

RECORD VERSION

STATEMENT BY

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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

Chairman Heck, Ranking Member Davis, and distinguished members of the subcommittee, thank you for the opportunity to discuss battlefield medical readiness today. Over the course of nearly 15 years of war, the military health system has made tremendous strides in improving wartime trauma care, achieving unprecedented survival rates for casualties arriving alive to a combat hospital. 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 Service member 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 any significant improvements in battlefield trauma care outcomes. Unfortunately, history tells us hard won combat medical lessons are often forgotten between wars, only to be re-learned at great cost during the next conflict. Our challenge this time is to break the historical cycle, truly reflect on our medical readiness lessons learned, and incorporate that knowledge into the military health system.

Even with superb in-hospital care, the evidence suggests that up to 25 percent of deaths on the battlefield are potentially salvageable. The vast majority of these casualties bleed to death before they ever reach a surgeon. The indisputable conclusion based on an unprecedented volume of combat casualty care research over the course of wars in Iraq and Afghanistan, is that any significant future improvement in combat casualty survival depends on advancing the capabilities of our medics, corpsmen, physician assistants, nurses and doctors on the battlefield and pushing advanced resuscitation forward. Improving prehospital combat casualty care, however, especially in a resource constrained interwar period, may be significantly more

challenging than improving hospital-based casualty care. I describe five key challenges to improving battlefield casualty care readiness and on-going work to overcome them.

Challenge 1: Ownership – Who is responsible for battlefield medical readiness?

We must better define ownership of battlefield medical readiness. Unity of command is not established, and thus no single senior military 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 medical force for their units. In turn, while the institutional base is responsible for determining the skills, equipment, initial and sustainment training requirements of the combat medical force, responsibility for battlefield care delivery is controlled by the 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. 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 the Journal of Military Medicine in 1996, 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 among the services.

Challenge 2: Data and Metrics- We can't improve what we don't measure

The Service 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. 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.

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 survivable. 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, 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 benefited from currently available 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. 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.

Systematically examining potentially survivable 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 emphasizing point-of-injury care. 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. The Army adopted a program—after nearly 40 battlefield after-action reports recommended it but without detailed supporting data—in 2011 to train critical care paramedics for helicopter medevac. To date, 350 critical care paramedics have graduated from this program. 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. Again, this number does not necessarily imply poor care, it simply highlights where we have the largest opportunity to save the most lives in future conflicts. 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.” A similar comprehensive review of combat casualty care in Iraq and Afghanistan is recommended.

Challenge 3: Prehospital and Trauma Expertise- Who are our prehospital experts?

If the prehospital setting is where nearly all potentially survivable 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 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. 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.

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.

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 four board certified prehospital physician specialists and about twenty trauma surgeons on Active duty out of about 4500 physicians. 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.

Challenge 4: Research and Development – Stuff versus people?

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. Second, staffing a forward battalion aid station with emergency medicine–trained providers showed a 30 percent reduction in deaths. Third, adopting current civilian air ambulance standards during helicopter evacuation in Afghanistan showed a 66 percent reduction in the risk of dying. 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 clinical 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 modern versions of tourniquets, junctional hemorrhage control devices, and intraosseous needles. Hemostatic bandages, first described following World War I, have been significantly refined and are a critical life-saving tool on the battlefield. The proposition is to balance the investment between things and people to optimize care on the battlefield.

Future research and development efforts should focus on mitigating the most significant preventable causes of mortality and morbidity on the battlefield. Because

non-compressible truncal hemorrhage is the leading cause of preventable death on the battlefield, developing training and tools to mitigate it should be the primary focus of research efforts. Outside of the operating room and the ability to surgically control truncal hemorrhage, several advanced prehospital interventions are possible using existing technologies. Recently, researchers have developed promising techniques to place endovascular or intercavitary devices to plug or compress shattered blood vessels and slow bleeding from severely damaged solid organs such as the liver, kidney or spleen. Examples include ResQFoam and “resuscitative endovascular occlusion of the aorta” (REBOA). REBOA requires a prehospital provider to access the large femoral artery in the groin – a technically demanding task in a hospital Emergency Room, but potentially feasible on a battlefield. It has been successfully used in the prehospital setting by physicians in London’s air ambulance service. ResQFoam is simpler. All it requires is a small incision into the abdomen. These and other invasive techniques have tremendous potential but their use must be governed with clinical leadership, carefully-crafted protocols and rigorous training by prehospital clinical specialist. All are designed to prolong the “Golden Hour” by slowing or stopping internal bleeding, so a casualty can reach the operating room before it is too late. These interventions are not now approved for battlefield use but these and similar technologies have potential to save lives on future battlefields.

