OTOLARYNGOLOGY/HEAD AND NECK SURGERY COMBAT CASUALTY CARE IN OPERATION IRAQI FREEDOM AND OPERATION ENDURING FREEDOM

Section VII: Unique Head and Neck Issues in the Deployed Setting

Soviet tank, minefield, Bagram Air Base, Afghanistan (2009).

Photograph: Courtesy of Colonel Joseph A. Brennan.

Chapter 45

OPERATING IN AUSTERE ENVIRONMENTS

RICHARD W. THOMAS, MD, DDS, FACS*

*Major General, Medical Corps, US Army; Director, Healthcare Operations, and Chief Medical Officer, Defense Health Agency, 7700 Arlington Boulevard, Suite 5101, Falls Church, Virginia 22042-5101; Chief, US Army Medical Corps

INTRODUCTION

He who wishes to be a surgeon should go to war.
— Hippocrates

Since the time of Homer, the primary mission of military medicine—*to support the warrior*—has remained largely unchanged. What has changed is our capability to deliver lifesaving medical technology to the leading edge of the battlefield and to ensure that our warfighter has the advantage of modern medicine wherever and whenever needed. Over the centuries, military medicine evolved from the practice of simply clearing wounded from the battlefield by relatively untrained individuals to today's US military medical forces' ability to provide state-of-the-art trauma care in some of the most remote places on the planet. Our nation's unique capacity to project military medical power is unprecedented and remains the envy of our allies and enemies.

The US government and its allies have long recognized the important role and significant contributions that military medics play in achieving broad strategic objectives. US military medical personnel have provided aid and support during numerous humanitarian assistance and disaster relief crises, even while engaged in support of combat operations elsewhere around the globe.[1–5]

Medical interventions not only provide critical humanitarian relief during crises, but also they facilitate stabilization of governments during uncertain times. Military medical professionals frequently provide medical care and medical training to host national healthcare providers throughout the world. In many ways, medicine is the ultimate "universal language" enabling collaboration and facilitating American military entry into areas otherwise closed to our access. This use of "medical diplomacy" is currently a valuable tool in the US and NATO (North Atlantic Treaty Organization) coalition forces' arsenal of efforts in Afghanistan. Because of its critical role, medical capabilities have been codified into US defense doctrine. Medical diplomacy serves as a critical component in the US military's Combatant Commanders' Theater Security Cooperation Program, providing a low-threat opportunity for nations to partner and collaborate while providing for the medical needs of the populace.

Although the primary mission to support and sustain the combatant forces remains largely a constant for military medicine, the nature of US military operations has certainly changed over time. As is evidenced in the most recent wars in Iraq and Afghanistan, military medicine must remain as flexible and adaptable as the combat forces we support. Challenges presented by the varying missions, terrain, and enemy forces require incredible creativity and adaptability by all aspects of our military forces, including those medical units supporting the warfighters. The ability to adapt to changing situations, austere environments, and other evolving mission requirements has emerged as the most essential element in ensuring optimal medical care during war. Delivering this world-class medical support to the warfighter requires continued strict adherence to the fundamental rules of battlefield medicine (Exhibit 45-1).

EXHIBIT 45-1

ARMY MEDICAL BATTLEFIELD RULES

- Be there (maintain a medical presence with the troops)
- Maintain the health of the command
- Save lives
- Clear the battlefield of casualties
- Provide state-of-the-art medical care
- Ensure early return to duty

In war, the only Victor is Medicine.[6]
— Mayo

Combat has always served as the greatest catalyst to medical innovation. In fact, most notable milestones in medicine are directly related to the experiences of military medics during wartime. The history of warfare is replete with examples of military campaigns that succeeded or failed due to the ability to adequately provide care for wounded, ill, and injured troops. In many cases, wars have been decided more on the basis of medical innovation and support than advances in military technology alone. Today's battlefields offer similar challenges and opportunities for advancing medical practice and enabling continued evolution of our modern healthcare system.

