



Challenges to Improving Combat Casualty Survivability on the Battlefield

By Robert L. Mabry

We succeed only as we identify in life, or in war, or in anything else, a single overriding objective, and make all other considerations bend to that one objective.

—DWIGHT D. EISENHOWER

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The United States has achieved unprecedented survival rates (as high as 98 percent) for casualties arriving alive to a combat hospital.¹ Official briefings, informal communications, and even television documentaries such as “CNN Presents *Combat Hospital*” highlight the remarkable surgical care

taking place overseas. Military physicians, medics, corpsmen, and other providers of battlefield medical care are rightly proud of this achievement. Commanders and their troops can be confident that once a wounded Servicemember reaches the combat hospital, his or her care will be the best in the world.

Combat casualty care, however, does not begin at the hospital. It begins in the field at the point of injury and continues through evacuation to the combat hospital or forward surgery. This prehospital phase of care is the first link in the chain of survival for those injured in combat and represents the next frontier for making significant improvements in battlefield trauma care.

Even with superb in-hospital care, recent evidence suggests that up to 25 percent of deaths on the battlefield are potentially preventable.² The vast majority of these deaths happen in the prehospital setting. The indisputable conclusion is that any meaningful future improvement in combat casualty outcomes depends on closing the gap in prehospital survival. Improving prehospital combat casualty care, however, may be significantly more challenging than improving hospital-based casualty care because of significant structural challenges facing the military medical establishment. I describe five key challenges and a plan to overcome them.

Challenge 1: Ownership

Responsibility for battlefield care delivery is distributed to the point where seemingly no one “owns” it. Unity of command is not established, and thus no single senior military medical leader, directorate, division, or command is solely focused on battlefield care, the quintessential mission of military medicine. This diffusion of responsibility is a result of multiple agencies, leaders, and units of the Service medical departments each claiming bits and pieces, with no single entity responsible for patient outcomes forward of the combat hospital. Combat arms commanders “own” much of the battlefield casualty care assets in that medics, battalion physicians, physician assistants, flight medics, and associated equipment are assigned to their operational units, yet combat arms commanders are neither experts in, nor do they have the resources to train their medical providers for, forward medical care. Commanders rely on the Service medical departments to provide the right

personnel, medical training, equipment allocations, doctrine, and the medical force mix in their units. In turn, while the institutional base trains and equips the combat medical force, it defers the responsibility of battlefield care delivery to line commanders. While this division of responsibility may at first glance seem reasonable, the net negative effect of line commanders lacking expertise and medical leaders lacking operational control has been documented.³ The axiom “when everyone is responsible, no one is responsible” applies.

The concept of Tactical Combat Casualty Care (TCCC) evolved to fill this gap for line commanders. Originating from a paper published in *Military Medicine* in 1993,⁴ TCCC created a conceptual framework focused on treating life-threatening battlefield injuries while taking into account tactical considerations. A Navy physician and former SEAL team member, Dr. Frank Butler spearheaded what has now emerged as the most significant battlefield medical advancement of the past decade. Before the advent of TCCC, combat medics were taught civilian-style first aid. Many of these techniques, based on civilian injury patterns such as motor vehicle accidents, were unhelpful or frankly dangerous when performed under fire.

The Committee on TCCC (CoTCCC) is organized under the Joint Trauma System and is responsible for promulgating the tenets of TCCC. Its origins were nontraditional, reflecting a grassroots effort by a dedicated group of surgeons, emergency physicians, and experienced combat medics to incorporate new evidence and best practices into prehospital treatment guidelines. As a paradigm, it is thoroughly grounded in the realities of the modern battlefield. The very existence of the CoTCCC, an organization born outside the traditional military medical establishment, exposes a void in ownership and expertise in battlefield care.

In contrast to combat casualty care, other areas of the military medical establishment are led by flag officers. In the Army Medical Department, for example, brigadier generals lead veterinary

medicine and warrior transition care. Dentistry and nursing are both led by major generals. Battlefield care would strongly benefit from similar centralized senior leadership. Establishing organizational ownership such as a battlefield medicine directorate, division, or command is the key first step.

Challenge 2: Data and Metrics

The Services’ medical departments repeatedly cite the reduction of case fatality rates to historically low levels as a major medical accomplishment during operations in Iraq and Afghanistan. While seemingly positive, this statistic tells only part of the story. The case fatality rate, or the percentage of those injured who died, reflects multiple factors including weapons and tactics, protective equipment, and medical care.⁵ In other words, current data equally support the conclusion that the enemy’s lack of regular combat units, artillery, and armor (the major casualty producers in conventional warfare) and reliance instead on improvised explosive devices is plausibly just as responsible. While many intended improvements have been made in military trauma systems, especially at the combat hospital and higher, there are few data to link specific actions to a direct and quantifiable relationship to lowered case fatality rates. Repeatedly citing “the lowest case fatality rate in the history of warfare” as an affirmation of military medicine’s success over the past decade, without a sober account of other contributory and confounding factors, risks sending the message that battlefield trauma systems are nearly perfected and no further significant improvements are required or even possible.

