

# REPORT DOCUMENTATION PAGE

*Form Approved*  
**OMB No. 0704-0188**

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing this collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (0704-0188), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.

<b>1. REPORT DATE (DD-MM-YYYY)</b> 23-04-2023			<b>2. REPORT TYPE</b> FINAL			<b>3. DATES COVERED (From - To)</b> N/A			
<b>4. TITLE AND SUBTITLE</b>  "Get Real, Get Better": Why Training-Based Initiatives are the Cornerstone to Preparing the Joint Medical Force for Great Power						<b>5a. CONTRACT NUMBER</b> N/A			
						<b>5b. GRANT NUMBER</b> N/A			
						<b>5c. PROGRAM ELEMENT NUMBER</b> N/A			
<b>6. AUTHOR(S)</b>  CDR Sean Stuart						<b>5d. PROJECT NUMBER</b> N/A			
						<b>5e. TASK NUMBER</b> N/A			
						<b>5f. WORK UNIT NUMBER</b> N/A			
<b>7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)</b>  Writing & Teaching Excellence Center Naval War College 686 Cushing Road Newport, RI 02841-1207						<b>8. PERFORMING ORGANIZATION REPORT NUMBER</b> N/A			
<b>9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)</b>  N/A						<b>10. SPONSOR/MONITOR'S ACRONYM(S)</b> N/A			
						<b>11. SPONSOR/MONITOR'S REPORT NUMBER(S)</b> N/A			
<b>12. DISTRIBUTION / AVAILABILITY STATEMENT</b> Distribution Statement A: Approved for public release; Distribution is unlimited.									
<b>13. SUPPLEMENTARY NOTES</b> A paper submitted to the faculty of the NWC in partial satisfaction of the requirements of the curriculum. The contents of this paper reflect my own personal views and are not necessarily endorsed by the NWC or the Department of the Navy.									
<b>14. ABSTRACT</b> <p>The Joint Force's Health Services Support (HSS) entities have provided world-class support that continues to be a source of combat power enhancement and preservation. However, the prospect of Great Power conflict gives reason for pause. Despite its many successes, HSS capabilities have vulnerabilities in its training paradigm that have been masked in recent conflicts by the overwhelming volume of theater medical assets and uncontested freedom of movement in the setting of relatively low casualty volumes. These challenges leave critical vulnerabilities in medical augmentation and hence combat power preservation of the Joint Force. While doctrinal and technological advances should be pursued, efforts must be directed towards tactical medical training, focused on closing current gaps as well as expanding the capabilities of existing frontline providers, as it delivers immediately actionable mitigation measures for the Joint Force in contested environments.</p>									
<b>15. SUBJECT TERMS (Key words)</b> Expeditionary medicine, health services support									
<b>16. SECURITY CLASSIFICATION OF:</b>						<b>17. LIMITATION OF ABSTRACT</b>	<b>18. NUMBER OF PAGES</b>	<b>19a. NAME OF RESPONSIBLE PERSON</b>	
a. REPORT UNCLASSIFIED	b. ABSTRACT UNCLASSIFIED	c. THIS PAGE UNCLASSIFIED				N/A		Director, Writing Center	
								<b>19b. TELEPHONE NUMBER (include area code)</b> 401-841-6499	

“Get Real, Get Better”

Why Training-Based Initiatives are the Cornerstone to Preparing the Joint Medical Force  
for Great Power Competition

## INTRODUCTION

The Joint Force's Health Services Support (HSS) entities have provided world-class support that continues to be a source of combat power enhancement and preservation. The cornerstone of combat medical support for US operational forces for the last century has been the "pull" system of medical echelons, which utilizes the iterative sequence of evaluation and treatment, with progressive evacuation to higher echelons of medical care if interventions at the previous echelon are inadequate.<sup>1</sup> The foundational tenants of this system are the employment of highly-capable medical entities coupled with rapid transport capabilities from the point of injury, as well as between echelons. This graded response allows maximal medical care while simultaneously facilitating the retention of combat power, a value few would dispute.

However, the prospect of Great Power conflict gives reason for pause. Despite its many successes, HSS capabilities have vulnerabilities in its training paradigm that have been masked in recent conflicts by the overwhelming volume of theater medical assets and uncontested freedom of movement in the setting of relatively low casualty volumes. Additionally, higher-intensity conflicts with near-peer/peer adversaries, with the associated precision-strike and A2/AD capabilities, threaten to neutralize both of the foundational tenets of combat medical support. These challenges leave critical vulnerabilities in medical augmentation and hence combat power preservation of the Joint Force.

---

<sup>1</sup> Department of Defense, Joint Chiefs of Staff, Joint Publication 4-02: Joint Health Services (Washington, DC: Department of Defense, 28 September 2018).

The granular details of solutions are beyond the scope of this paper, which seeks to provide justification for the imperativeness of training-centric efforts to the future success of the Joint Force. While doctrinal and technological advances should be pursued, efforts must be directed towards tactical medical training, focused on closing current gaps as well as expanding the capabilities of existing frontline providers, as it delivers immediately actionable mitigation measures for the Joint Force in contested environments.

## CURRENT GAPS IN THE JOINT MEDICAL FORCE

### Preventable Deaths of the Battlefield

To build a medical force capable of providing force enhancement and survivability in contested, degraded, and operationally limited (CDO) environments, existing and persistent deficits in our current forces must first be corrected. As of 6 September 2022, the United States military has incurred 7,075 fatalities over roughly two decades of fighting.<sup>2</sup> While casualties are an expected, if not an obligatory, cost of warfare, that does not mean they are all unavoidable. There are numerous retrospective studies that, while differing in their timeframes and theaters of war, consistently demonstrate the persistence of potentially preventable battlefield deaths.<sup>3</sup> The largest of these studies, by Eastridge et al., evaluated 4596 U.S. combat fatalities in Iraq and Afghanistan between 2001 and 2011, reporting 24.3% of the fatalities to be deemed potentially

---

<sup>2</sup> U.S. Department of Defense. "Casualty Status." U.S. Department of Defense Casualty Status. Accessed September 6, 2022. <https://www.defense.gov/Newsroom/Casualty-Status/%EF%BB%BF/>.