Historically, necessity drives enhancements in medical science. As tactics and weaponry change over time, military medicine builds new capabilities for treating

casualties and preventing disease. Among these advances, the development of a vertically integrated combat casualty care system delivering lifesaving medical care far forward on the battlefield and moving casualties both within and from the war zone has yielded survival rates exceeding 90%—unprecedented in the history of warfare. Through this "chain of care" from the point of injury in the most remote areas of Afghanistan to the major medical centers in the continental United States, our military medical professionals provide initial resuscitative care; medical evacuation; and transport to state-of-the-art, in-theater surgical care teams and eventually to stateside hospitals via the world's best, most advanced evacuation system. No other nation possesses a comparable tiered trauma response capability as refined or robust (Table 45-1; Figure 45-1).

Technological advancements born in war have improved routine and emergency treatment and patient evacuation capabilities. Specialties such as emergency medicine, trauma surgery, aviation medicine, and tropical medicine specifically evolved in response to combat wounding patterns. Our most recent experiences in combat operations in Iraq and Afghanistan reinforce the critical importance of military medicine's role in our national defense strategy. Today's US military healthcare system serves as the glue holding together our sometimes fragile coalitions with other nations.

TABLE 45-1

COMBINED US MILITARY PERCENT OF SURVIVABILITY IN OPERATION ENDURING FREEDOM/OPERATION IRAQI FREEDOM/ OPERATION NEW DAWN: 2001–2013

Year	Percent Survivability*
2001	89%
2002	82%
2003	89%
2004	91%
2005	89%
2006	89%
2007	89%
2008	89%
2009	89%
2010	92%
2011	93%
2012	93%
2013	94%
2001–2013	90%

*Percent survivability is equal to 100% — the number of soldiers Killed in Action (KIA) + the number of soldiers recorded as having Died of Wounds Received in Action (DOWRIA) ÷ the number of soldiers Wounded in Action (WIA) + KIA + DOWRIA for the theater of interest, ie,

Survivability = [1 – ((KIA + DOWRIA) / (KIA + DOWRIA + WIA))].

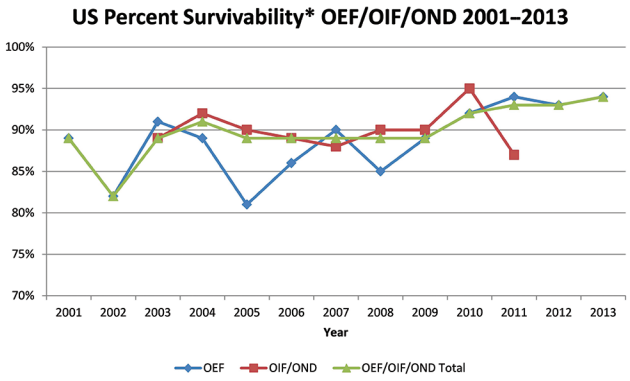

Figure 45-1. US percent survivability of Operation Enduring Freedom (OEF) / Operation Iraqi Freedom (OIF) / Operation New Dawn (OND): 2001–2013.

Recent innovations in traumatic brain injury research, treatment, and education have improved the ability of the warrior to respond and recover. Improvements in traumatic brain injury management, driven by research and practical experience in the military healthcare system, have advanced medical care for all of society. This is an exciting arena of evolving science where the experiences gained by those practicing military medicine benefit the much larger subset of society who experience concussive injuries.

Over the past dozen years, military medicine also championed and aggressively implemented enhanced pain management techniques and improved behavioral health treatment regimens. Military medical personnel led the development of a comprehensive pain management system subsequently adopted by the National Institutes of Health (Bethesda, MD) and the Institute of Medicine (Washington, DC) as a model for the management of patients suffering with chronic pain conditions.[7] This multidisciplinary and interdisciplinary management of complex cases included the establishment of clinical protocols emphasizing the use of traditional and nontraditional treatment modalities. A holistic, comprehensive approach has proven enormously successful in managing chronic pain and reducing substance abuse in these patients. Collaboration between military and civilian pain management professionals has enabled new opportunities for improving the lives of all Americans who struggle with similar conditions.