Another problematic statistic is the “died-of-wounds” (DOW) rate, or the percentage of those reaching medical care who later die. Remarkably, recent DOW rates exceed those of World War II and the Vietnam era.⁶ While startling, this does not necessarily reflect a decline in care. As evacuation becomes faster and prehospital care improves, the DOW rates will go up as more mortally injured casualties will reach the hospital alive.

Conversely, if evacuation is delayed or medic care is poor, more will die in the field and reduce the DOW rate. Neither the DOW nor the case fatality rate quantifies the effect of medical care on survival, nor do they provide insight into where specific improvements in combat casualty care can be made.

Another statistic that distorts the overall effectiveness of combat casualty care is the hospital survival rate. Surgical care in combat hospitals and care in the subsequent evacuation chain back to the United States have advanced to such a degree that 98 percent of casualties making it there alive will go on to survive their wounds. By definition, it does not capture those with potentially survivable injuries who died in the field or died during prehospital evacuation. In other words, it does not speak to all of the casualties who succumb prior to hospitalization. What is needed is a metric encompassing the full spectrum of care that includes the prehospital setting.

In contrast, the potentially preventable death rate illuminates where care can be improved along the entire chain of survival, from the point of injury to rehabilitation back in the United States. This rate is defined as deaths that could be avoided if optimal care could otherwise be delivered. The challenge of deriving this statistic comes from the complexity in determining if a death is potentially preventable. To accomplish this, specific clinical facts must be collected on each case; however, as we discuss shortly, prehospital data are often difficult to collect.

The potentially preventable death rate is derived by examination of autopsy and medical records by a multidisciplinary physician panel. One such review examined all the U.S. combat deaths in Iraq and Afghanistan from 2001 until 2011 and found up to 25 percent to be potentially preventable.⁷ The vast majority of these (87 percent) died before reaching a surgeon or combat hospital. Many of the remaining 13 percent who died in the hospital were in profound shock on arrival and would have likely benefited from aggressive prehospital resuscitation. It is important to recognize that this figure, like the DOW rate, does not necessarily

reflect inadequate care. All of these casualties were severely injured. Some would have required immediate, on-the-spot access to the most advanced care (that is, the kind found only in premier trauma centers in the United States) to have any hope of survival, and others died related to unavoidable delays due to ongoing combat operations (for example, hostile fire). However, many could have survived with currently available prehospital medical interventions if only these interventions were routinely and correctly employed. Unfortunately, we continue to know little about what care is provided before casualties reach the combat hospital.

The key goal is a coherent system to collect prehospital patient care information. We know little about this phase of care.⁸ Only one military unit we are aware of, the U.S. Army's 75th Ranger Regiment, has collected complete sets of casualty care data. The commander of the 75th Ranger Regiment has taken ownership of that unit's casualty response system. Using their Ranger Casualty Card and their unit casualty registry, unit leaders are able to determine what happened to every Ranger casualty during all phases of care. Ranger commanders routinely use this data to improve their casualty response systems. The Rangers are also the only unit in the U.S. military that can demonstrate no potentially preventable deaths in the prehospital setting after more than a decade of combat.⁹

Systematically examining potentially preventable deaths and prehospital care data gives a more accurate assessment of the entire continuum of care compared to other metrics. If collected and analyzed quickly, it also allows for the development of an agenda to improve casualty care in near real time. The Israel Defense Forces (IDF) medical corps has embraced the concept of eliminating preventable deaths as part of the next 10-year force build-up plan and emphasizes point-of-injury care.¹⁰

A significant recent positive example of data-driven combat casualty care improvement concerns the capabilities of medics staffing medical evacuation (medevac) helicopters, which have traditionally been staffed by medics trained at

the basic emergency medical technician level. Staffing civilian medical helicopters with advanced paramedics has been done since the 1980s and advocated for military medevac since the 1990s. A recent study comparing a National Guard medevac unit staffed with flight paramedics trained in critical care showed a 66 percent reduction in mortality compared to the standard flight medics.¹¹ The Army adopted a program—after nearly 40 battlefield after-action reports recommended it but lacked detailed supporting data—in 2011 to train critical care paramedics for helicopter medevac. With better data collection in the prehospital setting, it is likely the decision cycle could be far reduced from the 11 years observed.