Regulatory innovation needs to play a role. For example, freeze dried human plasma (FDP), which is widely used in Europe and by our NATO allies, is not approved for use in the United States. As a result, it is only available to Special Operations Forces (SOF) under an FDA investigational new drug (IND) protocol requiring thousands of man hours just for administrative compliance. Likewise, donor-to-donor transfusions of fresh whole blood, once a mainstay of battlefield care, are only performed by SOF medical personnel. Conventional US Army flight medics did not develop blood protocols until 2012, 11 years into the war. Pharmacologic agents like tranexamic acid (TXA) have been shown to improve survival by speeding blood clotting in trauma patients. Its FDA indications are for reducing abnormal menstrual bleeding and to reduce bleeding in hemophiliacs undergoing dental surgery. TXA is recommended by the Committee on Tactical Combat Casualty Care, but its use on the

battlefield by combat medics has been unevenly implemented. These techniques are well within the ability of combat medics to perform. They simply require the ability to establish intravenous (IV) or intraosseous (IO) access. FDP is not FDA approved in the US and most of the CoTCCC recommended battlefield use medications like TXA are considered “off-label” for their combat indications. As such, Title 10 prevents the Services from requiring their use as a common standard of care without prior written informed consent. Regulations such as these, designed to protect service members from experimentation, also paradoxically hinder the ability field innovative new therapies that have been proven to be safe for other FDA indications or in other countries.

While prehospital hemorrhage control and resuscitation will save lives, research designed to reduce suffering and improve recovery is needed as well. Pain control, infection prevention, and the use of pharmacologic agents that prevent development of post-traumatic stress may play as important a role in optimization long term outcomes as battlefield use of tourniquets did in lowering death rates in Iraq and Afghanistan.

Challenge 5: Hospital Culture - Are we aligned with the warfighter?

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. Future efforts should be devoted to breaking free from this seemingly intractable constraint.

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. 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 one US Army military treatment facility, their policy prohibits any combat medic from administering medications, including the ones they are expected to use in the dark and under fire on the battlefield, even under direct physician supervision in the controlled environment of the hospital. Policies such as these may explain why the majority of combat wounded receive no pain medication at the point of injury as medics are often prohibited from or unfamiliar with administering current battlefield analgesic recommendations. Untreated pain increases suffering and worsens the likelihood of morbidity such as post-traumatic stress disorder. Military hospitals cannot truly be considered to be combat medical readiness platforms unless they make a significant cultural and paradigm shift to train combat medics, corpsmen, flight paramedics and battalion medical officers to the top of their capability.

The Tourniquet

An excellent illustration of our challenges with battlefield medical readiness is the simple tourniquet. One of the most effective things a Soldier can do to save another Soldier's life on the battlefield is to stop bleeding from a limb.

The first documented case of a tourniquet used on the battlefield to stop extremity hemorrhage was in 1674. A simple stick, or windlass, is used as a mechanical advantage to twist and tighten a bandage until bleeding vessels are compressed. In the mid-1800's the Prussian military issued a "strap and buckle" tourniquet to their troops. This "strap and buckle" tourniquet was later adopted by the both Union and Confederate forces during the Civil War and subsequently issued to US forces during World War I, World War II, Korea and Vietnam. In 1993, I deployed to Mogadishu, Somalia as Special Forces medic in one the most well-trained and well-equipped unit in the world, with a strap and buckle tourniquet. We went to war in Iraq and Afghanistan with essentially the same tourniquet that was issued during the Civil War. The only problem with the strap and buckle tourniquet was that it did not work. In

1945, Dr. Luther Wolfe, an incredibly experienced US Army surgeon who cared for thousands of patients fighting in North Africa, during the Sicily invasion and across Europe, wrote an article in the Army Medical Department Journal describing how the strap and buckle tourniquet was ineffective and should be removed from the inventory in 1945.

