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Options for Maintaining Clinical Proficiency During Peacetime

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Preface

This report documents research and analysis conducted as part of a project entitled *Maintaining Deployment Clinical Proficiency During Peacetime*, sponsored by the Assistant Secretary of the Army for Manpower and Reserve Affairs and the Office of the Surgeon General of the U.S. Army. The purpose of the project was to develop recommendations for how the Army Medical Department can best develop and maintain the clinical skills required for deployment while engaged in garrison operations.

This research was conducted within RAND Arroyo Center's Personnel, Training, and Health Program. RAND Arroyo Center, part of the RAND Corporation, is a federally funded research and development center (FFRDC) sponsored by the United States Army.

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Summary

The Army Medical Department (AMEDD) has a dual mission: to care for soldiers who become injured or ill during deployments and to care for soldiers, their dependents, and retirees in garrison-based medical treatment facilities (MTFs). The differences between AMEDD's two missions has led some observers to ask whether providers whose in-garrison practice focuses on care for service members, dependents, and retirees—with little exposure to trauma care—are adequately prepared for the high volumes of combat trauma in kinetic environments common to the deployed mission. Further, as current operations wind down, the Army is concerned that lessons and skills learned about trauma care might be quickly forgotten. The Army therefore asked RAND Arroyo Center to examine whether the predeployment training and experience of physicians and other clinical personnel are conducive to maintaining a maximally ready medical force.

To address these issues, RAND Arroyo Center conducted a literature review, interviewed medical personnel who have been deployed, and examined quantitative data to understand medical providers' assignments, workloads, and course attendance.

Deployment of Medical Personnel

Medical personnel can be deployed either by being assigned to a deploying unit or, more commonly, by being selected to fill a medical position through the Army's Professional Officer Filler System (PROFIS). PROFIS is a method of providing necessary medical support to Army units in deployed settings while ensuring that medical providers maintain their clinical skills in garrison by providing care to family members, retirees, and soldiers. Providers who are called on to deploy through PROFIS typically need to prepare quickly for deployment.

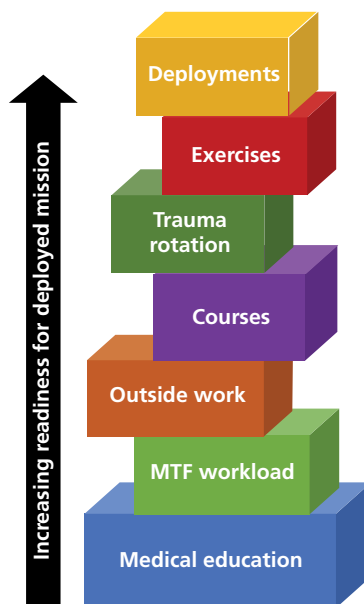
Providers deploy into many different types of facilities, including battalion aid stations (BASs), forward surgical teams (FSTs), and combat support hospitals (CSHs). The job at a BAS is that of a generalist, requiring skill at adult primary care, as well as at trauma care. Special skills are needed to manage higher-complexity cases—such as complex wound care—effectively and efficiently. Duty at the FST involves primarily

major-trauma resuscitation: An important skill here is the ability to prioritize the care of individual trauma patients, as well as care across multiple patients in a mass-casualty situation. At a CSH, medical personnel perform a wide range of duties, which require skills and experience with trauma management, as well as with basic primary care.

Building Blocks to Readiness

To understand how well medical providers—a term that, in this study, we scoped to include physicians, physician assistants (PAs), and nurse practitioners—are prepared for the deployed environment, we drew on findings of our literature review and interviews to identify seven “building blocks” to readiness (Figure S.1). The first three blocks are foundational, including a provider’s formal education and work experience. **Formal medical education**, including residencies and fellowships, serves as the starting point and can be used to identify gaps between a provider’s position in garrison and his or her assignment and duties in theater. **Clinical work at the MTF** provides experience and keeps skills sharp. Comparison between the diagnoses seen and procedures performed in MTFs and hospitals can indicate how providers’ experience in deployment differs from that in garrison. **Additional clinical work outside the MTF** allows many providers to increase case volume and see a greater diversity of cases, which can contribute to a provider’s learning and knowledge.

Figure S.1
Building Blocks to Readiness



The next four blocks are related to deployment. **Courses**, such as those from the AMEDD Center and School and the Defense Medical Readiness Training Institute, enhance providers' preparation. Identifying which training courses, trauma-center rotations, and exercises are required, and tracking providers' attendance at them, is important for understanding providers' readiness to deploy. Short-term **rotations at trauma centers** offer exposure to trauma patients prior to deployment, while **exercises with the unit** provide training in field operations. Finally, **deployments** over the course of a provider's career build important experience on which he or she can draw in subsequent deployments.

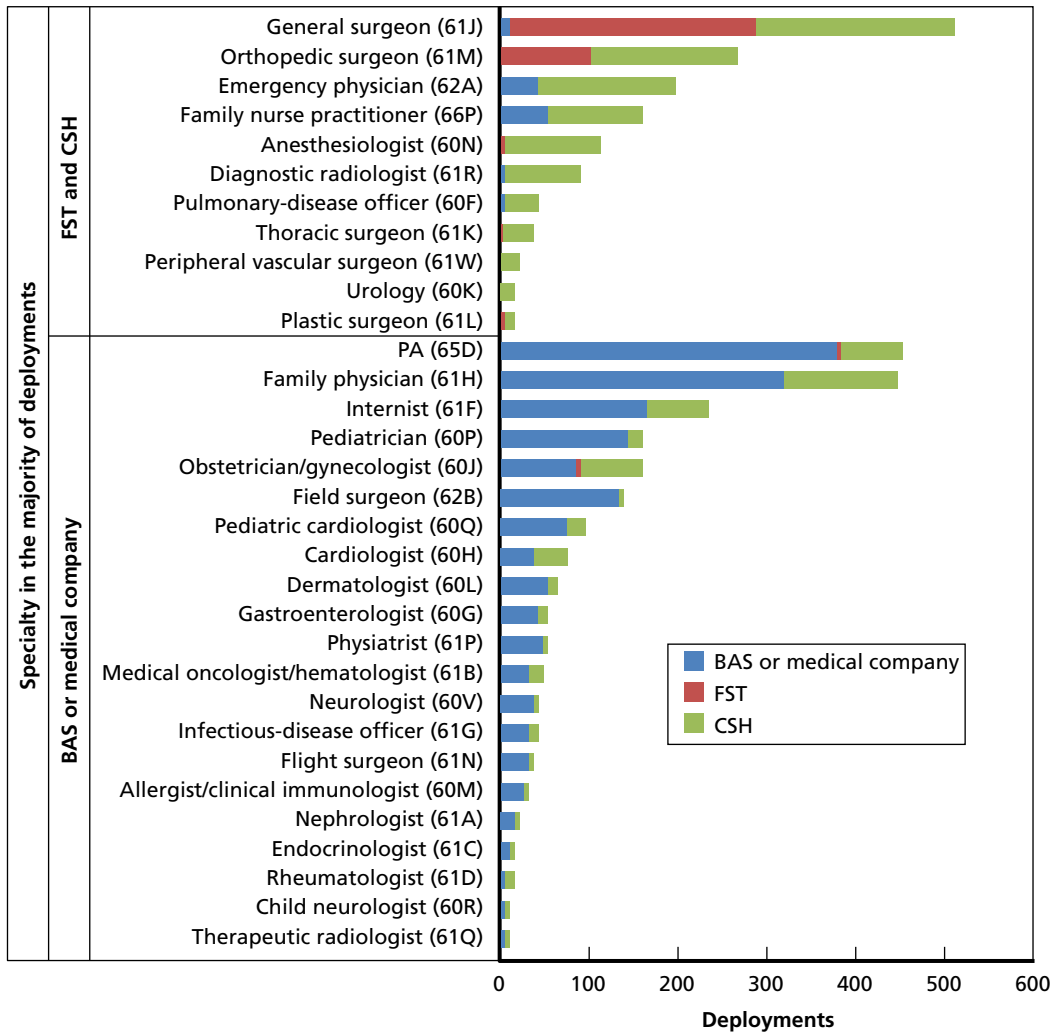
Using the Building Blocks to Understand Provider Readiness for Deployment

We note that, although the building blocks in Figure S.1 are shown the same height, they do not all contribute equally to readiness. Although mild deficiencies in one block might be mitigated by additional work in another block, severe deficiencies cannot be. As we discuss in this report, courses in trauma care are useful for refreshing the memories of students who do not ordinarily see trauma cases in their MTF work, but these courses cannot by themselves turn a student into a trauma expert. Similarly, although exercises contribute toward readiness, completing a few exercises cannot fully compensate for a shortfall in a provider's education or workload. True expertise and readiness depend on the depth and quality of each of these components, something that cannot be shown in a simple picture of blocks. However, the blocks provide us a framework for identifying and discussing the different areas in which gaps lie in providers' preparedness for deployment, as explained in the rest of this section.

Medical Education, Medical Treatment Facility Workload, and Outside Work

Ideally, providers' formal education and clinical work at home would prepare them for the deployed mission. However, our review found that this is often not the case. For example, many providers deploy into duties overseas that differ from what they see at home. The bottom panel of Figure S.2 shows the breakout of tasking for medical providers who deploy to BAS and medical companies to serve as field surgeons. These positions are often filled by personnel from specialties that would be unaccustomed to sick-call duties. This can result in increased evacuations of patients for suspected issues that a provider is uncomfortable handling on his or her own, as well as provider dissatisfaction and concern about degradation of his or her specialty skills while deployed. The top panel of Figure S.2 shows the breakout for specialists who were deployed predominantly to CSHs and FSTs. These deployments included surgeons of various types, as well as radiologists, anesthesiologists, and emergency-medicine physicians.

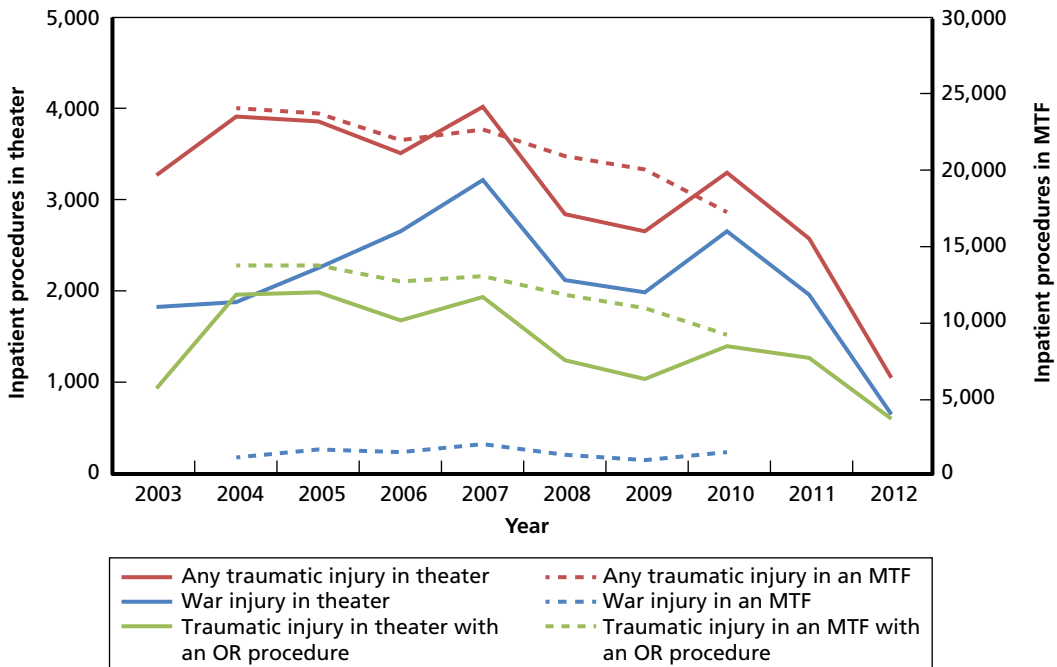
Figure S.2
Providers Tasked to Facilities, January 2005 to January 2015



SOURCE: AMEDD Resource Tasking System, 2005–2015 data.

The workload in theater tends to be very different from that seen in MTFs. Figure S.3 shows the number of hospitalizations for traumatic injuries and the number specifically for war-related injuries, by calendar year, for both theater and MTFs. Hospitalizations for war injuries in theater account for a large fraction of hospitalizations for traumatic injury in theater, as indicated by the proximity of the solid blue and solid red lines. In contrast, a far smaller fraction of the hospitalizations in MTFs is for injuries that would be considered war related, as indicated by the distance between the dotted blue and dotted red lines.

Figure S.3
Number of Hospitalizations for Traumatic Injury and War Injury in Theater and at Medical Treatment Facilities



SOURCES: 2004–2010 Military Health System Data Repository Standard Inpatient Data Record; 2002–2013 Patient Administration Systems and Biostatistics Activity Deployed Standard Inpatient Data Record.
 NOTE: OR = operating room.

The most-common procedures in theater differ from the most-common procedures in garrison. In theater, the most common major procedure was wound debridement (around 20 percent, compared with 2 percent of procedures at MTFs); at MTFs, it was cesarean section (13 percent). The surgical case mix was substantially less diverse in the deployed setting, as evidenced by the fact that the ten most-common procedures performed in theater made up 64 percent of the in-theater total, whereas the ten most-common MTF procedures made up only 39 percent of procedures performed at MTFs (data not shown). However, it is possible that similar home procedures could help providers prepare for theater workload. For example, laparoscopic appendectomy, which is common in garrison but not in theater, might help providers prepare to perform the more common “other appendectomy” in theater.

Despite these differences, most of the surgeons we interviewed felt that they were prepared for trauma care on the basis of their general medical education and training. In addition, nonsurgeon physicians in trauma-focused specialties, such as emergency medicine and critical care, also described feeling relatively prepared for trauma care

given their training and education. Most of the PAs with whom we spoke described feeling prepared to deal with combat trauma during deployment.

Despite feeling prepared, many surgeons and some trauma-focused physicians expressed dissatisfaction about their ability to maintain their level of preparation at MTFs and said that their skills in trauma care had degraded because of inadequate volume of high-acuity or complex cases (i.e., number and type of cases). Some interviewees remarked that, to be truly broadly prepared for any type of trauma, a provider must treat trauma care routinely and that MTFs should be centered on and designed to provide trauma care on a regular basis to allow for skill maintenance.

Most physicians who were not surgeons or otherwise trained in trauma care described feeling ill-prepared to provide trauma care while deployed, in large part because they lacked medical education and training in trauma care. Regardless of level of preparation or type of medical education and training, many of our physician and PA interviewees spoke of an “initial hump” or “shock” to get over in terms of seeing and dealing with trauma patients.

Providers used several options to compensate for gaps in preparation for deployment. As needed, providers compensated for inadequate preparation by referring back to textbooks and engaging in email and phone consultations, if available. Work outside the MTF, including moonlighting and medical training agreements, can also mitigate gaps from MTF caseload and mix. While in garrison, most surgeons report seeking off-duty employment to fill gaps in their case volume and acuity.

Regardless of level of preparation or training, providers described having to “make do” with what they had at their disposal, both in terms of resources and in terms of other staff and providers, and to take on duties as needed to ensure that patients are cared for to the best of the providers’ abilities. At times, this meant taking on positions or duties for which they were not specifically trained or prepared; however, many described this as an important aspect of supporting the deployed force.

Courses and Trauma Rotations

Predeployment courses and trauma training can fill some gaps in preparedness for deployment. Execute Order 096-09 requires that each provider attend predeployment training courses within 180 days of deployment. Such courses offered are the Army Trauma Training Course, Joint Forces Combat Trauma Management Course (JFCTMC), and Tactical Combat Medical Care (TCMC). The Army Trauma Training Course includes a trauma rotation at Ryder Trauma Center.

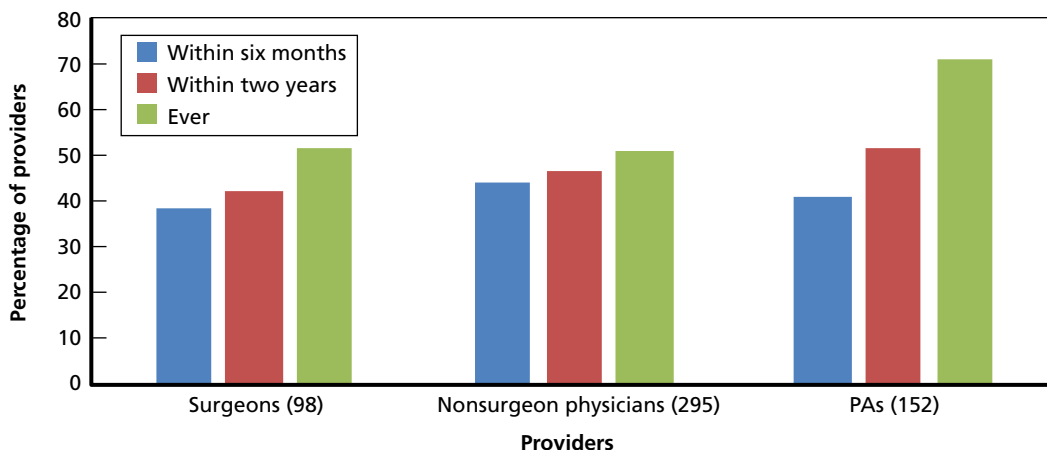
Interviewees praised the TCMC course in particular. Specific aspects of the course that they highlighted as being particularly salient included the live-tissue training, the simulated drills, and the quality of the teaching staff. Many appreciated that the faculty had significant experience in the field and were thus teaching the most-relevant aspects of trauma care to deployment.

However, as shown in Figure S.4, despite the requirement for predeployment training, many providers deploy without it. Depending on the provider type, attendance at the predeployment courses varies. Approximately 40 to 50 percent of all physicians and PAs attended predeployment courses within six months (for first-time deployers) or two years (for repeat deployers) of a deployment. However, PAs were more likely to have ever attended a course (70 percent had), regardless of the time frame considered.

Trauma-center rotations received mixed reviews from interviewees. Many surgeons emphasized that the trauma rotation at Ryder Trauma Center that is part of the Army Trauma Training Center (ATTC) program was neither useful nor an efficient use of time because they had little opportunity to provide hands-on care or take on primary management of the patient (which was primarily left to Ryder attending physicians and residents). Instead, they would have preferred either more time in garrison to practice specific procedures or more time in the surgical-skill labs that are part of the Army Trauma Training Course. Some interviewees also noted that the two-week time frame for the course was too long to be away from their clinical practices and families, especially before deployment.

Many providers also emphasized the need to maintain trauma preparedness by moving away from a model of just-in-time predeployment training and toward a model of routine trauma training. Some suggested requiring some type of basic combat trauma training every two years (or in some other appropriate and relevant time frame)

Figure S.4
Predeployment Course Attendance, by Primary Area-of-Concentration Group Deployed in Calendar Year 2013



SOURCES: Army Training Requirements and Resources System and Contingency Tracking System data on 2013 deployments.

NOTE: The numbers in parentheses are the numbers of 2013 deployments. The percentages are of active-component providers who deployed in 2013 and attended the Army Trauma Training Course, TCMC, or JFCTMC prior to deployment. Predeployment trauma training (PDTT) for officers includes the Army Trauma Training Course, JFCTMC, and TCMC.

instead. Within their descriptions of existing training courses, many emphasized the utility of live-tissue training, high-fidelity simulations, and stress drills as part of the courses and indicated a wish for greater emphases on these aspects of training. A few providers also indicated a wish to have clinical support staff (e.g., ward nurses, OR technicians) be better prepared for clinical duties and trauma care while deployed, to support overall care delivery.

Exercises and Deployment Experience

Interviewees reported that field experience, professional experience, and familiarity with units were all valuable to their preparation for deployment. Interviewees (particularly PAs) stressed the importance that having trained with their units had for their effectiveness in forward-deployed settings. Some noted that being able to train with their units, or being assigned to a unit prior to deployment, offered them the opportunity to understand and work with the population for whom they would be caring during their deployment—thereby increasing their effectiveness and credibility—as well as to prepare for the nonmedical aspects of the deployment (e.g., going on missions, returning fire).

Prior deployment experience was felt to be uniquely valuable in preparing providers for subsequent deployments. The extent to which providers felt unprepared for trauma care seemed to be related to how much and what kind of trauma they encountered while deployed, where they were located, the extent to which they had relevant resources (such as equipment and other staff) available to them, prior deployment experience, medical training, and evacuation times.

The deployment experience of PAs in particular was highlighted during interviews with PAs, surgeons, and other physicians, all of whom described a higher level of preparedness and experience among PAs. This was especially true among special operations force PAs (because of their more-extensive, more-routine trauma training) and among the many PAs who had previously served as medics (because of their prior training and experience with trauma on the frontline of battle). During interviews, physicians and PAs often stated that, because of their deployment experience, PAs were more comfortable than other providers were with BAS duties.

Findings

Our first main finding is that care in the deployed setting is often being delivered by people working outside their areas of specialty. Physicians deployed to caregiving functions deploy either to be field surgeons at BASs or medical companies or to work in surgical hospitals. In both settings, although there are exceptions, for many types of providers, the types of patient seen in theater are different from the types of patients seen at home.

Those who deploy as field surgeons are providing mostly primary care but must also be prepared to provide initial stabilization of trauma patients. Although family physicians and internists often deploy in this position and are well versed in primary care, the position is also often filled by other types of specialists who do not typically do primary care in their usual jobs. Moreover, few providers of any type see trauma care in their home-station jobs.

Meanwhile, surgeons, anesthesiologists, emergency-medicine physicians, and some internists deploy to FSTs or CSHs in theater. However, although they are being deployed into the same specialties as they normally work in their home stations, the nature of the work is different. At FSTs and CSHs, providers will see trauma cases that require surgical intervention. But, with few exceptions, providers at home-station MTFs do not see fresh trauma patients. Although some surgical skills from the peacetime setting can carry over to a wartime setting, it remains that trauma care in theater is often being delivered by people who do not see trauma at home.

Our second main finding is that PDTT is valuable but not sufficient. The Army and the U.S. Department of Defense offer a variety of PDTT courses, some of which are mandatory for personnel before they deploy to U.S. Central Command. The courses include a combination of classroom training, demonstrations, hands-on skill work, and simulations. Our interviews indicate that providers felt that these courses refreshed their skills and increased their comfort level with the mission.

However, there are three shortcomings with the trainings. The first shortcoming we found from our analysis is that, despite the requirement to attend training, too many providers deploy without it. The second shortcoming is that hands-on work is limited. Some courses, such as TCMC, use a variety of simulations but do not include work with human patients. Rotations at trauma centers, such as the ATTC, present the possibility of hands-on work, but, as the National Academies 2016 report on trauma care put it, “Brief ‘just-in-time’ rotations usually mean that nurses and physicians can observe clinical care but not actually perform it. This is analogous to watching someone fire a weapon, rather than actually firing it oneself” (National Academies of Sciences, Engineering, and Medicine, 2016, p. 375). The third shortcoming is that these training opportunities are limited in what they can accomplish in the time that they have, with TCMC being one week long and the Army Trauma Training Course being two. Even if students were to attend these trainings every two years, they would be, at best, refreshers and not a way of building lasting expertise.

Recommendations

Providers of all types of specialties learn and adapt to provide the best medical support that they can to soldiers, whether in BASs, medical-support companies, FSTs, or CSHs. After a decade and a half of war, AMEDD now includes people with the most

experience caring for those in the deployed setting, including combat trauma patients. But what of the next war? As operating tempo decreases and time goes on, experienced providers will leave the service and be replaced with newer providers without that war-time experience. How well would they care for service members, especially the most-critically injured trauma patients? How much expertise ought they have, and how can the Army ensure that expertise?

The National Academies of Sciences, Engineering, and Medicine’s 2016 report on trauma care provides a framework for thinking about where the Army is and where it ought to go. In a table, the report lays out five levels of clinical competence, ranging from novice to expert, along with examples of providers whose experience would fit into each of those levels. We have reproduced the content of that table in its entirety as Table S.1.

Where would AMEDD fit on this scale? Ideally, to provide the highest level of care in the event that someone is sick or injured, everyone in AMEDD would be at the expert level. Certainly, there are some in AMEDD who would be considered experts, including those who have had repeated deployments and those who, when not deployed, work in civilian trauma centers. However, not all providers have this level

Table S.1
National Academies of Sciences, Engineering, and Medicine’s Five Levels of Clinical Competence

Skill Level	Description	Trauma-Related Example
Novice	The novice has no experience in the environment in which he or she [is] expected to perform.	Administrator or technician who has never worked in a trauma center
Advanced beginner	The advanced beginner demonstrates marginally acceptable performance and has enough experience to note recurrent, meaningful situational components.	Medic [who] has had didactic trauma training but no clinical trauma experience
Competent	Competence is achieved when one begins to see one’s actions in terms of long-range goals or plans. [The competent provider] demonstrates efficiency, coordination, and confidence in his [or] her actions.	Board-eligible [or] -certified physician . . . has . . . rotated [only] as a resident at a trauma center
Proficient	The proficient [provider] perceives situations holistically and possesses the experience to understand what to expect in a given situation.	Board-eligible [or] -certified physician or new nurse starting [his or her] career at a high-volume and best-quality Level I trauma center
Expert	The expert has an intuitive and deep understanding of the total situation and is able to deliver complex medical care under highly stressful circumstances.	Trauma nurse coordinator or [fellowship-trained] trauma surgeon with years of experience at a high-volume and best-quality Level I trauma center

SOURCE: National Academies of Sciences, Engineering, and Medicine, 2016, Table 5-1.

NOTE: States define trauma-center levels differently, but the levels refer to the resources available and the annual patient volume, with Level I being the highest.

of expertise. Some might have far less. For this discussion, we divided the providers into two categories: The first category includes those who would be deployed as field surgeons, whether as the battalion surgeon or at a medical company. The second category includes those who will deploy at surgical facilities, whether at FSTs or CSHs; this includes the surgeons and the surgical teams, of course, but also those engaged in critical care. We then assessed the level of competence by comparing the level of training and type of work experience in which these providers normally engage with the “Trauma-Related Example” column of the National Academies table (in this report, Table S.1).

Providers who deploy as field surgeons to Role 1 BASs and Role 2 brigade support medical companies come from a variety of specialties (see Chapter Two).¹ Few of them are emergency-medicine physicians in their home-station jobs. Although these providers might have done emergency-room (ER) rotations as part of their training, for many of them, it has been a while since those rotations. Instead, their most-recent exposure to trauma would have been PDTT, such as the TCMC course—if they managed to attend it before deploying. Thus, it is possible that many of these providers have had didactic trauma training but no clinical trauma expertise. Consequently, we put them in the “advanced beginner” category.

According to the execute order, any provider deploying to an FST is supposed to do a rotation at the ATTC in Miami. Each FST member will thus have rotated through a trauma center, although, as interviewees noted, that member will not have had much patient contact during that time. Although some providers work in Level I trauma centers, relatively few of them have; most notably, the providers are assigned to Brooke Army Medical Center and, to a far lesser extent, the teaching cadre at the ATTC in Miami. Therefore, although some Army medical providers are “proficient” or “expert,” the bulk of FST and CSH providers, who do not work in trauma centers, would, if they had attended the ATTC, be in the “competent” category.