Changing the narrative of “unprecedented” survival rates to instead highlight the 25 percent potentially survivable death rate does place military medicine in a difficult strategic communications predicament. A fair and open accounting of the successes to date as well as where progress needs to be made is imperative. In 1984, Dr. Ron Bellamy examined many of the same issues discussed here following analysis of Vietnam-era casualty data. He noted, “A research program designed to improve health care delivery will have the greatest impact if its goals are chosen after a comprehensive review has been made in the ways of which the existing system fails.”¹² A similar comprehensive review of combat casualty care in Iraq and Afghanistan is recommended.

Challenge 3: Prehospital and Trauma Expertise

If the prehospital setting is the area where nearly all potentially preventable deaths occur, then it is likely not coincidentally an area of limited organizational expertise. It would be natural to expect that the Services, especially the ground forces, would invest heavily in clinical experts in far-forward combat casualty care. Paradoxically, the opposite appears true. The Army, for example, relies on the Professional Officers Filler System (PROFIS) to provide the bulk of forward medical officers. PROFIS is a Cold War-era program whereby primary care physicians from the base



Soldier from 1st Stryker Brigade Combat Team, 25th Infantry Division, based in Fort Wainwright, Alaska, gives thumbs-up to members of his unit after being injured by roadside bomb in Kandahar Province (DOD/Haraz Ghanbari)

hospital are tasked, often just before combat deployment, to serve as battalion surgeons responsible for the resuscitation of battle casualties in the battalion aid station. This is reminiscent of how emergency rooms (ERs) were staffed in the 1960s and 1970s, when junior physicians just out of training (or disinterested physicians from unrelated specialties) were rotated into the ER. Like the PROFIS physicians, these physicians had no in-depth training in resuscitation or emergency care or, worse, little interest in even learning it. Many of these PROFIS physicians, often inexperienced and unprepared, are placed into operational positions outside the scope of their training. This professionally unrewarding experience likely contributes to many leaving the military at the first available opportunity.¹³

The Korean and Vietnam wars set the stage for the emergence of modern emergency medical services (EMS) systems in the late 1960s. These wartime experiences spurred the development of a robust “system of systems” comprised

of emergency medical technicians, ambulances, communications, training programs, medical direction, and trauma centers that integrate prehospital and hospital trauma care. The investment paid off as trauma centers opened in nearly every major urban center, and large swaths of the population are now served by effective and cohesive trauma care systems. Yet the combat casualty on the battlefield today, like the accident victim in the 1960s ER, is likely attended to by a physician or physician assistant with no formal training in emergency medicine or trauma resuscitation. In the intervening years, ERs and the physicians who staff them have evolved into a sophisticated and specialized system of care, while the model for physician care in forward aid stations remains largely stuck in the practices of the past century.

Since the 1980s, programs have emerged to train physician specialists in trauma surgery, emergency medicine, and prehospital care. Without a major conflict since the emergence of these new specialties, there simply has not been

a demonstrated need for them in the military until now. Nor has there been a critical appraisal of how these relatively new specialties could be leveraged to optimize combat casualty care. For example, the Department of Defense has only one relatively new prehospital training program capable of training three physicians per year. Today, the Army has fewer than a dozen prehospital physician specialists and about the same number of trauma surgeons on Active duty. By comparison, the Army has roughly the same number of radiation oncologists and nearly three times the number of pediatric psychiatrists and orthodontists. This is largely because medical specialty allocations are based on traditional peacetime beneficiary care needs. Refocusing on the wartime needs could populate key institutional and operational billets with a critical mass of trained prehospital and trauma specialists and drive further advances in battlefield care during peacetime.



Flight medic treats Soldier from 1st Stryker Brigade Combat Team, 25th Infantry Division, while en route to Kandahar Airfield for additional treatment (DOD)

Challenge 4: Research and Development

Current research and development efforts are focused on material “things,” and our current medical combat development efforts are primarily focused on rearranging existing paradigms for doctrine, manpower, and equipment. Less attention is paid to training, leadership, and organization, yet the current literature shows these areas have made the most significant documented improvements in survival. Three examples can illustrate the potential for capitalization. First, the Rangers, with their command-led casualty response system, are able to document no potentially preventable prehospital deaths after more than a decade of combat.¹⁴ Second, staffing a forward battalion aid station with emergency medicine-trained providers showed a 30 percent reduction in deaths.¹⁵ Third, adopting current

civilian air ambulance standards during helicopter evacuation in Afghanistan showed a 66 percent reduction in the risk of dying.¹⁶ The training level and capabilities of the providers in these examples exceeded the existing doctrinal model, and the benefits were tangible. The solution lay with people, not technology. Using a sports analogy, the Department of Defense is spending billions of dollars trying to perfect golf clubs, golf balls, and golf shoes, and virtually no research dollars on how to train the best golfers.

