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Essential Medical Capabilities and Medical Readiness

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Executive Summary

The National Defense Authorization Act for Fiscal Year 2013, Section 671, established the Military Compensation and Retirement Modernization Commission (MCRMC) to perform a systematic review of the military compensation and retirement systems and to make recommendations to modernize them. Among the recommendations in its final report, released in January 2015,[1] the MCRMC addressed the issue of health benefits, including both the peacetime benefit and health and combat casualty care for those serving in an operational environment. The report noted that the ability of the Military Health System to provide operational healthcare is measured by the readiness of its medical personnel and related capabilities and went on to recommend that the Congress and the Department of Defense (DoD) define and measure essential medical capabilities (EMCs) to promote and maintain critical capabilities within the military medical force.

The MCRMC broadly defined EMCs as medical capabilities that "are vital to effective and timely health care during contingency operations." It further delineated these capabilities as follows:

> EMCs should include clinical and logistics capabilities necessary to accomplish operational requirements such as combat casualty care; medical response to and treatment of injuries sustained from chemical, biological, radiological, nuclear, and explosives incidents; diagnosis and treatment of infectious diseases; aerospace medicine; and undersea medicine. EMCs also include a limited number of SMCs [Specialized Military Conditions] not primarily performed in theater but commonly associated with military operations (e.g., therapy for post-traumatic stress disorder). EMCs should not include medical missions or specialties not commonly associated with operational military medicine or SMCs.[2]

Following release of its final report, the MCRMC participated in a number of hearings and staff level meetings with the Congress, where questions were asked about the concept of EMCs and how they would be implemented. The issues discussed can be summarized by the following four general questions:

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1 Military Compensation and Retirement Modernization Commission (MCRMC), *Report of the Military Compensation and Retirement Modernization Commission: Final Report*, January 29, 2015.

2 Ibid., 75.

- What is currently measured for medical readiness (i.e., readiness of the medical force) and why hasn't this been successful in creating a focus on medical readiness during extended periods of peacetime?
- How would EMCs be integrated into existing DoD readiness reporting systems?
- How should actual EMCs be developed and defined?
- What would be the quantitative standards to determine if an EMC were actually met, i.e., the force was ready with respect to that EMC?

The Institute for Defense Analyses (IDA) was asked to address these questions.

Current Readiness Reporting of Medical Units and Integrating EMCs

The *Department of Defense Dictionary of Military and Associated Terms*[3] defines *readiness* as "the ability of military forces to fight and meet the demands of assigned missions." DoD Directive (DoDD) 7730.65[4] establishes the policy for measuring the readiness for those missions. According to this directive, "DRRS [the Defense Readiness Reporting System] provides a means to manage and report the readiness of the DoD and its subordinate Components to execute the National Military Strategy (NMS)" consistent with DoD priorities and other planning documents. DRRS "captures readiness metrics and supporting data from authoritative data sources throughout the DoD" and calls for all "variations from standards [to be] identified and assessed in terms of performing mission-essential tasks (METs) and downgraded resource areas."

DoDD 7730.65 defines METs as "tasks based on mission analysis and approved by the commander that are necessary, indispensable, or critical to the success of a mission." These tasks provide the fundamental objects of assessment in DRRS and are individually rated according to the following three-tiered metric: Y (Yes, unit can accomplish task to established standards and conditions), Q (Qualified yes, unit can accomplish all or most of the task to standard under most conditions), or N (No, unit is unable to accomplish the task to prescribed standards and conditions). Missions are then assessed based on the ratings of their subordinate METs.

In August 2015, IDA obtained a large extract of DRRS data to determine how medical units were reporting readiness in that system. We found the underlying concepts of readiness reporting in DRRS to be sound, but the application to medical units to suffer from a lack of standardized METs that are meaningful to those units. METs were not

[3] Joint Publication 1-02, *Department of Defense Dictionary of Military and Associated Terms*, November 8, 2010 (As Amended Through February 15, 2016).

[4] DoD Directive 7730.65, "Department of Defense Readiness Reporting System (DRRS)," May 11, 2015.

drawn from a common task dictionary; instead, they came from at least six different sources that differed markedly in providing task detail (e.g., conditions and actions) and specifying metrics (e.g., measurement criteria and standards). Few of the units in the extract provided quantitative data to justify their assessments. In addition, we found that the current version of DRRS does not ensure that the right individuals (by specialty) are available for requirements and authorizations, or to measure individual and team readiness from a clinical currency perspective. For example, it appears that a combat support hospital could be reported as ready to deploy for delivery of combat casualty care when, in fact, no trauma surgeon with current trauma experience was assigned or available to the unit.

The most direct way to integrate the MCRMC EMC concept into readiness reporting is to establish EMCs as medical unit METs, to be used as the objects of DRRS assessments. DRRS has the capability to report on medical readiness, but currently does not because the data entered into DRRS do not adequately assess readiness. Properly constituted EMCs serving as METs would correct this problem.

Establishing EMCs and Their Standards

To aid in identifying clinically related EMCs and their associated standards for readiness, IDA looked at how the civilian healthcare sector assesses readiness. In the civilian healthcare sector, basic clinical "competency" is typically measured by appropriate licensure or board certification. In contrast, the higher level of "proficiency" denotes increased clinical skills and knowledge by adding a dimension of experience. In turn, "currency" is defined as being up to date, i.e., ready to immediately deliver care at a particular level of skill. We concluded that "readiness" is being current at a proficiency skill level. Procedure volume (i.e., procedures performed per unit of time) is one useful measure of this level of skill and directly translates to how readiness is measured in many communities across the DoD. For example, medical research has found that to achieve the best outcomes in many orthopedic surgical procedures (e.g., knee replacements), the surgeon should perform at least 50 per year and the facility should be doing at least 200 per year (which includes the team supporting the surgeon). For the military medical force, the relevant workload volume will likely be a key element of readiness measurement and reporting, but not the only one. Moreover, there are key gaps in our knowledge about how to operationalize that element, as much of the current literature is focused on complex, but relatively routine, surgical procedures (e.g., knee replacements).

To examine how clinical currency standards might be applied to the readiness of the military medical force, we drew data on deployed workload volume from the Theater Medical Data Store (TMDS). We also measured workload severity by applying the Trauma Mortality Prediction Model (TMPM) to in-theater trauma cases using data from the DoD Trauma Registry. The TMPM, which has gained increasing acceptance in the

civilian literature, was developed using data from a large civilian trauma database to estimate the collective impact of multiple diagnoses on the probability of death. Because the trauma mortality rates are predictions from a civilian-based model, the in-theater rates are not influenced by the more austere and stressful environment in which deployed surgical teams must work.

To develop a data-driven approach for establishing EMCs, we focused on trauma-related conditions because they represent a large majority of inpatient diagnoses encountered in theater as well as those associated with higher mortality (as measured by the TMPM). We identified 18 trauma-related diagnoses that met certain volume and severity thresholds; those diagnoses represent some of the most severe cases likely to be encountered in theater and require specialized skills to treat. We then identified the procedures performed to treat those diagnoses as the basis for establishing EMCs. After filtering out minor diagnostic and therapeutic procedures and selecting those occurring more than 10 times in theater in a single year, we identified 93 procedures as critical for treating severe trauma cases. This data-driven approach could lead to the establishment of EMCs, but the current paper stops short of developing actual capabilities because more clinical input is required.

Implications for Current Readiness Levels

To understand the likely implications for current readiness levels, we compared the distribution of medical diagnoses in theater to the distribution in direct care hospitals (i.e., the system of military hospitals and clinics delivering the peacetime healthcare benefit). Results from analyses of these data suggest that inpatient workload performed in the direct care system bears little resemblance to that encountered in theater. Furthermore, the frequency of occurrence of the top in-theater diagnosis (open wounds of head, neck, and trunk) is almost three times the corresponding frequency in the direct care system, and the frequency of occurrence of the second most common in-theater diagnosis (open wounds of extremities) is more than double that in the direct care system. In addition, when multiple diagnoses are present, as is usually the case with combat casualties, the gap in mortality rates is significant, with in-theater trauma mortality rates uniformly higher than those in a direct care setting. The large disparity in the multiple-diagnosis mortality rates indicates the relative severity of in-theater care versus direct care. These comparisons are only suggestive at this point, however, and more analysis on workload volume standards is required in order to draw specific conclusions about the degree to which direct care inpatient platforms are able to provide the workload volume needed for maintaining currency in wartime clinical skills.

Conclusions

The major conclusions from this study are summarized as follows:

1. Readiness is not reported in a consistent manner in DRRS.
2. As currently implemented, DRRS does not provide meaningful assessments of the readiness of medical units.
3. Medical readiness concepts are being developed, but contain confusion over missions.
4. With appropriate modification, DRRS could provide an appropriate framework for reporting readiness of EMCs.
5. Clinical capability should be a priority area for EMC development.
6. Civilian concepts of clinical currency are relevant to military medical readiness.
7. The inpatient case mix encountered in direct care training platforms differs significantly from that encountered in theater.
8. Analysis of mortality rates indicates that medical conditions encountered in theater are more severe than those confronted in the direct care system.
9. A data-driven approach for identifying candidate EMCs using data on in-theater diagnoses and procedures should be used as a basis for EMC development.

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1. Purpose of Report

The Military Health System (MHS) is responsible for maintaining a cadre of healthcare providers who are trained to provide quality medical care during contingency operations. The ability of the MHS to provide operational healthcare is driven by the readiness of its medical personnel and related capabilities. To train medical personnel, the MHS relies heavily on Military Treatment Facilities (MTFs) located on or near major military installations as training platforms to maintain the clinical skills of military medical personnel. While developing and maintaining their operational skill sets, medical personnel assigned to MTFs deliver a healthcare benefit to Active Duty Service members, Active Duty family members, retirees, and other eligible beneficiaries.

A. The Military Compensation and Retirement Modernization Commission

The National Defense Authorization Act for Fiscal Year 2013, Section 671, established the Military Compensation and Retirement Modernization Commission (MCRMC) to perform a systematic review of the military compensation and retirement systems and to make recommendations to modernize them. The healthcare benefit provided to Active Duty family members and military retirees is one major element of compensation that was examined by the MCRMC. Because of the tight connection between maintaining readiness for the operational medical mission and delivering the healthcare benefit, any examination of healthcare benefits must also consider medical readiness. Recommendation 5 of the *Report of the Military Compensation and Retirement Modernization Commission: Final Report* documented the results of the MCRMC examination of medical readiness.[1]

1. Findings and Recommendations

With respect to the operational medical mission, the MCRMC found that medical units have become highly effective in treating the recent casualties of combat:

> Service members have benefitted substantially from the joint nature of operations and the improvements from the rapid institutionalization of lessons learned during the recent wars. For example, the military medical

[1] Military Compensation and Retirement Modernization Commission (MCRMC), *Report of the Military Compensation and Retirement Modernization Commission: Final Report*, January 29, 2015.

> force was highly successful at treating combat casualties during the recent wars. Case fatality rates in theater hospitals were approximately 10 percent in Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF), down from 30 percent during WWII and 24 percent during the Vietnam and the 1991 Persian Gulf conflicts.[2]

However, a recently published journal article[3] refutes the extent of the difference in mortality rates between the Vietnam and OEF/OIF conflicts. The author found that: "A larger proportion of wounded personnel survived in Iraq and Afghanistan than during the Vietnam War, but the increased survival rates were not as high as some studies have asserted. The survival rates were 90.2% in Iraq and 91.6% in Afghanistan, compared with 86.5% in Vietnam." The author cited inconsistent and/or improper use of casualty data as the source of the discrepancy.

Despite the improvements in combat casualty care, the MCRMC identified concerns with the current approach to acquiring and maintaining readiness for the operational medical mission:

> Beneficiary care may not sufficiently provide ideal training opportunities to maintain and sustain the military medical capabilities developed during the last 13 years of war. For example, prevalent injuries and wounds during operations in Afghanistan and Iraq were a result of penetrating or blast trauma. As a result, there has been a preponderance of extremity, vascular, genital, visual, skeletal, and traumatic brain injuries. Yet surgeons were not adequately prepared to treat these injuries. A survey of general surgeons from all military Services who deployed between 2002 and 2012 found that 80 percent of respondents desired additional training on particular surgical disciplines or injury types prior to deployment. The most commonly requested types of training were extremity vascular repairs, neurosurgery, orthopedics, and abdominal vascular repairs. Surgeons overwhelmingly cited vascular surgeries as the most difficult cases, followed by neurosurgical procedures, burns, and thoracic cases. Surgeons reported they had difficulty with these procedures because they had not performed them in nondeployed clinical settings, and because there had been a substantial time lapse since they had last treated these types of injuries.[4]

The MCRMC reviewed—among other things—the distribution of inpatient MTF workload, and found that over half is related to labor and delivery, newborn care, and

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2 Ibid., 59.

3 Matthew S. Goldberg, "Casualty rates of US military personnel during the wars in Iraq and Afghanistan," *Defence and Peace Economics* (2016): 1–21, doi: 10.1080/10242694.2015.1129816.

4 MCRMC, *Final Report*, 63–64.

pediatrics.[5] Based on these findings, the Commission observed that current medical capabilities and operational requirements are in misalignment:

> Relying on existing MTF medical cases as a training platform for combat care can result in a misalignment of military medical personnel compared to the medical requirements necessary to support the operational missions. At the start of the wars in Afghanistan and Iraq, the military medical force was understaffed for surgeons, anesthesiologists, and other specialties critical to combat casualty care, and overstaffed in specialties that generally provide peacetime health care. 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.[6]

The MCRMC concluded that "readiness suffers during peacetime" and developed a wide-ranging recommendation to ensure that the high level of medical readiness achieved over more than 10 years of war is maintained. The elements of the recommendation systematically addressed the root causes of the problem within the Department of Defense (DoD) and included:

- Changes to command and Joint Staff structures to focus leadership attention on medical readiness and provide sufficient authority to make it a priority;
- Realigning funding to improve incentives for maintaining medical readiness;
- Providing new tools and access to new beneficiary populations to attract medical workload of the required case mix and complexity to maintain medical readiness; and
- Developing a new concept of "Essential Medical Capabilities" (EMCs) and integrating them into readiness reporting tools and processes to increase measurement, transparency, and accountability for medical readiness.

2. Case in Point

In a deployed setting, the medical community establishes a trauma system for regulating and treating severely injured patients.[7] All deployed medical personnel are part of this system, and to be ready to deploy, these personnel must be ready to perform in a trauma system. The following is the first-hand account of LTC Alec Beekly, an Army

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5 Ibid., Figure 11.

6 Ibid., 64–65.

7 The medical community also provides primary care in theater to maintain the effectiveness of deployed forces. While an important function that consumes resources in theater, this care is generally routine in nature and not a primary driver of clinical readiness requirements (the focus of this paper), which are focused on care requiring specialized knowledge and skills to save life and limb.

surgeon who provided medical care in Iraq. This episode provides an example of the importance of maintaining a focus on medical readiness during peacetime, the critical relationship between clinical currency and familiarity with a trauma system, and the holistic reform of medical readiness provided by the MCRMC recommendations.

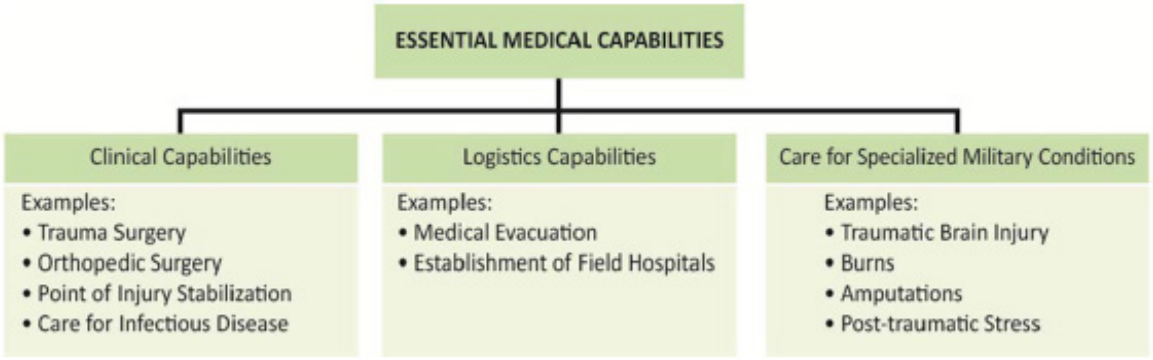
> I was assigned to a Forward Surgical Team (FST) that took us two hours driving south of Baghdad to reach by ground vehicle. It was my first time there; I was nervous about convoys, because we were driving through a heavily attacked route; and my intern classmate (a general surgeon) had been killed on an FST three weeks before I left for Iraq. Needless to say, my mind really wasn't on how far we were from the nearest Combat Support Hospital (CSH), what the evacuation times were, or even how far we were actually driving (we were going very slowly, stopping and starting a lot). So when we arrived at our FST site, it felt like we had come a long way to get there. On my prior FST experience in Afghanistan, our FST was two and one-half hours by fixed-wing aircraft to the nearest CSH.
>
> It turns out that we were only about 15 minutes by helicopter from the CSH. I assumed that we were much farther away. The proximity to more robust hospital support clearly makes a difference regarding how you triage multiple patients and what kind of operations you undertake. Nobody had oriented me to this, and at the time I didn't think to ask. I was at the FST 17 days before our first casualties arrived. There were four wounded casualties from an improvised explosive device (IED) attack. So here I am, three years out of residency, used to taking calls two to four times a month at a relatively slow Level II trauma center. I had performed maybe four or five blunt trauma-related operations in that period, and only a few penetrating trauma cases from Afghanistan. Now I had to simultaneously care for four wounded, multisystem trauma patients with one other surgeon, who was less than a year out of residency.
>
> We actually thought we did okay. One guy had an abdominal fragment wound but was stable and had a negative focused assessment with sonography in trauma (FAST). Two of the guys had extremity wounds and fractures, but were able to be splinted and were not hemorrhaging. One guy, however, had a systolic blood pressure (SBP) of 70 mm Hg, an inadequate improvised tourniquet on his leg, and open femur, tibial, and fibular fractures. He also had an injury to his distal superficial femoral artery. We spent some time getting proximal control in the groin, then dissecting out his artery through his huge, hematoma-laden, torn and distorted thigh, and putting in a temporary vascular shunt. We transfused him most of our blood bank of 20 units of red blood cells (RBCs). He was hemodynamically stabilized. He was cold, slightly acidemic, and coagulopathic when he left, but we had restored flow to his foot.
>
> Sorting out all these casualties took us maybe one and one-half hours. We finally got them on a helicopter and on their way about two hours after

they arrived to us. When they arrived to the CSH, the patient with the vascular injury had clotted off his shunt. He went back to the operating room (OR) at the CSH and was revascularized, but had too much ischemia time and ended up losing his leg.

When the trauma consultant to the Surgeon General came to visit us at the FST a few weeks later, he noted that it took him 17 minutes by slow-flying helicopter to get there from the CSH. As I reviewed the case with him, we realized that rather than a vascular shunt, which ended up being harder than it sounded and cost us a lot of blood products and time, we could have simply applied secure tourniquets to this guy, resuscitated him, and sent him on his way to the CSH. He would have reached a facility with vascular surgery support, robust blood bank and critical care services, and everything else he needed within an hour.[8]

B. Essential Medical Capabilities (EMCs)

The MCRMC recommended that "Congress should establish the statutory requirement for DoD to maintain EMCs to promote and maintain certain medical capabilities within the military"[9] and that these EMCs be integrated into the measurement and reporting of medical readiness. Figure 1 illustrates the recommended EMC framework.



Source: MCRMC, *Final Report*, Figure 12.

Figure 1. Essential Medical Capabilities Framework

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8 Eric Savitsky and Brian Eastridge, eds., *Combat Casualty Care: Lessons Learned from OEF and OIF* (Falls Church, VA: Office of the Surgeon General, United States Army, 2012), 5–6.

9 MCRMC, *Final Report*, 74.

The MCRMC defined EMCs as medical capabilities that "are vital to effective and timely health care during contingency operations." The Commission further delineated these capabilities as follows:

> EMCs should include clinical and logistics capabilities necessary to accomplish operational requirements such as combat casualty care; medical response to and treatment of injuries sustained from chemical, biological, radiological, nuclear, and explosives incidents; diagnosis and treatment of infectious diseases; aerospace medicine; and undersea medicine. EMCs also include a limited number of SMCs [Specialized Military Conditions], not primarily performed in theater but commonly associated with military operations (e.g., therapy for post-traumatic stress disorder). EMCs should not include medical missions or specialties not commonly associated with operational military medicine or SMCs. The Congress should require the Secretary of Defense and GAO [Government Accountability Office] to report annually on EMCs and their associated readiness metrics.[10]

C. Objectives of this Report

The MCRMC released its final report at the end of January 2015. A number of hearings were then held with the Senate Armed Services Committee (SASC), House Armed Services Committee (HASC), and the Personnel Subcommittees of these committees,[11] along with extensive staff-level meetings and briefings. During these exchanges, there was widespread recognition of the challenges found by the MCRMC and the importance of maintaining the readiness gains developed during the wars in Iraq and Afghanistan. There were also a number of questions raised about EMCs and how they would be implemented. Many of these questions can be summarized by the following four general questions:

- What is currently measured for medical readiness and why hasn't this been successful in creating a focus on medical readiness during extended periods of peacetime?
- How would EMCs be integrated into existing DoD readiness reporting systems?
- How should actual EMCs be developed and defined?
- What would be the quantitative standards to determine if an EMC were actually met, i.e., the force was ready with respect to that EMC?

