaining team members vary even more. Army and Marine Corps teams have a heavier orthopedic surgical capability: the FRSDs/FRSSs have an orthopedic surgeon, and the lighter SOF FRSTs have an orthopedic PA. SOF FRSTs also add an emergency/trauma nurse. Navy ERRS and Air Force SOST teams include a respiratory therapist.

Although all Services currently list a general surgeon as the primary surgical requirement for these units, the civilian best practice literature reviewed in Chapter 2 finds that this capability should be led by an experienced trauma surgeon. In interviews with subject matter experts, most agreed that the lead surgeon should be a trauma surgeon, but some felt a general surgeon would be sufficient if they worked in a high-volume trauma center.

Later in this report, we will explore the feasibility of embedding all forward surgical teams in civilian trauma centers as recommended.

4. Role 3

Role 3 theater hospitals have primary care; greater surgical capabilities (e.g., multiple operating rooms, surgical subspecialties, more support staff); and critical care capabilities. These facilities have advanced laboratory (lab), radiology (rad), and ancillary services and offer outpatient specialty care. They are also modular, allowing them to be configured with different bed counts and capabilities. Next, we provide an overview of how each Service structures Role 3 care.

a. Army

The Army can configure its Role 3 combat support hospitals (CSHs) with as few as 32 beds or as many as 240.[41] The specialty teams and detachments that augment the basic hospital include additional ICU beds staffed with critical care specialists (intensivists); intermediate care ward (ICW) beds staffed with internal medicine physicians and nurses to

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[40] The FRSSs are part of a larger platoon that includes a 10-person stabilization section staffed with 2 EM physicians, 1 PA, 1 IDC, and 6 corpsman (medics). These shock trauma platoons act as highly mobile emergency rooms and can be paired with the FRSS teams. See Rom A. Stevens, Harold R. Bohman, Bruce C. Baker, and Lowell W. Chambers, "The U.S. Navy's Forward Resuscitative Surgery System during Operation Iraqi Freedom," *Military Medicine* 170(4) (April 2005): 297–301, https://doi.org/10.7205/milmed.170.4.297.

[41] Department of the Army, ATP 4-02.10, *Theater Hospitalization*, August 2020, https://armypubs.army.mil/epubs/DR_pubs/DR_a/ARN30125-ATP_4-02.10-000-WEB-1.pdf.

manage surgical or medical patients who require observation; and teams of specialty providers. (For example, the Army has head-neck teams to provide ear, nose, and throat surgery; neurosurgery; and eye surgery augmentation in support of the theater hospitals.)[42]

b. Air Force

The Air Force uses expeditionary medical support (EMEDs) and Air Force Theater Hospital (AFTH) packages to provide care down range. These capabilities are grouped into distinct medical support packages with an incremental buildup of capability. The EMEDs Health Response Team (HRT) and the EMEDs+10 are considered Role 2. The next EMEDs increment, the EMEDS+25, is considered Role 3. The AFTH has a minimum of 58 beds (12 critical care and 46 medical/surgical). AFTH expansion packages are modular and can be added in multiple sets.[43] The CCCT+ specialists (e.g., neurosurgeons, vascular surgeons, etc.) will be found at Role 3.

The Air Force also plays a key role in patient movement through roles of care or aeromedical evacuation (AE). The Service establishes modular En Route Patient Staging Systems (ERSS) that can be incremented from 10 to 100 beds. Critical care air transport teams (CCATT) are used to transport the most critically injured patients. These teams can provide en route damage control resuscitation and lifesaving critical care intervention. The Air Force is also exploring embedding CCATT teams in MCPs.

c. Navy

The Navy's Role 3 assets include theater medical capabilities to support care afloat and ashore. Like the other services, these assets can scale to anticipated medical needs of the contingency, which includes hospital ships (T-AHs) configurable from 50 to 1,000 beds, depending on staffing, to include the full complement of critical care, surgical care, and ancillary services. Other afloat medical assets include surgical teams embarked aboard amphibious assault ships or aircraft carriers, which also include capabilities for lifesaving surgery or ICU support for theater casualties. Also ashore, the Navy supports medical needs of theater and U.S. Marine Corps operations on the ground with configurable Expeditionary Medical Facilities (EMFs) scalable for an entire range of joint military operations. EMFs can be configured from 25 to 150 beds with the full complement of

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[42] Army Techniques Publication ATP 4-02.10, *Theater Hospitalization*, August 2020, https://armypubs.army.mil/epubs/DR_pubs/DR_a/ARN30125-ATP_4-02.10-000-WEB-1.pdf.

[43] Air Force Tactics, Techniques, and Procedures 3-42.71, *Expeditionary Medical Support (EMEDS) and Air Force Theater Hospital (AFTH)*, July 27, 2006, https://static.e-publishing.af.mil/production/1/af_sg/publication/afttp3-42.71/afttp3-42.71.pdf.

critical care, surgical care, and medical services, including self-sustaining, base-operating support capabilities for enduring field hospitalization needs.[44]

The civilian literature reviewed in Chapter 2 also provides lessons for Role 3 hospitals. The lead surgeon should be an experienced trauma surgeon, and supporting surgeons can be non-trauma general surgeons and specialty surgeons with active and ongoing trauma experience. These specialties include vascular surgeons, neurosurgeons, oral maxillofacial surgeons, orthopedic surgeons, cardiothoracic surgeons, and others. The academic literature does not provide specific targets for the part-time trauma experience of supporting surgeons, so the IDA team interviewed experienced trauma surgeons and others with extensive combat experience. The consensus among interviewees was that 2 to 4 call shifts per month and a target of 10 to 20 percent trauma-related workload would likely be sufficient to achieve the best outcomes in combat. We note that this assumes these providers receive an adequate volume of non-trauma workload in their specialty while in the MTFs. While KSA benchmarks were not yet available for these providers, the IDA team found the Army and Air Force were moving some of these providers into MCPs due to lack of MTF volume.

5. Role 4

Role 4 provides definitive care (i.e., the full spectrum of comprehensive care) out of theater. It is provided in a variety of venues, including MTFs, VA hospitals, and civilian hospitals. The full range of life-saving and rehabilitative care is provided.

6. Active Duty Medical Force in Garrison

When they are not deployed, many AD medical personnel work in MTFs. Others work in headquarter elements or support other mission areas such as medical education and training and research and development. Some providers are also assigned directly to the combat units they support. Some are stationed at civilian trauma centers on a full-time basis.

The following analysis gives an overview of the AD providers working in MTFs. Specifically, we analyze assigned FTEs to capture where providers are working. We chose to avoid FY 2021 and FY 2020 data due to issues created by the rollout of the GENESIS electronic health record management system and the COVID-19 pandemic. For the majority of MTFs, we use data from FY 2019. However, MTF personnel data for several west coast sites was unavailable in FY 2019 due to the MHS GENESIS rollout; for these

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[44] Navy Medical Logistics Command, "About Us," Navy Medicine website, accessed March 23, 2022, https://www.med.navy.mil/Naval-Medical-Logistics-Command/Navy-Expeditionary-Medical-Support-Command/About-Us/.

sites, we use data from FY 2016.[45] The MTF data, therefore, is not an exact accounting of military personnel by MTF but can provide a close approximation.

Table 9 shows all military medical personnel FTEs assigned to MTFs by occupation category and MTF type. We also report student/trainee FTEs. For the purpose of this analysis, we group all parent MTFs into the categories listed below. The list of facilities included in each group can be found in Appendix C.

- **Medical Center:** Medical centers are defined as MTFs with more than 10,000 inpatient admissions (dispositions) in FY 2019.
- **Large Hospital:** Large hospitals are defined as MTFs with between 3,001 and 10,000 inpatient admissions in FY 2019.
- **Small Hospital:** Small hospitals are defined as MTFs with fewer than 3,000 inpatient admissions in FY 2019.
- **Clinics:** Clinics are MTFs with zero inpatient admission (e.g., outpatient clinics, ambulatory care centers, and so on). Note that clinics associated with a parent facility are grouped under that parent.

From the data we can see clinics employ the greatest number of FTEs followed by large hospitals, medical centers, and small hospitals. However, there is some variation by provider type. For instance, physicians and nurses have the largest presence in medical centers and large hospitals, while dentists, enlisted, and mid-level providers (e.g., PAs, nurse specialists, psychologists, etc.) are most likely to be in clinics. The majority of student FTEs are located at medical centers. This variation demonstrates the critical role medicals centers play in the graduate medical education (GME) mission.

[45] The parent sites with data impacted by the GENESIS rollout were AMC Madigan, Fairchild Air Force Base, NH Bremerton, and NH Oak Harbor (DMIS ID 1025, 0128, 0126, and 0127).

Table 9. Military Medical Personnel (assigned FTEs) in MTFs

	Medical Centers	Large Hospitals	Small Hospitals	Clinics	Total
Military Medical Personnel					
Physician	1,943	1,939	887	1,502	6,272
Dentist	269	397	356	932	1,955
Mid-Level (Skill Type II)	746	1,100	708	1,557	4,111
Nurse (RN)	1,860	1,913	1,084	1,227	6,084
Other	211	375	320	881	1,787
Enlisted	5,136	8,918	5,724	14,226	34,004
Total	10,165	14,643	9,080	20,325	54,213
Share	19%	27%	17%	37%	
Residents/Student/Trainees					
GME/GDE	1,681	656	109	528	2,975
Other Officer Students	150	143	15	126	434
Enlisted Students	264	143	34	176	617
Total	2,095	942	158	831	4,026
Share	52%	23%	4%	21%	

Source: Medical Expense and Performance Reporting System (MEPRS) data from FY 2019 (and FY 2016 for GENESIS sites).

Table 10 provides the same information for the CCCT specialties. We also report the share of each specialty working in medical centers as these facilities see the most trauma cases. On average, CCCT providers are more likely to be in a medical center than other specialties, but the majority still work in smaller facilities. For example, only 42 percent of MTF-based trauma surgeons are in medical centers. The share drops for general surgeons (27 percent) and orthopedic surgeons (31 percent). Highly specialized surgical specialists were most likely to be found in medical centers—vascular surgeons (62 percent), neurosurgeons (65 percent), and cardiac/thoracic (52 percent).

Table 10. CCCT Specialties (assigned FTEs) in MTFs

CCCT Specialties on Forward Teams	Medical Center	Large Hospital	Small Hospital	Clinic	Total	Share in Med Cent
General Surgery	79	133	41	35	287	27%
Critical Care/Trauma, Surgery	10	9	0	4	23	42%
Orthopedic Surgery	99	124	58	43	324	31%
Emergency Medicine	105	181	74	46	406	26%
Anesthesiology	113	98	35	38	284	40%
Nurse Anesthetist	136	155	82	32	405	34%
Critical Care Nurse	178	187	49	112	527	34%
Emergency/Trauma Nurse	120	177	110	74	481	25%
Medics	1,613	2,994	1,756	4,096	10,458	15%
PA/IDC	161	211	182	462	1,016	16%
Operating Room Services	412	626	329	269	1,636	25%
Respiratory Therapy Services	131	224	95	92	541	24%
Licensed Practical Nurse	348	340	92	9	789	44%
CCCT + Specialties						
Critical Care/Trauma, Medicine	6	3	2	3	14	43%
Cardiac/Thoracic Surgery	13	8	2	2	25	52%
Neurological Surgery	28	10	0	5	43	65%
Oral Maxillofacial Surgery	40	40	25	39	144	28%
Peripheral Vascular Surgery	23	9	2	3	37	62%
Ophthalmology	52	48	14	24	138	38%
Plastic Surgery	15	13	1	5	34	44%
Otorhinolaryngology	48	47	21	21	137	35%
Urology	38	46	9	7	100	38%

Source: MEPRS data from FY 2019 (and FY 2016 for Genesis sites).

7. Reserve Corp Medical Force in Civilian Occupations

The Department can track the workload of active duty personnel working in MTFs and construct workload-based metrics, such as the KSAs, to evaluate their clinical readiness. Reservist workload, on the other hand, is not tracked at this level of detail. Furthermore, while credentialed providers most often work within their clinical professions in their civilian jobs, enlisted medical reservists may have little to no clinical exposure in their civilian careers. Therefore, RC medical officers and enlisted have very different readiness and currency considerations.

In general, RC medical providers must provide the same credentialing and privileging materials as their AC counterparts. Credentials are centrally managed through the Joint Centralized Credentials Quality Assurance System (JCCQAS) and the appropriate Service command. Once credentials are centrally approved, a designated MTF (usually the mobilizing MTF) will grant privileges. National Guard (NG) providers are credentialed through the Credentials Certification and Privileging Preparation (C2P2) Board. NG providers initiate a credentialing request through their state credentialing coordinator. The coordinator and a contracted vendor then work with the applicant to assemble the credentialing packet for presentation to the C2P2 board. The board reviews the file and recommends for or against approval. The appropriate state surgeon then awards privileges based upon the recommendation of the board. Credentialing and privileging are reinitiated every 2 years. This guidance applies to all Title 32 Army National Guard (ARNG) credentialed and privileged healthcare providers, including physicians, physician assistants, nurse practitioners, dentists, social workers, psychologists and physical therapists. The process appears to be similar for credentialed providers in the other reserve components.

Nurses are required to maintain unrestricted licenses and meet a minimum number of clinical hours. SMEs emphasized that the hour minimums are very low (i.e., 180 hours) and that the nurses may work in largely managerial roles or clinical settings that are not consistent with their military occupation (e.g., a medical surgical nurse may work in an outpatient setting). The Air Force Reserve noted that they had recently instituted a requirement for certain nurse specialties, including critical care nurses, to practice within their assigned specialties. Enlisted may be required to maintain a certification (e.g., EMT-B, CRT, etc.) but they may or may not work in clinical practices.

While essential, the credentialing and privileging process sets minimum standards for practice rather than readiness standards for competency. In fact, commands have little visibility into the civilian medical practices of credentialed providers. Across IDA interviews, we indeed heard that civilian practices can vary considerably. However, for trauma and most surgical specialties, interviewees noted that it would be the exception rather than the norm to have a reservist be clinically less busy than an active duty physician stationed in an MTF. This is due to the alignment of financial incentives within civilian medicine that tie compensation to productivity and billing. For instance, physicians may have relative workload value (RVU) target requirements—this is an intensity-adjusted workload metric used in both the civilian and military systems. DoD currently sets RVU targets for MTF military providers at 50 percent of the civilian median. Table 11 presents the civilian RVU medians (from the Medical Group Management Association (MGMA)) and current MTF RVU targets for military, government civilians, and contractors for a select set of CCCT specialties.

Table 11. Civilian RVU Medians and MTF RVU targets

	MGMA Data	MTF Targets		
DoD Occupation Code	Civilian Median	50% Median (mil target)	60% Median (civ target)	70% Median (contractor target)
Emergency Medicine	6,526	3,263	3,915	4,568
Anesthesiology	6,548	3,274	3,929	4,584
General Surgery	6,795	3,398	4,077	4,757
Neurological Surgery	9,366	4,683	5,619	6,556
Orthopedic Surgery	8,087	4,044	4,852	5,661
Plastic Surgery	6,627	3,314	3,976	4,639
Cardiac/Thoracic Surgery	9,301	4,650	5,580	6,511
Urology	7,885	3,942	4,731	5,519
Peripheral Vascular Surgery	8,918	4,459	5,351	6,243
Critical Care/Trauma, Medicine	3,848	1,924	2,309	2,694
Critical Care/Trauma, Surgery	6,748	3,374	4,049	4,724

Source: This data was obtained from the Defense Health Agency (DHA) Productivity and Leakage (PAL) tool available through the Data Driven Decisions (D3) Portal on the CarePoint site.

If we assumed RC providers were achieving the civilian median, their workload would be much higher on average than AC MTF-based providers. We will return to the topic of RVU metrics in Chapters 4 and 6 when we examine provider workload in MCPs and MTFs, respectively. For now, we acknowledge that the lack of RC workload data hinders the tracking of clinical currency for RC service members. This makes it very difficult to systematically assess how the readiness of AC providers compares to RC providers. We will return to this topic in Chapter 7 when we introduce new force mix options.

C. Cost of the Total Medical Force

Medical personnel are some of the most expensive personnel employed by DoD. USD (P&R) and OSD CAPE have both conducted extensive analysis on the full cost of the total medical force. A history of these analyses along with a methodology for obtaining the full cost of military and civilian manpower can be found in Whitley et. al (2014);[46] a method

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

for costing RC personnel was developed in Whitley et al. (2018).[47] The cost estimates used in this analysis are based on that cost work.

For this analysis, we report two different estimates of cost: (1) total cost and (2) the DoD cash flow cost. The total cost is the most relevant estimate of cost for decision-making because it captures the full, long-run savings from reform to the taxpayer.

The total cost includes:

- Immediate costs borne by DoD such as pay, benefits, training, and so on;
- Fixed costs paid by DoD that will not adjust immediately in response to a change in force levels, but will respond over time (e.g., child care centers and commissaries);
- Deferred costs that will ultimately be borne by DoD (e.g., the non-Medicare eligible retiree healthcare benefit); and
- Costs borne by other federal agencies (e.g., benefits paid by the Veterans Administration).

The DoD cash flow cost includes only immediate costs borne by DoD. This cost provides an estimate of short-run budgetary savings that would occur from implementing a reform. Appendix D contains details on the data and methods used to construct each cost. Table 12 reports the results for occupation groups. For ease of presentation, we show Army data only; Appendix D reports the same tables for Navy and Air Force.

Maintaining providers in the RC costs approximately 15 percent of the amount to maintain providers in the AC. However, RC providers do not contribute to beneficiary care. Civilian providers are also less costly than AC providers (approximately 70 percent of what it costs to maintain AC providers.) Civilians do contribute to beneficiary care and are more productive in delivering beneficiary care, given they do not have military training, additional military roles, and deployments. Based on RVU workload targets for military versus civilian providers, we estimate civilians are 20 percent more productive.[48]

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[47] John E. Whitley et al., "Medical Total Force Management: Readiness and Cost," IDA Paper P-8805 (Alexandria, VA: Institute for Defense Analyses, May 2018).

[48] The MTF RVU workload target for military providers is set to 50 percent of the MGMA civilian median. The target for civilians is set to 60 percent of the median.

Table 12. Average Army Cost by Occupation Group and Personnel Type, in 1000s

	Total Cost			DoD Cash Flow Cost		
	AC	RC	Civ	AC	RC	Civ
Medical	545	99	410	510	67	385
Dental	422	88	356	387	56	333
Nurse	285	72	82	251	40	77
Other	236	70	174	202	38	163
Enlisted	135	20	88	101	15	82

Note: RC costs are dwell costs. When RC are activated, their costs increase to AC compensation and benefit levels.

Table 13 reports the same information for the CCCT specialties. Again, we show Army data only (with Navy and Air Force data available in Appendix D). CCCT physician specialties are among the costliest medical personnel (and military personnel in general). The primary factors that drive their costs up are the medical special pays and education and training costs. For instance, a general surgeon can receive a one-time critically short wartime specialty accession bonus of $400,000 as well as a significant retention bonus, over $100,000 annually for a 4-year commitment. Annual incentive pays and board certification pay are also available.[49] In addition, it generally costs the department at least $1.5 million to access a general surgeon (medical school plus residency costs, including stipends and compensation).[50]

[49] *Health Professions Officer (HPO) Special and Incentive Pay Plan*, FY 2022.

[50] For a detailed breakdown of physician accession costs, see Sarah K. John et al., "Analysis of DoD Accession Alternatives for Military Physicians: Readiness Value and Cost," IDA Paper P-10815 (Alexandria, VA: Institute for Defense Analyses, November 2019).

Table 13. Average Army Cost for CCCT Specialties by Personnel Type, in 1000s

CCCT Specialties on Forward Teams	Total Cost			DoD Cash Flow Cost		
	AC	RC	Civ	AC	RC	Civ
General Surgery	643	98	520	608	66	488
Critical Care/Trauma, Surgery	696	100	520	662	68	488
Orthopedic Surgery	693	97	531	659	65	492
Emergency Medicine	525	97	473	491	65	448
Anesthesiology	655	97	521	621	65	490
Nurse Anesthetist	363	72	262	328	40	244
Critical Care Nurse	283	72	187	248	40	175
Emergency/Trauma Nurse	269	72	187	234	40	175
Medics	136	20	81	101	15	75
PA/IDC	280	70	152	245	38	142
Operating Room Services	125	19	99	90	14	92
Respiratory Therapy Services	141	21	98	106	16	91
Licensed Practical Nurse	125	19	81	90	14	75
CCCT + Specialties						
Critical Care/Trauma, Medicine	557	100	506	523	68	475
Cardiac/Thoracic Surgery	571	100	525	537	68	487
Neurological Surgery	678	98	526	644	66	487
Oral Maxillofacial Surgery	617	88	474	583	56	446
Peripheral Vascular Surgery	531	101	519	497	69	487
Ophthalmology	546	98	476	512	66	447
Plastic Surgery	604	100	518	569	68	487
Otorhinolaryngology	532	100	515	497	68	487
Urology	564	100	517	530	68	486

Note: RC costs are dwell costs. When RC are activated, their costs increase to AC compensation and benefit levels.

4. Military-Civilian Partnerships

Placing military providers in civilian trauma centers to improve readiness training and skill sustainment is not new. A series of readiness training programs placing military personnel into large civilian trauma centers was established beginning in the late 1990s following calls for reform from the Government Accountability Office (GAO) and NDAA.[51] Over time, these programs evolved, matured, and grew in number and variety. Today, MCPs number in the hundreds and include both domestic and foreign partners.

The primary focus of our analysis is on MCPs established through memoranda of agreement/memoranda of understanding or teaching affiliation agreements (MOA/MOU or TAAs) for providing trauma/critical care readiness training and skill sustainment. We do not include MCPs supporting initial medical education, often through TAAs, such as medical students, medical residents, enlisted phase II clinical training, and others. However, we note, in some instances, initial medical education MCPs are co-located or integrated with trauma/critical care readiness and/or skill sustainment partnerships. For instance, in Las Vegas, the Air Force has partnered with the University Medical Center (UMC), a level I trauma center, and the University of Nevada Las Vegas (UNLV), whose school of medicine runs GME programs at UMC. Several Nellis AFB GME programs are now fully integrated with UNLV. Staff from the Nellis Office of Military Medicine (OMM) cite the GME programs as an integral part of the MCP's success. Phase II enlisted clinical training for respiratory therapists also occurs at UMC.

In this section we begin by developing a taxonomy for categorizing MCPs. We then present a quantitative analysis of existing MCPs using the Joint Partnership Register augmented with data collected by the IDA team.

A. MCP Categories

We classify U.S.-based MCPs into three broad categories: short-term rotational models (SRMs), full-time embedded sustainment models (ESMs), and part-time sustainment models (PSMs). The following sections describe each of these categories in broad terms. We include reference examples of the different program types and discuss their pros and cons. The discussion is neither comprehensive nor exhaustive. We also

[51] M. Margaret Knudson et al., "The Blue Book: Military-Civilian Partnerships for Trauma Training, Sustainment, and Readiness," (Chicago, IL: American College of Surgeons, 2020).

explore international partnerships and those with the VA. These partnerships are discussed separately as they differ from SRMs, ESMs, and PSMs.

1. Short-Term Rotational Models (SRMs)

Under the SRM MCP model, military personnel rotate through civilian trauma centers on short temporary duty (TDY) training assignments (generally 2 to 3 weeks). These programs are often referred to as "Just-in-Time" arrangements because it is common for personnel to rotate through in preparation for a coming deployment where specific skills are refreshed, or in some cases validated, in accordance with service checklists.[52] While the trainees attend these programs on TDY orders, there are also full-time military faculty (or cadre) present at the training site on longer permanent change of station (PCS) orders. Military faculty become fully credentialled/privileged members of the civilian hospital staff and work in the trauma center when they are not coordinating training events. The trainee curriculum varies by program, but generally includes a mix of classroom-based training; simulation and/or laboratory (cadaver or live tissue) training; and clinical rotations where trainees provide supervised hands-on patient care. Different tracks are available for different provider types (e.g., surgeons, nurses, enlisted, and so on).

These models were among the first MCPs established and are therefore some of the most mature. The first site was a Tri-Service partnership at Ben Taub General Hospital in Huston—the Joint Trauma Training Center (JTTC). Today, each Service operates at least one SRM program. These programs include the Army Trauma Training Center (ATTC) at the Ryder Trauma Center in Miami's Jackson Memorial Hospital; the Navy Trauma Training Center (NTTC) at the Los Angeles County Medical Center; and the Air Force Centers for the Sustainment of Trauma and Readiness Skills (C-STARS) partnerships out of Baltimore, Cincinnati, Saint Louis, and Omaha.[53] Each program was designed with a target population in mind. For instance, the ATTC program was designed primarily for Army forward surgical teams (now FRSDs) and the NTTC for Navy forward resuscitative surgical sites (now ERSSs). Similarly, the focus of Air Force C-STAR partnerships varies by site: the Baltimore and St. Louis sites cover ground-based expeditionary capabilities such as resuscitation, damage control surgery, and intensive care; the Cincinnati site focuses on pre-deployment readiness training for critical care air transport teams (CCATT); and the new site in Omaha focuses on infectious disease and biocontainment care.

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[52] Some Air Force programs are pass/fail: If someone does not meet a standard, the Air Force will recommend that the person does not deploy due to a skills deficit.

[53] For a detailed description of each of these programs, see James M. Bishop et al., "Medical Readiness within Inpatient Platforms," IDA Paper P-8464 (Alexandria, VA: Institute for Defense Analyses, August 2017).

In 2019, the Army created a new rotational program called the Strategic Medical Asset Training (SMART) program. There are currently three active partner sites. The SMART program provides short-term, 2-week rotational assignments for enlisted medical personnel from both AC and RC components who may not be part of a trauma team. Priority is given to Combat Medics, licensed practical nurses (LPNs), and operating room (OR) Technicians. Training occurs in the pre-hospital, emergency room, intensive care unit (ICU), and OR settings under the supervision of a civilian preceptor. Specialized laboratory training and cadaver/simulation is also available at select sites.[54]

These models have received a mixed review in the literature and have several advantages and disadvantages. One benefit of these models is that they may accommodate a large volume of rotating personnel (i.e., around 200 people rotate through the Cincinnati C-STARs platform each year).[55] Another benefit is that they deliver currency for the embedded military faculty who work as fully privileged members of the staff when they are not running training events. When interviewed, military faculty expressed that running training events also helps them feel connected to the military and the mission (something they may not get if they were simply working at the civilian cite on PSC orders). A recruitment benefit may also be associated with these sites. Civilian medical students, residents, and fellows who would typically have little exposure to military medical personnel and missions gain exposure to military faculty and trainees who may become mentors and/or role models. The IDA team heard several reports of civilians signing up for active or reserve duty service as a result of this type of exposure.

The key disadvantage of these models is that they do not deliver currency and/or skill sustainment for rotating personnel. Instead, they provide a short-term refresher course training with limited hands-on patient care. A recent RAND study found that surgeons often reported this type of trauma rotation offered little value given the limited availability to provide hands-on care or take primary management of the patient.[56] Another challenge for surgical rotators is competition with residents and interns at the host facility. This topic has been noted in surveys of participants and discussed in the literature on MCPs.[57] SMEs

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54 Cynthia Barrigan, "AMEDD Medical Skills Sustainment Program (AMSSP) Information Brief," Army Office of the Surgeon General, December 2021.

55 C-STARS, University of Cincinnati Medical Center Cincinnati, https://www.uchealth.com/education/c-stars/.

56 Edward W. Chan et al., *Options for Maintaining Clinical Proficiency During Peacetime* (Santa Monica, CA: RAND Corporation, 2020), https://www.rand.org/pubs/research_reports/RR2543.html. Also available in print form.

57 A survey of trainees who attended the ATTD between 2005 and 2007 felt that they were competing for hands-on time, including surgical time with patients, and that it was important to clarify the roles between the ATTD trainees and the Ryder Trauma Center residents and interns. See Carl I. Schulman et al., "Training Forward Surgical Teams: Do Military-Civilian Collaborations Work?" *U.S. Army Medical Department Journal* (2010):17–21, PMID: 21181670.

interviewed by the IDA team noted that this issue is resolved under embedding models where DoD providers act as attendings and take independent call duty.