<sup>3</sup> Russ Kotwal, et al. "United States Military Fatalities during Operation Inherent Resolve and Operation Freedom's Sentinel." *Military Medicine*, 2022. <https://doi.org/10.1093/milmed/usac119>, 4; Jeffrey Howard, et al. "Use of Combat Casualty Care Data to Assess the US Military Trauma System During the Afghanistan and Iraq Conflicts, 2001-2017." *JAMA surgery* vol. 154,7 (2019): 600-608. doi:10.1001/jamasurg.2019.0151, 606; Russ Kotwal. "Eliminating Preventable Death on the Battlefield." *Archives of Surgery* 146, no. 12 (2011): 1350. <https://doi.org/10.1001/archsurg.2011.213>.

preventable.<sup>4</sup> The size and consistency of this finding should provide sufficient validity as to the problem's existence. As it should be anticipated that medevac capabilities will be degraded in CDO arenas<sup>5</sup> and that any future Great Power conflict may see casualties on a larger scale<sup>6</sup>, it is reasonable to assume unaltered that this rate will increase.

### **Most Combat Deaths occur Prehospital**

With the establishment that there have been potentially preventable deaths of US service members, it becomes incumbent on us to perform a deeper dive to ascertain the details of these events in hopes of preventing a recurrence in future conflicts. An analysis of commonality yields a significant finding regarding the locality of these circumstances. With surprisingly little variation, numerous data sets reveal that the overwhelming majority (85-93%) of deaths occurred prior to patients reaching a military treatment facility.<sup>7,8,9</sup> It should be noted that a comparison to historical data demonstrates that this prevalence has remained essentially unchanged since

---

<sup>4</sup> Brian Eastridge, et al. "Death on the Battlefield (2001–2011).", 432.

<sup>5</sup> Kristen Lynch. Rep. *Analysis of Global Management of Air Force War Reserve Materiel to Support Operations in Contested and Degraded Environments*. RAND Corporation, 2021. [https://www.rand.org/pubs/research\\_reports/RR3081.html](https://www.rand.org/pubs/research_reports/RR3081.html).

<sup>6</sup> Todd South, "Army Prepares for Dispersed Warfare with High Casualties," *Army Times* (Army Times, October 11, 2022), <https://www.armytimes.com/news/2022/10/11/army-prepares-for-dispersed-warfare-with-high-casualties/>.

<sup>7</sup> Russ S Kotwal. *Saving Lives on the Battlefield: A Joint Trauma System Review of Pre-Hospital Trauma Care in Combined Joint Operating Area ? Afghanistan (CJOA-A)*. Report, 2013.

<sup>8</sup> Julio Lairer et al., "Prehospital Interventions Performed in Afghanistan between November 2009 and March 2014," *Military Medicine* 184, no. Supplement\_1 (January 2019): pp. 133-137, <https://doi.org/10.1093/milmed/usy311>, 135.

<sup>9</sup> Howard R. Champion et al., "A Profile of Combat Injury," *Journal of Trauma: Injury, Infection & Critical Care* 54, no. 5 (2003), <https://doi.org/10.1097/01.ta.0000057151.02906.27>, 14.

Vietnam (88%).<sup>10,11</sup> Furthermore, a retrospective analysis deemed that a significant number of the remaining who died in the hospital arrived in a decompensated state and would likely have benefited from extensive prehospital resuscitation.<sup>12</sup> As this relates to the value of training, comparing the survival of patients whose MEDEVAC care was provided by medics doctrinally trained to the civilian equivalent of emergency medical technician versus those trained to the higher standard of a paramedic, found this enhanced training brought with it a 66% lower risk of death.<sup>13</sup> In summation, these findings clearly demonstrate both the essential nature of prehospital medical interventions and the potential for current improvement. While significant in their own right, these findings are made even more relevant due to the indisputable fact that CDO arenas, by definition, will impair casualty movement and prolong the duration of the prehospital arm of medical care.

### **Types of Error in Execution**

As the preponderance of historic potentially preventable deaths have occurred in environments similar to those expected in CDO battlespaces, it is critical to identify what medical actions occur in this scenario and how they are linked to the suboptimal outcomes. Medical interventions consist of a combination of psychomotor (“how to do”) and cognitive (the assessment and

---

<sup>10</sup> Howard Champion, A profile of Combat Injury, 13.

<sup>11</sup> Ronald F. Bellamy, “The Causes of Death in Conventional Land Warfare: Implications for Combat Casualty Care Research,” *Military Medicine* 149, no. 2 (January 1984): pp. 55-62, <https://doi.org/10.1093/milmed/149.2.55>, 56.

<sup>12</sup> Russ S Kotwal. *Saving Lives on the Battlefield: A Joint Trauma System Review of Pre-Hospital Trauma Care in Combined Joint Operating Area ? Afghanistan (CJOA-A)*, 3.

<sup>13</sup> Robert L. Mabry et al., “Impact of Critical Care–Trained Flight Paramedics on Casualty Survival during Helicopter Evacuation in the Current War in Afghanistan,” *Journal of Trauma and Acute Care Surgery* 73, no. 2 (2012), <https://doi.org/10.1097/ta.0b013e3182606001>, 32.

analysis to decide “when” and “what”) functions, with a gap in either function jeopardizing the procedural outcome.

### **Cognitive Errors**

Gaps in the performance of pre-hospital medical interventions in the cognitive domain are complex as they yield errors of both commission, which result from improper treatment or technique, and omission, which arise from a delay or failure to render the indicated therapy. A 2014 review of over 2100 casualties during OEF found an alarming lack of performance of indicated life-saving interventions (LSI). This included failures to perform necessary procedures in the areas of the airway, thoracic, vascular access, hypothermia, and hemorrhage control ranging from 3.3% to over 19%.<sup>14</sup> Other interventions fared worse: pelvic fractures had binders placed prehospital only 2% of the time<sup>15</sup>, while administration of tranexamic acid (TXA) has seen compliance rates of only 1.3 to 5.6% despite its recommendation clearly stated by the Committee on Tactical Combat Casualty Care.<sup>16</sup> Other reports demonstrate the mixed omission/commission dilemma. A 2018 review of antibiotics for open combat wounds found they were administered only 54% of the time, and worse, only 11% of those received were in alignment with TCCC guidelines.<sup>17</sup> Furthermore, an analysis of 705 hypotensive patients found

---

<sup>14</sup> Julio Lairet et al., “Prehospital Interventions Performed in Afghanistan between November 2009 and March 2014,” *Military Medicine* 184, no. Supplement\_1 (January 2019): pp. 133-137, <https://doi.org/10.1093/milmed/usy311>, 136.