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[10] Ibid., 75.

[11] Hearings were held on February 3 (SASC), February 4 (HASC), February 11 (both SASC personnel subcommittee and HASC personnel subcommittee), and February 25 (SASC personnel subcommittee) of 2015.

Following DoD's review of the MCRMC report, both the White House and DoD stated that they support portions of the medical readiness recommendation.[12] DoD stated to the Commission that it intended to execute the EMC recommendation without waiting for legislative direction and established an internal EMC workgroup. The workgroup was formed and is conducting a Capabilities-Based Assessment (CBA) as part of the DoD Joint Capabilities Integration and Development System (JCIDS).[13]

The objective of this paper is to provide additional information to the Congress in support of Recommendation 5 and, in particular, respond to the questions raised by members of the Congress and their staff following the release of the MCRMC final report. The Institute for Defense Analyses (IDA) conducted much of the research for this paper in support of the MCRMC. The MCRMC was terminated prior to completion of this work, however, and this paper has not been reviewed or approved by the Commission.

Although the EMC concept defined by the MCRMC includes logistics capabilities, prehospital and evacuation care, and care for SMCs, the focus of this paper is on inpatient clinical care provided in theater. Inpatient care in theater is a valuable starting point for developing EMCs for a variety of reasons: it is an important element of total theater care, it represents some of the most complex care delivered in theater, it has some of the most complete data available, and it relates to some of the most important infrastructure investment decisions being faced by DoD with respect to peacetime military hospitals. This is not meant to diminish the importance of, for example, maintaining the general health and effectiveness of the force in the field, but it does recognize that readiness requirements and establishment of mission essential tasks (METs) should focus first on those capabilities that are the most critical for saving life and limb.

Following this introduction, Chapter 2 provides an overview of DoD's readiness measuring and reporting processes and what the medical community currently measures and reports within this system. Chapter 3 identifies the gaps that currently exist in medical readiness measurement and reporting, reviews what is done in the healthcare industry to measure clinical proficiency, and develops a framework for establishing and measuring EMCs. Chapter 4 describes the medical workload actually experienced in a deployed setting to identify what the medical force needs to be ready for. Chapter 5 lays

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[12] "Message to the Congress – Military Compensation and Retirement Modernization Commission," White House press release, https://www.whitehouse.gov/the-press-office/2015/04/30/message-congress-military-compensation-and-retirement-modernization-comm; "Statement by Secretary of Defense Ash Carter on the Military Compensation and Retirement Modernization Commission Report," DoD press release, http://www.defense.gov/News/News-Releases/News-Release-View/Article/605487/statement-by-secretary-of-defense-ash-carter-on-the-military-compensation-and-r.

[13] *Joint EMC Workgroup Charter*, provided to IDA November 4, 2015.

out a conceptual approach for developing EMCs using the in-theater data described in the previous chapter. It is important to note that this paper does not identify the full range of EMCs that are required to measure and report on medical readiness; instead, it provides a framework and process for developing EMCs. Finally, Chapter 6 ends with a list of conclusions that can be drawn from this entire effort.

2. Readiness Measurement and Reporting

This chapter begins with an overview and summary of DoD readiness measurement and reporting. This is followed by a more detailed examination of the current state of readiness reporting for medical units and individuals.

A. Strategic Framework for Readiness Measurement and Reporting

The *Department of Defense Dictionary of Military and Associated Terms* defines readiness as "the ability of military forces to fight and meet the demands of assigned missions."[14] Health (medical) readiness is further defined as "the ability to enhance DoD and national security by providing health support for the full range of military operations and sustaining the health of all those entrusted to our care."[15] The assigned missions and attendant operations of military forces are broadly articulated in the National Military Strategy (NMS), with specific operations being further delineated and detailed in the various DoD planning processes. DoD readiness reporting systems and capabilities development processes are the primary ways for measuring readiness and addressing gaps in needed capabilities.

1. Readiness Measurement and Reporting

Missions define the capabilities and timelines required for a military operation. The highest priority missions are generally required to have force planning that details the required number and type of units as well as time-phased force deployment data. Although not all assigned missions have the same level of force planning detail, the aggregate demands for military capabilities across plans and standing missions set a baseline for what, when, and where military forces are expected to be employed.

DoD Directive (DoDD) 7730.65 establishes the policy for measuring the readiness for these missions.[16] According to this directive, "DRRS [the Defense Readiness Reporting System] provides a means to manage and report the readiness of the DoD and its subordinate Components to execute the National Military Strategy (NMS)" consistent

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[14] Joint Publication 1-02, *Department of Defense Dictionary of Military and Associated Terms* (November 8, 2010) (As Amended Through February 15, 2016), 198.

[15] Office of the Secretary of Defense (Health Affairs) and Joint Staff (J4/Health Services Support Division), *Health Readiness Concept of Operations*, January 2010, 3-1.

[16] DoDD 7730.65, *The Defense Readiness Reporting System*, May 2015.

with DoD priorities and other planning documents. The reporting directive delineates DRRS as the Department-wide system used for readiness assessment.[17] This system "captures readiness metrics and supporting data from authoritative data sources throughout the DoD" and calls for all "variations from standards [to be] identified and assessed in terms of performing mission-essential tasks (METs) and downgraded resource areas." By policy, DRRS tracks deficiencies in the areas of training, personnel, equipment, ordnance, and supply.

DoD has a long history of unit readiness reporting.[18] Unit readiness "C-levels" have been used for decades and are broadly determined by calculating measures of resource adequacy in four areas: various percentage calculations on available personnel and equipment, training measures, and an operating status indicator for equipment.[19] These measures are based on the assets that a unit is authorized, and serve as flags for known unit shortfalls in readiness assessments.

Resource measures alone, however, are considered to be insufficient for determining whether a unit or organization is ready for the mission they are expected to perform.[20] Such issues and other limitations associated with resource calculations were addressed by DoD during DRRS implementation, via the addition of the MET framework to DoD readiness reporting. As illustrated in Figure 2, the four-phase MET framework allows DoD planners to systematically decompose and cascade a mission into tasks, conditions, and standards for different units and organizations from the strategic to the tactical levels of warfare. This process identifies, for individual units and organizations, the tasks they must perform to successfully accomplish their missions. This framework for developing unit mission essential task lists (METLs) serves to integrate and synthesize the efforts of multiple units, and can identify key shortfalls and critical nodes during the execution of war planning. The Chairman, Joint Chiefs of Staff (CJCS) publishes an instruction on the development and use of METs for joint training, exercises, and readiness assessment.[21]

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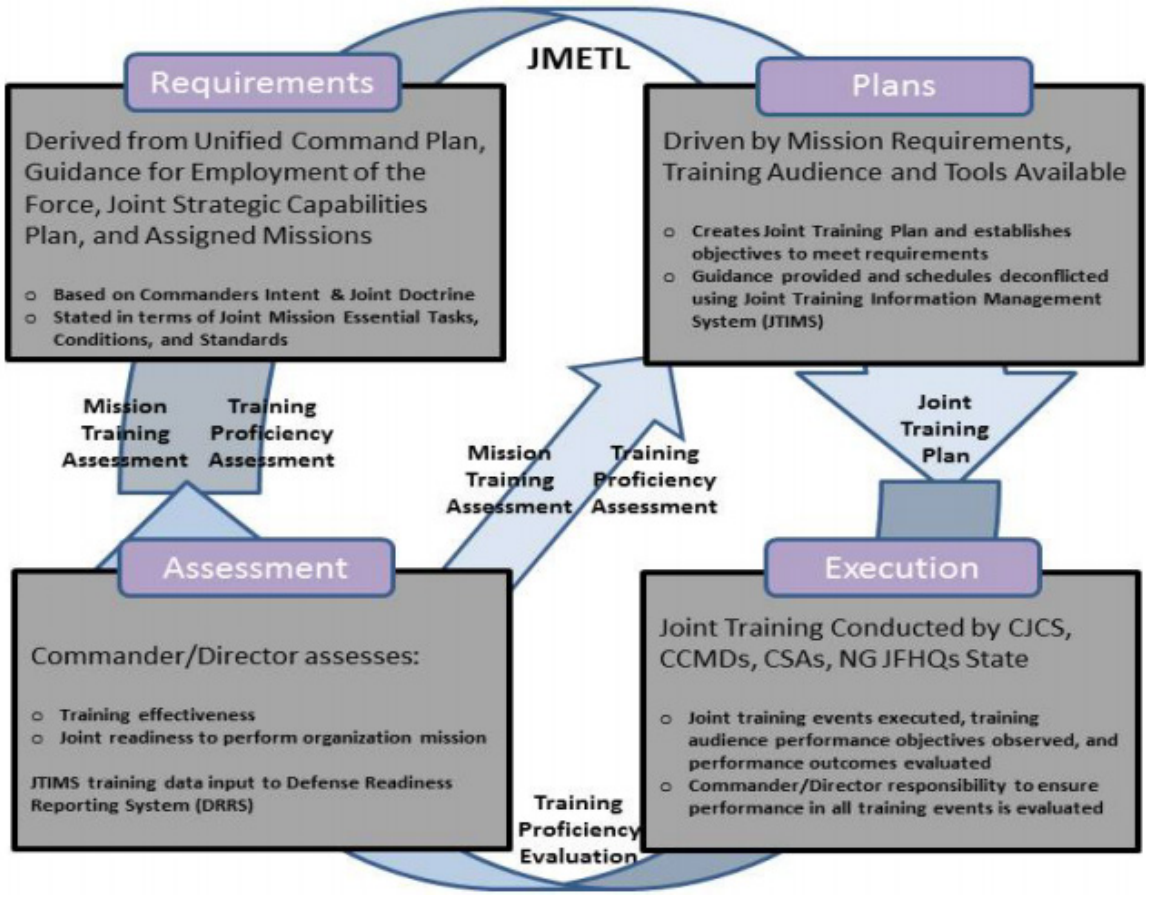
[17] Separate Service versions of DRRS are maintained by the Army (DRRS-A), Marine Corps (DRRS-MC), and Navy (DRRS-N). The Air Force reports directly in the version of DRRS that is designed to merge Service readiness data: the Defense Readiness Reporting System-Strategic (DRRS-S). Consistent with common usage, the use of "DRRS" in the present paper refers to the DRRS-S version of the system.

[18] John C. F. Tillson et al., "Independent Review of DoD's Readiness Reporting System," IDA Paper P-3569 (Alexandria, VA: Institute for Defense Analyses, November 2000), Chapter III.

[19] CJCS Instruction (CJCSI) 3401.02B, *Force Readiness Reporting*, July 2014.

[20] Tillson, "Independent Review of DoD's Readiness Reporting System," Executive Summary.

[21] CJCSI 3500.01, *Joint Training Policy for the Armed Forces of the United States*, April 2014.



Source: CJCSI 3500.01, *METL Development*, Annex B, B-2.
Note: JMETL – Joint Mission Essential Task List.

Figure 2. Joint Training System Four-Phase Process

The METL development process provides a robust and integrated baseline for assessing the capabilities of units and organizations in performance of wartime or assigned missions. Performing a given task to standard under wartime conditions requires that a unit (or organization) have trained personnel, the correct equipment, and adequate supplies for that mission. This provides the "ready for what" as well as the "when and where" context to the unit readiness view.

When implemented rigorously, a METL and its associated standards provide a necessary context to assess a unit's readiness and capability for its mission. This mission context, combined with appropriate measures of personnel, training, and equipment, provides valuable and actionable information on the readiness of the force. In developing EMCs, DoD should leverage the METL concept to specify the essential tasks of the deployable medical units. This requires careful consideration of the unit mission, given the strategic environment and joint operating concept.

Once the medical missions are specified and essential tasks cascaded to the tactical level, specific medical care standards—including key personnel and team proficiencies—can be used to assess the readiness of these units to meet wartime operational needs of the Combatant Commands (COCOMs).

2. Requirements Definition and Analysis

In addition to tracking and measuring medical readiness using readiness reporting systems, the Department seeks to identify and address current and future capability gaps through its deliberate capabilities development process, JCIDS. This process, governed by the Joint Staff and supporting the Joint Requirements Oversight Council, takes a strategy-to-task approach to identifying needed capabilities and validating them as military requirements. In some respects, the JCIDS process is similar to DRRS, which tracks the ability to address given METs. However, as described below, JCIDS is based upon a family of joint concepts that are derived from strategic guidance.

Figure 3 illustrates the relationship between strategic guidance, joint concepts, and Service concepts, focusing on those concepts that specifically address medical readiness. Joint concepts are derived from a series of strategic guidance documents—some are national strategies while others are specific to DoD. As with readiness measures, joint concepts are derived from the NMS. The overarching joint concept, the Capstone Concept for Joint Operations (CCJO), serves as the umbrella document for all subordinate concepts. Those concepts featured in Figure 3 are not the only joint concepts; rather, they are those concepts that directly address medical readiness. In turn, joint concepts are intended to inform the development of Service concepts.

Figure 3. Medical Readiness Concepts

Strategic guidance (e.g., National Security Strategy, National Defense Strategy) provides overarching direction from which joint concepts are derived. The strategic guidance documents do not make explicit reference to medical readiness. The first joint concept derivative of strategic guidance is the CCJO. Similar to the strategic guidance from which it is derived, the CCJO does not directly address medical readiness. It is first addressed in the *Joint Concept for Health Services*, which describes how the future joint force provides health services in support of activities across the range of military operations. The intent of this concept is "to apply the lessons learned from recent combat experiences as well as analysis of future concepts of operations to shape future solutions to the many health-care challenges the joint force will face."[22] The concept establishes the goal of developing Globally Integrated Health Services (GIHS), which it defines as "the strategic management and global synchronization of joint operational health services that are sufficiently modular, interoperable, and networked to enable their quick and efficient combination and synchronization by a joint force commander."[23] The GIHS is characterized by seven "supporting ideas:"

- Integrated Joint Requirements in Medical Force Development
- Global Synchronization of Health Services
- Modular and Interoperable Medical Capabilities
- Global Network of Health Service Nodes
- Tailored Medical Forces and Operations
- Leaders Integrating Joint Medical Capabilities
- Improved Performance

The concept elaborates on each of these supporting ideas and concludes with a listing of capabilities needed to achieve the goals set forth.

A more detailed characterization of the future of health readiness is provided by the *Health Readiness Concept of Operations (CONOPS)*. Published jointly by the Office of the Secretary of Defense (OSD) and the Joint Staff, the CONOPS "describes medical capabilities designed to provide optimal health services in support of our nation's military mission—anytime, anywhere."[24] It does so by describing the strategic environment (as depicted in strategic guidance), challenges faced by the MHS, elements of a strategy for overcoming the challenges, and a listing of medical capabilities needed to implement the strategy.

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[22] Chairman, Joint Chiefs of Staff (CJCS), *Joint Concept for Health Services*, August 31, 2015, i.

[23] Ibid., 5.

[24] OSD(HA) and Joint Staff (J4), *Health Readiness Concept of Operations*, January 2010, ES-1.

As outlined in the *Health Readiness CONOPS*, future aspects of the health readiness environment include:[25]

- Increased emphasis and concern for survivability and longevity of care for wounded warriors;
- A more complex and diverse operational environment that spans the global community and includes land, airspace, water, space, and cyberspace;
- Healthcare operations require a combination of joint capabilities to maximize complementary and additive effects;
- Technology proliferation; and
- Increased emphasis on containing DoD health costs.

Based upon the future security environment, the *Health Readiness CONOPS* lists several challenges that must be overcome in the MHS. These range from the need for medical capabilities to become more flexible, scalable, and modular to creating a more responsible medical logistics system.[26]

The *Health Readiness CONOPS* decomposes MHS health services into four mission elements, each with specific mission outcomes:

- Casualty Care and Humanitarian Assistance
- Fit, Healthy, and Protected Force
- Healthy and Resilient Individuals, Families, and Communities
- Education, Research, and Performance Improvement

These mission elements are accomplished through the three functions comprising health readiness: force health protection, health service delivery, and health system support. The capabilities required to perform these functions are detailed in the CONOPS and further described in separate CONOPS for each of the functions (addressed below).

In addition to describing the mission elements and functions for health readiness, the CONOPS also calls out two types of operations as "supporting ideas."[27] These operations are (1) homeland defense and civil support; and (2) stabilization, security, transition, and reconstruction operations. These operations are singled out because the concept contends that they are of increasing relevance to the future security environment.

A final section of the *Health Readiness CONOPS* discusses generally how the concept will be implemented and the medical capabilities identified and developed. Figure 4 illustrates this concept, reinforcing the approach outlined above of strategic

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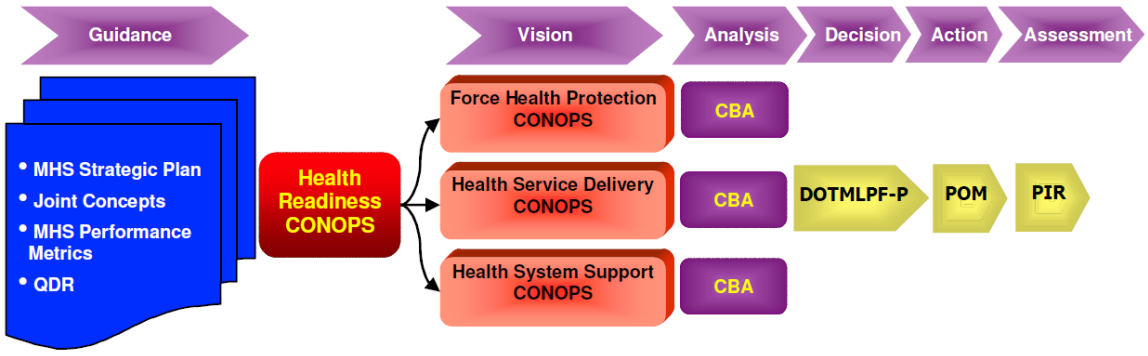
[25] Ibid., 2–3.

[26] Ibid., Section 2, 5–6.

[27] Ibid., 3-8 and 3-9.

guidance driving development of a family of concepts that serve as the basis for analysis. The expectation is that CBAs of health readiness functions will identify a range of potential solutions that will then be programmed for by the Services and become part of the joint force, thus strengthening medical readiness. As shown in Figure 4, CONOPSs and CBAs have been developed for each of the three identified functions: (1) force health protection, (2) health service delivery, and (3) health system support.[28]



Source: *Health Readiness Concept of Operations*, 5-4.

Note: QDR – Quadrennial Defense Review; DOTMLPF-P – Doctrine, Organization, Training, Materiel, Leadership, Personnel, Facilities-Policy; POM – Program Objective Memorandum; PIR – Post Implementation Review.

Figure 4. Health Readiness Implementation Concept

Each of these three CONOPSs follows a similar format and structure. They begin by largely repeating the introductory section of the *Health Readiness CONOPS*, which outlines the future challenges and four mission elements specified on the previous page. They then describe in greater detail attendant functional capabilities introduced in the *Health Readiness CONOPS*. The final sections of the CONOPS repeat the implementation concept illustrated in Figure 4.

The primary purpose appears in Appendix A ("Task, Conditions, and Standards") to each of the three functional CONOPSs. The appendix decomposes each of the capabilities in the CONOPS into specific subordinate tasks, conditions or attributes, and standards by which to measure them. Figure 5 is an excerpt from the *Health Service Delivery CONOPS* and illustrates the decomposition of each of the capabilities. This task-level decomposition provides the basis for CBAs of the CONOPS. The example (Inpatient Surgery) was chosen to illustrate a clinical capability to parallel the focus of

[28] OSD(HA) and Joint Staff (J4), *Force Health Protection Concept of Operations*, November 2011; OSD(HA) and Joint Staff (J4), *Health Service Delivery Concept of Operations*, February 2011; and OSD(HA) and Joint Staff (J4), *Health System Support Concept of Operations*, February 2011.

the present paper. Although such capabilities describe measurable aspects of health service delivery, they are too broadly defined to identify the specific technical competencies and needs that must be identified in EMCs.

The purpose of the family of joint concepts, and the above health/medical concepts, in particular, is to provide a depiction of future challenges and capabilities for addressing them. The concepts are intended to provide the basis for a subsequent CBA to identify capability gaps (and excesses) and offer both materiel and non-materiel solutions for addressing the gaps. The health/medical readiness concepts are no different, in that they form the basis for a series of JCIDS analyses and documentation. Some examples of analyses performed using these concepts include:

- *Force Health Protection Joint Doctrine, Organization, Training, Materiel, Leadership and Education, Personnel, Facilities and Policy (DOTMLPF-P) Change Recommendation (DCR)*, March 26, 2014.
- *Joint Force Health Protection Initial Capabilities Document, Version 1.0*, Joint Requirements Oversight Council, February 24, 2010.
- *Joint Medical Logistics and Infrastructure Support DCR*, February 24, 2012.
- *Medical Embedded Training Team DCR*, February 7, 2012.
- *Medical Presentation of the Force DCR*, August 15, 2012.
- *Tactical Critical Care Transport DCR*, February 27, 2012.

HSD Capability 28: Surgery (Inpatient)

DESCRIPTION OF CAPABILITY: The ability to treat disease or injury, improve or restore form or function, or close a previously sustained wound through surgical intervention. Inpatient surgery requires that the patient remain in the medical treatment facility for more than 24 consecutive hours following the completion of the procedure to recover from the procedure.