This type of model may be best suited for enlisted medical personnel who have a shorter training pipeline and who may gain a critical skill set quickly through emersion in a busy environment under supervision. RC personnel who spend little time training with their units in a clinical setting may also benefit from these models. On the other hand, we conclude these models are not suited for physician or nurse clinical skill maintenance for Role 2 or 3 surgical care, and recommend in our conclusions that they be discontinued for surgeons as part of the MCP optimization directed in section 757. We note that clinical practice guidelines for the forward surgical teams discussed in Chapter 2 also state:

> Expertise in trauma care is the cornerstone for ARSC teams, and trauma training to achieve and sustain clinical expertise of all team members is foundational. Historic abbreviated 'just-in-time' training for trauma care is highly discouraged.[58]

2. Full-Time Embedded Sustainment Models (ESMs)

Under the ESM model, military personnel are stationed at a civilian trauma center on a full-time basis (generally PCS orders for a period of 3 or 4 years). Assignments may be made at the individual or team level (i.e., a Role 2 surgical team). Like the faculty members at SRM MCPs, these personnel work in the trauma center as full-fledged hospital staff members. Specifically, they are licensed, credentialed, and privileged following the same processes for civilian staff (though they may have some restrictions placed on their practice depending on their training experience).[59] Personnel spend the majority of their time working in the civilian trauma center but may return to base on occasion for military-specific training or administrative needs.

Systematic use of this model began in Special Operation communities. These communities were among the first to deploy small expeditionary surgical teams with high-end surgical/resuscitative capabilities. Examples of these teams include Air Force Special Operations Surgical Teams (SOSTs) and Army Special Operations Resuscitation Teams (SORTs), as well as Special Operations Critical Care Evacuation Teams (SOCCET). It was recognized that smaller surgical teams required a higher level of clinical expertise given

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[58] *Joint Trauma System Clinical Practice Guideline (JTS CPG)*, October 30, 2019, https://jts.amedd.army.mil/assets/docs/cpgs/Austere_Resuscitative_Surgical_Care_30_Oct_2019_ID76.pdf.

[59] At some partnerships, non-fellowship-trained trauma surgeons were restricted to certain shifts or were required to demonstrate their abilities over several months before being allowed to take independent call. Arrangements vary by facility.

the austere environment and lack of support.[60] To provide this level of skill, Air Force Special Operation Command (AFSOC) began embedding SOST/SOCCET teams in civilian level one trauma centers. Current sites include the University of Alabama Birmingham (UAB) and UMC. Womack Army Medical Center and the Joint Special Operations Command (JSOC) have also partnered with two North Carolina level I trauma centers to embed JSOC teams using this model. Several special operations MCPs exist using the part-time model discussed in section 4.A.3.

The Army and Navy are now also pursing wider use of the ESM model for their forward surgical teams. For instance, the Army has created the AMEDD Military-Civilian Trauma Training Initiative (AMCT3), which uses this type of model at seven different partner sites (with expansion plans underway). Under the Army model, some personnel are embedded full time. The Navy recently established its first such site at Penn Medicine, a hospital of the University of Pennsylvania. The Navy reported they currently plan to embed a growing number of ERRS teams over the next few years at additional sites.

This model also has advantages and disadvantages. For those requiring the highest level of clinical expertise in trauma, this model is ideal. It allows military providers to be fully immersed in a busy trauma environment, maximizing their expose to complex trauma case mix. In addition to technical case experience, they also gain exposure to the trauma system process, research, systems of care, and access to mentorship from the fellowship-trained trauma experts that run the civilian trauma centers. Disadvantages include possible challenges associated with being away from base (i.e., administrative, IT, military acculturation, etc.), and that embedded providers do not contribute to beneficiary care. SMEs noted this may not be a true disadvantage if contributing to beneficiary care comes at the expense of readiness. Some nurses felt MCP assignment may affect their promotability as it is not viewed as a leadership position.

This type of model is optimal for Role 2 providers (e.g., Army FRSDs, Navy ERSSs, Air Forces GSTs, and SOST)—those who deploy in small medical teams and are expected to independently perform trauma resuscitation and damage control surgery in austere environments. In our analysis and recommendations, we develop options for embedding all Role 2 surgical teams in civilian trauma centers (and SAMMC).

3. Part-Time Sustainment Model (PSM)

Under the part-time model, military personnel are stationed (PCS orders) at an MTF and spend some of their time working in their specialty treating DoD beneficiaries in that facility. However, they are also integrated into the call schedule of a large civilian trauma

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[60] "Redefining SOF Surgical Support to Meet Joint Force," *Combat and Casualty Care*, Spring 2018 Issue, https://tacticaldefensemedia.com/redefining-sof-surgical-support-to-meet-joint-force-demand/.

center where they can access higher acuity/complexity cases for skills sustainment and trauma experience. Sometime providers spend most of their time at the MTF and sometimes they spend most of their time at the civilian facility—there is wide variation. While there is a rotational aspect to these partnerships, they differ from the SRMs in two important ways. First, the rotations occur regularly for sustainment purposes (not just once a year or pre-deployment). Second, participants are privileged/credentialed staff members at the civilian hospital (unlike SRM rotation participants).

This type of model appears to have the widest variety of arrangements. It may originate at the local level via an agreement between a medical unit and a local civilian trauma center (e.g., the 60th Medical Group at Travis has agreements with several civilian trauma centers in the San Francisco and Sacramento areas). For local models, a provider may split their time between the MTF and civilian trauma center—typically with the majority of time spent at the MTF (but not always). The IDA team observed rotators under these arrangements spending as much as several days a week or as few as 2 days a year in the civilian trauma center. For the centralized models, travel (TDY orders) may be required.

SMEs have described this type of model as optimal for providers who require exposure to the fast-paced trauma and/or complex critical care environments (i.e., busy ICU), but who do not need to work in a trauma center or ICU full time. Examples of these providers include surgical specialists such as cardiothoracic surgeons, vascular surgeons, and oral maxillofacial surgeons. These providers will typically deploy to Role 3 facilities where they will have more medical back-up, equipment, and supplies and should be working under the direction of an experienced trauma surgeon. To ensure these models provide true skill sustainment, SMEs estimate providers should take trauma call two to four times a month. They must also be able to access a sufficient workload volume in their specialty while working in the MTFs. If this requirement cannot be met, the ESM model will be more appropriate.

4. International and VA Partnerships

a. International Partnerships

International partnerships exhibit a wide spectrum of clinical training opportunities to uniformed providers. These partnerships range from short-term health fairs to foreign military, sales-funded, international trauma-capacity building programs. Similarly, the practice environments range from resource-constrained austere settings to modern international medical centers. It is worth noting that clinical currency training is not always, if not rarely, the primary objective of international partnerships. International partnerships and global health engagements are often initiated in order to enhance interoperability with allies, gain access and influence in the host nation, and advance the security agenda of the

COCOM commander. These partnerships are often a means for advancing health diplomacy in the region rather than the clinical currency of uniformed personnel. Nevertheless, there is inherent value in having medical teams practice in the environments in which they may one day deploy. Local cultural competency is essential for the interoperability of operations and cannot be readily taught in a classroom. While challenging to establish, international partnerships may present opportunities to concurrently address the clinical readiness of providers and enhance the capabilities of partner nations. The following sections provide a brief overview of the range of international partnerships for clinical currency and discusses some common limitations and challenges to establishing partnerships.

- **Medical Readiness Training Exercises (MEDRETEs) and Surgical Readiness Training Exercises (SURGRETEs)**
  - These COCOM-sponsored training exercises are designed to provide humanitarian assistance and free medical care to the people of the host nation. These exercises provide U.S personnel training and experience in the delivery of medical care in austere environments. Missions typically last 2 weeks and are closely planned with host nation officials. While surgical cases are not uncommon, most patients are seen for primary medical care, pediatrics, dental care, and preventive medicine. MEDRETEs are funded through humanitarian and civic assistance dollars.
- **Embedded Health Engagement Teams (EHET)**
  - Under the Embedded Health Engagement Team model, small teams of military medical personnel embed in partner nation medical facilities. In contrast to the 2-week health fair model of MEDRETE missions, EHETs embed with their host nation counterparts for an extended period of time. The composition of the teams is tailored to the needs of the host nation. There is a promising opportunity to expand the exchange to small surgical teams operating in underserved areas, but to date this model of international partnership still remains largely untested.[61]
- **Host Nation Local or Regional Rotations**
  - Some overseas MTFs have developed partnerships with local host nation facilities to allow uniformed personnel to rotate for 1 or 2 days per month to treat local patients. Medical providers stationed overseas are still required to

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[61] B. H. Neese and D. J. Robb, "Modernizing the Operational Design of the Medical Readiness Training Exercise," *Joint Force Quarterly: JFQ* no. 100 (First 2001): 88–93, https://www.proquest.com/trade-journals/modernizing-operational-design-medical-readiness/docview/2557271145/se-2?accountid=11558.

meet Service standards for clinical currency and readiness. Meeting these standards can be extremely difficult for specialists stationed at small overseas MTFs. Prior to the advent of these local partnerships, these providers would have to return to the continental United States (CONUS) on TDY orders in order to meet procedure and volume standards for annual Comprehensive Medical Readiness Program (CMRP) or Individual Critical Task List (ICTL) checklists. The best example of this type of partnership is at RAF Lakenheath in the United Kingdom. The medical staff at Lakenheath have, over the years, developed relationships with several National Health Service hospital trusts to allow military providers to practice in UK hospitals. For example, the Royal London Hospital permits general surgeons and trauma surgeons to practice alongside British surgeons in the UK's busiest trauma center. This partnership has been so successful that it has expanded to accommodate Army physicians stationed at Landstuhl and across Europe to help them meet regional currency standards.

- **International Trauma Training Partnerships**
  - The Trauma, Burn, and Rehabilitative Medicine (TBRM) partnership provides training, mentorship, and technical support to the United Arab Emirates (UAE) medical forces and the Sheikh Shakhbout Medical City Hospital in Abu Dhabi. The bilateral medical engagement is funded by the host nation through a foreign military sale between the UAE and United States. The Mayo Clinic serves as the hospital's operating entity and is involved in the partnership. At full capability, the TBRM will be staffed by a team of 11 personnel along with rotating forces consisting of physicians, surgeons, nurses, technicians, and health administrators from the three Services. The partnership also provides strategic access to a level 1 trauma center in the Central Command Area of Responsibility (CENTCOM AOR), increased operability with host nation partners, and critical health engagement.[62]

b. VA Partnerships

Historically, the DoD and the VA have had partnerships at nearby facilities to foster clinical exchange, share specialty labor, and provide training experiences to providers. The veteran population treated in VA facilities is sicker on average than the DoD beneficiary population, which could provide more complex case mix. Partnerships for surgical

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[62] Derek Licina and Jackson Taylor, "International Trauma Capacity Building Programs: Modernizing Capabilities, Enhancing Lethality, Supporting Alliances, Building Partnerships, and Implementing Reform," *Military Medicine*, usab539 (2022), https://doi.org/10.1093/milmed/usab539.

specialties, anesthesia, and critical care could potentially provide valuable case mix to uniformed providers. Critical care nurses and respiratory therapists could also benefit from VA partnerships. However, trauma is very limited in the VA system. Furthermore, the VA is the nation's primary GME pipeline—over 70 percent of physicians have trained in the VA medical system.[63] At some VA facilities, a sudden influx of DoD trainees could cause learner saturation (i.e., too many students competing for cases).

B. MCP Inventory

The IDA team was asked to create an inventory of existing MCPs. This task was difficult given that MCPs were not tracked centrally at the Service or ASD(HA) level. To produce an inventory, the IDA team worked with a DoD MCP workgroup that is currently creating an MCP register. We also sent data calls for more detailed information (e.g., number of personnel at each site, specialties, MCP type, etc.) to each Service representative in the workgroup. The data presented in this section is the product of these efforts. It contains all of the information we received, but may not be comprehensive.

Our final MCP register showed a total of 73 existing and 18 pending MCPs spread across 63 unique U.S. civilian trauma centers, 4 international trauma centers, and 6 VA facilities. A list of the unique partners may be found in Appendix E. Table 14 provides a summary count of unique domestic partners, international partners, and VA partners.

Table 14. Unique Partner Counts by Operating Status

Domestic MCP	Active	Pending
Level I	49	16
Level II	8	2
Level III	4	0
Pediatric	2	0
International MCPs	4	0
VA Partnerships	6	0
Total	73	18

As previously discussed, there are multiple categories of MCPs, and often more than one program exists at a given MCP site. Table 15 provides a count of unique programs by Service and category.

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[63] Department of Veterans Affairs (VA), "VA Celebrates 70 Years of Partnering with Medical Schools," news release, https://www.va.gov/opa/pressrel/includes/viewPDF.cfm?id=2747#:~:text=Today%2C%20VA%20conducts%20the%20largest,in%20the%20VA%20healthcare%20system.

Table 15. Unique Program Counts by Service and MCP Model

Service	Short-Term Rotational Model (SRM)	Embedded Sustainment Model (ESM)	Part-Time Sustainment Model (PSM)	Grand Total
Air Force	8	2	20	30
Army	4	8	6	18
Navy	3	4	17	24
Special Ops	3	7	5	15
Grand Total	18	21	48	87

Note: Excludes VA partnerships. Includes programs listed as pending.

As part of the inventory efforts, the IDA team also tried to capture the personnel stationed or rotating through MCPs, including administrative personnel. Data capture was incomplete for rotators through the SRM models and PSM participants. However, we were able to get fairly accurate counts of ESM participants and the teaching cadre fully embedded at rotator sites.

Table 16 reports provider counts by program and specialty.

Table 16. Personnel Currently Stationed at MCPs, 2021

	ESM Embeds				SRM Teaching Cadre (no rotators included)			
	AF SOST	Army AMCT3	Navy UPENN	Army USASOC	AF CSTARs	Army ATTC	Navy NTCC	Total
Trauma/General Surgeon	8	12	2	4	18	2	2	44
Orthopedic Surgeon	0	0	0	0	2	1	0	3
Emergency Physician	8	7	1	4	13	1	1	31
Anesthesiologist	0	2	1	0	11	0	1	15
PA/IDC	0	0	1	4	0	0	1	2
Critical Care Nurse	8	7	2	4	25	3	1	46
Emergency/Trauma Nurse	0	7	0	4	8	2	1	18
Nurse Anesthetist	8	8	0	4	2	2	1	21
Medic	0	0	0	10	30	1	0	31
OR/Surg Tech	8	0	1	4	4	1	1	15
Resp Therapist	8	0	0	0	13	0	0	21
LPN	0	0	0	0	0	2	0	2
Other	0	8	3	0	33	2	3	49
Total	48	51	11	38	159	17	12	298

Note: AF SOST teams are spread across 2 sites. The Army AMCT3 program includes 7 sites. The AF CSTARS data includes 6 sites. The other category includes personnel in specialties that do not align to the Service Role 2 forward surgical teams (e.g., vascular surgeons, cardiothoracic surgeons, perioperative nurses, infectious disease, and so on).

Based on these data and additional information provided on SRM programs, we can draw the following conclusions.

- There are roughly 110 ESM participants stationed across the ESM partner sites for which we have currently obtained FTE data. These include the Air Force SOST teams, the Army AMCT3 participants, and Navy participants at the University of Pennsylvania. Each Service indicated plans to expand embedded providers over the next 5 years.
- There are roughly 190 embedded teaching cadre for SRM models for which we have currently obtained FTE data. This includes the five Air Force C-STAR programs, the Army ATTC, and the Navy NTTC.
- There is wide variation in the rotator throughput at different SRM programs. For instance, Army SMART sites aim to offer four 2-week courses to 9 to 12 rotators (maximum of 48 per site annually), while the Army ATTC operates ten 2-week courses for 24 people (maximum of 240 students). The NTTC appears to have similar throughput to the ATTC. Throughput at Air Force C-STARs sites varies by course type, location, and occupation. At the University of Maryland, there are over 500 seats available annually, while Omaha has only 50. Many of the others are between 250 and 400.
- Data on PSM MCPs is the most difficult to capture given the decentralized nature of these programs. We did not receive comprehensive data on the inventory of programs and, for the programs that were reported, we received no data on the number of participants. The Services should work with Health Affairs to ensure better data capture for these arrangements if they are going to be used as a strategic training model for enhancing readiness.

C. MCP Effectiveness

This section describes the case mix and workload seen by providers in MCPs. It begins with a discussion of the data tracked by the Services to monitor MCP performance, outlines the specific measures used by the IDA team to understand MCP workload, and concludes with a presentation of data the IDA team obtained to evaluate MCP effectiveness.

1. Data Sources and Limitations

Civilian hospitals have strong incentives to accurately code workload because they must bill for all care provided. This makes billing claims data an accurate representation of workload for credentialed providers. For some, it may even be a conservative estimate because an assisting surgeon may not always receive billing credit for the workload they

perform. Billing data can easily be queried and extracted by civilian administrators to provide to MCP program management.

The other primary source of workload data is self-reported case logs. Case logs place the onus on individual providers to accurately and fairly report their workload. Although it is usually in the provider's self-interest to record workload, self-reported data are difficult to verify and have limited safeguards from workload inflation—unlike billing data, which are audited, legal documents.

Of the two, billing data are the preferred data source. These data are generally available for physicians in embedded or part-time MCPs where the physician is privileged and the care provided is billed. For physicians on short-term rotations that may not be privileged, and for enlisted personnel and nurses who are not billed for directly by a civilian hospital, self-reported case logs may be the only available source of data.

The current state of data capture varies across MCPs and usually involves a combination of self-reported case logs with partner-provided billing data. These data are then used to populate Service annual skill checklists. As MCP sites mature and shift more to team training—where teams of uniformed personnel practice together—it should be possible to more systematically capture and automate the team's workload based upon the procedures billed by the provider (e.g., estimate an OR nurse's currency skills based upon the billing of the general surgeon). In practice today, enlisted and non-billing provider workloads remain incomplete and largely unobserved.

2. Estimating Workload

Since standardized data capture and workload measures have not yet emerged for MCPs, the IDA team used several measures to quantify the workload performed by uniformed providers in MCPs for this analysis. Trauma volume measures a facility's number of inpatient admissions for traumatic injury. For severity, the American College of Surgeons uses the Injury Severity Score (ISS) as a standardized measure of patient injury. Scores are calculated based upon the number and severity of body systems injured and range from 0 to 75, with a score greater than 15 considered to be "severe" trauma. The IDA team used the International Classification of Disease Program for Injury Classification (ICDPIC) to calculate ISS from diagnoses codes.[64]

Several measures could be used to measure the workload performed by uniformed providers. The Department's metric, KSAs, was not an option as they are not yet routinely computed at MCP sites.[65] Work RVUs are widely used by both commercial and government payers to compensate physicians. RVUs were designed to provide relative

[64] This module is a validated and open-source package frequently used in the trauma literature.

[65] The IDA team did not have access to the algorithm used to generate KSA scores.

values for medical care based on the time it takes to perform the service, the technical skill required, the mental effort, and the stress of the potential risk to the patient. Each procedure's RVU value is inherently intensity-adjusted and standardized. The relative value of each procedure is periodically revaluated by the Relative Value Scale Update Committee of the American Medical Association. Given these advantages, the IDA team presents productivity using provider work RVUs. We supplement this analysis with a trauma surgeon KSA case study provided by the Army.

3. Challenges of the Data

Given the evolving nature of MCP relationships and the absence of systematic data capture and measurement, it is important to note that current workload estimates are imperfect. For example, comparisons across MCPs will be affected by differing structures, schedules, and maturities of the individual sites. It would be neither fair nor correct to conclude that one site is less productive than another because it performs less workload overall when myriad factors such as deployment, onboarding, or scheduling may be the root cause. One way to better level the playing field is to estimate the work RVUs per billable day. This effectively becomes a measure of the density of the clinical workload, and can help policymakers better judge the returns to readiness of MCPs relative to alternatives.

Similarly, the COVID-19 pandemic challenged health systems across the nation to respond to the needs of their communities. During site visits, civilian partners expressed their unanimous appreciation of military personnel in MCPs stepping in to aid in the response. However, for this analysis, the pandemic means that normal workload patterns may have been disrupted, and workload from the pandemic period may differ from the workload realized without the pandemic. For instance, critical care intensivists plausibly saw an increase in workload during the pandemic, while some surgical specialties may have felt downward pressure on their workloads through the cancellation or deferment of elective surgeries. The IDA team made every attempt to use the most current data from MCP sites to minimize any pandemic-related effects.[66] Data from Army MCPs cover the entirety of 2021, while data from Air Force MCPs cover July 2020 to July 2021. Data for comparisons to the direct care system are extracted from M2 for FY 2019 to avoid any pandemic-related impacts to patient care in the MTFs.

4. MCP Effectiveness Results

The following subsections present the data stratified by partnership model.

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[66] Pre-pandemic data was not available for many sites as they have been established only recently.

a. SRMs

SRM participants are generally embedded in MCP sites for 2 to 3 weeks. These sites are primarily geared toward enlisted clinical skill development and sustainment. As such, very few participants have billing data. IDA received data for the Army SMART program for enlisted personnel and the Air Force SMART program for regional clinical currency, which provides opportunities for physicians, nurses, and technicians. The acronyms are the same, but the programs differ in scope. Service representatives provided limited administrative data, which captures the number of annual rotators and the percentage of ICTL/CMRP checklist requirements completed during the rotation. This information is summarized in Table 17. In practice, local Service leadership curates the clinical experience for each rotating cohort in order to maximize the completion of annual administrative clinical currency requirements.

Table 17. SRM Rotations and Skill Validation

	MCP Partnership Site	Annual Rotators	Approximate Percent Completion of Annual Skill Verification Checklists
Air Force			
	UMC Las Vegas - SMART Program		
	Physicians	40	75%
	Nurses	100	90%
	Technicians	150	90%
Army			
	University of North Carolina	11	38%
	Cooper University - SMART Program	29	60%
	Vanderbilt - SMART Program	23	75%

The table shows that the Air Force's partnership provides refresher training for a significant number of personnel. While the Army has a smaller throughput, they are able to meet a considerable fraction of the annual ICT requirements. The Army has planned additional rotations for the following fiscal year.

b. ESM

For ESMs, IDA uses billing data provided by the Services to characterize the workload seen in MCPs. Since we do not have the full universe of a facility's billing data, we can calculate the ISS only of patients seen by uniformed providers. The average ISS of trauma admissions stratified by MCP site are presented in Table 18. We also present the share of trauma admissions considered to be severe trauma (as measured by an ISS greater

than 15). This measure provides a better picture of the distribution of trauma and how frequently providers are encountering clinical complexity.

Table 18. Average Injury Severity by MCP Site

	Military Civilian Partnership Site	Average Injury Severity Score	Share of Severe Trauma Admissions (ISS>15)
Air Force			
	University Medical Center - Las Vegas	7.53	34%
	University of Alabama Birmingham	8.07	21%
Army			
	University of North Carolina	7.46	17%
	University of Chicago	5.75	15%
	Cooper University	4.91	5%
	Harborview Medical Center	7.62	22%
	Vanderbilt University	10.42	39%
	Medical College of Wisconsin	7.95	28%
Direct Care	San Antonio Military Medical Center (SAMMC)	9.73	34%
	All other MTFs	4.90	11%

Almost all MCP sites provide consistent access to severe and moderate trauma. The average ISS available in MCP sites is comparable to that at the MHS's own level-1 trauma center at SAMMC and far exceeds the trauma available in other MTFs. Note that ISS scores are sensitive to the number of diagnoses fields provided in the billing data. Air Force partnerships provided up to four ICD-10 diagnoses code fields per patient, whereas the Army provided only one diagnosis per claim. This slight difference may bias the calculated ISS downward for Army.

To examine how much of this more complex care is seen, we next look at workload performed by clinical service line. The following tables provide workload levels and, where appropriate, comparisons to MTF workload. The IDA team presents the major specialties that embed in MCP sites: trauma/general surgery, critical care, emergency medicine, and other surgical specialties.

1) Surgery

As discussed earlier, the Services currently use both general surgeons and fellowship-trained trauma surgeons. For participating providers, Service leadership at MCP sites

provided educational information or Air Force Specialty Codes/Military Occupational Specialty (AFSC/MOS) codes. General surgeons and trauma surgeons are differentiated where possible in the data. Table 19 presents the workload of embedded trauma and general surgeons.

Table 19. Annual RVU Productivity of MCP Surgeons

	Total Work RVUs	Total Days in Clinic	Number of Providers	RVU Density per Provider	RVU Density Per Clinic Day
Air Force					
UMC Las Vegas - General Surgery/Trauma	19,036	295	8	2,379	64.50
UAB - General Surgery	13,253	244	4	3,314	54.31
Army					
Cooper University - Trauma	1,191	54	1	1,191	22.06
UNC - Trauma	931	33	1	931	28.20
Univ. Chicago - Trauma	11,293	263	2	5,647	42.94
Harborview - Trauma	4,720	61	1	4,720	77.38
Vanderbilt - Trauma	6,444	68	1	6,444	94.77
Medical College Wisconsin - General Surgery	6,704	166	1	6,704	40.39
MCP Total	**63,572**	**1,184**	**19**	**3,346**	**53.69**
MTF Physicians - General Surgery	**405,267**	**40,000**	**335**	**1,210**	**10.13**

The data show that MCPs provide considerable clinical currency particularly relative to MTFs. Nineteen surgeons embedded in MCPs deliver nearly 16 percent of the entire general surgery workload available across all MTFs. An embedded surgeon will deliver the same workload in less than 23 days than an MTF-based physician will deliver in an entire year. Embedded surgeons receive, on average, five times the workload per day. Note that MCP sites with lower RVU values should not be interpreted as worse-performing partnerships. Lower productivity in MCP sites reflects mid-year PCS moves and deployments rather than ineffective partnership.

The Army also provided the IDA team with a trauma surgeon case study from the University of Chicago containing self-reported procedures and KSAs. The following information is pulled directly from that document.[67] The case studied showed that the

[67] Cynthia Barrigan, "AMEDD Medical Skills Sustainment Program (AMSSP)," Brief, December 2021.

Lieutenant Colonel (LTC) embedded at Chicago performed 703 trauma assessments in 2021.

For comparison, the Army reported that SAMMC's busiest trauma surgeon performed only 78 between 2017 and 2019. The LTC also performed more fasciotomies, thoracotomies, and lateral canthotomies than SAMMC's hospital-wide averages. His overall procedure counts are reported below. His total KSA score was 22,682 (above the 18,000-point readiness benchmark). The case study noted that the average MTF surgeon's KSA score was only 8,603. Figure 1 reports the surgeon's procedure counts.

Individual Critical Task	Number Completed
Major Surgical Operations	177
Laparotomy	99
Thoracotomy	44
Vascular Exposure	20
Shunting and Repair	13
Fasciotomy	8
Tracheostomy	7
Below Knee Amputation	1
Craniotomy	0
Chest tube placement	104
Central line	9
Lateral canthotomy	1

Source: Data provided by the Army AMCT3 program office.

Figure 1. Case Study Data for AMCT3 Embedded Surgeon, University of Chicago

2) Critical Care

Physicians trained in critical care are essential to the Air Force's Critical Care Air Transport Teams (CCATTs). These physicians are primarily embedded at the University Medical Center Las Vegas. Due to the co-location of a nearby MTF, they are able to move between the MCP and the MTF. Table 20 presents the workload performed by these physicians at the MCP site. This table does not account for any additional workload that may be performed in the local MTF.

Table 20. Annual RVU Productivity of MCP Critical Care Specialists

	Total Work RVUs	Total Days in Clinic	Number of Providers	RVU Density per Provider	RVU Density per Clinic Day
UMC Las Vegas	20,128	230	5	4,025.65	87.58
MTF Physicians - Critical Care	76,225	10,287	106	719.11	7.41

Five embedded physicians delivered a quarter of the entire MHS critical care workload available across all MTFs. Embedded physicians delivered the same number of RVUs in 10 clinic days as the average MTF-based physician in an entire year. Their clinical daily workload is nearly 12 times as dense in the MCP site.