Future battlefields will pose new challenges and present opportunities for advancing medical practice and enabling the evolution of our modern

healthcare system. It is important to understand that major progress in developing civilian trauma care systems is rooted in lessons learned from wartime experience. It is also essential to recognize that the medical lessons from our most recent wars in Iraq and Afghanistan are only learned if we incorporate them into the current body of medical knowledge and practice.

THE BEGINNING OF US MILITARY MEDICINE

History documents the tremendous contributions of medical support on the morale and well-being of military forces from ancient times to the present.[8] Indeed, successful military commanders have long recognized the critical link between morale, warriors' health, and combat effectiveness. The existence of medical forces capable of conserving the fighting strength of the military remains a key factor in a unit's success. This concept proved true for Napoleon during his campaign to conquer the European continent. His chief surgeon, Baron Dominique Jean Larrey, relocated French surgeons closer to the fighting forces, thereby shortening the distance required to transport the wounded for care. Surgeons at the front could better evaluate and sort casualties for treatment. This triage system remains a fundamental component of both military and civilian medical management. Among the important modifications to military medicine attributed to Dr. Larrey and his colleagues were the following[8]:

- innovations in surgical techniques,
- timely delivery of wound care,
- enhancements in medical logistics,
- field sanitation, and
- an organized ambulance system.

Napoleon's enemies recognized the benefits of improved medical capabilities for the supported armies, and these concepts laid the groundwork for modern military medical doctrine.

The American Revolutionary War began with the initiation of hostilities in Boston, Massachusetts, in April 1775. General George Washington appealed to the Continental Congress, and on July 27, 1775, a "Hospital for the Army" was created.[9] Today's US Army Medical Department is the direct descendant of that fledgling service. However, unlike Napoleon's military, the Continental Army failed to establish a dedicated *ambulance volante* ("flying ambulance") to transport wounded soldiers for medical treatment. This omission led to delays in care and resulted in elevated mortality for those wounded in combat. Despite that error, significant developments in military medicine arose during the American Revolutionary War. The genius of military physicians such as Benjamin Rush, James Tilton, Joseph Lovell, and others enhanced preventive medicine practices, introduced vaccination programs, and improved hospital sanitation capabilities. Their collective contributions increased the understanding of disease pathophysiology, improved casualty survival, and reduced suffering among their patients.

The American Civil War served as an important era in the development of military medicine capabilities. The Army Medical Department proved woefully unprepared at the outbreak of hostilities with only "114 doctors to care for the 16,000 men" serving in the US Army.[10] Eventually, more than 12,000 physicians served in the military medical departments. One such doctor was Jonathan Letterman, who received an appointment as Medical Director for the Army of the Potomac. Letterman called on lessons learned from Larrey, and demonstrated his own ingenuity to organize and manage military hospitalization and evacuation systems. Although Letterman's innovations were undoubtedly responsible for saving numerous lives, the combination of increasingly lethal weapons, antiquated tactics, and an ill-prepared medical service led to a "strategic/capabilities" mismatch generating horrific numbers of casualties.[11] More than 620,000 Americans would eventually die during the Civil War.