Tasks	Conditions/Attributes	Standards
A) Admit patient who has been identified as needing surgery	Accessible	Surgical available within national standards for type of procedure and location of care.
	Secure	Patient's privacy protected.
B) Prepare patient for surgery	Timely	Patient ready for surgery on time.
	Secure	Patient's privacy protected.
	Complete	All required elements of pre-op evaluation present and documented.
	Safe	Patient is protected from harm.
	Integrated	Surgeon, anesthesia provider and perioperative nurse work as a team with excellent communication across the system.
C) Perform operation	Safe	Patient is protected from harm.
	Secure	Patient's privacy is protected.
	Accurate	The right operation is performed on the right patient.
D) Recover Patient	Safe	Patient is protected from harm.
	Secure	Patient's privacy is protected.
E) Provide inpatient post op care.	Safe	Patient is protected from harm.
	Secure	Patient's privacy is protected.
	Accurate	Correct medications and treatment provided to the correct patient 100% of the time.
F) Document care provided	Complete	All data elements are present.
	Comprehensive	Each data element includes all relevant information.
	Accurate	Information is correct and legible.
	Secure	Patient's privacy is protected.

Source: Health Service Delivery Concept of Operations, 2011, 29.

Figure 5. Example of Capability Decomposition from Health Service Delivery CONOPS

3. Assessment of Strategic Framework for Medical Readiness

The medical community has many of the foundational elements in place to improve the measurement, reporting, and maintenance of readiness. As described above, the *Joint Concept for Health Services* provides a vision for future operational medical capability that describes specific attributes that can be measured and assessed from a readiness perspective.

The more detailed *Health Readiness CONOPS*, however, provides a confused definition of missions that perpetuates the challenges identified by the MCRMC, hindering a focus on readiness. Of its four mission elements, only "Casualty Care and Humanitarian Assistance" is directly tied to the missions of the Department and the higher level strategic documents. This mission is mostly inherently governmental and military essential, and drives a readiness requirement that can be identified with EMCs.

Perhaps the most obvious challenge with the document is the third mission element, "Healthy and Resilient Individuals, Families, and Communities." Providing for family member and retiree care, this mission element is a critical function to be performed, but it is not inherently governmental or military essential (almost two-thirds of inpatient and outpatient care is delivered by the private sector[29]). More importantly, the focus of the medical community on trying to do as much of this mission as possible with military personnel and assets has been a primary cause of the lack of focus on readiness. The MCRMC report pointed out that

> [r]elying on existing MTF medical cases as a training platform for combat care can result in a misalignment of military medical personnel compared to the medical requirements necessary to support the operational mission. At the start of the wars in Afghanistan and Iraq, the military medical force was understaffed for surgeons, anesthesiologists, and other specialties critical to combat casualty care, and overstaffed in specialties that generally provide peacetime health care. Some military medical professionals have concluded that the expectation to deliver ongoing, high quality, beneficiary healthcare, while preparing for the possibility of war, creates competing interests and directs resources and training away from maintaining battlefield skills.[30]

Table 1 illustrates this misalignment in the early years of OIF and OEF. The Service-identified medical force requirements were for operationally required specialties such as surgeons and anesthesiologists, but the actual executed force was composed of specialties more in demand for beneficiary healthcare.

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[29] Richard R. Bannick et al., *Evaluation of the TRICARE Program: Access, Cost, and Quality – FY 2016 Report to Congress* (Washington, DC: Department of Defense, February 2016), 30.

[30] MCRMC, *Final Report*, 64–65.

Table 1. Misalignment of Medical Force

Specialty	FY 2004 Military Requirement	FY 2004 Executed End-Strength	End-Strength Minus Requirement
Pediatrics	286	645	359
Obstetrics	208	387	179
Anesthesiology	318	259	-59
General Surgery	685	443	-242

Source: *DoD Force Health Protection and Readiness—A Summary of the Medical Readiness Review, 2004–2007*, Force Health Protection and Readiness Policy and Programs, June 2008 (FOUO).

Although this misalignment improved during the wars,[31] more recent research has still found misalignment:

> Today the U.S. Army has less than a dozen prehospital physician specialists and about the same number of trauma surgeons on active duty. By comparison, the Army has roughly the same number of radiation oncologists and nearly three times the number of pediatric psychiatrists and orthodontists. This is largely because medical specialty allocations are based on traditional peacetime beneficiary care needs. Refocusing on the wartime needs could populate key institutional and operational billets with a critical mass of trained prehospital and trauma specialists and drive further advances in battlefield care during peacetime.[32]

By combining a (vitally important but conceptually distinct) personnel benefit function with the operational medical mission, the *Health Readiness CONOPS* is failing to provide useful and coherent guidance for focusing the medical force on its mission, developing EMCs, and measuring and maintaining readiness. Instead, it perpetuates a confusion over missions that has been a root cause of past readiness challenges. Fully implementing a rigorous and focused framework for measuring and ensuring medical readiness will require replacing documents like the *Health Readiness CONOPS* with a more appropriate framework driven by Departmental strategy that focuses on the actual mission of the military medical force.

B. DoD Readiness Reporting Framework

DoDD 7730.65 requires the Secretaries of the Military Departments "to ensure that Service readiness reporting systems meet or exceed the DRRS' minimum data

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

[32] Robert R. L. Mabry, LTC MC USA, and Robert R. DeLorenzo, COL MC USA, "Challenges to Improving Combat Casualty Survival on the Battlefield," *Military Medicine* 179, No. 5 (May 2014): 480477–82.

requirements and data standards."[33] Unfortunately, the Service readiness software implementation varies considerably in the application and use of METs, resource metrics, and performance standards. While DRRS was originally envisioned as a single common operating picture for unit readiness reporting, challenges over the course of its implementation resulted in a federated system with known data gaps and inconsistencies.[34]

Missions used for readiness assessment must also be considered. The Services, as force providers, are responsible for organizing, training, and equipping their units in accordance with Title X of the U.S. Code. To do this effectively, the Services often establish standardized or common METs across like units or specialized communities. These are referred to as the "core" mission METs, and are intended to reflect the tasks the unit was designed to perform. On the one hand, this approach allows the Service to standardize unit training, equipment, and personnel requirements, as well as to create a fungible inventory of capabilities to meet global sourcing demands.[35] On the other hand, the practice of assessing readiness on a common set of tasks is inconsistent with the DRRS concept of measuring readiness on tasks based on mission requirements.

Contingency or operational plans, conversely, are developed by the Combatant Commanders with theater-specific conditions and standards. These plans provide needed details regarding what, where, and when unit capabilities are needed. Unless a unit is assigned to, or under the operational control of, the Combatant Commander, these specific requirements of the contingency plan are not reflected in the readiness assessments of units that would likely be sourced for that mission. The significance of this potential mission mismatch in the unit readiness assessment depends on how and when a unit is to be employed in the battle. Once a unit is identified to deploy in support of a contingency, specific conditions, training, and environmental information is usually provided to the unit leadership, and adjustments are made to ready the unit for deployment. Whether the unit has the time and resources needed to be ready before deploying is unknown until that point.

DoD uses many separate processes and systems outside of readiness reporting to manage personnel, training, and equipment resources. Each of these domains has a large number of software tools and applications. As originally envisioned, the strategic version of DRRS (DRRS-S) was to employ the most current data from these other systems in order to inform the readiness assessment process. This proved to be a difficult challenge

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[33] DoDD 7730.65, Enclosure 2, 7.

[34] Congressional Budget Office, *Implications of the Department of Defense Readiness Reporting System*, Working Paper Series, May 2013, 10–12.

[35] For more discussion on the influence of global sourcing on medical readiness, see Section 3.A.2.

due to a lack of software data exchange standards, security issues, organizational barriers, and cost.[36] DoD did make progress in this area, but there is a lack of standardized resource data across the Services; hence, the DRRS-S application and the Service readiness tools contain some missing and/or incomplete data.

Some of the data not explicitly captured in DRRS are important to ensuring the readiness of the units. Perhaps the best example of this type of information is found in the Service aviation communities. These communities carefully track and monitor pilot and aircrew proficiency through dedicated processes and information systems, including the Air Force Ready Aircrew Program, the Navy and Marine Corps Training and Readiness Matrixes, and Army aircrew training programs. Generally speaking, these programs are used to determine the number of flight hours, training events, and proficiency gates needed, as well as refresh rates over time, to satisfy safety of flight, basic mission readiness, and combat mission readiness.

For the medical community, Service systems such as the Air Force's Medical Readiness Decision Support System (MRDSS), the Readiness Skills Verification Program (RSVP), and the Sustained Medical and Readiness Training (SMART) program are being implemented or used to record and monitor clinical skills and currency to support medical missions.

C. Medical Readiness Measurement and Reporting

This section provides a description—developed in a two-step process—of the types of data that are available on military medical units in DRRS. First, a large extract of data from DRRS was obtained on August 21, 2015. The extract was specifically designed to provide the task and mission assessments and associated comments for all medical units at that point in time. Second, DRRS reports were re-examined in detail for a select subset of units in the August data extract. This more detailed look occurred in November and December 2015.

1. Medical Units in the Data Extract

Each assessment was labeled by both a Unit Identification Code (UIC) and Unit Type Code (UTC). Whereas the UIC uniquely identifies specific units, the UTC describes a class or type of unit or capability. The UTC is a five-character alphanumeric code with the initial character describing the generic capability of the unit.

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[36] Sharon L. Pickup and Randolph C. Hite, *DoD Needs to Strengthen Management and Oversight of the Defense Readiness Reporting System*, GAO-09-518 (Washington, DC: US Government Accountability Office, 2009).

Medical units were identified by an initial "F" in their UTC. Using this criterion to retrieve records, over 700 medical units were identified in the August data extract.[37] Most were Army and Air Force units, with a few Navy elements included in the extract as well. These units represented 40 different unit types (i.e., UTCs), but only eight unit types accounted for more than 60 percent of all units in the data extract. These eight UTCs are listed in Table 2 in order of decreasing frequency.

Table 2. Most Frequent Types of Medical Units in August 2015 Data Extract

UTC	Description
FFAAA	Air Force Numbered Medical Squadrons and Groups
FTDAU	Army Major Medical Activities
FFDAA	Air Force Medical Clinics
FDASQ	Army Medical Companies Providing Area Support
F0OMM	Army Forward Surgical Teams
FFKAA	Air Force Aeromedical Evacuation Squadrons
F2CSQ	Army Combat Support Hospitals
FFMAA	Air Force Aerospace Medicine Flights and Squadrons

2. Task Assessments

The objects for assessment in DRRS are the collective tasks on unit METLs. As described in Sections 2.A and 2.A.3, a medical unit's METs are derived from an analysis of their missions. In practice, however, the METLs for over 75 percent of units in the data extract were based on a single "core" mission. Tasks for core missions reflect a standard set of generic METs that the Services have established for the unit type. This suggests that relatively few medical unit METLs (less than 25 percent) in the extract were based on contingency or operational plans developed by Combatant Commanders that reflect theater-specific conditions and standards.

As prescribed in CJCSI 3401.01E,[38] every MET is assessed according to the three-tiered metric described in Table 3. Note that, according to CJSCI 3401.01E, for every case where a MET is rated "Q" or "N," the reporting organization must provide an

[37] This analysis is based on medical units. There is also substantial medical capability embedded in non-medical units, and ensuring the readiness of this medical capability was also a priority of the MCRMC. These organic medical capabilities are outside of the scope of this paper, but most of the discussion in this section, and in the entire paper, applies equally to these capabilities.

[38] CJCSI 3401.01E, *Joint Combat Capability Assessment,* April 13, 2010 (current as of May 19, 2014).

explanation of the issue(s) driving the assessment in the accompanying free-text comments field.

The METs identified in the data extract came from a variety of sources, which differed in fundamental ways, including echelon of performance (strategic, operational, tactical) and key defining details such as task conditions, standards, and metrics. Most of the METs in the data extract can be characterized as falling into four broad categories: Army Service tasks, Air Force Service tasks, Navy Service tasks, and Joint tasks. These categories and sources are described in the following subsections. For each category, some of the more frequently cited METs are used as examples of the types of tasks listed on unit METLs. For some of the task examples, additional information was identified, including (1) the types of units that frequently listed these on their METLs, (2) any measurement standards and criteria used to assess those tasks, and (3) some typical assessment comments.

Table 3. Readiness Metric Used in DRRS

Rating	Definition
Yes (Y)	Unit can accomplish task to established standards and conditions.
Qualified yes (Q)	Unit can accomplish all or most of the task to standard under most conditions. The specific standards and conditions, as well as the shortfalls or issues affecting the unit's task, must be clearly detailed in the MET assessment.
No (N)	Unit unable to accomplish the task to prescribed standard and conditions at this time.

Note: Adapted from CJCSI 3401,01E, Table C-2, p. C-2.

a. Army Service Tasks

The Army category contained more tasks than any of the other categories. Within this category, there are two different sources: the Army Universal Task List (AUTL)[39] and Army Task Selections (TSs).[40]

1) Tasks from the AUTL

AUTL tasks are considered to be at the tactical echelon of war, as opposed to higher operational or strategic levels. AUTL task numbers are identified by the prefix "ART." The first number after the prefix refers to joint warfighting function as derived from the

[39] Army Doctrine Reference Publication (ADRP) 1-03, *The Army Universal Task List,* October 2015.

[40] US Army Training and Doctrine Command (TRADOC) Pamphlet 350-70-1, *Training Development in Support of the Operational Domain*, February 2012.

Universal Joint Task List (UJTL).[41] The function numbers as interpreted in AUTL are (1) Movement and Maneuver, (2) Intelligence, (3) Fires, (4) Sustainment, (5) Command and Control, (6) Protection, and (7) Tactical Mission Tasks and Military Operations. Table 4 lists the four most frequently provided AUTL tasks used as METs in the DRRS database extract. These are all collective tasks performed by the unit as a whole and pertain to general military as well as medical functions.

Table 4. Example METs Drawn from the AUTL

Number	Title
ART 5.0	Conduct Mission Command
ART 6.8	Provide Force Health Protection
ART 4.3	Provide Health Service Support
ART 7.4	Conduct Civil Support Operations

Of the four tasks listed in Table 4, only ART 4.3 (Provide Health Service Support) pertains to the delivery of medical services. This particular task was frequently listed on the METLs of Army Major Medical Activities (UTC FTDAU). Although ART 4.3 is listed in the current AUTL, it is not described as a singular task, but as a category of tasks that includes ART 4.3.1 (Provide Combat Casualty Care), ART 4.3.2 (Provide Medical Evacuation), ART 4.3.3 (Provide Medical Regulating Support), and ART 4.3.4 (Provide Medical Logistics). In AUTL documents, these lower tier tasks are described in detail and have suggested performance measures; however, none of these three-digit tasks was used as a MET in DRRS. In contrast, ART 4.3 describes health service support generally as a mission that "promotes, improves, conserves, or restores the mental and physical wellbeing of Soldiers and, as directed, other personnel and consists of three elements: casualty care, medical evacuation, and medical logistics."[42] Furthermore, the AUTL document provides no performance measures for the task. In practice, the performance measure frequently cited for ART 4.3 in DRRS is a single "yes/no" item: "THIS TASK HAS BEEN TRAINED IN ACCORDANCE WITH ARMY DOCTRINE AND STANDARDS."

With regard to the comments for ART 4.3, those tasks rated "Q" often noted personnel shortages as the reason for a Qualified yes assessment. These shortages were stated in terms of personnel categories (e.g., senior non-commissioned officers, nurses, dentists, physicians), as opposed to individual positions (e.g., surgeon, laboratory technician, critical care nurse). In one case, a unit indicated that they had many medical

[41] CJCSM 3500.04F, *Universal Joint Task Manual*, June 2011.

[42] ADRP 1-03, 4–89.

professionals, but that they were not ready to take on new assignments and deploy to support operations. In short, although some comments for this task implicated personnel problems, the problems were not specified in any detail.

2) Army Task Selections (TSs)

The other type of Army Service MET is a TS, described in US Army Training and Doctrine Command (TRADOC) Pamphlet 350-70-1. A TS is actually a collection of tasks. Tasks are grouped together because they (a) describe a specific mission and capability and (b) are logically trained together during a training event. Unlike the AUTL, there is not a common dictionary of standard TSs. Rather, units develop their own selections using some general guidance provided in the TRADOC pamphlet. This document also provides the following protocol for numbering TSs:

- The initial two characters denote the proponent for the tasks. For medical tasks, the proponent code is "08."
- The next two characters are "TS," indicating that this is a Task Selection as opposed to a single collective task.
- Following the two letters is a group of four numbers:
  - The initial number in the group denotes the echelon in which the TS is performed: (1) Battalion/ Squadron, (2) Company/Troop/Battery/ Detachment, (3) Platoon, (4) Squad/Sections, (5) Crew/Team, (6) Brigade/ Group/Regiment, (7) Division, (8) Corps, and (9) Echelons Above Corps.
  - The final three digits in the group of four uniquely identify the TS in sequence.

Table 5 presents some of the more frequently observed Army TSs in the DRRS data extract. Two of the four tasks pertain to the delivery of medical services: 08-TS-1214 (Provide Health Service Support) and 08-TS-4030 (Provide Forward Surgical Support). The first of these (08-TS-1214) is performed by Army Combat Support Hospitals—248 Bed (UTC F2CSQ) as well as Army Major Medical Activities (UTC FTDAU). Like ART 4.3, the performance measure for 08-TS-1214 is a single "yes/no" item: "THIS TASK HAS BEEN TRAINED IN ACCORDANCE WITH ARMY DOCTRINE AND STANDARDS." Also like ART 4.3, the comments for "Q" ratings of 08-TS-1214 often mention specific personnel shortages as explanations for the assessments. They also comment on a lack of collective training opportunities. However, it is notable that one Army Reserve unit provided a comment explaining why they were able to perform this task successfully in collective exercises: "MAJORITY OF PERSONNEL PERFORM MEDICAL TASKS ON THEIR CIVILIAN JOBS ON A DAY TO DAY BASIS WHICH SUPPORTS AND ELEVATES THEIR PROFICIENCY ON THIS TASK."

Table 5. Example METs Drawn from Army Task Selections

Number	Title
08-TS-1214	Provide Health Service Support
08-TS-4030	Provide Forward Surgical Support
08-TS-2117	Provide Medical Mission Command
08-TS-2020[a]	Deploy/Redeploy

[a] Another task selection with the same title (Deploy/Redeploy) but a different number (08-TS-2106) was also frequently cited as a MET.

The second task selection that relates to delivery of medical services, 08-TS-4030 (Provide Forward Surgical Support), was often associated with Army Forward Surgical Teams (UTC F0OMM). The comments on "Q" and "N" ratings often related to units being in reset and their lack of training opportunities. In particular, one comment for an "N" assessment stood out for its reference to a key personnel shortage: "UNIT IS UNABLE TO TRAIN ON THIS TASK DUE TO NOT HAVING ANY SURGEONS ASSIGNED…"

b. Air Force Service Tasks

Like the Army, there are also two sources for Air Force medical tasks: the Air Force Universal Task List (AFUTL) and the older Air Force Task List (AFTL). These two sources are described below along with examples of each.

1) Tasks from the AFUTL

In the data extract, most Air Force tasks were drawn from the AFUTL, which provides a standardized list of tasks for the Core Mission of most Air Force UTCs. The current AFUTL resides on a classified SIPRNet site.[43] All AFUTL task numbers have a four-letter prefix. The first two letters are "AF" indicating Air Force. The next two letters indicate echelon of war: Strategic National (SN), Strategic Theater (ST), Operational (OP), and Tactical (TA). The definitions of echelons are consistent with usage in the UJTL. No examples of SN or ST tasks were provided in the METLs of units in the data extract. Table 6 lists four unclassified OP- and TA-level AFUTL tasks that were often listed on Air Force METLs for medical units. Note that all four tasks begin with the number "4," indicating that they all support the "Sustainment" function, although only the first two pertain directly to the delivery of medical services. Nevertheless, like the Army tasks, they reflect collective tasks that the medical unit performs as a whole.

[43] Headquarters, United States Air Force, *Air Force Universal Task List (AFUTL) and Core-Unit Mission Essential Task Lists* (Washington, DC, 2012), accessed November 5, 2015, http://www.intelink.sgov.gov/sites/afog/operational_readiness/default.aspx.

Table 6. Example METs Drawn from the Current AFUTL

Number	Title
AFOP 4.4.3.1	Provide Expeditionary Medical Support (EMEDS) – Up to EMEDS +25
AFOP 4.4.3.3	Air Force Theater Hospital (AFTH) and Other Ground Medical Augmentation
AFOP 4.4.3.6	Conduct Medical In-place/Generation/Homeland Response Missions
AFTA 4.2.5	Conduct Aeromedical Evacuation

The first two tasks, AFOP 4.4.3.1 and 4.4.3.3, are similar in several regards. Both pertain to delivery of medical services in a field environment, although they differ in scope. Additionally, both are typically—although not exclusively—performed by Air Force Numbered Medical Squadrons and Groups (UTC FFAAA) and Air Force Medical Clinics (UTC FFDAA). Further, DRRS provides the identical description for both tasks: "Provide patient care and preparation for movement in an austere environment." The measures used to assess these tasks also appear to be related, but appropriately scoped. For instance, Measure 1, or M01, for AFOP 4.4.3.3 is described as "Provide ancillary and specialty services in support of AFTH (above EMEDS +25)" (yes/no), whereas the corresponding M01 for AFOP 4.4.3.1 is described as "Provide forward stabilization and treatment of deployed forces" (yes/no). Comments on tasks assessed "Q" or "N" often referenced specific personnel shortages (e.g., flight surgeons) or personnel not having received appropriate training (e.g., training provided by the Center for Shock Trauma and Readiness Skills, C-STARS).