3) Emergency Medicine

Emergency medicine physicians have varying roles across Army and Air Force. Embedded emergency medicine physicians at UMC Las Vegas support several programs, including the Special Operations Surgical Teams, flight pararescue (PJs), and the SMART Regional Clinical Currency site. Some Air Force providers also have clinical duties at the local MTF. Army emergency medicine providers embed as part of an FRSD. See Table 21 for data on emergency medicine physician RVUs.

Table 21. Annual RVU Productivity of MCP Emergency Medicine Physicians

	Total Work RVUs	Total Days in Clinic	Number of Providers	RVU Density per Provider	RVU Density per Clinic Day
Air Force					
UMC Las Vegas	10,275	156	9	1,142	65.90
Army					
Cooper University	6,036	125	2	3,018	48.29
UNC	4,206	97	4	1,052	43.36
Harborview	1,564	51	1	1,564	30.66
Vanderbilt	102	38	1	102	2.69
MCP Total	22,183	467	17	1,305	47.50
MTF Physicians - Emergency Medicine	751,210	41,256	486	1,221.48	18.21

MCP emergency medicine physicians perform workloads comparable to their MTF counterparts. However, they have a much denser clinical experience by a factor of 2.5. This dense clinical experience frees up time for other commitments, such as serving as a clinical

preceptor for rotating trainees, conducting administrative duties, or deploying. Emergency medicine physicians at MCP sites did repeatedly state that they spent a great deal of time supervising trainees rather than providing hands on care. Still, the average embedded physician could match the annual workload of an MTF-based physician in less than 26 clinical days.

4) Other Clinical Service Lines

In addition to FRSD personnel, the Army embeds several surgical subspecialists that have difficulty obtaining workload in MTFs. The Air Force also embeds other specialties in support of regional currency programs like the SMART program. These specialties include: anesthesiology, cardiothoracic surgery, neurosurgery, orthopedics, and obstetrics. Data received for anesthesiology was not in a standardized format that permitted analysis across partnerships (e.g., some partnerships provided minutes of anesthesia, others provided units of anesthesia, and some provided only the surgical CPT code associated with the anesthesia). Clinical workload data for these embedded specialists is provided in Table 22.

Table 22. Other Embedded MCP Specialties

Partnership Site	Total Work RVUs	Total Days in Clinic	Number of Providers	RVU Density per Provider	RVU Density per Clinic Day
Army					
Cardiothoracic Surgery					
Cooper University	3,169	72	1	3,169	44.01
Oregon University Hospital	793	46	1	793	17.24
Medical College of Wisconsin	4,670	116	1	4,670	40.26
Neurosurgery					
Cooper University	4,555	85	1	4,555	53.59

Each embedded surgeon contributes significantly to the MCP sites and generates considerable workload. While obstetrics, on average, has less workload per provider, embedded clinicians still benefit from the workload density of the MCP hospital. These providers are less of a concern as this service line has healthy demand within the nearby MTF.

c. PSM

The final model of clinical skill sustainment and currency is the PSM. This model is contingent on geographic proximity of the MCP site to an MTF. The IDA team received data from one MCP that supported this type of sustainment model. Due to the relative ease of transitioning between hospitals, this type of model is attractive to a greater variety of clinical service lines and offers a more varied experience. To provide a complete picture of these providers' productivity, the IDA team collected data on both their MCP workload performed in the civilian hospital as well as their workload performed at the MTF. The RVU density of the workloads in both facilities is compared to direct care averages for each provider's respective specialty in Table 23.

Table 23. Part-Time Sustainment RVU Workload Density

Specialty	RVUs per Clinic Day (Nellis AFB)	RVUs per Clinic Day (UMC)	RVUs per Clinic Day (Direct Care Avg.)
Cardiothoracic Surgeon	7.23	7.88	11.26
Colorectal Surgeon	9.02	15.00	10.35
Ophthalmologist	14.65	0.40	20.70
Orthopedic Surgeon	1.41	49.73	13.15
Otorhinolaryngologist	17.66	7.10	13.69
Plastic Surgeon	9.38	17.45	12.51
Plastic Surgeon	5.88	4.36	12.51

The PSM data shows that for some specialists, the civilian partner hospital is a good avenue to supplement MTF workload. For some specialties, the MCP site can deliver a very dense clinical experience without the need to embed full time in the partner facility.

5. Optimizing, Standardizing, and Scaling MCPs

In this chapter we examine how MCPs could be expanded to meet readiness shortfalls. We begin by estimating a requirement for MCP placement based on readiness needs and placement rules developed from SME input and the clinical literature. We then use this MCP placement requirement to estimate how many personnel should be embedded in MCPs and how many MCPs would be needed to meet readiness requirements. Next, we assess the feasibility of meeting this requirement using our inventory of civilian trauma centers and the register of existing MCPs. Lastly, we discuss best practices for MCPs and barriers to MCP expansion.

A. Determining MCP Requirements

To determine the total MCP requirement, the IDA team began with a simple framework based on three questions:

1. Who should be embedded in civilian trauma centers full time; i.e., who should participate in ESM model MCPs?
2. Who should be stationed to an MTF while also taking trauma call at a civilian trauma center; i.e., who should participate in PSM model MCPs?
3. Who does not need sustainment training in a civilian trauma center but will benefit from a short-term trauma training course prior to deployment; i.e., who should participate in SMR model MCPs?

Through interviews with SMEs and the literature review in Chapter 2.A, clear and consistent answers emerged. The resulting placement rules are described below.

1. ESM Placement Rules

The target population for ESM are the following:

- All Role 2 forward surgical and resuscitative teams
- The lead trauma surgeon at each Role 3 hospital

a. Review of Evidence for Role 2 Forward Surgical and Resuscitative Teams

Forward surgical teams perform trauma resuscitations and damage control surgery on severely injured patients in austere environments with little backup. In some cases, they

are single-surgeon teams. For these reasons, SMEs emphasized that trauma expertise was critical for these teams. The Joint Trauma System Clinical Practice Guideline (CPG ID:76) for Austere Resuscitative and Surgical Care (ARSC) states:

> Expertise in trauma care is the cornerstone for ARSC teams and trauma training to achieve and sustain clinical expertise of all team members is foundational. Ideally, ARSC teams will achieve expertise by working routinely as a team in high volume, high quality trauma centers in order to develop trust, fluid team dynamics, and to cross train on key roles and tasks in order to maximize use of limited available hands.[68]

Current Service MCP efforts also appear to target these populations. For instance, the Air Force has now embedded all SOST teams in civilian partnerships. The Army AMCT3 program targets FRSD personnel, and the Navy is moving to embed ERSS teams.

b. Review of Evidence for the Lead Trauma Surgeon at Each Role 3 Hospital

The clinical literature reviewed in Chapter 2.A established that patients have better outcomes when they are treated in a structured trauma program let by an experienced trauma surgeon. The literature also found that non-trauma surgeons with some trauma experience can have equally good outcomes when working under the supervision of experienced trauma surgeons. We therefore conclude the lead surgeon at Role 3 medical units should be an experienced trauma surgeon (e.g., a fellowship-trained trauma surgeon working in a busy level I trauma center). Other supporting surgeons at Role 3 facilities do not need to be placed in ESMs full time.

2. PSM Placement Rules

The PMS target populations are the following:

- All Role 1/2/3 CCCT specialties who are not members of forward surgical teams and are not the lead surgeon of a Role 3 facility
- All Role 3 CCCT+ specialties

a. Review of Evidence for all Role 1/2/3 CCCT Specialties

Some CCCT providers deploy to Role 1 units where a lower level of care is provided (e.g., emergency room physicians) or to enhanced Role 2 or Role 3 units where they will have more back-up than members of forward surgical and resuscitative teams. SMEs emphasized that is was important for these providers to have experience taking trauma call, but that these providers did not need to work in a trauma center full time. The clinical literature review in Chapter 2.A agrees with this assessment.

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[68] *Joint Trauma System Clinical Practice Guideline (JTS CPG)*, October 30, 2019.

b. Review of Evidence for all Role 3 CCCT+ Specialties

The CCCT+ specialties are high-end subspecialists in surgical (e.g., vascular surgery, neuro surgery, cardio thoracic surgery, etc.) or critical care fields. They will deploy to Role 3 units to augment the basic CCCT specialties. While it might be optimal for these providers to work in busy trauma centers full time, SMEs felt it was sufficient for them to take trauma call two to four times a month and to work in their specialty the remaining time. It was noted that some MTFs do not provide enough workload volume for these specialists to maintain currency. In those circumstances, it may be optimal to embed these providers full time. For instance, under the AMCT3 model, Army is embedding CCCT+ providers, such as vascular and cardiothoracic surgeons.

3. SRM Placement Rules

The target populations for SMR models are the following:

- Enlisted personnel deploying to Roles 1 or 2 assignments (not already embedded), including RC personnel
- RC personnel

The evidence does not support use of the SRM model for trauma surgeons and other physicians and high-skill nurses. We recommend discontinuing that practice.

a. Review of Evidence for Enlisted Personnel

Enlisted personnel play a key role in delivering combat casualty care. However, their skill sets are more limited and their training pipeline is much shorter than credentialled providers, who take many years to reach competency in their fields. For instance, Army combat medics (68Ws) attend an initial 80-day training course before being assigned to a unit where they may receive several more weeks of advanced medical training in specific areas and/or clinical training.[69] Course lengths for Navy Corpsman and Air Force technicians are very similar. Training for OR technicians and respiratory therapy services are longer (i.e., 196 days for respiratory therapy). Once these providers complete their training, they should be proficient in their critical skill sets (e.g., starting IVs, placing tourniquets, loading and unloading patients, and so on).

However, most personnel will have little clinical experience treating trauma patients. The SRM models provide an opportunity for these personnel to refresh their trauma skill sets and an opportunity to gain hands-on experience treating trauma patients.

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[69] Sarah K. 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, September 2019).

b. Review of Evidence for RC Personnel

Officers such as physicians, dentists, PAs, and nurses are required to maintain their credentials, licenses, and meet a minimum hours' requirement. However, under the current system, it is difficult to observe the clinical currency of these providers or to know whether they routinely work on trauma cases. Less is known for enlisted providers. For these reasons, RC personnel of all skill types (e.g., physicians, nurses, enlisted) may greatly benefit from a refresher or skills verification course pre-deployment.

B. Determining Scale

In this section we use the placement rules above and force structure data from Chapter 3 to examine what an optimally scaled MCP system might look like. Here we attempt to quantify the scale of MCPs that might be required to meet this target. We build our analysis around the concept of embedding all forward surgical teams. We use this framework for two reasons: (1) these teams have long been one of the key target populations for MCPs, and the Services seem to be moving forward with MCPs focused on these groups; and (2) once surgical teams are embedded at a site, it is possible to layer on SRM and PSM programs for individuals who do not require full-time embedding.

1. Forward Surgical and Resuscitative Teams

In Chapter 3, we presented the unit composition and number of units for each Service's forward surgical and resuscitative teams. Table 24 shows the total estimated number of personnel assigned to these AD teams by Service. If the objective was to embed all forward surgical teams in level I trauma centers, approximately 1,000 personnel (or 1 percent of the AD force) would need to be embedded.

Table 24. Active Duty Forward Surgical and Resuscitative Team Requirements

	Army	Navy	Air Force	Total
General Surgeon	40	59	26	125
Orthopedic Surgeon	36	35	0	71
Emergency Physician	40	24	26	90
Anesthesiologist	0	35	18	53
PA/IDC	4	59	0	63
Critical Care Nurse	40	59	26	125
Emergency/Trauma Nurse	40	0	0	40
Nurse Anesthetist	40	24	8	72
Medic	62	35	0	97
OR/Surg Tech	40	94	26	160
Resp Therapist	0	24	8	32
LPN	36	0	0	36
Total Officers	240	295	104	639
Grand Total	378	448	138	964
Total Teams	40	59	26	125
Share of Medical Force	1%	1%	0.50%	1%

Note: We include Army FRSDs, Navy ERSSs, Marine Corps FRSSs, Air Force GSTs, and the Army and Air Force Special Operation Units.

The first adjustment to make is that some of these personnel are already stationed at SAMMC or a civilian trauma center through an MCP. Table 17 in Chapter 4 showed our best estimate of the accounting of personnel embedded in MCPs. We subtract these personnel from the requirement shown in Table 16. We also assume SAMMC can accommodate four Army teams (two FRSDs) and four Air Force GSTs. After accounting for providers already in level I trauma centers, we estimate another 751 providers would need to be embedded. Table 25 shows a rough distribution of these providers by specialty. Just over half are officers. The Air Force has embedded the greatest number of providers. While embedded providers may not all directly correspond to small surgical teams, we compare them to the surgical team requirement to get a sense of the share of the requirement already embedded. Under this analysis:

- The Air Force embedded providers would cover 85 percent of the surgical team requirement.
- The Army embedded providers would cover 34 percent of the surgical team requirement.
- The Navy embedded providers would cover about 5 percent of the surgical team requirement.

Table 25. Remaining Forward Surgical Team Providers to Embed

	Army	Navy	Air Force	Total
Trauma/General Surgeon	18	55	0	73
Orthopedic Surgeon	31	35	0	66
Emergency Physician	24	22	3	49
Anesthesiologist	0	33	5	38
PA/IDC	0	57	0	57
Critical Care Nurse	22	56	0	78
Emergency/Trauma Nurse	23	0	0	23
Nurse Anesthetist	22	23	0	45
Medic	45	35	0	80
OR/Surg Tech	31	92	12	135
Resp Therapist	0	24	0	24
LPN	30	0	0	30
Total	246	432	20	698
Share Already Embedded	34%	4%	85%	27%

To embed 700 additional providers, the Services can send some providers to existing MCPs that are not at full capacity, but they will likely also require the formation of several additional sites. For analytic simplicity we will shift from considering individual providers back to team units. We will count teams by the number of trauma/general surgeons remaining to be embedded. Using this framework, we estimate the Services will need to embed an additional 73 surgical teams. We round this up to 80 given that we have counted embedded personnel who do not map directly to surgical team units.

2. Model for Embedding Teams with a Planned Deployment Cycle

The IDA team observed a variety of models for embedding forward teams at MCPs while conducting this study. To determine how many total MCP sites might be needed, we needed to adopt a framework for assessing how many teams can be assigned to each site while factoring in deployments.

The Air Force has moved to embedding all eight of its SOST teams across two different MCPs—four teams per site. Under their model, one team is generally assumed to be out the door for training or deployments while the remaining three are available to work at the MCP. The Army has four USASOC teams embedded under a similar model at Atrium Health Carolinas.[70] The Navy is currently exploring a similar model for embedding

[70] The embedded teams are on a four-cycle battle rhythm. They spend 4 months at Atrium, 4 months doing training, 4 months on mission, and then 4 months in reset. During reset, the goal is to get back to Atrium as soon as possible.

ERSS teams. A proof-of-concept is currently being developed at UPENN with plans to expand to three or four additional sites. The Navy currently estimates three ERSS teams will be embedded per site. They also plan to embed several of the smaller two-person en route care system (ERCS) teams, which consist of a critical care or emergency medicine technician and a search-and-rescue medical technician.

To explore the possibility of embedding an additional 80 teams, we adopt the Air Force/Army special forces model of four teams per site (four trauma/general surgeons and their teams). For peacetime, we assume the Service will adopt a predictable deployment cycle for embedded teams. This has several benefits including: the civilian partner becomes used to having military embeds deploying, the military personnel remain tied to the operational mission, and non-clinical aspects of readiness are maintained. Those scheduled to deploy could be sent on:

- Operational missions: Teams could be offered as an asset to each combatant command for operational needs, medical diplomacy, contingency support, and so on.
- Global Health Engagement Missions: Teams can participate in surgical global health engagement. This can take the form of train-the-trainer exchanges; military medical exercises and training (such as those offered by the Defense Institute from Medical Operations); or large-scale COCOM exercises (such as Pacific Partnership, African Lion, and Continuing Promise).
- Defense Support to Civil Authority missions: Teams can participate in domestic disaster response and disaster preparedness exercises. Teams would work to integrate with other federal partners such as Department of Homeland Security, Federal Emergency Management Agency, and Department of Health and Human Services. Their engagement would advance interoperability and provide opportunities for military-civilian collaboration among federal agencies, civilian hospitals, and the DoD.

Under this planning cycle, one team would be out the door at a given time, one would be in a reset period, and two would be in a preparation period.[71] The cycle could be completed annually if deployments were 3 months (90 days). A 3-month deployment followed by 9 months at the MCP (or training) would be consistent with a steady-state rotation policy of 1:3. It would also be possible to have a surge rotation policy where a prepare period is cut (e.g., deploy for 3 months followed by 6 months in reset/prepare). Several SMEs emphasized the desirability of 3-month deployments instead of longer 6- or

[71] During the reset period, the team would handle post-deployment business and then head back to the MCP. They could stay there for their two2 prepare periods or use one1 period (or part of a period) for training elsewhere.

12-month deployments. A primary argument in favor of shorter deployments was the fact that skills can quickly degrade in a deployed setting. In OEF/OIF, demand for surgical resuscitative care was very lumpy. It was not uncommon for surgeons to go many weeks between events that required their critical skills. However, we note planning cycles could be designed around 6-month or 12-month deployments as well. Table 26 illustrates a notional cycle for a four-team setup. With this set-up, four teams are required to have one team continuously out the door in the steady state. We will return to this concept in Chapter 7 when we explore force mix.

Table 26. Notional Deployment Schedule

Team/Cycle	Deploy	Reset	Prepare	Prepare
Team A	X			
Team B		X		
Team C			X	
Team D				X

If this model were adopted, 80 teams would require an additional 20 MCP sites. This site requirement could be lower if existing sites could expand to include additional teams. Alternatively, the site requirement could be higher if facilities could accommodate only three teams (but still under 30).

C. Feasibility

In this section, we consider how feasible it would be to establish 20 additional MCP sites. The focus of this analysis is the capacity and willingness of the civilian sector to absorb another 20 partnerships. Chapter 6 explores feasibility from the DoD resource perspective (e.g., cost and impact on the beneficiary care mission).

To better understand whether the civilian sector could absorb an additional 20 MCPs, we constructed a database of all U.S. trauma centers and cross-referenced it with the list of existing MCPs.[72] The final database contained roughly 1,100 trauma centers. These are shown in Table 27 by level, ACS verification status, and DoD partnership status. In total, roughly 5 percent of U.S. trauma centers have a DoD partnership. However, the share rises to nearly 20 percent for level I trauma centers that have been the primary target for partnering. Still, of the 234 level I centers, only 39 had partnerships. This means there are

[72] We attempted to collect data on all level I, II, and III U.S. trauma centers, both ACS-verified and non-ASC (but state-designated). Data for all ACS-verified centers was collected from https://www.facs.org/search/trauma-centers. Data on state-designated centers was collected from individual state trauma system web pages. Data available upon request.

nearly 200 level I trauma centers available as potential partners. If we use ACS verification as a proxy for larger, higher-quality institutions, there are still 160 potential facilities.

Table 27. U.S. Trauma Centers by Level and DoD Partnership Status

	DoD Partnership			
	Yes	**No**	**Total**	
Level I	37	196	233	**16%**
ACS Verified	35	161	196	
Non-ACS Verified	4	33	37	
Level II	10	330	340	**3%**
ACS Verified	8	207	215	
Non-ACS Verified	2	123	125	
Level III	3	516	519	**1%**
ACS Verified	1	117	118	
Non-ACS Verified	2	399	401	
Pediatric	2	44	46	**4%**
Total	52	1083	1138	**5%**

Source: MCP inventory and IDA DoD trauma center database.

In summary, 20 additional sites at level I trauma centers would increase DoD's total from 63 to 83 level I MCPs and would require support from 20 out of 160 trauma centers. For the U.S. trauma sector, this is a fairly small change. In the course of conducting this study, we met with and interviewed numerous surgeons at level I trauma centers that were interested in establishing an MCP with DoD.

Ultimately, the willingness of the civilian sector to absorb more partnerships will depend on how it perceives the benefits and costs of these arrangements. This will, in turn, depend on how DoD implements MCPs.

The workload delivered by embedded uniformed personnel is the primary incentive for civilian hospitals to enter MCP agreements. The Services provide highly trained, skilled, and experienced providers in specialties that may be hard to attract, expensive to recruit, and difficult to retain. As the civilian facilities bill for their services, the revenue generated by the MCP is an important factor in the decision to enter an agreement and at what scale the partnership is financially sustainable for both parties. In Table 28, we present the billed charges and a range of estimates for payments received by the hospital for trauma care rendered by uniformed providers. Note that billed charges and collection ratios are highly variable between facilities and depend upon a variety of factors. Rarely do hospitals collect the full billed amount for services. This can occur for a number of reasons, ranging from agreements with insurers, caring for the uninsured, or delays in payment. This

situation is particularly true in trauma care, a service line that is generally subsidized by other specialty surgical service lines.

Table 28. Billed Charges and Estimated Payments Received

		Payments Received		
	Billed Charges	**15% Collection Ratio**	**20% Collection Ratio**	**30% Collection Ratio**
Air Force				
UMC - Trauma and General Surgery	$2,406,608	$360,991	$481,322	$721,982
UAB - General Surgery	$2,677,169	$401,575	$535,434	$803,151
Air Force Total	$5,083,777	$762,567	$1,016,755	$1,525,133
Army				
Cooper University - Trauma	$276,912	$41,537	$55,382	$83,074
UNC - Trauma	$175,027	$26,254	$35,005	$52,508
Univ. of Chicago - Trauma	$4,355,189	$653,278	$871,038	$1,306,557
Harborview - Trauma	$842,711	$126,407	$168,542	$252,813
Vanderbilt - Trauma	$1,191,592	$178,739	$238,318	$357,478
Medical College of Wisconsin - General Surgery	$3,538,533	$530,780	$707,707	$1,061,560
Army Total	$10,379,965	$1,556,995	$2,075,993	$3,113,989
Grand Total	$15,463,742	$2,319,561	$3,092,748	$4,639,123
Average per Surgeon	$813,881	$122,082	$162,776	$244,164

This analysis shows that the average MCP site generates nearly $2 million dollars annually in additional billable revenue for trauma care alone. Each surgeon generates. on average, $813,000 dollars in billable revenue. Applying a range of collection rates can illustrate reasonable ranges for the facility's actual collections. Billing practices vary highly among facilities and rarely reflect the true costs of delivering care. Billing per RVU among partnership sites ranged from $126 per RVU to $528 per RVU. It is more reasonable to examine collections. The IDA team had empirical data from Air Force MCPs that showed a collection ratio of between 17 to 18 percent. We apply a range of estimates to capture regional variability in payer mix and other factors that may influence collections. Using these factors, surgeons generate $120,000 to $250,000 in collections.

In addition to revenue generation, there are several ways that utilizing uniformed labor is a strong incentive to MCPs. Consider that a large portion of trauma and emergency room care is for the uninsured. Since uniformed providers are no-cost labor to the facilities, this can increase the financial solvency of low-margin service lines. Physicians, while revenue generating, are not the sole consideration. Uniformed nurses and technicians help MCP sites reduce labor costs. The average nursing FTE cost facilities $185,000 in 2018.[73] Across Army MCPs, there are 25 embedded nurses. This equates to $4.6 million in averted labor costs. Recently during the COVID-19 pandemic, hospitals were forced to resort to traveling nurses to maintain safe staffing ratios or face reducing services. This very quickly increased the costs of nursing labor.[74]

Civilian partners do incur some costs as part of the MCP agreements. These costs relate primarily to the privileging of providers and coverage of malpractice insurance. The IDA team did not receive cost data from any MCP sites. Estimates of these costs are presented in Table 29.

Table 29. Estimating MCP Physician Costs

	Costs	
	Emergency Medicine	**General Surgery**
Malpractice	$12,000	$34,000
Privileging Costs	$800	$800
Parking - Annual	$1,200	$1,200
Office Space	Variable	Variable
Total Costs	**$14,000**	**$36,000**

Note: Average premium data is derived from the Medscape Medical Malpractice Premium Report for 2019. Privileging costs are derived from Medical Group Managers Association (MGMA) facility survey estimates. Parking costs represent the IDA team's best reasonable estimate. All of these estimated costs are highly location-dependent.

Malpractice costs are extracted from the Medscape Medical Malpractice Premium Report for 2019.[75] This survey provides average premiums for medical liability insurance.

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[73] KPMG's 2017 U.S. Hospital Nursing Labor Costs Study, https://f.hubspotusercontent10.net/hubfs/494565/JacksonNurseProfessionals_January2021/pdf/use-on-Employer-Hospital-Nursing-Labor-Costs-2017_Final-Secured-Web.pdf.

[74] American Hospital Association, *Study: Hospitals Paying $24B More per Year for Clinical Labor amid Pandemic*, October 7, 2021, https://www.aha.org/news/headline/2021-10-07-study-hospitals-paying-24b-more-year-clinical-labor-amid-pandemic.

[75] Medscape login page, https://www.medscape.com/slideshow/2019-malprac-prem-rep-6012332#7.

Note that most civilian health systems participating in MCPs have self-funded, rather than commercially purchased, malpractice insurance funds. Self-funding makes the marginal cost of an additional physician a fraction of the cost to purchase commercial malpractice insurance. Privileging costs are derived from Medical Group Managers Association surveys of health facilities.[76] As Table 29 shows, the workload of providers more than covers any of their onboarding costs. Hospitals also save physician recruitment and relocation costs that they would otherwise pay to civilian doctors.

D. Opportunities and Risks of MCP Expansion

Discussions with SMEs identified potential opportunities and risks associated with MCP expansion, as shown in Table 30. We summarize these across the following focus areas: (1) education and training, (2) skill sustainment and medical readiness, (3) recruitment and retention, (4) reserve integration, and (5) military and civilian integration. Cost will be addressed separately in Chapter 6.

[76] Medical Group Management Association (MGMA), *Navigating the Credentialing Gauntlet: Key Actions for Revenue Cycle Management*, December 14, 2021, https://www.mgma.com/resources/revenue-cycle/navigating-the-credentialing-gauntlet-key-actions.

Table 30. Opportunities and Risks for MCP Expansion

	Opportunities	Risks
Education and Training	• **GME:** MCP sites are willing to provide GME slots to DoD; in some cases, MCPs can integrate GME programs with local MTF GME programs. • **Fellowships:** MCP are sites willing to provide trauma fellowship slots to DoD. • **Mentorship:** MCPs offer access to leading civilian trauma faculty. • **Training:** SRM models can accommodate a high volume of rotators for refresher or just-in-time trauma training; MCP partners have also provided access to simulation training, cadaver labs, etc. • **USUHS/HPSP:** Many MCP sites also have HPSP students who could benefit from the training, career mentoring, and cultural indoctrination of embedded MCP clinicians. USUHS could pursue agreements to rotate medical students through MCP sites for clinical away rotations. • **Phase II Enlisted Training:** As MTF caseloads shrink, MCPs could be tapped to accommodate enlisted personnel completing Phase II training.	• **GME:** Removing surgeons from DoD medical centers could impact sustainability of current GME programs by removing clinical faculty. • **Learner saturation:** DoD personnel may face competition with civilian residents, fellows, and other trainees. • **Standardization:** Some learners may have an inconsistent experience subject to the MCP's case mix and volume during their rotation. This especially impacts SRM participants with limited clinical experience windows.
Skill Sustainment and Readiness	• **Medical Readiness:** MCPs provide access to high-volume (and high-severity) trauma and critical care workload not available in the MTF system (outside of SAMMC). • **Clinical Immersion:** Clinical practice is the predominant focus of the MCPs. MCP embedded cadre can focus on clinical practice and training with limited other obligations.	• **Deployments:** The Services must be able to deploy personnel embedded in MCPs as needed. Agreements must be designed to accommodate this need while maintaining a good relationship with the civilian partner.

