Military Medicine’s Value to US Health Care and Public Health
Bringing Battlefield Lessons Home

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Abstract

IMPORTANCE Military medicine in the US was established to treat wounded and ill service members and to protect the health and well-being of our military forces at home and abroad. To accomplish these tasks, it has developed the capacity to rapidly adapt to the changing nature of war and emerging health threats; throughout our nation’s history, innovations developed by military health professionals have been quickly adopted by civilian medicine and public health for the benefit of patients in the US and around the world.

OBSERVATIONS From the historical record and published studies, we cite notable examples of how military medicine has advanced civilian health care and public health. We also describe how military medicine research and development differs from that done in the civilian world. During the conflicts in Afghanistan and Iraq, military medicine’s focused approach to performance improvement and requirements-driven research cut the case fatality rate from severe battlefield wounds in half, to the lowest level in the history of warfare.

CONCLUSIONS AND RELEVANCE Although innovations developed by military medicine regularly inform and improve civilian health care and public health, the architects of these advances and the methods they use are often overlooked. Enhanced communication and cooperation between our nation’s military and civilian health systems would promote reciprocal learning, accelerate collaborative research, and strengthen our nation’s capacity to meet a growing array of health and geopolitical threats.


Introduction

Throughout our nation’s history, military medicine has advanced US medicine and public health. Because this work is done with little fanfare and is part of a national security mission, military medicine’s role in these developments is often overlooked or soon forgotten. In this essay, we cite notable examples from the historical record and recently published studies of how advances in military medicine have improved US health care and public health. We also explain how the military health’s focused approach to performance improvement and requirements-driven research differs from the approach typically taken by civilian research agencies. Finally, we offer suggestions for how civilian health systems and specialty societies can forge more effective partnerships with their military counterparts to strengthen civilian health care, public health, and the national security of the US.

A History of Innovation

Military medicine’s impact was felt within months of the founding of our republic. In January 1777, General George Washington directed that the Continental Army be inoculated against smallpox.1 It...
was the first time in history that an army was immunized by command order. Shortly afterward, in a letter to William Shippen, MD, Washington offered the following explanation for his decision: "Necessity not only authorizes but seems to require the measure, for should the disorder infect the Army in the natural way and rage with its usual virulence, we have more to dread from it than from the sword of the enemy." Washington also instituted policies on camp cleanliness and other preventive measures to preserve his army's health. These principles still guide military medicine today.

Following the War of 1812, the US Army established a medical department and appointed its first surgeon general, Joseph Lovell. He directed that all posts, camps, and stations report cases of disease—an early model of public health surveillance. In 1862, shortly before the Battle of Antietam, Major Jonathan Letterman was named medical director of the Army of the Potomac. Adopting the principle of triage and other ideas first advanced by French doctor Dominique Jean Larrey in the Napoleonic era, Letterman moved swiftly to institute reforms. To speed evacuation of wounded troops from the battlefield to forward aid stations, he replaced civilian teamsters with soldiers trained for the role. He also implemented a structured approach to evaluating and treating casualties and documenting the results of care.

Although Major Letterman is known today as "the Father of Battlefield Medicine," he understood, like General Washington before him, the importance of protecting the health of the force. In 1866, he wrote: "A corps of medical officers was not established solely for the purpose of attending the wounded and sick. The leading idea is to strengthen the hands of the Commanding General by keeping his army in the most vigorous health, thus rendering it, in the highest degree, efficient for enduring fatigue and privation, and for fighting." In the years following the Civil War, Letterman's words rang true. When the US began projecting power beyond its borders, tropical diseases ravaged its forces. During the Spanish-American War, the US lost twice as many soldiers to disease as to combat. This prompted the Army to invest in infectious disease research. The groundbreaking work of Major Walter Reed and General William Gorgas not only protected US troops from malaria and yellow fever; it enabled the US to complete the Panama Canal. Additional discoveries followed, including greater knowledge of vector-borne diseases and development of insect repellants, antibiotics, and vaccines. All of these innovations paid huge dividends for people back home.