2) Tasks from the Air Force Task List

A smaller number of Air Force Service tasks were drawn from the AFTL, dating back to 1998.[44] These tasks are not associated with particular echelons and are all labeled with the prefix "AFT" for Air Force Task. Table 7 provides some examples of those types of tasks. Note that all tasks begin with the number "6." The AFTL taxonomy did not align with UJTL functions, but AFT Function 6 (Provide Agile Combat Support) is closely associated with UJTL Function 4 (Sustainment).

Only the first task in Table 7, AFT 6.6.1.4, appears to relate to the delivery of medical services. The definition of the task in the AFTL is not specific: "to support Air Force forces with medical support as required." The performance measures and standards varied considerably between units. No comments were provided because tasks were

[44] Air Force Doctrine Document (AFDD) 1-1, *Air Force Task List (AFTL)*, August 1998.

either assessed as "Y" or "NR." Assessments for this particular task had not been updated in over five years.

Table 7. Example METs Drawn from the 1998 AFTL

Number	Title
AFT 6.6.1.4	Perform Medical Support Activities
AFT 6.1.1	Ready the Force
AFT 6.2.1	Protect the Force
AFT 6.2.3	Equip Forces to Protect the Force

c. Navy Service Tasks

METs for the few Navy units in the data extract were all drawn from the Universal Naval Task List (UNTL), a compendium of Navy, Marine Corps, and Coast Guard tactical tasks.[45] The units were of one type, Forward Deployable Preventative Medicine Unit (UTC FDPMU), and the tasks shown in Table 8 all pertain to public health and preventative medicine issues, not to medical services.

Table 8. Example METs Drawn from the UNTL

Number	Title
NTA 4.12.8	Obtain and Analyze Medical Information
NTA 4.8.5	Maintain Cultural Awareness
NTA 4.3.2.1	Perform Preventative Maintenance
NTA 6.6.1	Provide Safety and Occupational Health (SOH) Programs

d. Universal Joint Tasks

Medical units assigned to COCOMs are sometimes assigned tasks from the UJTL. UJTL tasks begin with a two-letter prefix denoting echelon of war as described for AFUTL tasks (i.e., SN, ST, OP, or TA), and are followed by numbers. The initial number denotes a joint warfighting function, as follows:

1. Deployment and Redeployment
2. Intelligence

[45] Office of the Chief of Naval Operations Instruction (OPNAVINST) 3500.38B/Marine Corps Order (MCO) 3500.26A/USCG Commandant, United States Coast Guard Instruction (COMDTINST) 3500.1B, *Universal Naval Task List (UNTL), Version 3.0*, January 2007.

3. Employment of Forces
4. Sustainment
5. Command and Control
6. Mobilization/Force Protection
7. Force Development/Readiness/Counter Chemical, Biological, Radiological, Nuclear, and Explosives (CBRNE)
8. Multinational/Interagency
9. CBRNE Deterrence

Table 9 provides examples of METs drawn from the UJTL at each of the four echelons of war. It also indicates that the SN, ST, and OP tasks represent the sustainment function, whereas the TA task is a force protection function.

Table 9. Example METs Drawn from the UJTL

Number	Title
SN 4.2.1	Determine National Military Support Infrastructure
ST 4.2.2.3	Manage Medical, Dental, and Veterinary Services and Laboratories
OP 4.4.3	Provide Medical Services
TA 6	Protect the Force

The first three tasks pertain to medical services. However, the first task (SN 4.2.1) pertains to strategic logistical matters—that is, determining lines of support and lines of communication for sustaining bases in a Joint Operating Area. The other strategic task (ST 4.2.2.3) more directly pertains to providing medical and veterinary services in theater. Only one unit reported this as a MET in August 2015 and provided no comments. For the November 2015 look back at DRRS, this unit no longer listed this task on their METL.

In contrast to the strategic level tasks, 17 different units reported the operational level task (OP 4.4.3 Provide Medical Services) on their METL in August 2015. The current UJTL describes this task as follows: "Perform, provide, or arrange all services to promote, improve, conserve, and/or restore the mental or physical well-being of personnel."[46] The UJTL lists 10 suggested quantitative metrics for this task:

- M1: Percent accountability of personnel entering the joint health service support (HSS) system.

[46] Joint Electronic Library, *PDF Version of Approved Universal Joint Task List (UJTL) Database (as of 13 November 2015),* downloaded December 12, 2015, http://www.dtic.mil/doctrine/training /ujtl_tasks.pdf.

- M2: Percent of patients returned to duty (RTD) versus transported to definitive care facilities outside of the theater.
- M3: Percent of patients who died of wounds (DOW).
- M4: The number of patients per day provided medical treatment.
- M5: Time (in minutes) from wounding or injury to receipt of stabilizing care.
- M6: Turnaround time (in hours) for medical lab serology and other technical lab testing results.
- M7: Time (in hours) to assess all medical protective actions and make recommendations upon notification of specific bio-agent.
- M8: Number of personnel able to communicate with partner nation security forces and civilian agencies in native language.
- M9: Number of personnel able to communicate with local populace in their native language.
- M10: Number of personnel who understand social and religious customs and cultural sensitivities.

It is striking how Joint Task OP 4.4.3 (Provide Health Services) resembles five Service Tasks that were often used as METs for their medical units: ART 4.3 (Provide Health Service Support), 08-TS-1214 (Provide Health Service Support), AFOP 4.4.3.1 (Provide Expeditionary Medical Support (EMEDS) – Up to EMEDS +25), AFOP 4.4.3.3 (Air Force Theater Hospital (AFTH) and Other Ground Medical Augmentation), and AFT 6.6.1.4 (Perform Medical Support Activities). To achieve some standardization across Services and provide quantitative performance metrics, it is suggested that the Joint task be used as a model for updating corresponding Service tasks.

e. Conclusions Concerning Task-Based Assessments of Medical Readiness

The task-based assessments in DRRS provide very little information about the readiness of individual personnel in medical units or the readiness of the unit as a whole.[47] For example, a review of in-theater workload data in Chapter 4 shows that significant multiple trauma is likely the largest source of inpatient workload for many of the units reviewed in this section; it appears that a unit could be recorded as ready in DRRS even if none of the unit's personnel had experience treating trauma cases.

[47] As described in Section 3.A.3, there is a partial exception to this generalization in the Air Force DRRS assessments, which are based on individual data in the Medical Readiness Decision Support System (MRDSS). However, although information on individuals in MRDSS is passed to DRRS, individual data in MRDSS cannot be accessed in DRRS.

The general conclusions about task-based assessments in DRRS were derived from the following specific observations:

- Medical unit METs are collective tasks that provide limited information about the readiness of individuals in the unit.
- Medical unit METs are drawn from at least six different task documentation sources that differ in terms of information provided, including task conditions, standards, and measures.
- Medical unit METs represent a variety of military functions. Only a small subset of those METs pertain directly to providing medical services.
- Medical unit METs are not consistently assessed against a uniform set of conditions, standards, and metrics.
- Although units sometimes provide information concerning individual personnel certification and/or training issues in the free-text comments accompanying their collective assessments, they are not compelled to report such information in a reliable and consistent manner.

3. DRRS Personnel Tab

Information about individual members of units is available in the DRRS Personnel Tab. Information in this tab is segmented into five subordinate tabs: (1) Commissioned, (2) Enlisted, (3) Warrant, (4) Civilian, and (5) Authorized. Data on assigned military personnel are provided on the first three of these subtabs. Individual military personnel are listed by Name, Rank, Primary Skill Code (e.g., 44F1, Family Health Physician), and their Individual Medical Readiness (IMR) rating. The IMR rating is based on four health assessments (Dental Readiness, Immunization Status, Medical Laboratory Studies, and Periodic Health Assessment) plus a fifth determination as to whether the individual is free of any deployment-limiting medical conditions.[48] The overall IMR rating is a "yes/no" determination; individuals must receive a passing grade on all five IMR elements to be deemed ready for deployment.

The Civilian subtab lists non-military unit members by Name, Pay Grade (e.g., GS09), and Primary Skill Code (e.g., 0610, Nurse). IMR ratings are not provided for civilian employees.

The Authorized subtab lists all military and civilian positions that are authorized to the unit by Title, Skill Code, Rank/Pay Grade, and Count. In an example Air Force Medical Operations Squadron, two lines in this subtab revealed that the unit was

[48] DoDI 6025.19, *Individual Medical Readiness*, June 2014.

authorized three O3 military clinical nurses (Skill Code 46N3) and two GS09 civilian nurses (Skill Code 0610).

To illustrate how data in the DRRS Personnel Tab can be used to calculate percent fill for a unit, 21 medical units were sampled in November and examined in detail. This sample of units was drawn from the eight most populated UTCs as identified in the August data extract. For each of the 21 units in this sample, the data described above were obtained for authorized positions and assigned personnel. Table 10 compares authorized and assigned numbers for the sample and indicates no striking trends: nearly as many units were overstaffed as understaffed, and the assigned staff of the plurality of units were within ±10 percent of their authorized strengths.

Table 10. Comparison of Assigned Staff and Authorized Positions

Method	Number of Units
Assigned staffing fell behind authorized positions by more than 10%	7
Assigned staffing within ±10% of authorized positions	9
Assigned staffing exceeded authorized positions by more than 10%	5

In summary, the Personnel Tab in DRRS provides a list of authorized positions, assigned individuals, and assigned individuals who are medically available for deployment. Although the authorized positions are identified by skill code, the Personnel Tab does not list qualifications or required certifications associated with those positions.

4. Status of Resources and Training System

The Global Status of Resources and Training System (GSORTS or, more simply, SORTS) is a legacy readiness reporting system for assessing resources in personnel, equipment, and training. The functionality of SORTS will eventually be integrated into DRRS. For now, a SORTS summary sheet is provided as an element on the Current Unit Status (CUS) Tab of DRRS.

As described in *Force Readiness Reporting*,[49] the overall SORTS assessment, the C-rating, is determined by the lowest of the following four component ratings: (1) Personnel, (2) Equipment and Supplies on Hand, (3) Equipment Conditions, and (4) Training. Only Personnel and Training pertain to medical readiness as defined herein, and these two elements are discussed below.

[49] CJCSI 3401.02B, *Force Readiness Reporting,* May 31, 2011 (current as of July 17, 2014).

a. Personnel Rating

The personnel assessment for SORTS is based on an aggregated measure: the percent of available personnel (available personnel divided by authorized/required positions × 100) as aggregated for three populations: (1) all personnel in the unit, (2) those in critical specialties, and (3) those in critical grades. These percentages are converted to P-Ratings (P-1 to P-4) using the guidance in Table 11.

Table 11. Conversion of Personnel Fill Percentages to P-Rating

	Resource Area Status Level			
Rule	**P-1**	**P-2**	**P-3**	**P-4**
1. **Total Available Strength**. Total available strength divided by structured strength.	>=90%	>=80%	>=70%	<70%
2. **Critical Personnel**. Designated critical MOS (Military Occupational Specialty)/personnel specialty available strength divided by critical MOS/personnel specialty structured strength.	>=85%	>=75%	>=65%	<65%
3. **Critical Grade Fill** (Optional)	>=85%	>=75%	>=65%	<65%

Note: Taken from CJCSI 3401.02B, Table 1, C-8.

Although SORTS guidance on how to calculate readiness is clear, it was noted that medical units in the extract were not necessarily in full compliance. To examine SORTS outputs in more detail, the sample of 21 units described in Section 2.C.3 was examined to determine the method that was actually used to calculate their P-Rating. Table 12 presents three methods observed for those units and the frequency of application. Note that the prescribed method for determining P-Rating based on percent of available personnel was used only once.

Table 12. Method Used to Determine P-Rating and Frequency of Application

Method	Number of Units
Provided P-Rating based on a qualitative reason or code (e.g., P52 – PERSONNEL SHORTAGE--MEDICAL)	15
Did not provide P-Rating	5
Provided P-Rating based on percent of available critical personnel	1

b. Training Rating

According to CJCSI 3401.02B, the training assessment for SORTS is based on one of two calculations. Both measures represent aggregates of individual training readiness:

- *Percent of Operationally Ready and Available Crews*: Determine the number of crews operationally ready (i.e., trained) and available and divide by the number of available crews. Multiply by 100 to obtain percent.
- *Percent of Mission Essential Tasks Trained*: For each assigned individual, determine the number of METs that they must be trained on to maintain currency. Add across individuals to determine total number of tasks requiring training. Then determine the total number of tasks that individuals are currently qualified on and divide by the total number of tasks requiring training. Multiply result by 100 to obtain percent.

Training percentages described above are converted to T-Ratings (T-1 to T-4) using the guidance in Table 13.

Table 13. Conversion of Percent Trained to T-Rating

	Resource Area Status Level			
Rule	**T-1**	**T-2**	**T-3**	**T-4**
1. Percentage of operationally ready and available crews	>=85%	>=70%	>=55%	<55%
2. Percentage of mission-essential tasks trained to joint, Service, or agency-designated standards for available personnel	>=85%	>=70%	>=55%	<55%

Note: Taken from CJCSI 3401.02B, Table 4, C-16.

The same sample of 21 medical units described above was used to determine which method was used to calculate the T-Rating. Table 14 presents four methods observed for those units and the frequency of application. Again, the prescribed method for determining T-Rating based on either percent of ready crews or percent of METs trained was used only once.

Table 14. Method Used to Determine T-Rating and Frequency of Application

Method	Number of Units
Provided T-Rating based on a qualitative reason or code (e.g., T41 – TRAINING INCOMPLETE)	13
Did not provide T-Rating	5
Provided T-Rating but no reason	2
Provided T-Rating based on percent of available critical personnel	1

c. Summary of Medical Readiness Data in SORTS

The SORTS element in DRRS has the capability to report data that are relevant to medical readiness. However, the data are aggregated and therefore are more relevant to unit readiness than individual readiness. Further, the data from the extract sample indicated that most medical units do not use SORTS capabilities as intended.

5. Case Study: The 115th Combat Support Hospital

A well-established unit type that is used extensively in combat was chosen for a more detailed analysis: UTC F2CSQ, the Army CSH. The 115th CSH, home stationed at Fort Polk, LA, was chosen in particular as the representative of UTC F2CSQ because IDA had been asked to do a series of market analyses that included the central Louisiana market.

In addition to reporting readiness of the overall 115th CSH, DRRS records readiness of three of its deployable subordinate units: the 33rd Medical Detachment (Optometry Team), 485th Medical Company (Preventive Medicine), and 948th Medical Detachment (Forward Surgical Team).

a. MET Assessments

The METL for the 115th CSH was composed of collective tasks drawn from the task selections described in the Army Task Selections section on page 25. There are seven TSs on the METL for the overall unit: four TSs represent basic medical functions common to most Army CSHs and three are less common and relate to the 115th's deployed mission. Tasks for the three subordinate units were also TSs, but more narrowly defined according to the subordinate units' specific missions and functions. The fact that specific tasks were associated with different missions suggested that they were derived from a formal analysis of the missions. In contrast, the METs for most medical units observed in the August 2015 data extract represented generic medical functions derived from a single undifferentiated "core" mission.

With regard to assessments, the METs for the tasks on all four of the 115th CSH's METLs were rated with regard to a single performance measure ("THIS TASK HAS BEEN TRAINED IN ACCORDANCE WITH ARMY DOCTRINE AND STANDARDS") using a dichotomous "yes/no" scale. In other words, the assessment criteria for the 115th were very typical of other medical units observed in the data extract.

b. Personnel Tab

On the DRRS Personnel Tab, most of the individual authorized positions in the 115th CSH were listed at the hospital level, but assigned personnel were mostly posted for the subordinate units. However, DRRS can export a consolidated personnel list as an

Excel file that includes all authorized positions and assigned personnel. Both positions and individuals are listed by skill code and location, making it possible to calculate percent fill for each occupation at each location.

As typically observed in other units, the 115th Personnel Tab listed the IMR status of available individuals, but provided no information about the requirements or standards of performance for individual medical positions and no data on the training attainments or certifications of available medical personnel.

c. SORTS Tab

SORTS Tabs were available for the 115th CSH and its three subordinate units. For all four units, the SORTS personnel assessments were based on the percent of total personnel available, as prescribed in Joint Staff guidance.[50] The personnel ratings were based on aggregated data that did not identify which individuals were available. However, that information could be calculated from the assigned and authorized data in the Personnel Tab.

Similarly, the SORTS training assessments were based on the percent of total METs as prescribed.[51] Like the personnel ratings, the training ratings were based on aggregated data that did not identify which individuals were trained or not trained. Unlike the personnel ratings, however, this information could not be obtained from other parts of DRRS. Individual or team training information was sometimes provided anecdotally in the comments accompanying the assessments.

Thus, unlike most other medical units observed in the August data extract, the 115th's SORTS assessments were based on prescribed calculations and not on subjective appraisals. Nevertheless, the calculations represented aggregated data and did not allow DRRS users to identify which individuals were and were not trained and ready for deployment.

d. Summary of the Case Study

The 115th's readiness reporting in DRRS was superior to typical medical units observed in the August 2015 data extract in at least three ways: (1) METs were derived from a multiple-scenario mission analysis; (2) personnel data were organized to facilitate calculation of percent fill by skill code and by location; and (3) SORTS assessments were based on objective quantitative data as prescribed in CJCSI 3401.02B. It may be the case that a reason that the 115th provides more detailed and quantitative data in DRRS is the

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[50] Ibid., Table 1.

[51] Ibid., Table 4.

fact that the 115th UTCs deploy often and thus must monitor readiness more diligently than units that deploy less frequently. Another reason they more closely comply with readiness reporting procedures may be that they have a training mission and therefore provide instruction on the "right way" to use DRRS.

In other respects, however, the 115th's readiness reporting in DRRS suffers from the same inadequacies of other observed medical units in at least three ways: (1) METs were underspecified, omitting key features such as conditions, standards, and metrics; (2) the Personnel Tab in DRRS did not include medically relevant information, such as experiential currency and certifications attained; and (3) the SORTS data were aggregated over the unit, which did not allow identification of individuals who are trained and ready. These shortcomings are probably less due to lack of diligence in reporting and more due to inherent weaknesses in DRRS for medical readiness reporting.

3. Framework for EMC Development

The previous chapter examined how DoD measures and reports on readiness. This chapter identifies gaps in in the application of this measurement and reporting of readiness for the medical community, examines how the academic literature and civilian healthcare sector look at readiness-related issues, and concludes with an outline of a framework for developing EMCs. The focus of this and subsequent chapters is primarily on clinical currency. Medical readiness has more elements than clinical currency (e.g., logistics), but development of readiness reporting should start with the most essential tasks and capabilities. For healthcare, clinical currency for the most complex and severe injuries is one of the most essential elements of readiness.

A. Gaps in Medical Readiness Measurement and Reporting

Based on our findings in Chapter 2, IDA identified three primary gaps in medical readiness measurement and reporting:

1. Readiness measurement criteria in DRRS are not being consistently used and/or reported for medical units.
2. Even if the DRRS structure were fully utilized, the system would not ensure that the right individuals (by specialty) are available for requirements and authorizations, given how the data are fed from the Services.
3. Even if the DRRS structure were fully utilized, the system would not provide capabilities for measuring individual and team readiness from a clinical currency perspective, given how the data are fed from the Services.

1. DRRS Not Consistently Used

An examination of DRRS outputs from medical units indicates that the system is not used consistently and that users do not take full advantage of its capabilities. Some specific usage problems are discussed below.

a. Medical METLs Not Based on Operational Missions

A fundamental precept of DRRS is that a unit's METL is derived from an analysis of the unit's operational missions. As discussed in Section 2.C.2, most medical unit METLs are based on a standard set of METs established for their unit type, and *not* on the contingency or operational plans developed by Combatant Commanders.

b. Medical METs Not Standardized

Examination of tasks on medical unit METLs revealed that they came from at least six different sources. Further, most tasks were drawn from Service-based, as opposed to Joint, sources. These sources do not provide a uniform set of conditions, standards, and metrics for medical tasks. Because DRRS is task-based, these differences lead to serious discrepancies in assessment practices both within and between the Services.

c. Personnel Tab Not Relevant to Medical Competencies

The Personnel Tab in DRRS provides the structure to report attributes of individual authorized positions and assigned personnel. As presently configured, authorized positions are reported by title, skill code, rank/paygrade, and count. Assigned individuals are listed by name, rank/paygrade, and primary skill code (e.g., 0610, Nurse). Military individuals are also provided IMR ratings, which indicate their medical readiness to deploy. Our investigation indicated that medical units usually populate these current fields. Missing from these fields are attributes that relate to individual medical competencies, such as qualifications or requirements associated with positions and certifications or currency levels attained by individuals.

d. SORTs Ratings Not Consistently Used

The SORTS Tab within DRRS provides an objective system for rating personnel and training resources. A limitation of SORTS is that the ratings are based on data aggregated over the unit—that is, not on data on individuals or teams within the unit. Regardless, findings from the data extract indicated that units either do not enter data in SORTS, or do not use it as prescribed by Joint guidance.

2. Does Not Ensure Right Individuals are Available

As discussed in Section 1.A.1 and repeated in Section 2.A.3, the MCRMC report described the essential dilemma in medical readiness as follows:

> Relying on existing MTF medical cases as a training platform for combat care can result in a misalignment of military medical personnel compared to the medical requirements necessary to support the operational missions.[52]

Table 1, on page 19, illustrates this misalignment in the early years of OIF and OEF, showing that the specialty mix of the actual executed force was composed of specialties more in demand for beneficiary healthcare.