	Opportunities	Risks
Recruitment/Retention	• **Recruitment:** MCPs make military medical personnel more visible to civilian providers and communities. The IDA team heard several cases of civilian providers joining reserve components after learning more from embedded military colleagues. MCPs could become a valuable recruitment platform with investment designing more purposeful recruitment efforts. • **Retention:** Current and past MCPs stated they would have left service earlier if not for opportunity to participate in MCP. This was especially true for trauma surgeons who felt they had no way to maintain skills in MTFs (outside of SAMMC). The IDA team encountered several trauma surgeons who attended civilian GME programs and then spent entire AD careers in MCPs. Some remained at the MCP facility as reservists when they ended AD service. • **Career Path:** MCPs offer military providers faculty appointments at the best trauma institutions in the country. Desirable appointments help the overall career of the provider.	• **Retention:** Some have expressed concerns that providers embedded at MCPs will be more likely to leave the military (e.g., the civilian facility will lure them away with higher pay). • **Career Path:** Some providers, particularly nurses, expressed concerns about how an MCP assignment would impact their career progression and promotability. Currently, an MCP assignment for a nurse is viewed as a clinical assignment and not a leadership position. Many stated that they really wanted the clinical experience offered by the MCP assignment but feared it would make them less competitive for promotions.
Reserve Integration	• **Training:** RC providers working in MCPs have a close connection to the military mission on a routine basis. • **Interoperability:** RC and AC providers working side by side in MCPs could improve interoperability of the joint medical force. Sometimes this is across AC and RC, but also across Services. • **Data Capture:** Better integration with RC providers may provide better insight into and ways to quantify the civilian workloads of RC providers.	• No risk identified

	Opportunities	Risks
Integrating Military and Civilian Trauma Systems	• **Research:** MCPs offer military personnel the opportunity to collaborate with leading civilian thought leadership in trauma. MCPs can also collaborate with each other to more efficiently conduct research of interest to the DoD. • **Lessons Learned:** MCPs offer military personnel a platform to share trauma lessons from the military experience with civilian leaders (and vice versa). • **DSCA/Homeland Defense Missions:** MCPs provide a platform to keep highly trained trauma teams ready in case of a short-term deployment. • **National Disaster Medical System:** MCPs move the nation towards an integrated National Disaster Medical System that more seamlessly bridges mil-civ functions.	• **Mission Creep:** Embedded MCP cadre are there to maintain currency—not to become the nation's elite first responders or researchers. MCP directors must ensure balance is maintained.

As MCPs expand, the Services should plan to purposely capitalize on the opportunities outlined here (e.g., GME integration, recruitment, etc.) while minimizing identified risks. Some areas, such as retention, may require further analysis as contradictory evidence has been offered about how MCPs might impact retention.

E. Key Considerations and Establishing MCP Best Practices

Over the last 30 years, many lessons have been learned about how to establish successful MCPs and overcome initial barriers. In this section, we outline some of the key considerations for establishing MCPs. We then offer best practices for establishing MCPs. We organize these considerations and best practices according to three distinct times across an MCP's maturity: (1) the planning and development phases, (2) the execution and operation stage, and (3) the sustainment and expansion phase. An overview is presented in Figure 2. The sections that follow expand upon considerations and best practices highlighted in the figure.

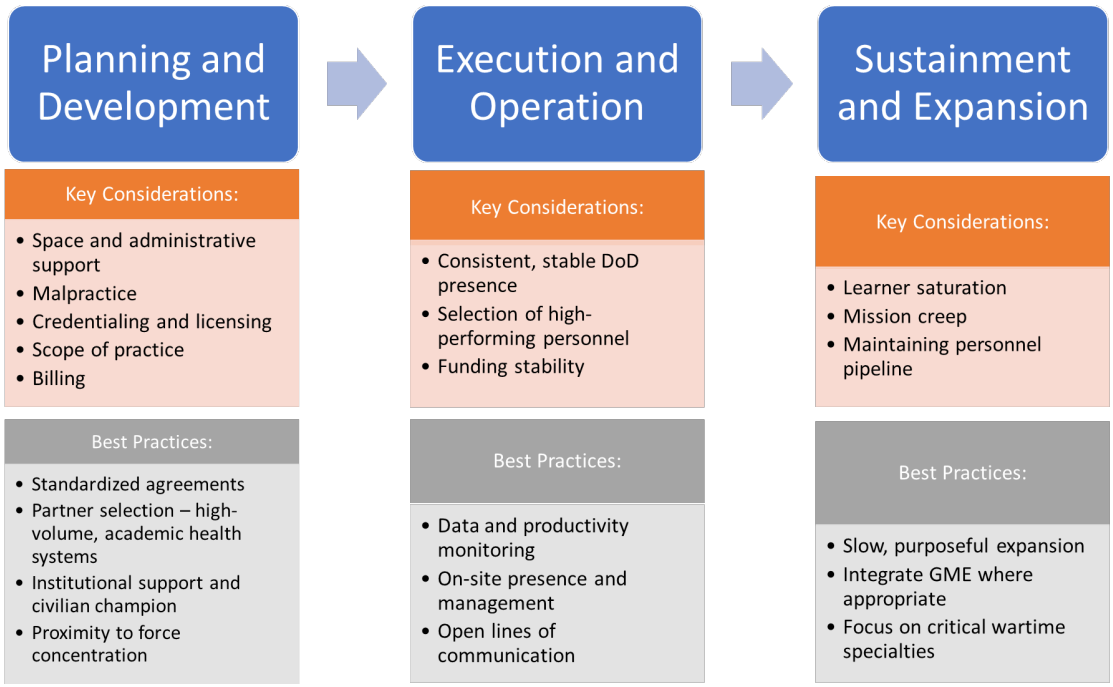

Figure 2. MCP Considerations and Best Practices

1. Planning and Development Phase

The planning and development phase includes the identification of potential MCP sites and the establishment of partnerships. The following sections present key considerations and best practices to pursue. The Services have found solutions to overcome many of the historical barriers to establishing MCPs and should continue to share lessons learned across partnerships.

a. Key Considerations

When the Department first began to establish MCPs, common barriers were soon identified. These included: (1) the handling of malpractice insurance for military personnel, (2) the credentialing and licensing of military personnel, (3) privileging military personnel, (4) determining enlisted scope of practice, and (5) whether the facility could bill for the military provider's workload. These challenges are outlined below:

- **Malpractice:** Military providers in MTFs do not carry malpractice insurance. They are covered by the Feres Doctrine, which prevents military healthcare professionals from being sued for malpractice. While the doctrine could be applied to military providers practicing in civilian partnerships, all MCPs visited by the IDA team required malpractice coverage for credentialed military personnel. These MCPs provided the coverage to the military personnel as part of the MOU/MOA agreement. Most MCPs were self-insured (as opposed to

group-purchased insurance), meaning the direct costs of providing insurance are minimal.

- **Credentialing and Licensing:** For civilians, these processes are generally governed at the state level (i.e., a civilian provider must have a Virginia medical license to practice medicine in Virginia). Military personnel, on the other hand, are authorized to practice with an out-of-state license in "any location authorized by the Secretary of Defense."[77] This means a military provider with a Florida license can practice in a Virginia MTF without obtaining a Virginia license. It would be possible for MCPs to recognize this authority and waive in-state license requirements. However, in practice, the MCPs visited by the IDA team require embedded personnel to obtain in-state licenses. While some in the DoD feel that "federalization" or recognizing of any state license should be a key priority, civilian partners we interviewed did not seem receptive to this idea. However, most civilian partners are academic health systems used to handling credentialing for large volumes of trainees and visiting faculty.
- **Enlisted Scope of Practice:** Some enlisted occupations do not have a civilian equivalent (or they may not hold a civilian license). Individual states vary in the scope of practice covered through licensure of various technical specialties. For example, some states recognize technical training of military respiratory therapist technicians as equivalent to state certification. Some states may not recognize such equivalencies or may impose restrictions to the scope of practice while participating in the MCP, such as preventing insertion of artificial patient airways. Depending on the scope of individual state licensure practice limitations or varied recognition of military technical training certifications, the ability of enlisted members to gain important clinical currency experiences may be constrained in an MCP.
- **Billing:** All MCPs bill for the care provided by uniformed physicians embedded in their facilities. This is one of the foundational incentives for civilian hospitals to participate. They are allowed to bill all insurances for the care delivered by DoD personnel, including other federal insurance programs such as Medicare and Medicaid. The one exception is that MCPs cannot bill TRICARE for care rendered to beneficiaries by a uniformed provider. In practice, either TRICARE beneficiaries are steered to a civilian provider or the facility does not bill TRICARE for the care. IDA learned that this is a relatively rare occurrence and not of major concern to civilian hospital administrators.

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[77] Title 10 United States Code (USC), Section 1094(d), *Licensure Requirement for Health-Care Professionals*, 2010, https://www.govinfo.gov/app/details/USCODE-2010-title10/USCODE-2010-title10-subtitleA-partII-chap55-sec1094.10 USC §1094(d).

b. Best Practices

While none of these barriers are insurmountable, each takes time to work through. Historically, most MCP agreements—typically an MOU or MOA between a DoD organization and the civilian partner—have taken years to develop and implement. This section provides some best practices that are universal across leading MCPs.

- **Standardized agreements:** Historically, each military organization reinvented the process for each MCP. While some barriers may be unique to a given MCP (e.g., a specific state regulation, a specific civilian partner requirement, or a Service-specific need for a certain occupation), most are not. Sharing lessons learned across Services and civilian partners can help minimize these barriers and reduce start-up times. So too can the adoption of more standardized agreements. Greater standardization of agreements will ensure DoD has a common framework to handle important issues such as privileging, medical malpractice coverage, performance reporting, billing, or disciplinary issues without having to re-adjudicate each agreement for approval. The Services have already begun moving toward some degree of standardization for their MCP agreements. For example, Army AMCT3 has developed a standard agreement that can be implemented nationally with little modification.
- **Umbrella agreements and a primary military lead for MCPs with multiple programs:** Many MCPs begin with one program (e.g., embedded teams) but expand to include others (i.e., an SRM model and a PSM model). Sometimes, more than one rotator model is present. For example, we observed Several sites where there were embedded teams, a rotational program for conventional forces, and a special operations program. Often each program had its own agreement, which could create confusion. Civilian staff sometimes had trouble understanding which military personnel belonged to which program, what they were allowed to do in the facility, and which military organization to contact about questions/issues. These challenges can be minimized if all MOUs/MOAs are brought under an umbrella agreement with a primary military POC. The Las Vegas Office of Military Medicine represents one successful model for consideration.
- **Partner selection:** Civilian partners should be carefully selected. These partnerships are intended to be both enduring and mutually beneficial. It is essential that partners have a good understanding of the military's goals, requirements, and expectations for their personnel while embedded. Mutual trust is essential and bidirectional to ensure that uniformed medical personnel are getting the requisite experiences to be battle ready. In general, civilian hospitals should be considered for partnership if they: (1) have high trauma volume, (2) have a high degree of penetrating trauma, and (3) have good outcomes as

measured by the Trauma Quality Improvement Program (TQIP). Other desirable characteristics include affiliation with an academic health center, a thriving research enterprise, and stable GME programs. Many SMEs emphasized that academic medical centers were the best partners as they are most familiar and supportive of training missions. Faculty in these centers is more comfortable dealing with new learners of diverse backgrounds. This is especially important for enlisted personnel who may have a military scope of practice beyond what is traditional for their civilian counterparts.

- **Strong institutional commitment from partner:** The civilian partner must be willing to provide resources, such as dedicated space and administrative support, to the military personnel. All departments involved in the MCP (e.g., trauma, emergency department, anesthesia, etc.) must be supportive, as should associated medical schools. The partner must be willing to accept all DoD trauma team providers, including nurses and enlisted personnel (not only the high-end surgical specialists that will generate the most revenue). SMEs often discussed the need for a strong civilian champion within the trauma department or leadership. Often this person had a military connection (former service member or reservist). The ACS Bluebook outlines a long list of items required from the civilian institution to document their institutional commitment.[78]
- **Strong institutional commitment from DoD:** Likewise, the DoD must commit to being a reliable partner by ensuring clinical and administrative personnel are provided according to the MOU/MOA.
- **Proximity to force concentration**: While not essential, the IDA team observed that many opportunities arise when MCPs are close to a military base. For instance, providers stationed to the MTF can easily rotate through on a part-time basis. At Nellis, GME programs were integrated with UMC. In addition, it is much easier for embedded providers to return to base to deal with administrative issues, fitness tests, IT issues, and so on.

2. Execution and Operation Phase

The execution and operation phase covers the time from program stand-up to the first few cohorts of personnel. This is a critical period for the MCP when it must demonstrate value to both civilian and military leadership and prove the partnership concept. A few common themes emerged from the programs during this time.

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[78] American College of Surgeons, *The Blue Book: Military-Civilian Partnerships for Trauma Training, Sustainment, and Readiness*, https://www.facs.org/member-services/mhsspacs/blue-book.

a. Key Considerations

Key considerations during this phase are presented below.

- **Consistent and stable DoD Presence:** DoD must be a reliable partner. While operational needs are paramount, the Services should make every effort to minimize deployment-related disruptions to the civilian facility. MCPs have pursued several strategies that can ensure a consistent and stable DoD presence that does not strain the partnership. For example, Air Force embeds four SOST teams in each of their MCPs so if one or even two teams need to deploy, the remaining teams can cover the workload without burdening the civilian facility. In practice, it is essential to set expectations early so that civilian leadership sees embedded military providers as personnel overage and recognizes the need for flexibility around deployments. On the other hand, MCP program managers should be cognizant of the need to communicate, be a consistent partner, and spread the deployment burden across MCPs so no one facility is overly taxed. Personnel changes during PCS cycles can also be disruptive. The Service should try to minimize personnel gaps that occur at these times.
- **Selecting high-performing personnel:** The embedded military personnel can help an MCP succeed or fail. It is essential that the Services screen and select the highest performers to fill the MCP training slots, particularly in newer partnerships. The first few cohorts that pass through an MCP set the precedent for cohorts that follow. It is essential that they are stewards of the MCP's reputation and represent their Service and clinical specialty to the highest degree possible. A few bad actors can spoil the trust between institutions and limit opportunities for those that follow. Having on-site program management can help resolve any issues.
- **Stable funding:** The inconsistencies of DoD budgeting may be foreign to civilian partners. The funding of activities should be made transparent and stable to the extent possible. For example, one MCP offered an annual fellowship slot in their trauma program to the DoD, but the department could ensure neither consistent funding nor a consistent pipeline of personnel. This resulted in the civilian hospital leaving the fellowship slot unfilled, producing a ripple effect of ramifications for the civilian faculty, residents, and program directors. For embedded DoD personnel, supporting even a small contingent of military members in an MCP requires resources. Military personnel may require dedicated facility space or computers for training activities, administrative support to navigate institutional reporting/coordination needs of participants, or financial support for unanticipated or recurring incidental expenses. As civilian health systems participating in MCPs are allowed to bill and collect for the services rendered by active duty providers, clear and consistent guidelines

should be developed for reimbursement of incidental expenses incurred by military members that they would not otherwise incur working in an MTF. The IDA team observed inconsistencies across Services with respect to incidental expenses. For example, Air Force partners appeared to cover expenses related to parking, licensing, and everyday items like scrubs. Army partners were not. Some military members were frustrated in having to pay out-of-pocket for items like scrubs or parking that would normally be provided by the MTF in a direct care setting. While relatively minor in total, MCP agreements should be standardized to allow the hosting facility to reimburse or provide "in kind" services to participating military members as a minor offset to the collections received by the facility. By standardizing resourcing, reimbursement, and administrative support requirements in the MCP agreements, participating MCP locations and military member parent commands may have a more consistent understanding of incidental expense responsibilities.

b. Best practices

Best practices for this phase are presented below.

- **Data and productivity monitoring:** All MCPs monitor data collected from the providers and the civilian hospitals. Some use self-reported case logs, some use Service-specific clinical skill checklists, and others use billing data. The data collected should be standardized across all MCPs regardless of Service. Billing data has many advantages in this respect. It is already standardized (e.g., ICD diagnosis codes, CPT procedure codes, units of service, etc.); validated (e.g., it must be accurate to bill insurance); and easy to acquire from the partnership (e.g., all facilities must collect this data in order to bill insurance). MCP program leadership should be centrally monitoring productivity in order to ensure that the MCPs are achieving desired outcomes.
- **On-site presence:** MCPs unanimously agreed that an on-site program management presence to bridge the divide between the military and civilian institution is incredibly valuable. This person serves as a liaison between the institutions and is a daily reminder of the commitment to the partnership. This on-site presence is particularly useful for MCPs with a high volume of rotating personnel. Program managers help facilitate administrative approvals, clinical rotations, and proactively resolve issues. They also form an institutional memory that lasts beyond the PCS moves of embedded cadre. In practice, these on-site program staff are also a primary conduit to communicate with the civilian facility. To create this presence, MCPs have filled this role using full-time active duty staff (e.g., the Office of Military Medicine at UMC/Nellis), contract staff,

or federal employees. As MCPs expand, the Services must receive resourcing for support personnel who are critical to MCP success.

- **Open lines of communication:** Maintaining open lines of communication is essential for setting expectations and upholding the relationship with the civilian partner. Army has more centralized communication with the program office at Army MEDCOM HQ. The other Services have a more decentralized approach with local site leadership. Both models work, and both use frequent and transparent communication.

3. Sustainment and Expansion Phase

The final phase covers the transition from newly established to more mature partnerships. This time period begins after both military and civilian parties have found an equilibrium of operations and decide to expand the collaboration.

a. Key Considerations

Key considerations during this phase are presented below.

- **Learner saturation:** As most MCPs are associated with academic medical centers, there is already a considerable number of students and trainees practicing in the facility. Dramatically increasing the number of embedded DoD personnel may saturate the hospital with trainees and lead to competition for clinical substrate between training programs. Each facility must find its own equilibrium and work with the Services to find the right balance, while maintaining the quality of the experience and training opportunities.
- **Mission creep:** Several MCPs have expanded their scope to explore collaboration for disaster response and preparedness, mass casualty exercises, and trauma research. These are inherently positive developments that strengthen the partnership overall. It is important, however, that these secondary objectives and activities do not detract from the primary purpose of the MCPs, which is to maintain readiness and sustain clinical skills.
- **Maintaining the personnel pipeline:** As MCPs mature and expand, it will be more challenging to maintain a steady pipeline of personnel to fill training slots. The partnership may be affected if provider billets are left empty for extended periods of time. Predictability of personnel and the skill sets they bring can help ensure the mutual benefit of all parties.

b. Best Practices

Best practices for this phase are presented below.

- **Purposeful expansion:** Most mature MCPs have a large number of embedded surgical team personnel along with multiple other programs like an SRM, PSM, and residency positions. This is an ideal end state; however, SMEs emphasized the need to start programs small and build them slowly. Doing so allows the initial military personnel to build trust with the civilian facility and work through the many challenges that can arise. The civilian institution will need time to learn more about the various military occupations and the military mission. Expansion must also be resourced properly by the DoD—more support personnel may be needed on site or in MCP program offices to maintain and grow programs.
- **Integrate GME and trauma fellowship training:** Integrating GME with the MCP clinical currency training creates a natural pipeline of clinical professional development that spans residency, fellowship, and currency training. GME funding is extremely limited in civilian medicine, so additional GME trainee slots for residencies and fellowships are highly coveted by academic health centers. Integrating GME would create centers of gravity around MCP sites.
- **Focus on critical wartime specialties:** While Role 2 surgical teams are the focus of MCPs, part-time sustainment models can also support other specialties. MCPs located near an MTF may see more local rotators working 1 or 2 days a month. Not all local rotators have clinical specialties geared toward battlefield medicine. MCPs should focus on developing and providing opportunities for providers with critical wartime specialties. Under no circumstances should their training opportunities be sacrificed due to specialties with organic demand inside MTFs.

6. The Cost of MCP Expansion

When discussing a potential large-scale expansion of MCPs, cost and competition with the beneficiary care mission were the most common concerns raised by Service and DHA personnel. While overhead costs associated with MCPs are low, many raised the point that the providers embedded in MCPs do not contribute to the beneficiary care mission. By this reasoning, the DoD would need to incur additional costs by: (1) hiring more MTF providers to replace MCP participants and/or (2) purchasing more civilian care.

The IDA team analyzed these arguments and found that they were not empirically supported. Specifically, they do not factor in the high overhead costs associated with operating an MTF beneficiary care mission, productivity inefficiencies in the current system, and current risks taken against the operational mission. In this chapter, we analyze the impacts of MCPs on MHS costs. We begin in Section A with an illustrative "blank sheet" analysis that compares the cost of the MTF system with the cost of an approach based entirely on a civilian trauma center. In Section B we then modify this analysis to consider the existing MTF structure to examine the marginal cost impacts of expanding MCPs. In Section C we review the economics of the current MHS training approach to explain the flaws in the logic that leads to the DHA concerns.

A. Blank Sheet Approach

To illustrate the cost of running hospitals and using military personnel to deliver beneficiary care versus the cost of purchasing all beneficiary care, we present results from a prior *Health Affairs* analysis. This analysis was refined and reproduced in a 2016 IDA report.[79] We use the re-created IDA estimates here. The analysis compares the full cost of producing care in house to the value of the care (what it would have cost to purchase the care from the TRICARE network).

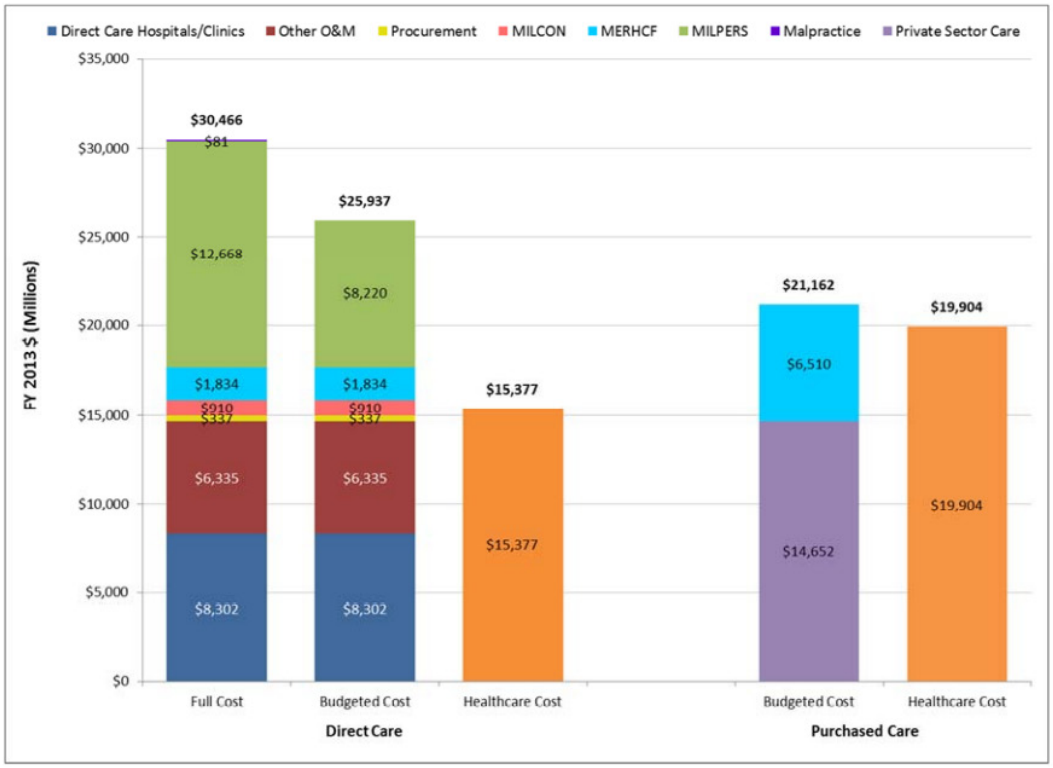
Figure 3 provides the full analysis. The left three bars assess the MTF system (direct care) and the right two bars assess purchased care. The analysis compares the cost of producing/delivering the care with the "value" of the care as determined by how much it

[79] Philip M. Lurie, "Comparing the Costs of Military Treatment Facilities with Private Sector Care," IDA Paper P-5262 (Alexandria, VA: Institute for Defense Analyses, February 2016).

would cost to purchase the same mix of care in each geographic market. The focus here is on the left bars for the MTF system.

The left-most bar of Figure 3 shows that the full cost to the taxpayer of care produced in the MTFs in 2013 was $30 billion. The next bar shows that the directly budgeted cost for this care was $26 billion.[80] These numbers are them compared to the third bar with the value of that care—$15 billion. From the data, we observe that choosing to produce care in house costs approximately twice as much as purchasing it. Of most relevance for this report is that the cost of purchasing all care and the cost of all military medical personnel added together ($15 plus $13 billion) is less than the cost of running the MTF system. In other words, all beneficiary healthcare could be purchased from the private sector, with all military medical personnel embedded without reimbursement in civilian facilities for clinical skill maintenance, and the total cost of the military health system would be lower. The cost reduction for improving readiness in this way would be about $2 to $3 billion dollars. The actual cost reduction would be larger because many military medical personnel are not actually required for the operational mission and are maintained on active duty primarily because of the MTF system.

[80] The difference between full cost to the taxpayer and directly budgeted costs results from many costs of the military health system not being directly reflected in the health system budget. For example, DoD pays malpractice claims each year, but this is not reflected in the healthcare budget. Similarly, military medical personnel cost significantly more than average military personnel (because of medical specialty pays and training), but are reflected in budget documents at the average military personnel cost.



Sources: IDA Paper P-5262, "Comparing the Costs of Military Treatment Facilities with Private Sector Care"; USD (C), *Defense-Wide Budget Documentation-FY 2015*, Vol 1, Sec 8; PB-11, "Cost of Medical Activities," DHP PB15 MEPRS; and M2.

Figure 3. Healthcare Costs by Sources of Care, FY 2013

B. Marginal Change Approach

If DoD started with a "clean sheet," it would reduce cost to place all military medical personnel in civilian facilities for clinical skill maintenance, however, that is not a policy option DoD would likely consider. DoD has a system of MTFs in place, and a realistic cost assessment of MCP expansion should occur from this baseline. Most SMEs that we interviewed thought it was important to maintain the largest MTFs (medical centers) for their roles in supporting education and training, as well as casualty receiving, and other operational missions. Some are also located in remote areas with little civilian infrastructure.

The change in cost from expansion of MCPs in this context depends on how DoD adjusts MTF operations. At the high-cost end of the spectrum, DoD can backfill military personnel reallocated to MCPs with civilians. At the low-cost end of the spectrum, DoD can adjust MTF productivity and footprint (e.g., downsize select facilities by closing product lines and purchasing more care). The analysis below compares the magnitude of the highest cost approach (backfilling) with potential options for cost-neutral or cost-saving options (that would require adjusting the MTF footprint).

1. No MTF Adjustments—Civilian Backfill Option

Costs would increase if the department was not willing to adjust the MTF footprint (e.g., reduce certain surgical service lines, downsize facilities, convert clinics to active duty only clinics, etc.) or remove providers from the MTFs without backfilling. Table 31 shows the number and cost of required civilian backfills to replace the AC providers reallocated to MCPs. We consider the full replacement scenario and a scenario of 80 percent replacement. The second scenario assumes 20 percent of the military personnel can be pulled from a combination of low volume MTFs that not require a backfill (i.e., remaining providers can cover the workload); staff and other non-clinical jobs; and the education and training pipeline. For both analyses, we use a conversion factor of .8 civilians per 1 AC personnel.[81] In the full replacement scenario, we estimate it would cost roughly $130 million (or $122 million cash flow) to backfill. Costs fall to $105 million (or $98 million) under the 80 percent replacement scenario.