Prehospital care experts should direct and advise key research and development efforts and set research priorities focused on improving prehospital casualty survival. Traditional measures of research program success (grants awarded, papers published, and abstracts presented) should be shifted in favor of measurable solutions to specific battlefield problems

(such as reducing preventable death, improving procedural success, and reducing secondary injury).

To be sure, advanced technology can pave the way for enhanced combat casualty care. Examples of recent tools placed in the hands of medics and battalion medical officers include tourniquets, junctional hemorrhage control devices, and intraosseous needles. Yet many of these so-called new tools and concepts have existed for decades or even centuries. With the exception of the hemostatic dressing, no new technology has been put into the medic’s aid bag today that did not exist a century ago. The proposition is to balance the investment between things and people to optimize care on the battlefield.

Challenge 5: Hospital Culture

The delivery of health care in fixed facilities is military medicine’s largest

mission, dwarfing all the others. At a cost of nearly \$60 billion, the Military Health System (MHS) represents one of the most expensive components of the overall defense budget and is under constant scrutiny from Pentagon leaders. Former Assistant Secretary of Defense for Health Affairs Dr. Sue Bailey stated that “we are an HMO [health maintenance organization] that goes to war,” a statement that sums up a continuing concept regarding military medicine’s primary focus on beneficiary care at fixed facilities. Indeed, when physicians are tasked to deploy from hospitals in the United States to the combat zone, a regulation calls them “fillers,” and hospital personnel officers colloquially refer to the loss of skilled physicians as “the operational tax.”¹⁷

Regarding the combat medics’ role, the traditional conceptual framework for some medical leaders starts not at the point of injury but rather in the combat hospital (or forward surgical team): “Get the casualty to the hospital and we will take care of them.” This is a legacy of the Cold War era when the combination of massive casualties and limited far-forward capability meant few meaningful interventions were possible until the casualty reached a combat hospital.¹⁸ Today, we know the actions or inactions of the ground medic, flight medic, or junior battalion medical officer *can* mean the difference between delivering a salvageable casualty or a corpse to the combat hospital. We expect medics to perform life-saving treatment under the most difficult of circumstances, but we invest minimal institutional effort toward training them to a high level or insisting they train alongside physicians and nurses in our fixed military hospitals during peacetime.

In their defense, military medical leaders face a unique set of challenges combat arms commanders do not face. Combat arms commanders focus on preparing for war. When not deployed or in a recovery or support cycle, they are focused on training and preparing for the next mission. Conversely, the MHS is expected to perform its mission of delivering high-quality healthcare to

military beneficiaries in its fixed facilities every day *and* be prepared to go to war at a moment’s notice. Historically, the overwhelming pressures of providing beneficiary care in clinics and hospitals have conspired to redirect resources away from maintaining or improving battlefield care skills during peacetime.¹⁹ Future efforts should be devoted to breaking free from this seemingly intractable constraint.

A Way Forward

If history is any guide, making significant interwar advancements in battlefield medical care will be difficult. As the current conflicts end, repeating the narrative of low case fatality and high survival rates without a comprehensive and sober review of both successes and where improvements could be made risks impeding the ability to truly learn the lessons that would improve the survival of Soldiers, Marines, Sailors, and Airmen in the next conflict.

As a call to action, the following steps offer a potential way forward to overcome these five challenges.

- Adopt the Israel Defense Forces or similar model of combat casualty care focus and make an institutional commitment to eliminating potentially preventable death. Allow careful study of these deaths to drive the training, research, and development agenda.
- Establish leadership of battlefield care at the most senior level, and hold the Service medical departments accountable for improving it.
- Obtain data and metrics from the point of injury and throughout the continuum of care, and use this information to drive evidence-based decisions.
- Commit to training physician, nursing, and allied health providers to become “combat medical specialists” and placing them in key operational and institutional positions to leverage improvements in training, doctrine, research, and development.
- Direct research funds toward solving prehospital clinical problems, and balance these funds to include

research on training, organization, and leadership, not just material solutions.

- Evolve the current paradigm of military medicine from an organization culture chiefly focused on full-time beneficiary care in fixed facilities and part-time combat casualty care—the “HMO that goes war”—toward an organizational culture that treats battlefield care delivery as its essential core mission. This need not lessen the importance or scope of beneficiary care and, if agilely executed, could enhance the prestige and cachet of the beneficiary mission.