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[52] MCRMC, *Final Report*, 64–65.

These alignment issues are a significant readiness challenge. During the wars, the medical force experienced very uneven deployment rates, with the operationally required specialties having relatively high deployment rates and experiencing force stress, while other specialties were hardly deployed.[53] Interviews conducted with COCOM staffs by the MCRMC found challenges in sourcing operational medical requirements.

It is also important to note that this readiness failure occurred with direct assignment to deployable units; the subsequent shift to global sourcing makes this tracking even more difficult. For many deployable medical units, many of the required personnel were not physically resident with the unit during peacetime. Instead, they were working at MTFs or other clinical skill maintenance training venues delivering healthcare. At the start of the wars, even though the individuals were not resident with the unit, they were still assigned individually to units; for example, an individual may have had two UICs on their assignment orders—a primary UIC (the MTF) where they would work on a regular basis, and a secondary UIC (the deployable unit) to which they would switch if war broke out. This practice changed during the war to a global sourcing model, which meant that individuals were not directly assigned to deployable units and were instead considered to be part of a global pool of personnel to staff units prior to deployment.

As currently practiced, global sourcing violates the basic principle in readiness reporting that all deployable individuals must show up in DRRS to be assessed and reported on. As a result, DRRS cannot address basic questions, such as how many units could be staffed with the available ready medical force? As discussed in Section 2.C.3, data in the Personnel Tab in DRRS are often incomplete (in part due to global sourcing) and the readiness of units from the perspective of having the right number of the right specialties cannot be determined.

There are multiple ways to address problems that are caused or exacerbated by global sourcing. One obvious method is to eliminate global sourcing and return to the more rigorous direct assignment of personnel to deployable units. Then, the risk being taken to readiness when personnel are substituted into beneficiary care specialties would become directly visible to senior leadership. If, conversely, global sourcing is retained, two methods could be used to address this challenge: (1) individuals could be virtually assigned to units so that they appear in the Individuals tab of DRRS for each deployable unit, or (2) separate (virtual) units can be created in DRRS that list each of the individuals from the global source pool.

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[53] Whitley et al., "Medical Total Force Management."

3. Does Not Measure Clinical Currency

The MCRMC report described the problem that military surgeons have had acquiring and maintaining currency in trauma care:

> [s]urgeons overwhelmingly cited vascular surgeries as the most difficult cases [they faced in combat], followed by neurosurgical procedures, burns, and thoracic cases. Surgeons reported they had difficulty with these procedures because they had not performed them in nondeployed clinical settings, and because there had been a substantial time lapse since they had last treated these types of injuries.[54]

The GAO found similar problems after the First Gulf War:

> [s]ince most military treatment facilities provide health care to active-duty personnel and their beneficiaries and do not receive trauma patients, military medical personnel cannot maintain combat trauma skills during peacetime by working in these facilities.[55]

Establishing *competence* of personnel in providing healthcare is relatively straightforward because it can be measured by basic certifications. In contrast, *clinical currency* denotes a higher skill standard. Mark Boston defines clinical currency as the "state of having up-to-date clinical qualifications in a practice environment that maintains readiness and leads to proficiency."[56] In other words, *currency* has two requirements beyond competence: readiness and proficiency. *Readiness*, the focus of this paper, is being prepared to act or be used immediately. *Proficiency* is the step beyond competent and requires the provider to be highly competent, skilled, and adept.[57]

Maintaining currency in combat trauma care is particularly difficult, given the workload in the MTFs. Table 15 lists the top 10 most frequent diagnostic groups for military hospitals in 2015. Half of the top 10 groups and 52 percent of the dispositions for those groups pertain to pre-natal and post-natal care of babies and mothers.[58]

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54 MCRMC, *Final Report*, 63–64.

55 US General Accounting Office, *Medical Readiness: Efforts are Underway for DoD Training in Civilian Trauma Centers*, GAO/NSIAD-98-75, April 1998, 2.

56 COL Mark Boston, "Readiness and Currency: The Competency Continuum," (Briefing, HQ U.S. Air Force, November 2013), slide 8.

57 Ibid.

58 For a comparison of these diagnoses in military hospitals to those in combat theaters, see Section 4.B and Table 23.

Table 15. Top 10 Inpatient Diagnosis Groups in Military Hospitals (2015)

Diagnosis Group	Dispositions
Newborn Care	48,437
Normal Pregnancy and Delivery	47,435
High Blood Pressure	44,927
Unclassified Care	42,800
Screening/History of Mental Health and Substance Abuse	42,357
Complications of Pregnancy	42,080
Perinatal Conditions	35,320
Disorders of Lipid Metabolism	34,696
Complications of Pregnancy - Care of Mother	29,611
Nutritional, Endocrine, and Metabolic Disorders	25,291

Given the long-standing challenge to maintaining clinical currency during peacetime for the most mission-critical skills for deployable medical personnel, it is critical that readiness measurement and reporting include a direct focus on clinical currency. Although DRRS currently contains no measurement of clinical currency for these mission-critical skills, the Air Force has begun to incorporate some measurement of clinical currency into its readiness reporting. For instance, the Air Force's MRDSS incorporates clinical currency data for individual personnel. For surgeons, this includes reports on training completion and on logbook completion status, which are used to determine SORTS and DRRS ratings. Thus, a lower-level reporting process and supporting system is in place to compile clinical currency data for Air Force medical personnel. At this point, it does not feed the more detailed information into DRRS. Nonetheless, this system demonstrates that it is feasible to set up a medical readiness reporting system that measures clinical currency.

With respect to the current reporting structure in DRRS, IDA proposes the development of two capabilities for improving performance measurement:

- A training tab within DRRS that would include measurement of clinical currency. A training tab was actually part of the original vision for DRRS for all forces, but has not been implemented to date.
- A stand-alone system that feeds DRRS/SORTS. This is how a similar challenge was addressed for air crews and how the Air Force is evolving for its medical force.

B. Clinical Currency in the Civilian Healthcare Sector

To aid in identifying EMCs and their associated standards for readiness, it is helpful to look at how the civilian healthcare sector looks at clinical currency. Although the civilian healthcare sector may sometimes have issues requiring the consideration of

readiness (e.g., a major trauma center's readiness for a mass casualty event), for the most part the civilian sector examines clinical currency from a different perspective than the military. In particular, most civilian healthcare providers are engaged in their craft on a day-to-day basis, and the focus is more on the quality with which the care is delivered every day. Although this focus is slightly different and the language used to consider the issues is different, the end result is largely the same—DoD wants providers who are ready to deliver high quality care in a deployed setting—and the civilian literature and practice does provide a valuable reference for development of EMCs.

1. What is Clinical Proficiency?

As discussed above, Boston identified two requirements of clinical currency: readiness and proficiency. Similarly, Graser et al. maintained that a surgeon is clinically current if he or she is "capable of performing surgery in his or her specialty immediately after arrival at a deployment site."[59] They define clinical currency as

> what medical personnel possess who have received the required training and experience to perform their medical duties without further training, instruction, or experience. Thus, a surgeon would be clinically current if he or she were capable of performing surgery in his or her specialty immediately after arrival at a deployment site.[60]

Boston's use of the term *proficiency* is adapted from Dreyfus' model of skill acquisition.[61] Figure 6, modified by Boston, illustrates the Dreyfus framework.[62] In this framework, *proficient* is the step beyond *competent*. *Proficient* means highly competent, skilled, or adept. It refers to expertise. Clinical currency combines this higher level of skill (proficiency or, even better, expert) with readiness—the ability to execute that level of skill immediately without requiring additional time to attain the level of skill.

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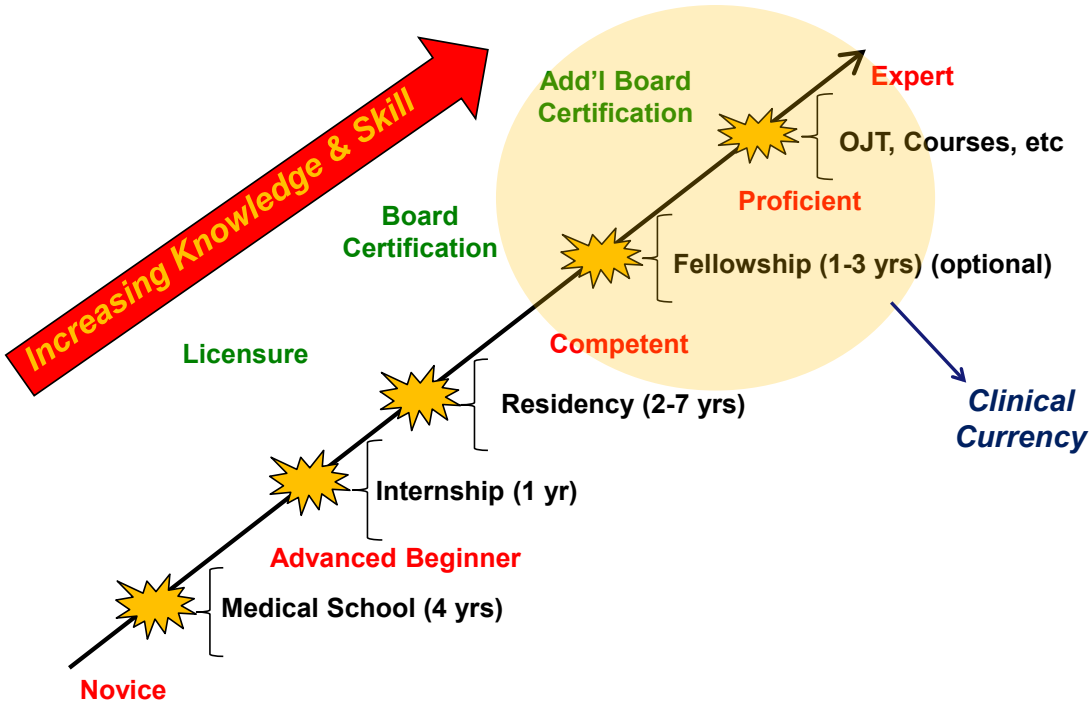
[59] John C. Graser et al., *The Economics of Air Force Medical Service Readiness,* Report TR-859 (Santa Monica, CA: The RAND Corporation, 2010), xxiii.

[60] Ibid., footnote 2, 2.

[61] S. E. Dreyfus, "The five-state model of adult skill acquisition," *Bulletin of Science, Technology & Society* 24 (2004): 177–81.

[62] Boston, "Readiness and Currency," slide 9.



Source: Boston, "Readiness and Currency," slide 9.
Note: OJT – On-the-Job Training.

Figure 6. Model of Skill Acquisition

2. How is Clinical Proficiency Measured in the Private Sector?

a. Measurements and Certification

Because competence is associated with a certification process, a surgeon who has completed residency and has been certified by an American Board of Medical Specialties (ABMS) board is assumed to have demonstrated six core competencies established by the Accreditation Council for Graduate Medical Education (ACGME) and the ABMS (www.abms.org). To obtain ABMS certification, the requirements are the following:

- Education: pre-med, medical degree, 3–5 years residency;
- Letters of attestation from program director or faculty;
- Unrestricted license to practice medicine in the United States or Canada; and
- Written/oral ABMS examination.

To maintain certification, the ABMS requires participation in its Maintenance of Certification program, involving ongoing measurement of six core competencies: (1) practice-based learning and improvement, (2) patient care and procedural skills, (3) systems-based practice, (4) medical knowledge, (5) interpersonal and communication skills, and (6) professionalism. Beyond board certification, however, there are no

published quantitative licensing standards for measuring clinical proficiency (or, beyond that, the expert level of skill).[63]

b. Correlating Volume with Quality

Across the military forces, experience is used as a key measure in readiness measurement and reporting. This provides a valuable bridge to the civilian healthcare sector because volume (procedures performed per unit of time) has become a generally accepted predictor of clinical quality and health outcomes. Quality and outcomes are, in turn, important indicators of individual skill level and clinical proficiency. Some data and standards are available from the academic literature, insurers, state health organizations, and non-profit organizations. However, only some areas have been studied, and much of the literature that does exist addresses complex, but relatively routine, surgical procedures.

The academic literature contains a large number of studies that address the volume/quality relationship in clinical work. These studies show that a higher volume of surgeries correlates with a lower number of surgical complications and higher quality outcomes for patients. Full citations for the studies listed below can be found in the References section of this paper.

Overviews of this literature can be found in the following sources:

- Boston, Mark, COL USAF, "Readiness and Currency: The Competency Continuum." 2013.
- Brevig, Holly et al. "The Quality-Volume Relationship: Comparing Civilian and MHS Practice." 2015.
- Chowdhury, M. M., H. Dagash, and A. Pierro. "Systematic Review of Impact of Volume of Surgery and Specialization on Patient Outcome." 2007.
- Gandjour, Afschin, Angelika Bannenberg, and Karl W. Lauterbach. "Threshold Volumes Associated with Higher Survival in Health Care: A Systematic Review." 2003.
- Halm, Ethan A., Clara Lee, and Mark R. Chassin. "Is Volume Related to Outcome in Health Care? A Systematic Review and Methodological Critique of the Literature." 2002.
- Harrell, Thomas W. "Achieving Medical Currency via Selected Staff Integration in Civilian and Veterans Administration Medical Facilities." 2012.
- Henderson, W. G. et al., "Comparison of Risk-Adjusted 30-Day Postoperative Mortality and Morbidity in Department of Veterans Affairs Hospitals and

[63] Boston, "Readiness and Currency."

Selected University Medical Centers: General Surgical Operations in Men," *Journal of the American College of Surgeons* 204, No. 6 (June 2007): 1103–14.

Research on specific conditions and procedures include the following studies:

- Treatment for penetrating abdominal trauma (e.g., gunshot wounds) – Nathens, Avery et al. "Relationship between Trauma Center Volume and Outcomes." 2001.
- Spine decompression and fusion – Bederman, S. S. et al. "The who, what and when of surgery for the degenerative lumbar spine: a population-based study of surgeon factors, surgical procedures, recent trends and reoperation rates." 2009.
- Knee replacements – Katz, Jeffrey N. et al. "Association between Hospital and Surgeon Procedure Volume and the Outcomes of Total Knee Replacement." 2004; and Wei, Min-Hsiung et al. "Effects of Provider Patient Volume and Comorbidity on Clinical and Economic Outcomes for Total Knee Arthroplasty: A Population-Based Study." 2010.
- Hip replacements – Ravi, Bheeshma et al. "Relation between surgeon volume and risk of complications after total hip arthroplasty: propensity score matched cohort study." 2014; and Katz et al. 2004.
- Sepsis – Reinikainen, M. et al. "Are small hospitals with small intensive care units able to treat patients with severe sepsis?" 2010.
- Pneumonia – Lin, H. C. et al. "Physician's case volume of intensive care unit pneumonia admissions and in-hospital mortality." 2008.
- Cardiac conditions – Carr, B. G. et al. "Inter-hospital variability in post-cardiac arrest mortality." 2009; and Cowan, John A. et al. "Surgeon Volume as an Indicator of Outcomes after Carotid Endarterectomy: An Effect Independent of Specialty Practice or Hospital Volume." 2002.
- Intubation – Wang, Henry E. et al. "Defining the Learning Curve for Paramedic Student Endotracheal Intubation." 2004.
- Mechanical ventilation treatment – Darmon, M. et al. "Procedure volume is one determinant of centre effect in mechanically ventilated patients." 2011.
- Intensive Care Unit treatment – Glance, L. G. et al. "Impact of patient volume on the mortality rate of adult intensive care unit patients." 2006.

Across this literature, the generally accepted conclusion is that higher volume surgeons are more skilled, and that higher volume hospitals provide better patient outcomes.[64]

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[64] An important note about this literature is that correlation is not the same as causation, and there is significant ongoing work attempting to identify the causes of the higher quality.

3. Standards for Clinical Proficiency

The use of volume as a partial measure of quality (and, for our purposes, proficiency) has expanded into many areas of civilian healthcare. For example, ACGME standards for residency training include some lower limits on the number of procedures done.[65] Moreover, some medical insurance programs specify minimum annual volumes for some procedures for candidates for their facility recognition programs.[66] Table 16 shows volume standards for Aetna's Institutes of Quality and Institutes of Excellence. Table 17 shows volume standards for Blue Cross Blue Shield Blue Distinction Centers.

Table 16. Aetna Institutes of Quality and Institutes of Excellence Volume Standards

Procedure	Required Annual Surgeon Volume	Required Annual Facility Volume
Bariatric surgery (inpatient)	100	125
Bariatric surgery (ambulatory)		75
Open heart procedures		200
Angioplasty or stent		200
Cardiac resynchronization (pacemaker, implanted defibrillator)		125
Knee replacement	50	200
Hip replacement	50	100
Spinal surgery	50	200
Adult kidney transplant		40
Adult bone marrow transplant		40
Adult liver transplant		30
Infertility clinic implant	20	

Source: Aetna Institutes of Quality® Facilities Fact Book. Extracted from Brevig et al., 2015.

65 Boston, "Readiness and Currency."

66 Holly Brevig et al., "The Quality-Volume Relationship: Comparing Civilian and MHS Practice" (Arlington, VA: CNA, January 2015).

Table 17. Blue Cross Blue Shield Blue Distinction Centers Standards

Procedure	Required Annual Surgeon Volume	Required Annual Facility Volume
Total joint (knee + hip) replacement	At least 21% of the program's active surgeons performed at least 50 total joint replacements	250
Spine surgery	At least 32% of the program's active surgeons performed at least 50 total spine surgeries	100
Bariatric surgery	Primary surgeon performed 50 in last 12 months, at least 125 in career	
Cardiac care		10 episodes
Bone marrow transplant		24

Source: Blue Cross Blue Shield Association. Extracted from Brevig et al., 2015.

In some cases, volume is used as an implicit measure of quality. For example, eleven states have publicly accessible websites that provide hospital quality and cost information. This includes volume data but not standards. Additionally, some medical professional associations have policy statements that recognize the importance of procedure volume but without proposing or specifying volume standards. However, no associations have, to date, used volume as an explicit indicator of surgeon or facility quality.

The Leapfrog Group is a non-profit organization that compiles and publishes safety ratings based on data provided by hospitals that volunteer to participate in its program. Leapfrog membership includes many large corporations and public agencies that buy health benefits for their enrollees—covering more than 34 million beneficiaries and representing more than $62 billion in healthcare expenditures. Leapfrog ratings are publicly available on the organization's website.[67] The hospitals are rated on patient outcomes, on their use of appropriate safety processes, and on meeting minimum annual volumes for select procedures. Table 18 shows Leapfrog Group volume standards for select procedures.

[67] The Leapfrog Group, accessed February 23, 2016, http://www.leapfroggroup.org/.

Table 18. Leapfrog Hospital Volume Targets

Procedure	Annual Surgeon Volume		Annual Facility Volume		
	2008 Fact Sheet	2011 Fact Sheet	2008 Fact Sheet	2011 Fact Sheet	2014 Fact Sheet
CABG	100		500	≥450	
PCI	75		≥400		
Aortic valve replacement	22		≥50	≥120	≥120
Elective abdominal aortic aneurysm (AAA) repair	8		3	≥50	≥50
Pancreatic resection	2		≥11		
Esophagectomy	2		6	≥13	
Bariatric Surgery	20	50	>125		
High-risk births	N/A	N/A		≥50	≥50

Sources: Leapfrog Group data (Evidence-based Hospital Referral (EBHR) Fact Sheets for 2008, 2011, and 2014), cited in Brevig et al., 2015.

The Leapfrog Group's volume standards are supported by a study done by Allareddy et al.,[68] which showed that meeting Leapfrog Group minimum hospital volumes for a number of these procedures correlated with lower in-hospital mortality rates for those procedures.

The Agency for Healthcare Research and Quality (AHRQ), an agency of the US Department of Health and Human Services, publishes Inpatient Quality Indicators (IQI) in order to provide insight into hospital care quality and to identify areas for further attention. AHRQ calculates these metrics from hospital administrative records. The IQI program contains 34 measures, which can be broken down into three types of metrics:

- Mortality rates for different types of surgery and conditions (17 measures). An example is IQI 12, Coronary Artery Bypass Graft (CABG) Mortality Rate, which measures in-hospital death rates for CABG patients aged 40 and older. AHRQ finds that high-quality facilities have lower mortality rates.
- Procedure rates within a given population (11 measures). For example, IQI 21 is Cesarean Delivery Rate, Uncomplicated. AHRQ finds that high-quality facilities perform fewer C-sections on uncomplicated patients.

[68] V. Allareddy, V. Allareddy, and B. R. Konety, "Specificity of procedure volume and in-hospital mortality association," *Annals of Surgery* 246, No. 1 (July 2007): 135–9.

- Metrics based on procedure volume (6 measures). These metrics address procedures for which lower mortality is known to be associated with procedure volume. As provided by Brevig et al.,[69] these metrics are as follows:
  - IQI 01, Esophageal Resection Volume;
  - IQI 02, Pancreatic Resection Volume;
  - IQI 04, Abdominal Aortic Aneurysm (AAA) Repair Volume;
  - IQI 05, Coronary Artery Bypass Graft (CABG) Volume;
  - IQI 06, Percutaneous Coronary Intervention (PCI) Volume; and
  - IQI 07, Carotid Endarterectomy Volume.