Near-Term Recommendations

For the immediate term, we recommend that the Army should take steps to ensure that there is no backsliding from the current expertise levels. For those who might deploy as field surgeons, the Army should make sure everyone maintains at least an advanced beginner level. **We recommend enforcing the requirement for predeploy-**

¹ According to Joint Publication 1-02 (Joint Chiefs of Staff, 2018, p. 201), the roles of medical care are

[t]he characterization of health support for the distribution of medical resources and capabilities. a. **Role 1.** Provides medical treatment, initial trauma care, and forward resuscitation, not including surgical care. Also known as unit-level medical care. b. **Role 2.** Provides medical treatment, advanced trauma management, emergency surgery, and resuscitative care. c. **Role 3.** Provides emergency and specialty surgery, intensive care, medical specialty care, and extended holding capacity and capability augmented by robust ancillary support. d. **Role 4.** Provides the full range of preventive, acute, restorative, curative, rehabilitative, and convalescent care found in United States base hospitals and robust overseas facilities.

ment training and further adding a requirement for refreshers every two years, not just prior to a deployment. Some courses, such as TCMC, were nearly universally praised by interviewees. However, although those courses are required, the Army has been falling short in ensuring that providers receive that valuable training before they deploy.

Anyone who deploys to an FST is required to do a rotation at a trauma center as his or her PDTT. We recommend enforcing that requirement, including with refreshers and not just prior to a scheduled deployment. In addition, we recommend that those deploying to CSHs also do such rotations at least every two years. These rotations need not be limited to attendance at the Miami program. It could also take the form of a requirement to periodically work in the ER of a local civilian trauma center, whether on duty as part of a training agreement or as off-duty employment. Critical to the usefulness of these rotations will be that they be designed to provide the attendees with hands-on work with trauma patients.

Longer-Term Recommendations

In the longer term, we recommend, the Army should move toward increasing the level of competence of providers—both those in the field-surgeon category and for those deploying to an FST or CSH—one step up each along the National Academies scale. We summarize these recommendations in Table S.2.

We recommend that anyone who will be deployed as a field surgeon attain at least the “competent” level on trauma as defined by the National Academies scale, meaning that he or she would have rotated in a trauma center. Although many providers will have had this as part of their initial medical training, for many, this will have been some time ago. Therefore, they should do regular rotations in such programs as the ATTC in Miami or periodically work in the ERs of their local civilian trauma centers.

We recommend that those who will deploy to FSTs or CSHs have at least the same level of proficiency as the Army would expect out of those who provide trauma care in civilian trauma centers. A way to ensure this would be to assign

Table S.2
A Proposed Longer-Term Way Forward

Deployed Duty	Key Phrase from the National Academies Report	Where the Army Is Now	Where the Army Should Be	What Would Be Needed
Field surgeon (BAS or medical-support company)	“Didactic trauma training but no clinical trauma experience”	Advanced beginner	Competent	Regular rotation at a trauma center
FST or CSH	“Rotated as a resident at a trauma center”	Competent	Proficient	Work at a high-volume Level I trauma center

FST and CSH providers in a way that they will see civilian trauma patients on a continuing basis, whether this be in MTFs that are or become trauma centers or in civilian Level I trauma centers. Preferably, they would be assigned together as teams so that they train together to work together. Regular work at a trauma center would give Army providers as much exposure to trauma as possible in a peacetime setting. Even if were not possible for the Army to place all their FST and CSH members in trauma centers, the Army might find it useful to designate more of its providers as trauma specialists and place them at trauma centers.

Finally, we recommend constructing a dashboard that would bring together the various information sources necessary to produce a picture of readiness for each provider. Although this does not directly help provider readiness per se, it enables providers and leaders to understand where gaps might lie for each person.

Acknowledgments

We are especially appreciative of the candid engagement from Anthony Stamilio, then–Deputy Assistant Secretary of the Army for Military Personnel and Quality of Life, and MG Robert D. Tenhet, Deputy Surgeon General of the Army.¹ Their support and feedback throughout the course of the study made the research possible, and their action officers, COL Felicia F. Pehrson of the Army Office of the Surgeon General and COL Michael L. Place of the Office of the Assistant Secretary of the Army for Manpower and Reserve Affairs, ensured that we had the necessary resources from the Army, including access to data and information about related work that was being done within the Army.

The Army has long been concerned with ensuring proficiency of its medical providers and, during the course of this study, was engaged in different efforts to monitor and improve provider readiness. Several people deserve special thanks for working with the RAND Arroyo Center research team to ensure that we were aware of their ongoing efforts. In particular, the Patient Administration Systems and Biostatistics Activity shared with us the Provider Ready tool, which enables a provider to see how his or her workload compares with that seen in theater. Its staff went above and beyond to engage with us, help us acquire data, and keep us informed of Patient Administration Systems and Biostatistics Activity work. Additionally, the Surgical Services Service Line was developing a concept model for assigning surgeons to medical treatment facilities in a way that would ensure that surgeons achieved the necessary case acuity, volume, and diversity.

We learned about the Army’s predeployment trauma training from representatives from the Army Trauma Training Center and the U.S. Army Medical Department Center and School Center for Prehospital Medicine, the latter of which invited us to attend the Tactical Combat Medical Care Course. We appreciate the insights provided to us by people who oversee Air Force and Navy efforts to keep providers medically ready, including the Air Force Medical Operations Agency, the Centers for the Sustainment of Trauma and Readiness Skills, and the Navy Trauma Training Center. Finally, to understand how medical requirements are determined, we consulted with the U.S.

¹ Ranks, titles, and affiliations are current as of this writing but, of course, might have changed since then.

U.S. Army Medical Command Manpower Division and Army Medical Department Personnel Proponent Directorate.

We visited two Army installations and interviewed providers from a third to learn about experiences while deployed, training that occurred prior to deployment, and preparedness for patient mix in theater. We appreciate the time and insight that providers at Fort Bragg, Fort Sam Houston, and Fort Riley shared with us. In addition, we interviewed several Office of the Surgeon General consultants who provided us with an overview of how personnel in their respective career fields are managed.

This research relied heavily on data from the Army, the Defense Manpower Data Center, and the Defense Health Agency. We appreciate their timely efforts to ensure that the data were of the highest possible quality.

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Abbreviations

ACS	American College of Surgeons
AHRQ	Agency for Healthcare Research and Quality
AMEDD	U.S. Army Medical Department
AOC	area of concentration
AR	Army regulation
ARTS	Army Medical Department Resource Tracking System
ASSET	Advanced Surgical Skills for Exposure in Trauma
ATLS	Advanced Trauma Life Support
ATOM	Advanced Trauma Operative Management
ATRRS	Army Training Requirements and Resources System
ATTC	Army Trauma Training Center
BAS	battalion aid station
C4	Combat Casualty Care Course
CCS	Clinical Classifications Software
CESC	Combat Extremity Surgery Course
CONUS	continental United States
CSH	combat support hospital
C-STARS	Centers for the Sustainment of Trauma and Readiness Skills
CTS	Contingency Tracking System
CY	calendar year

DMDC	Defense Manpower Data Center
DMRTI	Defense Medical Readiness Training Institute
DoD	U.S. Department of Defense
DoDTR	Department of Defense Trauma Registry
ER	emergency room
EWSC	Emergency War Surgery Course
EXORD	execute order
FNP	family nurse practitioner
FST	forward surgical team
GI	gastrointestinal
GME	graduate medical education
HCUP	Healthcare Cost and Utilization Project
HQDA	Headquarters, Department of the Army
ICD-9	<i>International Classification of Diseases, 9th rev.</i>
ICU	intensive care unit
JFCTMC	Joint Forces Combat Trauma Management Course
MDR	Military Health System Data Repository
MEDCOM	U.S. Army Medical Command
MHS	Military Health System
MTA	medical training agreement
MTF	medical treatment facility
N/A	not applicable
OB/GYN	obstetrician/gynecologist
ODE	off-duty employment
OEF	Operation Enduring Freedom
OIF	Operation Iraqi Freedom
OND	Operation New Dawn

OR	operating room
OTSG	Office of the (Army) Surgeon General
PA	physician assistant
PASBA	Patient Administration Systems and Biostatistics Activity
PDTT	predeployment trauma training
PHTLS	Prehospital Trauma Life Support
PROFIS	Professional Officer Filler System
SIDR	Standard Inpatient Data Record
SME	subject-matter expert
TAA	training affiliation agreement
TCMC	Tactical Combat Medical Care
TMDS	Theater Medical Data Store
USAF	U.S. Air Force
WEX	Work Experience File

Introduction

The U.S. Army Medical Department (AMEDD) mission statement says, “Army Medicine provides sustained health services and research in support of the Total Force to enable readiness and conserve the fighting strength while caring for our Soldiers for Life and their Families” (U.S. Army, 2016). Fulfilling this mission requires AMEDD providers to be proficient both while deployed overseas on the battlefield and while stationed at in-garrison MTFs caring for families, retirees, and soldiers.

The differences between the two dimensions of this mission have led some observers to perceive that two separate, almost unrelated systems exist; for example, a former Assistant Secretary of Defense for Health Affairs described the Military Health System (MHS) as “an HMO [health maintenance organization] that goes to war” (cited in Mabry and DeLorenzo, 2014, p. 83). The Military Compensation and Retirement Modernization Commission noted that “the medical care provided in typical military hospital and clinic settings is seldom directly applicable to combat-care injuries” and goes on to say, “Some military medical professionals have concluded that the expectation to deliver ongoing, high quality, beneficiary health care, while preparing for the possibility of war, creates competing interests and directs resources and training away from maintaining battlefield skills” (Military Compensation and Retirement Modernization Commission, 2015). Schwab, 2015, echoes this concern:

Readiness is critical to national defense and cannot be duplicated by any other agency or group of medical or surgical providers. Trauma combat casualty care is the core value of military medicine and for the medical corps of the tri-services. However, very few senior surgeons are focused on assuring readiness. (p. 239)

The skill sets required to meet this dual mission have some overlap but differ for some specialties. When deployed, health care providers treat injuries caused by combat trauma, as well as diseases and nonbattle injuries that are not routinely seen in garrison. Conversely, in garrison clinics and hospitals, providers treat active-duty soldiers and their dependents, who are generally healthy, as well as military retirees, but see relatively few trauma cases. As a result, the skills required to treat patients in theater,

including those with endemic and tropical diseases or trauma injuries, can atrophy during peacetime or dwell cycles.

In addition, in the deployed setting, billets for certain medical positions may be filled by personnel not accustomed to performing those specific duties. For example, billets for general medical officers are sometimes filled by specialists who, when in garrison, do not ordinarily treat a wide range of conditions, or even see patients of that age range. Therefore, predeployment activities must prepare Army medical personnel to provide care for the conditions they are reasonably likely to encounter in theater, including trauma cases and any other types of conditions and patients that a particular provider might not ordinarily see in garrison.

The military medical system has made great achievements in the wars in Afghanistan and Iraq. Soldiers survive injuries that they might not have survived in previous wars, benefiting from a combination of better protective equipment and better trauma care. As a Joint Trauma System review of care in Afghanistan noted, if a patient makes it to the theater hospital, his or her chance of survival is better than 98 percent (Kotwal, Butler, et al., 2013). However, this improved survival was the product of hard-won lessons from caring for injured soldiers, translated into new clinical practice guidelines that had to be taught to medical personnel so that they would adopt these new practices (Butler and Blackbourne, 2012; Eastridge, Mabry, et al., 2012). Soldiers surviving injuries also means that providers must be prepared to treat more—seriously injured soldiers than in the past, such as patients with multiple amputations from blast injuries (Dismounted Complex Blast Injury Task Force, 2011).

Despite the improvements in survival, more could be done. A 2009 study of in-hospital deaths at the Combat Support Hospital at Ibn Sina Hospital in Baghdad found “opportunities for improvement,” which they defined as “significant deviation from optimal care,” in 49 percent of the cases (Martin et al., 2009, p. S51). Among the study’s recommendations are several related to training, including mandatory predeployment trauma training (PDTT), regular mass-casualty exercises, and intensive care unit (ICU) staffing by board-certified intensivists. In addition, although the study was focused on deaths in the hospital, it noted that the opportunities for improvement most commonly existed in the care given before the patient arrived at the hospital—in transport and in early resuscitation—a finding echoed in Eastridge, Mabry, et al., 2012, that nearly one-quarter of all prehospital deaths in Operation Iraqi Freedom (OIF) and Operation Enduring Freedom (OEF) were potentially survivable. Thus, there are deaths that might have been prevented with more-proficient providers both inside and outside the hospital. For the research reported in Schwab, 2015, the author surveyed and interviewed surgeons who had deployed and found “a mismatch between the clinical training of fellowship and the surgical techniques necessary to control massive wounding and mass casualty incidents” (p. 237).

Further, as current operations wind down, the Army is concerned that lessons and skills learned about trauma care might be quickly forgotten as medical providers tran-

sition back to in-garrison care. The Army therefore asked RAND Arroyo Center to examine whether the predeployment training and experience of physicians and other clinical personnel are conducive to maintaining a maximally ready medical force. Understanding the trade-offs between providing medical care while in garrison and while deployed is a first step toward identifying and recommending mitigation strategies for any gaps in provider medical skills before a deployment.

RAND Arroyo Center's study sought to understand the following questions:

- **How does medical providers' experience in theater differ from that in garrison?** How does the clinical case mix at medical treatment facilities (MTFs) compare with that encountered in theater? To which clinical settings do providers deploy? Which types of specialists deploy to which types of positions?
- **How well do providers' education, training, and workload prepare them for the combat mission?** Specifically, how do the skill sets needed for the domestic mission differ from those needed for deployment? Are there gaps in the Army medical force's readiness to support combat operations?
- **How important are the "building blocks of readiness" for Army medical personnel?** That is, to what extent is readiness determined by specialty choice and the core skills that are part of residency training in the chosen residency? To what extent can new skills be learned through formal training beyond residency or fellowship? How important is ongoing training versus just-in-time training? Is it important that clinicians care for patients with certain kinds of illnesses or injuries, see a certain number of patients, or perform a certain number of procedures while they are deployed in garrison?
- **What options exist for improving the readiness of Army medical personnel?** To the extent that problems are identified and their causes understood, what can the Army do differently to mitigate these issues? What are the solutions that would improve the readiness of the Army's medical force?

Although the readiness of all medical personnel is of concern to the Army, for this study, we limited the scope to physicians and extenders, such as physician assistants (PAs) and nurse practitioners; in this report, for brevity, we refer to this population as *providers*. We recognize that this omits many others who are vital members of the care team, including nurses and enlisted medical technicians. In the course of interviews conducted during the study, we sought to capture those concerns where possible.

Building Blocks to Readiness

Many components contribute to the readiness of an Army medical provider. Although medical providers all have some elements of training in common, each provider also

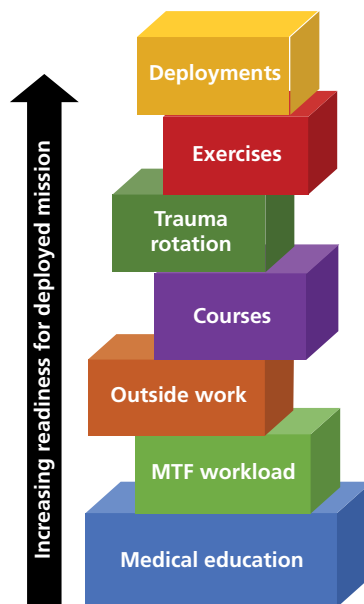
brings a different set of skills by virtue of his or her choice of specialty, work environment, and experience; consequently, each provider might have a different set of needs when preparing to deploy. We conceptualized this as a series of building blocks that contribute to a provider's readiness to perform tasks during a deployment (Figure 1.1).

The first three blocks are foundational, coming from a provider's original medical training and normal peacetime work experience. **Formal medical education and training**, including medical school, residencies, and fellowships, serve as the starting point. **Clinical work at the MTF** provides experience and keeps skills sharp. **Additional clinical work outside the MTF**, such as moonlighting or work performed under a medical training agreement (MTA), can increase case volume and provide a diversity of cases, which contribute to a provider's learning and knowledge.

The next four blocks are elements that are specific to knowledge needed during a deployment. **Courses**, such as those from the AMEDD Center and School and the Defense Medical Readiness Training Institute (DMRTI), can enhance a provider's preparation. Short-term **rotations at trauma centers** offer exposure to trauma patients. **Exercises** with a unit provide training in field operations and familiarity with fellow providers and soldiers in the unit. Finally, **deployments** over the course of a provider's career, in combat zones and in humanitarian-assistance operations, provide important experience.

We note that, although the building blocks in the diagram are shown as the same height, they do not all contribute equally to readiness. Although mild deficiencies in

Figure 1.1
Building Blocks to Readiness



one block might be mitigated by additional work in another block, severe deficiencies cannot be. As we discuss in this report, courses in trauma care are useful for refreshing the memories of students who do not ordinarily see trauma cases in their MTF work, but these courses cannot by themselves turn a student into a trauma expert. Similarly, although exercises contribute toward readiness, a few exercises cannot fully compensate for a shortfall in a provider's education or workload. True expertise and readiness depend on the depth and quality of each of these components, something that cannot be shown in a simple picture of blocks.

Overview of Data Sources and Methods

To examine the extent to which Army medical providers are ready for future deployments, we conducted qualitative analyses using primary data that we collected by interviewing providers, as well as quantitative analyses of existing administrative data. In this section, we provide an overview of our data sources, and the next section describes how we used them. Appendix A provides additional information on our quantitative data and methods, and Appendix B details our qualitative analysis.

Qualitative Data (Interviews)

We conducted semistructured interviews with providers who had previously or were currently deployed in support of OEF, OIF, or Operation New Dawn (OND). We also interviewed subject-matter experts (SMEs) in the areas of graduate medical education (GME); predeployment training for health care providers, including trauma training; and in individual clinical specialties. Our goals in conducting these interviews were to (1) learn about the challenges that providers encountered during deployments with respect to their training and skills and (2) identify potential solutions for overcoming these obstacles with the ultimate goal of improving patient outcomes in theater.

Most interviews were conducted by phone, but we also conducted two in-person site visits—to Fort Riley and Fort Sam Houston—to interview providers and SMEs. During the course of the study, we interviewed 71 people: 44 deployed providers (25 physicians, of whom 13 were surgeons; 14 PAs; and five nurses), 11 Office of the Surgeon General (OTSG) medical corps consultants, nine SMEs on Army trauma care and training, two directors of Army trauma training programs, and five directors or assistant directors of non-Army (other services') trauma training programs.

Quantitative Data

The secondary data that were used in our quantitative analyses included the following:

- the AMEDD Resource Tracking System (ARTS), which contains information on Professional Officer Filler System (PROFIS) deployments, the most relevant of which were the provider's assigned and duty areas of concentration (AOCs)
- the Army Training Requirements and Resources System (ATRRS), the Army's system of record management for tracking training, including information on PDTT courses that providers are required to attend prior to a scheduled deployment
- the Contingency Tracking System (CTS), a data-exchange system maintained by the Defense Manpower Data Center (DMDC) that contains individual-level, historical information on deployment activities
- the Deployed Standard Inpatient Data Repository (SIDR), which contains inpatient records from theater MTFs and is owned and maintained by AMEDD's Patient Administration Systems and Biostatistics Activity (PASBA)
- the MHS Data Repository (MDR), Defense Health Agency's data repository containing inpatient and outpatient health care encounters within the MHS and network of civilian providers
- the Work Experience File (WEX), a file owned and maintained by DMDC, which includes a small amount of administrative personnel information, such as pay grade, occupation, service, and component, for all active-duty active- and reserve-component service members who served since fiscal year 1991. We used this file to obtain primary, secondary, and duty AOCs for the providers covered in this study.

Appendix C contains a table that lists each of the specialists (and their AOCs) in the Army Medical Corps, Army Medical Specialist Corps, and Nurse Corps, which together encompass the population of providers covered in this report. It also describes which providers we included in our empirical analyses. Of the 41 Medical Corps officers, 30 are included in all of our analyses, and all 41 are included in some analyses. Among the four medical specialist provider types, we included only PAs (65D). There are 11 nurse specialties, and we focused on one: family nurse practitioners (FNPs) (66P).

Using the Building Blocks to Examine Provider Readiness

We used these building blocks as our conceptual framework for examining areas in which provider readiness could be improved. The extent to which medical education and MTF workload prepare a provider for the deployed mission depends on how well

the diagnoses seen and procedures performed give the provider the skills and practice necessary to handle the types of diagnoses and procedures seen in theater.

The first set of analyses addressed how well formal education prepares providers for their deployed duty. Our purpose here was not to judge the adequacy of medical education but rather to look at difficulties encountered when a provider is deployed to duties that differ from his or her training in a medical specialty. Some specialists, such as emergency-medicine physicians and surgical-team members, have duties in theater that are similar to their formal training and their MTF work. Others tend to be used differently, such as medical subspecialists who are often assigned to function as general medical officers when deploying to be battalion surgeons. We therefore looked at how providers of various specialties were assigned in theater. We cover this in Chapter Two.

The second set of analyses examines the difference between the work that providers do at home, particularly in the MTF, versus the work that they do in theater. In our quantitative analysis, we used garrison and theater medical records to compare the types of patients seen in the two settings. We also interviewed providers to understand their perceptions of how well their normal workload, whether inside the MTF or outside, helped prepare them for their missions. We cover this in Chapter Three.

In Chapter Four, we examine the utility of courses, trauma-center rotations, and other exercises that are designed to bridge the gap between life as a provider at home and life as a provider in the deployed setting. Here, too, we performed both quantitative and qualitative analyses. We analyzed attendance records of PDTT courses and cross-referenced them with deployment records to see whether people were receiving training before deployment. We also interviewed providers to get their views on the utility of such courses, as well as their perspectives on working with providers and soldiers with whom they had not previously worked.

Potential solutions for the Army to consider, informed by our analyses, are in Chapter Five. Recommendations are in Chapter Six.

How Medical Education Prepares Providers for Deployments

To examine how well providers are prepared for their deployed missions, one must first understand how they are deployed and how they are used when deployed. We begin by describing the Army's current process for deploying medical personnel. We then look at the extent to which the jobs into which providers are deployed differ from the ones in which they are formally trained. This chapter establishes the foundation for our subsequent discussion of medical personnel's preparation for combat missions.

The Army's Deployment Process

AMEDD contains all of the medical personnel in the Army. AMEDD is organized into six separate officer corps: Dental Corps, Medical Corps, Medical Service Corps, Nurse Corps, Specialist Corps, and Veterinary Corps; there is also an enlisted Health Services branch. Among the providers who were the focus of our study, physicians, the main focus, are in the Medical Corps; PAs are in the Medical Specialist Corps, and FNPs are in the Nurse Corps.¹

Roles of Care

When the Army deploys medical capabilities, the capabilities are categorized into "roles" according to Joint Publication 4-02 (Joint Chiefs of Staff, 2012). A typical combat battalion has a medical platoon that operates the battalion aid station (BAS). Because that represents the first level of care, it is referred to as a Role 1 capability (Joint Chiefs of Staff, 2012). The next role is the brigade support battalion's medical company, which provides a more robust set of medical services in support of the brigade and is known as a Role 2 facility. Role 2 facilities have more personnel and equipment than Role 1 facilities do, including added capabilities, such as X-ray, lab, and dental. Role 2 also

¹ Appendix C contains a list of all specialties in the Medical Corps, Medical Specialist Corps, and the Nurse Corps. The scope of this report includes all 41 specialists in the Medical Corps (although only 30 are included in the analysis in Chapter Two, also detailed in Appendix C), one of four specialists in the Medical Specialist Corps, and one of 11 specialists in the Nurse Corps.

adds a surgical function in the form of forward surgical teams (FSTs), which are small teams that perform resuscitative surgery in austere locations. Combat support hospitals (CSHs) provide hospital capability in theater, including a fuller surgical capability and inpatient capability, and are known as Role 3 facilities.

Some AMEDD providers are assigned to deployable operating force combat units (e.g., medical platoons within an infantry or armor battalion or a medical company within the brigade support battalion of a brigade combat team) or medical units, which include FSTs and CSHs. For example, a medical platoon has a PA who is assigned full time to that battalion; that PA is said to be organic to the unit and is the primary-care provider to the unit's soldiers in garrison. The battalion also has a position for a physician, known as the battalion surgeon or, more generically, as a field surgeon (AOC 62B). That position is not normally filled when the battalion is in garrison. When the battalion is called on to deploy, it requests a physician to fill the position of field surgeon (AOC 62B) to supplement the organic PA and ensure adequate battlefield medical capability. This request goes through PROFIS.² Similarly, a medical company typically has an authorized 62B, as well as a PROFIS required-not-authorized 62B position. A typical FST is made up of 20 personnel, half of whom are officers, and half of its officer positions are identified as PROFIS positions. A typical CSH has more than 150 officer positions, but only about 25 of these are authorized while the unit is in garrison, with the rest being PROFIS positions.

Thus, there are Army medical personnel who are assigned to a deploying combat or medical unit and who deploy when the unit deploys. However, the majority of Army medical personnel deploy through PROFIS. Because PROFIS is commonly used in deploying Army medical personnel, we describe the system in more detail below.

Filling Medical Positions Using the Professional Officer Filler System

If an operating force unit has a vacant medical provider authorization that should be filled while in garrison but is not (perhaps because of lack of personnel or the last provider leaving the unit sooner than expected), the Army uses PROFIS to fill the position before the unit deploys. The system provides necessary medical support to Army units in deployed settings while ensuring that medical providers maintain their clinical skills in garrison by providing care to family members, retirees, and soldiers.

Some active-duty medical corps officer AOCs do not have authorized positions in deployable Army operating force (combat or medical) units, although personnel in these positions can still be deployed. For example, a 60H cardiologist, while authorized in MTFs in garrison, is not required or authorized in any deployable modification-table-of-organization-and-equipment unit. These AOCs can deploy as either an AMEDD immaterial 05A position, a medical corps immaterial 60A position, or a Medical Corps

² For more information about PROFIS, see Army Regulation (AR) 601-142 (Headquarters, Department of the Army [HQDA], 2007) and Sorbero et al., 2013.

field-surgeon 62B position.³ Although the 05A and 60A positions tend to be mostly administrative leadership jobs, the field-surgeon 62B position is a medical provider job. In accordance with AR 601-142, many Medical Corps AOCs can be used to fill 62B field-surgeon positions.⁴

Importantly, physicians who are called on to deploy through PROFIS typically need to prepare quickly for deployment. When an operating force unit with a PROFIS position is tasked to deploy, U.S. Army Medical Command (MEDCOM) receives a tasking from the Assistant Chief of Staff of the Army for Operations and Training (G3). MEDCOM identifies a “filler” for the PROFIS position from one of its subordinate units using the PROFIS Deployment System; the provider selected to fill the PROFIS tasking is typically assigned to a generating-force MTF to provide patient care to soldiers, their families, and retirees. Providers in an MTF understand that, even though the MTF does not deploy as a unit, the provider might deploy with an operating force unit through PROFIS.

Although the provider remains assigned to the current MTF, he or she receives orders that administratively attach him or her to a deploying unit (which might or might not be at the same duty station). MTF providers typically have patient schedules planned for six to eight weeks in advance so, once a PROFIS task comes through, there is a sense of urgency to support that provider in quickly transitioning from caring for patients in garrison to preparing for a deployment. Providers are often processed through the Continental United States (CONUS) Replacement Center to ensure the completion of all required deployment tasks (e.g., mandatory training, weapon qualification) prior to deployment.

If an MTF provider is identified early enough for a future deployment, the provider might have the opportunity to join the unit in collective training at the unit’s home station or at a combat training center prior to deployment. However, such training is not always possible, given the timelines and amount of coordination needed for deployment.

³ An immaterial position is one that “is not identified with or limited to one specific branch of the Army but . . . that any commissioned officer may fill” (HQDA, 1983, p. 33).