In addition to the development of organized hospital and medical evacuation systems, this period heralded the delivery of echeloned care on the battlefield. Streamlining patient evacuation, positioning surgeons on the battlefield, and organizing medical units served to shorten the distance between the "point of injury" and available treatment. Apportioning medical assets and treatment according to defined levels of need remains a concept still utilized by modern-day combat medics and trauma surgeons.[12] Minimizing the time and distance from the point of injury to lifesaving treatment and care remains the central focus of modern trauma care.[12]

World War I saw the mobilization of nearly five million US military men and women. This represented the first large-scale deployment of American troops overseas, and the military medical effort was significant. Although modern weapons delivered increased lethality, battlefield deaths dropped to nearly half (8 per 100) of those seen during our Civil War.[13] An echeloned care system for evacuation and treatment of the wounded proved effective, although those requiring lifesaving surgery still traveled to hospitals in the rear

areas. This prompted surgeons to champion efforts to position surgical units closer to the front in order to save more lives.

World War II (WWII) also brought about dramatic improvements in American medicine. The "died of wounds" rate for US forces dropped from the World War I level of 8% to approximately 3.5% in WWII.[12] Advances in patient survivability were largely driven by improvements in surgical care, the introduction of antibiotics (penicillin and sulfa), enhanced patient evacuation systems, and increased emphasis on preventive medicine practices.[14] WWII saw the first use of plasma and whole blood products on the battlefield, further contributing to increased survival rates. These enhancements provided by American military medical forces were highlighted in an analysis of WWII casualty care capabilities[15] conducted by Lieutenant Colonel (Dr) Michael DeBakey and colleagues. DeBakey proved instrumental in recognizing the importance of many of the medical techniques and practices pioneered in WWII and later helped establish the first Mobile Army Surgical Hospital concept.[16] These mobile hospital units proved their value during the Korean War as the ultimate refinement of frontline surgical capability. Their smaller, modularized, and transportable configuration transformed combat medical care, and later generations of these hospitals saw service in Vietnam.

All the circumstances of war surgery thus do violence to civilian concepts of traumatic surgery. The equality of organizational and professional management is the first basic difference. The second is the time lag introduced by the military necessity of evacuation. The third is the necessity for constant movement of the wounded man, the fourth—treatment by a number of different surgeons at different places instead of by a single surgeon in one place—is inherent in the third. These are all undesirable factors, and on the surface they seem to militate against good surgical care. Indeed, when the overall circumstances of warfare are added to them, they appear to make more ideal surgical treatment impossible. Yet this is not true in the war we have just finished fighting, nor need it ever be true. Short cuts and measures of expediency are frequently necessary in military surgery, but compromises with surgical adequacy are not.[12]

— Michael E. DeBakey, MD

Additional improvements in combat medicine during the Korean and Vietnam Wars include advancements in vascular surgery techniques and the evolution of other subspecialty services that provided unprecedented levels of surgical expertise to hospitals deployed to the combat zone. The introduction of the helicopter for patient movement streamlined access to resuscitative and surgical care while enabling the timely forward delivery of blood and vital medical supplies. Further maturation of patient evacuation systems providing intra- and intertheater transport of wounded, ill, and injured service members has continued to evolve to present-day combat operations (Figure 45-2).

The combination of all of the described factors enables our US military medical system to achieve historic survival rates during combat operations in Iraq and Afghanistan.[17] During WWII, approximately one in every three wounded service members died of wounds. That number decreased to nearly one in ten for Operation Iraqi Freedom. A major contributing factor to higher survival rates is the enhanced trauma care training provided to frontline medics and corpsmen. Regardless of the number of medical units deployed to a combat zone, the skill of the combat medic (or other "first responder") determines the outcome for the majority of wounded.[18] Improved skill sets for these medical providers have proven decisive in saving lives on the battlefield.

September 17, 2013	OEF	OIF	OND	OCO	
Casualty Type	October 7, 2001 — September 17, 2013	March 19, 2003 — August 31, 2010	September 1, 2010 — December 18, 2011	All Theater	
Hostile Death (KIA or DOWRIA)	1,277	2,536	38	3,851	KIA, DOWRIA
Nonhostile Death	319	697	22	1,038	—
Wounded in Action (WIA)	13,633	22,225	293	36,151	WIA

Figure 45-2. US Army casualty summary (2001–2013).
DOWRIA: Died of Wounds Received in Action; KIA: Killed in Action; OCO: overseas contingency operations; OEF: Operation Enduring Freedom; OIF: Operation Iraqi Freedom; OND: Operation New Dawn; WIA: Wounded in Action
Data source: Defense Manpower Data Center (Washington, DC).