<sup>15</sup> William Parker et al., “Military Experience in the Management of Pelvic Fractures from OIF/OEF,” *BMJ Military Health*, 2020, <https://doi.org/10.1136/bmjmilitary-2020-001469>, 2.

<sup>16</sup> Andrew D. Fisher et al., “An Analysis of Adherence to Tactical Combat Casualty Care Guidelines for the Administration of Tranexamic Acid,” *The Journal of Emergency Medicine* 57, no. 5 (2019): pp. 646-652, <https://doi.org/10.1016/j.jemermed.2019.08.027>, 649.

<sup>17</sup> Steven G Schauer et al., “Prehospital Administration of Antibiotic Prophylaxis for Open Combat Wounds in Afghanistan: 2013-2014,” *Journal of Special Operations Medicine* 18, no. 2 (2018): p. 53, <https://doi.org/10.55460/zrik-eoe3>, 54.

that most efforts performed did not match current guidelines.<sup>18</sup> It is highly relevant that these omissions not only contribute to morbidity and mortality and the resultant loss of combat power but are associated with higher downstream resource utilization.<sup>19,20</sup> Given the inherent limitations of operating in a DCO environment, the further logistical burden is unfeasible. As noted, these lapses occurred across differing theaters, timelines, and the spectrum of medical interventions. Therefore, while there is rarely a single point of failure, the nature of these lapses connected with the one unifying factor, the pre-deployment training paradigm, provides ample evidence as to the presence of deficits in our current system.

### **Psychomotor Errors**

Skeptics may attempt to probe for hindsight bias or lack of resource allocation as an etiology of the aforementioned failures vice training deficiencies. While unsubstantiated, particularly in light of its ubiquitous presence across time and space, these arguments would fail to address the gaps in the technical execution of critical LSIs in the prehospital setting. A multisite study of eight military treatment facilities in Afghanistan from 2009-2014 reported prevalences of improper performance of airway, thoracic, vascular access, and hemorrhage control procedures of 8.9%, 5.5%, 4.1%, and 2.1%, respectively.<sup>21</sup> Similarly, an assessment of

---

<sup>18</sup> Steven G Schauer et al., "Prehospital Resuscitation Performed on Hypotensive Trauma Patients in Afghanistan: The Prehospital Trauma Registry Experience," *Military Medicine* 184, no. 5-6 (June 2018), <https://doi.org/10.1093/milmed/usy252>, 54.

<sup>19</sup> Zachary Arthurs et al., "The Impact of Hypothermia on Trauma Care at the 31st Combat Support Hospital," *The American Journal of Surgery* 191, no. 5 (2006): pp. 610-614, <https://doi.org/10.1016/j.amjsurg.2006.02.010>, 612.

<sup>20</sup> Alec C. Beekley, Benjamin W. Starnes, and James A. Sebesta, "Lessons Learned from Modern Military Surgery," *Surgical Clinics of North America* 87, no. 1 (2007): pp. 157-184, <https://doi.org/10.1016/j.suc.2006.09.008>, 173.

<sup>21</sup> Julio Lairet et al., "Prehospital Interventions Performed in Afghanistan between November 2009 and March 2014," *Military Medicine* 184, no. Supplement\_1 (January 2019): pp. 133-137, <https://doi.org/10.1093/milmed/usy311>, 136.

the management of failing airways by cricothyrotomy found placement failure in one out of every three. This represents a failure rate five times higher than comparable civilian studies.<sup>22</sup>

Meanwhile, numerous case series highlight a myriad of complications from technical errors, such as one from OEF discussing instances of complications from improper application of a basic tourniquet, including one from the erroneous placement on the upper arm for an amputated finger.<sup>23</sup> Similarly, post-mortem feedback from the Armed Forces Institute of Pathology highlights concerns such as a series of 23 cases of needle thoracostomy, which yielded a success rate of only 59%.<sup>24</sup> Tourniquets and needle thoracostomy are core, fundamental procedures in tactical combat casualty care, yet there is evidence of significant deficiencies. These psychomotor deficiencies are no less consequential than those in the cognitive domain regarding their impact on the injured warfighter. Furthermore, it is reasonable to extrapolate that they, too will produce a secondary logistical burden like their cognitive counterparts. However, their performance removes any defense of shortfalls in logistical prerequisites. The ability to execute these core lifesaving procedures with failed outcomes, therefore, is directly attributable to a fallacy in the state of our current training paradigm.

---

<sup>22</sup> Robert L Mabry and Alan Frankfurt, "An Analysis of Battlefield Cricothyrotomy in Iraq and Afghanistan," *Journal of Special Operations Medicine* 12, no. 1 (2012): p. 17, <https://doi.org/10.55460/fyqg-8e49>, 22.

<sup>23</sup> Russ Kotwal, "Saving Lives on the Battlefield: A Joint Trauma System Review of Pre-Hospital Trauma Care in Combined Joint Operating Area Afghanistan (CJOA-A)," 2013, 14.

<sup>24</sup> Edward Mazuchowski, "Feedback to the Fleet: Needle Thoracentesis Observations," 2012.

## Errors occur even in Peacetime and Controlled Environments

While the psychological impact of the battlefield can reasonably be expected to have a detrimental impact on performance, a fact that has been validated in simulated environments,<sup>25</sup> it cannot be used as a justification for the aforementioned procedural failures. Given the evidence that such mistakes occur in controlled, training environments, their presence in the deployed setting was regrettably inevitable. Take, for example, the proper application of a tourniquet, one of the most basic and critical medical interventions on the battlefield. In a controlled setting, a cohort of 138 Army soldiers, trained as Combat Life Savers, correctly placed a tourniquet less than 20% of the time.<sup>26</sup> While performing better, yet still woefully inadequate, studies showed Navy Corpsmen and en route care teams with success rates of 60% and 64%.<sup>27,28</sup> These peacetime shortcomings were not limited to tourniquets. In one simulated study, en-route care teams performed the critical actions of needle thoracostomy, blood transfusion, and analgesia administration in only 51%, 64%, and 24% of the cases respectively.<sup>29</sup> It's important to re-emphasize that in all these cases, the subjects' performances were evaluated in safe and low-stakes environments. Devoid of threats to their safety, resource limitations, or potential poor

---

<sup>25</sup> Richard Schreckengast, Lanny Littlejohn, and Gregory J. Zarow, "Effects of Training and Simulated Combat Stress on Leg Tourniquet Application Accuracy, Time, and Effectiveness," *Military Medicine* 179, no. 2 (2014): pp. 114-120, <https://doi.org/10.7205/milmed-d-13-00311>, 114.