⁴ The other specialties and subspecialties that can substitute for 62B are pediatrician (general or fellowship trained) (60P); internist (61F); family physician (61H); preventive-medicine officer (60C); occupational-medicine officer (60D); pulmonary-disease officer (60F); gastroenterologist (60G); cardiologist (60H); dermatologist (60L); neurologist (60V); endocrinologist (61C); rheumatologist (61D); flight surgeon (61N); physiatrist (61P); emergency physician (62A); obstetrician/gynecologist (OB/GYN) (60J); allergist, clinical immunologist (60M); medical oncologist/hematologist (61B); and clinical pharmacologist (61E).

How Medical Specialties Were Used During Recent Deployments

To understand how different specialties were deployed during recent operations, we used data from ARTS, which contains records of deployment taskings. Our data set included records from 2005 through 2015. Using this data set, we could see where and how various specialists were used in theater. We focused our attention on Role 1 through Role 3 medical facilities: BAS (Role 1) and medical company (Role 2), which provide primary care and initial trauma care; FST (Role 2), which provides surgical care; and CSH (Role 3), which provides surgical care and hospitalization. Each role has a unique set of duties and skills, as described further in this section.

For each position that needed to be filled, these data provide the AOC of the position, the AOC of the person deployed to fill it, and the unit being supported. Table 2.1 provides an overview of the ways in which Army medical providers have been deployed.

Battalion Aid Station and Brigade Support Battalion Medical Company

Physicians assigned to the battalion are called battalion surgeons and, along with those assigned to the brigade support battalion medical company, are more generically referred to as field surgeons. The field-surgeon position is that of a generalist. Duties are likely to require providing minor outpatient acute care not directly related to combat (i.e., “sick call”), including minor musculoskeletal injury and wound care and minor respiratory care for colds, flus, and allergies. Other duties might include providing major-trauma resuscitation related to combat, including mass-casualty situations, in which the care is generally focused on immediate damage control in preparation for evacuation to a higher role of care. These duties require providers to have skills in and experience with both basic adult primary care and minor-trauma care. Although primary care and basic trauma care are part of the training that physicians

Table 2.1
How Providers Are Deployed

Type of Job or Facility	Type of Provider Deployed	Kind of Workload Generally Seen
Field surgeon <ul style="list-style-type: none"> • BAS • Brigade support battalion medical company 	<ul style="list-style-type: none"> • Most specialties 	<ul style="list-style-type: none"> • Outpatient care (sick call) • Trauma resuscitation
FST	<ul style="list-style-type: none"> • Surgeons and supporting specialties 	<ul style="list-style-type: none"> • Trauma surgery
CSH	<ul style="list-style-type: none"> • Surgeons and supporting specialties • Internal-medicine specialties • Emergency-medicine physicians 	<ul style="list-style-type: none"> • Trauma and other surgery • Inpatients • Outpatient care

get during their schooling, for many specialties, these skills would not be practiced in the course of the normal patient workload.

Forward Surgical Team

Here, duties involve predominantly major-trauma resuscitation and damage-control surgery. Necessary skills include being able to lead a clinical team in the treatment of a major-trauma patient and being proficient with a range of emergent, high-risk, potentially life-saving procedures. An important skill for the FST (and indeed in any major-combat trauma situation) is the ability to prioritize the care of the individual trauma patient and care across multiple patients in a mass-casualty situation. Trauma resuscitation skills are explicit core competencies of emergency medicine and general surgery but not of most other provider specialties. Whether or not there is a need for expertise in trauma-specific surgical skills is an area of disagreement between those who believe that general surgery residencies provide training that should be sufficient for independent trauma surgery practice and those who advocate trauma fellowship training for anybody who is responsible for leading a surgical trauma team. However, many U.S. trauma centers require trauma surgeons to have training or experience beyond residency training, suggesting that general surgery training alone does not meet civilian standards for independent care of major trauma.

Combat Support Hospital

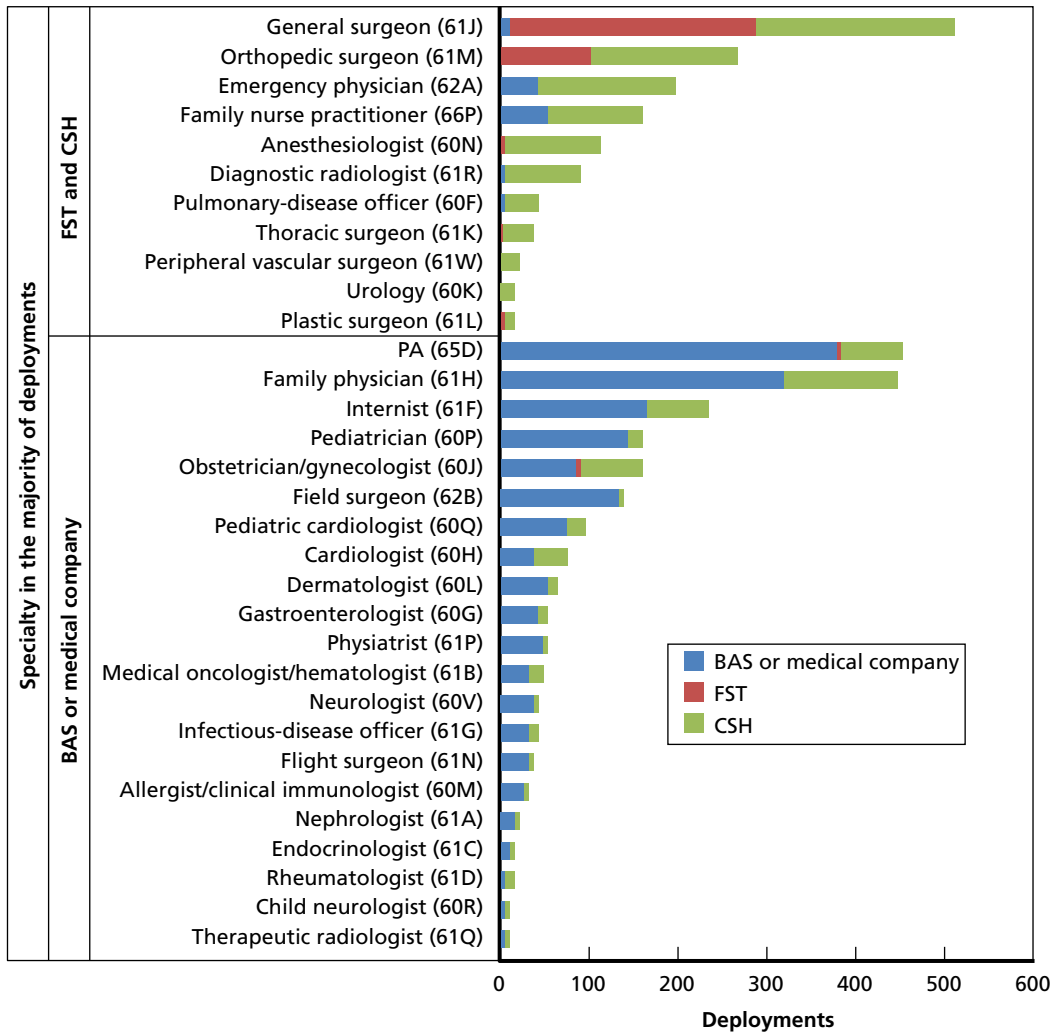
At the CSH, medical personnel perform a wide range of duties, so many of the specialists who deploy to Role 3 facilities will perform duties associated with their specialties, such as internists functioning as hospitalists and intensivists overseeing care in ICUs. In general, duties at the CSH involve providing trauma care, such as major surgery (damage control and reparative), critical care management, and stabilization for transport out of theater, as well as sick call and specialty care on an as-needed basis.

How Various Specialties Are Used During Deployment

Ideally, providers' formal education and clinical work done at home would prepare them for the deployed mission, but those experiences can fall short when deployed providers are asked to serve in positions that differ from their garrison specialties. We looked at the match between providers' areas of specialization in garrison—the positions for which they were prepared as a result of their formal education and training—and their deployment positions.

As seen in Figure 2.1, providers fall into two groups as far as where they are deployed. The first group, shown in the top panel of the figure, includes specialties that deploy predominantly into FST and CSH. These deployments included surgeons of various types, as well as radiologists, anesthesiologists, and emergency-medicine physi-

Figure 2.1
Providers Tasked to Facilities, January 2005 Through January 2015



SOURCE: ARTS 2005–2015 data.

NOTE: Data included in this figure are limited by the information available in ARTS. Of the 41 Medical Corps specialties, ARTS contained data on 30. Appendix C provides a full list of AOCs in the Medical, Nurse, and Specialist Corps and which providers in each corps we included in the analyses reported in this chapter.

cians. Specialists who deploy to those facilities work in their general areas of expertise, although they might be called on for work that might be supervised by physicians with additional qualifications at the best civilian centers (e.g., trauma surgery, pediatric trauma surgery, burn surgery). Urologists deploy primarily to CSHs, as do pulmonary-disease officers. The latter are listed as working in their own specialties or as internists; interviews indicate that they work primarily in ICUs. Emergency physicians, whose

skill sets would be well suited at all levels, deploy to field-surgeon positions but have deployed mainly to CSHs.

The second group, shown in the bottom panel of Figure 2.1, consists of specialties that deploy primarily to either BASs or medical companies, where they are listed as serving as field surgeons.⁵ Some people with those specialties are deployed to CSHs; the records generally list them as serving in the positions of family physicians or internists (especially for internal-medicine subspecialists) or in their specialties (e.g., some dermatologists are listed as serving at CSHs). OB/GYNs with fellowship training in gynecologic oncology can be deployed, within limits specified in AR 601-142 (AMEDD's PROFIS regulation), as general surgeons to facilities that have at least one residency-trained general surgeon on site (HQDA, 2007).

Preparation for Duties of a Field Surgeon

From our interviews, some providers felt uncomfortable in the position of field surgeon. The field-surgeon position, whether at a BAS or a medical company, is that of a generalist; however, this position is often filled by specialists who are unaccustomed to sick-call duties.

Nontrauma care or sick call was frequently described by our provider interviewees and constituted the majority of care provided at Role 1 facilities (i.e., BASs). Types of nontrauma care provided included minor wound care; minor orthopedic or musculoskeletal care (i.e., aches and sprains, including sore muscles or minor sprains often from gym activity or routine maintenance work on base); minor respiratory care, such as treating colds, flus, or allergies; and, less frequently, area-specific conditions, including diseases (such as leishmaniasis) or unusual disease manifestations (such as cystic tuberculosis, a form of the disease not typically seen in the United States). The latter category included patients from the local area, as well as U.S. soldiers.

To varying degrees, the ability to provide sick-call care (i.e., outpatient medical care and minor injury and wound care) is considered to be among the core skill set of any medical school graduate. However, although every physician should be familiar with the basics of evaluating acute complaints among healthy patients, treating minor infectious illnesses, suturing lacerations, and the like, some will have had little experience in this regard since medical school, and the ability to manage higher-complexity cases of these types effectively and efficiently does require additional skills. The variety

⁵ The field-surgeon position is unique to the deployed environment and is designated 62B. However, this same designation is used in the home environment to denote a physician who does not hold a specialty per se, such as someone awaiting admission to a fellowship program.

of provider types shown in Figure 2.1 would have different levels of preparation for addressing the generalist duties required in combat:

- Internists (including internal-medicine subspecialists), in their usual practice in garrison, typically have limited exposure to complex wound care or to care of patients with acute orthopedic injuries (e.g., splinting, decisionmaking regarding need for radiography, duration of immobilization).
- Most surgeons would be well trained in the care of patients with minor injuries but would not have received specific training in ambulatory care of patients with medical complaints.
- Family medicine and emergency medicine are two specialties whose scope of training explicitly includes the spectrum of both medical and surgical complaints and conditions that would be expected in this type of setting. Family-medicine training focuses more than emergency medicine does on follow-up care (beyond the initial injury or first visit for illness), whereas emergency medicine focuses less on follow-up care and more on higher-complexity cases.
- Neurology, dermatology, and physiatry are primary specialties that are quite narrow in scope; residency in these specialties would not include any formal training in care of a broad spectrum of acute illness or injury.
- Pediatrics is a special case in which acute illness and injury are both within the scope of training, but only for patients up to 18 years of age; the degree to which these skills translate to a patient population older than that is not well defined.
- Likewise, although OB/GYNs often act as primary-care providers for their patients, their formal training in acute care beyond the conditions and complaints common in that population is limited (Accreditation Council for Graduate Medical Education, American Board of Obstetrics and Gynecology, and American College of Obstetrics and Gynecology, 2015).

During interviews, both physicians and PAs expressed a range of reactions to the need to take on more generalist duties during deployment. PAs and those in some physician specialties—internal medicine, family practice, and emergency medicine—described feeling comfortable providing sick-call care while deployed; some remarked that their deployed patients were essentially the same population with the same needs as they were used to caring for in garrison. These providers said that both their medical training and their current clinical practice were well aligned with their sick-call duties and responsibilities while deployed. A few of these providers mentioned dealing with area-specific conditions that were new to them but said that they had enough support via email, telephone-to-theater consultants, and specialists in the United States to adequately evaluate and treat (or evacuate, if appropriate) these patients.

Internal-medicine subspecialist physicians described being less comfortable or prepared to manage sick-call duties while deployed, given the amount of time between

their internal-medicine training and their deployment, during which they were practicing only in their specialties. Still, these providers noted that, without too much additional effort, they were able to come up to speed fairly rapidly once deployed and take on their sick-call duties. Some said that they would refer back to their internal-medicine textbooks, contact theater consultants, or use an email consulting service that connected them with specialists in San Antonio for anything they were having trouble evaluating or treating. By drawing on their own medical training and these resources, these providers generally felt prepared to take on primary-care duties while deployed. A few providers suggested that a short rotation in a primary-care or orthopedic clinic prior to deployment might have been helpful but also noted that, in the end, they were able to manage sick call without such an experience.

Specialists without internal-medicine training (e.g., dermatology or neurology) tended to feel further out of scope in providing sick-call care, lacking both the medical training and clinical practice experience in primary care. They pointed out that the Army model treats physicians as “all the same” when there is, in reality, a vast difference between some specialist skills and scope of practice and those of a general-medicine physician. Often, these providers relied on PAs to support their practice while deployed, and a few described an unspoken but functional arrangement of sharing patient workload and, when needed, evaluating or treating patients collaboratively. Providers talked about “bouncing ideas off each other” and “confirming suspected diagnoses” with each other, in addition to utilizing the resources described above, in their care of nontrauma patients.

The issue of provider comfort with and preparedness for providing generalist care during deployment did not arise during nurse interviews.

This discussion has shown that, for many providers, there is a significant gap between the provider’s area of specialization and his or her job in theater. In Chapter Three, we build on this discussion by looking more closely at the medical workload in garrison and in theater.

Summary

Most AMEDD medical providers are not assigned full time to combat units but rather to MTFs where they work in their respective specialties caring for patients. When units deploy, providers are pulled from their MTF duties to fill positions in theater hospitals, surgical teams, or general officers within medical companies or the BAS. Surgical and hospital specialists deploying to the FST and CSH typically work within their specialty areas there, so their formal training is a good match for their deployed duties. However, most other specialties are called on to fill the field-surgeon position, such as at the BAS. This position requires the provider to be a generalist, which requires skill at both adult primary care and minor-trauma care. For these providers especially, there

can be a very large difference between the work they normally do at home and the work they are called on to do in theater.

In Chapter Three, we take a more detailed look at how the work performed by providers, caring for patients at MTFs in garrison, differs from the work performed in theater.

How Medical Treatment Facility Workload and Outside Work Prepare Providers

To understand how well providers' work prepares them for deployment, we needed first to look more closely at the medical environment in theater. In Chapter Two, we focused on the need for medical specialists to serve in generalist positions, addressing sick call and other forms of nontrauma care. Here, we focus more specifically on the need for major-trauma care.

Beyond operative skills, successful care of the critically injured trauma patient requires proficiency in specific cognitive and procedural skills, including the following:

- leadership of a multidisciplinary clinical team in evaluating and treating a major-trauma patient within the first hour after arrival at a medical venue
- rapid implementation of highly protocolized methods of evaluation, decision-making, and treatment
- proficiency at a range of emergent, high-risk, potentially life-saving procedures, including endotracheal intubation, cricothyrotomy, tube thoracostomy, and central venous access
- the ability to prioritize both the care of the individual trauma patient and the care of multiple patients in a mass-casualty situation.

Trauma skills are explicit core competencies of emergency medicine and general surgery, but few other medical specialties are likely to have significant and relevant trauma-care training or prior experience. Emergency-medicine physicians and general surgeons are typically deployed at CSHs or FSTs, which routinely expect to receive major-trauma patients. However, physicians with no formal trauma training, often deployed at outpatient facilities farther downrange, might also find themselves having to treat trauma patients and thus provide care that is outside their usual scope of training, experience, and abilities. Providers at these facilities (e.g., BASs and medical companies) might serve as “first responders” until the patient can be evacuated to higher levels of care but might also be called on to provide extended care when evacuation is not possible.

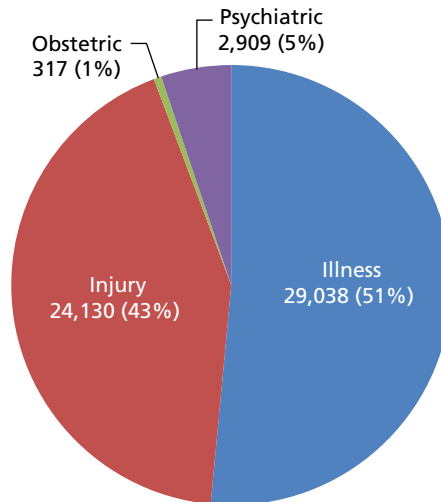
To better understand the extent to which providers might be prepared for trauma care in the deployed environment, we first compare case mix and volume between the garrison and deployed settings to understand whether and how in-garrison practice

reflects, and thus supports, deployed practice. We then describe qualitative findings from our interviews with previously deployed providers regarding their perceptions of preparation for trauma care.

Hospitalization in Theater Compared with That in Garrison

We compared 56,394 hospitalization records for patients at theater CSHs (Figure 3.1) and 823,169 for patients treated at garrison MTFs (Figure 3.2) across three major categories: medical and surgical, obstetric, and psychiatric conditions.¹ In theater, the majority of hospitalizations were for illness and injury complaints (combined, 94.2 percent), with far fewer hospitalizations for psychiatric (5.2 percent) and obstetric condi-

Figure 3.1
Reasons for Hospitalization in Theater, 2004–2010



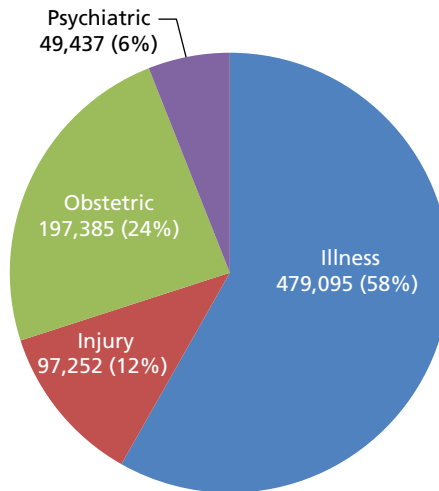
SOURCES: Deployed SIDR; World Health Organization, 1978; HCUP, undated.

NOTE: The data represent all hospitalizations at CSHs in theater ($N = 56,394$) between 2004 and 2010. The reason for hospitalization is based on the coded principal discharge diagnosis.

¹ Theater data from settings other than CSHs (i.e., BAS, medical company, FST) were not available. They exist in a system called Theater Medical Data Store, but we did not have access to those data for this study. Given that much of the care that is delivered in theater is outpatient, nontrauma care, the absence of these data is a limitation of our analysis.

Hospitalizations were categorized by mapping the *International Classification of Diseases*, 9th rev. (ICD-9) (World Health Organization, 1978) code for principal discharge diagnosis to Agency for Healthcare Research and Quality (AHRQ) single-level clinical classification categories (the Healthcare Cost and Utilization Project's [HCUP's] "Clinical Classifications Software (CCS) for ICD-9-CM" for diagnoses). Obstetric hospitalizations

Figure 3.2
Reasons for Hospitalization in Garrison, 2004–2010



SOURCES: MDR; World Health Organization, 1978; HCUP, undated.
 NOTE: The data represent all hospitalizations ($N = 823,169$) at MTFs between 2004 and 2010. The reason for hospitalization is based on the coded principal discharge diagnosis. Live births ($N = 172,596$) were counted as one hospitalization for the mother, not one each for the mother and child.

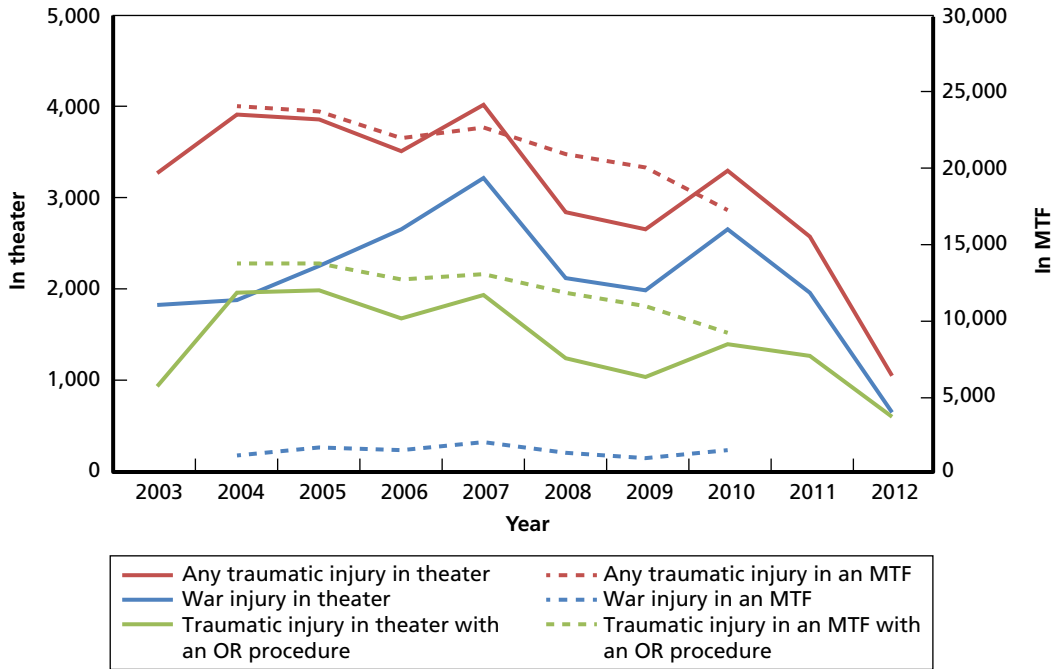
tions (0.6 percent). In Garrison, in contrast, nearly one-quarter of hospitalizations were for obstetric-related conditions.

We also compared the number of hospitalizations for traumatic injury (ICD-9 code for principal diagnosis that maps to AHRQ a clinical classification category between 225 and 244) and for war injuries (the presence of an E code between E990 and E999 in any diagnosis field), across the two venues.² Figure 3.3 shows the number of hospitalizations for traumatic injuries and the number specifically for war-related injuries, by calendar year (CY), for both theater and MTFs. Hospitalizations for war injuries in theater account for a large fraction of hospitalizations for traumatic injury in theater, as indicated by the proximity of the solid blue line to the solid red line. In contrast, a far smaller fraction of the hospitalizations in MTF is for injuries that would be considered war related, as indicated by the distance from the dotted blue line to the dotted red line.

were defined by categories 176 through 196 and psychiatric by categories 650–670. Hospitalizations that mapped to category 218 (live-born infant) were excluded. All other hospitalizations were classified as illness or injury.

² An E code is an ICD-9 code for an external cause of injury or poisoning. Codes E990 through E999 are those for injuries resulting from operations of war.

Figure 3.3
Numbers of Hospitalizations with Inpatient Procedures for Traumatic and War Injuries in Theater and at Medical Treatment Facilities



SOURCES: 2004–2010 MDR SIDR; 2002–2013 PASBA Deployed SIDR.

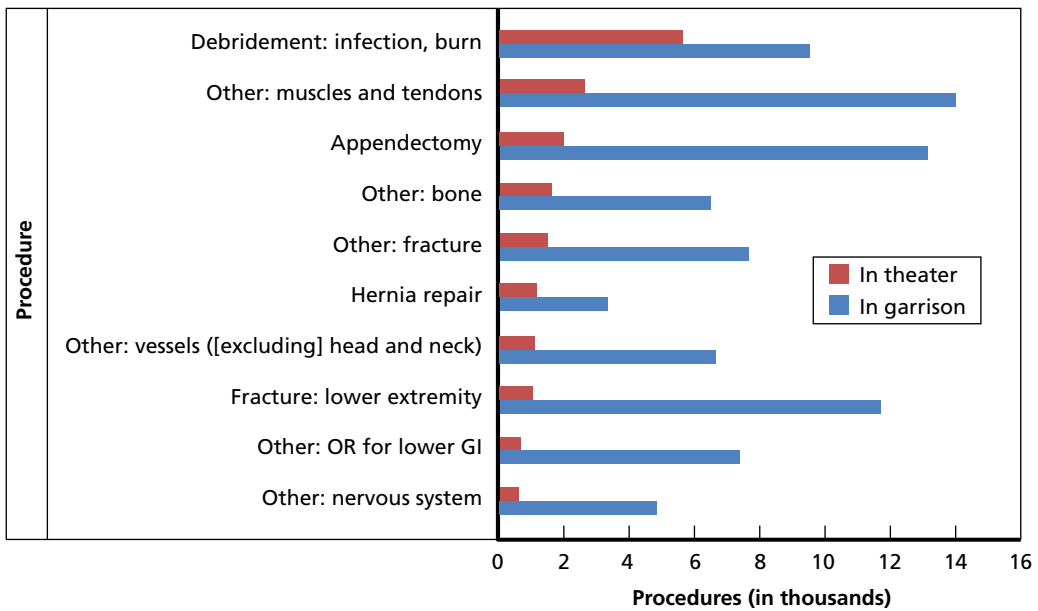
It is important to note that hospitalizations for traumatic injury in theater are likely to involve penetrating or blunt polytrauma, which, in garrison, would be seen predominantly only at trauma centers. It is likely that many of the MTF hospitalizations for traumatic injury include elective (e.g., orthopedic) procedures less reflective of theater combat trauma care.

Major Procedures in Theater Compared with Those in Garrison

We also compared the most-common major therapeutic procedures performed in theater and in garrison MTFs to understand the clinical focus at the organizational and provider levels. Major therapeutic procedures are defined by a classification algorithm developed by AHRQ’s HCUP, which groups ICD-9 procedure codes into four mutually exclusive categories (Minor Diagnostic, Minor Therapeutic, Major Diagnostic, and Major Therapeutic). Major therapeutic procedures were then further subdivided into procedure types according to AHRQ’s clinical classification scheme for services and procedures (HCUP Clinical Classifications Software for Services and Procedures).