Increased survivability for the combat wounded is directly attributable to access to emergency medical and surgical treatment, decreased evacuation times, enroute medical care, and the use of improved body armor.[19] Wound-related statistics maintained by the U.S. military's Joint Theater Trauma Registry Treatment Registry have been exceptionally useful in documenting the impact of injuries, and enabling and evaluating improvements in medical practices and individual protective equipment.[20]

THE WAY AHEAD: FUTURE MILITARY MEDICAL CARE IN THE COMBAT ZONE

The US Military Health System (MHS) has a long and proud history in ensuring the health and safety of our Armed Forces. The MHS responds to combat, humanitarian, and other contingencies around the world and advances medical practice for all of society. The US MHS is unique in its capabilities; no other military has a medical force to rival ours anywhere on the planet. The performance of our MHS has been tested time and again, and its success has been characterized by ever-increasing joint operations. The future force will leverage technologies that protect the warfighter and place unparalleled capabilities in the hands of soldiers. Networked systems of sensors, communications, battle command, and computational power will enable soldiers to "see first, understand first, act first, and finish decisively" on the future battlefield.[21] The 21st century medical capabilities will be similarly empowered to support the future warrior. To be ready and relevant, we must be prepared and trained to operate in a joint environment with a rapidly deployable medical force. Our ability to adapt and enhance our capabilities to be successful across the entire spectrum of military conflict from major combat to stability operations is an essential core competency for the future military medical force[21] (Figure 45-3).

The amazing medical capabilities described thus far represent a significant cost to our nation. The MHS presently consumes nearly 10% of the entire Department of Defense budget. If the MHS cannot bend the cost curve, anticipated defense-related healthcare costs will rise to $65 billion by 2016 and $95 billion by 2030. This increasing financial burden has prompted efforts to lead changes in the MHS focused