Addressing leadership, strategy, metrics, workforce, and patient outcomes is the common methodology for promoting excellence in hospital-based healthcare. The same methodology could be used to improve care forward of the hospital. Such a program would require a significant realignment of resources and priorities within military medicine that would challenge existing bureaucratic and leadership hierarchies. Acting on what we have learned to prepare for the next conflict in a resource-constrained interwar period will challenge our medical leaders. Civilians can operate peacetime hospital systems, perhaps even more efficiently than the military. Yet ultimately, going to war is the unique mission of military medicine that distinguishes us from civilian healthcare and justifies our cost to the Nation. If military medicine cannot demonstrate ownership of and expertise in its quintessential mission, prehospital and battlefield trauma care, we must ask ourselves why military medicine exists. JFQ

Notes

¹ The author would like to recognize Surgeon Commodore Alasdair Walker, the United Kingdom’s Military Health Services’ Medical Director, as the inspiration for this article. During the 2013 Military Health System Research Symposium in Fort Lauderdale, Florida, Dr. Walker described a concept called the “Walker Dip.” Citing the abysmal medical care available to British forces during the Crimean War, he traced recurrent historical cycles whereby medical care improves during con-



Aeromedical evacuation technician with 651st Expeditionary Aeromedical Evacuation Squadron checks on Afghan man in critical but stable condition for transport, Forward Operating Base Tarin Kowt, Afghanistan (U.S. Air Force/Greg Biondo)

flicts, but the lessons are forgotten afterward and have to be relearned again during the next war, thus repeating the cycle. The Walker Dip can be traced from the American Civil War through every U.S. conflict since, including Iraq and Afghanistan. The author hopes this discussion will help the U.S. military health system avoid the Walker Dip and thanks Dr. Walker for his inspiration.

² Brian J. Eastridge et al., “Death on the Battlefield (2001–2011): Implications for the Future of Combat Casualty Care,” *Journal of Trauma and Acute Care Surgery* 73, no. 6, Supplement 5 (December 2012), S431–S437; Joseph F. Kelly et al., “Injury Severity and Causes of Death from Operation Iraqi Freedom and Operation Enduring Freedom: 2003–2004 Versus 2006,” *Journal of Trauma and Acute Care Surgery* 64, no. 2 (February 2008), S21–S26; discussion S27.

³ Robert L. Mabry and Robert A. De Lorenzo, “Improving Role I Battlefield Casualty Care from Point of Injury to Surgery,” *Army Medical Department Journal* (April–June 2011), 87–91.

⁴ Frank K. Butler, Jr., John Hagmann, and E. George Butler, “Tactical Combat Casualty Care in Special Operations,” *Military Medicine* 161, no. 1, Supplement 1 (August 1996), 3–16.

⁵ John B. Holcomb et al., “Understanding Combat Casualty Care Statistics,” *Journal of Trauma and Acute Care Surgery* 60, no. 2 (February 2006), 397–401.

⁶ Ibid.

⁷ Eastridge et al.

⁸ Brian J. Eastridge et al., “We Don’t Know What We Don’t Know: Prehospital Data in Combat Casualty Care,” *Army Medical Department Journal* (April–June 2011), 11–14.

⁹ Russ S. Kotwal et al., “Eliminating Preventable Death on the Battlefield,” *Archives of Surgery* 146, no. 12 (August 2011), 1350–1358.

¹⁰ Author correspondence with Dr. Elon Glassberg, Head of Trauma and Combat Casualty Care Branch, Israel Defense Forces, August 20, 2013.

¹¹ 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, Supplement 1 (August 2012), S32–S37.

¹² R.F. Bellamy, “The Causes of Death in Conventional Land Warfare: Implications for Combat Casualty Care Research,” *Military Medicine* 149, no. 2 (February 1984), 55–62.

¹³ Melony E. Sorbero et al., *Improving the Deployment of Army Health Care Professionals: An Evaluation of PROFIS* (Santa Monica, CA: RAND, 2013).

¹⁴ Kotwal et al.

¹⁵ Robert T. Gerhardt et al., “Out-of-Hospital Combat Casualty Care in the Current War in Iraq,” *Annals of Emergency Medicine* 53, no. 2 (February 2009), 169–174.

¹⁶ Mabry et al.

¹⁷ Sorbero et al.

¹⁸ Robert A. DeLorenzo, “Improving Combat Casualty Care and Field Medicine: Focus on the Military Medic,” *Military Medicine* 162, no. 4 (1997), 268272.

¹⁹ Robert A. DeLorenzo, “How Shall We Train?” *Military Medicine* 170, no. 10 (2005), 824–830.