To understand clinical focus at the organizational level, we compared the relative frequency of major therapeutic procedures performed in theater ($N = 28,313$) versus in garrison ($N = 411,557$) without regard to the specialty of the physician performing the procedure.³ In Figure 3.4, we list the ten most-common procedures performed in theater and compare the frequencies with which they are performed in theater and in garrison. In Figure 3.5, we list the ten most-common procedures performed in garrison, again comparing the frequencies with which they are performed in theater and in garrison. In theater, the most common major procedure was wound debridement (around 6,000 procedures, compared with nearly 10,000 procedures at MTFs). In contrast, at MTFs, the most common procedure was cesarean section (more than 50,000). The surgical case mix was substantially less diverse during deployments than in the domestic MTF setting, as evidenced by the fact that the ten most-common procedures performed in theater made up 64 percent of the in-theater total, whereas the ten most-

Figure 3.4
Frequency of the Most-Common Procedures in Theater, All Specialties, Compared with Their Frequency in Garrison

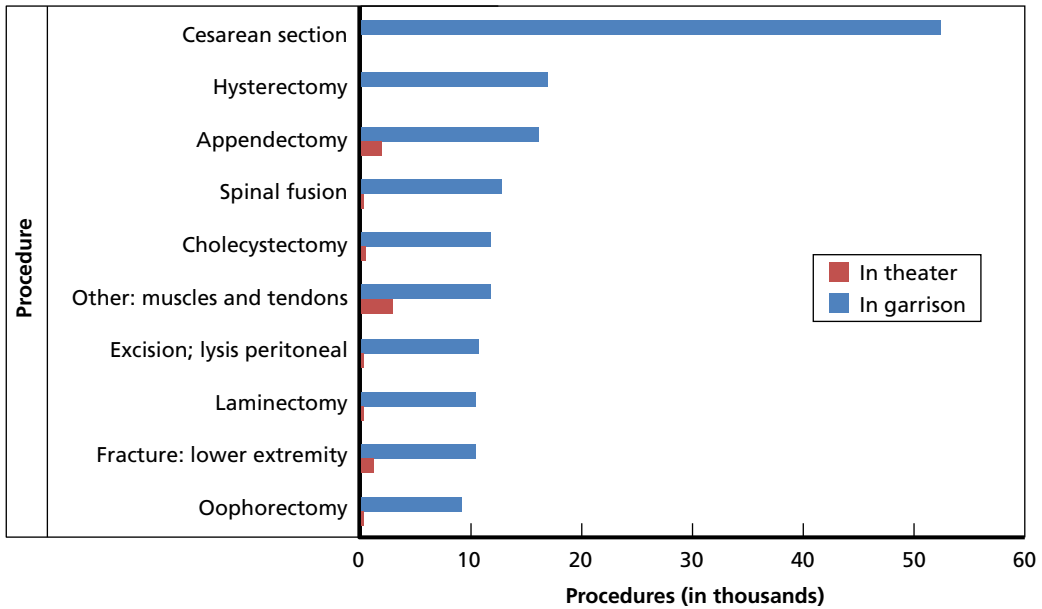


SOURCES: Deployed SIDR, 2004–2010; MDR 2004–2010. Theater data show all services; garrison data show Army MTF only. Circumcisions (procedure category 115), performed primarily on newborn infants, were excluded from the numerators and denominators.

NOTE: OR = operating room. GI = gastrointestinal.

³ The unit of analysis was the procedure. A given hospitalization might not involve a major therapeutic procedure or might involve more than one.

Figure 3.5
Frequency of the Most-Common Procedures in Garrison, All Surgical Specialties, Compared with Their Frequency in Theater

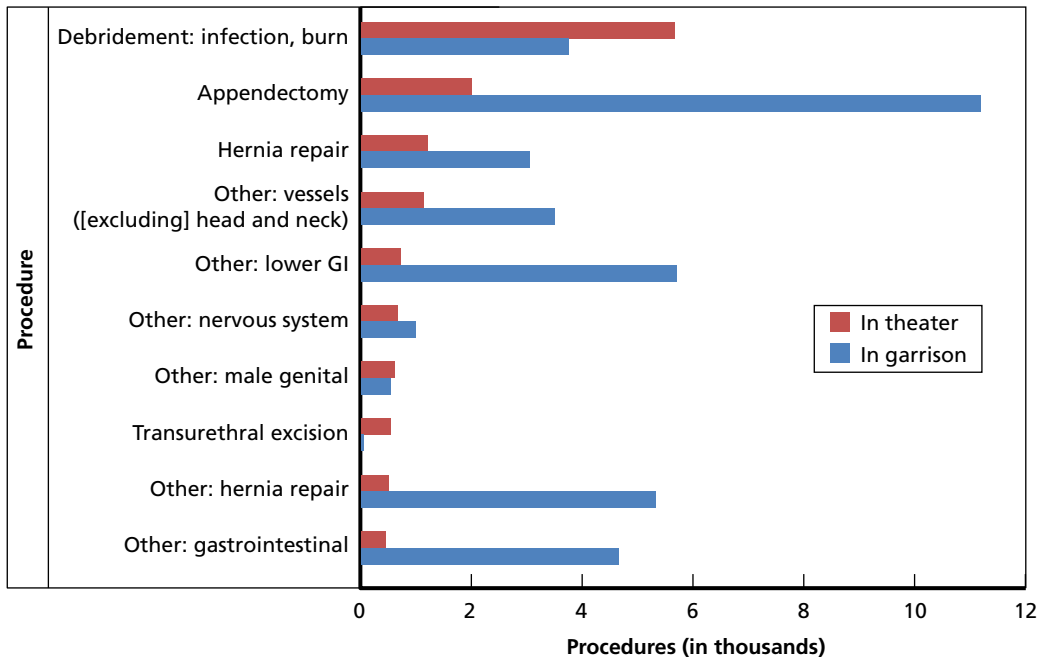


SOURCES: Deployed SIDR, 2004–2010; MDR 2004–2010. Theater data show all services; garrison data show Army MTF only. Circumcisions (procedure category 115), performed primarily on newborn infants, were excluded from the numerators and denominators.

common MTF procedures made up only 39 percent of procedures performed at MTFs (data not shown).

To understand the clinical focus at the provider level, we compared the surgical case mix for a specific provider type: general surgeons. Our in-theater data did not provide the specialty of the physician performing the procedure. However, we approximated the in-theater general surgery case mix by excluding orthopedic and neurosurgical procedures from the analysis. On the MTF side, we used AOC description as a close surrogate for physician specialty; here, we included all subspecialties of general surgery but excluded current trainees and physicians with different primary boards (e.g., neurosurgeons, otolaryngologists), who would not typically deploy into the position of general surgeon. Figures 3.6 and 3.7 show the results of this analysis: Deployed surgeons performed almost 6,000 wound-debridement procedures in theater, compared with approximately 4,000 at MTFs. With the exception of this procedure, however, all common procedures in theater are actually performed more frequently in garrison. Of course, at any point in time, there are many more providers in garrison performing all of these procedures than there are in theater. However, data limitations can minimize true disparities. Trauma laparotomy, craniotomy, and reduction and washout of open femur fractures are examples of relatively common life-

Figure 3.6
Frequency of the Most-Common Procedures in Theater, General Surgeons, Compared with Their Frequency in Garrison

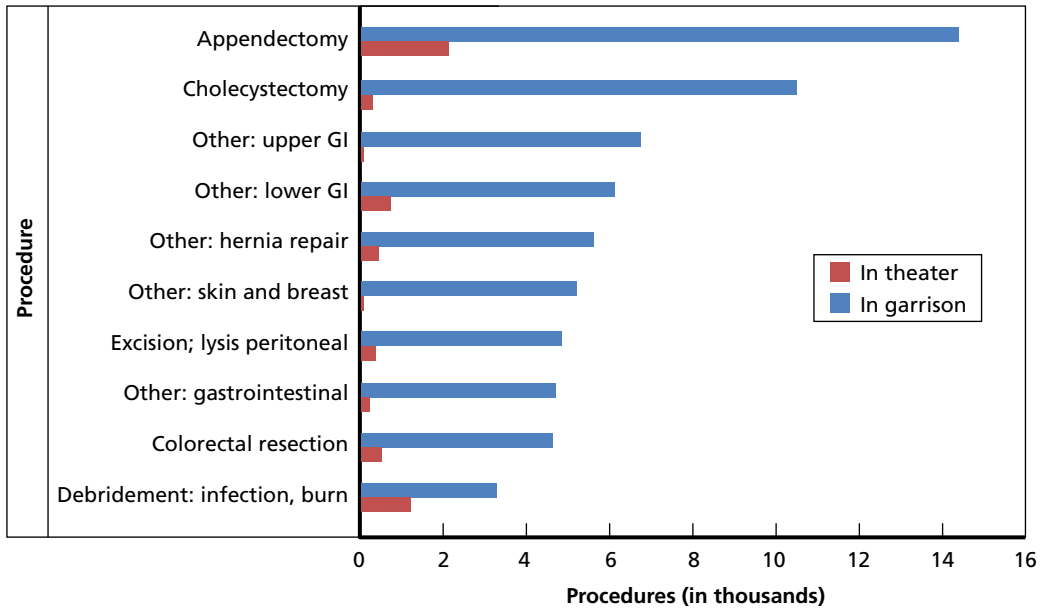


SOURCES: Deployed SIDR, 2004–2010; MDR 2004–2010. Theater data show all services; garrison data show Army MTF only. Circumcisions (procedure category 115), performed primarily on newborn infants, were excluded from the numerators and denominators.

saving procedures on the battlefield that most general surgeons would never encounter as part of their regular duties in garrison.

For the most part, procedures commonly performed by general surgeons in theater were also performed in large numbers at MTFs. Appendectomy (the second-most common procedure performed by general surgeons in theater) was performed nearly six times as often in garrison MTFs as in theater (2,000 times in theater, compared with 11,000 times in MTFs). Somewhat surprisingly, (inguinal) hernia repair (usually elective) was relatively *more common* in theater than at MTFs (that is, more hernia repairs are performed in MTFs than in theater, but hernia repair is among the most frequently performed in theater [Figure 3.6] but not at MTFs [Figure 3.7]). Both these results might seem counterintuitive unless one considers that the patient population in theater is made up of almost entirely young, healthy soldiers, whereas there is a much more heterogeneous mix (with a greater disease burden) at domestic MTFs. In contrast, there are many procedures performed frequently by general surgeons in MTFs that are rarely performed in theater. These consist primarily of procedures for conditions seen in older or sicker patient populations or for conditions that are not compat-

Figure 3.7
Frequency of the Most-Common Procedures in Garrison, General Surgeons, Compared with Their Frequency in Theater



SOURCES: Deployed SIDR, 2004–2010; MDR 2004–2010.

NOTE: Theater data show all services; garrison data show Army MTF only.

ible with active duty (e.g., laparotomies performed for small-bowel obstruction or for colon-cancer resection).

Of the ten nonorthopedic, nonneurosurgical procedures most commonly performed in theater (as listed in Figure 3.6), three stand out as relatively infrequently performed by general surgeons at MTFs (in that they do not appear in the list of most-frequently performed procedures in Figure 3.7): two sets of genitourinary procedures (“other: male genital” and transurethral excision) and one neurological procedure (“other: nervous system”). At domestic MTFs, such procedures would typically be performed by urologists and neurosurgeons, rather than general surgeons. However, the degree to which general surgeons perform these procedures in theater (without the participation of urologists or neurosurgeons) cannot be determined from the available data. Urologists (who may fill up to one in four of general surgery positions at any given CSH) can be involved in some of the genitourinary cases in theater, although the small number of urology deployments suggests that often they are not. The frequency with which neurosurgeons perform neurological procedures in theater is also unclear from the available data.

Although the most-common procedures differ for garrison and theater, interviewees pointed out that performing some similar garrison procedures might help provid-

ers prepare for theater workload. For example, laparoscopic appendectomy, which is common in garrison but not in theater, might help providers prepare to perform the more common open appendectomy in theater. A full mapping of similar procedures, out of scope for this study, would be necessary to fully assess the extent to which garrison procedures prepare providers for similar theater procedures. Any attempt to do so would need to consider preparedness in terms of both preoperative decisionmaking (e.g., the decision whether to operate) and technical skills.

In addition, the numbers reported above include activity performed at all Army MTFs, aggregated over a seven-year period, from 2004 to 2010. The data used in the analysis did not allow for a proper accounting of the number of providers who performed these procedures in a given year, which would have enabled us to calculate the average number of procedures per provider per year, or better still, provider-level procedure counts per year. Such metrics could be used to assess adequacy by comparing to benchmarks, perhaps those set by specialty boards or by the Army or the U.S. Department of Defense (DoD). Annual provider-level procedure counts would also allow the Army to match soon-to-deploy providers with limited recent experience performing procedures likely to be seen in theater to MTFs with an active caseload for a short rotation in which the provider could gain some additional experience before deploying. The benefit of scrubbing in for procedures, even if not as the lead surgeon, is likely greater than just attending a trauma refresher course.

Importantly, the right metrics to use in these types of assessments is the *number* of procedures performed, not the *percentage* of certain types of procedures as a fraction of all MTF activity. Because obstetric procedures dominate the activity in garrison MTFs, it would be misleading to calculate the percentage of all procedures that appendectomies, for instance, represent. Instead, by comparing counts, we find that nearly six times as many appendectomies are performed in garrison than in theater. This relative result of more procedures occurring in garrison than in theater holds across most procedures we examined, although the aggregation smooths year-to-year variation, in which annual counts might show higher volume in theater during years with heavy deployment tempo. Additional information on the number of providers would allow the Army to assess which providers have adequate hands-on experience with common deployment procedures prior to being mobilized and to target training opportunities to those who do not.

Treating Major Trauma in Garrison and in Theater

Comparing only coded surgical procedures (or discharge diagnoses) between the theater and garrison settings understates important differences in the clinical case mix, particularly with regard to major trauma. Of the domestic MTFs, only one is designated as a Level I trauma center for the local community (Brooke Army Medical

Center in San Antonio). A few others have been verified by the American College of Surgeons (ACS) as meeting Level II trauma-center standards, but they typically receive few patients from outside the base. In general, patients with acute, life-threatening trauma would never be treated at most domestic MTFs. Therefore, few of the domestic hospitalizations or procedures classified in the preceding analyses as being for “traumatic injury” represent acute, major trauma. Moreover, surgeons interviewed suggested that the mix of injuries encountered in theater is substantially different and more severe than that seen in any domestic (even Level I) trauma center.

One window into the type and severity of trauma seen in theater is the DoD Trauma Registry (DoDTR), which represents all patients (not just military) treated for traumatic injury at Role 3 facilities in theater. We had access to trauma registry data for CY 2011. In that year, a total of 6,260 theater trauma patients (4,571 battle and 1,689 nonbattle injuries) were treated. Nearly two-thirds (63 percent) were classified as having penetrating injuries, and 1,593 (25 percent) had injury-severity scores of 16 or higher, a typical definition of *major trauma*. Three hundred sixty-one patients were intubated, and 80 had cricothyrotomies prior to arrival. Published statistics describing the patient population at U.S. civilian trauma centers suggest that the proportion classified as major trauma in theater in 2011 was similar to that of the median domestic Level I trauma center (ACS, 2013).

Provider Perspectives on Adequacy of Education and Medical Treatment Facility Preparation for Deployment Duties

Our interview findings suggest that there are significant and pervasive gaps in providers’ preparedness to provide trauma care in the deployed environment. Although the experiences that our interviewees described indicate that surgeons and nonsurgeons faced slightly different and potentially smaller gaps, most of our interviewees, regardless of provider type, noted that no one could be truly prepared for combat trauma because of the relative absence of this level of trauma at home (barring disaster events). A few remarked that, to be really prepared for any type of trauma, it is crucial for a provider to treat trauma care routinely and that, indeed, at least some MTFs should be centered on, and designed to provide, trauma care on a regular basis.

The majority of trauma described by our interviewees was related to major combat, primarily blast injuries from improvised explosive devices and gunshot wounds, often in mass-casualty situations involving multiple patients, and sometimes involving polytrauma. A few interviewees described managing major noncombat trauma (for example, because of a vehicle rollover during maintenance or a motor vehicle crash).

An issue that some surgeons reported as pertinent to their ability to practice in deployed environments was the time of their first deployment relative to training and medical residency. On one hand, surgeons noted that they were most proficient right

out of their training (after which many experienced a steady decline in their skills) and were thus most prepared to deploy soon after surgical residency. Indeed, many of the surgeons we interviewed said their first deployment was right out of residency, which caused some to delay their board certifications. On the other hand, for many, deploying immediately following residency meant that they were expected to take senior duties on surgical teams despite having no experience practicing surgery without supervision or guidance or with leading a surgical team independently. In several cases reported, this was experienced in an FST deployment, in which a newly minted surgeon might be called on to be the FST commander. We also heard of instances in which the FST might have been staffed with several very junior surgeons without any senior oversight. Surgeons expressed concern about this situation, noting that it not only contributed to personal anxiety but was potentially dangerous for patient care.

Concerns About Adequacy of Medical Treatment Facility Preparation for Deployed Environment

Surgeons and nonsurgeons expressed varying views on the adequacy of their in-garrison preparation. Because most MTFs do not care for major-trauma patients, most providers had little opportunity to treat trauma patients while in garrison. Some felt that their skills at trauma procedures had degraded because of the limitations of the MTF workload, and some lacked confidence in their trauma decisionmaking capabilities. Many providers also described being unprepared for the emotional impact of providing trauma care.

Surgeons expressed concern about skill degradation during their time in garrison. Most of the surgeons we interviewed felt that they were prepared for trauma care, on the basis of their GME and training, but said that their skills in some areas had degraded at MTFs. Several remarked that they joined the Army specifically because they felt that their skills as surgeons were relevant and important and that they wanted to contribute to the mission. However, many surgeons felt that, since completing GME and entering practice at their MTFs, their clinical and surgical skills had degraded because of inadequate high-acuity or complex-case volume. This was particularly true of surgeons practicing at smaller MTFs and community hospitals who were seeing very few cases of any type annually or who had the opportunity to treat only low-complexity cases, such as hemorrhoid removal. However, even surgeons at larger centers, including Level I and Level II trauma centers (or centers that would likely meet that designation), reported skill degradation as a result of low case volume, largely because of having to split existing case volume across a large number of other surgeons. The relationship between surgical case volume and quality of care is well established, and there is evidence that trauma surgery is no different (Minei et al., 2014). The concern of whether MTFs have high enough case volume to ensure good outcomes has been the topic of other studies including a recent one by CNA Analysis and Solutions (Brevig et al., 2015). Assigning surgeons to locations where they can get sufficient case

volume was a concern raised by the MHS Modernization Study Team and is an area of work by MEDCOM (MHS Modernization Study Team, 2015; AMEDD, undated).

An overwhelming majority of surgeons reported that this skill degradation in garrison led to an overall decline in surgical proficiency, which hurt their confidence as surgeons and affected their ability to perform effectively in high-stress deployed environments. Importantly, many reported feeling poorly equipped to handle major-trauma surgeries and described anxiety about providing patient care while deployed. Some described other surgeons as being unsafe to practice while deployed because of the skill degradation experienced in garrison.

It should be noted that, although our interviewees consistently described insufficient surgical volume at the MTFs as affecting their preparedness and proficiency in theater, published literature offers little guidance as to what types of procedures should be counted or how many procedures of a particular type would be sufficient. One systematic review concluded that, for certain procedures, “high-volume” surgeons had better outcomes than “low-volume” surgeons, although the study acknowledged a lack of evidence-based consensus on the definition of *high volume* (Chowdhury, Dagash, and Pierro, 2007, p. 154). Even less is known about the degree to which one type of clinical experience helps maintain currency for another (e.g., is a busy bariatric surgeon any more prepared for trauma surgery than a bariatric surgeon who treats only a few cases?) or how to measure clinical currency for the majority of physicians who are not surgeons.

The majority of nonsurgeon physicians whom we interviewed described feeling ill prepared to provide trauma care while deployed, with the exception of few trauma-focused specialties, such as emergency medicine and critical care. In contrast, most of the PAs with whom we spoke described feeling relatively prepared to deal with combat trauma during deployment. Everyone—PAs and physicians—spoke of an “initial hump” or “shock” to get over, in terms of seeing and dealing with trauma patients. Some described this as the intensity of receiving incoming trauma patients and trying to remain calm while caring for patients in a state of extreme pain and fear. This initial “breaking-in” period was described even by providers who felt clinically prepared to provide trauma care.

Effects of Skill Gaps

For traumatic injuries in the United States, there is substantial evidence that a well-organized system of trauma care improves survival after trauma. There is little dispute that well-trained interdisciplinary trauma teams are a key mechanism causing better outcomes. The value of trauma surgery (or acute-care surgery) as a specific discipline is also widely recognized, particularly for the duties that specialists perform in advancing knowledge, setting trauma-center standards, and overseeing trauma-center operations. There is less consensus, however, as to whether the surgeon on duty for trauma-center coverage must always have specific postgraduate training and board certification in

trauma or acute-care surgery. Opinions tend to divide according to physician supply in the local community. In general, surgeons in urban areas, where physician supply is highest, have advocated for more restrictions, whereas those in rural areas tend to be more inclusive (Dissanaike, 2016; Louras et al., 2016). Retrospective studies of centers that use a mix of general surgeons and subspecialty-trained acute-care surgeons have not demonstrated a mortality difference according to the training or experience of the surgeon on duty during the initial hours of management (Louras et al., 2016; Haut et al., 2009). Authors of these studies note, however, that most trauma is caused by blunt-force injury and that immediate operative intervention is relatively rare. Whether outcomes differ by training for the subset of patients with penetrating trauma or who require immediate surgical intervention to mitigate the risk of death or grave injury remains unanswered.

A related question is whether surgeons who perform more trauma operations have better outcomes. This relationship has been shown to hold for other types of non-trauma surgery, up to a point—once a certain threshold is reached, this effect is less clear (Luft, Bunker, and Enthoven, 1979; Chowdhury, Dagash, and Pierro, 2007). It would seem likely that the relationship between case volume and outcomes would also hold for trauma surgeons, but, because most domestic trauma cases do not require operative intervention, proof remains elusive. It has been argued that trauma surgeons with specific training and credentials are more likely to maintain adequate case volume (Strumwasser et al., 2017). If this is true on average, exceptions to this rule are likely common. Published literature on the topic should be interpreted with caution because retrospective studies might not adequately account for nonrandom differences between the patients, injuries, and ancillary services and the training of the surgeon on call. For example, non-specialty-trained surgeons might be more likely to work on weekends and evenings. Furthermore, injuries, the underlying health of the patients, and the quality of hospital services might differ with the time of day and day of week in ways that affect outcomes.

For traumatic injuries in wartime, a published review of trauma registry and autopsy records for trauma deaths among patients with battle injuries who survived to hospital presentation (2001 through 2009) identified 287 patients classified as having potentially survivable injuries who died in hospital (Eastridge, Hardin, et al., 2011). Although many experts think that the quality of prehospital care and time to evacuation are more-important factors than care rendered in hospital, it also seems likely that, like with trauma resuscitation, the closing of any existing skill gap in this domain has a high potential for impact (Martin et al., 2009; Kotwal, Montgomery, et al., 2011; Eastridge, Mabry, et al., 2012; Kotwal, Butler, et al., 2013).

Regarding surgeons' preparation, although some interviewees reported observing negative patient outcomes resulting from lack of experience with operative trauma in garrison, more generally, interviewees reported provider anxiety stemming from providers' concern for patient welfare. Many described the issue of lack of surgical

proficiency as having significant potential for negative consequences but noted that providers worked as a team to provide the best patient care they could and to avoid bad outcomes. Some noted that it was “just luck” that nothing negative attributable to surgical preparation happened during their deployment, while others remarked that it was only because of the difficulty in attributing causes to negative patient outcomes that surgical deployments had escaped greater scrutiny.

Nonsurgical providers described several adverse patient outcomes as occurring because of inadequate preparation for trauma. These included misplaced chest tubes, failed chest tubes leading to cricothyrotomies, and failed cricothyrotomies. Other negative consequences that interviewees described included significant provider anxiety about having to provide trauma care and concern for patient welfare, sometimes leading to moral dilemmas about whether the provider should care for the patient. In a few instances, providers described other providers who avoided trauma altogether, thereby increasing the workload on the rest of the team and potentially endangering patient care.

Addressing Skill Gaps During Deployment

Surgeons described various approaches they had used to mitigate any gaps in their preparation for deployment. Some surgeons noted that, while they were deployed, to “cover” for other surgeons whose proficiency was suboptimal, they had to double scrub on surgical procedures or make arrangements to have other surgeons manage certain cases.

Nonsurgeon providers described various approaches to dealing with gaps in their preparedness for trauma care. Many battalion surgeons described a natural “division of labor” that mitigated any proficiency gaps, in which the battalion PA took on the procedural trauma-care responsibilities while the physician took on regular primary-care duties. Other approaches included consulting other providers when possible and leveraging medics to support the trauma-care process. Many providers noted that the provision of trauma care while deployed was not optimal but was the best that could be managed. There was an expressed sense of “making do” and just “getting through it” and even “winging it.”

Utility of Off-Duty Employment in Preparing Providers for Deployment Responsibilities

Before concluding this chapter, we want to briefly touch on another building block to provider readiness for deployment: the utility of off-duty employment (ODE) in supplementing the preparation provided through MTF work. While in garrison, most surgeons report, they sought ODE (e.g., moonlighting) to fill gaps in their case volumes and acuity. Some commented that they were able to perform more-complex sur-

gical procedures—trauma and nontrauma—over one weekend of ODE at a local hospital than in an entire year at their MTFs. Others noted that they were able to practice enough high-complexity surgical procedures within their specialties to become proficient and feel confident in their surgical abilities overall.

Although all surgeons we interviewed felt that ODE was a viable approach to maintaining or increasing surgical proficiency and thereby enhancing their preparation for deployment, some surgeons felt that ODE was unsupported by their MTF and by the Army at large and were consequently discouraged from utilizing this avenue. One reason for the lack of support is that ODE was often viewed as merely a way to supplement income, rather than as a way to increase skills. The absence of a mechanism for the Army to track the caseload completed by Army providers during their ODE contributes to the difficulty in evaluating its usefulness for proficiency. We note that this perception varied considerably across interviews, with some surgeons reporting that their MTFs were fully supportive, and even encouraging, of ODE. Of note is that the U.S. Air Force (USAF) uses training affiliation agreements (TAAs), which allow providers to work at civilian hospitals while on duty. Although the Army has MTAs, according to our interviews with providers, the use of such agreements appears to be low.

Caveats

In this chapter, we compared garrison MTF workload against theater workload from OEF and OIF. One area of caution is to not “overlearn” lessons from these wars: Future contingencies in which providers are deployed might look very different.

Injury types are one area in which there could be changes. OEF and OIF have been “characterized primarily by high lower extremity amputations, pelvic and genital injuries, and spine injuries” especially in Afghanistan toward the later years of the war (Dismounted Complex Blast Injury Task Force, 2011). This is a product of the types of operations being conducted, which involved ground patrols. Future wars could include different mechanisms of injuries, such as blasts coming not from improvised explosive devices but rather from artillery fire or ballistic-missile attacks on U.S. operating bases. Future wars could also include chemical, biological, radiological, or nuclear weapons, which would cause injuries currently unfamiliar to most medical providers. Effective treatment of these injuries would require that different skills be taught and practiced, which would be likely only if these types of injuries were anticipated prior to the conflict.

Another potential difference between OEF and OIF on the one hand and future scenarios on the other is the medical infrastructure that would be available. After more than a decade of operations, OEF and OIF are mature theaters, with a well-developed chain of care, including readily available medical evacuation and FSTs and

CSHs placed so that soldiers can receive surgical care within the “golden hour” (Clarke and Davis, 2012), followed by aeromedical evacuation to Germany and then CONUS within days. This led to an assumption, in later years, that BASs would not see much in the way of trauma because such patients would be more likely to be flown directly to a Role 2 or Role 3 facility. However, not all patients, even in a mature operation, such as OEF, could be evacuated quickly. Weather, availability of aircraft, and other considerations sometimes meant that BASs received trauma patients and had to hold them for longer periods. According to interviewees, this required field surgeons to be adept not only at immediate trauma stabilization but also at intensive care. Future scenarios might involve casualties before FSTs and CSHs can be set up. Or they might involve theaters in which such facilities are few and far away. Providers would need to be ready to handle more-serious cases and to hold them longer.