4. Conclusions from Civilian Healthcare

Clinical currency can be defined as being clinically proficient and ready to deliver care immediately and at that level of skill. Procedure volume is one useful measure of this level of skill and directly translates to how readiness is measured in many communities across DoD. For the military medical force, volume of the relevant case mix will likely be a key element of readiness measurement and reporting, but it will not be the only element. Moreover, there are key gaps in our knowledge about how to implement this element. Much of the current literature is focused on complex, but relatively routine, surgical procedures.

C. Developing a Framework for EMCs

Based on the review of readiness reporting (Section 2.C), the assessment of the gaps in medical readiness reporting (Section 3.A), and the review of how the academic and civilian sectors assess clinical currency (Section 3.B), IDA recommends that, for readiness measurement and reporting, EMCs be considered similar in many ways to METs and be developed in a similar fashion.

For readiness reporting, METs are determined through mission analyses that determine "what tasks, under what conditions, performed to what standard."[70] This is the well-known task/condition/standard framework. A mission analysis provides an analytic process for relating mission requirements to the tasks that must be performed to accomplish mission and, subsequently, developing standards for these tasks.

Medical capabilities have some advantages in this process because some academic literature on deployed healthcare already exists, providing many of the key ingredients of a mission analysis in specific areas. For example, Eastridge et al. (2012) focused on

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[69] Brevig et al., "The Quality-Volume Relationship."

[70] *Joint Mission Essential Task List (JMETL) Development Handbook* (Washington, DC: Joint Chiefs of Staff, September 2002).

saving lives from potentially survivable injuries and identified key tasks in prehospital care for improving survivability.[71]

A first step in establishing EMCs and METs is to determine what is "essential." Medical units, like all military units, do many things during a deployment. Some of these tasks are more important to mission accomplishment than others, and some, whether critical to mission accomplishment or not, are harder to perform, while others are easier to perform. In developing EMCs and METs, the objective is to start with those tasks that are most critical for mission accomplishment and hardest to perform. This objective assumes that if a medical unit can perform the most difficult METs, it can perform related but less difficult tasks at least as well. Routine tasks and tasks that are not critical for mission accomplishment are lower priorities for development in a readiness measurement and reporting framework. Guidance on this includes:

- *Joint Mission Essential Task List (JMETL) Development Handbook*, 2002: "[J]oint training resources are constrained. As a result, joint commanders cannot train to every task for every possible mission and must therefore be selective in establishing their joint training requirements…To accommodate the constraints on joint training resources, joint force commanders must identify the tasks most essential to their assigned or anticipated missions, with priority given to their wartime missions."[72]
- Army FM 7-0, *Training for Full Spectrum Operations*, 2008: "Because sufficient resources, especially time, are not available, units cannot train to standard on every task needed for all operations across the spectrum of conflict. Therefore, commanders focus training on the most important tasks—those that help units prepare to conduct operations. They do this through mission focus and their mission-essential task list (METL)."[73]

For medical readiness, there are obvious places to start this assessment. First and foremost, what tasks are most critical for saving life and limb? The academic literature mentioned above discusses "preventable deaths" or "potentially survivable" injuries and examines essential tasks for savings lives with these injury types. A wide range of clinical tasks are performed in a combat theater, treating everything from basic flus and

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[71] B. J. Eastridge et al., "Death on the battlefield (2001-2011): implications for the future of combat casualty care," *Journal of Trauma and Acute Care Surgery* 73, No. 6 Suppl 5 (December 2012): S431–7.

[72] *JMETL Development Handbook*, 2.

[73] Army FM 7-0, *Training for Full Spectrum Operations* (Washington, DC: Headquarters, Department of the Army, December 2008), Section 4, 6.

sprained ankles to multiple severe traumatic injuries. The development of EMCs should start with the most important tasks for saving lives.

Two key data sources can be used for mission analyses in the development of clinical EMCs: actual medical workload data from deployed settings, and modeling and simulation (M&S) of potential alternative workload distributions based on alternative warfighting scenarios.[74] Although imperfect and incomplete, DoD has captured a large amount of data on medical workload performed in deployments. These data are discussed in detail in Chapter 4.

With this background, the following are the basic steps of a mission analysis for identifying key clinical EMCs:

1. Review deployed workload data to identify the distribution of diagnoses. The focus begins with diagnosis codes and injury types. Review data on frequency and severity (e.g., measured by injury severity score). The objective is to identify priority categories of diagnoses that are frequent and severe, i.e., have a high risk of loss of life or limb.
2. Identify essential tasks by relating the prioritized categories of diagnoses to the procedures performed. When the deployed workload data contain procedure codes, these can be used. When the deployed workload data are incomplete on procedure coding, other sources of diagnoses-to-procedure data can be used. The objective is to identify the essential, complex procedures that must be performed to save life and limb.
3. Relate the procedures performed to existing literature on standards for clinical currency. When literature exists that identifies standards for clinical currency for the key procedures (tasks), use that literature to identify the standards.
4. Identify gaps in the existing literature and begin developing studies and analyses to determine standards in areas that the existing literature does not cover.

[74] M&S will usually start with actual workload data from deployments and then modify them by, for example, modeling different distributions of casualties to generate alternative workload distributions.

4. Ready for What? Deployed Medical Workload

In its final report, the MCRMC recommended that DoD define and measure EMCs to promote and maintain critical competencies within the military medical force.[75] The Commission defined EMCs as those medical capabilities that the military needs to perform its operational mission, and that must be retained within the military for national security purposes. These capabilities are vital to effective and timely healthcare during deployed operations.

When we talk about the readiness of the medical force, what does that actually mean—that is, ready for what? There are two ways to address that question quantitatively: (1) examine actual workload performed during contingency operations, and (2) use modeling and simulation (e.g., campaign analysis) to generate projected workload distributions for future conflict scenarios. Section 4.A examines the former approach in detail, whereas Section 4.C briefly discusses the latter. To highlight the unique requirements of the operational medical mission, Section 4.B compares the medical workload performed in theater with that performed at DoD's system of military hospitals.

A. Theater Medical Workload

Medical workload performed in theater runs the gamut from routine sick call visits to multiple significant trauma cases, and from the treatment of diseases and non-battle injuries (DNBI) to combat-related injuries. Some in the military medical community have argued that analyzing workload performed in theater gives only a historical view of what the medical force needs to be prepared for and is unrepresentative of what they may encounter in the next major conflict. Perhaps in future conflicts we will see a different mix of types and mechanisms of injury than we have seen in the past, but it seems unlikely that the medical force will face an entirely new set of medical conditions that it has never encountered before (in fact, explosions, fragmentation, and high-velocity gunshot wounds have been the predominant causes of injury since World War I).[76] Because it is possible to

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[75] MCRMC, *Final Report.*

[76] An exception to this statement would be a future conflict involving chemical and/or biological agents. Such a scenario would have to be addressed by a combination of historical data analysis and modeling and simulation.

statistically adjust workload data collected from historical conflicts to align more closely with future war and casualty scenarios (see discussion in Section 4.C), analyzing historical theater workload data still provides the best starting approach for identifying EMCs.

1. Sources of Theater Medical Data

Three major data sources hold the greatest promise for identifying EMCs:

- The DoD Trauma Registry (DoDTR),
- The Theater Medical Data Store (TMDS), and
- Deployed Standard Inpatient Data Records (SIDRs).

The DoDTR is managed and maintained by the US Army Institute of Surgical Research and is the main data repository for DoD trauma-related injuries. The registry documents patient demographics, cause and mechanism of injury, diagnoses, treatments, and outcomes of injuries from the point of wounding to final disposition. A major goal of the DoDTR is to provide a resource for improving the quality of trauma care and to help develop and maintain clinical best practices in the treatment of trauma cases. For the purpose of identifying those EMCs that involve treating the most intensive cases, require the greatest amount of surgical skill, and for which life hangs in the balance, the DoDTR probably provides the best resource.

The TMDS, administered by the Deployment Health Support Directorate of the Deputy Assistant Secretary of Defense for Force Health Protection and Readiness, provides a central collection point for data from:

- The Mobile and Theater versions of the Armed Forces Health Longitudinal Technology Application (AHLTA—DoD's electronic health record),
- The Theater Medical Information Program Joint Composite Health Care System – Caché (TC2),
- The Transportation Command Regulating and Command and Control Evacuation System (TRAC2ES), and
- The Maritime Medical Modules (MMM).[77]

AHLTA–Mobile is a handheld medical application used by first responders and clinical providers at Level 1 treatment facilities at the point of injury to document diagnoses, treatments, and clinical encounters of Service members. AHLTA–Theater, which documents primarily outpatient encounters at Level 2 and 3 facilities, is a fully compatible and deployable system having much the same functionality as AHLTA but tailored to operate in the theater environment. TC2 documents inpatient care, capturing admission, discharge, and transfer encounter data. TRAC2ES is an application that helps

[77] MMM was formerly known as the Shipboard Automated Medical System (SAMS).

deployed medical staff coordinate and monitor patient movement between MTFs during peacetime, contingencies, and war, including mass casualty situations. MMM is a Navy application that tracks medical and dental readiness of operational units by monitoring the medical environment and health of personnel who live and work on a ship, submarine, or other facility.

Although trauma cases are documented in the TMDS, there is no data sharing between that system and the DoDTR. Because there is a greater level of detail on trauma cases in the DoDTR, in particular on injury severity, we use the DoDTR to identify EMCs related to significant trauma cases and the TMDS to identify non-trauma-related EMCs. Both data sources contain diagnosis and procedure codes for all echelons of care, but not all echelons are equally well documented. The TMDS data also contain information (such as specialty) on the treating provider.

Deployed SIDRs, managed by the US Army Medical Command, Patient Administration Systems and Biostatistics Activity (PASBA), record detailed in-theater inpatient data from Level 3 facilities,[78] including up to 20 diagnosis and procedure codes, reporting MTF, and attending provider specialty.[79] The PASBA division also manages a dataset[80] compiled from scans of large amounts of paper records returned from Iraq and Afghanistan. Additionally, PASBA employs medical coders who review whatever information on diagnoses and treatments exists on these paper records and enter the codes onto the SIDRs. As the majority of evacuations from theater are for non-trauma-related issues, Deployed SIDRs will provide a useful supplement to TMDS Level 3 inpatient records. These systems may also supplement DoDTR data in cases where procedure codes and provider information may be missing.

2. Theater Medical Workload Statistics

The most comprehensive of our data sources, including both inpatient and outpatient data for all echelons of care, is the TMDS. To illustrate how TMDS data can be used to identify high-volume EMCs, we computed the top 25 inpatient and outpatient diagnosis groups in terms of frequency for the conflicts in Iraq and Afghanistan. Because there are thousands of possible diagnosis codes, we grouped them into clinically similar categories using the Clinical Classifications Software (CCS) tool developed at AHRQ.[81] When defining EMCs, however, we will use the original diagnosis codes, not CCS groups.

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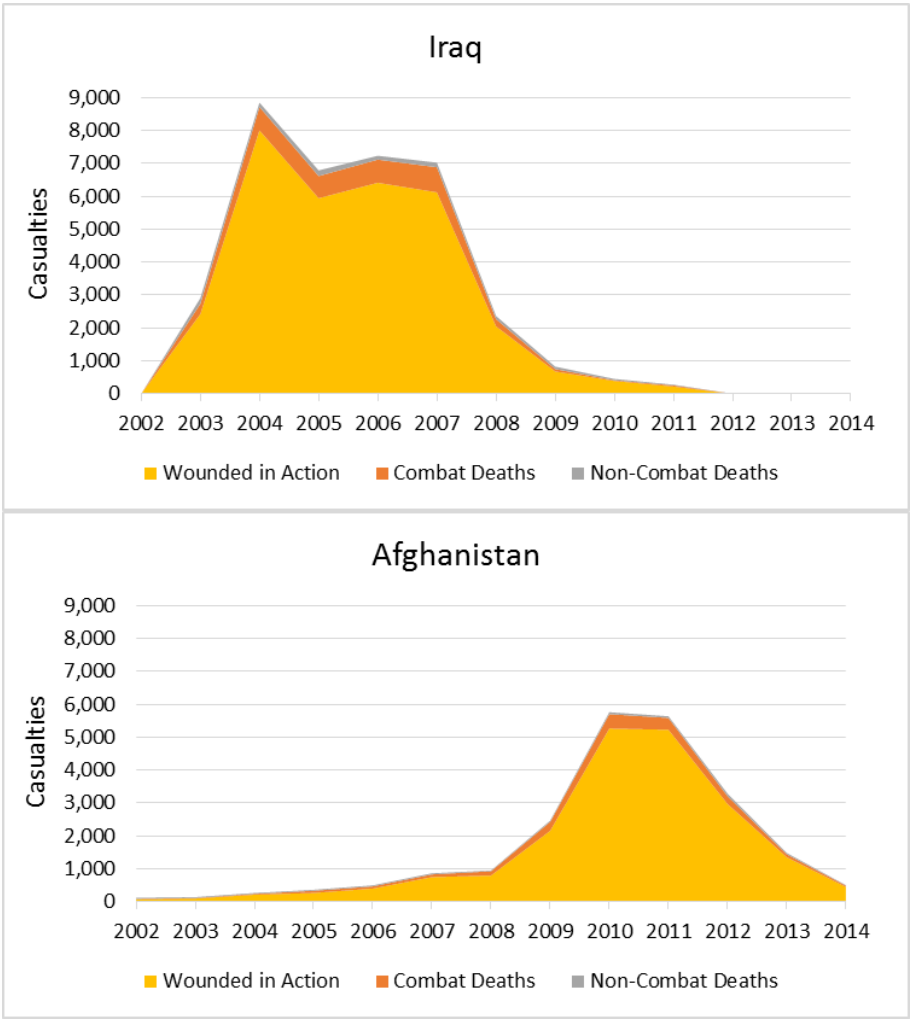
[78] These are fully equipped field hospitals providing resuscitation, damage control surgery, and stabilization before evacuation from the combat zone.

[79] It remains to be seen how well-populated this field is.

[80] The dataset is referred to by its acronym, WISPR—Web Interface for Scanned Patient Records.

[81] The CCS software can be downloaded at http://www.hcup-us.ahrq.gov/toolssoftware/ccs/ccs.jsp#download.

To determine which years to display, we collected casualty data from the Defense Casualty Analysis System, maintained by the Defense Manpower Data Center. Figure 7 shows casualties for Iraq and Afghanistan for the period from 2002 to 2014. The charts show the peak year for casualties was 2004 for Iraq and 2010 for Afghanistan. However, because there are large gaps in the TMDS data prior to 2007, we selected 2007 as the year to display for Iraq. Although not the peak year, 2007 had the third highest casualty count in the 13-year span.



Source: Defense Casualty Analysis System.

Figure 7. Historical Casualty Counts in Iraq and Afghanistan

The following four tables show the top diagnosis groups in theater by frequency of occurrence, broken out by type of injury or disease: inpatient diagnoses in Iraq (Table 19), outpatient diagnoses in Iraq (Table 20), inpatient diagnoses in Afghanistan (Table 21), and outpatient diagnoses in Afghanistan (Table 22). Note that, for all four tables, individuals can have more than one encounter and more than one diagnosis per

encounter, so the totals shown do not correspond to the number of unique individuals or encounters.

Table 19. Top 25 Inpatient Diagnosis Groups in Iraq (2007)

CCS Diagnosis Group	Battle Injury	Non-Battle Injury	Disease	Unknown	Total
Open wounds of head, neck, and trunk	2,882	182	25	399	3,488
Open wounds of extremities	2,015	226	18	391	2,650
Other injuries and conditions due to external causes	905	362	80	927	2,274
Fracture of lower limb	464	179	4	345	992
Nonspecific chest pain	10	25	783	168	986
Abdominal pain	17	38	559	69	683
Crushing injury or internal injury	304	74	27	184	589
Fracture of upper limb	198	155	3	207	563
Skin and subcutaneous tissue infections	1	20	369	153	543
Burns	263	128	9	128	528
Appendicitis and other appendiceal conditions	0	9	350	126	485
Intracranial injury	248	63	9	72	392
Calculus of urinary tract	0	4	271	32	307
Skull and face fractures	101	65	0	139	305
Anxiety disorders	3	7	204	28	242
Superficial injury, contusion	126	67	18	28	239
Spondylosis, intervertebral disc disorders, other back problems	50	92	35	20	197
Other fractures	75	30	0	55	160
Epilepsy, convulsions	0	5	107	40	152
Other connective tissue disease	31	34	50	31	146
Other non-traumatic joint disorders	41	61	30	13	145
Pneumonia (except that caused by tuberculosis or sexually transmitted disease)	0	1	84	49	134
Headache, including migraine	25	10	79	19	133
Syncope	2	9	74	34	119
Other lower respiratory disease	3	4	77	19	103
Total	**7,764**	**1,850**	**3,265**	**3,676**	**16,555**

Source: Theater Medical Data Store

Note that in Table 19, about half of the top 25 inpatient diagnoses (47 percent) were related to combat injuries, 11 percent were for injuries unrelated to combat, 20 percent were related to diseases, and 22 percent did not have an injury type recorded.

Compared to inpatient diagnoses in Table 19, the frequency of outpatient diagnoses in Iraq (Table 20) shows, as would be expected, far fewer diagnoses related to combat (6 percent). About equal percentages are related to non-combat-related injuries and diseases (46 and 42 percent, respectively), and the remainder (6 percent) are of unknown type. Many outpatient diagnoses are for routine medical and psychological examinations and orthopedic conditions.

Table 20. Top 25 Outpatient Diagnosis Groups in Iraq (2007)

CCS Diagnosis Group	Battle Injury	Non-Battle Injury	Disease	Unknown	Total
Medical examination/evaluation	236	3,295	3,003	162	6,696
Rehabilitation care, fitting of prostheses, and adjustment of devices	556	4,851	64	74	5,545
Administrative/social admission	443	438	3,997	190	5,068
Spondylosis, intervertebral disc disorders, other back problems	151	3,603	703	240	4,697
Sprains and strains	165	3,705	399	417	4,686
Other non-traumatic joint disorders	150	3,383	414	214	4,161
Other connective tissue disease	168	2,670	593	187	3,618
Blindness and vision defects	30	1,966	918	34	2,948
Other upper respiratory infections	3	171	2,345	132	2,651
Immunizations and screening for infectious disease	0	614	1,858	29	2,501
Other ear and sense organ disorders	786	111	1,104	66	2,067
Other skin disorders	3	205	1,544	107	1,859
Skin and subcutaneous tissue infections	12	246	1,350	118	1,726
Adjustment disorders	6	51	1,014	638	1,709
Abdominal pain	13	335	1,087	133	1,568
Superficial injury, contusion	223	951	305	76	1,555
Other eye disorders	110	460	897	86	1,553
Allergic reactions	3	83	1,024	68	1,178
Essential hypertension	1	101	945	94	1,141
Miscellaneous disorders	75	100	639	251	1,065
Open wounds of head, neck, and trunk	434	458	92	42	1,026
Fracture of upper limb	272	686	39	25	1,022
Residual codes, unclassified	41	147	707	102	997
Mycoses	2	124	801	49	976
Nonspecific chest pain	12	126	723	109	970
Total	**3,895**	**28,880**	**26,565**	**3,643**	**62,983**

Source: Theater Medical Data Store

For inpatient diagnoses in Afghanistan (Table 21), a large percentage of inpatient injury types are unrecorded (60 percent) but, of those that are recorded, most are related to combat (63 percent). The distribution of injuries and diseases in Afghanistan in 2010 looks very similar to the distribution in Iraq in 2007.

Table 21. Top 25 Inpatient Diagnosis Groups in Afghanistan (2010)

CCS Diagnosis Group	Battle Injury	Non-Battle Injury	Disease	Unknown	Total
Open wounds of extremities	499	65	3	717	1,284
Open wounds of head, neck, and trunk	471	42	3	685	1,201
Other injuries and conditions due to external causes	166	83	17	448	714
Fracture of lower limb	198	65	3	436	702
Nonspecific chest pain	3	8	196	266	473
Intracranial injury	120	33	6	295	454
Fracture of upper limb	114	43	2	239	398
Crushing injury or internal injury	73	22	12	176	283
Skull and face fractures	67	31	1	161	260
Abdominal pain	7	5	94	152	258
Other fractures	77	22	2	145	246
Other connective tissue disease	54	11	30	151	246
Spondylosis, intervertebral disc disorders, other back problems	57	27	14	137	235
Appendicitis and other appendiceal conditions	1	1	60	143	205
Burns	24	54	4	122	204
Superficial injury, contusion	53	11	7	117	188
Epilepsy, convulsions	2	5	59	95	161
Skin and subcutaneous tissue infections	0	2	55	94	151
Calculus of urinary tract	0	0	38	63	101
Delirium, dementia, and amnestic and other cognitive disorders	43	1	2	53	99
Syncope	0	0	32	52	84
Pneumonia (except that caused by tuberculosis or sexually transmitted disease)	0	0	31	47	78
Other eye disorders	13	4	8	50	75
Spinal cord injury	27	2	0	42	71
Other gastrointestinal disorders	3	0	19	47	69
Total	**2,072**	**537**	**698**	**4,933**	**8,240**

Source: Theater Medical Data Store

The top outpatient diagnoses in Afghanistan (Table 22) are less similar to those in Iraq than are the distributions of inpatient diagnoses between the two theaters. In particular, there are more disease-related diagnoses (48 vs. 42 percent) and fewer non-combat related injuries (34 vs. 46 percent) in Afghanistan than in Iraq.