Table 31. Estimated Cost of Backfilling AC providers with Civilians (in Millions)

	Full Replacement			80 Percent Replacement		
	Backfills	Full	Cash Flow	Backfills	Full	Cash Flow
Trauma/General Surgeon	58	27	26	47	22	21
Orthopedic Surgeon	53	26	24	42	21	20
Emergency Physician	39	16	15	31	13	12
Anesthesiologist	30	14	13	24	11	11
PA/IDC	46	6	6	36	5	5
Critical Care Nurse	62	11	10	50	8	8
Emergency/Trauma Nurse	18	3	3	15	3	2
Nurse Anesthetist	36	9	8	29	7	6
Medic	64	5	4	51	4	4
OR/Surg Tech	108	10	9	86	8	7
Resp Therapist	19	2	2	15	1	1
LPN	24	2	2	19	1	1
Total Cost	558	131	122	447	105	98

These cost estimates represent an extreme upper bound for the cost of expansion. In the following section, we demonstrate why backfilling low-volume MTFs is inefficient and

[81] This factor accounts for the fact that civilians have higher productivity targets because they do not have additional military duties. The RVU target for civilians is 20 percent higher than the RVU target for military personnel.

discuss alternative options for reallocating providers to MCPs with cost-neutral or cost-saving scenarios. Both scenarios require MTF adjustments.

2. MTF Productivity and Footprint Adjustments

Military providers in CCCT specialties working in MTFs have very low productivity compared to civilian metrics. One reason for this is that military providers have training responsibilities and other military-specific duties. To account for these differences, the MHS sets productivity targets equal to 50 percent of the civilian productivity median reported by the MGMA (measured in RVUs). Appendix F contains more detail on these targets and RVU calculations. For general surgeons, this corresponds roughly to the 10th percentile of civilian productivity. Figure 4 shows the distribution of RVUs for all general surgeons working in MTFs. Nearly 90 percent fall short of the productivity target. A cluster of providers producing 500 or less RVUs per year is expected; these are likely providers with other jobs that take them away from clinical practice (e.g., MTF leadership roles, GME program directors, faculty appointments, and so on). Low RVU counts for other providers below the target is likely due to providers being case-bound (e.g., there is simply not enough demand for surgical services). The RVU distributions for emergency medicine physicians and orthopedic surgeons are very similar. These can be found in Appendix F.

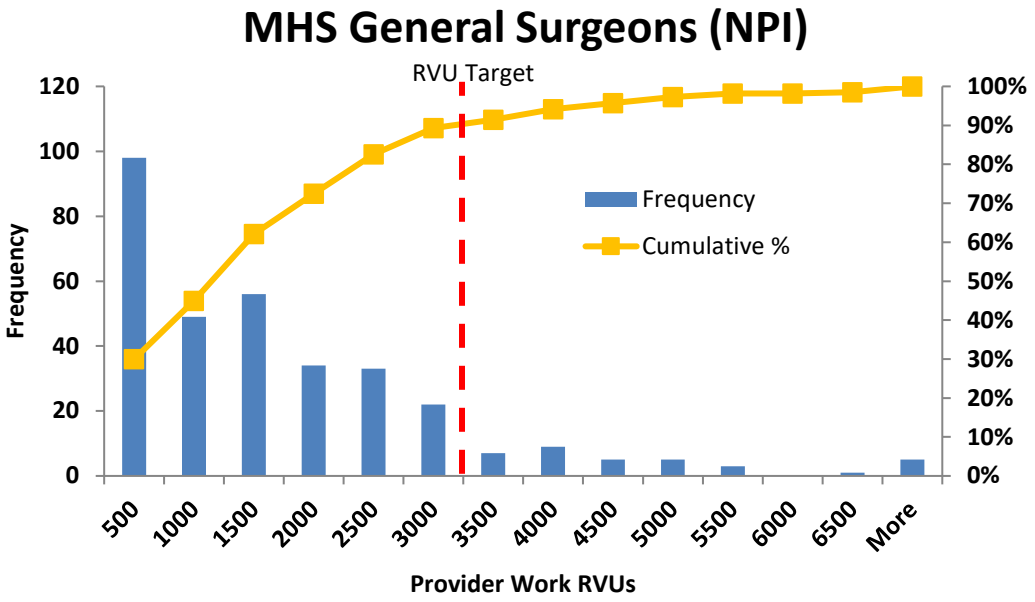


Figure 4. Work RVUs for MHS General Surgeons

The productivity challenge increases, on average, as the size of the MTF decreases. Table 32 illustrates this challenge by presenting work RVUs per surgeon across the four MTF categories described in Chapter 3 (medical center, large hospital, small hospital,

clinic). We separate SAMMC to demonstrate the difference between a level I military trauma center and the other MTF categories. The data show that providers at SAMMC, on average, are nearing the DoD RVU target (set to 50 percent of the civilian median). Moving to the other large medical centers, we see RVUs per surgeon drop by over 40 percent. While this is very inefficient, we do not recommend removing providers from medical centers as these facilities play key roles in GME and have other strategic value (e.g., casualty receiving). Productivity continues to fall in smaller sized hospitals and clinics.

Table 32. General Surgeon Allocation and Work RVUs by Facility Type

Facility Type	General Surgeon Count	Appointment Provider Work RVU	Work RVU per Surgeon	Percent of SAMMC
SAMMC	34	100,356	2,952	
MedCen	63	108,747	1,726	58%
Hosp-L	79	125,197	1,585	54%
Hosp-S	36	51,197	1,422	48%
Clinic	25	19,770	791	27%
Total	**237**	**405,267**		

This pattern demonstrates two things: (1) surgeons in clinics and small MTFs are least productive due to medical demand constraints and, as a result, face the greatest currency challenges, and (2) the economics of backfilling most MTFs are not favorable. If the DoD wants to reallocate surgeons from MTFs to MCPs, the Department should look to reallocate them from clinics, followed by small hospitals, and then large hospitals.

Placing the additional 73 surgeons (or 698 total billets displayed in Table 24) into MCPs does not require DoD to create new requirements for surgical team billets or necessarily backfill every reallocated surgeon. A blended option that reassigns underutilized surgeons in hospitals and clinics while holding SAMMC and medical centers constant as GME force-generating facilities, could provide almost all the necessary MCP surgeons while improving utilization of those providers remaining in MTFs. For example, Table 33 lays out a scenario where 50 percent of the general surgeons at hospitals and clinics are reassigned to MCPs to show the improved utilization of those remaining in the MTFs.

Table 33. Reassignment Scenario, General Surgeons from Hospitals and Clinics

Facility Type	Current General Surgeon Count	*New General Surgeon Count*	Appointment Provider Work RVU	*New RVU per Surgeon*	*Percent of SAMMC*
SAMMC	34	*34*	100,356	*2,952*	
MedCen	63	*63*	108,747	*1,726*	*58%*
Hosp-L	79	*40*	125,197	*3,170*	*107%*
Hosp-S	36	*18*	51,197	*2,844*	*96%*
Clinic	25	*13*	19,770	*1,582*	*54%*
Total	**237**	***167***	**405,267**		
MCP Surgeons		***70***			

In this simple example, which frees 70 surgeons for MCP assignment, RVU utilization at large and small hospitals approaches that of SAMMC (107 percent and 96 percent, respectively) while clinic utilization doubles to approximately 54 percent. Under this scenario, the nine additional required surgeons could come from the remaining clinics where surgical services may be discontinued, medical centers refocused on high-acuity care, civilian backfill, or all of these options. The purpose of this example is not to identify specific policy recommendations, but to illustrate feasibility and improved utilization of existing military personnel resources through reallocation. Medical readiness opportunities improve for both the remaining surgeons and the general/trauma surgeons reassigned to MCP locations.

Additional challenges will invariably occur by embedding the remaining forward surgical team personnel identified in Table 23 into MCP locations (e.g., ER physicians, nurses, enlisted, and others). As with the general surgeons, a blended approach that considers reallocation based on current utilization may provide many of the required medical providers without growing the force.

Reallocation opportunities also lie in current DoD plans to better align billets and medical infrastructure (footprint) to operational medical support requirements. Section 703 of the FY 2017 NDAA directed the Department to implement standard approaches to the definition and medical service offerings of medical centers, hospitals, and ambulatory care centers (clinics).[82] As part of that response, starting in FY 2022, the Department will shift approximately 30 clinics to active duty primary care only or downsize some hospitals to clinics, thereby freeing medical resources. Another example lies in the Department's

[82] *NDAA for FY 2017*, Section 703.

response to Section 719 of the FY 2020 NDAA where the DHA and military services identified more than 3,200 billets whose workloads could be absorbed by remaining MTF personnel, thereby freeing additional military medical manpower.[83]

While support to beneficiary care provided in MTFs should and will remain of primary importance, the marginal cost approach of placing all forward surgical military medical teams in MCPs can be entirely offset through planned changes in infrastructure or personnel reallocation. Taken over multiple years, this approach can grow MCP participation while optimizing military medical manpower to improve readiness without growing the medical force or replacing underutilized active duty personnel with civilians.

C. Economics of MHS Training Approach

To analyze the marginal cost in each of the above adjustment scenarios, the IDA team empirically examined the current MHS business practice of using military personnel to provide beneficiary healthcare. We found many in DoD did not understand the underlying economics this business practice. A common statement we heard was that "using military providers required for the operational mission to provide beneficiary healthcare during peacetime is very efficient, saving money by preventing DoD from having to purchase the beneficiary healthcare." In reality, the practice makes beneficiary healthcare less efficient and costlier.

To understand the underling economics involved, it is useful to look separately at the readiness mission and beneficiary mission. The readiness mission requires trauma, emergency medicine, and critical care specialists with experience in delivering this type of care. As reviewed in Chapter 2, the current MHS business practice takes risk against this requirement by not staffing the force fully to those specialties and, for the appropriate specialists it does staff, not providing sufficient workload of the right case mix to maintain clinical readiness. In short, DoD takes risk against the operational mission by failing to staff deployable military medical personnel that meet the requirement. This practice does save money: failing to meet a requirement is less expensive than meeting a requirement.

The beneficiary care mission requires pediatrics, obstetrics, and similar areas of care. There are three ways to deliver this care: in an MTF with a military provider, in an MTF with a civilian provider, and using civilian healthcare. That list is in rank order from most expensive to least expensive. In other words, using a military pediatrician or obstetrician to deliver beneficiary healthcare is the most expensive (i.e., least efficient) way to do so.

Combining the two missions reveals the underlying economics. The readiness mission drives a requirement for a military trauma surgeon or emergency medicine physician, DoD takes risk against that requirement by not staffing that specialist, and DoD then fills the

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[83] *NDAA for FY 2020*, Section 719.

military billet with an obstetrician or pediatrician so that the billet can be used to deliver beneficiary healthcare. Beneficiary healthcare is now delivered in the most expensive way, and savings arise only from choosing not to meet a readiness requirement; i.e., taking risk against casualty care when the next war starts.

7. Force Mix Options

In this chapter we return to the topic of force mix. The previous chapters were based on the AC and RC number of surgical units currently identified as requirements. We built a requirement for embedding all AC teams in MCPs (leaving RC teams in their current state) and explored the cost of moving to this MCP-based model.

Under the MCP model, AC teams are employed by civilian institutions (similar to an RC model), but DoD pays their full salaries, and in exchange, maintains close control. Here we consider how to introduce a lower cost RC model into the mix. The three key attributes of the trade space between AC and RC performance are: (1) accessibility and control, (2) cost in dwell time, and (3) readiness.

- **Accessibility and Control:**
  - How quickly, reliably, and often can forces be deployed? AC forces are generally more accessible.
  - How close does DoD monitor readiness? The workloads of AC forces in MCPs are tracked and readiness reported. RC forces are required to maintain credentials, privileges, licenses, certifications, and so on and meet minimum requirements. Workload is not rigorously monitored.
  - How much can DoD control training? AC forces in MCPs regularly train together as teams. RC forces train with their units only during annual training or prior to deployment.
- **Cost:** How much does it cost to maintain the forces between deployments; i.e., during dwell time? RC forces are significantly less costly in dwell.
- **Readiness:** Are the forces working in a level I trauma center? AC forces in MCPs are all assigned to high-volume level I trauma centers where they train together as a team. RC forces may work in level I trauma centers or smaller trauma centers maintaining a high-volume practice. However, RC forces may also work in smaller hospitals, outpatient settings, managerial roles with little clinical work, or even in non-medical occupations (e.g., enlisted medics may be police officers, firefighters, or office workers).

The simplest scenario would be shifting a certain share of AC teams into the RC under the traditional RC model rather than embedding them in MCPs. While this would lower costs, accessibility and control would be reduced as would clinical readiness monitoring.

To address these issues, we expand the RC options to include an operational reserve concept with varying options for the parameters of access and control, cost, and readiness. We also introduce a life-cycle career management concept that allows service members to select options, with service in the AC followed by service in the operational RC.

A. MCP/Traditional RC Model

For this analysis, we limit our focus to forward surgical teams in the conventional forces (e.g., we exclude special operations teams). Table 34 shows the current number of forward surgical teams in the AC and RC, along with total personnel and the AC share. Roughly 60 percent are currently in the AC while the remainder are in the RC. We note force mix varies considerably by Service and team type.

Table 34. Forward Surgical Team Counts and Force Mix

	Army FRSD*	Navy ERSS	Marine Corps FRSS*	Air Force GST	Total Members
Team Members	10	7	8	6	1484
AC Teams	36	24	35	18	916
RC Teams	44	0	10	8	568
AC Share	45%	100%	78%	69%	62%

Note: *One Army FRSD is equal to two teams to keep them comparable to other Service teams.

Next, we present the cost of maintaining AC teams under the MCP model and the cost of maintaining all RC teams under the traditional RC model, as shown in Table 35. The costs are related to personnel and do not include the overhead associated with running MTFs or MCPs. These costs are constructed using the Service and specialty-specific costs presented in Chapter 3. The costs for RC personnel are dwell costs. Subsequent analyses will factor in deployment costs based on deployment factors.

Table 35. Full Cost of AC and RC Teams, in Millions

	AC Team Cost	AC Total	RC Team Cost (Dwell)	RC Total
Army FRSD*	3.25	117.18	0.58	25.52
Navy ERSS	2.40	57.54	0.41	-
Marine Corps FRSS	2.98	104.16	0.44	4.36
Air Force GST	2.26	40.60	0.32	2.55

Note: *One Army FRSD is equal to two teams to keep them comparable to other Service teams.

Table 35 indicates that maintaining teams in the RC component is significantly less costly. The tradeoff is their availability level.[84] When policy-makers consider the appropriate mix of AC/RC teams, they factor in deployment planning factors such as:

- **Minimum Lead Time:** How quickly can the team be deployed (e.g., within 48 hours or in 30 days)?
- **Duration:** For how many periods can a deployed team remain deployed (e.g., 2 months, 3 months, 6 months, etc.)?
- **Rotation:** How may periods must pass before the team can be redeployed?

Table 36 shows examples of current deployment planning factors by Service. Some Services have both a "steady-state" rotation policy and a "surge" rotation policy. A surge rotation policy allows for a shorter dwell period during an initial surge.

Table 36. Deployment Planning Factors for Medical Force Requirements

	Rotation		Duration (Months)		Minimum Lead Time (Days)	
Service	**AC**	**RC**	**AC**	**RC**	**AC**	**RC**
Air Force	1:2	1:5	6	6	0	30
Army	1:3-1:2	1:5-1:4	12	9	0	30
Navy	1:3	1:5	12	12	0	30

Sources: Rotation and duration: DoD, "Report on Military Health System Modernization: Response to Section 713 of the Carl Levin and Howard P. 'Buck' McKeon National Defense Authorization Act for Fiscal Year 2015." Lead time: David S. C. Chu, Memorandum to Secretaries of the Services, "Revised Mobilization/Demobilization Personnel and Pay Policy for Reserve Component Members Ordered to Active Duty in Response to the World Trade Center and Pentagon Attacks – Section 1," March 15, 2007.

If cost were the only important factor, all teams would be placed in the RC. However, once we factor in lead time, we can establish a constraint for the minimum number of AC teams. This number must equal the number of teams a Service wants to have immediately available for deployment. The other critical factor is the number of teams a Service wants to have continuously available during steady-state operations (or the number of teams, deployment rate adjusted.) For instance, if a Service has a 1:3 rotation policy for AC teams, four teams are required to ensure one team is continuously available for deployment. If the Service's RC teams have a 1:5 rotation policy, six are needed to have one continuously available for deployment. In this scenario, we would need to trade six RC teams for four AC teams to maintain the same number of deployment-available teams. We use rotation

[84] Clinical readiness may also vary. For this analysis, we assume the same clinical readiness level for AC and RC teams. The following section allows for different readiness levels between AC/RC teams.

policies of 1:3 for AC and 1:5 for RC in the following analyses. The analyses also factor in the cost of pre- and post-mobilization by assuming the RC members are activated (but not deployed) for an additional 45 days.[85]

Table 37 illustrates the AC/RC trade space by showing total steady-state available teams, total immediately available teams (AC teams), total cost for the status quo, and a policy change scenario where we shift Navy, Marine Corps, and Air Force Teams to the Army mix.[86] For this analysis, we hold the number of steady-state available teams constant (so the number of RC teams has to increase by more than the number of AC teams that are reduced). Shifting to the Army mix reduces total cost by nearly 50 million. Savings would be greater if we simply traded AC teams for RC teams—but so, too, would the number of teams available in the steady state.

Table 37. Force Mix Status Quo and Change Scenarios

		Status Quo			Army Mix		
	Steady-State Teams Available (AC+RC)	AC Teams	RC Teams	Total Cost	AC Teams	RC Teams	Total Cost
Army FRSD*	16.3	36	44	$154	36	44	$154
Navy ERSS	6.0	24	0	$58	13.2	16.2	$42
Marine Corps FRSS*	10.4	35	10	$111	23.0	28.1	$87
Air Force GST	5.8	18	8	$44	12.9	15.7	$37
Total	38.6	113	62	$367	85	104	$319

Note: *One Army FRSD is equal to two teams to keep them comparable to other Service teams.

The overall trade space is illustrated more completely in Figure 5. Each line represents different combinations of AC/RC teams that would hold the total number of steady-state deployable teams constant. The x-axis plots AC teams and the y-axis plots annual savings. Each line intersects the x-axis at the current number of AC teams (and zero savings). As AC teams are shifted to RC, thus reducing the number of AC teams, savings accrue. The Army steady state is represented by the dots.

[85] They receive AC compensation during the deployment and pre and post mobilization period. A fixed deployment cost of $4500 per person is also added.

[86] We use the AC steady-state deployment share force mix of 55 percent. The total Army AC/RC mix is 45/55 but we estimate AC accounts for 55 percent of steady-state deployed teams based on deployment parameters. We assume a rotation policy of 1:3 for AC and 1:5 for RC.

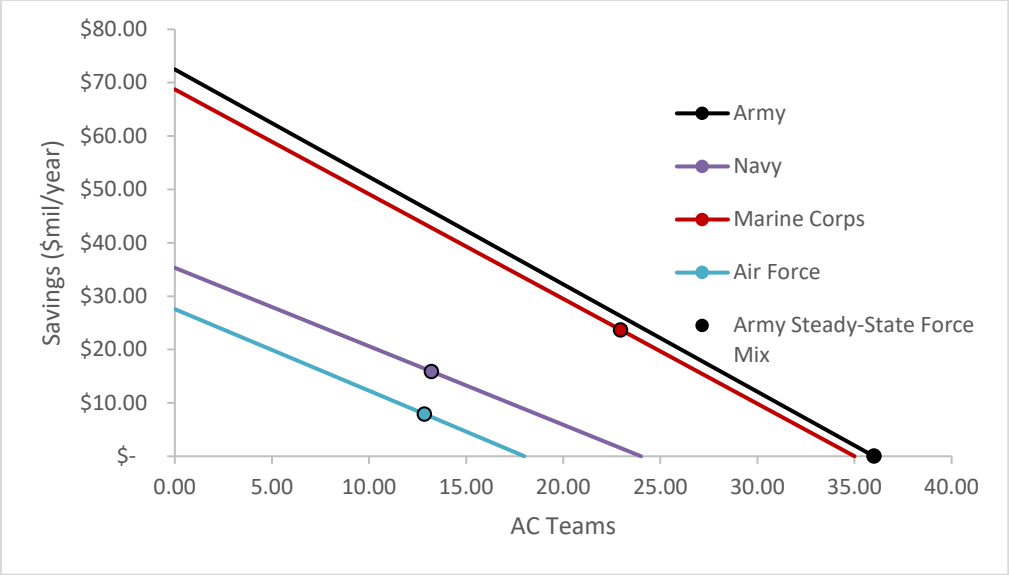

Figure 5. Surgical Team Force Mix Trade Spaces by Service

B. Introducing an Operational Reserve

The previous section abstracted away from readiness and assumed AC in MCPs and traditional RC members would have the same level of clinical readiness. In this section, we consider that traditional RC members may have lower clinical readiness levels, and we introduce an operational reserve concept that could be used to improve readiness.

An operational reserve could be constructed several ways. We can think of the options as falling along a spectrum where we can increase access/control and readiness in exchange for higher costs. To illustrate this, we create two models at different ends of the spectrum:

- **Operational Reserve "High-Tether" Model:** This option emulates the MCP concept. Under this model, DoD would establish MOU-type agreements with civilian trauma centers to embed RC trauma teams. These agreements would be similar to the MOUs in place for existing AC MCPs, but they would give the civilian facility greater control of the providers' schedules. For instance, each team would have a set deployment schedule like the notional deployment schedule outlined in Chapter 5. The DoD could not deploy the operational reserve teams outside their scheduled deployments. In exchange for guaranteeing available teams of providers, the civilian facility would cover a large share of the providers' salaries. For instance, the DoD might offer to cover 20 percent of each provider's salary while he or she is not activated (providing a subsidy and incentive to the civilian facility) and, of course, would pay providers the full AC compensation during deployments. This option would increase dwell costs relative to the traditional RC model but it would allow for

enhanced access/control and readiness. For instance, DoD would be able to track the providers' workloads just as they track AC provider workload in MCPs. The teams would also be training together regularly as a unit. The defining characteristic of this approach is that the primary agreement is with the facility, and the facility has positions with reserve duty requirements as part of employment. This facility-based approach has been used throughout DoD's history; e.g., much of the World War II mobilization for medical personnel was accomplished this way.

- **Operational Reserve "Low-Tether" Model:** This option emulates the traditional RC concept, augmented by stricter requirements on where individuals may practice (e.g., require the member to hold privileges at a level I trauma center); enhanced monitoring of readiness; and regular deployments. Enhanced requirements and monitoring would be expected to increase certain administrative costs (e.g., reservists would have to verify their employment requirements are met and upload workload to verify currency on a regular basis). Regular deployments could have both positive and negative impacts on recruitment and retention. Some reserve physicians we interviewed stated that they had joined the reserves to contribute to the war effort with deployments, and were disappointed with initial arrangements that had them backfilling MTFs and performing other administrative duties. These reservists would have left the reserves if they had not found relationships (usually through special operations) that involved regular deployments. Alternatively, some reservists may be less willing to serve if there is a requirement for regular deployments. To accommodate this range of uncertainty, we consider a cost multiplier (which could be awarded as additional special pay, for example) to compensate RC medical personnel in dwell periods. The cost multiplier could be zero (indicating reservists value the operational experience) or a positive value that would increase costs.

To analyze these options, we must create assumptions about how the cost of RC teams would change. For the high-tether option, we assume the following:

- The same deployment planning factors apply (1:3 for AC; 1:5 for RC).
- The RC dwell cost increases by a factor that would cover the subsidy to the civilian facility. We use a load factor of 33 percent for this example.[87]

[87] We derive this load factor using the average annual salary of a civilian surgeon ($252K according to the Bureau of Labor Statistics). Assuming this person spends 10 months in dwell (based on a 1:5 rotation factor), a 20 percent subsidy of this person's dwell salary would be roughly $42K. This is roughly 33 percent of his/her current cost.

- RC costs while deployed remain the same as in the scenario presented in Section A.

For the low-tether option, we assume the following:

- The same deployment planning factors apply (1:3 for AC; 1:5 for RC).
- RC dwell costs increase by a factor that would cover additional overhead expenses for enforcing enhanced practice requirements and enhanced RC workload monitoring. We use a load factor of 15 percent for this example.
- RC costs while deployed remain the same as the scenario presented in Section A.

Using the parameters stated previously, we re-estimate the savings from shifting Navy, Marine, and Air Force teams to the Army force mix using the new RC models. Results are shown in Table 38. We find the high-tether RC model reduces savings by about 4 million, while the low-tether model reduces savings by less than 2 million. We conclude RC readiness can be enhanced without significant cost increases.

Table 38. Estimated Savings from Army Force Mix with New RC Models, in Millions

	Traditional RC	High-Tether RC	Low-Tether RC
Navy ERS	15.9	14.2	15.1
Marine Corps FRSS	23.7	21.7	22.8
Air Force GST	7.9	7.27	7.6
Total Savings	47.4	43.2	45.5

We illustrate the overall impact of the new RC models on the AC/RC savings trade space in Figure 6. We use the example of the Navy ERSS teams shifting to the Army force mix under the three RC alternatives.

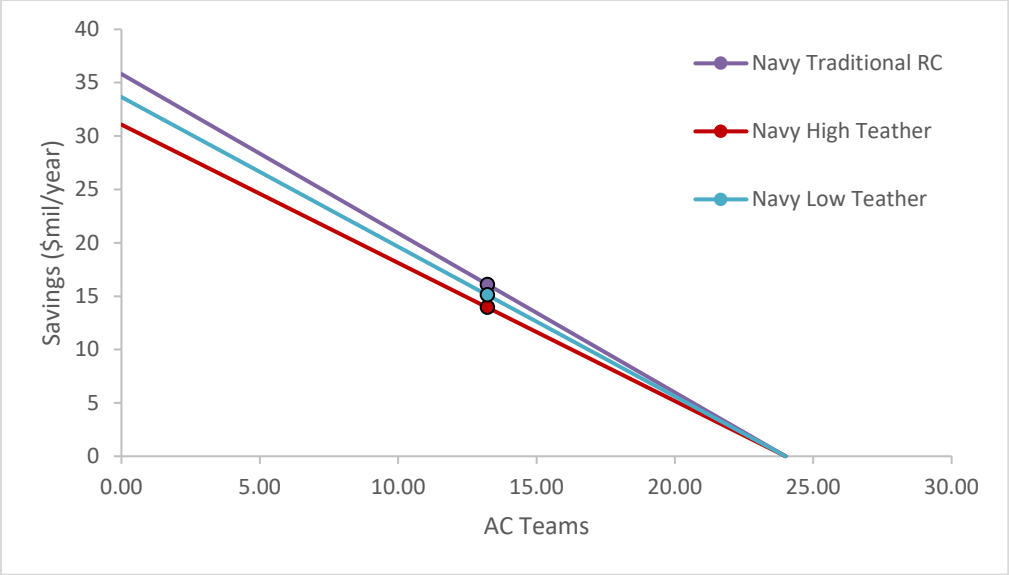

Figure 6. Navy Surgical Team Force Mix Trade Space for Alternative RC Models

C. A Life-Cycle AC/RC Model

Recruitment (or accession) and retention are key aspects of career management and maintaining a ready medical force. Today, recruitment/retention models and policies for AC and RC personnel share many common features (e.g., accession and retention bonuses, education benefits, retirement benefits, etc.) but also vary significantly. The result is that different components face different challenges with certain aspects of career management. In this section, we review current challenges, examine how they may be impacted by MCPs, and discuss how an AC-to-RC life-cycle model could be designed to help minimize such challenges and improve military-civilian trauma integration

1. Recruitment and Retention Challenges under the Status Quo

a. Recruitment and Accession

The AC offers very generous education benefits, which generally allow AC personnel to meet (or come very close to) accession targets. These programs are one of the key drivers of the high cost of AC physicians: The Department typically spends over $1 million dollars per accession.[88] This cost includes civilian medical school tuition, fees, and stipends (for those who use the Health Professions Scholarship Program (HPSP)), and the costs of GME training. The cost is higher for students who attend DoD's medical school (the Uniformed

[88] James M. Bishop et al., "Analysis of DoD Accession Alternatives for Military Physicians: Readiness Value and Cost," IDA Paper P-10815 (Alexandria, VA: Institute for Defense Analyses, November 2019). See the paper for a detailed analysis of physician accession costs by source and specialty.

Services University), but so too is the Service payback requirement. The vast majority of AC physicians enter service as medical students and take advantage of these programs. Only a handful of physicians enter as residents, and even fewer as fully trained physicians (known as direct accessions). Thus, accession targets are typically met, but the cost is high and the pipeline is long (4 years of medical school plus 3 to 5 years of residency training).