Summary

Significant gaps exist in providers’ preparation and training for their deployed duties. It is likely that emergency-medicine providers, and some family-medicine physicians, are optimal deployers, able to manage both primary-care and minor trauma-care duties. Secondarily, internal-medicine physicians are also optimal for positions consisting primarily of sick-call duties, with some internal-medicine physicians also having some trauma training. All other nonsurgical specialties, with the possible exception of intensivists, are likely to face some challenges in providing patient care while deployed. Surgeons are generally trained to provide trauma care, but, if they do not see a sufficient number of these cases in garrison, their ability to provide proficient surgical care in theater could be affected. The results of our data analysis in this chapter—a comparison of the number of times common procedures are performed in theater versus in garrison—show that many common theater procedures were actually performed more often in garrison. However, we lacked information on provider counts to be able to compute the average number of times each individual provider performed these procedures. Such data would allow for an assessment of whether individual providers had sufficient experience with common theater procedures while in garrison.

Physicians interviewed for this study were quite consistent in describing the importance of “caring for sick patients” (both operatively and nonoperatively) to maintaining clinical currency. Interviewed surgeons confirmed that many operations performed on trauma patients in theater would rarely be performed by anyone stationed at a domestic MTF that is not a trauma center (i.e., all but one). They also said consistently that the most challenging aspect of their deployed duties was cognitive, not physical. They described the mechanics of the procedures to be relatively straightforward compared with the challenges of having to make operative decisions and regarding postoperative management.

The impact that providers' preparation has on nontrauma care received in theater is hard to ascertain, primarily because long-term follow-up of anyone seen in theater is difficult and confounded by various other factors. It is challenging to characterize an association between a provider's training and preparation and outcomes, such as the number of days out of service, theater evacuation, or longer-term disability.

In general, providers felt that the potential negative consequences to patient outcomes of an inadequately trained or ill-prepared provider in their sick-call duties were minimal, in large part because of the relatively inconsequential nature of complaints addressed in theater. Instead, providers more frequently described negative consequences to their morale and, ultimately, to their desire to stay in the Army. Many specialists and subspecialists described feeling resentful at having to deploy into a position in which they were unable to practice their specialties and had to provide care out of the scope of their usual practice. They reported significant skill degradation during deployment, without a formal train-up plan for their return to garrison practice. They also noted that they had entered into their specialty for a reason, which centered largely on a preference to avoid the very care they were being asked to provide while deployed. Some described physicians in their specialties as "getting out the first chance they had" because of this issue. Others described some specialties as potentially detrimental deployments—specialists who lacked adequate training in or experience with both sick call and trauma care and who were also biased against their deployed duties, preferring instead to practice only their specialties.

The impact of inadequate preparedness for trauma care is evident in poor patient outcomes, as well as poor provider outcomes, such as anxiety and low morale. In contrast, the impact of inadequate preparedness for sick-call and primary-care duties is less evident and uncertain but centers on provider morale and, ultimately, the Army's ability to retain specialists for whom primary care is out of their usual scope.

In garrison, some providers proactively seek outside work to maintain their skills, especially in regard to trauma care. In theater, providers often rely on makeshift arrangements and ad hoc shifting of workload and tasks to ensure an adequate level of patient care and that soldiers are appropriately cared for. No matter what the preparation and training are, providers "make do" with what they have, both in terms of resources and other staff and providers, and they take on duties as needed to ensure that patients are cared for to the best of their abilities. Making do, however, is far from ideal.

Predeployment Training: Courses, Trauma Rotations, Exercises, and Prior Deployments

We now turn to the remaining building blocks: courses, trauma-center rotations, exercises, and the experience acquired during prior deployments. It provides an opportunity for providers to improve their proficiency in areas that are not often seen in their regular garrison caseloads. The training can take the form of courses (classroom training and simulation exercises) or short rotations at civilian trauma centers (helping care for civilian trauma patients). In practice, some of these training programs are a combination of all of the above, so, in this chapter, we refer to them collectively as *predeployment training* or *courses*.

Attendance at Mandatory Predeployment Trauma Training

Interviewees reported that training courses can be useful to prepare providers for their requirements in theater. The AMEDD Center and School and the DMRTI are two schools that offer such training opportunities for providers.

Some of these courses are required as PDTT for those deploying after October 1, 2009. An execute order (EXORD) issued by the Army, HQDA EXORD 096-09, specified certain courses that are offered by the AMEDD Center and School, depending on the provider type and the position in which the provider is to be deployed. The courses relevant to populations in this study were Tactical Combat Medical Care (TCMC), the Army Trauma Training Course, and the Joint Forces Combat Trauma Management Course (JFCTMC). TCMC and JFCTMC are courses that combine classroom training with hands-on simulations that use realistic scenarios that include equipment, supplies, and evacuation capabilities used during combat. TCMC is intended for field surgeons deploying to Role 1 and Role 2 facilities, while JFCTMC is intended for those deploying to Role 3 CSHs. The Army Trauma Training Course is designed for FSTs and CSH trauma teams and is located at Ryder Trauma Center at Jackson Memorial Hospital in Miami. The program there includes classroom training, simulations, and rotations through the trauma center, where students are exposed to civilian trauma patients being treated at the hospital.

Providers are required to attend predeployment training courses within 180 days of deployment; those who have taken the course within the past two years do not have to retake the course. Table 4.1 summarizes the target audiences for the courses specified in the EXORD.

Method

To examine the extent to which PDTT contributes to a provider's preparation for deployment, we calculated the proportion of provider deployments for which the provider received training courses prior to deployment, as recorded by ATRRS. The ATRRS data record the courses taken by each soldier and the dates of attendance. We combined the ATRRS data with the CTS deployment data so that deploying providers could be credited for attending the courses if they were recorded in ATRRS. In addition, we merged with the WEX data to determine the provider's primary AOC at the time of deployment. We have ATRRS and CTS data from January 2001 through June 2014. We have WEX data from January 1990 through June 2014. Therefore, we focused our analysis on CY 2013 as the most recent, complete year.

This analysis focused on Regular Army officer deployments worldwide, and the course analysis was limited to courses offered by the AMEDD Center and School (including predeployment training) and DMRTI.

Attendance at Any Required Predeployment Trauma Training Courses

First, we present our analysis of EXORD-required PDTT for 2013. The EXORD specifies courses according to where the provider will be deployed. However, the available data that allowed us to link deployments and AOC to course attendance did not include information on the type of facility to which the provider was deployed. Consequently, in this analysis, we calculated the percentage of deployments for which the provider had taken any predeployment training course. By giving credit for any PDTT course taken, we created an upper bound on compliance with the EXORD.

Table 4.1
Target Audiences for Courses Specified in Execute Order 096-09

Personnel	Army Trauma Training Course	JFCTMC	TCMC
Surgeons	x ^a	x	
Nonsurgeon physicians (excluding surgeons)		x	x
PA (65D)			x
FNP (66P)			x

NOTE: Unless otherwise noted, all providers of this type must attend.

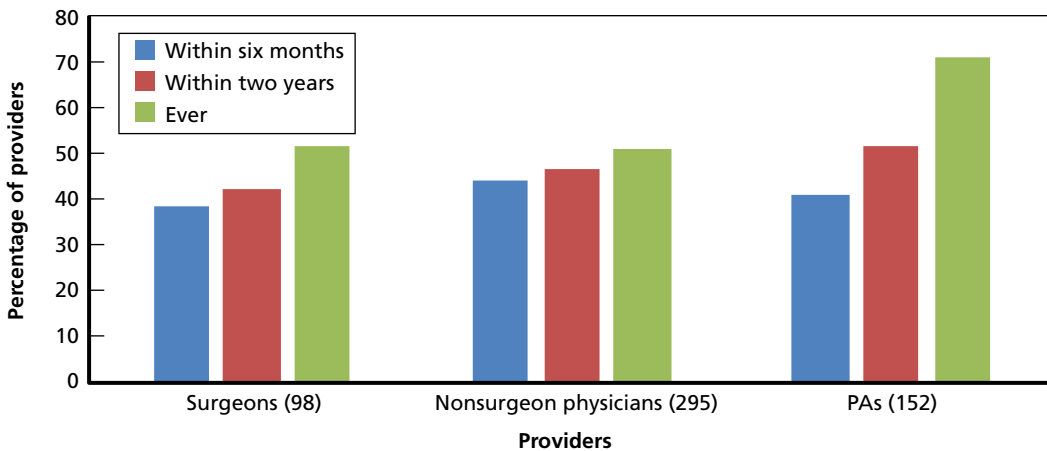
^a The provider must attend if assigned to an FST or CSH trauma team.

We varied the time window of credit by giving credit only for courses taken within 180 days of deployment (as the EXORD requires), within two years of deployment (which the EXORD allows for repeat deployers), or ever before deployment (as the most-generous granting of credit).

We found that PDTT course attendance in 2013 occurred at a much lower rate than the EXORD requirement of 90 percent. Figure 4.1 shows predeployment course attendance by provider group in 2013. The figure shows three predeployment credit windows such that credit is shown for attendance: 180 days, two years, or ever prior to deployment. In general, a higher proportion of PAs attended than of surgeons and other physicians. Attendance varied depending on the predeployment credit window. As an example, 41 percent, 51 percent, and 71 percent of PA deployments attended any predeployment course 180 days, two years, and ever prior to deployment, respectively.

Each nurse practitioner assigned to a brigade combat team is also required to attend at least one PDTT course, but no attendance in 2013 was observed despite the fact that a total of two nurse practitioners deployed in 2013. Because of the small number of deployments among nurse practitioners in 2013 and all other years, we excluded them from the analyses presented in the remainder of this chapter.

Figure 4.1
Predeployment Course Attendance, by Primary Area-of-Concentration Group in Calendar Year 2013



SOURCES: ATRRS; CTS (2013 deployments).

NOTE: The numbers in parentheses represent the numbers of 2013 deployments. The percentages are of active-component providers who deployed in 2013 and attended the Army Trauma Training Course, TCMC, or JFCTMC prior to deployment. PDTT for officers includes TCMC, the Army Trauma Training Course, and JFCTMC. Appendix C contains a list of all AOCs, their categorizations (surgeon, nonsurgeon physician), and an indicator of whether we included them in these analyses.

Attendance at Specific Predeployment Trauma Training Courses

Second, we present a finer granularity of courses and their attendance for a broader set of courses offered by the AMEDD Center and School and DMRTI, including the PDTT courses. As indicated earlier, the data available for this analysis did not include the facilities to which providers were assigned in their deployment. Consequently, the attendance percentages shown are relative to the total number of each specialty deployed that year, rather than the total number of each specialty deployed to the type of facility, and consequently cannot be used to compare to the 90-percent target mandated in the EXORD. Nonetheless, it is useful to look at the relative attendance for each course. Table 4.2 displays attendance by PDTT course and whether credit is given for attendance 180 days, two years, or ever prior to deployment for deployments in 2013.

The EXORD requires every PA or physician deploying to a Role 1 or Role 2 facility to attend TCMC, yet many do not do so. Most of the physicians did not attend

Table 4.2
Predeployment Training Attendance Percentage, by Primary Area-of-Concentration Group and Course in Calendar Year 2013

Time Frame	Course	Primary AOC		
		Surgeon (98 Deployments in 2013)	Nonsurgeon Physician (295 Deployments in 2013)	PA (152 Deployments in 2013)
Ever prior to deployment	Army Trauma Training Course	22 ^a	1 ^b	2 ^b
	JFCTMC	29	11	0
	TCMC	1 ^b	38	66
Within two years of deploying	Army Trauma Training Course	13 ^a	0	1 ^b
	JFCTMC	28	11	0
	TCMC	1 ^b	33	49
Within six months of deploying	Army Trauma Training Course	10 ^a	0	1 ^b
	JFCTMC	28	11	0
	TCMC	1 ^b	33	40

NOTE: JFCTMC = Joint Forces Combat Trauma Management Course. TCMC = Tactical Combat Medical Care. Unless otherwise noted, the EXORD requires all providers to attend. Numbers in the table represent the percentages of all providers of that type who deployed in 2013 and attended the course prior to deploying. Appendix C contains a list of all AOCs, their categorizations (surgeon, nonsurgeon physician), and an indicator for whether we included each in these analyses.

^a The provider must attend only if assigned to an FST or CSH trauma team.

^b Providers are not required to attend.

TCMC before deployment (295 deployments with 38-percent attendance). PA attendance was better; most of the PAs attended TCMC before deployment (152 deployments with 66-percent attendance). Of the PAs who attended TCMC, 38 percent attended the course more than 180 days prior to deployment.

The EXORD requires all physicians and surgeons deploying to CSHs to attend JFCTMC, and some attend, but most do not. Eleven and 29 percent, respectively, of the nonsurgeon physicians and surgeons attended JFCTMC before deployment. Most providers who did attend did so within 180 days of deployment.

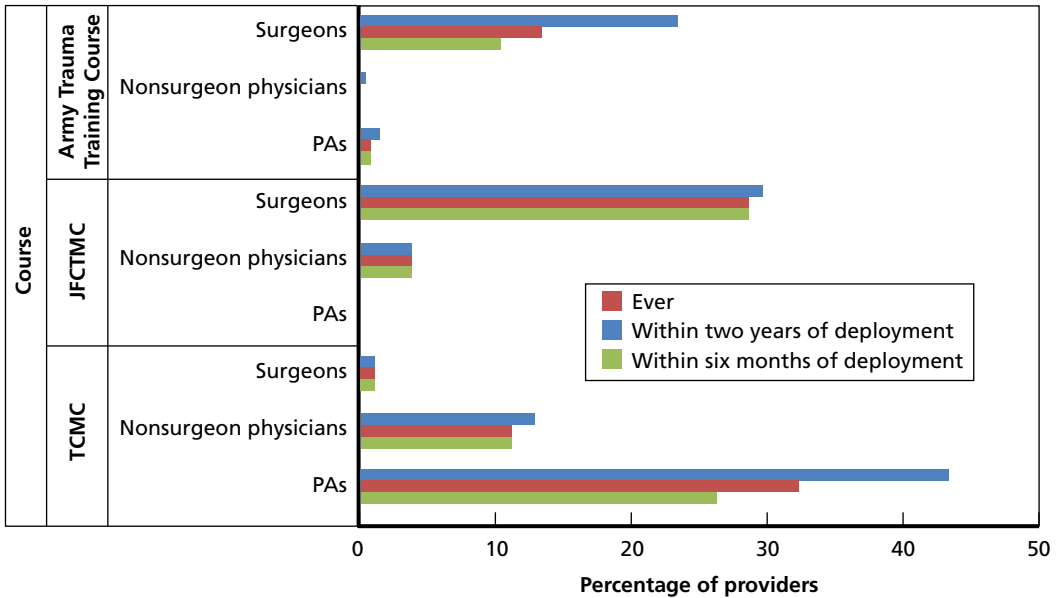
The EXORD requires surgeons who are assigned to FSTs or CSH trauma teams to attend the Army Trauma Training Course. Because the research did not provide visibility into where providers were assigned, we could not tell how far off attendance was from the EXORD's 90-percent attendance target. Table 4.2 displays the attendance as a percentage of total deployments in 2013; Figure 4.2 shows this in graphical form.

Attendance at Other Training Courses

We also looked at training attendance for other courses offered by the AMEDD Center and School and DMRTI. Providers attend other courses that the EXORD does not specify. The following non-PDPTT courses were of interest to our analysis:

- Combat Extremity Surgery Course (CESC): intended for surgeons and nurse anesthetists and focused on “resuscitation, stabilization, and management of battlefield extremity injuries” (Training Program Management, 2015, p. 121)
- Advanced Trauma Life Support (ATLS): offered in conjunction with the Combat Casualty Care Course (C4) to many types of providers and designed to “assist doctors in providing emergency care for the trauma patient” (Training Program Management, 2015, p. 154)
- C4: can be taken independently of ATLS and offers training to many types of providers in “field leadership, knowledge and skills that may be necessary for direct medical support in conditions related to any combat situation or contemporary Operational Environment” (Training Program Management, 2015, p. 154)
- Emergency War Surgery Course (EWSC): designed for surgeons and offers lectures and laboratory practicum in “various aspects of military field trauma including head and neck, ophthalmologic injuries, orthopedic, urologic, thoracic and abdominal trauma” (Training Program Management, 2015, p. 159)
- Prehospital Trauma Life Support (PHTLS): based on the ATLS curriculum, intended for various provider types, and offers an “intensive 2-1/2 day experience with lecture and skill stations content to identify the need for life saving interventions for the multisystem trauma patient” (Training Program Management, 2015, p. 157).

Figure 4.2
Percentage of 2013 Deployers, by Specialty, Attending Predeployment Trauma Training



NOTE: Appendix C contains a list of all AOCs, their categorizations (surgeon, nonsurgeon physician), and an indicator of whether we included them in these analyses.

Table 4.3 displays the percentage of 2013 deployments who attended each course any time prior to deployment. The most-common non-PDPTT courses that surgeons attended were CESC, ATLS, and C4. Among surgeons who deployed in 2013, 21 percent, 52 percent, and 51 percent attended CESC, ATLS, and C4, respectively, prior to deployment. The EWSC, however, had lower attendance, with only 2 percent of surgeon deployments attending.

Among other providers (i.e., not surgeons), ATLS, C4, and PHTLS were attended with some frequency. Of the 2013 physician deployments, 49 percent attended ATLS any time prior to deployment. C4 was attended by all provider groupings, but the percentage of attendance ranges widely. For C4, 51 percent of surgeons and 51 percent of nonsurgeon physicians were the largest groups of attendance, while 5 percent of PAs attended C4. PAs and physicians attended PHTLS at a rate of 5 percent and less than 1 percent, respectively.

Table 4.3
U.S. Army Medical Department Center and School and Defense Medical Readiness Training Institute Course Attendance Any Time Prior to 2013 Deployment

School	Course	Primary AOC		
		Surgeon (98 Deployments in 2013)	Nonsurgeon Physician (295 Deployments in 2013)	PA (152 Deployments in 2013)
AMEDD Center and School	Army Trauma Training Course	22	<1	2
	CESC	21	1	1
	JFCTMC	29	11	
	TCMC	1	38	66
DMRTI	ATLS	52	49	2
	C4	51	51	5
	EWSC	2	<1	<1
	PHTLS	3	<1	5

NOTE: The numbers in the table represent the percentages of all providers of that type who deployed in 2013 and attended that course prior to deploying. Appendix C contains a list of all AOCs, their categorizations (surgeon, nonsurgeon physician), and an indicator of whether we included them in these analyses.

Provider Perspectives on Army Training Programs and Trauma Rotations

Our interview data suggest that the Army’s existing trauma training programs have the potential to fill real or perceived gaps in providers’ preparedness for deployment but that there is room for improvement in both their utilization and in their content and approach.

Providers seem to attend trauma training courses primarily as part of their pre-deployment preparation. Specific courses mentioned included TCMC in San Antonio, the Army Trauma Training Course at Ryder Trauma Center at Jackson Memorial in Florida, JFCTMC offered by the AMEDD Center and School in San Antonio, and the EWSC offered by DMRTI, also in San Antonio.

Tactical Combat Medical Care

With very few exceptions, the PAs we interviewed reported that they attended TCMC prior to deployment, and many of the nonsurgeon physicians we interviewed also noted that they had attended TCMC. Across the board, impressions of the course were strongly positive. Interviewees described the course as “invaluable” and an “abso-

lute necessity” prior to deployment, and several physicians noted that it was the only trauma preparation they had ever had. Many felt that they would not have been able to manage the trauma they saw in theater had they not attended TCMC. Some providers reported being able to take the TCMC curriculum and pass it on to their team in theater, in particular to support medic training.

Specific aspects of the course interviewees highlighted as particularly salient included the live-tissue training, the simulated drills, and the quality of the teaching staff. Many appreciated that the faculty had significant experience in the field and were thus teaching the aspects of trauma care that were most relevant to deployment. Almost every provider who attended remarked that the live-tissue training gave them confidence to conduct trauma procedures in real-life situations, in addition to the opportunity to learn and practice new procedures and hone existing skills. Several providers noted that TCMC was responsive to lessons from the field, such that, even as the mission continued, the course imparted the latest information on combat trauma care and procedures. It was this aspect of TCMC that providers highlighted as separating it from a civilian ATLS course, which many providers had taken early in their medical training. Some providers voiced strong concerns about the possibility that TCMC would be cut from the Army training schedule. Others raised the possibility of making TCMC a regular training requirement, in which the course might be required every two years or at another suitable interval, regardless of deployment, to reflect a model of routine trauma training rather than a reactive, just-in-time training strategy.

All the PAs we interviewed were aware that TCMC attendance was a predeployment requirement; in contrast, very few physicians were aware of the requirement. Instead, physicians described learning of TCMC through word of mouth (e.g., a colleague who recently deployed mentioning TCMC, or a PA advising a physician to attend). Relatedly, a few physicians also noted that there was no verification of completion of the course. A few physicians reported wanting to attend TCMC but not being able to attend either because (1) the course was full, (2) they were not on orders to deploy yet, or (3) timing did not allow it (e.g., two-week deployment notice).

In general, providers who attended TCMC felt that the five-day course was a valuable use of their time prior to deployment. Trauma experts and TCMC students both noted that there was a limit to how much could be learned in five days. However, students also emphasized that more time away from family and clinical practice in the rush before deployment was undesirable. In that sense, there was an unspoken consensus among former students that five days was an appropriate amount of time.

Army Trauma Training Course and Joint Forces Combat Trauma Management Course

Surgeons reported attending the Army Trauma Training Course or, to a lesser degree, JFCTMC. They remarked that, in comparison with TCMC, which focused on front-line, basic damage-control trauma procedures, the content of these two courses was

more relevant to their specific operating room roles and duties in deployed environments. In particular, the Army Trauma Training Course included a surgical-skill lab, as well as curriculum from the ACS Advanced Trauma Operative Management (ATOM) and Advanced Surgical Skills for Exposure in Trauma (ASSET) courses, which many surgeon interviewees described as particularly helpful for obtaining practice with surgical trauma procedures. Some noted (in the context of both the Army Trauma Training Course and JFCTMC) that the ATOM and ASSET course curricula provided important hands-on experience with managing penetrative injuries for which vascular exposure was involved, a complex clinical situation that general surgeons (as opposed to, e.g., vascular specialist surgeons) do not typically encounter in enough volume to be proficient at managing. Some also noted that these courses were especially helpful in their respective foci on general pre- and postmanagement (which is not common in current garrison surgical practice and has a focus on nonoperative care) and vascular access of the operative patient, another area typically assigned to other providers (e.g., the intensivist) rather than the surgeon.

Most of the surgeons reported having attended the Army Trauma Training Course as part of their predeployment orders. Several said that they did not attend the course because they were physicians who were rotating into the unit middeployment, so attendance was not part of their deployment orders. Fewer surgeons mentioned that they did not attend because they did not have time prior to deployment or because they had heard it was not useful.

Some surgeons and many hospital-based providers (e.g., intensivists, subspecialists) reported attending JFCTMC. This course was frequently described as an adequate didactic refresher on critical care management and related practice; providers reported selecting and attending the portions of the course most relevant to their practice. Fewer providers mentioned JFCTMC than mentioned the Army Trauma Training Course and TCMC. It is unclear whether this was specific to our particular sample or because fewer providers in general were aware of JFCTMC. Some providers reported attending trauma courses and were able to describe some components of the course but could not recollect the course name.

Trauma Rotations Within the Army Trauma Training Center

Many of our surgeon interviewees emphasized that the trauma rotation at Ryder Trauma Center that is part of the Army Trauma Training Center (ATTC) program was not useful or an efficient use of time because they had little opportunity to provide hands-on care or take on primary management of the patient (which was left mainly to Ryder attending physicians and residents). Instead, they would have preferred either more time in garrison to practice specific procedures or more time in the surgical-skill labs that were part of the course. In a few instances, this was noted in the context of the two-week time frame for the course, which was generally thought to be too long to be away from their clinical practices and families, especially before deployment.

Surgeons differed from one another in their beliefs about the importance of trauma-specific training and surgical practice. Some surgeons believed that trauma surgery should be a core skill of all deploying Army surgeons, requiring critical care training and experience. They cited the need to be able to identify “sick” patients, to be able to make clinical decisions based on knowledge of the critical care pathway subsequent to damage-control trauma surgery, and the ability to monitor postoperative patients in the ICU, including, for example, knowledge of ventilator management and medication management in the trauma patient. In contrast, other surgeons felt that knowledge of and training in specialized trauma skills were not critical to their preparation for deployed practice for several reasons, including the beliefs that the trauma training and rotations provided during GME for all surgeons are likely to be adequate for deployed practice and that combat trauma is so unlike any other trauma typically encountered at home (predominantly nonpenetrating trauma with a focus on non-operative intervention) that any training or experience at home is unlikely to fill gaps in preparation for deployed practice. In addition, many surgeons we interviewed characterized trauma surgery in deployed environments as damage control and not geared toward longer-term management, thereby precluding the need for critical care training.

The importance that trauma experience on patient outcomes is discussed in the trauma section of Chapter Three. Here, the point we wish to make is that the usefulness of the Army Trauma Training Course depends on how much opportunity the students have to provide hands-on care to trauma patients during the very limited time they have during their rotations. We note that the staff of the ATTC has pointed out that the curriculum has been substantially revised in recent years and continues to be revised. We do not know whether the interviewees with whom we spoke had taken the Army Trauma Training Course before or after those revisions.

Emergency War Surgery Course

A handful of surgeons mentioned attending the EWSC or CESC (or both). Some of these providers remembered taking CESC on its own, while others said that it was a component of the EWSC and the part they found most useful about the EWSC. Both courses had been identified by word of mouth and by surgeons who had taken their own initiative to attend.

Data on Prior Deployment Experience of Medical Personnel

The final two building blocks for medical readiness are exercises and deployments. We first describe prior deployment experiences using administrative data, and we then summarize what interviewees told us about the utility of exercises and deployments in preparing for future deployments.

Figure 4.3 shows the percentage of deploying providers with previous deployment experience, by provider type, from 2001 through 2014. Results are shown for surgeons, physicians, and PAs.

As seen in Figure 4.3, different types of providers have varying levels of prior deployment experience. In particular, as OEF, OIF, and OND progressed, PAs had more experience with deployment than other providers did; by the end of the period, about 80 percent of deploying PAs had previous deployment experience. In comparison, by the end of the period, approximately 50 percent of surgeons and nonsurgeon physicians had deployment experience.