The major conflicts of the 20th century prompted many transformational advances in medical and surgical care, including blood transfusions (World War I), mass-produced penicillin (World War II), vascular injury repair (Korea), and widespread use of medical evacuation (medevac) helicopters, advanced burn care, and trauma centers (Vietnam). All of these innovations were swiftly adopted by civilian health care. Military service shaped the careers of some of the 20th Century's most impactful physicians and surgeons, including William J. and Charles H. Mayo, George W. Crile, Edward D. Churchill, and Michael E. DeBakey.

Recent Advances

The wars in Afghanistan and Iraq presented US military health with its toughest challenge since the Vietnam war. Faced with the need to support major combat operations in 2 countries thousands of miles from the continental US, while simultaneously caring for millions of servicemembers and beneficiaries at home, military medicine cut the case-fatality rate from battle injuries in half, to the lowest level in the history of warfare. When the COVID-19 pandemic emerged in the spring of 2020, US military health professionals played key roles in accelerating our nation's response. As impressive as what was done is how it was done.

The Joint Trauma System

In the early phases of the conflicts, the Army, Navy, and Air Force had different approaches to triage, medical evacuation, and casualty treatment. In addition, military medical leaders in all 3 services...
lacked actionable data on combat-related deaths or the effectiveness of care. As casualties mounted, it became clear that a more organized approach was needed.15

In 2004, the armed services agreed to establish a Joint Trauma System (JTS) supported by a global trauma registry modeled after high-performing civilian systems. Under the auspices of the JTS, the services standardized their approach to triage, issued and updated clinical practice guidelines, and jointly staffed many military treatment facilities. This produced a seamless continuum of care from the point of injury to definitive care and eventually, postacute treatment in the US. To promote the rapid exchange of quality improvement information, the JTS initiated weekly teleconferences spanning 3 continents that combined focused case discussions with insights gleaned from the Department of Defense's (DoD) Trauma Registry. Actions like these enabled the JTS to quickly pinpoint shortcomings and take corrective action.15,16

The success of the JTS highlighted the value of a unified approach to casualty care. In 2013, the DoD established the Defense Health Agency to integrate medical service delivery by the Army, Navy, and Air Force to nearly 10 million beneficiaries of the Military Health System. As a combat support agency, the Defense Health Agency oversees health care delivery to servicemembers and retirees in the US and seeks to optimize training and assure the readiness of military health care practitioners for deployment.17

**Tactical Combat Casualty Care**

In prior wars, casualties who died before reaching a health care facility were considered unsalvageable and classified as killed in action. As a result, battlefield treatment barely changed for 130 years. In the 1990s, medical leaders in the Special Operations community created Tactical Combat Casualty Care (TCCC), a doctrine that challenged this long-held assumption.18 In 2004, one of TCCC's leading architects, Navy Captain Frank Butler, was appointed US Special Operations Command (USSOCOM) surgeon. Shortly thereafter, he requested Colonel John Holcomb, a trauma surgeon in charge of the US Army Institute of Surgical Research, and Dr Howard Champion, a civilian trauma expert at the Uniformed Services University, to analyze USSOCOM's battlefield fatalities. Based mainly on autopsy data from the Armed Forces Medical Examiner System, 70 of the first 82 deaths were deemed instantaneous or inevitable. However, 12 were due to potentially survivable injuries, mainly uncontrolled bleeding.19

Spurred by these findings, USSOCOM directed that all special operations combatants carry TCCC equipment, including redesigned tourniquets and hemostatic dressings.18 The updated tourniquet the military selected was created by 2 Delta Force medics and tested at the US Army Institute of Surgical Research to confirm that it reliably stops arterial bleeding. After widespread adoption of the combat application tourniquet, deaths from uncontrolled extremity bleeding dropped by two-thirds.20 In the 75th Ranger Regiment, an elite unit that trained every one of its medics and combatants to a high standard, prehospital preventable deaths were reduced to zero.21