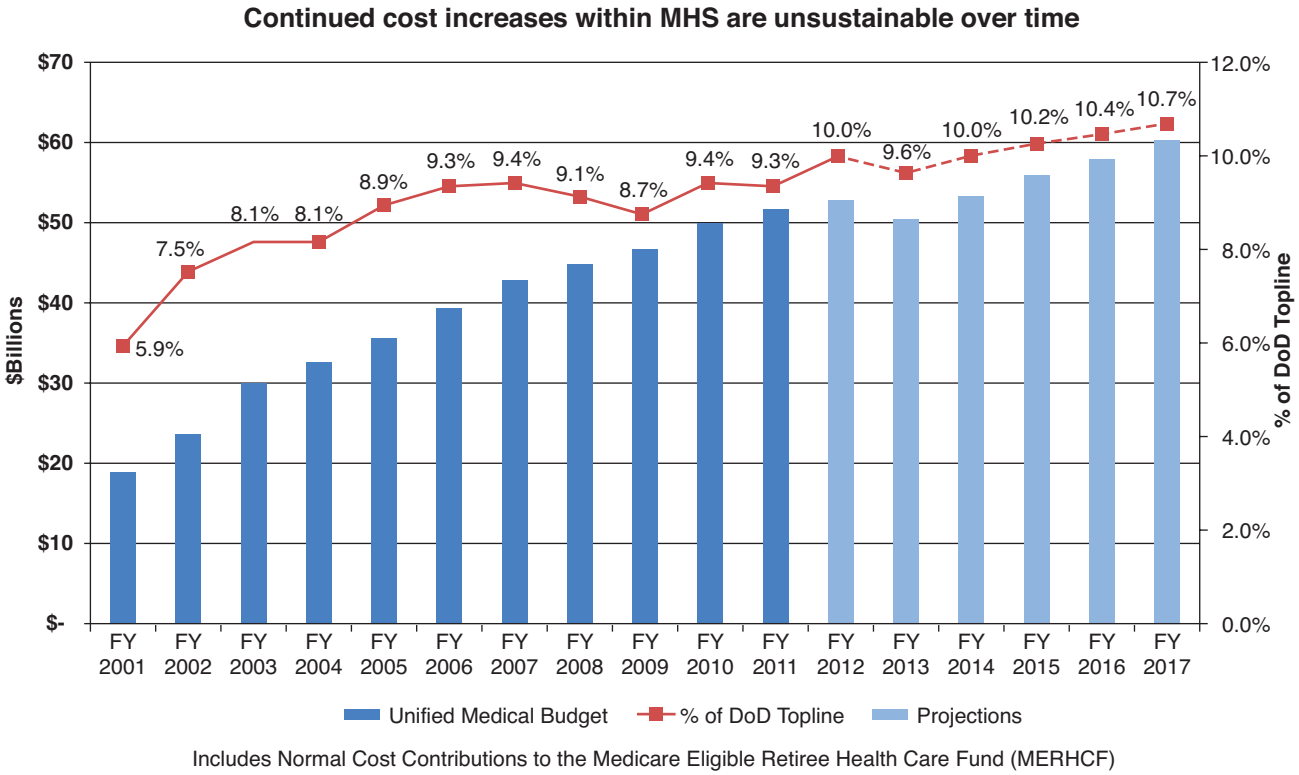

Figure 45-3. Current and projected defense medical budget as a percentage of the Department of Defense's budget.
DoD: Department of Defense; FY: fiscal year; MHS: Military Health System
Data source: comptroller.defense.gov (Office of the Under Secretary of Defense [Comptroller]).