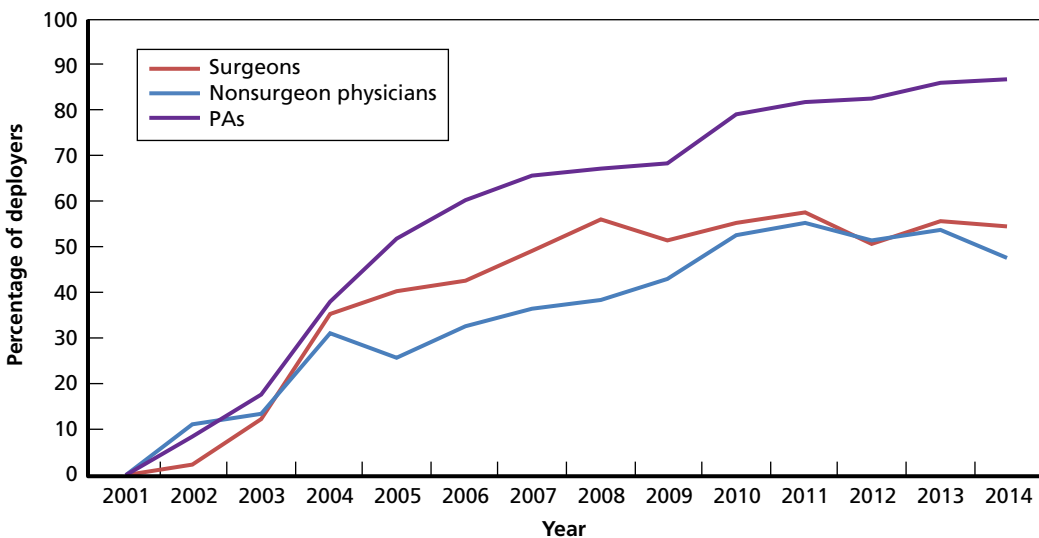
Provider Perspectives on Exercises and Deployment Experience

Exercises

Interviewees reported that field experience, professional experience, and familiarity with units were all valuable to their preparation for deployment. Interviewees (particularly PAs) who had deployed to Role 1 and 2 facilities stressed the importance that having trained with their units had on their effectiveness in forward-deployed settings.

Some of the providers with whom we spoke noted that being able to train with their units or being assigned to units prior to deployment offered them the opportunity

Figure 4.3
Percentage of Deploying Providers with Previous Deployment Experience, by Provider Type, 2001–2014



NOTE: Appendix C contains a list of all AOCs, their categorizations (surgeon, nonsurgeon physician), and an indicator of whether we included them in these analyses. The chart shows the percentage of deployment providers with previous Global War on Terrorism deployment experience.

to understand and work with the populations for which they would be caring during their deployments, thereby increasing their effectiveness and credibility, and to prepare for the nonmedical aspects of the deployment (e.g., going on missions, returning fire). One PA interviewed even suggested that physicians who had not trained with their units were more of a liability than a benefit in forward positions because of their lack of familiarity with combat tactics and thus their potential for becoming injured themselves; that interviewee suggested that BASs would be best be staffed entirely by PAs.

One provider noted that humanitarian-assistance missions serve as useful exercises for Army providers. In addition to presenting patients and conditions that providers might not ordinarily see in their home-station MTFs, such missions let providers gain experience treating patients in austere environments, without the equipment they would ordinarily have at home.

Prior Deployment Experience

Prior deployment experience was viewed as uniquely valuable in preparing providers for subsequent deployments. The extent to which providers felt unprepared for trauma care seemed to be related to how much, and what kind of, trauma they encountered while deployed; where they were located and the extent to which they had relevant resources, such as equipment and other staff available to them; prior deployment experiences; medical training; and evacuation times.

The deployment experience of PAs in particular was highlighted during interviews with PAs, surgeons, and other physicians, all of whom described a higher level of preparedness and experience among PAs. This was especially true among special operations force PAs (because of their more-extensive, more-routine trauma training) and among the many PAs who had previously served as medics (because of their prior training and experience with trauma on the frontline of battle). During interviews, physicians and PAs often stated that, because of their deployment experience, PAs were more comfortable than other providers with BAS duties.

Other reasons described for the difference in preparedness between PAs and physicians included (1) the training received at the Army's Interservice PA Program for those who trained in the Army, (2) the routine trauma training to which PAs had access after their medical education, (3) more prior deployment experience among PAs than among PROFIS physicians, and (4) the fact that PAs were organic to the unit and more "in touch" with the soldiers for whom they were responsible. Related to this last point was some interviewees' observation of a difference between a PROFIS physician whose focus was on his or her daily specialty practice and an organic PA whose focus was on care of his or her soldiers both in garrison and while deployed, the latter of which is centered on trauma care. Still, both physicians and PAs noted that the presence of a physician was important because of a physician's clinical decisionmaking skills and the ability to appropriately identify a "sick" patient (i.e., to know when a clinical situation was deteriorating). We heard a few instances recounted by both PAs and physicians in

which a PA might have overlooked a step on a checklist (e.g., prior to intubation) that the physician was able to catch, even if the PA was more procedurally proficient.

The timing of the deployment affected the perceived value of deployment experience. For example, multiple surgeons commented on the effect of deploying during the current drawdown. Surgeons described the lack of surgical cases encountered during these deployments (at times, none during the entire deployment) as leading to further skill degradation. In addition, there is not a consistent and systematic “train-up” plan for ensuring that surgeons had opportunities to improve their surgical skills before returning to full independent practice. These two characteristics of deployments completed by surgeons motivated some to pursue additional fellowships and formal training upon their return home and others to switch the focus of their garrison practice to lower-complexity cases. This problem was compounded for more-junior surgeons who had to prepare for and take their board certification exams upon returning home, effectively extending their time away from in-garrison practice and patient care beyond their deployments.

Summary

In summary, our findings regarding trauma training suggest that courses exist to fill some of the potential gaps in preparedness that our interviewees described, but greater attention to class attendance and efforts to increase access to live-tissue training and high-fidelity simulations, as well as an overall strategy focused on routine rather than just-in-time training, could further enhance provider preparedness for deployment.

During interviews, providers reiterated several themes relevant to trauma courses and rotations. Many providers emphasized the need to maintain trauma preparedness by moving away from a model of just-in-time predeployment training and toward a model of routine trauma training. Some suggested requiring some type of basic combat trauma training every two years (or at some other appropriate and relevant time frame), which they noted would require MTF support to leave garrison practice for the training. In their descriptions of existing training courses, many emphasized the utility of live-tissue training, high-fidelity simulations, and stress drills as part of the courses and indicated a wish for greater emphases on these aspects of training. Although an every-two-year refresher falls well short of developing expertise, it would still be an improvement over the current situation, in which too many fail to receive the training before deploying.

Several identified the challenge of being away from family prior to deployment to attend training and indicated a preference for minimizing the nonmedical predeployment training and instead augmenting trauma preparedness training. As an example, a few providers noted that their deployments never included the “breaking-down-doors” activities on which the nonmedical predeployment trainings focused but that they all

involved providing trauma care, for which they wished they had had more training time.

Finally, a few providers indicated a wish to have clinical support staff (e.g., ward nurses, OR techs) be better prepared for clinical duties and trauma care while deployed, to support overall care delivery. They noted that many of these providers might not be involved in any patient-care duties prior to deployment and thus required considerable support and training during the first few months of deployment to become comfortable again with supporting the care team. This points to the importance of training not just individual providers but the entire group as a team.

Solution Options

In this chapter, we identify a variety of possible approaches for addressing the gaps described in Chapters Two through Four. These approaches can be organized into four categories, each of which requires increasing change from the status quo. The four categories are shown in Figure 5.1.

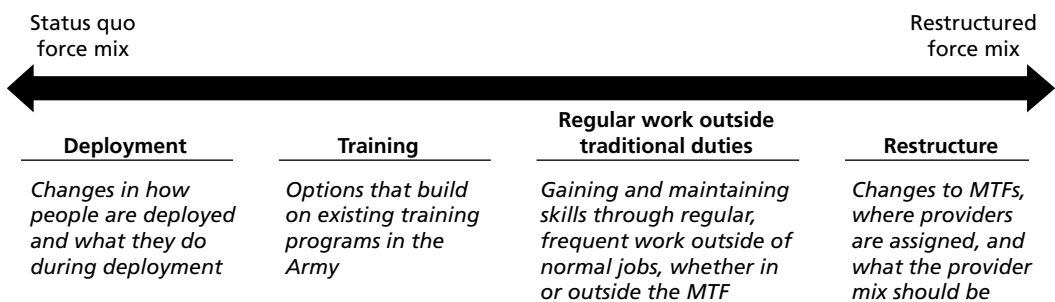
Deployment

The first set of options we present are ones that the Army might adopt in the deployment process or during the deployment itself as a way of better matching providers' skills to jobs into which they will be deployed and mitigating training gaps.

Promote Low-Tech Telemedicine in Theater

One of the challenges cited by providers who served as battalion surgeons is that, in the course of doing sick call, they came across diseases and minor injuries that were outside of their areas of usual expertise. This concern might come from subspecialty providers who must now function as generalists or might be heard from any provider seeing a condition that requires a specialty other than his or her own. Interviewees reported consulting with others outside their locations. Some phoned colleagues they knew back

Figure 5.1
Categories of Options for Addressing Gaps in Provider Preparedness



in CONUS, while others mentioned being taught at TCMC about online resources and email addresses from which they could receive specialty consults.

Although telemedicine often carries the connotation of real-time video connectivity, the experience of these providers suggests that even the low-tech approaches of telephone, email, and uploaded photographs can provide much benefit. These methods require some level of connectivity and thus might not be sufficient to address the most time-sensitive needs. Nonetheless, they can provide the solo deployed provider with some level of backup. In future deployments, the Army should retain and promote the use of consults, whether to reach resources elsewhere within or outside the theater.

Pair Less Experienced Providers and More-Experienced Providers

When a unit decides that, for deployment, it needs battalion-surgeon positions to be filled, the unit sends a request to MEDCOM. MEDCOM fills the request via PROFIS. The gaining unit has little knowledge, and even less say, as to what type of provider it will get to fill the battalion-surgeon position. The result will be a mix of different specialties and experience levels at different locations.

There might be benefits to deploying providers to positions more carefully based on the skill mix and experience level at each location. For example, it might be useful to pair up physicians who are less experienced at being battalion surgeons with more-experienced battalion PAs. Looking beyond battalion-surgeon positions, we find that there could be opportunities for junior surgeons to be paired with senior surgeons or with senior officers who have other duties on the surgical team, such as senior nurse anesthetists. Mentoring across AOCs might be more difficult than within AOCs, but the respect accorded to senior rank and position might make that relationship easier in the military than in a civilian setting.

Once providers are in theater, the brigade has some ability to move people around to help create such matches. However, matches would likely be better if they could be made earlier in the deployment process. This would require visibility into the skill and experience levels of PROFIS providers, as well as of the personnel in theater. The Army would also need to develop principles on what constitutes a good pairing.

Deploy Subspecialists Filling Field-Surgeon Positions to Role 2 Facilities and Higher

Just as there could be benefits to rethinking the placement of less experienced providers, there could be benefit in rethinking how subspecialists are placed in field-surgeon positions. Subspecialists whom we interviewed indicated a preference to be used in positions where they could exercise their specialties. In addition, subspecialists, while having been trained in the basic medical knowledge expected of general medical officers, tend to not have practiced those general skills.

Given the number of field surgeons required during deployment and the mix of Medical Corps officers in the Army, it would be impractical for subspecialists not to be used in general medical officer positions. However, when possible, it would be desir-

able to place subspecialists serving as field surgeons at Role 2 or Role 3 facilities rather than at Role 1 facilities. This would have two benefits. First, it would place them where they would not be solo providers and would have backup and guidance from other medical personnel. Second, it would allow the possibility that they would be referred patients who would require their specialties.

Training

The next set of options includes recommendations that build on existing training programs within the Army.

Enforce Mandatory Predeployment Training and Refresher Training

Interviewees who attended PDTT offered by the AMEDD Center and School at Fort Sam Houston reported the courses to be helpful. The TCMC course, geared toward providers who would be working at Role 1 and Role 2 facilities, was particularly singled out for praise. Interviewees stressed the hands-on nature of the training, including working with live tissue. They also acknowledged the limitations of receiving only five days' worth of training just before a deployment.

PDTT was mandated by HQDA EXORD 096-09, which required deploying medical personnel, starting October 1, 2009, to have taken the course appropriate to their deployed positions within 180 days of their deployment or, in the case of repeat deployers, to have taken the course within two years. For Medical Corps officers, this would mean primarily the TCMC or JFCTMC for Role 3 personnel, and, for surgical teams, the Army Trauma Training Course. However, some interviewees reported having deployed without having had this training, a finding consistent with our analysis of course data. Others reported that their attendance was almost happenstance, in that they heard about the course from fellow service members, and that they had to seek out the course themselves. A few reported having so little notice of their deployments that they would not have had time to take the training even if they had been aware of it.

Thus, one immediate recommendation would be for the Army to ensure that deploying personnel are aware of and attend the course prior to deployment. Ideally, the whole team would attend the training together. Regardless of whether the whole team can train together, care must be taken to ensure that PROFIS personnel who rotate into a unit midway through the unit's deployment have received the training.

The Army might also want to consider adopting a regular requirement for trauma training, rather than requiring it only prior to deployment. For example, it might be desirable to require all Army providers to go through refresher training every two years, a cycle consistent with the EXORD. The advantage of making such training a regular requirement is that it would relieve the time pressure associated with having to

fit in the training just prior to deployment. In addition, it would improve the general readiness of all medical personnel to handle unexpected cases of trauma.

A possible disadvantage that interviewees cited was that, if the training were not tied to an impending deployment, some students might not take the training as seriously as they would otherwise. In addition, there are approximately 4,000 Medical Corps officers in the Regular Army. A two-year refresher cycle would mean approximately 2,000 students per year at TCMC, JFCTMC, or Army Trauma Training Course for the Medical Corps alone, not counting the need to train nurses and medics and students from the reserve component. This would require a vast increase in teaching capacity and would require relationships with more hospitals than just the one Army Trauma Training Course arrangement with Ryder.

The Army could consider incorporating a validation requirement to the training. The USAF Centers for the Sustainment of Trauma and Readiness Skills (C-STARS) program in Cincinnati trains members of its Critical Care Air Transport Team. Students are given scenarios in which they work on instrumented mannequins within a mock-aircraft environment and are filmed for later debriefing. The program must certify a team before it is ready to deploy (Thorson et al., 2012). Similarly, the United Kingdom Ministry of Defence built a mock-up of its Camp Bastion (what is now Camp Shorabak) theater hospital (Lever, 2010a, 2010b). According to U.S. Army interviewees who have attended, the Ministry of Defence requires personnel who will be deploying to Camp Bastion to train and exercise at its mock-up and uses that as an opportunity to evaluate whether students are ready. Adding such a validation requirement would help ensure the readiness of providers who deploy. However, last-minute rejections of deploying providers would create a scramble for replacements.

Increase Availability of Short-Term Trauma-Center Rotations

Each of the services has partnerships with civilian Level I trauma centers in which service members do short-term rotations through the facility (two to three weeks, depending on the program) as a way of gaining exposure to patients with trauma that is normally not seen in MTFs. The Army Trauma Training Course takes place at Ryder Trauma Center in Miami and focuses on the training of FSTs. The Navy Trauma Training Center is at the Los Angeles County + University of Southern California Medical Center. The USAF has three locations for its C-STARS program, one at the R. Adams Cowley Shock Trauma Center in Baltimore, one at St. Louis University Hospital geared toward reserve-component students, and one at the University of Cincinnati Medical Center, which focuses on Critical Care Air Transport Teams. Each of these programs includes a combination of lectures, simulations, and work with patients at the trauma center (Thorson et al., 2012).

It is the exposure to real trauma patients that makes these programs distinctive from courses like TCMC. According to interviews, the extent to which students can work on these patients played a large role in students' perceptions of the course.

Although military personnel posted to the facility as faculty for the course function as members of the hospital staff and facilitate access to patients, the opportunity for student contact with patients can still be limited. Patients remain the responsibility of hospital staff, who perform the most-critical procedures themselves. Further, the rotating military students are competing with the hospitals' other trainees (e.g., residents) for access to patients. Thus, the military students can be relegated to observation or assisting. For some students, this exposure is quite useful; for others, this limitation is frustrating.

Interviewees noted that seeing trauma at civilian centers still did not fully prepare medical providers for the wartime injuries that they might encounter, a view seen also in the literature (Schreiber, Holcomb, et al., 2002; Schreiber, Zink, et al., 2008). Most civilian trauma is blunt-force injury from car accidents, and, even when there is penetrating trauma, such as from a knife or gunshot wound, these injuries are typically less severe than the multiple wounds that would be expected from high-powered assault weapons or an explosive device. Nonetheless, "any trauma is better than no trauma," as one surgeon phrased it. Thus, increasing opportunities for military providers to attend trauma-center rotations would give needed exposure for those who normally see no trauma at all in garrison, with the caveat that ensuring hands-on access to patients is critical. To prevent overloading the existing programs, which would result in even less exposure for students to patients, more partnerships would have to be created.

Creating more partner locations would require permanently positioning more providers at the trauma centers to serve as faculty. This provides what might be an even bigger benefit to the military: keeping up the skills of the permanent-party cadre. These providers can then be used as the senior trauma experts at deployed locations, providing guidance to the other providers who are less experienced at trauma. The USAF does this, placing surgeons who specialize in trauma and critical care in trauma centers to serve as the training cadre and deploying them to be "trauma czars" at theater hospitals.

Regular Work Outside Traditional Duties

Although predeployment training can be helpful, it still represents only one or two weeks of training, done at most once every two years. Simulation with mannequins, cadavers, and animal models is important and can be used to present students with scenarios that they would not encounter elsewhere. In other respects, however, these models do not fully replicate work on real human patients, and, even within the trauma-center rotation courses, opportunities for hands-on work with real patients are limited.

These next two options examine ways in which Army providers can gain or maintain skills needed for a deployment through working in areas that are outside their normal jobs. This includes both work within the MTF and work outside the MTF.

Encourage Subspecialists to Regularly Take Sick-Call and Emergency Room Duty

Interviewees indicated that certain types of subspecialists were often unfamiliar with performing the sick-call functions expected of field surgeons. This was especially true for subspecialists who do not handle the variety of illnesses and injuries outside their areas of expertise. Although their medical education and internal-medicine residency (for those who have done it) give them the basic knowledge for coping with diseases, there might have been some length of time since the subspecialists have used these primary-care skills. Musculoskeletal injuries were also cited as an area with which many providers were not familiar.

A few interviewees suggested that deploying providers should spend some time shadowing providers doing sick call to refresh themselves on the diagnostic skills necessary. Thus, a rheumatologist who is preparing to deploy as a field surgeon might spend some time in the primary-care clinic, while a pediatrician could spend some time seeing adults. Even a primary-care provider might find value in refreshing skills, such as spending some time in the orthopedic clinic. The downside would be that obtaining additional experience of this sort would add to the list of things providers need to do just before deployment. In addition, such activities would pull providers away from their normal jobs caring for patients in the MTFs, right when they must prepare to offload their patients to colleagues during the providers' deployments.

Whether the benefits of providing these within-MTF rotations outweigh the cost is hard to assess, given the difficulty of assessing the consequence of having a provider who is unfamiliar with sick-call skills. Most interviewees who started their deployments uncomfortable with taking sick call got help from fellow providers and, in short order, got used to it in the course of their deployments. Still, it is an option that the Army could consider as an optional offering if not a requirement. At least one MTF we visited provides these opportunities to deploying providers on an individual basis.

Promote Regular Work in Civilian Hospitals

Some providers we interviewed indicated that they did not get sufficient numbers of patients, with sufficient complexity, to keep their skills up. Further, with few exceptions, Army MTFs in garrison do not receive substantial numbers of trauma patients. One possibility would be for the Army to increase the number of patients seen in the MTFs, starting with recapturing beneficiary patients who currently seek care outside the MTF, and perhaps including civilian trauma patients as well. We address this possible option below.

However, if the Army cannot bring cases to its providers to maintain skills within the MTFs, it should enable providers to get those cases outside the MTFs. This would mean having active-duty providers work in civilian facilities on a regular basis, whether as part of their on-duty time or off duty. Examples would be surgeons performing operative cases at the local hospital and emergency physicians taking shifts at civilian emergency departments.

On-duty options for military providers to work on patients in civilian facilities who are not military beneficiaries, for the express purpose of training, are known in the USAF and Navy as TAAs and in the Army as MTAs (Deaver and Harris, 2012; Moore et al., 2016). In this case, military providers work part time at civilian facilities as part of their duty hours and are thus paid at their military salaries, while the hospital essentially gets the services of the provider for free. Providers who made use of such arrangements found them useful but also reported that the arrangement was driven primarily by their personal initiative. In contrast, the USAF's Sustained Medical and Readiness Trained (SMART) concept, currently in its early stages at Nellis Air Force Base, more formally promotes the use of TAAs to cycle Nellis MTF personnel through the nearby University Medical Center of Southern Nevada regularly to work on patients and thus maintain skills.

In our interviews with Army providers who worked outside MTFs, more often, the arrangement was off-duty employment (moonlighting). In this case, the provider works during his or her off-duty hours and is paid by the civilian hospital accordingly. Providers who moonlit expressed dismay that others at the MTF often looked down on such arrangements because moonlighting was often seen as a way of making extra money. They would rather see the Army promote the use of off-duty employment as a way of ensuring proficiency. However, for off-duty employment to be useful for maintaining proficiency, the Army would need a way to track the cases being handled by providers during the off-duty time.

A significant drawback to having providers go outside the MTFs to gain clinical proficiency, whether on duty or off duty, is that these opportunities are typically available only to medical doctors, often only to surgeons or specialists whose skill sets are in demand by the local hospital. Thus, nurses, medical technicians, supporting functions, and other members necessary to the care team are excluded. So bringing more patients into the MTF would enable more people to benefit from increased practice. However, if increasing patient load within MTFs does not bring the necessary number of complex cases, promoting the regular work at civilian hospitals, whether on duty or off duty, can be a way of expanding the volume and case mix providers see.

Restructuring

In contrast to the options above, the final three options presented require the Army to rethink how AMEDD is structured. This includes where providers are assigned and what the provider mix should be.

Bring More Patients, Including Trauma Cases, into Medical Treatment Facilities

With few exceptions, MTFs do not see many cases of fresh trauma; only the San Antonio Military Medical Center is a Level I trauma center (and is ACS verified); five other

MTFs are also considered trauma centers but at lower levels.¹ Furthermore, interviewees reported that the smaller MTFs might not have enough cases of sufficient complexity to keep surgeons and surgical teams clinically proficient.

Increasing the caseload within MTFs holds significant appeal in that it creates opportunities for all of the MTF staff to practice their skills. Indeed, the report of the Military Compensation and Retirement Modernization Commission notes that “the MHS relies heavily on Military Treatment Facilities . . . as training platforms to maintain the clinical skills of military medical personnel” (Military Compensation and Retirement Modernization Commission, 2015, p. 57).

Recapturing the caseload of military beneficiaries that might otherwise be handled by TRICARE providers would be one way to increase the volume of work at MTFs. This would increase the amount of practice for MTF staff in taking care of patients, including inpatient and surgical cases. In addition to treating military beneficiaries, MTFs could engage in agreements with the U.S. Department of Veterans Affairs to treat its beneficiaries.²

But these would generally be nontrauma cases. To get trauma cases, the MTF would have to be approved under the Secretarial Designee Program to accept emergency patients, be verified by ACS as a trauma center, and, most importantly, be designated by the local community to receive trauma cases (Under Secretary of Defense for Personnel and Readiness, 2011 [2013]; ACS, 2014). MTFs would have to be staffed with trauma specialists to provide round-the-clock coverage of the necessary specialties as specified by ACS. The trauma-care specialists would have to be backed by the capacity necessary to handle admissions and potentially to handle follow-on care. Arrangements would also have to be made to allow ambulances to go rapidly through security to enter the base. Finally, turning MTFs into trauma centers that would accept civilian patients could put the MTF in competition with existing civilian hospitals in the area. This could result in a loss of revenue for the civilian hospital, a consideration that could cause civilian hospitals to oppose the designation of MTFs as trauma centers. Perhaps even more problematic is that the addition of a trauma center in geographic area that already has sufficient trauma capacity would cause a dilution in the patient pool necessary for all of the trauma centers to have sufficient caseload to maintain proficiency (National Academies of Sciences, Engineering, and Medicine, 2016, pp. 372–374). Determining whether turning MTFs into trauma centers is feasible from a cost perspective or from a political perspective was beyond the scope of this study.

¹ The others are Walter Reed National Military Medical Center (ACS verified) and Madigan Army Medical Center at Level II, Carl R. Darnall Army Medical Center and Landstuhl Regional Medical Center (ACS verified) at Level III, and Tripler Army Medical Center at Level IV (National Academies of Sciences, Engineering, and Medicine, 2016, p. 250).

² See Moore et al., 2016, for a discussion of military–civilian medical synergies.

Permanently Assign More Providers to Civilian Trauma Centers

In the course of our interviews, we heard two distinct opinions regarding trauma skills. One view is that trauma surgery in theater is well within the skill set of any general surgeon and that trauma care by nonsurgeons involves basic principles that can be taught to any provider. Under this view, it is important to keep providers busy when they are in garrison, but the work does not need to be trauma care per se. The other view is that care for trauma patients does require distinctive skills and decisionmaking abilities that are perishable. Under this view, care to trauma patients would best be provided by medical personnel who practice on trauma patients day in and day out; a one- or two-week course, no matter how well taught, will not suffice.

According to interviews with trauma leaders in the Army and the USAF, these two differing philosophies can be seen in the ways in which the Army and USAF place their respective surgeons at home and in the deployed setting. The Army considers every general surgeon to be subject to deployment as a trauma surgeon in war. Consequently, it does not matter where the surgeon is posted in garrison, as long as he or she can maintain a practice as a surgeon. In contrast, the USAF recognizes that a subset of its surgeons is specifically trained as trauma or critical care surgeons and will seek to place those providers where they can practice trauma surgery. In addition to being assigned to the San Antonio Military Medical Center, trauma surgeons are assigned to civilian Level I trauma centers, where they function as members of the hospital trauma team while serving as the faculty cadre for students rotating through the C-STARS program. When the USAF is called on to deploy, it then sends at least one of these trauma surgeons to each theater hospital, where they could serve as trauma directors and provide guidance to the other nontrauma surgeons. Members of the USAF Special Operations Surgical Teams are also based in civilian trauma centers full time when not deployed.

As discussed earlier, research published by the U.S. Army Institute of Surgical Research argues for the importance of trauma training and maintenance of trauma skills. The development of trauma systems and protocols for sending trauma patients to trauma centers in the civilian sector further argues for the importance of ensuring that care is provided by people who are trained and equipped for trauma. The Army might wish to consider having a set of providers who are trained specifically as trauma surgeons and kept at a higher level of trauma readiness, a specialty that Schwab, 2015, calls a *combat surgeon* (p. 249). These providers would then be assigned to work full time at civilian trauma centers, caring for the civilian patients to keep their trauma skills up. This would include not only surgeons but other members of the surgical team, as well as intensive care specialists and emergency department personnel. Further, it should include not only doctors but nurses and technicians as well.

The advantage of such an arrangement would be to have a corps of personnel who would be at a higher level of trauma readiness than the typical provider at a non-trauma center MTF. During wartime, this corps could serve as the backbone

for trauma care, deployed to theater hospitals to provide guidance to other surgeons. During peacetime, this corps could serve as faculty for other Army medical personnel who might rotate through, providing more opportunities for students to gain exposure to, if not true hands-on experience with, trauma patients.

One disadvantage to this arrangement would be increased cost. Assigning providers to civilian centers means losing their workload within the MTFs. Either civilian providers would have to be brought into the MTF or the cases would have to be sent out to the purchased care network. Estimating this cost, in light of caseloads and provider productivity, should be the subject of a future study. Another disadvantage is that experiences to date for placing providers in civilian centers tend to be limited to physicians, especially surgeons, as well as certain specialties, such as radiology and cardiology (Moore et al., 2016; Eibner, 2008).