In contrast to rapid adoption by the US military, uptake of modern tourniquets by civilian emergency medical services was slower.22 In 2008, a review of more than 5.5 million activations did not document a single use.23 Over time, more emergency medical services units and law enforcement personnel acquired them. In 2015, with support from the US military's Combat Casualty Care Research Program, the American College of Surgeons and the White House launched Stop the Bleed, a program that teaches the members of the public how to apply a modern tourniquet and use other techniques to stop life-threatening bleeding.24

**Requirements-Driven Research**

When the JTS identified a needed technology or capability, it asked senior leadership to designate it as a requirement.15 Examples include a battlefield tourniquet that can be applied with one hand, effective hemostatic dressings and topical agents, adjuncts capable of controlling life-threatening internal (torso) bleeding, and identifying the best mix of blood products to use in trauma resuscitations.25-28 In each instance, the research team that proposed the surest and quickest path
to meet the requirement was awarded the work.15,29 This requirements-driven approach proved so effective, it was subsequently adopted by Operation Warp Speed and the Advanced Research Projects Agency for Health.30,31

Focused Empiricism
In the civilian medical community, it takes an average of 17 years for a new discovery to change practice.32 Working with a research budget a fraction of the size of the National Institute of Health’s, military medicine developed, refined, and/or rapidly expanded more than 25 major innovations in a much shorter span of time.15,33 Because it is impossible to ethically conduct randomized clinical trials in a war zone, military medical leaders deployed the most promising technologies and approaches to care and directly measured their effects. Those that improved outcomes were retained, and those that did not were revised or quickly withdrawn. This practical approach, termed focused empiricism, combined input from practitioners and teams in the field with outcome data from the JTS trauma registry to drive a rigorous process of continuous quality-improvement.29 It produced a remarkable number of advances in a short amount of time.15,33 In a 2016 editorial in JAMA, Donald Berwick, MD, founder of the Institute for Healthcare Improvement, wrote that “…military medicine put the learning health system framework into practice before the Institute of Medicine described it.”34(p927)

Recent Contributions to Public Health and Basic Science
Less than a month after China first reported a cluster of flulike illnesses in Wuhan, the USS Theodore Roosevelt, a nuclear-powered aircraft carrier, was hit with a large-scale outbreak of the COVID-19 infection. The Navy’s swift response, and the epidemiologic investigation that followed, produced early insights about disease symptomatology and transmission among young adults.35 When the pandemic hit the US, large numbers of military doctors, nurses, medics, and other health care professionals were repeatedly deployed to augment the beleaguered staff of civilian hospitals. Some filled the duty 5 or 6 times over a 2-year period.36 Most notably, in May of 2020, the DoD contributed a 140-person military team of vaccine, logistics, and contracting experts to augment those assembled by the US Department of Health and Human Services (HHS) Assistant Secretary of Preparedness and Response to launch Operation Warp Speed.30 Under the leadership of Gustave F. Perna, a 4-star army general, this joint DoD/HHS team ensured that safe and effective vaccines, diagnostics, and therapeutics reached the public in record time, potentially saving more than 1 million lives.37,38

Military health has made vital contributions to the basic sciences as well. Military laboratories, including the Walter Reed Army Institute for Research, the Naval Medical Research Center, the US Army Medical Research Institute of Infectious Diseases, and a network of military laboratories around the world have long been global leaders in the fight against high-impact infectious diseases, including malaria, dengue fever, Ebola, and HIV/AIDS.39,40 While on active duty in the medical corps of the US Navy, Carl June, MD, made important discoveries that paved the way for his later development of chimeric antigen receptor T-cell therapy.41

A Cultural Divide
Despite this remarkable track record, military medicine’s value to civilian health care is often overlooked. For example, election to the National Academy of Medicine is supposed to recognize individuals for outstanding achievements and commitment to service. Of the more than 1800 members inducted into the Academy since 2000, only 7 (less than 0.4%) are former military health professionals.