Table 22. Top 25 Outpatient Diagnosis Groups in Afghanistan (2010)

CCS Diagnosis Group	Battle Injury	Non-Battle Injury	Disease	Unknown	Total
Medical examination/evaluation	1,482	2,723	6,637	418	11,260
Sprains and strains	524	7,996	983	594	10,097
Spondylosis, intervertebral disc disorders, other back problems	768	7,159	1,526	606	10,059
Administrative/social admission	213	1,519	6,724	820	9,276
Residual codes, unclassified	832	578	6,441	731	8,582
Other upper respiratory infections	14	622	7,562	349	8,547
Other non-traumatic joint disorders	485	5,767	1,140	426	7,818
Other connective tissue disease	270	5,152	1,382	403	7,207
Headache, including migraine	2,230	535	2,041	529	5,335
Other skin disorders	8	720	3,430	398	4,556
Blindness and vision defects	160	904	3,343	83	4,490
Adjustment disorders	208	385	2,968	913	4,474
Anxiety disorders	1,139	332	2,090	849	4,410
Rehabilitation care, fitting of prostheses, and adjustment of devices	945	2,900	16	125	3,986
Superficial injury, contusion	516	2,513	658	229	3,916
Other aftercare	417	1,828	1,382	77	3,704
Immunizations and screening for infectious disease	5	190	3,318	31	3,544
Allergic reactions	4	357	2,792	290	3,443
Other injuries and conditions due to external causes	1,804	754	311	411	3,280
Skin and subcutaneous tissue infections	29	604	2,182	196	3,011
Intracranial injury	2,075	403	64	410	2,952
Mood disorders	125	251	2,039	440	2,855
Other gastrointestinal disorders	21	319	2,287	190	2,817
Screening and history of mental health and substance abuse codes	92	394	1,874	325	2,685
Abdominal pain	20	509	1,773	227	2,529
Total	**14,386**	**45,414**	**64,963**	**10,070**	**134,833**

Source: Theater Medical Data Store

In Chapter 5, we extend our analyses to include the inpatient medical procedures associated with trauma diagnoses. Because the DoDTR has more detailed information on trauma diagnoses and procedures than does TMDS, we use the former data source as the basis for establishing trauma-related EMCs. For non-trauma cases, procedure codes are

rarely recorded in TMDS, but that information may be available from the Deployed SIDR data.

B. Comparing In-Theater with Direct Care Inpatient Workload

As stated previously, the MHS has two overarching but intertwined missions: the readiness mission and the benefits mission. Although the benefits mission exists to provide healthcare services to Active Duty Service members and other eligible beneficiaries, the primary mission of the MHS is "maintaining a medically ready fighting force, and a ready medical system that is prepared to respond to the full spectrum of military operations."[82] The nexus of these two missions is DoD's system of military hospitals and clinics (often referred to as the "direct care" component), which are used as training platforms to maintain the clinical skills of military medical personnel. In theory, the readiness of military medical personnel is enhanced in the course of delivering the healthcare benefit.

1. Workload Volume

The most critical life-saving skills needed to prepare military medical personnel for delivering care during wartime are supposed to be acquired in an inpatient MTF setting.[83] It is therefore useful to compare the diversity of workload performed in direct care hospitals with that which might reasonably be encountered in theater. To make this comparison, we ranked the top 10 inpatient diagnosis groups (in terms of volume) in Iraq in 2007 and contrasted them with the corresponding ranks in direct care hospitals in 2015 (results for Afghanistan are similar). We obtained direct care inpatient data from the MHS Management Analysis and Reporting Tool (M2), which allows the user to run custom queries on both summary and detailed population, clinical, workload, and financial data. The results are shown in Table 23.

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[82] Department of Defense, "Fact Sheet: Overview of the Department of Defense's Military Health System," http://archive.defense.gov/home/features/2014/0614_healthreview/docs/Fact_Sheet_Overview.pdf.

[83] Military medical personnel may also receive proficiency training at selected civilian institutions under programs such as the Air Force's C-STARS program mentioned in Section 2.C.2. The Army and Navy have similar programs in place. However, these programs primarily offer just-in-time training to trauma surgeons about to deploy, and are limited in extent and of short duration. Additionally, San Antonio Military Medical Center and Madigan Army Medical Center are each part of a civilian regional trauma system, allowing them to admit civilian trauma patients and increase workload volume. The civilian cases, however, are not visible in the M2 database.

Table 23. Top 10 Inpatient Diagnosis Group Ranks and Frequencies in Iraq vs. in Direct Care Hospitals

CCS Diagnosis Group	In-Theater Rank (Frequency)		Direct Care Rank (Frequency)	
Open wounds of head, neck, and trunk	1	(3,488)	143	(1,225)
Open wounds of extremities	2	(2,650)	146	(1,196)
Other injuries and conditions due to external causes	3	(2,274)	67	(4,190)
Fracture of lower limb	4	(992)	116	(1,969)
Nonspecific chest pain	5	(986)	40	(8,139)
Abdominal pain	6	(683)	75	(3,544)
Crushing injury or internal injury	7	(589)	139	(1,273)
Fracture of upper limb	8	(563)	125	(1,702)
Skin and subcutaneous tissue infections	9	(543)	59	(4,932)
Burns	10	(528)	101	(2,299)

Sources: TMDS (in theater) and M2 (direct care).

Note: Iraq data are from 2007 and direct care from 2015.

Each inpatient diagnosis in Iraq in 2007 can be sorted into one of 211 diagnosis groups. Table 23 shows that the top inpatient diagnosis groups encountered in theater (83 percent of which are related to trauma) are well down the list in the direct care system. In fact, the first appearance of any of the top in-theater diagnosis groups occurs for nonspecific chest pain at position number 40. The top two in-theater inpatient diagnoses do not appear until positions 143 and 146 in the direct care system. These results suggest that the inpatient case mix encountered in the direct care system bears little resemblance to that encountered in theater. Furthermore, the frequency of occurrence of the top in-theater diagnosis (open wounds of head, neck, and trunk) is almost three times the corresponding frequency in the direct care system and the frequency of occurrence of the second most common in-theater diagnosis (open wounds of extremities) is more than double that in the direct care system. Without workload volume standards, however, we cannot draw any conclusions about whether direct care inpatient platforms are providing the workload volume needed for maintaining currency in wartime clinical skills.

2. Workload Severity

In theater, the conditions that pose the most serious risk for loss of life or limb are generally related to trauma. For the past 50 years, the most widely used trauma scoring system has been the Injury Severity Score (ISS), which is based on an anatomical scoring system that provides an overall score for patients with multiple injuries. Ranging from 0 to 75, the higher the ISS, the more unsurvivable the injury. Each injury is assigned an

Abbreviated Injury Scale (AIS) score ranging from 1 (minor) to 6 (unsurvivable) for up to six body regions (head, face, chest, abdomen, extremities, external).[84] Only the highest AIS score in each body region is used. The three most severely injured body regions have their AIS scores squared and added together to produce the ISS. Although the ISS is correlated with mortality, morbidity, hospital stay, and other measures of severity, it takes on only a limited number of values, and there are many different injury patterns that can yield the same ISS.

The DoDTR data include both AIS diagnoses and scores, the ISS, and International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) diagnosis codes. Until September 30, 2015, the ICD-9-CM was the official system of assigning codes to diagnoses and procedures (not just trauma cases) associated with hospital utilization in the United States, including DoD hospitals.[85] Because the direct care hospital data do not contain ISSs, we need a scoring system based on ICD-9-CM codes if we want to compare in-theater with direct care data. The clinical literature contains many proposed alternatives to the ISS, but one that seems to have gained considerable traction is the Trauma Mortality Prediction Model (TMPM),[86] which is based on ICD-9-CM codes. The TMPM was developed using data from the National Trauma Data Bank (NTDB)[87] to estimate the collective impact of multiple diagnoses on the probability of death. The software (for the Stata statistical package) needed to apply the TMPM to both the DoDTR and direct care hospital data is available for download online.[88]

A drawback to the TMPM for our purposes is that burn diagnoses are excluded. By design, the TMPM does not predict mortality when the ICD-9-CM codes are vague about the extent of a patient's injuries. In particular, the ICD-9-CM burn diagnosis codes are not considered specific enough to calculate a probability of death. Although burns account for only about 3 percent of all in-theater diagnoses, their treatment is very resource intensive and we will have to explore other ways of integrating them into our analyses.

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84 Trauma.org, "Trauma Scoring," http://www.trauma.org/archive/scores/iss.html.

85 Effective October 1, 2015, all parties covered by the Health Insurance Portability and Accountability Act were required to transition to ICD-10-CM coding.

86 Laurent G. Glance et al., "TMPM-ICD9: A Trauma Mortality Prediction Model Based on ICD-9-CM Codes," *Annals of Surgery* 249, No. 6 (June 2009): 1032–1039.

87 The National Trauma Data Bank was created by the American College of Surgeons to serve as the principal national repository for trauma center registry data.

88 https://ideas.repec.org/c/boc/bocode/s457663.html.

The American Burn Association publishes an annual report[89] that includes statistics based on data from the National Burn Repository. In particular, the report includes a table of mortality rates by age group and burn size (total body surface area affected). Although most burn diagnoses encountered in Iraq in 2007 indicated the burn location and degree, only 2 percent indicated the burn size. We will therefore need to consult the clinical community to determine which, if any, burn diagnoses qualify as the basis for an EMC.

For each trauma case in the DoDTR, we input the ICD-9-CM diagnosis codes into the TMPM and computed the probability of death. The model is non-linear, so the separate effects of each diagnosis are not additive. However, we were able to configure the data in such a manner as to allow the model to estimate the probability of death for each diagnosis as if it were the only one on the record. Both TMPM estimates are useful for identifying EMCs—the combined effect of all diagnoses on a record indicates the overall complexity of a case and the effect of a single diagnosis indicates the complexity of that diagnosis on its own.

We also applied the TMPM to direct care hospital data and compared the results to those obtained from the DoDTR. Because the trauma mortality rates are predictions from a civilian-based model (the TMPM), the in-theater rates are not influenced by the more austere and stressful environment in which deployed surgical teams must work. This results in a fairer comparison between in-theater and direct care mortality rates than if actual observed mortality rates were used. The comparison is shown in Table 24.

[89] American Burn Association, "2015 National Burn Repository Report of Data from 2005-2014."

Table 24. Predicted Trauma Mortality Rates: Iraq vs. Direct Care Hospitals

	Single Diagnosis		Multiple Diagnoses	
CCS Diagnosis Group	In Theater	Direct Care	In Theater	Direct Care
Joint disorders and dislocations, trauma-related	1.4%	0.9%	7.0%	1.5%
Fracture of neck of femur (hip)	2.7%	1.8%	10.9%	2.2%
Spinal cord injury	6.1%	5.6%	18.6%	10.0%
Skull and face fractures	2.3%	1.1%	14.4%	3.3%
Fracture of upper limb	1.3%	0.9%	8.5%	2.4%
Fracture of lower limb	1.8%	1.2%	7.6%	2.2%
Other fractures	2.9%	1.7%	16.4%	4.4%
Sprains and strains	0.4%	0.5%	2.7%	0.7%
Intracranial injury	5.0%	6.5%	22.0%	9.7%
Crushing injury or internal injury	4.0%	3.3%	17.5%	7.6%
Open wounds of head, neck, and trunk	2.1%	1.8%	9.4%	4.2%
Open wounds of extremities	1.8%	1.3%	7.9%	2.1%
Superficial injury, contusion	1.3%	1.3%	6.9%	2.4%
Other injuries and conditions due to external causes	1.9%	2.4%	8.4%	3.1%

Sources: DoD Trauma Registry (in-theater diagnoses) and M2 (direct care diagnoses).

Notes: Iraq data are from 2007 and direct care from 2015. Burn diagnoses are excluded.

The results show that the differences between in-theater and direct care mortality are small for cases involving only a single diagnosis. When multiple diagnoses are present, as is usually the case with combat casualties, the gap in mortality rates widens significantly, with in-theater trauma mortality rates uniformly higher than those in a direct care setting. The large disparity in the multiple-diagnosis mortality rates indicates the relative severity of in-theater care versus direct care.

C. Modeling and Simulation

Modeling and simulation (M&S) provides an opportunity to build on the use of actual historical data to generate synthetic data, for use in mission analyses and identification of essential tasks and capabilities for operating in a deployed setting. In some situations, campaign analysis (a form of M&S) is conducted, because no readily available data exist on what will happen in the deployed setting. An example of a scenario with little data may be an innovative warfighting operation employing a new weapon system in a country in which the United States has never operated before. Fortunately, the medical community has extensive data collected from recent deployments on the workload it performed. By reweighting these data in a simulation, a

more complete analysis of EMCs and what types of workload the medical community will be called on to perform in future deployed settings can be performed.

Conflicts differ; even though combat trauma care will remain the most essential care for saving life and limb in a deployed setting, the distributions of specific types of injuries can vary. For example, a prevalent cause of injury in Iraq and Afghanistan was IEDs, leading to a large number of blast injuries with associated extremity wounds and traumatic brain injuries. If IEDs are less prevalent in a future conflict, the distribution of injury types might show a higher prevalence of other types of injuries. M&S techniques can be used to examine these alternative scenarios by varying the distribution of injury types.

An advantage of the M&S approach to developing EMCs is that it is similar to the approach used in medical planning to set the theater requirements for medical capabilities, personnel, and logistics. Similar to the description above, in preparing for a contingency, the medical planning community estimates a distribution of ICD-9 diagnoses, identifies the associated procedures that would need to be performed for this distribution of cases, and then identifies the required medical units, personnel, and supplies to be able to perform the workload. Developing EMCs for readiness measurement and reporting by the same general methods promotes consistency with how the COCOMs (and programmers) are developing medical requirements.

A simple example of these issues may be the early (kinetic) phase of an operation (with, perhaps, more gunshot injuries) versus the follow-on phases, with a more static battlefield providing greater opportunities for IEDs. Another example is provided by the recent conflict in Ukraine. Russian forces using unmanned aerial systems to target rocket and cannon artillery were able to cause widespread casualties, with severe burns being one of the major diagnoses.[90] M&S can be applied to examine new situations like this and determine readiness requirements.

[90] Sydney Freedberg, "Russian Drone Threat: Army Seeks Ukraine Lessons," *Breaking Defense*, October 14, 2015.

5. Developing EMCs

Although EMCs include logistical as well as clinical capabilities, the focus in this chapter is on the latter. In particular, our initial focus is on inpatient care at Level 3 facilities, recognizing that, to address the full spectrum of battlefield care, we must eventually take into account the entire chain of survival, starting at the point of injury and continuing through the evacuation and hospitalization phases (the majority of preventable deaths occur in the prehospital setting). Our initial approach is to define EMCs at the individual physician level. However, most inpatient encounters, particularly those requiring surgery, involve a team of physicians, nurses, anesthesiologists, and other medical staff working together to provide coordinated care to the patient. The proficiency of a surgical team may be even more important than that of an individual member, but that is an issue that will have to be addressed by future research.

We employ three criteria for identifying categories of diagnoses or conditions that could constitute the basis for defining an EMC: (1) volume (diagnoses occur frequently in theater), (2) severity (conditions pose a sufficiently serious risk for loss of life or limb), and (3) complexity (treatments require specialized skills to perform). The rationale for the complexity criterion is the recognition that if a physician is proficient in performing the most complex procedures that correspond to his or her specialty, he or she should be able to perform related but less intensive procedures at an equal or greater level of proficiency.

As a starting point for identifying EMCs, we focus primarily on diagnoses with the highest volume and severity. Diagnoses that meet those conditions tend to be trauma-related. Most of the top 10 inpatient diagnoses in Iraq in 2007 and Afghanistan in 2010 were trauma cases (83 percent). In fact, trauma cases constitute a majority (60 percent) of all inpatient diagnoses in theater. Further, of those trauma cases that have an injury type recorded (battle injury, non-battle injury, or DNBI), 81 percent were due to battle injuries. Therefore, trauma cases satisfy both the volume and severity conditions for defining an EMC. How to incorporate the complexity condition as well will require further input from clinical subject matter experts (SME).

Focusing on trauma cases is not meant to minimize the importance of non-trauma-related conditions, including primary care and other cases typically treated on an outpatient basis in theater. It merely recognizes the fact that severe trauma cases, particularly those related to combat, require specialized training, skills, and experience to treat effectively and increase the chances of survival. Of course, many other conditions

require specialized skills to treat as well, such as coronary heart disease (often treated by a coronary artery bypass graft), but such conditions are less commonly encountered in theater (they may be encountered more frequently among reservists, who tend to be older, and among the local civilian populace). Ambulatory primary care can be performed by a variety of general and specialty providers without introducing an increase in the risk of loss of life or limb, as they all have the basic skills to perform that type of care. Therefore, provider currency and proficiency (and hence readiness) are generally not issues in ambulatory primary care. Additionally, as discussed in Chapter 3, Joint and Service guidance directs focus on the most "essential" tasks and capabilities, which for healthcare means the most important procedures for saving life and limb, rather than routine outpatient services.

In this chapter, we lay out a conceptual approach for developing EMCs using data on in-theater diagnoses and procedures related to trauma. Using the methodology employed in the previous chapter, we measure the severity of a trauma case using the TMPM, which estimates the probability of death using the diagnoses reported on a DoDTR record. For economy of presentation, we limit the number of diagnoses by setting lower bounds on the single-diagnosis mortality rate, the multiple-diagnosis mortality rate, and frequency of occurrence.

A. High Volume and Severity Diagnoses

As a first attempt at using a data-based approach to developing trauma EMCs, we set lower-bound thresholds for the single-diagnosis mortality rate at 10 percent, for the multiple-diagnosis mortality rate at 20 percent (excluding burns), and for the diagnosis count at 10. We applied the thresholds to individual diagnoses rather than CCS groups. These lower-bound thresholds are admittedly arbitrary but are meant only to be illustrative of a possible process for defining EMCs. The results, sorted in descending order of severity (as measured by the multiple-diagnosis mortality rate), are shown in Table 25.

A total of 18 diagnoses (excluding burns) meet the criteria we set as the basis for defining trauma EMCs. These diagnoses represent some of the most severe cases likely to be encountered in theater and require specialized skills to treat.

Table 25. Diagnoses as Basis for Developing EMCs

CCS Diagnosis Group	Diagnosis	Single-Diagnosis Mortality Rate	Multiple-Diagnosis Mortality Rate	Count
Crushing injury or internal injury	Injury to multiple and unspecified intrathoracic organs without mention of open wound into cavity	57.6%	70.0%	54
Crushing injury or internal injury	Laceration with penetration of heart chambers, without mention of open wound into thorax	41.6%	59.2%	25
Intracranial injury	Fracture of base of skull, closed with subarachnoid, subdural, and extradural hemorrhage, unspecified state of consciousness	10.8%	53.6%	12
Crushing injury or internal injury	Injury to inferior vena cava, unspecified	22.7%	48.5%	16
Intracranial injury	Other and unspecified intracranial hemorrhage following injury, without mention of open intracranial wound, unspecified state of consciousness	13.1%	44.4%	440
Intracranial injury	Fracture of vault of skull, open with intracranial injury of other and unspecified nature, unspecified state of consciousness	16.0%	42.7%	246
Intracranial injury	Fracture of vault of skull, closed with intracranial injury of other and unspecified nature, unspecified state of consciousness	16.6%	42.3%	41
Crushing injury or internal injury	Laceration of liver, major, without mention of open wound into cavity	16.4%	37.0%	69
Crushing injury or internal injury	Laceration of lung without mention of open wound into thorax	14.2%	35.2%	130
Crushing injury or internal injury	Injury to iliac artery	12.7%	34.0%	20

CCS Diagnosis Group	Diagnosis	Single-Diagnosis Mortality Rate	Multiple-Diagnosis Mortality Rate	Count
Spinal cord injury	Closed fracture of c5-c7 level with complete lesion of cord	15.7%	33.4%	21
Joint disorders and dislocations, trauma-related	Closed dislocation, cervical vertebra, unspecified	14.1%	32.7%	12
Open wounds of extremities	Traumatic amputation, leg(s), unilateral, level not specified, without mention of complication	13.6%	29.8%	26
Spinal cord injury	Closed fracture of c1–c4 level with other specified spinal cord injury	12.6%	25.9%	12
Other fractures	Unspecified open fracture of pelvis	12.2%	25.7%	162
Open wounds of head, neck, and trunk	Open wound of chest (wall), complicated	10.3%	25.0%	76
Skull and face fractures	Other and unqualified skull fractures, open without mention of intracranial injury, unspecified state of consciousness	11.1%	22.2%	169
Fracture of lower limb	Other, multiple and ill-defined fractures of lower limb, closed	10.4%	21.4%	48

Source: DoD Trauma Registry (diagnoses and frequencies)

B. Candidate Procedures

To the extent they exist, standards for clinical currency are based on procedures, not diagnoses. There is no exact correspondence between diagnoses and procedures, as multiple procedures can be performed for a single diagnosis and vice versa. However, each DoDTR record contains ICD-9-CM procedure codes in addition to diagnosis codes. We can therefore use the procedures performed for the set of diagnoses to form the basis for establishing EMCs.

Treatment of a hospital patient can encompass a wide variety of procedures, from routine diagnostic tests (e.g., chest x-ray) to complex therapeutic procedures (e.g., laparotomy). On its website, AHRQ provides a downloadable file[91] that classifies all ICD-9-CM procedure codes into one of four categories:

1. Minor Diagnostic: non-operating room procedures that are diagnostic,
2. Minor Therapeutic: non-operating room procedures that are therapeutic,
3. Major Diagnostic: all procedures considered valid operating room procedures by the Diagnosis Related Group (DRG) grouper and that are performed for diagnostic reasons, and
4. Major Therapeutic: all procedures considered valid operating room procedures by the DRG grouper and that are performed for therapeutic reasons.