<sup>26</sup> Avishai Michael Tsur et al., "High Tourniquet Failure Rates among Non-Medical Personnel Do Not Improve with Tourniquet Training, Including Combat Stress Inoculation: A Randomized Controlled Trial," *Prehospital and Disaster Medicine* 34, no. 03 (February 2019): pp. 282-287, <https://doi.org/10.1017/s1049023x19004266>, 282.

<sup>27</sup> Christopher Treager et al., "A Comparison of Efficacy, Efficiency, and Durability in Novel Tourniquet Designs," *Journal of Trauma and Acute Care Surgery* 91, no. 2S (February 2021), <https://doi.org/10.1097/ta.0000000000003216>, 139.

<sup>28</sup> Christine A DeForest et al., "An Evaluation of Navy En Route Care Training Using a High-Fidelity Medical Simulation Scenario of Interfacility Patient Transport," *Military Medicine* 183, no. 9-10 (2018), <https://doi.org/10.1093/milmed/usx129>, 383.

<sup>29</sup> Christine A DeForest et al., "An Evaluation of Navy En Route Care Training Using a High-Fidelity Medical Simulation Scenario of Interfacility Patient Transport," 383.

patient outcomes, many of these study environments represent optimal situations, and yet performances remain subpar, leaving little choice but to conclude attribution to flaws in our existing training paradigm.

### **Deviations in Tactical Combat Casualty Care Training**

The tactical combat casualty care (TCCC) program is a standardized curriculum set that is the most ubiquitous medical training program across the Joint Force, and yet even it falls short. A prospective review of four TCCC class sites, including 184 students, discovered that not one covered all the material within the set curriculum, using 71%, 57%, 63%, and 1% of the total TCCC curriculum slide deck. Additionally, only 25% used exclusively TCCC-recommended questions to evaluate final competency. Unsurprisingly, in their conclusions the authors state the exclusion of material could likely result in adverse patient outcomes.<sup>30</sup> This pairs with a 2020 cross-sectional survey which found less than 60% of physicians and physician assistants expressed confidence in the ability of their medics to perform TCCC skills.<sup>31</sup> The fact that the most uniform and widely used medical training program in the DoD demonstrated such variances coupled with medical subject matter experts' lacking confidence in medics' ability to perform core, life-saving procedures should be immediately alarming and provides painfully clear evidence of systemic gaps in training. Furthermore, not only do training lapses in a program as large as TCCC have direct, widespread implications for medical care and force

---

<sup>30</sup> Dominique J Greydanus, Lyndsey L Hassmann, and Frank K Butler, "Quality Assurance in Tactical Combat Casualty Care for Medical Personnel Training 16 April 2020," *Journal of Special Operations Medicine* 20, no. 2 (2020): p. 95, <https://doi.org/10.55460/t63h-30xx>, 95.

<sup>31</sup> Jennifer M Gurney et al., "Tactical Combat Casualty Care Training, Knowledge, and Utilization in the US Army," *Military Medicine* 185, no. Supplement\_1 (2020): pp. 500-507, <https://doi.org/10.1093/milmed/usz303>, 505.

preservation but they raise strong concerns about the quality of the numerous lesser-resourced training mechanisms.

### **Anticipated Decline: The Walker Dip**

To compound the concerns of our current training deficiency it should be presumed, without intervention, that they will continue on an ever-worsening trajectory. Modern warfare has seen each conflict exhibit higher-than-expected fatality rates at its onset compared to the previous war. This is attributed to an interwar loss in combat medical experience and lessons learned, referred to as the Walker Dip.<sup>32</sup> A paper from Vietnam lamented the “lack of improvement in the pre-hospital phase of treatment to combat wounds in the past hundred years”.<sup>33</sup> Far from a historical anomaly, a comparison of deaths from Vietnam and the early years of Iraq and Afghanistan showed nearly identical rates of death from extremity hemorrhage (7.4% vs 7.8%).<sup>34</sup> The intensity of armed conflict with a peer adversary will not offer time for a “learning curve.”

Our current training structure must be reevaluated, refined to include evidence-based, educational best practices, and nested within a robust accountability system. If left unchecked, our current shortfalls in medical training portend even greater hurdles to the preservation of

---

<sup>32</sup> Daniel Holena, “U.S. Military Has Improved Mortality Since World War II, But There Have Been Some Alarming Exceptions,” *Penn Medicine*, July 21, 2020, <https://www.pennmedicine.org/news/news-releases/2020/july/us-military-has-improved-mortality-since-world-war-ii-but-there-have-been-some-alarming-exceptions>.

<sup>33</sup> J Maughon, “An Inquiry into the Nature of Wounds Resulting in Killed in Action in Vietnam,” *Military Medicine* 135 (January 1970): pp. 8-13, <https://doi.org/PMID:4985194>, 11.

<sup>34</sup> Alec C. Beekley, Benjamin W. Starnes, and James A. Sebesta, “Lessons Learned from Modern Military Surgery,” *Surgical Clinics of North America* 87, no. 1 (2007): pp. 157-184, <https://doi.org/10.1016/j.suc.2006.09.008>, 157.

combat power in the perspective of Great Power conflicts. As is, the sheer volume of casualties in such conflict coupled with disaggregated, capability-dense units threatens to create risky diseconomies of scale in combat power that posed a critical threat to the mission.

### **TRAINING CAN SHAPE THE FORCE TO ADDRESS FUTURE CHALLENGES**

In addition to correcting contemporary liabilities in our training structure, the impacts of proliferated precision long-range fires and other smart weapons on the operating environment and the new challenges they impose must be addressed.<sup>35</sup> With A2/AD restricting the safe forward posturing or movement of field hospitals and potentially neutralizing our MEDEVAC capability to “pull” patients to them, the Joint Force must contend with the chasm created between injured warfighters and medical care. The remaining option to preserve combat power is to push more advanced care out to the frontlines before conflict arises. However, in this regard, it is not a push of emergency/surgical physician-based assets, which are limited in quantity, logistically heavier, and whose movement should be presumed restricted for the aforementioned reasons. Instead, force multipliers can be created by expanding the skillset of embedded, frontline corpsmen/medics to buffer both the clinical and temporal challenges of this new environment.