The RC also offers education benefits, but they are less generous and less widely used. Direct accessions are most common, so many benefits target loan repayment assistance. For example, the Health Professions Loan Repayment program (HPLRP) provides up to $250,000 in loan reimbursement for physicians and dentists (paid out at up to $40,000 per year). Nurses and other health professionals are eligible for up to $60,000 in reimbursement (paid out at up to $20,000 per year). We note that financial data from the component budget justification documents suggest take rates for these programs are relatively low, and that most individuals do not receive the maximum award amount. For instance, in the Army Reserve, we estimate about 5 percent of reserve medical officers participate in the program with an average payment rate of $20,689.[89] While most RC personnel enter as fully trained providers, some do enter as residents or other trainees. The Specialized Training Assistance Program (STRAP) is a stipend program for physicians in select specialties currently enrolled in residency programs. The monthly stipend is over $2,300 dollars, but take rates appear to be low (5 percent or less).

Accession bonuses are also used by the AC and RC. Active duty providers in select specialties are eligible for the Critically Short Wartime Specialty Accession Bonus (CSWSAB). These bonuses are specialty-specific and range between $200,000 and $400,000 total for a 4-year commitment (annual payments range between $50,000 and $100,000). Annual payments for RC physician accession bonuses range between $25,000 and $75,000.[90]

Overall, the DoD spends significantly more to recruit AC providers than it does to recruit RC providers. Unsurprisingly, the RC faces greater challenges recruiting high-end medical personnel. A recent GAO report found the reserve components had physician end strengths that were nearly 24 percent below authorization levels on average.[91] AC physician end strengths were only 2 percent below authorization levels. The RC

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89 Based on data from the FY 2022 Budget Estimates (reserve personnel, Army justification book), https://www.asafm.army.mil/Portals/72/Documents/BudgetMaterial/2022/Base%20Budget/Military%20Personnel/RPA_VOL_1_FY_2022_PB.pdf.

90 *Health Professions Officer (HPO) Special and Incentive Pay*, https://comptroller.defense.gov/Portals/45/documents/fmr/current/07a/07a_05.pdf.

91 GAO, *Military Personnel: Additional Actions Needed to Address Gaps in Military Physician Specialties*, GAO-18-77, February 2018, https://www.gao.gov/assets/gao-18-77.pdf.

components also had a higher share of specialties with end strengths below authorizations by more than 80 percent. These were often CCCT specialties.

b. Retention

While the AC offers very generous education benefits, studies have shown that wages vary fairly significantly between military and civilian physicians, and that these differences tend to be highest for surgeons and surgical specialties such as trauma surgeons, vascular surgeons, cardiothoracic surgeons, neurosurgeons, and others.[92] Wage differentials create retention challenges for maintaining AC providers. Professional job satisfaction is another factor in the AC retention decision. The specialties that face the greatest wage differentials are the same specialties that are most likely to struggle with maintaining adequate case volume in the MTF system (e.g., surgical specialists). Many surgeons have reported low MTF surgical volumes as a reason for leaving service.[93] They also report fears that low-volume assignments will make it hard for them to obtain civilian employment when they leave the military.

RC providers work in the civilian sector when they are not activated. However, the military-civilian pay differentials still affect them when they are deployed. Some RC member we interviewed noted the pay gap could feel substantial. In addition, some stated most expenses (e.g., mortgages, car payments, student loans, etc.) remain the same during deployments. Further analysis is needed to examine the extent that other forms of military compensation (e.g., education and retirement benefits, drill pay, bonuses, etc.) offset these losses. While most RC members felt compensation could be improved, a larger concern was the impact of long deployments on their civilian careers (e.g., can their private practice survive their absence, does serving in the RC prevent them from taking leadership positions like department chairs or academic assignments, and so on). Many reservists also found the requirement to attend drill weekends and other training events burdensome.

2. The Impact of MCPs on Recruitment and Retention

Some have expressed concern that MCPs will hurt AC retention (i.e., AC members will see their civilian counterparts earning higher salaries for the same work and want to leave the military). For instance, AC members might choose to stay at the civilian facility

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92 Shayne Brannman, Michele Almendarez, Cori Rattelman, and Elaine Scherer, *Health Professions' Retention-Accession Incentives Study Report to Congress (Phase 1: Compensation Comparison of Selected Uniformed and Private-Sector Health Care Professionals)*, (Alexandria, VA: CNA, 2001), https://www.cna.org/CNA_files/PDF/D0003360.A1.pdf.

93 *U.S. News & World Report*, "A Crack in the Armor: Surgeons Criticize the Military Health System," October 10, 2019, https://www.usnews.com/news/national-news/articles/2019-10-10/surgeons-give-damaging-assessments-of-the-military-health-system#:~:text=Among%20the%20harshest%20critics%20of,participate%20in%20a%20confidential%20survey.

after their commitment is up. It has also been noted that a faculty appointment at a prestigious trauma center will provide better civilian job opportunities for those that chose to leave. The IDA team also heard counter arguments that MCPs would increase retention—that surgeons who would have left may choose to stay for an MCP assignment. Similarly, some felt MCPs might improve recruiting of students interested in careers in trauma and critical care. Cases were also reported in which civilian providers at MCPs expressed interest in joining the reserves after learning more about military medicine.

This topic deserves further study; empirical evidence is needed to truly understand the impact of MCPs on recruitment and retention. Then, policy could be designed to address potential challenges. For instance, the Services could consider the timing of MCP placement in a service member's career or offer assignment preferences to those willing to commit to additional AC or RC service. Nurses felt MCP assignments might make them less competitive for promotion as MCPs are viewed as "clinical" rather than "leadership" positions. This perception could also impact retention and warrants additional study and potential policy intervention.

3. A Life-Cycle Model with MCPs

Today, a small share of AC providers transition to RC service after completing their AC commitment. While this does occur, most recruiting and retention efforts are focused on one population or the other. Here we consider how a purposefully designed AC-to-RC career path with MCP participation could improve recruitment and retention for key CCCT personnel.

As previously discussed, generous education and training benefits are a key component to accessing AC military physicians. The high cost of civilian medical schools followed by low paying residencies lead many to consider military service as an attractive alternative to student debt. Once AC providers are fully trained and practicing as board-certified physicians, retention becomes key to maximizing DoD's return on these large investments. Civilian wage differentials and limited practice opportunities for surgical specialists are known factors in these individuals' decisions to leave military service. Additional factors include the PCS cycle and long deployments. MCPs targeted at AC providers address the practice opportunity issue by creating opportunities for placement at high-volume academic centers. If MCPs were expanded to offer more RC options, the other issues could be addressed. For example, after paying back their AC commitment, service members could move into the RC at an MCP location. Doing so would allow AC members to settle in one location, earn civilian wages, and have shorter deployments while continuing military service. In addition to being available for deployments, AC members would also be serving as mentors for the next generation of military trauma teams and as military-civilian trauma ambassadors.

Early evidence suggests this may already be happening informally. Reservists were often present in leadership roles at the MCP sites the IDA team visited—especially the more established programs. Many were trauma surgeons who spent part of their AC career at an MCP. They did not want to leave military service but also did not want to lose the clinical practice experience they felt they could receive only in level trauma centers. Staying on in the RC offered the best of both worlds. The IDA team also encountered several AC providers at MCP sites who stated they planned to leave active service but were planning to join the reserves. Some of these individuals were planning to stay on at the MCP site, and several were general surgeons who were going to enter the fellowship program. Purposefully establishing this AC to RC movement as a career path option could turn into a very viable model for recruiting and retaining high trauma experts. This could be achieved various ways:

- Increase use of RC incentives available for select CCCT specialties (e.g., bonus for remaining at an MCP site or level 1 trauma department).
- Reduce barriers to signing up for RC service. The IDA team heard several reports that this was a lengthy and difficult process.
- Offer an option to convert AC service payback requirements to RC services (e.g., 1 year of AC service could be traded for 3 years of RC service at an MCP or level 1 trauma department).
- Minimize RC training requirements away from the MCP (e.g., drill weekends) in exchange for contributing to training military personnel at the MCP. For instance, RC members could train reservists passing through an SRM model at their facility.
- Offer financial support to complete a trauma fellowship in exchange for RC service.

These options have important implications for sizing the medical training pipeline and shaping the medical force and must be studied carefully. A full analysis of how such policies would impact accession, retention, and life-cycle costs was beyond the scope of this analysis. We recommend the concept be explored further as MCP sites mature and the reserve components increase their MCP involvement.

8. Integrating Trauma and National Disaster Management Systems

The primary focus of Section 757 of the FY 2021 NDAA and this report has been on the role of MCPs and force mix improvements "to enhance the readiness of the medical forces of the Armed Forces to deliver combat care on the battlefield."[94] Section 757 also directed consideration of their ability to "assist public health responses to pandemics or other national public health emergencies." In support of this element of Section 757, IDA was asked to "[r]eview and assess proposed models for a more integrated federal trauma and national disaster response systems. As MCPs are expanded and standardized, it may become feasible to realize broader strategies for a more integrated national trauma care system (NTS)."

This chapter provides that review and assessment. In 2016, a panel from the National Academies of Science, Engineering, and Medicine published a report on integrating military and civilian trauma systems to achieve zero preventable deaths after injury.[95] That report provided a detailed review of military and civilian trauma systems, their shortcomings, and how improved integration between military and civilian systems could provide benefits to both sectors. This section draws heavily on that analysis and focuses on two broad areas of improvement. First, it outlines opportunities to leverage MCPs to improve integration between systems. Second, it identifies opportunities to better translate innovation from the battlefield to clinical practice through the MCPs.

A. Overview of Existing Civilian Systems

Trauma care, like healthcare more broadly, is generally delivered at the local level subject to state-level regulation and oversight. States usually have a lead agency that oversees activities like trauma center designation and patient regulation through the integrated system. States designate the level of a trauma center based on its capabilities. Level I trauma centers are the most capable, have all specialties represented, can provide definitive care to all patients, and provide leadership in the system. Level II trauma centers

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94 *NDAA 2021*, Section 757.

95 The National Academies of Science, Medicine, and Engineering (NASEM), *A National Trauma Care System: Integrating Military and Civilian Trauma Systems to Achieve Zero Preventable Deaths after Injury* (Washington, DC: The National Academies Press, 2016), https://doi.org/10.177226/23511.

have most specialties represented and can treat most patients, but cannot provide the complete spectrum of trauma care. Level III trauma centers can perform initial evaluation and management of critically injured patients and can provide general and orthopedic surgical interventions when required. Some states also designate level IV and V trauma centers for initial evaluation and stabilization, with transfer agreements to higher level trauma centers.[96]

Trauma systems form an essential element of state response frameworks for natural disasters and mass casualty events. Like healthcare, most responses are local with state government support. States have emergency management organizations, and these frequently overlap or are highly integrated with the agency that oversees the state's trauma system. State and local authorities maintain disaster and crisis response plans that include medical care and regulating patients through healthcare systems. States also have military forces in the National Guard that can operate in title 32 status in support of the state.

At the federal level, the National Disaster Medical System (NDMS) supports state and local authorities responding to disasters with patient care, transportation, mortuary affairs, and other response capabilities. The NDMS is also organized to support DoD and the VA in caring for combat casualties if their patient loads exceed their capacity. The NDMS is overseen by the Department of Health and Human Services (HHS) Assistant Secretary for Preparedness and Response (ASPR), with the cooperation of the Department of Homeland Security, VA, and DoD. The NDMS covers all phases of domestic response, including emergency medical response and stabilization; patient movement and evacuation; patient movement tracking; aeromedical evacuation; and definitive care.

DoD has a long history of providing support to civil authorities during times of national emergency. Defense support of civil authorities (DSCA) is carried out according to the National Response Framework and National Incident Management System. Federal law outlines the mechanisms for the Secretary of Defense and state authorities to call upon National Guard (NG) forces, as well as active duty and reserve. Note that DSCA is carried out only on home soil.[97] DoD historically fields the full breadth of its medical capabilities in support of DSCA missions as required by the nature of the national emergency. This support may include first responder care, forward resuscitative care, en route care, theater hospitalization, and definitive care. The focus of DoD medical support is to save lives and restore essential health services, with the intention of transferring back authority and operation to local and state authorities. In parallel, the VA has a "fourth mission" to

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[96] NASEM, 2016.

[97] Joint Chiefs of Staff, *Defense Support of Civil Authorities*, Joint Publication 3-28, October 29, 2018, https://www.jcs.mil/Portals/36/Documents/Doctrine/pubs/jp3_28.pdf#page=24&zoom=100,0,0.

improve the nation's preparedness for war, terrorism, national emergencies, and natural disasters by serving as a strategic backstop to civilian health systems.

B. Challenges with Civilian Systems

Chapter 2 provided a detailed review of challenges with the military trauma system. However, civilian trauma systems also face many challenges. Trauma is the leading cause of death for Americans under age 46 and, like the wars in Iraq and Afghanistan, many trauma deaths result from potentially survivable injuries.[98] While some local trauma systems have worked very hard and have minimized preventable deaths, survival rates vary across trauma systems, with many performing below the optimal level of care. This variability is a key source of preventable deaths to trauma across the United States. The 2016 NASEM report identified three key factors driving this variability: variability in access to trauma systems, variability in adoption of best practices by trauma systems, and variability in Emergency Medical Services (EMS) systems across the United States. The report provides the following detailed assessment of variability in access to trauma systems:

> Nearly 2,000 trauma centers exist nationwide; 2013 estimates from the American Trauma Society suggest there are 213 Level I, 313 Level II, 470 Level III, and 916 Level IV or V centers. However, these centers are not distributed evenly across the country. Although several factors influence geographic variability in trauma mortality, the association between the lack of access to an appropriate level of trauma care and higher mortality rates among trauma patients is compelling. Studies have shown that 69.2 percent and 84.1 percent of Americans have access to a Level I or Level II trauma center, respectively, within 1 hour by land or by air, but the availability of trauma center care at any level is still severely limited in some areas of the country. Most dramatic is the disparity between rural and urban/suburban regions; only 24 percent of rural residents have access to a Level I or Level II trauma center within 1 hour, compared with 86 percent and 95 percent of suburban and urban residents, respectively.

It has been estimated that if all civilian trauma systems attained the survival rates of the highest performing systems, then 100,000 lives would be saved over 5 years.[99]

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[98] NASEM, 2016.

[99] Z. G. Hashmi, S. Zafar, T. Genuit, E. R. Haut, D. T. Efron, J. Havens et al., *15.12 The Potential for Trauma Quality Improvement: One Hundred Thousand Lives in Five Years*, Academic Surgical Congress Abstracts Archive, https://www.asc-abstracts.org/abs2016/15-12-the-potential-for-trauma-quality-improvement-one-hundred-thousand-lives-in-five-years/.

Partnerships between military and civilian systems can expand capacity and access to trauma care and emergency medical services while facilitating the transfer of lessons learned and continued advancement of trauma care in both sectors. As the NASEM report states, "[t]he potential benefits are clear: the first casualties of the next war would experience better outcomes than the casualties of the last war, and all civilians would benefit from the hard-won lessons learned on the battlefield." More broadly, the NASEM report states that "[p]artnership across the military and civilian systems can facilitate the transfer of lessons learned and encourage the continued advancement of trauma care in both sectors."

Civilian challenges extend beyond trauma care systems. The recent COVID-19 pandemic response revealed challenges in medical response to crises and disasters. Although a full understanding of the lessons learned will take years to develop, some preliminary observations can be made now. The highest demands from the civilian response sector for DoD assistance appear to have been high-skill medical professionals (e.g., critical care physicians and nurses); medical supplies and equipment (e.g., stockpiled masks); contracting and research and development infrastructure (e.g., for vaccine development); and infrastructure contracting and construction (e.g., Army Corps of Engineers). Interestingly, military beds were not generally demanded and, in the few exceptions like the hospital ship deployments, were not widely used when requested. Fortunately for DoD, these lessons are very consistent with lessons from the wars in Iraq and Afghanistan; e.g., DoD needs more high-skill providers focused on treating very sick patients. The NASEM report anticipated this overlap, stating that improved integration of military and civilian trauma care would "also further read[y] our civilian trauma and emergency response systems for disasters and other mass casualty incidents."

C. MCP Opportunities to Improve Integration

Previous chapters of this report examined in detail the tactical-level readiness benefits of military-civilian partnership to DoD; i.e., improving the clinical currency of military medical personnel. The NASEM report describes DoD benefits at a strategic level, "[g]iven the intermittent nature of war, the nation requires a platform that can be used by the military to sustain the readiness of its medical force and advance best practices in trauma care during interwar periods." As stated in the previous section, greater integration could also provide significant benefits to civilian health care. Greater integration helps with all three core problems identified by the NASEM report: trauma system access, lack of best practice adoption, and EMS inconsistency. Improved integration also extends beyond just the trauma systems. Domestic and international crisis responses would also benefit from improved integration with the military.

1. Improving Integration with Civilian Trauma Systems

Placing military forward surgical teams in civilian trauma centers is an obvious MCP expansion of available care and access and an opportunity to improve standards of care in civilian trauma systems. However, there are other ways MCPs can expand access to trauma care, adoption of best practices, and EMS capability. First, in some locations, DoD could partner with the civilian sector to create or expand trauma centers in underserved markets. Lurie et al. (2017) provided a detailed review of DoD locations to identify potential markets.[100] Two of the most promising are in North Carolina.

Camp Lejeune is in an underserved trauma market, with the closest trauma center 80 miles away. Navy Hospital Camp Lejeune recently earned state designation as a level III trauma center and may be able to attract enough patients to become a viable and busy trauma center, expanding access to trauma care in an underserved market while providing clinical training to military medical personnel.

Womack Army Medical Center at Fort Bragg is located 8 miles from a busy level III trauma center—Cape Fear Valley Medical Center. Cape Fear has trauma volumes sufficient to earn level II designation but does not have the full range of medical specialties required for this designation. This means that local patients must be evacuated to level I facilities in Raleigh over an hour away. Womack has many of these specialties, all of them are in the Army inventory, and the Army needs additional workload for them. A partnership between Womack and Cape Fear could allow Cape Fear to earn level II designation, improving trauma care access in a high-demand market while expanding DoD's access to skill-sustaining care.

More broadly, the MHS was directed in the FY 2017 NDAA to reform and right size the medical force and its physical footprint. DoD has developed MTF downsizing plans to better reflect the needs of the patient populations they serve, according to FY 2017 NDAA Section 703. Despite this Congressional direction, the MHS is making considerable military construction (MILCON) investments to refurbish some MTFs. A replacement for ACH Fort Leonard Wood is currently under construction at a cost of nearly $300 million. Walter Reed National Military Medical Center is also being renovated at a cost of $570 million. These considerable capital costs to upgrade facilities drive up overhead costs in the MHS.

An alternative model would be to leverage investments in MCP sites to construct dedicated space for DoD operations and personnel within the civilian institution. This space could be used to maintain surge capacity during contingencies and times of war, and could be used as clinical swing space to provide training to uniformed personnel during

[100] James M. Bishop et al., "Medical Readiness within Inpatient Platforms," IDA Paper P-8464 (Alexandria, VA: Institute for Defense Analyses, August 2017).

peacetime. Most MCPs provide office space as part of the partnership agreement; this model would expand the partnership to fund the construction of additional clinical space (operating rooms, wards, recovery rooms etc.) to be used by the military in times of emergency and war. When not needed by the Department, the civilian facility would be free to use the additional space to improve their own operations. Military personnel embedded at the MCP could then freely move between facilities to see both military and civilian patients. Revenue generated from the treatment of patients using this space during peacetime could subsidize or completely cover the operating costs of the additional space. This agreement effectively reduces the overhead costs of maintaining surge capacity by sharing those costs between the DoD and the civilian partner, while also creating a win-win for maintaining readiness and augmenting disaster preparedness. Any sort of partnership or shared space could also include the VA in a resource-sharing agreement to maximize use of the space.

This model is not without precedent. The United Kingdom's Joint Hospital Group (formerly known as Ministry of Defense Hospital Units) operates under the authority and direction of the Defense Medical Services, but are embedded within civilian National Health Service hospitals.[101] Military providers are fully integrated with civilian staff and can treat both military and civilian patients. If needed, military providers deploy to support military operations across the globe, and during peacetime they maintain their skills supporting the local population's health needs. Queen Elizabeth Hospital Birmingham is a 1,200-bed tertiary care facility in the UK, a location that is also home to the Royal Centre for Defence Medicine where military providers and patients have a dedicated ward within the hospital.[102]

Partnership can also help with EMS capacity. Although this report has focused mostly on Role 2 surgical capability, Chapter 2 described the significant portion of the military medical force focused on pre-hospital care. These forces include first responders like basic and paramedic-level emergency medical technicians, ground ambulance units, air ambulance units, and triage stations. Like providers in Role 2 surgical units, all of these personnel struggle to maintain clinical currency during peacetime. Many military first responders already work at least part-time in partnership relationships with civilian EMS organizations, but there remains significant room for expansion.

A final opportunity to examine is medical forces in the Reserves. The Army RC includes the Army Reserves and the Army National Guard. States can directly access their National Guard forces through title 32 status but must rely on situations like DSCA to access Reserve forces. The historic allocation of capability between these forces includes

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[101] Defense Medical Services (website), https://www.gov.uk/government/groups/defence-medical-services.

[102] Caroline Wyatt, *Inside Europe's Biggest Military Critical Care Ward*, November 10, 2010, https://www.bbc.com/news/health-11718320.

placing core AC combat support units in the Reserves while placing full-line units in the National Guard. This means that units like FRSDs are in the Reserves and not accessible to states in title 32 status. Medical forces are one of the most relevant military capabilities for states to access, and a realignment between the Reserves and National Guard may make more forces available to states, increasing partnership opportunities and capacity.

2. Improving Integration with Domestic Disaster Response

As discussed previously, the NDMS has multiple functions. One particularly relevant function for MCPs is the Definitive Care Program, which coordinates the movement of patients through 65 DoD and VA federal coordinating centers to over 1,900 partner civilian hospitals. The costs of care to these patients is then reimbursed through centralized funding.

MCP sites could become focal points within the NDMS system of hospitals. These leading civilian medical facilities already have a concentration of military personnel and a civilian work force accustomed to the military that can act as a critical conduit between the military during times of emergency. The MCP sites also have the requisite patient movement capabilities to facilitate patient flow through the NDMS. Section 740 of the FY 2020 NDAA directed a pilot program on civilian and military partnerships to enhance interoperability and medical surge capability and capacity of the NDMS. In addition, the 2020 NDAA has called for NDMS pilot sites to better integrate capabilities for all hazard responses across the Federal Government. MCP sites are good candidates for inclusion as many of the challenging aspects of standing up a partnership have already been solved. Furthermore, these sites offer geographic diversity; general proximity to military, transportation, and medical infrastructure; and critical capabilities through reachback to both the DoD and the civilian institution. Investing in the physical infrastructure of the partnership, as previously described, would further augment the surge capacity of the facility and the NDMS as a whole.

3. Improved Integration with International Response

The United States Agency for International Development (USAID) Office of U.S. Foreign Disaster Assistance (OFDA) is the designated lead for foreign disaster response. When requested, the DoD works in a supporting capacity to civilian relief agencies. DoD support can generally be requested only when there is a need for a unique capability that cannot be provided elsewhere. Activating military support is subject to a strict process and guidelines to ensure that the DoD does not become the instrument of first resort in the time of crisis. Of the roughly 70 disasters that OFDA responds to each year, around 10 percent require support from DoD.[103] In the wake of large-scale disasters, OFDA deploys Disaster

[103] USAID (website), U.S. Government Agencies & Military, https://www.usaid.gov/partnership-opportunities/us-government-and-military.

Assistance Response Teams (DARTs), which travel to coordinate and manage the unified U.S. Government (USG) response.

DoD's Role 2 surgical teams are a unique asset across the USG. These teams could play a role in the short-term response phase of disasters if requested by USAID OFDA, particularly when responding to crushing trauma or burns. While DoD should not become a backstop of international response, there likely will be events for which DoD can uniquely meet the requirements, and it is in the interests of national security to do so. In some cases, there is a short window of time post-disaster where the situation could warrant the deployment of DoD surgical teams to augment capacity, stabilize patients, and alleviate human suffering while civilian non-governmental organizations (NGOs) mobilize a more enduring response. Use of military resources can increase timeliness and capability of response, provide valuable training for military personnel, and support U.S. interests overseas.

The 2021 earthquake in Haiti is a recent example. In the days following the earthquake, the number of injuries had already surpassed 9,900. The earthquake had overwhelmed an already fragile health infrastructure. US SOUTHCOM was called upon to provide logistical support, and two additional US Coast Guard helicopters performed 170 sorties and 315 medical evacuations.[104] NGOs deployed field hospitals and activated clinical teams around the country, but the trauma caseload overloaded surgical teams for weeks.[105] Surgical follow-ups are still ongoing months after the earthquake.

D. Better Translating Lessons Learned from the Battlefield to Civilian Practice

In addition to expanding capacity and access to care, MCPs can help translate lessons learned on the battlefield into advancing clinical practice.

1. Federal Trauma Training

Many of the educational trauma and battlefield courses developed by the military have applications in other federal agencies, as well as in state and local response systems. Other agencies with operational and tactical needs similar to those of the military could benefit from training and refresher currency training for their first responders and medical personnel. The Federal Bureau of Investigation operates an Operation Medicine program to train special agents for collateral duty as medical personnel. The Central Intelligence

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[104] USAID (website), Haiti – Earthquake, August 22, 2021, https://www.usaid.gov/sites/default/files/documents/2021_08_22-USAID-BHA-Haiti-Earthquake-Fact-Sheet-6.pdf.

[105] Médecins Sans Frontières (website), *After the Earthquake, A Surgical Team Works Nonstop*, https://www.msf.org/surgical-team-works-nonstop-after-haiti-earthquake.

Agency is also known to have needs for well-trained medical personnel. Agencies with particular operational needs could benefit from trauma training and should participate alongside rotating military staff. For example, Cooper University Hospital currently has a contract to train medics working for the Department of Homeland Security. Opening this program to accept other federal trainees could enhance the program while providing value to other organizations.

2. Trauma Research and Innovation Networks

Despite its prevalence, trauma does not receive the same level of research support in the civilian sector as other major causes of death. The National Institutes of Health provide funding for trauma research, but much of this funding is for basic research. This is another area where MCPs could improve both military and civilian trauma systems. DoD could become a focal point for funding trauma research and execute much of this research at MCP locations. Experts we interviewed believed that there is a large unmet demand for trauma research, and that DoD taking the first step and creating momentum could lead to significant increases from other funding sources as well.

A wide range of research exists that could make a significant difference for civilian and military survival rates. Two concepts that are foundational to the pursuit of good outcomes are (1) high reliability (fewer than anticipated adverse events despite highly complex, high-risk environments); and (2) a learning health system (the systematic integration of internal data and experience with external evidence and knowledge in order to improve clinical practice). These concepts are foundational to all clinical care, but are particularly relevant to trauma care where the margins between life and death are thin. Research, evidence generation, and translation to practice are essential to improving outcomes across the nation and on the battlefield in pursuit of zero preventable deaths.

One way to accelerate collaboration and innovation is through leveraging the network of MCPs. Most MCPs are partnered with leading academic institutions that have already built extensive research infrastructure. In fact, the nature of MCPs connects the civilian academic research enterprise and the operational testbed of battlefield medicine that can accelerate innovation and improvements to care. MCPs offer an opportunity to tighten feedback loops to more quickly generate evidence and translate best practice into both battlefield and civilian medicine. An even greater opportunity exists to accelerate innovation when considering the nationwide network of military and civilian institutions that could collectively contribute to advancing our understanding of trauma and the systems of care.