Rebalance the Force Mix in Favor of Areas of Concentration Better Suited to the Deployment Mission

Interviews with deployed providers identified providers filling battalion-surgeon positions as having the largest skill gaps. The battalion-surgeon position requires two sets of skills: trauma care and sick call. Interviewees described emergency-medicine doctors as being ideal for the job, with family-medicine physicians also valued for their ability to treat disease and injuries for a variety of age ranges. Internal-medicine physicians would be suited for diseases but might be less suited for minor injuries.

Although family physicians might be better suited to field-surgeon positions, the Army, in the interest of fairness, has chosen to spread the deployment burden across specialties, rather than deploying only family physicians while not deploying others. Thus, specialists and subspecialists are deployed into field-surgeon positions, even though their training and work experience are not ideal.

The logical question then arises: Why have these subspecialties in uniform? Many do not have formal positions within their specialties even at CSHs and are used instead for handling general medical duties or to run ICUs. If specialties are required only for garrison care or for training residents, the logic goes, perhaps those positions should be filled with civilian or contractor providers, or the care outsourced to the purchased-care network. Instead, the Army would recruit more emergency and family physicians.

Rebalancing the force to better suit deployment needs might be something the Army should consider. However, the Army would need to be mindful of two concerns. The first is recruitment. Interviews with personnel planners indicate that the variety of specialties in the Army plays a role in the recruitment and retention of physicians. The choices of residencies and fellowship opportunities are what incentivize people to join, and later stay in, AMEDD. For example, the Army could entice a physician to stay by supporting the physician's desire to do a fellowship in a specialty area. If the number of specialties supported by the Army were reduced, some of these avenues would become closed, so recruitment and retention could suffer.

The second concern would be placement. Even if the Army were able to convert positions from subspecialists to emergency or family medicine, it would then face the problem of where to place them so that they had sufficient workload to stay active.

Tracking

Create a Dashboard to Track Training Gaps

The final option presented does not fall into any of the above categories but cuts across all of them in that it represents a way to track the readiness of providers. As we have discussed through the building blocks of provider readiness for deployment, many elements contribute to a provider's readiness to perform tasks during a deployment. Formal medical education and training, including medical school, residencies, and fellowships, serve as the starting point. Clinical work at the MTF provides experience and keeps skills sharp. Additional clinical work outside the MTF can bring extra case volume and a diversity of cases. Courses, such as those from the AMEDD Center and School and DMRTI, add to preparation. Short-term rotations at trauma centers give exposure to real trauma patients. Exercises with the unit provide training in field operations. Finally, deployments over the course of a provider's career provide important experience. Tracking all these elements for each provider and comparing them with possible duties in theater would help providers, unit commanders, and specialty consultants get a better picture of individual and collective readiness.

Constructing a dashboard could provide an integrated view of readiness with respect to potential missions. Data sources exist for many of these elements (and are described in Appendix D), but these sources need to be linked together. For other elements, no central data exist, so new systems will need to be built.

The first element of the dashboard would look at a provider's specialty and identify the positions into which that type of provider is likely to be deployed, based on historical deployments found in ARTS. This would enable providers to start preparing, particularly if their deployed duties are likely to be very different from their garrison duties.

Work performed at MTFs contributes to proficiency; this is tracked in the MDR. Theater medical data can provide insight on the likely diagnoses seen and procedures performed in the deployed environment, which might be quite different from those seen by providers in garrison. This can be used to identify clinical skills that need practice or sharpening. Work that providers do outside the MTF also contributes to clinical proficiency; this is an area that is currently not well tracked centrally.

Tracking the courses, trauma-center rotations, and exercises attended helps ensure that providers have the necessary training before deployment. ATRRS is one source of this information; a major gap is that civilian-sector courses would not be in that system. Finally, deployment records can be used to identify who has had field experience—

whether that be wartime, humanitarian assistance, or another austere environment—which can then become a factor in making deployment decisions.

Building a dashboard that contains this information would provide benefits to a variety of user types. Providers would be able to use it to identify their potential weak areas. MTF commanders and unit commanders could use it to track the training of their personnel. Corps chiefs and specialty consultants could use it to track the readiness of people within their professions. Combining the information that exists in disparate sources to produce a single picture of readiness is the first step to building and maintaining readiness.

Evaluating Options

According to our interviews and analyses, the two areas of concern in terms of readiness are the ability to handle sick call and the ability to handle trauma. Our interviews also indicated that the most-effective interventions for maintaining readiness were ones that involved regular practice. But to be effective at all, they had to be available to everyone. Therefore, we rated each option on the following four criteria:

1. Does the option help providers handle **sick-call** duties (yes [Y] or no [blank])?
2. Does the option help providers handle **trauma** (yes [Y] or no [blank])?
3. Does the option involve the provider **regularly practicing** the necessary skills on a day-in day-out basis (yes [Y] or no [blank])?
4. Do **more** or **fewer** provider types **benefit**?

We did not attempt to rate which options would be more helpful than others.

For **sick call**, we deemed the use of telemedicine, the pairing of less experienced and more-experienced providers, and the assignment of subspecialists to Role 2 facilities and higher as being helpful because each of these enables a deployed provider to get advice from others either in person or technologically. In addition, the taking of sick call and ER duty would provide opportunities for a provider to refresh his or her skills. Rebalancing the force is deemed useful because it would allow for better alignment between the skill mix in the force and the skills necessary in deployment. Therefore, we deemed these options useful for improving providers' ability to handle sick call. All the other options are specific to trauma.

For **trauma**, we deemed all of the options to be helpful. Training and trauma-center options are clearly designed to improve trauma training. We also deemed changes to deployment assignments as being helpful, in that they place providers in places where others would be able to assist them with trauma cases.

For **regular practice**, we deemed only the regular work outside MTFs, the increase in patients within MTFs, permanent assignments, and force rebalancing to

be *yeses*. The other options were short-term courses, last-minute practice, or changes to assignments in theater.

For **who benefits**, courses were considered to benefit *more*, assuming that they would be open to all interested. Options related to adjustments to deployment were also deemed to benefit all. On the other hand, trauma-center rotations, regular work outside the MTF, and permanent assignment to civilian trauma centers were considered to benefit *fewer* because those opportunities have historically been filled by only a few specialties, such as surgeons.

We summarize the results in Table 5.1. We note that the dashboard is a way of tracking readiness rather than a strategy that directly improves readiness, so we rated that as not applicable (N/A) across the board. We also note that, although we did not attempt to assess the cost of each of these options, the options are grouped in categories (see Figure 5.1): making changes to existing training, changes that affect deployment, changes that affect regular garrison work, and changes that affect the force structure as a whole.

Table 5.1
Evaluation of Options

Option	Helps Sick Call?	Helps Trauma?	Permits Regular Practice?	Relative Number of Provider Types Who Benefit
Promote low-tech telemedicine in theater	Yes	Yes	No	More
Pair less experienced and more-experienced providers	Yes	Yes	No	More
Deploy subspecialists filling field-surgeon positions to Role 2 facilities and higher	Yes	Yes	No	More
Enforce mandatory PDTT and refresher training	No	Yes	No	More
Increase availability of short-term trauma-center rotations	No	Yes	No	Fewer
Encourage subspecialists to regularly take sick call and ER duty	Yes	Yes	No	More
Promote regular work in civilian hospitals	No	Yes	Yes	Fewer
Bring more patients, including trauma cases, into MTFs	No	Yes	Yes	More
Permanently assign more providers to civilian trauma centers	No	Yes	Yes	Fewer
Rebalance the force mix in favor of AOCs better suited to the deployment mission	Yes	Yes	Yes	More
Create dashboard	N/A	N/A	N/A	N/A

NOTE: ER = emergency room.

Findings and Recommendations

Findings

In this study, we conducted qualitative and quantitative analyses to examine ways in which Army medical providers can maintain their clinical proficiency for the duties they would have to perform during deployment. We conducted interviews with providers who had deployed, examined data on the jobs into which providers of different types were deployed, compared the workload of providers at home-station MTFs with that at deployed locations, and cross-referenced records of deployments with records of PDTT. We have two main findings.

There Is a Mismatch Between Medical Treatment Facility Care and Deployed Care

Our first main finding is that care in the deployed setting is often being delivered by people working outside their areas of specialty. Physicians deployed to caregiving functions deploy either to be field surgeons at BASs or medical companies or to work in surgical hospitals. In both settings, although there are exceptions, for many types of providers, the types of patients seen in theater differ from the types of patients seen at home.

Those who deploy as field surgeons are providing mainly primary care but must also be prepared to provide initial stabilization of trauma patients. Our analysis of deployment data indicates that, although family physicians and internists often deploy in this position and are well versed in primary care, the position is also often filled by subspecialists, such as cardiologists, dermatologists, and oncologists, who do not typically do primary care in their usual jobs. Moreover, few of these providers see trauma care in their home-station jobs. Although they would have received some training in primary and trauma care in their formal education, for most, it will have been a while, and is certainly not regular practice.

Meanwhile, surgeons, anesthesiologists, emergency-medicine physicians, and some internists deploy to hospitals in theater. However, although they are being deployed into the same specialties as they normally work in their home stations, the nature of the work is different. Those who deploy to hospitals, whether FSTs or CSHs, will see trauma cases that require surgical intervention. But our analysis of deployed

and home-station MTF data shows that the mix of patients seen at home is very different from that seen in the deployed setting. With few exceptions, home-station MTFs do not see fresh trauma patients. Some surgical skills from the peacetime setting might carry over to the wartime setting, and more research is needed to determine exactly which skills carry over and which do not. However, it remains that trauma care in theater is often being delivered by people who do not see trauma at home.

Predeployment Trauma Training Is Valuable but Not Sufficient

Recognizing the need to train providers for the deployed mission, the Army and DoD offer a variety of PDTT courses, some of which are mandatory for personnel before they deploy. The courses include a combination of classroom training, demonstrations, hands-on skill work, and simulations. Our interviews indicate that providers found that these courses refreshed their skills and increased their comfort levels with the mission. However, there are three shortcomings with the trainings.

The first shortcoming we found from our analysis is that, despite the requirement to attend training, too many providers deploy without it. Some interviewees reported being unaware of the training, others reported finding out just by luck, and some reported the difficulty of fitting in the training during the short window after being notified of impending deployment. The end result is that attendance among deployers falls short of the 90-percent target set in the EXORD.

The second shortcoming is that hands-on work is limited. Courses, such as TCMC, use a variety of simulations but do not include work with human patients. Rotations at trauma centers, such as the ATTC, present the possibility of hands-on work, but, as the National Academies 2016 report on trauma care put it, “Brief ‘just-in-time’ rotations usually mean that nurses and physicians can observe clinical care but not actually perform it. This is analogous to watching someone fire a weapon, rather than actually firing it oneself” (National Academies of Sciences, Engineering, and Medicine, 2016, p. 375). We note that the trauma-center partnerships do serve a valuable purpose for those who are assigned as the faculty cadre. In addition to teaching military personnel who rotate through in their courses, the cadre members function as members of the hospital staff and thus regularly see trauma patients, so they are able to build expertise.

The third shortcoming is that these training opportunities are limited in what they can accomplish in the time that they have, with TCMC being one week long and the Army Trauma Training Course being two. Even if students were to attend these courses every two years, it would be at best a refresher, not a way of building lasting expertise. Again, the example of trauma-center cadres is useful because those members are assigned to the trauma centers on a longer-term basis.

Recommendations

The Army culture is one of persevering to accomplish the mission regardless of the difficulties and lack of resources. AMEDD is no different. Providers of all types of specialties learn and adapt to provide the best medical support that they can to soldiers, whether in BASs, medical-support companies, FSTs, or CSHs. After more than a decade and a half of war, AMEDD now includes people with the most experience caring for those in the deployed setting, including combat trauma patients.

But what of the next war? As operating tempo decreases and time goes on, experienced providers will leave the service and be replaced with newer providers without that wartime experience. How much expertise would those providers have on day 1 of their deployments? How well would they care for service members, especially the most-critically injured trauma patients? How much expertise ought they have, and how can the Army ensure that expertise?

The National Academies of Sciences, Engineering, and Medicine's 2016 report on trauma care provides a framework for thinking about where the Army is and where it ought to go. The report lays out five levels of clinical competence, ranging from novice to expert, along with examples of providers whose experience would fit into each of those levels. We have reproduced the content of the report's summary table in Table 6.1.

Where would AMEDD fit on this scale? Ideally, everyone in AMEDD would be at the expert level, in order to provide the best level of care in the event that service members or others become sick or injured. Certainly, there are some in AMEDD who would be considered experts, including those who have had repeated deployments and those who, when not deployed, work in civilian trauma centers. However, not all providers have this level of expertise. Some might have far less. For this discussion, we divided the providers into two categories: The first category consists of those who would be deployed as field surgeons, whether as the battalion surgeon or at a medical company. The second category consists of those who would deploy at surgical facilities, whether at FSTs or CSHs; this includes the surgeons and the surgical teams, of course, but also those engaged in critical care. We then assessed the level of competence by comparing the level of training and type of work experience in which these providers normally engage with the trauma-related example given in Table 6.1.

Providers who deploy as field surgeons to Role 1 BASs and Role 2 brigade support medical companies come from a variety of specialties, as shown in Figure 2.1 in Chapter Two. Few of them are emergency-medicine physicians in their home-station jobs. Although these providers might have done ER rotations as part of their training, for many of them, it has been a while since those rotations. Instead, their most-recent exposure to trauma would have been the PDTT, such as the TCMC course—if they managed to attend it before deploying. Thus, it is possible that many of these providers

Table 6.1
National Academies of Sciences, Engineering, and Medicine’s Five Levels of Clinical Competence

Skill Level	Description	Trauma-Related Example
Novice	The novice has no experience in the environment in which he or she [is] expected to perform.	Administrator or technician who has never worked in a trauma center
Advanced beginner	The advanced beginner demonstrates marginally acceptable performance and has enough experience to note recurrent, meaningful situational components.	Medic [who] has had didactic trauma training but no clinical trauma experience
Competent	Competence is achieved when one begins to see one’s actions in terms of long-range goals or plans. [The competent provider] demonstrates efficiency, coordination, and confidence in his [or] her actions.	Board-eligible [or] -certified physician [who] has . . . rotated [only] as a resident at a trauma center
Proficient	The proficient [provider] perceives situations holistically and possesses the experience to understand what to expect in a given situation.	Board-eligible [or] -certified physician or new nurse, starting [his or her] career at a high-volume and best-quality Level I trauma center.
Expert	The expert has an intuitive and deep understanding of the total situation and is able to deliver complex medical care under highly stressful circumstances.	Trauma nurse coordinator or [fellowship-trained] trauma surgeon with years of experience at a high-volume and best-quality Level I trauma center

SOURCE: National Academies of Sciences, Engineering, and Medicine, 2016, Table 5-1.

have had didactic trauma training but no clinical trauma expertise. Consequently, we put them in the advanced beginner category.

According to the EXORD, providers deploying to FSTs are supposed to do rotations at the ATTC in Miami. FST members will thus have rotated through a trauma center, although, as interviewees have noted, they have not had much patient contact during that time. Although some providers work in Level I trauma centers, it is relatively few of them—most notably, the providers are assigned to Brooke Army Medical Center and, to a far lesser extent, the teaching cadre at the ATTC in Miami. Therefore, although some Army medical providers are proficient or experts, the bulk of FST and CSH providers, who do not work in trauma centers, would, if they had attended the Army Trauma Training Course, be in the competent category.

Near-Term Recommendations

We recommend that, in the immediate term, the Army take steps to ensure that there is no backsliding from the current expertise levels. For those who might deploy as field surgeons, it should make sure everyone maintains at least advanced beginner status. **We recommend enforcing the requirement for predeployment training and further adding a requirement for refreshers every two years, not just prior to a deployment.** Interviewees nearly universally praised courses, such as TCMC. But,

although those courses are required, the Army is falling short in ensuring that providers are getting that valuable training before they deploy.

Those who deploy to FSTs are required to do rotations at trauma centers as their PDTT. We recommend enforcing that requirement, including with refreshers and not just prior to scheduled deployment. In addition, we recommend that those deploying to CSHs also do such rotations at least every two years. These rotations need not be limited to attendance at the Miami program. This could also take the form of a requirement to periodically work in the ER of a local civilian trauma center, whether on duty as part of a training agreement or as ODE. Critical to the usefulness of these rotations will be that they be designed to provide the attendees with hands-on work with trauma patients.

Longer-Term Recommendations

We recommend that, in the longer term, the Army move toward increasing the level of competence of providers, both those in the field-surgeon category and those deploying to FSTs or CSHs, one step up each along the National Academies scale. This is summarized in Table 6.2.

We recommend that those who will be deployed as field surgeons attain at least the competent level on trauma as defined by the National Academies scale, meaning that they would have rotated in trauma centers. Although many providers will have had this as part of their initial medical training, for many, this will have been some time ago. Therefore, they should do regular rotations in such programs as the Army Trauma Training Course in Miami or periodically work in the ERs of their local civilian trauma centers.

We recommend that those who will deploy to FSTs or CSHs have at least the same level of proficiency as we would expect out of those who provide trauma care in the civilian trauma centers (proficient). A way to ensure this would be to assign FST and CSH providers in a way that they will see civilian trauma patients on a continuing basis, whether this be in MTFs that are or become trauma centers or in civilian Level I trauma centers. Preferably, providers would be placed as teams,

Table 6.2
A Proposed Longer-Term Way Forward

Deployed Duty	Key Phrase from the National Academies Report	Where the Army Is Now	Where the Army Should Be	What Would Be Needed
Field surgeon (BAS or medical-support company)	"Didactic trauma training but no clinical trauma experience"	Advanced beginner	Competent	Regular rotation at a trauma center
FST or CSH	"Rotated as a resident at a trauma center"	Competent	Proficient	Work at a high-volume Level I trauma center

so that they train together to work together. Trauma experts stressed the importance of regular work, which they deemed more effective than courses taken or practice done only prior to deployment. Pulling Army providers out of MTFs to be placed in trauma centers might require backfill at the MTFs to handle beneficiary care or sending those patients out to the TRICARE network. However, doing this gives Army providers as much exposure to trauma as is possible in a peacetime setting. The Air Force Medical Service relies on partnerships with civilian hospitals to a higher degree than AMEDD does, with providers assigned as cadre members at three C-STARS locations, compared with the Army's one Army Trauma Training Course, as well as placing its five-person Special Operations Surgical Teams, as teams, at other trauma centers on a full-time basis. Even if were not possible for the Army to place all its FST and CSH members in trauma centers, the Army might find it useful to increase the number of providers whom it designates trauma specialists and places at trauma centers.

Finally, we recommend constructing a dashboard that would bring together the various information sources necessary to produce a picture of readiness for each provider. Although this does not directly help provider readiness per se, it enables providers and leaders to understand where gaps might lie for each person.

Quantitative Methodology

We used the following data sources to conduct the analyses described in this report:

- The **Army Medical Department Resource Tracking System (ARTS)** is an application within the Medical Operational Data System that houses information on PROFIS deployments, including the deploying provider's AOC (both assigned and filled in the deployed setting), the mission, event (theater), and unit that the deployment supports, as well as the dates of deployment. The ARTS extract used in this study covered 2005 through 2015, and the combination of assigned AOC and AOC being filled in the deployed setting allowed us to compare the position the provider typically plays in a garrison clinical setting with the position that that provider filled while deployed.
- The **Army Training Requirements and Resources System (ATRRS)** is the Army's system of record management for managing student input to training. Extracts from ATRRS contain individual-level data related to soldier training, such as course numbers, titles, locations, and student enrollment and completion information and dates. For the purposes of the course-attendance analysis, we focused on PDTT and other clinically relevant courses that could help augment the preparation for deployment that a provider obtains from working in a garrison MTF during peace or dwell time. We compared course-attendance records with deployment dates to determine recency of training relative to the start of a deployment. ATRRS data covered 2001 through 2013.
- The **Contingency Tracking System (CTS)** is a DMDC file that contains information on all deployments among people involved in contingency operations, where a deployment for OEF or OIF is defined as a DoD service member who is or has been physically located in the OEF or OIF combat zones or areas of operation or has been specifically identified by his or her service as "directly supporting" the OEF or OIF mission outside the designated combat zone (Bonds, Baiocchi, and McDonald, 2010). The file is updated monthly and includes a separate record for every deployment event, including start and end dates for each deployment. This file was used to document the percentage of providers with

previous deployment experience, as well as in our analysis of the percentage of providers who attended PDDT prior to deploying.

- The **Deployed Standard Inpatient Data Record (SIDR)** is a data repository maintained by AMEDD's PASBA and contains inpatient records from theater MTFs. Like the MDR's inpatient data files, the deployed SIDR includes information on diagnoses, procedures, and dates on which care was delivered, but it does not document the types of providers who cared for the patient. These data were used to characterize, in aggregate, the care that was delivered in inpatient facilities in theater. Data used in the analysis covered 2003 through 2012.
- The **Military Health System Data Repository (MDR)** is the centralized data repository that contains Defense Health Agency corporate health care data worldwide. It receives and validates data from DoD's network of health care facilities and therefore contains information on inpatient and outpatient health care encounters within the MHS and network of civilian providers. For the purposes of this study, we used medical encounter data captured in the MHS (direct care) system to characterize the care that Army active-duty providers deliver while stationed in U.S.-based garrison MTFs. In our analyses, we used primarily diagnoses, procedures, location (inpatient, outpatient), and provider information. Data were available on all beneficiaries (service members, dependents, and retirees) from 2004 through 2010.
- The **Work Experience File (WEX)** is a DMDC-derived file (from Active Duty Military Personnel Master File and Reserve Component Common Personnel Data System files) that contains snapshots of basic service member personnel information. A snapshot is defined by the service member's military branch, component, reserve status, pay grade, primary service occupation, secondary service occupation, duty service occupation, and unit identification code. When one of those variables changes, a new record is generated with start and end dates. The WEX includes career data for all active-duty or reserve-component personnel who served on or after September 30, 1990. Since 1993, the WEX has been a month-level file, detecting changes in any of the above variables every month. This file was used primarily for its occupation codes. If an Army officer was observed to have a primary, duty, or secondary occupation from the list of providers under consideration in this study, we identified the provider here and located his or her records in all other files.

Specifications for Empirical Analyses

Garrison and Theater Workload Analysis

We conducted our analysis using the following steps:

1. Illustrate war injuries, traumatic injuries with OR procedures, and any traumatic injury using the deployed SIDR for theater injuries and the MDR SIDR for injuries seen in garrison MTFs (see Figure 3.3 in Chapter Three). Definitions of each are as follows:
 - a. **war injury:** a diagnosis code between E900 and E999 in any of the diagnosis fields
 - b. **trauma all:** primary diagnosis with a CCS code between 225 and 244 (HCUP, 2016) or any E code
 - c. **trauma with an OR procedure:** trauma (as defined under “trauma all”), plus at least one major therapeutic procedure code (in any procedure field), where *major therapeutic procedure* is defined in HCUP, undated, as any procedure “considered [a] valid operating room [procedure] by the Diagnosis Related Group (DRG) grouper and that [is] performed for therapeutic reasons (e.g., 39.24 Aorta-renal bypass)”
2. Determine how to treat the most-common therapeutic procedures in garrison and in theater.
 - a. Treat all procedure fields equally. In other words, count two major procedures for one patient the same as one procedure performed on each of two patients.
3. Determine how to treat the most-common discharge diagnoses treated in garrison and in theater.
 - a. Count only the primary diagnosis.

Army Training Requirements and Resources System Course-Attendance Analysis

1. Using the WEX, identify all Regular Army officers present since 2001 and with any of the following AOC codes: 60A, 60B, 60C, 60D, 60F, 60G, 60H, 60J, 60K, 60L, 60M, 60N, 60P, 60Q, 60R, 60S, 60T, 60U, 60V, 60W, 61A, 61B, 61C, 61D, 61E, 61F, 61G, 61H, 61J, 61K, 61L, 61M, 61N, 61P, 61Q, 61R, 61U, 61W, 61Z, 62A, 62B, 63A, 63B, 63D, 63E, 63F, 63H, 63K, 63M, 63N, 63P, 63R, 65A, 65B, 65C, 65D, 66B, 66C, 66E, 66F, 66G, 66H, 66N, or 66P.
2. Using CTS, identify all deployments for providers identified in step 1.
3. Using ATRRS, identify all courses attended for providers identified in step 1.
4. Merge course data into the deployment file.
5. For each deployment, create a flag for whether the provider attended a course of interest within six months, within two years, or ever prior to a deployment start date.

The output is, for all providers identified in step 1, a deployment-level data set with flags for whether the deployed provider attended a PDTT course prior to a deployment.

Qualitative Methodology

We conducted semistructured interviews with previously or currently deployed providers and with SMEs to characterize (1) the challenges facing deployed providers pertaining to their training and skills, including potential mismatches between skill sets and deployed tasks and responsibilities and (2) potential approaches to addressing these challenges and maximizing the use of Army providers' in-theater operations and improving clinical practice processes and outcomes in theater. This study was approved by RAND's Human Subjects Protection Committee and the U.S. Army's Human Research Protections Office.

Data Source and Recruitment

We targeted clinical providers with OEF, OIF, or OND deployment experience, as well as SMEs in GME; predeployment training for health care providers, including trauma training; and individual clinical specialties. Most of our interviewees fell into multiple categories, particularly because almost everyone had deployment experience. For recruitment purposes, we maintained separate categories for interviewees, but our analysis combined and integrated interview findings across recruitment categories.

To identify SMEs in GME, we searched the Army GME website (U.S. Army Directorate of Medical Education, undated) to identify program directors and assistant program directors across various clinical specialties. To identify SMEs in predeployment training, including trauma training, we started with contacts provided to us by our action officers and then employed a snowball sampling approach whereby we asked interviewees to identify additional people in charge of or involved with existing training platforms (across the three services: Army, Navy, and USAF) for us to interview. To identify SMEs within individual clinical specialties, we targeted the Army Medical Corps consultants to the Army Surgeon General for a broad range of clinical specialties.

To identify deployed providers, we utilized several different approaches. First, as we began to meet with and interview the SMEs described above, we asked interviewees to help us identify providers with known deployment experience within their respec-

tive disciplines or clinical specialties. Second, we planned to conduct three site visits to military installations to conduct in-person interviews. We selected military installations on the basis of (1) the size of the population they served in garrison; (2) relatedly, the sizes of their medical operations; (3) the relative numbers of providers they had deployed or expected to deploy to theater and frequency of deployments; and (4) whether they were already engaged in site visits for other projects. We finalized trips to Fort Bragg, Fort Sam Houston, and Fort Riley. At each of these installations, the point of contact helped to set up in-person interviews with providers. Because provider availability was limited at Fort Bragg, we opted to conduct those interviews by telephone. Third, we asked each OTSG consultant we interviewed to identify deployed providers within his or her specialty for us to interview. Fourth, we asked deployed providers whom we interviewed to identify additional providers. To capture the relevant range of deployed experiences, we purposively sampled across provider types (focusing on physicians and PAs), clinical disciplines (generalist and specialist disciplines), and facility roles to which they deployed (Roles 1 through 3).

With the exception of the site-visit recruitment led primarily by the points of contact at each installation, recruitment for the interviews was led by the study investigators and conducted via email. We sent each identified potential interviewee a brief description of the study with the signed project description and requested a day and time for the interview. After five days, we sent a reminder email. If there was no response after the second email, we discontinued contact. From anyone who agreed by email to participate in an interview and for whom we were able to schedule a time, we obtained consent using approved institutional review board procedures and language at the start of the interview (by telephone or in person).