#### **Increasing Operational Reach through Expansion of Clinical Scope**

The Joint Force ground elements envision “units that are flexible and resilient with the ability to perform distributed operations, in degraded conditions, for extended periods of time,

---

<sup>35</sup>Scott Cuomo, “ON-THE-GROUND TRUTH AND FORCE DESIGN 2030 RECONCILIATION: A WAY FORWARD,” *War On the Rocks*, July 12, 2022, <https://warontherocks.com/2022/07/on-the-ground-truth-and-force-design-2030-reconciliation-a-way-forward/>.

while minimizing the need for enablers from higher echelons”.<sup>36</sup> Inherent to this is the concept of employing capabilities at the lowest practical level.<sup>37</sup> This is exactly the approach the Joint Medical Force must take to bridge the gap left by A2/AD weapons systems. While intuitive, there is evidence supporting increasing the clinical capabilities of forward units and improving the parameters of critically injured casualties.<sup>38</sup> As the aim is to demonstrate how training solutions can bridge the capability shortfall, it is outside the scope of this section to try to define the exact skill sets required. However, the evaluation of mortality-time charts and retrospective casualty data can provide some insight into the medical aptitudes required.<sup>39</sup>

Additionally, it is vital to assess and train to address factors less encountered in recent conflicts. Given the inherent resource confinements of DCO operations coupled with the potential for higher per capita casualty rates, training in triage will be vital, as both under and over-triage have risks including increased mortality, resource utilization, and return to duty times, all of which diminished combat power.<sup>40,41</sup> Additionally, operations in INDOPACOM

---

<sup>36</sup> United States Army-Marine Corps. Ms. *Multi-Domain Battle: Combined Arms for the 21st Century*. White Paper, 2017. <https://govtribe.com/file/government-file/w911w618r0002-multi-domain-battle-white-paper-final-18-jan-2017-dot-pdf>.

<sup>37</sup> United States Army-Marine Corps. Ms. *Multi-Domain Battle: Combined Arms for the 21st Century*. White Paper, 2017. <https://govtribe.com/file/government-file/w911w618r0002-multi-domain-battle-white-paper-final-18-jan-2017-dot-pdf>.

<sup>38</sup> Robert L. Mabry et al., “Impact of Critical Care–Trained Flight Paramedics on Casualty Survival during Helicopter Evacuation in the Current War in Afghanistan,” *Journal of Trauma and Acute Care Surgery* 73, no. 2 (2012), <https://doi.org/10.1097/ta.0b013e3182606001>, 32.

<sup>39</sup> Ronald F. Bellamy, “The Causes of Death in Conventional Land Warfare: Implications for Combat Casualty Care Research,” *Military Medicine* 149, no. 2 (January 1984): pp. 55-62, <https://doi.org/10.1093/milmed/149.2.55>, 57.

<sup>40</sup> “Mass Casualty Trauma Triage Paradigms and Pitfalls: Technical Resources.” ASPR TRACIE, July 2019. <https://asprtracie.hhs.gov/technical-resources/resource/7082/mass-casualty-trauma-triage-paradigms-and-pitfalls>.

<sup>41</sup> Brent Thomas, “Preparing for the Future of Combat Casualty Care,” RAND Corporation, July 26, 2021, [https://www.rand.org/pubs/research\\_reports/RRA713-1.html](https://www.rand.org/pubs/research_reports/RRA713-1.html), 42.

come with a host of disease-non-battle injuries that have historically taken a toll on forces.<sup>42</sup>

While it must be emphasized such training cannot fully replace the capability of physician assets, it provides a scalable mitigation step that is immediately actionable.

### **Training to Overcome the Time-Space Dilemma**

From a medical standpoint, prehospital providers are currently trained for proverbial “sprints”, while future great power conflicts will be more akin to marathons, putting them at a decided disadvantage. Their training is focused on immediate care in the first approximately one hour, a timeline further codified with the advent of the “Golden hour” mandate. Additionally, due to our historically robust medical system, corpsmen have only had experience managing injured patients for relatively brief periods of time. A review of casualty data for OEF demonstrated an average prehospital tourniquet time of 70 minutes<sup>43</sup> with a median transport time of only 36 minutes.<sup>44</sup> Given the vast landscape of the INDOPACOM theater and the planned disaggregated force posture, this timeline may pose a challenge even in the best of circumstances. In the event of a conflict with an A2/AD adversary, this timeline could easily be measured not in minutes but in days. In fact, many war game timelines include weeks of heavy fighting, during which time assets will be predominately focused on offensive and not medical

---

<sup>42</sup> Charles Van Way, “War and Trauma: A History of Military Medicine,” *Missouri Medicine* 113, no. 4 (2016): pp. 260-263, <https://doi.org/PMID:30228466>, 260.

<sup>43</sup> Alec C. Beekley, Benjamin W. Starnes, and James A. Sebesta, “Lessons Learned from Modern Military Surgery,” *Surgical Clinics of North America* 87, no. 1 (2007): pp. 157-184, <https://doi.org/10.1016/j.suc.2006.09.008>, 5.

<sup>44</sup> Joseph K. Maddry et al., “Impact of Prehospital Medical Evacuation (MEDEVAC) Transport Time on Combat Mortality in Patients with Non-Compressible Torso Injury and Traumatic Amputations: A Retrospective Study,” *Military Medical Research* 5, no. 1 (2018), <https://doi.org/10.1186/s40779-018-0169-2>, 70.

support operations.<sup>45</sup> The prolonged care of a polytrauma patient does not entail “doing the same things but for longer”, the importance of which cannot be understated. On the contrary, it involves a vastly different and expansive array of diagnostic and treatment skills and methods. Therefore, it is indisputable that failing to address this disconnect will deploy medics/corpsmen woefully ill-equipped and represents a critical vulnerability to force preservation.

### **UNPRECEDENTED BATTLEFIELD SURVIVAL AND SURGICAL ASSESTS**

There are those that would take issue with the proposition that deficits exist in our current training structure. They would propose that the underlying data as presented is the sensationalizing of isolated failures due to lack of equipment vice training shortfalls or within an acceptable margin of error given the chaotic nature of the battlefield. They would also submit that the preponderance of data is retrospective in nature and, therefore, may be complicated by artifacts and bias. Certainly, the unprecedented 92% battlefield survival rate<sup>46</sup> is admirable, as is the mere 2% fatality rate<sup>47</sup> for those reaching a Role 2 level of care. Both of these facts suggest that there are no glaring deficits in our current training structure.