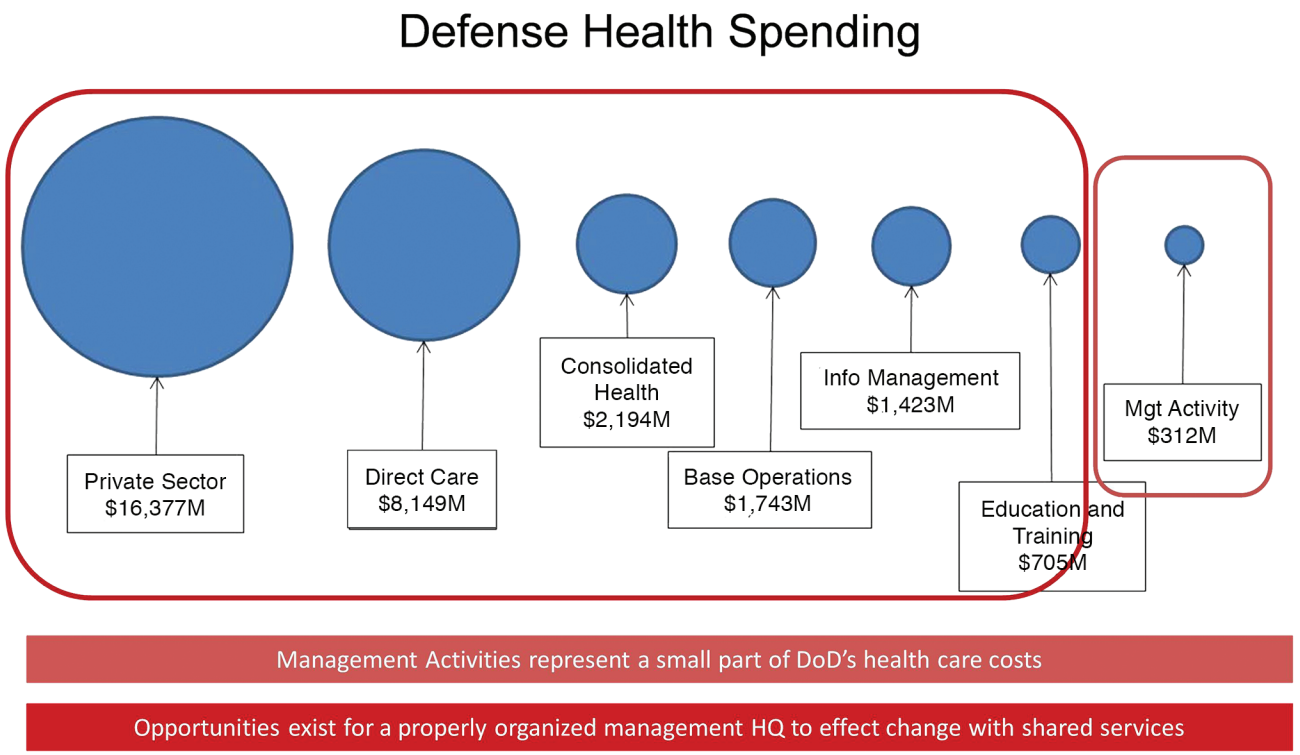

Figure 45-4. DoD healthcare expenditures.
DoD: Department of Defense; Info: information; HQ: headquarters; Mgt: management
Data source: Fiscal year President's budget position for Defense Health Program Operations & Maintenance.

on reducing cost while ensuring a world-leading medical system capable of supporting the military both at home station and while deployed around the globe (Figure 45-4).

To meet these emerging demands, the MHS is being restructured to a Defense Health Agency (DHA), which is intended to serve as the integral and accountable institution in constructing a more joint, integrated MHS. The global mission for military healthcare will be supported by the DHA, which will serve as a new model for sustainable, effective, and efficient medical support to our combatant commanders. The DHA represents the Department of Defense's interservice, joint combat support agency chartered to operate and oversee shared services affecting all aspects of military medicine.

The evolution of a DHA highlights the spirit of innovation in military medicine—recognizing challenges, applying creativity and intelligence in developing workable solutions, and then investing significant organizational energy to achieve success. Although early in its evolution, the DHA has the potential to serve as a model for collaboration and integration for other military optimization efforts.

As these reforms unfold, it is essential that we also maintain our unique "go-to-war" medical capabilities. After all, the evolution of the MHS into the finest medical care delivery system in the world was not an accident. Military medicine has evolved to support the warfighter (anywhere and at any time). Whether providing lifesaving medical care at the most remote areas on a distant battlefield or in one of the US military's major medical centers, our ability to continue the sacred mission of military medicine will depend on future requirements. If the United States is to maintain a vertically integrated combat trauma care system in support of our national security interests, we must continue to evolve and modify our medical force capabilities.

Maintaining an expeditionary capability is essential for the future medical force. Modularity in the design of deployable medical units has proven to be immensely important as we seek to improve our medical capabilities in austere environments. The US military now routinely tailors medical support elements to optimize capabilities. Mission requirements drive the size and complexity of the deployable medical force. It is important to recognize that the synchronization

of efforts in the provision of joint service medical capabilities remains essential in the future medical force. Coordination between various service component medical commands will best enable a mutually supportive healthcare system.[20] The DHA organizational construct helps ensure the continuum of care from the leading edge of the battlefield to continental US military treatment facilities.

This concept of future medical support to the warfighters can be realized through the joint-capable DHA, where integration of medical support to the military services is ultimately aligned under one strategic command element. Theater-specific military medical support remains an essential, joint, interagency, and intergovernmental function. Continuity of care will require synchronization of the joint medical system to include planning, treatment, evacuation, and sustainment of the force.