This model has worked well with other public-private partnerships. For example, the National Intrepid Center of Excellence was built with funds from the Intrepid Fallen Heroes Fund to advance the rehabilitation of service members with traumatic brain injuries and service-related psychological health challenges. The original facility was built

adjacent to Walter Reed National Military Medical Center, but has grown to a network of eight affiliated Intrepid Spirit Centers.[106] In the context of trauma and MCPs, a research and innovation network would provide a forum for increasing collaboration and innovation across and within MCPs; sharing resources for conducting research; and providing an infrastructure to trial new technologies and approaches in real-world settings.

3. Integration of Graduate Medical Education (GME)

Previous sections of this report have noted the shrinking caseloads within the direct care system.[107] Supporting the same number of high-quality GME programs will be a challenge in the absence of systemic changes. MCPs are usually affiliated with leading teaching hospitals, which operate their own residency and fellowship programs. The IDA team observed varying degrees of integration between embedded currency programs and GME. Some sites "adopted" residents and fellows by including them in group training and providing a connection to military life, while others were aware of military residents but largely kept to their programs.

A natural extension of MCPs would be integration with GME to develop and foster trainees. For the military, this approach creates centers of gravity within civilian institutions that can reduce the need for duplicative overhead, encourage esprit de corps, and create connection to the mission. For civilian partner institutions, GME slots are a precious commodity due to funding caps from Medicare. DoD funding for additional uniformed trainees would be better allocated to busy civilian centers rather than low-volume MTFs and would be a welcome financial incentive for civilian partners. In addition, many Health Professions Scholarship Program students already attend civilian medical schools that are affiliated with MCP sites, and it is easy to envision a strategic pipeline that spans undergraduate medical education, GME, and currency training. Early exposure to opportunities in trauma and critical care medicine might even incentivize specialization in critical wartime specialties. MCPs might be a valuable "marketing" tool to shift the composition of the force toward readiness.

4. International Partnerships Rotating through MCPs

As DoD continues to pursue opportunities for embedding U.S. uniformed personnel in host nation facilities, it should also consider opening short-term rotational partnerships to international allies. The Navy Trauma Training Center at Los Angeles County's

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[106] Intrepid Fallen Heroes Fund (website), https://www.fallenheroesfund.org/intrepid-spirit.

[107] M. K. Dalton, K.N. Remick, M. Mathias et al., "Analysis of Surgical Volume in Military Medical Treatment Facilities and Clinical Combat Readiness of US Military Surgeons," *JAMA Surgery* 157(1) (2022): 43–50, https://doi.org/doi:10.1001/jamasurg.2021.5331.

University of Southern California Medical Center has hosted Israeli surgical teams.[108] While international partners cannot practice on patients, they can benefit from the fresh tissue dissection, simulation training, observation, and clinical exchange. These partnerships increase interoperability, create professional networks among allies, and challenge embedded teaching cadre. To the extent feasible, opportunities to train and exercise alongside allies should be explored.

[108] Randy Mitchell, *Navy Restarts Medical Training with Israel Defense Force Surgeons*, February 22, 2022, https://www.dvidshub.net/news/415056/navy-restarts-medical-training-with-israel-defense-force-surgeons.

9. Conclusions and Recommendations

Congress and DoD have recognized the serious readiness challenges experienced by the medical force and are undertaking significant reforms. MCPs are a foundational element of these reforms. Significant progress has been made, and DoD has more access to highly complex trauma care for clinical skill maintenance than ever before. But DoD is still in the developmental stages of these reforms, and there is significantly more that needs to be done if DoD wants to start the next war with a higher survival rate than that with which we finished the last. This final chapter summarizes the findings of this report and provides recommendations for MCPs moving forward.

A. Summary of Findings

The IDA team conducted numerous analyses and documented them in this report. Listed next are a summary of the key findings.

1. Medical Readiness Challenges

Our report began with an overview in Chapter 2 of DoD's medical readiness challenges, for which we identified four primary causes, including the following:

- **Combining the readiness and beneficiary care mission poses challenges:** There is a well-documented mismatch between the inpatient workload performed in the MTFs and the lifesaving care delivered in theater. One consequence of this mismatch is the tendency to understaff key combat casualty care specialties during peacetime (and overstaff beneficiary care specialties). Currently, the Services do not have a specific requirement for trauma surgeons. While some are in the inventory, the Services still list their trauma surgeon requirements as general surgeon requirements. Another consequence is that providers self-report feeling ill-prepared to deliver combat casualty care.
- **MTF trauma and combat casualty care relevant cases are limited:** Across the MHS, moderate to severe trauma cases account for just over 1 percent of inpatient admissions. The cases that do occur are highly concentrated at SAMMC. Overall, SAMMC had more than 10 times the severe trauma volume than any other large MTF. Even large medical centers like NMC San Diego, NMC Portsmouth, and Walter Reed see fewer than 100 severe cases a year (or less than two per week on average). The result is very low trauma workload per provider, a situation that is well documented in the literature.

- **MTF surgical, non-trauma critical care, and emergency care are also limited:** Trauma SMEs we interviewed emphasized that a high volume of elective surgical cases would be a poor substitute for routine trauma cases. Even so, the literature and our analysis demonstrate MTFs have low volumes in most surgical areas. MTF emergency and critical care workload is also very limited. As with trauma, SAMMC provided a significant share of all MHS critical care volume (33 percent).
- **Specialization in trauma and critical care decreases mortality:** The literature from Iraq and Afghanistan found reduced mortality for patients treated by providers who specialized in trauma, emergency medicine, and critical care as opposed to generalists (e.g., emergency medicine physician versus family practice; critical care-trained flight paramedic versus basic emergency medical technicians, and so on). This finding applied to multiple platforms, including combat support hospitals, battalion aide stations, and aeromedical evacuation. In the civilian sector, mortality drops significantly for patients treated in level 1 trauma centers with structured trauma programs. Finally, a SME interview provided insight on why a trauma surgeon's unique skills are essential for saving as many lives as possible when delivering trauma care in theater. These findings have important implications for specialty requirements and clinical currency for military medical personnel. We outline these in the Recommendations section later in this chapter

2. Overview of the Medical Force

Chapter 3 examined the size, composition, and utilization of the current force. Key findings include:

- **The total medical force is large, with a force mix that varies by Service and occupation:** Including civilians, the total medical force has nearly 240,000 personnel. The active component, reserve component, and civilian mix (AC/RC/Civ) is 48/33/19 overall but with significant differences across Services. The Army has the most balanced force mix (38/40/22), while the Navy has the greatest share in the active component (66/20/14). Force mix also varies by occupation. It appears all Services have the highest AC share for physicians (72 percent on average) followed by dentists (59 percent on average). Nurses have the lowest AC share at 50 percent.
- **CCCT specialties are a small part of the total medical force:** We identified 17 officer specialties considered to be CCCT specialties—those critical to the combat casualty care mission (and those that face the greatest readiness challenges in the MTFs.) These providers constitute roughly 4 percent of the medical force.

- **Medical force utilization – in deployed setting:** The DoD uses roles of care to categorize deployed medical capabilities. CCCT specialties can be found at each role of care. However, SMEs emphasized trauma expertise was most critical for Role 2 forward surgical and resuscitative teams. This was due to their mission: perform trauma resuscitations and damage control surgery for severely injured patients in austere environments with minimal personnel, equipment, and supplies. We made these teams the focus of our subsequent MCP and force mix analyses. We note the Services have also emphasized the importance of readiness for patient movement platforms such as Air Force CCATT teams and Navy ERSC teams. These should be explored further in subsequent analyses.
- **Medical force utilization – in garrison:** AC providers work in MTFs in various capacities, including staff assignments (supporting headquarter elements and other mission areas like medical education and training or research and development), or combat units to which they are directly assigned. For providers working in MTFs, the largest number are employed in clinics. CCCT specialties are more likely to be in larger medical centers, but the majority still work in smaller facilities. For example, only 42 percent of MTF-based trauma surgeons are in medical centers. The share drops for general surgeons (27 percent) and orthopedic surgeons (31 percent).
- **RC medical force employment:** DoD does not track provider employment and workload data for RC personnel to the same degree as AC providers. Tracking is best for credentialed personnel who verify credentials, privileges, licensure, minimum hours, and so on biannually. This process sets minimum standards for practice rather than readiness standards for competency. For non-credentialed providers, tracking is more limited. For instance, enlisted RC military personnel may not even work in healthcare.
- **Medical providers are expensive, and CCCT specialties that have limited MTF workload are the most expensive:** The average cost of an AC physician is $544,000 while the average cost of a civilian is $410,000. The average cost of an RC physician is only $100,000—roughly 18 percent of an AC provider. The CCCT are among the most expensive to maintain in the AC. For instance, an AC general surgeon costs $643,000 on average, while an AC neurosurgeon costs $678,000.

3. Military Civilian Partnerships

Chapter 4 explored MCPs as readiness training models. Our analysis categorized the different MCP models, created an inventory of existing programs, and assessed effectiveness. Key findings are outlined next:

- **There are three broad categories of MCPs with different target populations:** SMRs provide quick refresher or "just-in-time" training. These models do not provide skill sustainment but can be ideal for enlisted providers whose skill sets are relatively narrow and easy to refresh. They are not sufficient for those requiring trauma expertise. ESMs allow military personnel to sustain critical skills through full-time practice in a civilian trauma center. They are ideal for members of Role 2 forward surgical teams and other personnel with a significant requirement for trauma/critical care expertise. PSMs allow providers stationed in MTFs to gain some routine trauma experience through periodic trauma call at nearby trauma centers. They are ideal for the CCCT+ specialties (e.g., vascular surgeons, cardiothoracic surgeons, etc.) who should have routine trauma exposure but do not require full-time trauma practice.
- **The number of MCPs is growing:** Our final MCP register showed a total of 73 existing and 18 pending MCPs spread across 63 unique U.S. civilian trauma centers, four international trauma centers, and six VA facilities. Many MCPs are home to multiple programs (e.g., embedded trauma teams and a rotator program). We estimate that there are over 100 EMS participants currently embedded across U.S. civilian trauma centers. In addition, we estimate there are another 170 embedded teaching cadre (for SRM models). MCP throughput for rotators varies by partner, but the range is generally between 50 and 400 students per year. We were unable to produce an accurate estimate of PSM participants.
- **Embedded providers have a much higher trauma, critical care, and emergency medicine workload volume than MTF-based providers:** We measure this by total volume (RVUs) and volume density (RVUs per shift). Acuity level is reflected in the RVU metric. We also found higher case acuity/severity reflected in average ISS scores.
  - **On average, embedded trauma and general surgeons perform about five times the daily workload of MTF-based surgeons.** We estimate that it takes an embedded surgeon 23 days to perform the annual workload volume of an MTF-based provider.
  - **On average, embedded critical care physicians perform about 12 times the daily workload of MTF-based surgeons.** We estimate that it takes an embedded critical care physician 10 days to perform the annual workload volume of an MTF-based provider.
  - **On average, embedded ER physicians perform about 2.5 times the daily workload of an MTF-based surgeon.** We estimate that it takes an

embedded ER physician 26 days to perform the annual workload volume of an MTF-based provider.

- **SRM participants also get a high-density training experience at MCP sites:** We measured workload density for rotators based on the share of their Service and specialty-specific annual procedure goals completed (e.g., ICTLs for Army, CRMPs for Air Force). Air Force rotators completed between 75 and 90 percent of their total procedure/volume checklists on average. Army rotators completed between 40 and 75 percent on average. We note the site with the lowest average performance has been discontinued.
- **The experience of providers participating in PSM models appears more variable and requires further study:** We were able to obtain data on only a handful of PSM participants. Results were mixed but, in general, MCPs appeared to provide access to desirable case mixes. The Services need a strategy for tracking the workload of providers participating in these models.

4. Optimizing, Standardizing, and Scaling MCPs and the Cost of Expansion

Chapters 5 and 6 examined MCP expansion. Chapter 5 focused on optimizing, standardizing, and scaling while Chapter 6 considered the cost of expansion.

- **The DoD lacks a requirement for establishing the total desired scale of MCPs:** The IDA team developed one key requirement—placing all Role 2 forward surgical teams in MCPs—using a simple framework and SME input. We then estimated that approximately 700 additional military personnel would need to be embedded to meet this target. We estimate this would take an additional 20 MCP sites.
- **Expanding MCPs to accommodate all Role 2 forward surgical teams is feasible:** Twenty additional sites at level I trauma centers would increase DoD's total from 63 to 83 level I MCPs and would require support from 20 of the remaining 200 level I trauma centers without MCPs. For the U.S. trauma sector, this is a fairly small change. If level II centers were considered, the pool of potential partners would double.
- **Maintaining a system of MTFs is a very costly training model:** We show that the DoD could save $2 to $3 billion if it chose to purchase all beneficiary care and embed all providers in the civilian sector (paying their full costs). Savings would be larger because many military personnel are not actually required for the operational mission and are maintained on active duty primarily because of the MTF system. While this could save money and increase readiness, we do not expect DoD to seriously consider this policy option.

- **DoD can expand MCPs while maintaining the MTFs; the cost increase or savings will depend on DoD willingness to alter the MTF footprint:** For example, we estimate it would cost DoD around $130 million per year if it were to backfill the 700 personnel that should be reallocated to MCPs. If some or all providers were not backfilled, MCP expansion could be achieved in a cost-neutral or cost-saving manner. Adjustments to the MTF footprint that focus on clinics and smaller facilities could yield enough personnel and savings to allow for a cost-neutral MCP expansion.

5. Force Mix

In Chapter 7, we returned to force mix considerations. We examined the readiness and cost implications of moving some AC teams to the RC (as an alternative to embedding them in MCPs).

- **RC personnel and teams are significantly less costly to maintain relative to their AC counterparts:** For example, we estimate it costs roughly $3.3 million to maintain one Army team in the AC but only $650,000 to maintain them in the RC. The tradeoff is deployment accessibility and readiness. RC providers require longer lead times before deploying, deploy for shorter durations, and require more time between deployments.
- **We estimate the DoD could save $50 million annually by shifting Navy and Air Force forward surgical teams to the AC/RC mix currently used by Army:** This analysis held the number of steady-state deployable teams constant (i.e., more than one RC team was required to replace one AC team to account for differences in deployment planning factors). While steady-state deployable teams were held constant, fewer teams would be available for immediate deployment. The readiness of RC providers is also less known under the traditional RC model.
- **To account for RC readiness, we expand RC force mix options to include a high-tether and low-tether RC:** The high-tether option emulates an MCP where teams of RC providers are embedded together at civilian trauma centers. The low-tether option emulates the current RC model but requires additional practice requirements and workload monitoring. These options increase RC dwell costs but ensure higher levels of readiness. With the higher cost/higher readiness option (high-tether), estimated savings are still around $40 million.

6. Integrating Trauma and National Disaster Management Systems

Chapter 8 discussed the roles MCPs can play in integrating military and civilian trauma systems and creating an improved national disaster management system. Key findings are outlined below:

- **The civilian trauma system has its own challenges, which result in civilian preventable deaths and variable outcomes across regions:** The 2016 NASEM report identified three key factors driving this variability: variability in access to trauma systems, variability in adoption of best practices by trauma systems, and variability in EMS systems across the United States. It has been estimated that if all civilian trauma systems attained the survival rates of the highest performing systems, then 100,000 lives would be saved over 5 years.[109] Greater integration between the military and civilian systems could address some of these challenges.
- **MCPs offer ways to improve military and civilian trauma integration:** Moving underutilized military trauma teams to civilian trauma centers is one way to expand civilian trauma access. Embedding military providers in EMS organizations (as many MCP sites do) is another. As the DoD pursues MCP expansion, the Department should work with civilian partners to identify underserved markets that may benefit most from MCPs. There may also be opportunities for MTFs to help underserved communities like Camp Lejeune.

B. Recommendations

Based on these findings, the IDA team recommends the following actions:

- **The Services should clearly identify their requirements for trauma surgeons and other key CCCT specialties.** Today, there are approximately 74 fellowship-trained trauma surgeons (58 AC/16 RC) in the military. However, the official requirements provided by the Services to staff their deployed trauma centers are for general surgeons. Future medical personnel requirements should determine which billets should be staffed by trauma surgeons versus general surgeons. This recommendation also applies to emergency medicine and critical care physicians.
- **The DoD should expand MCPs to place all forward surgical teams in busy trauma centers full time.** Each Service appears to be moving forward with MCP expansion. The Army is moving to embed its FRSDs; the Navy is looking to embed its ERSS and ERSC teams; and the Air Force has already embedded SOST surgical teams and a large number of CCCT personnel, and is considering

[109] Z. G. Hashmi, S. Zafar, T. Genuit, E. R. Haut, D. T. Efron, J. Havens et al.

embedding for CCATT teams and potential EMEDs. At this point, the end state is unclear and appears to be constrained by the beneficiary care mission. The DoD should have each Service develop an official MCP requirement similar to the requirement developed in Chapter 5. A strategic roadmap for achieving the expansion should then be developed.

- **Consider increasing the use of RC forces for CCCT specialties including expanded RC force mix options.** Placing AC providers in civilian trauma centers is similar to placing them in a reserve status. The difference is they are more accessible for deployments and DoD pays their full cost. Moving some share of these providers to an RC status would lower costs while maintaining similar levels of readiness.

C. Implementation Challenges

We identified three primary challenges related to carrying out these recommendations. These were overcoming barriers to forming MCPs, beneficiary care mission barriers, and barriers to increasing RC use.

1. Barriers to Forming MCPs

In Chapter 5 we discussed the many barriers that must be overcome when establishing new MCPs. We then offered key considerations and best practices based on lesson learned over the last 30 years. These were organized by three distinct times across an MCP's maturity: (1) the planning and development phases, (2) the execution and operation stage, and (3) the sustainment and expansion phase. In general, we found that moving toward more standardized MCP agreements (that still allow for state- or facility-specific circumstances) was beneficial for reducing the planning and development phase. Increased sharing of lessons learned across the Services and Service organizations can also be beneficial. These efforts should include reserve component representatives as the RCs are beginning to explore greater use of MCPs and could learn much from the experience of the active components.

2. Beneficiary Care Mission

Many stated that the beneficiary care mission was the biggest barrier to MCP expansion. They discussed the difficulties they faced in getting military personnel assigned to MCPs when they were also required in the MTFs. Many noted they were trying to accomplish the same beneficiary care mission and a new MCP readiness mission with a fixed or diminishing workforce. The IDA team often heard statements such as "if 100 percent of personnel are required to maintain adequate staffing at MTFs and sustain GME programs, then they cannot be available for MCP placement."

To address this challenge, the Services should be given the full ability to assign CCCT personnel to MCPs (the readiness mission). The DoD should also ensure the Services receive adequate support personnel (military, civilian, or contractors) to administer MCP programs or sites. The DHA should be responsible for backfilling MTF personnel with civilians or making changes to MTF footprints. This is consistent with congressional direction given in the 2017 NDAA that transferred the MTFs to the DHA. The organizations must work closely together to develop a strategic plan for absorbing the loss of personnel reallocated to MCPs.

3. Expanding Use of RC Providers

Many argued that RC providers were not a reliable substitute for AC providers. While data on the general civilian physician population suggests RC providers may have higher workload volumes than MTF-based providers, a comparison is not possible with the current RC workload tracking system. Less is known about the readiness of RC nurses and enlisted. Recruitment of RC providers was another challenge raised the SMEs we interviewed. Many felt it would be hard to recruit additional RC trauma surgeons, ER physicians, critical care nurses, and others under the current system.

The current RC system of recruitment, training, and deployment of reserve personnel is not well suited for high-skill medical providers. Many RC providers have migrated to special operations assignments so that they directly support the operational mission while avoiding the bureaucracy and hassle of traditional RC service. DoD should develop more operationally focused and flexible reserve structures for attracting and retaining high-skill medical providers.

Appendix A.
Congressional Study Direction

Section 757. Study on Force Mix Options and Service Models to Enhance Readiness of Medical Force of Armed Services

(a) STUDY.-Not later than 30 days after the date of the enactment of this Act, the Secretary of Defense shall seek to enter into an agreement with a federally funded research and develop-ment center or other independent entity to conduct a study on force mix options and service models (including traditional and nontraditional active and reserve models) to enhance the readiness of the medical force of the Armed Forces to deliver combat care on the battlefield and assist public health responses to pandemics or other national public health emergencies.

(b) ELEMENTS.-The study under subsection (a) shall include, at a minimum and conducted separately with respect to members of the Armed Forces on active duty and members of the reserve components-

(1) a review of existing models for such members who are medical professionals to improve clinical readiness skills by serving in civilian trauma centers, Federal agencies, or other organizations determined appropriate by the Secretary;

(2) an assessment of the extent to which such existing models can be optimized, standardized, and scaled to address readiness shortfalls; and

(3) an evaluation of the cost and effectiveness of alternative models for such members who are medical professionals to serve in the centers, agencies, and organizations specified in subparagraph (A).

(c) REPORT.-Not later than 15 months after the date of the enactment of this Act, the Secretary shall submit to the Committees on Armed Services of the Senate and the House of Representatives a report on the findings and recommendations resulting from the study under subsection (a).

2017 NDAA Section 708, Subsection C

(c) PARTNERSHIPS.—

(1) IN GENERAL.—The Secretary may enter into partnerships with civilian academic medical centers and large metropolitan teaching hospitals that have level I civilian trauma centers

to provide integrated combat trauma teams, including forward surgical teams, with maximum exposure to a high volume of patients with critical injuries.

(2) TRAUMA TEAMS.—Under the partnerships entered into with civilian academic medical centers and large metropolitan teaching hospitals under paragraph (1), trauma teams of the Armed Forces led by traumatologists of the Armed Forces shall embed within the trauma centers of the medical centers and hospitals on an enduring basis.

(3) SELECTION.—The Secretary shall select civilian academic medical centers and large metropolitan teaching hospitals to enter into partnerships under paragraph (1) based on patient volume, acuity, and other factors the Secretary determines necessary to ensure that the traumatologists of the Armed Forces and the associated clinical support teams have adequate and continuous exposure to critically injured patients.

(4) CONSIDERATION.—In entering into partnerships under paragraph (1), the Secretary may consider the experiences and lessons learned by the military departments that have entered into memoranda of understanding with civilian medical centers for trauma care.

Appendix B.
Defining Trauma and Injury Severity

Defining Trauma

For our analysis, the IDA team used a standard definition of trauma that is used nationwide by the American College of Surgeons National Trauma Data Bank. This is the same trauma definition used by state trauma registries and any facilities participating in ACS verification or the Trauma Quality Improvement Program (T-QIP). In essence, for a case to be considered trauma, it must include at least two things:

1. An injury ICD diagnostic code, excluding superficial injury codes
    a. **S00-S99 with 7th character modifiers of A, B, or C only**. These code an initial encounter for injuries to specific body parts.
    b. **T07**. This codes an initial encounter for unspecified multiple injuries.
    c. **T14**. This codes for an injury of an unspecified body region.
    d. **T79.A1-T79.A9 with 7th character modifier of A only**. This codes for an initial encounter for traumatic compartment syndrome.
2. At least one of the following:
    a. Patient death
    b. Patient transfer via EMS or air ambulance
    c. Inpatient admission

Defining Injury Severity

Injury severity scores (ISS) are an anatomically based scale that permits the comparison of trauma across patients and facilities. ISS is a widely accepted measure that is often reported to quantify the severity of a patient and the severity of a facility's trauma case mix. Scores range from 1 to 75 with a score of 1 being minor injury and 75 indicating certain death. To calculate ISS, the body is divided into six distinct regions: head and neck; face; chest; abdomen and pelvis; extremities and pelvic girdle; and external. Each region that has an injury is scored from 1 (minor injury) to 6 (possibly lethal injury) based on the most extreme injury to that region. The ISS is then calculated as the sum of the squares of the highest three regions. If any region scores a 6, then the patient's ISS is automatically calculated as 75.[1]

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[1] M. Stevenson, M. Segui-Gomez, and I. Lescohier et al., "An Overview of the Injury Severity Score and the New Injury Severity Score," *Injury Prevention* 7 (2001): 10–13.

While this sounds complex, the availability of highly detailed ICD diagnosis data from patient billing data permits the easy calculation of ISS. Researchers have created, used, and validated statistical software to automatically calculate the ISS from ICD codes. This statistical package is available for STATA and is called "icdpic." For our analysis, we ensured that data was structured properly for use with the icdpic module and then ran the package to calculate ISS. More on the icdpic package can be found at https://econpapers.repec.org/software/bocbocode/s457028.htm.

Appendix C.
MTF Size Categories

We classify MTFs as medical centers (dispositions greater than 10,000), large hospitals (dispositions between 3,000 and 10,999), small hospitals (dispositions under 3,000), and clinics (no inpatient dispositions). Table C-1 lists all MTFs by these categories. We also report the inpatient dispositions and total outpatient encounters.