Data Collection

We conducted in-depth interviews by telephone and, where possible, in person during site visits. Conduct of the interviews was aided by the use of a semistructured protocol developed to elicit perceptions and beliefs about clinical proficiency for the deployed mission, with a focus on the utility of in-garrison practice and training in supporting clinical practice in theater. The protocol included open-ended questions that covered but were not limited to the following key topics: (1) clinical duties, responsibilities, and practice during deployment; (2) perceptions of clinical proficiency and comfort level with clinical tasks during deployment; (3) any challenges faced with regard to clinical care during deployment and approaches used to mitigate these challenges; (4) perceived utility that medical training, in-garrison workload, and predeployment training had on in-theater clinical proficiency; and (5) wishes for additional preparation or training needed to support the deployed mission. We developed the interview guide based on a review of existing literature on clinical practice and proficiency in the military,

with input from project team members. As we gathered and analyzed initial interview data, we refined the interview protocol by adding new questions, modifying existing questions, and adding probes, to further pursue and characterize emerging content. Interviews were 30 to 60 minutes long and were attended by a facilitator and at least one dedicated notetaker (in some cases, there were two notetakers) to supplement the facilitator's notes. We used a structured note-taking template to support consistency across notetakers and subsequent analyses. To the extent possible, we documented the interview content verbatim.

Following each interview, the facilitator and notetaker (or notetakers) documented self-reflective thoughts in their field notes of impressions or perceptions recognized during the interview, then together debriefed the interview, focusing on synthesizing notes and impressions, identifying the main content, identifying follow-up questions if relevant, and making any necessary revisions to the interview protocol.

The research team met weekly to discuss the conduct and content of the interviews. We purposively recruited and interviewed potential interviewees as needed throughout the study to explore emerging themes, until we reached agreement that no new data were appearing from the interviews and all identified themes were well developed.

Data Analysis

Interview notes were synthesized and typed, reviewed by the qualitative research team members, and then entered into Dedoose for content analysis. We first developed a draft code list with code definitions, guided by the research questions and questions in the interview protocol. Using this initial code list, one researcher began coding interviews, adding and refining codes and code definitions as they arose during the analysis. After the researcher had coded five interviews, the research team met to discuss new codes and further refine the code list to capture emerging concepts revealed through the analysis. Subsequent coding was completed by a single researcher, with regular research team meetings to iteratively review and agree on new codes, their definitions, and the application of codes to the interviews, resolving any issues through group discussion and consensus. Once all interviews were coded, two research team members who had also participated in the interviews compared codes within and between transcripts to identify larger categories of data and themes that integrated the categories.

Participant Description

We interviewed a total of 71 people: 44 deployed providers, 11 OTSG Medical Corps Consultants, nine SMEs on Army trauma care and training, two directors of Army

trauma training programs, and five directors or assistant directors of non-Army (other services') trauma training programs.

Of the 44 deployed providers, we interviewed 25 physicians, 14 PAs, and five nurses (two of whom were FNPs and one of whom was a certified registered nurse anesthetist). We asked deployed providers about the different facilities to which they had deployed; 13 reported that most or all of their experience was at a Role 1 facility; 13 at a Role 2; and 15 at a Role 3 CSH or field hospital. Three providers discussed their deployed experiences to both Roles 1 and 2.

Of the 36 physicians we interviewed in total—25 as deployed providers and 11 physicians who were OTSG Medical Corps consultants—we interviewed ten primary-care physicians (family or internal medicine, pediatrics, OB/GYN), 13 specialty or subspecialty physicians (e.g., cardiology, emergency medicine, rheumatology, intensive care), and 13 general and specialty surgeons.

Here, we summarize the agencies and types and numbers of providers we interviewed over the course of this study:

- on workload and currency measurement and modeling, representatives from
 - MEDCOM
 - PASBA
 - Surgical Services Service Line
 - USAF Medical Operations Agency
- on trauma and training, representatives from
 - U.S. Army Institute of Surgical Research
 - Army Trauma Training Course
 - AMEDD Center and School
 - Committee on Tactical Combat Casualty Care
 - USAF C-STARS
 - Navy Trauma Training Center
- providers who had deployed to Roles 1 through 3
 - PAs (14)
 - nurses (5)
 - physicians (27)
 - surgeons (general, trauma)
 - primary care (e.g., family medicine, pediatrics)
 - specialists (e.g., cardiology, rheumatology)
- other SMEs
 - consultants to OTSG (11)
 - trauma thought leaders (6)
 - trauma training program leadership (7).

Provider Areas of Concentration and Definitions of Groupings

In Table C.1, we define the AOCs within each of the three corps studied in this analysis (Medical Corps, Nurse Corps, and Medical Specialist Corps) and indicate which providers we included.

Table C.1
Areas of Concentration and Indicators for Whom We Included in Our Analyses

AOC	Description	Corps	Grouping	Included in ARTS Analysis (Chapter Two)	Included in PDDT and Prior-Deployment Analyses (Chapter Four)
60A	Operational medicine ^a	Medical	Nonsurgeon physician	No	Yes
60B	Nuclear-medicine officer	Medical	Nonsurgeon physician	No	Yes
60C	Preventive-medicine officer	Medical	Nonsurgeon physician	No	Yes
60D	Occupational-medicine officer	Medical	Nonsurgeon physician	No	Yes
60F	Pulmonary-disease officer	Medical	Nonsurgeon physician	Yes	Yes
60G	Gastroenterologist	Medical	Nonsurgeon physician	Yes	Yes
60H	Cardiologist	Medical	Nonsurgeon physician	Yes	Yes
60J	OB/GYN	Medical	Nonsurgeon physician	Yes	Yes
60K	Urologist	Medical	Nonsurgeon physician	Yes	Yes
60L	Dermatologist	Medical	Nonsurgeon physician	Yes	Yes

Table C.1—Continued

AOC	Description	Corps	Grouping	Included in ARTS Analysis (Chapter Two)	Included in PDDT and Prior-Deployment Analyses (Chapter Four)
60M	Allergist, clinical immunologist	Medical	Nonsurgeon physician	Yes	Yes
60N	Anesthesiologist	Medical	Nonsurgeon physician	Yes	Yes
60P	Pediatrician	Medical	Nonsurgeon physician	Yes	Yes
60Q	Pediatric cardiologist ^b	Medical	Nonsurgeon physician	Yes	Yes
60R	Child neurologist	Medical	Nonsurgeon physician	Yes	Yes
60S	Ophthalmologist	Medical	Nonsurgeon physician	No	Yes
60T	Otolaryngologist	Medical	Nonsurgeon physician	No	Yes
60U	Child psychiatrist	Medical	Nonsurgeon physician	No	Yes
60V	Neurologist	Medical	Nonsurgeon physician	Yes	Yes
60W	Psychiatrist	Medical	Nonsurgeon physician	No	Yes
61A	Nephrologist	Medical	Nonsurgeon physician	Yes	Yes
61B	Medical oncologist/hematologist	Medical	Nonsurgeon physician	Yes	Yes
61C	Endocrinologist	Medical	Nonsurgeon physician	Yes	Yes
61D	Rheumatologist	Medical	Nonsurgeon physician	Yes	Yes
61E	Clinical pharmacologist	Medical	Nonsurgeon physician	No	Yes
61F	Internist	Medical	Nonsurgeon physician	Yes	Yes
61G	Infectious-disease officer	Medical	Nonsurgeon physician	Yes	Yes
61H	Family physician	Medical	Nonsurgeon physician	Yes	Yes

Table C.1—Continued

AOC	Description	Corps	Grouping	Included in ARTS Analysis (Chapter Two)	Included in PDTT and Prior-Deployment Analyses (Chapter Four)
61J	General surgeon all units	Medical	Surgeon	Yes	Yes
61K	Thoracic surgeon	Medical	Surgeon	Yes	Yes
61L	Plastic surgeon	Medical	Surgeon	Yes	Yes
61M	Orthopedic surgeon	Medical	Surgeon	Yes	Yes
61N	Flight surgeon	Medical	Nonsurgeon physician	Yes	Yes
61P	Physiatrist	Medical	Nonsurgeon physician	Yes	Yes
61Q	Therapeutic radiologist	Medical	Nonsurgeon physician	Yes	Yes
61R	Diagnostic radiologist	Medical	Nonsurgeon physician	Yes	Yes
61U	Pathologist	Medical	Nonsurgeon physician	No	Yes
61W	Peripheral vascular surgeon	Medical	Surgeon	Yes	Yes
61Z	Neurosurgeon	Medical	Surgeon	No	Yes
62A	Emergency-medicine physician	Medical	Nonsurgeon physician	Yes	Yes
62B	Field surgeon	Medical	Nonsurgeon physician	Yes	Yes
65A	Occupational therapist	Specialist	Specialist	No	No
65B	Physical therapist	Specialist	Specialist	No	No
65C	Dietitian	Specialist	Specialist	No	No
65D	PA	Specialist	Specialist	Yes	Yes
66B	Community health nurse	Nurse	Nurse	No	No
66C	Psychiatric/mental health nurse	Nurse	Nurse	No	No
66E	OR nurse	Nurse	Nurse	No	No
66F	Nurse anesthetist	Nurse	Nurse	No	No

Table C.1—Continued

AOC	Description	Corps	Grouping	Included in ARTS Analysis (Chapter Two)	Included in PDDT and Prior-Deployment Analyses (Chapter Four)
66H	Medical–surgical nurse	Nurse	Nurse	No	No
66N	Generalist nurse	Nurse	Nurse	No	No
66P	FNP	Nurse	Nurse	Yes	No
66R	Psychiatric nurse practitioner	Nurse	Nurse	No	No
66H8A	Critical care nurse	Nurse	Nurse	No	No
66HM5	Emergency nurse	Nurse	Nurse	No	No
66H8D	Midwife	Nurse	Nurse	No	No

^a Operational medicine is not currently publicized in recruiting materials as an Army AOC, but it was during the years covered by our analysis (U.S. Army Quality Management Office, undated).

^b Pediatric cardiologist is currently double-listed with cardiologist as a 60H (U.S. Army, 2018); during the years that our analysis covers, it was a separate AOC (60Q) (U.S. Army Quality Management Office, undated).

The Dashboard

During the course of our study, we were informed of efforts already underway by MEDCOM to build a dashboard for tracking provider readiness. MEDCOM asked RAND Arroyo Center to contribute ideas that could be helpful in a dashboard, as well as to assess the availability of data for feeding such a dashboard. This appendix contains ideas that the Army might wish to incorporate in its ongoing efforts.

Building Blocks to Readiness

Multiple elements contribute to a provider's readiness to perform tasks during a deployment. Formal medical education, including residencies and fellowships, serves as the starting point. Clinical work at the MTF provides experience and keeps skills sharp. Additional clinical work outside the MTF can bring extra case volume and a diversity of cases. Courses, such as those from the AMEDD Center and School and DMRTI, add to the preparation. Short-term rotations at trauma centers give exposure to real trauma patients. Exercises with the unit provide training in field operations. Finally, deployments over the course of a provider's career provide important experience. Together, these elements are the building blocks toward one's readiness, as shown in Figure D.1.

Elements of a Dashboard

Each provider has his or her own set of background and expertise. Each provider thus has a different level of readiness, and therefore a different set of training needs when it comes to being prepared for the deployed mission. Moreover, the degree to which a provider is prepared for deployment will depend on what his or her mission and position will be. A dashboard for tracking an individual's readiness and training needs must therefore take this into account. Our proposed dashboard is therefore built around those building blocks, as shown in Figure D.2.

Understanding how a provider of a given type will be used in a deployed environment is the first step to determining his or her likely skill gaps. Some providers,

Figure D.1
Building Blocks to Readiness

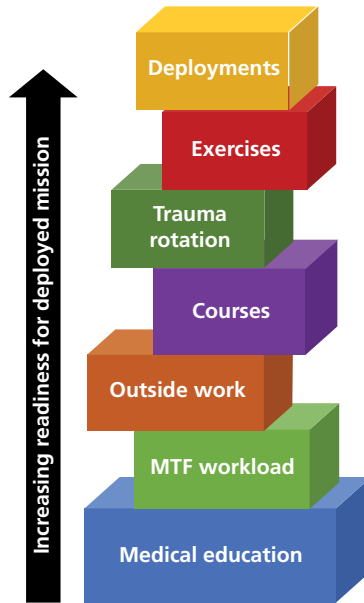
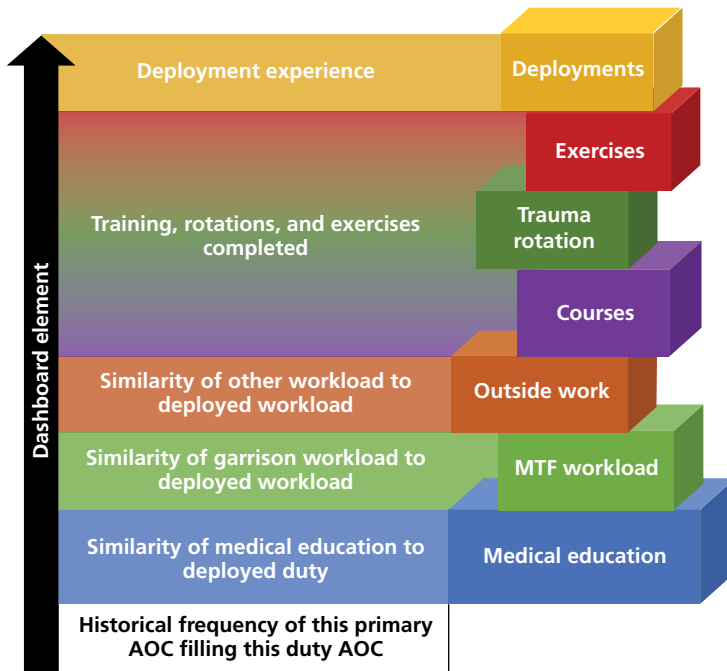


Figure D.2
Dashboard Elements Built Around Building Blocks



such as emergency physicians and surgical-team members, have duties in theater that are similar to their garrison duties. Other providers tend to be used differently, such as subspecialists who deploy as battalion surgeons. Therefore, the first element of the dashboard would look at a provider's specialty and identify the positions into which those types of providers are likely to be deployed, based on the historical frequency with which providers of that AOC are used to fill certain duty AOCs. This information can be derived from deployment records, such as those found in ARTS.

The degree to which the deployed duties differ from a provider's formal training would be the second element of the dashboard. In Chapter Two, we made an initial identification of potential gaps based on what is included in the formal training for the specialty. When building this dashboard, the Army should add advice from the various specialty consultants regarding the areas in which members of their specialties will likely require extra training or practice.

Work that providers perform daily contributes to their clinical proficiency. The MHS regards MTFs "as training platforms to maintain the clinical skills of military medical personnel" (Military Compensation and Retirement Modernization Commission, 2015, p. 57). However, as noted in Chapter Three, the diagnoses seen and procedures performed in MTFs are different from those seen and performed in theater. Comparison between the two can be used to identify clinical skills that will need practice or sharpening and therefore is the third element of the dashboard. The workload that providers perform at MTFs is tracked in the MDR. Theater medical data can provide insight on the likely diagnoses seen and procedures performed in the deployed environment. Creating a scoring system on how well MTF work prepares providers for the theater is an area that will require more research. AMEDD's PASBA has already built a prototype tool, known as Provider Ready, that serves this function, enabling providers to look up their individual workloads and compare them with diagnoses and procedures seen in theater. Currently, the theater patient profile is based on the theater as a whole; a more refined view that we would recommend would be to segment the theater patient profile based on the patients seen by specific provider types.

Some providers supplement their MTF work with work in other hospitals, in order to increase their caseloads and broaden their case mixes to keep their skills up. This might be done during the duty day through MTAs, or it might be done as ODE. Either way, this is work that is not currently captured in any central system of which we are aware. This should therefore be a fourth element of the dashboard.

The courses that each provider needs can vary depending on that provider's formal training, his or her workload in and outside the MTF, and his or her likely deployed duties. Thus, a provider's training gaps would be informed by the above elements of the dashboard. Identifying which training courses, trauma-center rotations, and exercises are required, and tracking the provider's attendance at them, make up the fifth element of the dashboard. The ATRRS is one source of this information; a major gap is that civilian-sector courses would not be in that system.

Finally, the dashboard should include the provider's previous deployment experience. This serves two purposes. The first is that it acknowledges that those who have deployed frequently and recently might not need as much training as those with less experience. The second is that it can inform those making deployment decisions, so that they might be able to pair up providers who have experience with those who have less experience or to pair up providers who have complementary skill sets.

Four Uses of a Dashboard

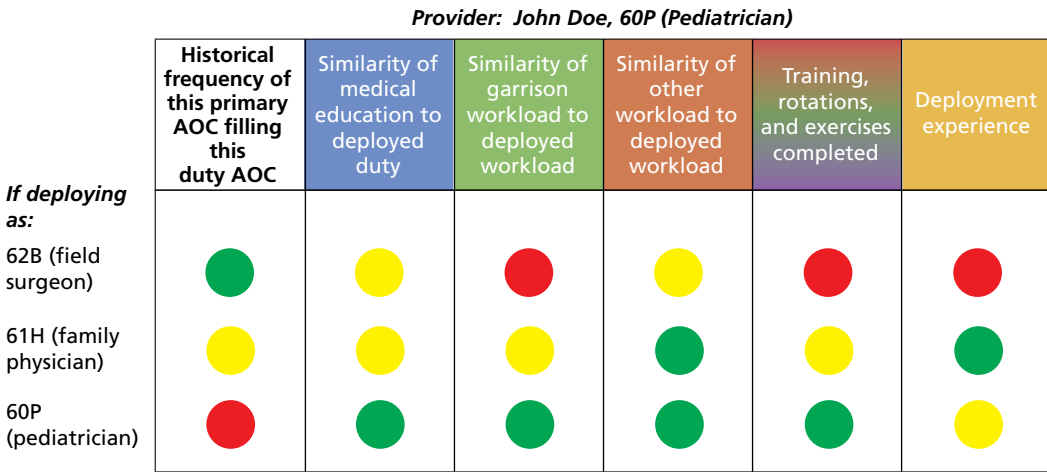
We envision four uses of such a dashboard. The first use would be by the individual provider who is tracking his or her own training. A rheumatologist would see how rheumatologists have been deployed in the past, such as to function as a field surgeon at a BAS or as an internist in the ICU of a CSH. The dashboard would then compare the diagnoses seen by that provider with those seen by field surgeons and those seen in the ICU within the CSH. Meanwhile, a pediatrician would see how pediatricians had deployed, such as to function as a field surgeon or as a family physician, and rate his or her readiness accordingly.

Figure D.3 shows a notional example of what such a dashboard might look like. Walking through the first row as an example, we see that the first column, "Historical Frequency of This Primary AOC Filling This Duty AOC," would indicate that, historically, pediatricians have been frequently deployed in theater as field surgeons, so any pediatrician has a high likelihood of being deployed as such. The next, "Similarity of Medical Education to Deployed Duty," would be a rating based on expert opinion of how well a pediatrician's education prepares him or her for field-surgeon duties. The next two, "Similarity of Garrison Workload to Deployed Workload" and "Similarity of Other Workload to Deployed Workload," would be based on analyzing the records of that provider's garrison and ODE work, along with expert opinion on how well that workload would prepare the provider for the deployed duty. "Training, Rotations, and Exercises Completed" would track the provider's progress in completing training needed for the position of field surgeon. And "Deployment Experience" would track how much experience this provider has had deploying in that position.

The second use would be by those making deployment decisions. Given a duty AOC to fill, such as a field-surgeon slot, the consultant for a specialty, such as pediatrics, would look across members of his or her specialty to ascertain which providers are ready to deploy.

Composite views that look at an AOC as a whole, rather than at individuals, might also be useful. The third use we envision would be by a consultant for a specialty area, looking at the fitness of his or her specialty for the different duty AOCs on which specialists might be called to fill. A pulmonology consultant might find that, overall, pulmonologists are well suited to running ICUs and have had the necessary

Figure D.3
Notional Dashboard Display



NOTE: In the first column, the dashboard colors indicate how often people with the provider’s primary specialty are deployed into the various positions listed. Green indicates that pediatricians are often deployed into theater as field surgeons, while red indicates that they are rarely deployed into theater as pediatricians per se. For the remaining columns, the dashboard colors indicate how well suited the provider is for the mission for which that provider will be deployed, based on the similarity of the provider’s education or workload to that of the potential deployed position or based on the provider’s recent training or deployment experience. For these, green indicates a good level of readiness, while red indicates areas in which the provider should increase training or experience prior to deployment.

CSH training but are less suited to deploying as field surgeons and overall need more training in that area.

The fourth use we envision would be by personnel planners looking toward future force needs. Given a need to fill field-surgeon positions, which type of primary AOCs would be best suited? The dashboard could be used to show the relative strengths and weaknesses of, for instance, dermatologists versus nephrologists in that position. The dashboard could also be used to indicate which specialists, on the whole, have higher proportions of peers who have completed the necessary predeployment training.

Data Sources for Building a Dashboard and Their Limitations

In the course of performing the different pieces of analysis in this report, such as the deployment assignment analysis, the MTF workload comparison, and the course-attendance analysis, we made use of a variety of data sources and, in general, tied together more than one data source in each analytical piece. These same data sources would be useful in the building of a dashboard; the value of the dashboard would be in bringing together the disparate sources of information into one operating picture. We also became aware of limitations in many of the data sources. In this section, we

describe the categories of information that would be used, possible sources of those data, and limitations we ran into.

The first category of information is that on historical deployments and the ways in which providers of each specialty are generally used in theater. The CTS Global War on Terrorism database contains information on personnel who have deployed, including the deployment dates, the locations to which they deployed, and the units with which they deployed. The WEX database contains personnel information, including each provider's primary AOC, which represents his or her formal training, as well as the duty AOC, which is the position in which he or she serves. We initially used these two sources to determine how various AOCs were used during deployments and what units they supported. However, we ran into problems with the accuracy of the data for medical providers. The location and unit listed in CTS most often appear to reflect the provider's home station in CONUS. In the WEX, the duty AOCs seemed too often to be identical to the provider's primary AOC, suggesting that subspecialists were being deployed into their subspecialties, a conclusion that was inconsistent with interview results that indicated that subspecialists were most likely used in more generalist positions, such as field surgeons. Conversations with Army personnel suggest that there might be problems with how personnel data are updated in theater, in that, when a brigade receives a PROFIS provider, it might not be updating the provider's unit information or his or her duty AOC. A better source of this information is ARTS, which is a component of the Medical Operational Data System. The location and duty AOC information was much more consistent with what we would expect of deploying providers. One possible limitation was a concern raised by an Army officer familiar with the system who noted that only information on current providers might be stored; those who had separated from the service might not be readily visible in ARTS, making the building of a comprehensive history of deployments more difficult.

The second category of information is medical records, for use in comparing the types of patients seen and the procedures performed at home-station MTFs with those in theater. Home-station MTF data are found in the MDR, complete with information about the providers, a necessary component to tracking what cases providers see at home. Theater data are less complete. As referenced earlier, during this study, we learned about a tool, Provider Ready, that AMEDD's PASBA developed. That tool utilizes a data set of inpatient records that PASBA has compiled, known as the PASBA SIDR. The PASBA SIDR has two limitations. The first is that it contains only inpatient records and thus has no information on outpatient visits. The second is that, as of September 2015, it did not have information about providers in theater. This might change in the future: Meetings we held with PASBA and with the keepers of the Theater Medical Data Store (TMDS) have led to TMDS sharing information about providers with PASBA. For this study, however, we could not determine what providers of different types do in theater. We sought to supplement the PASBA SIDR with information from the DoDTR, maintained by the Joint Trauma System based at the U.S.

Army Institute of Surgical Research. By design, the DoDTR is limited to trauma cases that have entered Role 3 facilities in theater. However, it offers the potential of visibility into care given at Role 1 and Role 2 facilities, as well as while in transit. A final source, as mentioned above, is TMDS. It is an official repository of medical records from the theater and one of the sources of information that feeds the PASBA SIDR. It contains some information about providers, although in a way more limited than that of the MDR, including only the provider from the admitting service, rather than every provider who performed a procedure. Further, the field is not always populated.

Although DoD has records on home-station MTF and theater care, one area that is entirely missing is the ability to track the workload of providers who work outside the MTF, whether it be on duty as part of a training agreement, or off duty as outside employment. Individual providers might keep their own records, but there is no central source for keeping this information. This is an area that will need development if the Army is to recognize outside work as an element of keeping providers proficient.

The third category of information is on enrollment in training courses. We used ATRRS. This provided us with visibility on enrollments in courses offered by the AMEDD Center and School in San Antonio; the Army Trauma Training Department at Ryder Trauma Center in Miami, thus including the PDTT mandated by EXORD 096-09; and those offered by DMRTI, the joint program also based in San Antonio. A limitation of ATRRS might lie in the accuracy of its numbers; when we sent samples of these data to the coordinators of the AMEDD Center and School courses, one reported that the numbers were accurate, while another thought that enrollment figures seemed lower than those kept by the course itself. This is an area that will require more exploration. Even if ATRRS is accurate, it still leaves two areas untracked. One is exercises and other training provided by individual units. The other is courses taught by the civilian sector, such as courses offered through the ACS, such as ATOM and ASSET.

The data sources discussed above are summarized in Table D.1.

Table D.1
Potential Data Sources for Building a Dashboard and Their Limitations

Dashboard Element	Data Source	Information Provided	Note
Historical frequency of primary AOC filling duty AOC	WEX	Primary AOC and duty AOC of personnel	The receiving brigade might not be properly updating duty AOC for PROFIS providers.
	CTS	Deployment history, including dates, location, and units	Deployed location and unit information might not be properly updated for PROFIS providers.
	ARTS	Deployment tasking, including primary AOC, duty AOC, and unit supported	This has better duty AOC information than the WEX but might contain information only on current soldiers, limiting its usefulness in building an overall history
MTF workload	MDR	Garrison medical records, including provider information	
Outside workload	No data source identified		
Theater workload	PASBA SIDR	Theater inpatient records	This lacks outpatient information. As of September 2015, it did not contain theater provider information, although PASBA will receive that information in future feeds.
	PASBA Provider Ready tool	Compares an individual provider's workload (MDR) with the theater inpatient profile (PASBA SIDR)	This has the same limitations as PASBA SIDR.
	TMDS	Theater medical records	This has fields for provider information, but the field is not always populated; it includes only the admitting service at Role 3 and little information on Role 1 and 2 facilities.
	DoDTR	Theater trauma records; includes some information on procedures done at Role 1 and 2 facilities	The registry includes only trauma cases that reached Role 3 facilities.
Courses attended within DoD	ATRRS	Registrations for training course	This covers only DoD courses.
Courses attended outside DoD	No data source identified		
Deployment	See entries on CTS and ARTS above.		

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The U.S. Army Medical Department has a dual mission: to care for the war wounded during times of conflict and to operate medical treatment facilities (MTFs) that provide care to service members, their beneficiaries, and military retirees. Because the injuries that require treatment during wartime can be very different from the case mix seen in MTFs, the Army asked RAND Arroyo Center to identify ways to help providers prepare for wartime missions while they are stationed at home.

Using a variety of data sources, RAND Arroyo Center quantified how providers were assigned during wartime relative to their home duties, how the types of procedures seen in theater compared with those performed at home-station MTFs, and the rate at which providers attended mandatory predeployment trauma training (PDTT). In addition, the research team interviewed previously deployed providers to gather their perspectives on how they prepared—clinically and for trauma specifically—for the deployment mission, what their roles were in theater and how their patient mix in theater differed from the types of cases they treated in MTFs, and what additional training or other preparation would have helped them for the deployment mission.

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