Modularizing field medical forces alone will not ensure optimal healthcare for the future force of the 21st century. Although modularity and restructure of medical mission command have proven paramount to the military medicine transformation, key enablers to this process include incorporation of medical technology advances and training innovations.[22] Military medicine continues to adapt doctrine and leverage advanced technologies to improve deployable medical capabilities. Today, US military medical researchers lead the development of

- more effective vaccines,
- hemorrhage control devices,
- improved patient monitoring systems,
- improved patient transport equipment, and
- blood products

to further enable survivability for trauma patients. By leveraging and investing in emerging technologies, the medical force can be more efficiently deployed, better employed, and ultimately save more lives.

Ongoing combat operations present opportunities for learning and improving our military medical capabilities. The US military system for training combat medics and corpsmen is continually adapted to incorporate and reflect lessons learned from recent wartime experiences and to integrate new technologies.[23] Trauma training for both medical and nonmedical personnel has proven to be a principal contributor to increased survival rates. Combat Lifesavers, nonmedical personnel who receive enhanced first-aid training under the direction of medical professionals, help augment medical care for wounded troops.

Time delays remain a primary concern in combat casualty care. Historically, approximately 50% of combat deaths were the result of unchecked hemorrhage, and 62% died within a few minutes of wounding.[24] Innovative training of medics and other military personnel has resulted in improved survival statistics for combat casualties: 12% over the past decade (Figure 45-5).

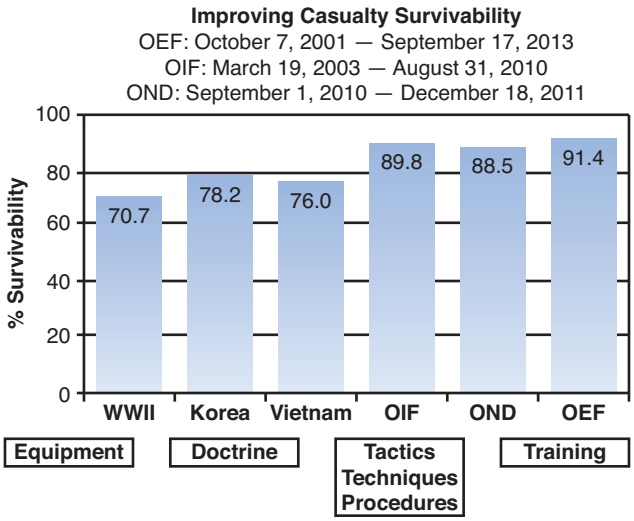

Figure 45-5. Improving casualty survivability.
OEF: Operation Enduring Freedom; OIF: Operation Iraqi Freedom; OND: Operation New Dawn; WWII: World War II

SUMMARY

The US military medical force possesses unparalleled capabilities with which to accomplish our strategic national objectives. Protecting the health and welfare of our military has been the mission of military medicine since the establishment of the Army Medical Department in 1775. Over the course of our nation's history, US military medicine has evolved into the preeminent medical force in the world. Military medicine produced numerous innovations and technological advancements improving the care of patients both on the battlefield and within our society. Lessons learned from wartime service by many thousands of dedicated healthcare professionals have revolutionized the practice of medicine. In particular, the evolution of trauma care is directly attributable to our military experiences with combat casualty care.

Today's US military provides state-of-the-art medical care to millions of beneficiaries in hospitals and clinics across the globe. The challenges facing

today's military healthcare system are as diverse as the military operations they support. Perhaps the most significant enhancement to military medicine in recent years has been the increased awareness by commanders of the vital role of force health protection. Modern military leaders fully understand the importance of a deployable medical force to sustain the warfighting force. Future demands for force medical support will include combat support and humanitarian assistance/disaster relief missions. It is unlikely that a nation will deploy without the support of others. We have seen the increased dependency on coalitions to support combat and contingency operations in recent years. Both civilian and military leaders understand that medical support is a true "force multiplier," and commanders would not conceive deploying without their medical professionals. Through appropriate allocation of medical assets and the continued applications of new, evolving technologies, US military medicine will continue to support the warfighter and provide optimal care to the wounded, ill, and injured.

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