What accounts for this disparity? The architects of military health’s advances are not anonymous.33 Their scholarship equals or exceeds that of most civilian academics. When its thought leaders leave active duty, many join academic institutions or research laboratories.
The challenge, in our view, is culture. Civilian institutions tout the achievements of their stars to garner prestige, research grants, and patients. The military prioritizes teamwork and service above self. Military promotions are tied to demonstrated leadership, not numbers of research grants or publications. When military authors submit manuscripts to civilian journals, they are often told that their work is too specialized for the journal’s readers. The resulting lack of visibility hinders the exchange of knowledge and may discourage some students from considering a military health career.42 Limited visibility has political consequences as well. In contrast to marked growth of spending on veterans’ health and US health care overall, funding for military health has been flat for 10 years.36

**Bridging the Gap Through Strategic Partnerships**

To help sustain the clinical skills of military physicians, nurses, and other health care professionals, the armed services have established a small number of military-civilian partnerships with busy level I trauma centers.43 Expanding such partnerships would strengthen readiness, increase academic output, and promote reciprocal learning.10,44 The Mission Zero program enacted by Congress in 2019 and recently launched by the HHS is a promising start.45 State governments could help by easing licensure requirements for military health care professionals assigned to civilian hospitals and allowing more military hospitals to participate in civilian trauma systems.36 Actions like these would improve access to care and enable more military health professionals to sustain their skills between deployments. This would help military health avoid the Walker Dip—a peacetime decline in performance first described by Alasdair Walker, MBBS, former Surgeon General of the UK Armed Forces.46

Specialty societies can play an important role. The American College of Surgeons has led the way by forging a formal alliance with the military health system.44,47 Others should follow its lead. Journal editors should publish high-quality military health research. In July 2023, the National Academy of Medicine informed its members that it is adding veteran status to the descriptors it monitors to measure diversity. It should do the same for nominees. This would increase the likelihood that outstanding service members, past and present, are fairly considered for membership.

**Conclusion**

In a report entitled, “A National Trauma Care System: Integrating Military and Civilian Trauma Systems to Achieve ZERO Preventable Deaths After Injury,”48 the National Academies of Sciences, Engineering, and Medicine cited numerous examples of how the US military has improved civilian trauma care. Noting the benefits that could come from greater synergy, the report’s authors declared that “Military and civilian trauma care and learning will be optimized together, or not at all.”48(p3) The same can be said for civilian medicine and public health.
**Author Contributions:** Dr Kellermann had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

**Concept and design:** Kellermann, Rasmussen.

**Acquisition, analysis, or interpretation of data:** Kotwal.

**Drafting of the manuscript:** Kellermann.

**Critical review of the manuscript for important intellectual content:** Kotwal, Rasmussen.

**Supervision:** Kellermann, Rasmussen.

**Conflict of Interest Disclosures:** Dr Kellermann reported receiving a salary as an employee of Uniformed Services University of the Health Sciences from 2013 to 2020 and being considered for appointment as an adjunct professor, unpaid, outside the submitted work. Dr Rasmussen reported having patents for endovascular bleeding control and temporary vascular shunt devices, being a paid consultant for and having stock options in Perfusion Medical and Prytime Medical, and receiving clinical research support paid to Mayo Clinic from Humactye. No other disclosures were reported.

**Disclaimer:** The authors' opinions are their own. They do not necessarily reflect the positions of their past or current employers.

**Additional Contributions:**

- We thank Dale Smith, PhD, of Military Medical History at the Uniformed Services University for his teaching and writings and for keeping the military medicine’s past alive for 2 generations of military health leaders. We thank for their helpful comments and suggestions 4 outstanding former military medical officers: Frank Butler, MD, a former Navy SEAL, dive medical officer, and ophthalmologist who championed the development of Tactical Combat Casualty Care; Vik Bebarta, MD, a former active duty Air Force emergency physician, now reservist and a professor at the University of Colorado School of Medicine; Michael J. Yazemski, MD, PhD, a former Air Force orthopedic surgeon who retired at the rank of brigadier general and is now a professor of orthopedic surgery and biomedical engineering at the Mayo Clinic College of Medicine, and Robert Kadlec, MD, MA, a former Air Force medical officer who, as the assistant secretary of Health and Human Services for Preparedness and Response from 2017 to 2021, envisioned Operation Warp Speed. No financial compensation was received for these contributions.

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