Table C-1. List of MTFs by Category, FY 2019

Facility Category	Parent DMIS ID	Parent Treatment DMIS ID Name	Inpatient Dispositions	Total Encounters
MedCen	0109	AMC BAMC-FSH	24,206	1,147,951
MedCen	0029	NMC SAN DIEGO	16,125	1,201,600
MedCen	0124	NMC PORTSMOUTH	13,607	1,194,784
MedCen	0067	WALTER REED NATL MIL MED CNTR	13,224	964,453
MedCen	0052	AMC TRIPLER-SHAFTER	11,403	996,776
MedCen	0089	AMC WOMACK-BRAGG	10,063	1,263,348
Hosp-L	0108	AMC WILLIAM BEAUMONT-FT BLISS	8,543	851,572
Hosp-L	0110	AMC DARNALL-FT HOOD	8,001	1,178,674
Hosp-L	0123	FT BELVOIR COMMUNITY HOSP-FBCH	7,183	971,679
Hosp-L	0091	NMC CAMP LEJEUNE	7,043	613,069
Hosp-L	0032	ACH EVANS-CARSON	6,253	870,874
Hosp-L	0014	AF-MC-60th MEDGRP-TRAVIS	5,038	252,021
Hosp-L	0060	ACH BLANCHFIELD-FT CAMPBELL	5,028	801,323
Hosp-L	0047	AMC EISENHOWER-FT GORDON	4,757	625,262
Hosp-L	0607	LANDSTUHL REGIONAL MEDCEN	4,496	467,477
Hosp-L	0024	NH CAMP PENDLETON	4,262	671,171
Hosp-L	0079	AF-MC-99th MEDGRP-NELLIS	4,233	310,863
Hosp-L	0048	ACH MARTIN-FT BENNING	3,835	677,940
Hosp-L	0042	AF-H-96th MEDGRP-EGLIN	3,398	270,813
Hosp-L	0621	NH OKINAWA	3,381	308,142
Hosp-L	0039	NH JACKSONVILLE	3,318	470,501
Hosp-L	0006	AF-H-673rd MEDGRP JBER-ELMNDRF	3,099	194,318
Hosp-L	0095	AF-MC-88th MEDGRP-WRIGHT-PAT	3,001	274,109

Facility Category	Parent DMIS ID	Parent Treatment DMIS ID Name	Inpatient Dispositions	Total Encounters
Hosp-S	0049	ACH WINN-FT STEWART	2,892	534,550
Hosp-S	0073	AF-MC-81st MEDGRP-KEESLER	2,823	220,308
Hosp-S	0057	ACH IRWIN-RILEY	2,587	357,929
Hosp-S	0075	ACH LEONARD WOOD	2,211	281,646
Hosp-S	0120	AF-ASC-633rd MEDGRP JB-LANGLEY	1,889	230,539
Hosp-S	0620	NH GUAM-AGANA	1,873	97,594
Hosp-S	0622	NH YOKOSUKA	1,471	205,890
Hosp-S	0005	ACH BASSETT-WAINWRIGHT	1,419	207,659
Hosp-S	0612	ACH BRIAN D ALLGOOD-PYEONGTAEK	1,088	336,313
Hosp-S	0030	NH TWENTYNINE PALMS	1,076	146,313
Hosp-S	0633	AF-H-48th MEDGRP-LAKENHEATH	1,066	132,880
Hosp-S	0064	ACH BAYNE-JONES-POLK	903	143,551
Hosp-S	0131	ACH WEED-IRWIN	704	104,750
Hosp-S	0086	ACH KELLER-WEST POINT	573	122,170
Hosp-S	0639	AF-H-35th MEDGRP-MISAWA	517	51,362
Hosp-S	0640	AF-H-374th MEDGRP-YOKOTA	457	53,404
Hosp-S	0617	NH NAPLES	412	47,089
Hosp-S	0618	NH ROTA	374	49,042
Hosp-S	0624	NH SIGONELLA	268	70,550
Hosp-S	0104	NH BEAUFORT	231	205,909
Hosp-S	0615	NH GUANTANAMO BAY	114	21,217
Hosp-S	0638	AF-H-51st MEDGRP-OSAN	72	56,184
Clinic	0117	AF-ASC-59th MDW-WHASC-LACKLAND	0	724,496
Clinic	0105	AHC MONCRIEF-JACKSON	0	425,727
Clinic	0038	NHC PENSACOLA	0	391,941
Clinic	0069	KIMBROUGH AMB CAR CEN-MEADE	0	323,866
Clinic	0098	AHC REYNOLDS-FT SILL	0	322,584
Clinic	0609	BAVARIA MEDDAC-VILSECK	0	301,397
Clinic	0121	AHC MCDONALD-EUSTIS	0	222,603
Clinic	0330	AHC GUTHRIE-DRUM	0	217,710
Clinic	0066	AF-ASC-316th MEDGRP-ANDREWS	0	200,041
Clinic	0122	AHC KENNER-LEE	0	199,829
Clinic	0280	NHC HAWAII	0	179,606
Clinic	0100	NHC NEW ENGLAND	0	167,058
Clinic	0061	AHC IRELAND-KNOX	0	164,767
Clinic	0033	AF-ASC-10th MEDGRP-ACADEMY	0	162,222
Clinic	0003	AHC LYSTER-RUCKER	0	147,796

Facility Category	Parent DMIS ID	Parent Treatment DMIS ID Name	Inpatient Dispositions	Total Encounters
Clinic	0045	AF-C-6th MEDGRP-MACDILL	0	139,675
Clinic	0385	NHC QUANTICO	0	128,872
Clinic	0092	NHC CHERRY POINT	0	125,393
Clinic	0078	AF-C-55th MEDGRP-OFFUTT	0	120,823
Clinic	0058	AHC MUNSON-LEAVENWORTH	0	117,400
Clinic	0009	AF-C-56th MEDGRP-LUKE	0	108,016
Clinic	0055	AF-C-375th MEDGRP-SCOTT	0	103,813
Clinic	0028	NHC LEMOORE	0	99,894
Clinic	0806	AF-C-86th MEDGRP-RAMSTEIN	0	99,333
Clinic	0326	AF-C-87th MDGRP-MCGR-DX-LKHRST	0	96,782
Clinic	0252	AF-C-21st MEDGRP-PETERSON	0	89,518
Clinic	0306	NHC ANNAPOLIS	0	87,043
Clinic	0010	AF-C-355th MEDGRP-DM	0	85,174
Clinic	0001	AHC FOX-REDSTONE ARSENAL	0	83,823
Clinic	0096	AF-C-72nd MEDGRP-TINKER	0	83,405
Clinic	0119	AF-C-75th MEDGRP-HILL	0	83,215
Clinic	7139	AF-C-1st SPCL OPS MED-HURLBURT	0	80,330
Clinic	0068	NHC PATUXENT RIVER	0	77,613
Clinic	0008	AHC R W BLISS-HUACHUCA	0	77,304
Clinic	0804	AF-C-18th MEDGRP-KADENA	0	74,975
Clinic	0013	AF-C-19th MEDGRP-LITTLE ROCK	0	73,525
Clinic	0101	AF-C-20th MEDGRP-SHAW	0	71,355
Clinic	0287	AF-C-15th MEDGRP JBHP-HICKAM	0	69,184
Clinic	0062	AF-C-2nd MEDGRP-BARKSDALE	0	67,830
Clinic	0004	AF-C-42nd MEDGRP-MAXWELL	0	67,805
Clinic	0103	NHC CHARLESTON	0	67,217
Clinic	0051	AF-C-78th MEDGRP-ROBINS	0	63,608
Clinic	0083	AF-C-377th MEDGRP-KIRTLAND	0	62,612
Clinic	0112	AF-C-7th MEDGRP-DYESS	0	60,348
Clinic	0118	NHC CORPUS CHRISTI	0	60,097
Clinic	0076	AF-C-509th MEDGRP-WHITEMAN	0	58,332
Clinic	0085	AF-C-27th SPCLOPS MDGRP-CANNON	0	58,210
Clinic	0094	AF-C-5th MEDGRP-MINOT	0	56,710
Clinic	0084	AF-C-49th MEDGRP-HOLLOMAN	0	56,560
Clinic	0113	AF-C-82nd MEDGRP-SHEPPARD	0	56,532
Clinic	0053	AF-C-366th MED SQ-MT HOME	0	54,905
Clinic	0090	AF-C-4th MEDGRP-SJ	0	52,103

Facility Category	Parent DMIS ID	Parent Treatment DMIS ID Name	Inpatient Dispositions	Total Encounters
Clinic	0036	AF-C-436th MEDGRP-DOVER	0	48,789
Clinic	0356	AF-C-628th MEDGRP-CHARLESTON	0	48,266
Clinic	0106	AF-C-28th MEDGRP-ELLSWORTH	0	47,040
Clinic	0046	AF-C-45th MEDGRP-PATRICK	0	46,919
Clinic	0050	AF-C-23rd MEDGRP-MOODY	0	46,150
Clinic	0077	AF-C-341st MEDGRP-MALMSTROM	0	43,486
Clinic	0808	AF-ASC-31st MEDGRP-AVIANO	0	39,757
Clinic	7200	AF-C-460th MEDGRP-BUCKLEY	0	36,951
Clinic	0015	AF-C-9th MEDGRP-BEALE	0	36,054
Clinic	0059	AF-C-22nd MEDGRP-MCCONNELL	0	35,985
Clinic	0364	AF-C-17th MEDGRP-GOODFELLOW	0	35,290
Clinic	0129	AF-C-90th MEDGRP-FE WARREN	0	35,129
Clinic	0802	AF-C-36th MEDGRP-JB ANDERSEN	0	34,816
Clinic	0018	AF-C-30th MEDGRP-VANDENBERG	0	33,221
Clinic	0805	AF-C-52nd MEDGRP-SPANGDAHLEM	0	32,819
Clinic	0019	AF-C-412th MEDGRP-EDWARDS	0	31,616
Clinic	0097	AF-C-97th MEDGRP-ALTUS	0	22,759
Clinic	0203	AF-C-354th MEDGRP-EIELSON	0	22,006
Clinic	0093	AF-C-319th MEDGRP-GRAND FORKS	0	21,539
Clinic	0310	AF-C-66th MEDSQ-HANSCOM	0	20,221
Clinic	0074	AF-C-14th MEDGRP-COLUMBUS	0	19,535
Clinic	0610	AHC BG CRAWFORD SAMS-CAMP ZAMA	0	19,464
Clinic	0114	AF-C-47th MEDGRP-LAUGHLIN	0	18,318
Clinic	0248	AF-C-61st MED SQ-LOS ANGELES	0	18,224
Clinic	0635	AF-C-39th MEDGRP-INCIRLIK	0	17,135
Clinic	0338	AF-C-71st MEDGRP-VANCE	0	15,161
Clinic	0637	AF-C-8th MEDGRP-KUNSAN	0	14,704
Clinic	0043	AF-C-325th MEDGRP-TYNDALL	0	13,930
Count	**125**	**Sum**	**198,517**	**28,281,830**

Appendix D.
Cost of Medical Force

In section 3.C, we presented cost estimates for AC, RC, and civilian physicians by Service for the occupations of focus in this paper. We derived the AC and civilian cost estimates from the methodology developed in a previous IDA study (see IDA Paper P-5047[1] for details). RC cost estimates were constructed using the methodology developed in follow-on work (see IDA Paper P-8805[2]).

AC cost estimates are based primarily on composite rate, health profession special incentive pays, and bonus data provided by Health Affairs, CAPE Full Cost of Manpower tool (FCoM), and Medical Readiness Review (MRR) data. AC cost components and sources are listed in Table D-1. Civilian cost estimates are based primarily on VA pay table data, the CAPE FCoM tool, and MRR data. Civilian cost components and sources are listed in Table D-2. RC personnel costs estimates are initially based on RC personnel cost elements specific to Service and rank, but not occupation. We then derived rank-specific average physician incentive and special pays using data from FY 2021 budget exhibits for each of the five RCs. We then aggregated our RC personnel cost estimates to the Service-occupation level, weighting by the 2020 HMPDs occupation-specific rank distributions. RC cost component and sources are listed in Table D-3. Most cost elements are based on FY 2021 data. Cost elements that were not available for 2021 were converted to 2021 dollars using Service-specific inflation factors for military personnel published by the Office of the Under Secretary of Defense (Comptroller) (OUSD(C))/Chief Financial Officer.

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

2 John E. Whitley et al., "Medical Total Force Management: Readiness and Cost," IDA Paper P-8805 (Alexandria, VA: Institute for Defense Analyses, May 2018).

Table D-1. Active Component Personnel Cost Components and Sources

Cost Component	Source	DoD Cash Flow Costs	Full Cost
Basic Pay, Allowances, Social Security and Medicare, Retired Pay (accrual), Travel/PCS/Transportation subsidy, HealthBenefit, retiree (>65 MERHCF accrual)	Composite Rate	✓	✓
Incentive and Special Pays	Health Professions Officer Special and Incentive Pay Plan (Health Affairs FY2022)	✓	✓
Health Benefit (Active Duty and Dependents)	DoD Comptroller	✓	✓
Training Costs, Recruitment and Advertising, and Education Assistance	IDA P-10814, "Life-Cycle Costs of Selected Uniformed Health Professions," Eric Christensen et al., 2009; Medical Readiness Review 2006; 2021 FCoM tool	✓	✓
Child Development, Family Support Services, Discount Groceries	2021 FCoM tool		✓
Health Benefit, Retiree (<65 retiree and family), >65 Plus Up	DoD Actuary		✓
Health Benefit, Other (TAMP and CHCBP), Discount Groceries, Retiree, Separation Pay and Travel, Unemployment Benefits, Death Gratuities and Survivor Benefits	Medical Readiness Review 2006		✓
Tax Shortfall Payment (Treasury)	Medical Readiness Review 2006		✓
Concurrent Receipt (Treasury)	DoD Actuary		✓
Child Education (Education)	2021 FCoM tool		✓
VA Benefits (Veterans' Affairs)	Congressional Budget Office Report 2002/Budget Report 2000		✓
Employment Training (Labor)	Medical Readiness Review 2006		✓

Table D-2. Civilian Medical Personnel Cost Components and Sources

Cost Component	Source	DoD Cash Flow Costs	Full Cost
Annual Pay, Basic Pay, Locality Pay	VA Pay Tables (Medical and Dental Corps), Medical Readiness Review 2006 (allother corps)	✓	✓
OC11 (other) Load Factor: Overtime/Holiday/Other Pays, Incentive/Performance Awards	2021 FCoM tool	✓	✓
OC12 load factor: Health Benefit (government share of FEHBP), Social Security and Medicare, Retired Pay (government share), Travel/PCS/transportation subsidy/relocation bonus, Life insurance/worker'scompensation benefits	2021 FCoM tool	✓	✓
Education Assistance	Medical Readiness Review 2006	✓	✓
Recruiting, Advertising, etc. (Amortized)	Medical Readiness Review 2006	✓	✓
OC 13 load factor: Severance Pay/ Separation Incentive, Severance Health Benefit	2021 FCoM tool		✓
Child Development	Medical Readiness Review 2006		✓
Retirement Benefits: Civilian Retirement, Post-Retirement Healthcare, Post-Retirement Life Insurance	"DoD Civilian Personnel Fringe Benefits Rates," memo, http://www.dod.mil/comptroller/rates/		✓

Table D-3. Reserve Component Personnel Cost Component and Sources

Cost Component	Source	DoD Cash Flow Costs	Full Cost
Basic Pay, Allowances, Continuation Pay, Incentive/special pays (including Health Professions Loan Repayment Program, Specialized Training Assistance Program, accession and retention bonuses)	Defense Finance & Accounting Service (DFAS); component budget execution rates	✓	✓
Activation Costs			
Social Security	Social Security Administration	✓	✓
Medicare	Comptroller (OSD(C))	✓	✓
Travel	Component budget justification rates	✓	✓
Health Benefit	TRICARE Reserve Select premiums, beneficiary cost shares, and take rates	✓	✓
Retirement	DoD Actuary, US (P&R)	✓	✓
Recruitment and Advertising	Fiscal Year Defense Program (FYDP)	✓	
			✓
Training	FYDP		✓
Child Development, Discount Groceries, Family Support Services, Death Gratuities, Unemployment, Survivor Benefits	FYDP		✓
Separation Pay	Component budget justification rates		✓
Tax shortfall payment; concurrent receipt	Department of the Treasury		✓
Employment Training (Labor)	CBO estimates adjusted proportionally to component-specific average OIF/OEF disability payments		✓

Activated RC personnel are paid identically to AC personnel, plus DoD incurs the costs of additional pre-mobilization training and post-mobilization services. Using FY 2017 budget justification estimates for overseas contingency operations funding, we derive pre- and post-mobilization costs of $4,633, $4,468, and $5,966 per deployment for the Army, Navy, and Air Force, respectively.

Chapter 2 reported AC, RC, and civilian costs for Army providers. Table D-4 and Table D-5 report the same data for Navy and Air force.

Table D-4. Average Navy Cost by Occupation Group and Personnel Type, in 1000s

	Total Cost			DoD Cash Flow Cost		
	AC	RC	Civ	AC	RC	Civ
Medical	530	75	362	495	43	337
Dental	407	75	324	372	42	302
Nurse	288	69	104	253	37	97
Other	244	71	150	209	39	140
Enlisted	143	21	74	108	16	69

Note: RC costs are dwell costs. When RC are activated, the cost is the same as AC providers.

Table D-5. Average Air Force Cost by Occupation Group and Personnel Type, in 1000s

	Total Cost			DoD Cash Flow Cost		
	AC	RC	Civ	AC	RC	Civ
Medical	529	76	358	494	44	337
Dental	410	76	315	376	45	302
Nurse	283	68	93	249	37	97
Other	246	70	166	206	39	140
Enlisted	138	21	88	104	16	69

Note: RC costs are dwell costs. When RC are activated, the cost is the same as AC providers.

Appendix E.
Master Partnership List

Table E-1 provides a complete list of all U.S. trauma centers included in the MCP register. A DoD workgroup, the "military civilian partnership," maintains the MCP register and will continue to collect more information.

Table E-1. U.S. Trauma Centers

Trauma Center
Barnes-Jewish Hospital
Carolinas Medical Center
Cincinnati Children's Hospital
Cooper University Hospital
Cox Medical Center
Duke University Hospital
Froedtert Hospital
Grady Memorial Hospital
Hackensack University Medical Center
Harborview Medical Center
Hurley Medical Center
J.W. Ruby Memorial Hospital
Jackson Memorial Hospital
John H. Stroger Jr. Hospital of Cook County
Kettering Medical Center
LAC+USC Medical Center
MedStar Washington Hospital Center
Merit Health - Biloxi
Miami Valley Hospital
Nebraska Medical Center
North Bay Medical Center
Not in MTCL
Not in MTCL - OCONUS
Not in MTCL - VA
Oregon Health & Science University Hospital
Palomar Medical Center

Trauma Center
Penn Presbyterian Medical Center
Poudre Valley Hospital
Prince George's Hospital Center (UMCRH)
R Adams Cowley Shock Trauma Center/University of Maryland Medical System
Riverside Community Hospital
Riverside Regional Medical Center
Sacred Heart Hospital
Scripps Memorial Hospital
Scripps Mercy Hospital
Sentara Norfolk General Hospital
Singing River Hospital
St Anthony Summit Medical Center
St. Francis Medical Center
St. Louis Children's Hospital
Tampa General Hospital
UC Irvine Health
UC San Diego Medical Center
UC Davis Medical Center
UF Health Shands Hospital
UNC Hospitals
UNC Hospitals
University Hospital
University Medical Center New Orleans
University Medical Center of Southern Nevada
University of Chicago Medicine
University of Colorado Hospital
University of Louisville Hospital
University of Alabama Hospital
University of Cincinnati Medical Center
University of Colorado Hospital
UW Health University Hospital
Vanderbilt University Medical Center
Vidant Medical Center
Zuckerberg San Francisco General Hospital and Trauma Center

Appendix F.
Provider Productivity

RVUs are calculated for all physicians practicing in MTFs. We exclude residents from these calculations. The calculations are made using National Provider Identification (NPI) numbers to uniquely identify physicians. This approach avoids challenges associated with capturing the workload of providers who work in more than one MTF over the year. The analysis uses 2019 data to avoid the impact of the COVID-19 pandemic on workload and the rollout of the GENESIS system, both of which have impacted RVU data reporting.

The ACGME reports the distribution of physician RVU workload by specialty. This is often used for benchmarking in civilian facilities who set RVU productivity targets for their providers. DoD workload targets are currently set equal to 50 percent of the civilian median. IDA obtained RVU and productivity targets from the DHA productivity and leakage (PAL) dashboard available through the CarePoint portal.[1]

[1] Military Health System portal, https://carepoint.health.mil/sites/D3P.

Figure F-1 shows the work RVU distribution for emergency medicine physicians. The workload patterns are similar to the surgeon patterns. A large share of physicians falls in the 500 or less RVU category. Around 80 percent of providers are below the ER-specific work RVU target of 3,263.

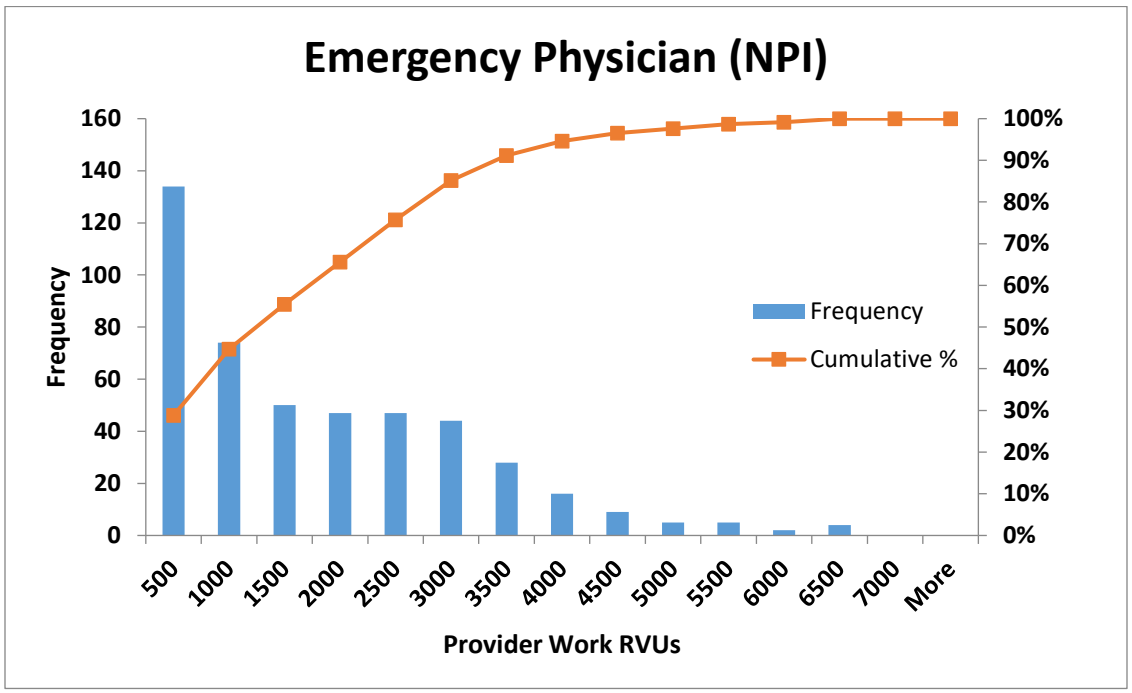

Figure F-1. Emergency Physician Work RVUs

Figure F-2 shows the work RVU distribution for orthopedic surgeons. The workload patterns are similar to the surgeon patterns. A large share of physicians falls in the 500 or less RVU category. Around 90 percent of providers are below the ER-specific work RVU target of 4,044.

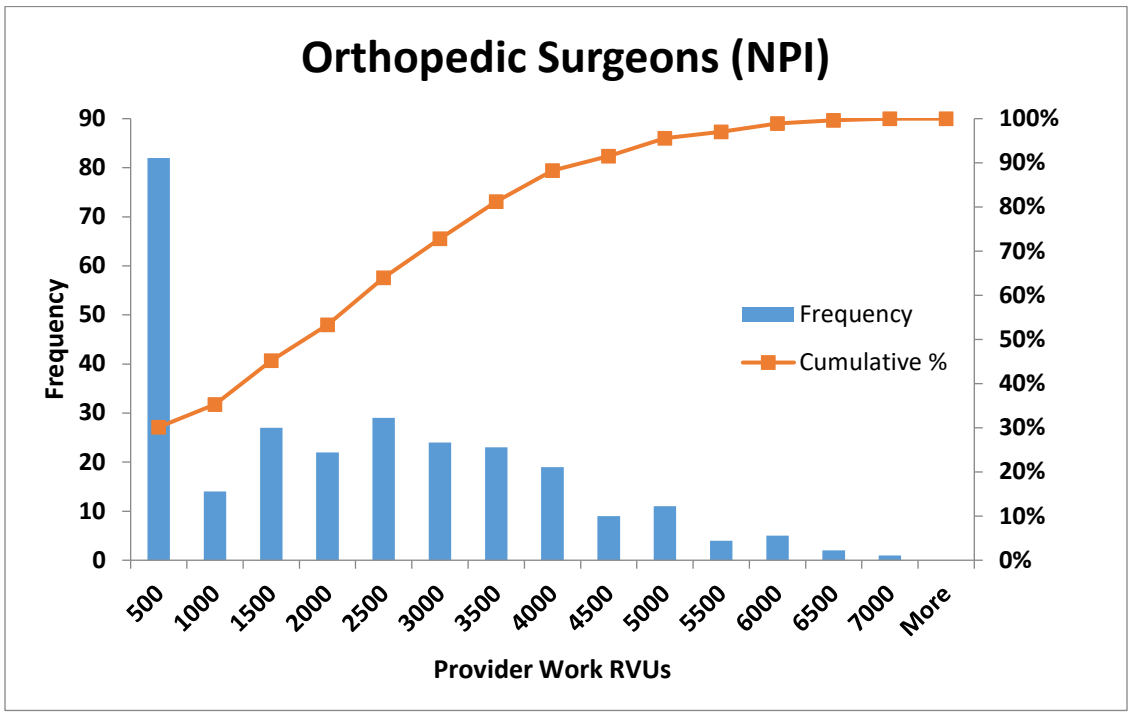

Figure F-2. Orthopedic Surgeon RVUs

Illustrations

Figures

Tables

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Abbreviations

AC	Active component
ACH	Army Community Hospital
ACS	American College of Surgeons
AD	Active duty
AE	Aeromedical evacuation
AFSC/MOS	Air Force Specialty Codes/Military Occupational Specialty
AFSOC	Air Force Special Operation Command
AFTH	Air Force Theater Hospital
AMC	Army Medical Center
AMCT3	Army Military-Civilian Trauma Team Training
ARSC	Austere Resuscitative and Surgical Care
ASPR	Assistant Secretary for Preparedness and Response
ATTC	Army Trauma Training Center
BAS	Basic Allowance for Subsistence
C2P2	Credentials Certification and Privileging Preparation
CCATT	Critical care air transport team
CCC	Combat casualty care
CCC-RC	Combat Casualty Care Relevant Cases
CCCT	Combat casualty care team
CCCT-C	Combat casualty care team-core
CNRA	Certified Registered Nurse Anesthetist
COCOM	Combatant Command
CPT	Current procedural terminology
CRMP	Comprehensive Medical Readiness Program
CRT	Certified Respiratory Therapist
CSH	Combat support hospital
C-STARS	Centers for the Sustainment of Trauma and Readiness Skills
DART	Disaster Assistance Response Team
DHA	Defense Health Agency
DMDC	Defense Manpower Data Center
DoD	Department of Defense
DSCA	Defense support of civil authorities
E	Enhanced
EHET	Embedded Health Engagement Team
EMC	Essential medical capability
EMEDS	Expeditionary Medical Support System
EMF	Expeditionary Medical Facility

EMS	Emergency Medical Services
EMT-B	Emergency Medical Technicians-Basic
ERCS	En Route Care System
ERSS	Expeditionary Resuscitative Surgical System
ERSS	En Route Patient Staging System
ESM	Embedded sustainment model
FRSD	Forward resuscitative and surgical detachment
FTE	Full-time equivalent
FY	Fiscal year
GAO	Government Accountability Office
GME/GDE	Graduate medical education/graduate dental education
GST	Ground surgical team
GWOT	Global War on Terrorism
HHS	Department of Health and Human Services
HMPDS	Health Manpower and Personnel Data System
HPSP	Health Professions Scholarship Program
HRT	Health Response Team
ICD	International Classification of Diseases
ICDPIC	International Classification of Disease Program for Injury Classification
ICTL	Individual Critical Task List
ICU	Intensive care unit
ICW	Intermediate care ward
IDA	Institute for Defense Analyses
ISS	Injury Severity Score
ISS	Injury Severity Score
JCCQAS	Joint Centralized Credentials Quality Assurance System
JSOC	Joint Special Operations Command
JTTC	Joint Trauma Training Center
KSA	Knowledge, skills, and abilities
LM	Light maneuver
MCP	Military civilian partnership
MCRMC	Military Compensation and Retirement Modernization Commission
MEDRETE	Medical Readiness Training Exercise
MEPRS	Medical Expense and Performance Reporting System
MGMA	Medical Group Management Association
MHS	Military Health System
MILCON	Military construction
MOA/MOU	Memoranda of Agreement/Memoranda of Understanding
MTF	Military Treatment Facility
NASEM	National Academies of Sciences, Engineering, and Medicine
NDAA	National Defense Authorization Act

NDMS	National Disaster Medical System
NGO	Non-governmental organization
NH	Naval Hospital
NMC	Naval Medical Center
NOD	Night Observation Device
NP	Nurse practitioner
NS	Non-survivable
OFDA	Office of U.S. Foreign Disaster Assistance
OFMS	Oral and maxillofacial surgery
OMM	Office of Military Medicine
OSD CAPE	Office of Cost Assessment and Program Evaluation
OUSD P&R	Office of the Under Secretary of Defense for Personnel and Readiness
PA	Physician's assistant
PCS	Permanent change of station
PS	Potentially survivable
PSM	Part-time sustainment model
RC	Reserve component
RVU	Relative value unit
SAMMC	San Antonio Military Medical Center
SMART	Science, Mathematics, and Research for Transformation
SME	Subject matter expert
SMR	Short-run rotational model
SOCCET	Special Operations Critical Care Evacuation Team
SOF	Special Operations Forces
SORT	Special Operations Resuscitation Team
SOST	Special Operations Surgical Teams
SURGRETE	Surgical Readiness Training Exercise
TAA	teaching affiliation agreement
T-AH	Hospital ship
TBRM	Trauma, Burn, and Rehabilitative Medicine
TDY	Temporary duty
T-QIP	Trauma Quality Improvement Program
UAB	University of Alabama Birmingham
UMC	University Medical Center
UNLV	University of Las Vegas
USASOC	United States Army Special Operations Command
USUHS	Uniformed Services University

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14. ABSTRACT

The Department of Defense (DoD) has an operational requirement for a deployable medical force. A mix of active component (AC) and reserve component (RC) military medical providers provide these essential capabilities. The wars in Iraq and Afghanistan revealed significant readiness challenges with the current medical force mix and military treatment facility (MTF)-based training model. This study examines the use of alternative training models such as military-civilian partnerships (MCPs) with civilian trauma centers and alternative force mix models. We find MCPs are highly effective training models and recommend that the Services expand their use of such partnerships.

15. SUBJECT TERMS

Military-Civilian Partnership (MCP); Trauma; Medical Readiness

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