While the US did experience historically low fatality rates, this cannot be attributed strictly to the provisions of medical care. Advances in personal protection equipment, armored

---

<sup>45</sup> Todd South, “In Think Tank's Taiwan War Game, US Beats China at High Cost,” *Military Times* (*Military Times*, August 15, 2022), <https://www.militarytimes.com/news/2022/08/12/in-think-tanks-taiwan-war-game-us-beats-china-at-high-cost/>.

<sup>46</sup> Russ Kotwal, “Saving Lives on the Battlefield: A Joint Trauma System Review of Pre-Hospital Trauma Care in Combined Joint Operating Area Afghanistan (CJOA-A),” 2013, 3.

<sup>47</sup> Samuel W Sauer et al., “Saving Lives on the Battlefield (Part II) - One Year Later: A Joint Theater Trauma System and Joint Trauma System Review of Prehospital Trauma Care in Combined Joint Operations Area-Afghanistan (CJOA-A),” *Journal of Special Operations Medicine* 15, no. 2 (2015): p. 25, <https://doi.org/10.55460/gi15-hvcy>, 4.

vehicles, and the enemy's lack of conventional armaments are a few of the numerous factors that are at play. Furthermore, the data presented on procedure-specific and peacetime training gaps circumvent the above arguments. Additionally, historic battlefield shortfalls occurred during “favorable” conditions in that they offered both the forward posturing of large field hospitals as well as ready access to medevac capabilities, all in the setting of relatively low casualty volumes. Given none of the above three elements should be a planning factor in future Great Power conflicts, one would be incredulous to assume current shortfalls will not exponentially worsen.

Others might argue that the primary focus should be on preserving the ability to surge surgical assets forward as it is considered the current standard of medical care. The Golden hour mandate, enacted by the Secretary of Defense required all forces to be within one hour of surgical care. The results of this mandate have been associated with improved survival rates in recent conflicts.<sup>48</sup> This suggests that surgical assets are a must. Furthermore, the fact remains that certain traumatic injury patterns irrevocably require surgical intervention for survival.

There is no doubt that surgical assets are a vital tool in the HSS armamentarium, and efforts should continue to refine and explore how to maximize their use. However, by rigidly planning based on outcomes from recent small-scale operations, we risk shaping the medical force in a way that will make large-scale combat operations medically unsupportable.<sup>49</sup> The

---

<sup>48</sup> Luke Richmond, “Prolong the ‘Golden Hour,’” U.S. Naval Institute, December 14, 2019, <https://www.usni.org/magazines/proceedings/2019/december/prolong-golden-hour>.

<sup>49</sup> Cameron Jackson, “Military Review,” *Military Review*, (blog) (Combined Arms Center, Fort Leavenworth, Kansas, 2019), <https://cgsc.contentdm.oclc.org/digital/collection/p124201coll1/id/1329/>, 42.

reality is that armed conflict against an adversary with A2/AD and precision fire munitions will make the functional emplacement or movement of these limited assets impossible, if not at least extremely risky. The solutions of paring down the elements, both in terms of personnel and equipment, to make them more mobile may again work in limited instances, though it does not remove the A2/AD threat to movement and at some point will become prohibitive costly in terms of capacity.

### CONCLUSION

The aim is not to discount the valiant efforts of medical teams in recent conflicts. Individual heroic actions combined with advancements in medical technology and tactics have no doubt allowed warfighters to survive what previously was deemed catastrophic. Medical elements provide a critical capability to prepare, enhance and maintain combat power for the Joint Force. This value will be critical in overcoming the challenges of Great Power conflicts.

A problem set of such complexity requires us to innovatively leverage all arms of the “organize, train, and equip” paradigm. Technological and equipment investments will no doubt be of value, though they come tethered to uncertain timelines and logistic baggage, whereas knowledge is here now and weighs nothing. Therefore, the most immediate and enduring measures are within the realm of training, aimed at correcting current deficits and enhancing the capabilities of frontline medical assets. As Col. Marby stated, “The solution lay with people, not technology. Using a sports analogy, the Department of Defense spends billions of dollars

trying to perfect golf clubs, balls and shoes and virtually no research on how to train the best golfers.”<sup>50</sup>

To acknowledge that our medical system has critical gaps in its current training structure may cause considerable discomfort, as may the reality that future fights will not benefit from the same level of medical capability. However, it is only through a disciplined acceptance of this harsh reality that we can focus our efforts on making the joint force the best it can be vice chasing the fantasy of what we wish it could be. Per CNO guidance, we need to “Get Real, Get Better”<sup>51</sup>

---

<sup>50</sup> “Ensuring Medical Readiness in the Future: Hearing before the Subcommittee on Military Personnel of the Committee on Armed Services, House of Representatives, One Hundred Fourteenth Congress, Second Session, Hearing Held February 26, 2016,” Ensuring Medical Readiness in the future: Hearing before the Subcommittee on military personnel of the Committee on Armed Services, House of Representatives, One Hundred Fourteenth Congress, second session, hearing held February 26, 2016 § (n.d.).

<sup>51</sup> *Get Real Get Better: A Message to Navy Leaders, DVIDS*, 2022, <https://www.dvidshub.net/video/854857/get-real-get-better-message-navy-leaders>.

## BIBLIOGRAPHY

Arthurs, Zachary, Daniel Cuadrado, Alec Beekley, Kurt Grathwohl, Jeremy Perkins, Robert Rush, and James Sebesta. "The Impact of Hypothermia on Trauma Care at the 31st Combat Support Hospital." *The American Journal of Surgery* 191, no. 5 (2006): 610–14. <https://doi.org/10.1016/j.amjsurg.2006.02.010>.

Beekley, Alec C., Benjamin W. Starnes, and James A. Sebesta. "Lessons Learned from Modern Military Surgery." *Surgical Clinics of North America* 87, no. 1 (2007): 157–84. <https://doi.org/10.1016/j.suc.2006.09.008>.

Bellamy, Ronald F. "The Causes of Death in Conventional Land Warfare: Implications for Combat Casualty Care Research." *Military Medicine* 149, no. 2 (1984): 55–62. <https://doi.org/10.1093/milmed/149.2.55>.