We used the AHRQ file to filter out minor diagnostic and therapeutic procedures. To reduce the final set of procedures to a manageable size, we further restricted the set to those that were performed at least 10 times in Iraq in 2007—the critical ones needed to treat severe trauma cases. We identified a total of 93 procedures using this approach, the top 10 (in terms of volume) of which are shown in Table 26. (The full set of procedures can be found in Appendix A.) Although all but one of the top 10 procedures are major therapeutic procedures, the top procedure in terms of volume is a major diagnostic procedure.

[91] http://www.hcup-us.ahrq.gov/toolssoftware/proceduretoolssoftwareprocedure/procedure.jsp.

Table 26. Top 10 Candidate Trauma Procedures by Volume

Procedure	Category	Frequency
Other diagnostic procedures on brain and cerebral meninges	Major Diagnostic	115
Other craniectomy	Major Therapeutic	88
Excisional debridement of wound, infection, or burn	Major Therapeutic	77
Elevation of skull fracture fragments	Major Therapeutic	76
Exploratory laparotomy	Major Therapeutic	75
Fasciotomy	Major Therapeutic	63
Delayed closure of granulating abdominal wound	Major Therapeutic	49
Suture of laceration of diaphragm	Major Therapeutic	47
Closure of laceration of liver	Major Therapeutic	47
Exploratory thoracotomy	Major Therapeutic	44
Other repair of cerebral meninges	Major Therapeutic	44

Source: DoD Trauma Registry

C. Next Steps

The previous sections described a data-driven process that could lead to the establishment of trauma-related EMCs. However, the process stops short of developing actual EMCs because more clinical input is required. For example, it will take an experienced trauma surgeon (or surgeons) to determine the relative complexities of the procedures we have identified. It may also be possible to combine some procedures into more general categories based on similar clinical skills needed to perform them.

So that EMCs can be tailored to specific specialties, we will need to associate each procedure (or group of procedures) with the specialty or specialties that normally perform it. For example, each procedure in our list could be arrayed against the various physician specialties that staff a CSH. Physicians could be classified as either the primary specialty to conduct the procedure or as a secondary specialty that could conduct the procedure in an emergency situation or if a physician with the primary specialty was unavailable.

Developing non-trauma-related EMCs presents some additional challenges. To develop those EMCs, we will have to rely on TMDS and/or deployed SIDR data, for which procedure codes are seldom recorded. Follow-on analysis should explore the possibility of using the National Inpatient Sample (NIS)[92] to match procedures with the

[92] The NIS is the largest publicly available all-payer inpatient healthcare database in the United States, yielding national estimates of hospital inpatient stays. See http://www.hcup-us.ahrq.gov/nisoverview.jsp.

diagnoses they treat. Furthermore, there is no analogue to TMPM that we are aware of for non-trauma diagnoses, making severity difficult to measure.

Finally, we need to benchmark workload volume for each procedure against clinical currency standards. This can be difficult, given that clinical currency standards do not exist for many procedures. One possible way to ascertain standards is to use the criteria major US hospitals employ to grant privileges to various surgical specialties. Another possibility is to use data from civilian trauma registries such as the NTDB or from military trauma registries (e.g., from San Antonio Military Medical Center) by examining the frequency distributions for each procedure at Level 1 Trauma Centers and selecting the median or other percentile as a standard. Any standards developed in this manner will have to be corroborated by clinical SMEs.

6. Conclusions

The present effort was designed to answer questions posed by the Congress concerning the MCRMC recommendations on medical readiness. Their questions concerned the concept of EMCs and how they could be implemented by DoD. The major conclusions from this paper can be summarized as follows:

1. ***Readiness is not reported in a consistent manner in DRRS.*** In DRRS, units are assessed on performance of their METs—that is, the tasks that are essential for units to accomplish their assigned mission(s). According to DRRS guidance, METs are developed for the specific missions or contingency operations assigned to units. However, medical units are often assessed only on a set of standardized or common METs that are designed to reflect the tasks that the unit was given the responsibility to perform. This approach allows the Service to standardize unit training, equipment, and personnel requirements, as well as to create a fungible inventory of capabilities to meet global sourcing demands. On the other hand, the practice of assessing readiness on a common set of tasks is inconsistent with the DRRS concept of measuring readiness on tasks derived from the unique requirements of a unit's mission(s).
2. ***As currently implemented, DRRS does not provide meaningful assessments of the readiness of medical units.*** IDA obtained a large extract of DRRS data to determine how medical units were reporting readiness in that system. A fundamental problem observed in those data was that unit METs were not drawn from a common task dictionary; tasks came from at least six different sources that differed markedly in providing task detail (e.g., conditions and actions) as well as specifying metrics (e.g., measurement criteria and standards). As a result, very few of the units in the extract provided quantitative data to justify their assessments. In addition, the extract revealed that the current version of DRRS is not structured to ensure that the right individuals (by specialty) are available for requirements and authorizations, or to measure individual and team readiness from a clinical currency perspective. For example, it appears that a combat support hospital could be reported as ready to deploy for delivery of combat casualty care when, in fact, no trauma surgeon with current trauma experience was assigned or available to the unit.
3. ***Medical readiness concepts are being developed, but contain confusion over missions.*** The DoD strategic planning and requirements-generating processes

related to medical readiness are beginning to be used with multiple documents concerning strategic guidance, Joint concepts, and Service concepts. But the systematic confusion over the mission of the military medical force that has driven past readiness challenges remains.

4. ***With appropriate modification, DRRS could provide an appropriate framework for reporting readiness of EMCs.*** Despite current problems, the fundamental concepts of readiness reporting are relevant to EMCs. One such concept is the determination of METs. Through a detailed analysis of their mission, units identify tasks they must successfully perform. Essential medical tasks can be identified through workload data that indicate the frequency and severity of conditions treated in theater. Along with the identifying METs, mission analyses specify conditions under which those tasks are performed and standards of performance. Also, the medical community could adopt readiness reporting practices from Service aviation communities. Those communities carefully track and monitor pilot and aircrew proficiency through dedicated processes and information systems. Analogous medical readiness systems could be developed and incorporated into DRRS.

5. ***Clinical capability should be a priority area for EMC development.*** EMCs were defined as military medical capabilities that "are vital to effective and timely health care during contingency operations."[93] Although EMCs include a variety of different capabilities related to healthcare (e.g., medical logistics, diagnosis of infectious diseases), the focus of the present effort was on clinical capabilities related to inpatient care in a deployed setting because those skills are the most critical for saving life and limb and require a long-term effort to achieve and maintain.

6. ***Civilian concepts of clinical currency are relevant to military medical readiness.*** In the civilian healthcare sector, basic clinical "competency" is typically measured by appropriate licensure or board certification. The higher level of "proficiency" denotes increased clinical skill and knowledge by adding a dimension of experience. In turn, "currency" is defined as being clinically proficient and ready to immediately deliver care at that level of skill. Procedure volume (i.e., procedures performed per unit of time) is one useful measure of this level of skill and directly translates to how readiness is measured in many communities across DoD. For example, research has found that, to achieve the best outcomes from many orthopedic surgical procedures (e.g., knee replacements), the surgeon should perform at least 50 per year and the facility at

[93] MCRMC, *Final Report*, footnote 300, 71–72.

least 200 per year (which includes the team supporting the surgeon). For the military medical force, volume of the relevant case mix will likely be a key element of readiness measurement and reporting, but it will not be the only element. Moreover, there are key gaps in our knowledge about how to implement this element. Much of the current literature is focused on complex, but relatively routine, surgical procedures (e.g., knee replacements).

7. ***The inpatient case mix encountered in direct care training platforms differs significantly from that encountered in theater.*** Data on in-theater inpatient workload volume and diversity were drawn from the TMDS and compared to the distribution in direct care hospitals. Analyses of those data suggest that inpatient workload performed in the direct care system bears little resemblance to that encountered in theater. In fact, the top inpatient diagnoses treated in DoD hospitals are related to pregnancy and childbirth. Furthermore, the frequency of occurrence of the top in-theater diagnosis (open wounds of head, neck, and trunk) is almost three times the corresponding frequency in the direct care system, and the frequency of occurrence of the second most common in-theater diagnosis (open wounds of extremities) is more than double that in the direct care system. Without workload volume standards, however, we cannot draw any conclusions about whether direct care inpatient platforms are providing the workload volume needed for maintaining currency in wartime clinical skills.
8. ***Analysis of mortality rates indicates that medical conditions encountered in theater are more severe than those confronted in the direct care system.*** The analysis focused on trauma-related conditions because they represent high levels of criticality or essentiality to combat medical missions. We used the estimated mortality rate as a measure of the severity of a trauma case by applying the TMPM—which estimates the collective impact of multiple diagnoses on the probability of death—to the recorded diagnoses. Because the TMPM is based on civilian data, the in-theater rates are not influenced by the more austere and stressful environment in which deployed surgical teams must work. When multiple diagnoses are present, as is usually the case with combat casualties, the gaps in mortality rates were significant, with in-theater trauma mortality rates uniformly higher than those in a direct care setting. The large disparity in the multiple-diagnosis mortality rates indicates the relative severity and complexity of in-theater care versus direct care.
9. ***A data-driven approach for identifying candidate EMCs using data on in-theater diagnoses and procedures should be used as a basis for EMC development.*** As a basis for developing trauma-related EMCs, we started by identifying those diagnoses that met minimum volume and severity thresholds. Next, we identified the procedures that were done to treat those diagnoses,

filtering out minor diagnostic and therapeutic procedures, and selecting those that occurred more than 10 times in theater in a single year. Based on data from Iraq in 2007, we identified 93 procedures as critical for treating severe trauma cases. This data-driven approach could lead to the establishment of trauma EMCs, but it stops short of developing actual capabilities because more clinical input is required.

Appendix A.
Candidate Procedures for EMC Development

We identified a total of 93 candidate procedures for establishing trauma-related EMCs using the methodology developed in Chapter 5. For economy of presentation, that chapter displayed only the top 10 in terms of volume. The full list is shown in Table A-1. All but two are major therapeutic procedures; the remaining two are major diagnostic procedures.

Table A-1. Full List of Candidate Trauma-Related Procedures

Procedure	Category	Frequency
Other diagnostic procedures on brain and cerebral meninges	Major Diagnostic	115
Other craniectomy	Major Therapeutic	88
Excisional debridement of wound, infection, or burn	Major Therapeutic	77
Elevation of skull fracture fragments	Major Therapeutic	76
Exploratory laparotomy	Major Therapeutic	75
Fasciotomy	Major Therapeutic	63
Delayed closure of granulating abdominal wound	Major Therapeutic	49
Suture of laceration of diaphragm	Major Therapeutic	47
Closure of laceration of liver	Major Therapeutic	47
Other repair of cerebral meninges	Major Therapeutic	44
Exploratory thoracotomy	Major Therapeutic	44
Total splenectomy	Major Therapeutic	43
Other incision of soft tissue	Major Therapeutic	42
Other suture of abdominal wall	Major Therapeutic	39
Colostomy, not otherwise specified	Major Therapeutic	36
Debridement of open fracture of tibia and fibula	Major Therapeutic	35
Other craniotomy	Major Therapeutic	34
Ventriculostomy	Major Therapeutic	34
Eye examination under anesthesia	Major Diagnostic	34
Formation of cranial bone flap	Major Therapeutic	33
Revision of amputation stump	Major Therapeutic	32
Other skin graft to other sites	Major Therapeutic	32
Open chest cardiac massage	Major Therapeutic	30

Procedure	Category	Frequency
Other excision or destruction of lesion or tissue of brain	Major Therapeutic	29
Reopening of recent laparotomy site	Major Therapeutic	29
Application external fixator device, tibia & fibula	Major Therapeutic	29
Other incision of thyroid field	Major Therapeutic	28
Debridement of open fracture of radius and ulna	Major Therapeutic	28
Debridement of open fracture of other specified bone, except facial bones	Major Therapeutic	26
Other partial resection of small intestine	Major Therapeutic	26
Incision of cerebral meninges	Major Therapeutic	25
Other incision of brain	Major Therapeutic	24
Debridement of open fracture of femur	Major Therapeutic	24
Other surgical occlusion of other thoracic vessels	Major Therapeutic	24
Other enucleation of eyeball	Major Therapeutic	23
Small-to-small intestinal anastomosis	Major Therapeutic	23
Other local excision or destruction of lesion or tissue of lung	Major Therapeutic	23
Debridement of open fracture of humerus	Major Therapeutic	23
Pericardiotomy	Major Therapeutic	23
Suture of laceration of small intestine, except duodenum	Major Therapeutic	22
Other amputation below knee	Major Therapeutic	22
Closure of laceration of lung	Major Therapeutic	20
Lobectomy of brain	Major Therapeutic	19
Other and unspecified partial excision of large intestine	Major Therapeutic	19
Other surgical occlusion of lower limb veins	Major Therapeutic	19
Other suture of muscle or fascia	Major Therapeutic	18
Other surgical occlusion of abdominal arteries	Major Therapeutic	18
Nephroureterectomy	Major Therapeutic	18
Application of external fixator device, femur	Major Therapeutic	18
Other surgical occlusion of lower limb arteries	Major Therapeutic	18
Open and other right hemicolectomy	Major Therapeutic	17
Other repair of heart and pericardium	Major Therapeutic	17
Suture of artery	Major Therapeutic	17
Application of external fixator device, humerus	Major Therapeutic	17
Multiple segmental resection of small intestine	Major Therapeutic	16
Other suprapubic cystostomy	Major Therapeutic	16
Other small-to-large intestinal anastomosis	Major Therapeutic	16
Other repair of diaphragm	Major Therapeutic	16

Procedure	Category	Frequency
Debridement of open fracture of phalanges of hand	Major Therapeutic	16
Debridement of open fracture of tarsals and metatarsals	Major Therapeutic	16
Control of hemorrhage, not otherwise specified	Major Therapeutic	16
Amputation and disarticulation of finger	Major Therapeutic	16
Amputation above knee	Major Therapeutic	15
Repair of blood vessel with tissue patch graft	Major Therapeutic	15
Other myectomy	Major Therapeutic	15
Other surgical occlusion of vessels, unspecified site	Major Therapeutic	15
Other surgical occlusion of abdominal veins	Major Therapeutic	14
Other arthrotomy of knee	Major Therapeutic	14
Open reduction of fracture of humerus with internal fixation	Major Therapeutic	14
Other surgical occlusion of aorta	Major Therapeutic	14
Open reduction of fracture of radius and ulna with internal fixation	Major Therapeutic	13
Suture of laceration of large intestine	Major Therapeutic	13
Open and other resection of transverse colon	Major Therapeutic	13
Open reduction of fracture of other specified bone, except facial bones, with internal fixation	Major Therapeutic	13
Canthotomy	Major Therapeutic	13
Segmental resection of lung	Major Therapeutic	13
Other surgical occlusion of other vessels of head and neck	Major Therapeutic	13
Suture of laceration of stomach	Major Therapeutic	13
Other (peripheral) vascular shunt or bypass	Major Therapeutic	13
Enucleation of eyeball with other synchronous implant	Major Therapeutic	12
Excision or destruction of lesion or tissue of abdominal wall or umbilicus	Major Therapeutic	12
Debridement of open fracture of carpals and metacarpals	Major Therapeutic	12
Open and other left hemicolectomy	Major Therapeutic	12
Open reduction of fracture of tibia and fibula with internal fixation	Major Therapeutic	11
Suture of laceration of bladder	Major Therapeutic	11
Partial hepatectomy	Major Therapeutic	11
Other cranial osteoplasty	Major Therapeutic	11
Other repair of injury of eyeball or orbit	Major Therapeutic	11
Incision of abdominal wall	Major Therapeutic	11

Procedure	Category	Frequency
Open and other sigmoidectomy	Major Therapeutic	11
Lobectomy of lung	Major Therapeutic	10
Other surgical occlusion of upper limb vessels	Major Therapeutic	10
Internal fixation of other bone, except facial bones, without fracture reduction	Major Therapeutic	10

Source: DoD Trauma Registry

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Abbreviations

AAA	Abdominal Aortic Aneurysm
ABMS	American Board of Medical Specialties
ACGME	Accreditation Council for Graduate Medical Education
ADRP	Army Doctrine Reference Publication
AFDD	Air Force Doctrine Document
AFTH	Air Force Theater Hospital
AFTL	Air Force Task List
AFUTL	Air Force Universal Task List
AHLTA	Armed Forces Health Longitudinal Technology Application
AHRQ	Agency for Healthcare Research and Quality
AIS	Abbreviated Injury Scale
AUTL	Army Universal Task List
CABG	Coronary Artery Bypass Graft
CBRNE	Chemical, Biological, Radiological, Nuclear, and Explosives
CCJO	Capstone Concept for Joint Operations
CCS	Clinical Classifications Software
CJCS	Chairman, Joint Chiefs of Staff
CJCSI	Chairman, Joint Chiefs of Staff Instruction
CNA	Center for Naval Analyses
COCOM	Combatant Command
COMDTINST	Commandant, United States Coast Guard Instruction
CONOPS	Concept of Operations
CSH	Combat Support Hospital
C-STARS	Center for Shock Trauma and Readiness Skills
CUS	Current Unit Status
DCR	DOTLMPF-P Change Recommendation
DNBI	Diseases and Non-Battle Injuries
DoD	Department of Defense
DoDD	DoD Directive
DoDI	DoD Instruction
DoDTR	DoD Trauma Registry

DOTMLPF-P	Doctrine, Organization, Training, Materiel, Leadership, Personnel, Facilities, and Policy
DOW	Died of Wounds
DRG	Diagnosis Related Group
DRRS	Defense Readiness Reporting System
DRRS-A	DRRS (Army version)
DRRS-MC	DRRS (Marine Corps version)
DRRS-N	DRRS (Navy version)
DRRS-S	DRRS-Strategic
EBHR	Evidence-Based Hospital Referral
EMC	Essential Medical Capability
EMEDS	Expeditionary Medical Support
FAST	Focused Assessment with Sonography in Trauma
FM	Field Manual
FST	Forward Surgical Team
GAO	General Accounting Office/Government Accountability Office
GIHS	Globally Integrated Health Services
GSORTS	Global Status of Resources and Training System
HASC	House Armed Services Committee
HSS	Health Service Support
ICD-9-CM	International Classification of Diseases, Ninth Revision, Clinical Modification
IDA	Institute for Defense Analyses
IED	Improvised Explosive Device
IMR	Individual Medical Readiness
IQI	Inpatient Quality Indicator
ISS	Injury Severity Score
JCIDS	Joint Capabilities Integration and Development System
JMETL	Joint Mission Essential Task List
M&S	Modeling and Simulation
M2	MHS Management Analysis and Reporting Tool
MCO	Marine Corps Order
MCRMC	Military Compensation and Retirement Modernization Commission
MEDCOM	U.S. Army Medical Command
MET	Mission-Essential Task
METL	Mission-Essential Task List

MHS	Military Healthcare System
MMM	Maritime Medical Modules
MOS	Military Occupational Specialty
MRDSS	Medical Readiness Decision Support System
MTF	Military Treatment Facility
NMS	National Military Strategy
NTDB	National Trauma Data Bank
OEF	Operation Enduring Freedom
OIF	Operation Iraqi Freedom
OJT	On-the-Job Training
OP	Operational
OPNAVINST	Office of the Chief of Naval Operations Instruction
OR	Operating Room
OSD	Office of the Secretary of Defense
OSD(HA)	Office of the Secretary of Defense (Health Affairs)
PASBA	Patient Administration Systems and Biostatistics Activity
PCI	Percutaneous Coronary Intervention
PIR	Post Implementation Review
POM	Program Objective Memorandum
QDR	Quadrennial Defense Review
RBC	Red Blood Cell
RSVP	Readiness Skills Verification Program
RTD	Returned to Duty
SAMS	Shipboard Automated Medical System
SASC	Senate Armed Services Committee
SBP	Systolic Blood Pressure
SIDR	Standard Inpatient Data Record
SMART	Sustained Medical and Readiness Training
SMC	Specialized Military Condition
SME	Subject Matter Expert
SN	Strategic National
SORTS	Status of Resources and Training System
ST	Strategic Theater
TA	Tactical
TC2	Theater Medical Information Program Joint Composite Health Care System – Caché

TMDS	Theater Medical Data Store
TMPM	Trauma Mortality Prediction Model
TRAC2ES	Transportation Command Regulating and Command and Control Evacuation System
TRADOC	US Army Training and Doctrine Command
TS	Task Selection
UIC	Unit Identification Code
UJTL	Universal Joint Task List
UNTL	Universal Naval Task List
UTC	Unit Type Code
WISPR	Web Interface for Scanned Patient Records

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Paper was written for the Military Compensation and Retirement Modernization Commission as a standard IDA report, but Commission was disestablished before they could review and approve it.

14. ABSTRACT

The Military Compensation and Retirement Modernization Commission found that there is a significant risk that gains to medical readiness developed during the wars in Iraq and Afghanistan will be lost as the medical community returns to a peacetime focus on beneficiary healthcare. To prevent this loss and improve medical readiness, they provided a comprehensive recommendation to reform military healthcare—including introducing the concept of Essential Medical Capabilities (EMCs). In hearings on the Commission's recommendations, the Congress asked how EMCs should be developed and implemented. This paper provides a systematic analysis of current readiness reporting processes and gaps, and makes recommendations on how EMCs can be used to fill these gaps and how a rigorous process can be established for the development of EMCs.

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