Champion, Howard R., Ronald F. Bellamy, Colonel P. Roberts, and Ari Leppaniemi. "A Profile of Combat Injury." *Journal of Trauma: Injury, Infection & Critical Care* 54, no. 5 (2003). <https://doi.org/10.1097/01.ta.0000057151.02906.27>.

Committee on Armed Services. Bill, Ensuring Medical Readiness in the future: Hearing before the Subcommittee on military personnel of the Committee on Armed Services, House of Representatives, One Hundred Fourteenth congress, second session, hearing held February 26, 2016 § (114AD).

Cuomo, Scott. "On-The-Ground Truth And Force Design 2030 Reconciliation: A Way Forward." *War On the Rocks*, July 12, 2022. <https://warontherocks.com/2022/07/on-the-ground-truth-and-force-design-2030-reconciliation-a-way-forward/>.

DeForest, Christine A, Virginia Blackman, John E Alex, Lauren Reeves, Alejandra Mora, Crystal Perez, Joseph Maddry, Domenique Selby, and Benjamin Walrath. "An Evaluation of Navy En Route Care Training Using a High-Fidelity Medical Simulation Scenario of Interfacility Patient Transport." *Military Medicine* 183, no. 9-10 (2018). <https://doi.org/10.1093/milmed/usx129>.

Eastridge, Brian J., Mark Hardin, Joyce Cantrell, Lynne Oetjen-Gerdes, Tamara Zubko, Craig Mallak, Charles E. Wade, et al. "Died of Wounds on the Battlefield: Causation and Implications for Improving Combat Casualty Care." *Journal of Trauma: Injury, Infection & Critical Care* 71, no. 1 (2011). <https://doi.org/10.1097/ta.0b013e318221147b>.

Eastridge, Brian J., Robert L. Mabry, Peter Seguin, Joyce Cantrell, Terrill Tops, Paul Uribe, Olga Mallett, et al. "Death on the Battlefield (2001–2011)." *Journal of Trauma and Acute Care Surgery* 73, no. 6 (2012). <https://doi.org/10.1097/ta.0b013e3182755dcc>.

Fisher, Andrew D., Brandon M. Carius, Michael D. April, Jason F. Naylor, Joseph K. Maddry, and Steven G. Schauer. "An Analysis of Adherence to Tactical Combat Casualty Care Guidelines for the Administration of Tranexamic Acid." *The Journal of Emergency Medicine* 57, no. 5 (2019): 646–52. <https://doi.org/10.1016/j.jemermed.2019.08.027>.

Gilday, Michael. Get Real Get Better: A Message to Navy Leaders. DVIDS, 2022. <https://www.dvidshub.net/video/854857/get-real-get-better-message-navy-leaders>.

Greydanus, Dominique J, Lyndsey L Hassmann, and Frank K Butler. "Quality Assurance in Tactical Combat Casualty Care for Medical Personnel Training 16 April 2020." *Journal of Special Operations Medicine* 20, no. 2 (2020): 95. <https://doi.org/10.55460/t63h-3oxx>.

Gurney, Jennifer M, Caryn A Stern, Russ S Kotwal, Cord W Cunningham, Dallas R Burelison, Kirby R Gross, Harold R Montgomery, et al. "Tactical Combat Casualty Care Training, Knowledge, and Utilization in the US Army." *Military Medicine* 185, no. Supplement\_1 (2020): 500–507. <https://doi.org/10.1093/milmed/usz303>.

Holena, Daniel. "U.S. Military Has Improved Mortality Since World War II, But There Have Been Some Alarming Exceptions." *Penn Medicine*, July 21, 2020. <https://www.pennmedicine.org/news/news-releases/2020/july/us-military-has-improved-mortality-since-world-war-ii-but-there-have-been-some-alarming-exceptions>.

Howard, Jeffrey T., Russ S. Kotwal, Caryn A. Stern, Jud C. Janak, Edward L. Mazuchowski, Frank K. Butler, Zsolt T. Stockinger, Barbara R. Holcomb, Raquel C. Bono, and David J. Smith. "Use of Combat Casualty Care Data to Assess the US Military Trauma System during the Afghanistan and Iraq Conflicts, 2001-2017." *JAMA Surgery* 154, no. 7 (2019): 600. <https://doi.org/10.1001/jamasurg.2019.0151>.

Jackson, Cameron. "Don't Get Wounded: Military Health System Consolidation and the Risk to Readiness." *Military Review*, (blog). Combined Arms Center, Fort Leavenworth, Kansas, 2019. <https://cgsc.contentdm.oclc.org/digital/collection/p124201coll1/id/1329/>.

Kotwal, Russ S, Jud C Janak, Jeffrey T Howard, Andrew J Rohrer, Howard T Harcke, John B Holcomb, Brian J Eastridge, Jennifer M Gurney, Stacy A Shackelford, and Edward L Mazuchowski. "United States Military Fatalities during Operation Inherent Resolve and Operation Freedom's Sentinel." *Military Medicine*, 2022. <https://doi.org/10.1093/milmed/usac119>.

Kotwal, Russ S. "Eliminating Preventable Death on the Battlefield." *Archives of Surgery* 146, no. 12 (2011): 1350. <https://doi.org/10.1001/archsurg.2011.213>.

Kotwal, Russ. Rep. Saving Lives on the Battlefield: A Joint Trauma System Review of Pre-Hospital Trauma Care in Combined Joint Operating Area ? Afghanistan (CJOA-A), 2013.

Lairet, Julio, Vikhyat S Bebarta, Joseph K Maddry, Lauren Reeves, Alejandra Mora, Lorne Blackbourne, and Todd Rasmussen. "Prehospital Interventions Performed in Afghanistan between November 2009 and March 2014." *Military Medicine* 184, no. Supplement\_1 (2019): 133–37. <https://doi.org/10.1093/milmed/usy311>.

Lairet, Julio, Vikhyat S Bebartha, Joseph K Maddry, Lauren Reeves, Alejandra Mora, Lorne Blackbourne, and Todd Rasmussen. "Prehospital Interventions Performed in Afghanistan between November 2009 and March 2014." *Military Medicine* 184, no. Supplement\_1 (2019): 133–37. <https://doi.org/10.1093/milmed/usy311>.

Lynch, Kristin. Rep. Analysis of Global Management of Air Force War Reserve Materiel to Support Operations in Contested and Degraded Environments. RAND Corporation, 2021. [https://www.rand.org/pubs/research\\_reports/RR3081.html](https://www.rand.org/pubs/research_reports/RR3081.html).

Mabry, Robert L, and Alan Frankfurt. "An Analysis of Battlefield Cricothyrotomy in Iraq and Afghanistan." *Journal of Special Operations Medicine* 12, no. 1 (2012): 17. <https://doi.org/10.55460/fyqg-8e49>.

Mabry, Robert L., Amy Apodaca, Jason Penrod, Jean A. Orman, Robert T. Gerhardt, and Warren C. Dorlac. "Impact of Critical Care–Trained Flight Paramedics on Casualty Survival during Helicopter Evacuation in the Current War in Afghanistan." *Journal of Trauma and Acute Care Surgery* 73, no. 2 (2012). <https://doi.org/10.1097/ta.0b013e3182606001>.

Maddry, Joseph K., Crystal A. Perez, Alejandra G. Mora, Jill D. Lear, Shelia C. Savell, and Vikhyat S. Bebartha. "Impact of Prehospital Medical Evacuation (MEDEVAC) Transport Time on Combat Mortality in Patients with Non-Compressible Torso Injury and Traumatic Amputations: A Retrospective Study." *Military Medical Research* 5, no. 1 (2018). <https://doi.org/10.1186/s40779-018-0169-2>.

"Mass Casualty Trauma Triage Paradigms and Pitfalls: Technical Resources." ASPR TRACIE, July 2019. <https://asprtracie.hhs.gov/technical-resources/resource/7082/mass-casualty-trauma-triage-paradigms-and-pitfalls>.

Maughon, J. "An Inquiry into the Nature of Wounds Resulting in Killed in Action in Vietnam." *Military Medicine* 135 (January 1970): 8–13. <https://doi.org/PMID:4985194>.

Mazuchowski, Edward. Rep. Feedback to the Fleet: Needle Thoracentesis Observations, 2012.

Parker, William, R W Despain, J Bailey, E Elster, C J Rodriguez, and M Bradley. "Military Experience in the Management of Pelvic Fractures from OIF/OEF." *BMJ Military Health*, 2020. <https://doi.org/10.1136/bmjmilitary-2020-001469>.

Richmond, Luke. "Prolong the 'Golden Hour'." U.S. Naval Institute, December 14, 2019. <https://www.usni.org/magazines/proceedings/2019/december/prolong-golden-hour>.

Sauer, Samuel W, John B Robinson, Michael P Smith, Kirby Gross, Russ S Kotwal, Robert L Mabry, Frank K Butler, et al. "Saving Lives on the Battlefield (Part II) - One Year Later: A Joint Theater Trauma System and Joint Trauma System Review of Prehospital Trauma Care in Combined Joint Operations Area-Afghanistan (CJOA-A)." *Journal of Special Operations Medicine* 15, no. 2 (2015): 25. <https://doi.org/10.55460/gi15-hvcy>.

Schauer, Steven G, Andrew D Fisher, Michael D April, Katherine A Stolper, Cord W Cunningham, Robert Carter, Jessie Renee Fernandez, and James Pfaff. "Prehospital Administration of Antibiotic Prophylaxis for Open Combat Wounds in Afghanistan: 2013-2014." *Journal of Special Operations Medicine* 18, no. 2 (2018): 53. <https://doi.org/10.55460/zrik-ee3>.

Schauer, Steven G, Jason F Naylor, Michael D April, Andrew D Fisher, Cord W Cunningham, Jessie Renee Fernandez, Brian P Shreve, and Vikhyat S Bebarta. "Prehospital Resuscitation Performed on Hypotensive Trauma Patients in Afghanistan: The Prehospital Trauma Registry Experience." *Military Medicine* 184, no. 5-6 (2018). <https://doi.org/10.1093/milmed/usy252>.

Schreckengaust, Richard, Lanny Littlejohn, and Gregory J. Zarow. "Effects of Training and Simulated Combat Stress on Leg Tourniquet Application Accuracy, Time, and Effectiveness." *Military Medicine* 179, no. 2 (2014): 114–20. <https://doi.org/10.7205/milmed-d-13-00311>.

South, Todd. "Army Prepares for Dispersed Warfare with High Casualties." *Army Times*. *Army Times*, October 11, 2022. <https://www.armytimes.com/news/2022/10/11/army-prepares-for-dispersed-warfare-with-high-casualties/>.

South, Todd. "In Think Tank's Taiwan War Game, US Beats China at High Cost." *Military Times*. *Military Times*, August 15, 2022. <https://www.militarytimes.com/news/2022/08/12/in-think-tanks-taiwan-war-game-us-beats-china-at-high-cost/>.

Thomas, Brent. "Preparing for the Future of Combat Casualty Care." RAND Corporation, July 26, 2021. [https://www.rand.org/pubs/research\\_reports/RRA713-1.html](https://www.rand.org/pubs/research_reports/RRA713-1.html).

Treager, Christopher, Tyler Lopachin, Sally Mandichak, Bradley Kinney, Megan Bohan, Michael Boboc, Christian Go, Emily Friedrich, and Sean Stuart. "A Comparison of Efficacy, Efficiency, and Durability in Novel Tourniquet Designs." *Journal of Trauma and Acute Care Surgery* 91, no. 2S (2021). <https://doi.org/10.1097/ta.0000000000003216>.

Tsur, Avishai Michael, Yaara Binyamin, Lena Koren, Sharon Ohayon, Patrick Thompson, and Elon Glassberg. "High Tourniquet Failure Rates among Non-Medical Personnel Do Not Improve with Tourniquet Training, Including Combat Stress Inoculation: A Randomized Controlled Trial." *Prehospital and Disaster Medicine* 34, no. 03 (2019): 282–87. <https://doi.org/10.1017/s1049023x19004266>.

U.S. Department of Defense. "Casualty Status." U.S. Department of Defense Casualty Status. Accessed September 6, 2022. <https://www.defense.gov/Newsroom/Casualty-Status/%EF%BB%BF/>.

United States Army-Marine Corps. Ms. Multi-Domain Battle: Combined Arms for the 21st Century. White Paper, 2017. <https://govtribe.com/file/government-file/w911w618r0002-multi-domain-battle-white-paper-final-18-jan-2017-dot-pdf>.

Van Way, Charles. "War and Trauma: A History of Military Medicine." *Missouri Medicine* 113, no. 4 (2016): 260–63. <https://doi.org/PMID:30228466>.