Yet death rates from extremity hemorrhage during the Korean and Vietnam Era ranged from 7-9%. That means nearly 7000 service members lost their lives because they did not have an effective tourniquet. In the 1980's, Dr. Ron Bellamy conducted an extensive study of combat casualties following the Vietnam War and recommended an effective tourniquet be fielded to US Forces. In the initial phases of OEF and OIF, our death rates from extremity hemorrhage were the same as Vietnam and Korea. In 2004 or so, a Special Forces medic invented the Combat Applications Tourniquet. This new windlass tourniquet worked well and was adopted widely by US Forces in 2005 driving down deaths from extremity hemorrhage to virtually nothing. Meanwhile, the strap and buckle tourniquet, first issued during the Civil War, noted not work during World War II, was finally removed from the DoD inventory in 2008.

How did this happen? How did the most advanced, well-equipped military in the world miss this? More so, how do we prevent something like this from happening again? How do we truly learn the lessons from nearly 15 years of war? Ownership, expertise, data, research and culture.

Current Efforts to Address the Challenges

The commander of the Army Medical Department Center and School (AMEDD C&S) is currently responsible for the development of battlefield medical doctrine, training and equipment sets. In response to the changing operational and future strategic environment, he has initiated a number of studies and working groups designed to address many of the described challenges. The Early Entry Medical Capabilities (EEMC) Concept of Operations (CONOP) is the product of that analysis. It provides recommendations for necessary capabilities and capacities across the doctrine, organization, training, materiel, leadership and education, personnel, facilities,

and policy (DOTMLPF-P) domains and provides the intellectual foundation for further efforts in these areas.

The CONOP identifies six major capability areas. These are broad areas that the AMEDD must focus efforts in order to provide effective medical support to entry operations:

Battlefield Trauma Management. This focuses on the need to provide hemorrhage control, in the form of damage control resuscitation (DCR), as close to point of injury as possible, the need for improved injury identification and treatment at point of injury and the development of prolonged care capability. DOTMLPF-P recommendations include improved training of DCR concepts and standards for point of injury care.

Trauma System. This highlights the importance and benefit of a pre-existing trauma system due to the short notice nature of entry operations. DOTMLPF-P recommendations include the development of trauma systems in each Combatant Command, training for medical and non-medical personnel on trauma systems and increased leadership awareness of trauma systems and their importance in improving patient outcomes.

Medical Evacuation and En-Route Critical Care. This area underscores the need for agility in medical evacuation and en-route critical care. Lack of air superiority and limited medical evacuation assets in entry operations necessitate flexible approaches to evacuation and en-route critical care. DOTMLPF-P recommendations include training for the provision of en-route critical care on any platform, and educating commanders on medical care vs capability risks.

Medical Training and Preparedness. Medical skills development and ongoing training needs to focus on battlefield medicine and wartime trauma requirements. The reliance on pre-deployment and just-in-time training to ensure mission specific skills are up-to-date is not feasible or suitable for the conduct of entry operations due to deployment time constraints. Variance in provider training and competence leads to inconsistency in the provision of care and patient outcomes. DOTMLPF-P recommendations include an increased emphasis on pre-hospital medical training to include DCR and Tactical Combat Casualty Care guidelines, programs to reduce reliance on just-in-time training

and development of leadership relationships that promote and improve training and readiness of medical personnel.

Medical Information Management. The use of simple, intuitive, and nonintrusive systems to capture, transmit, disseminate and analyze medical data from the point of injury through to definitive care is essential to improving patient outcomes. DOTMLPF-P recommendations include leader emphasis on the importance of accurate medical data collection from existing and future systems and establishment of policy for minimum standards of medical data capture.

Mobility, Protection and Sustainment. Lightweight, expeditionary and protected platforms and forces will be required in the future to ensure medical assets can maintain pace with the supported elements. DOTMLPF-P recommendations include improved ability to task organize and novel materiel approaches that can reduce the sustainment burden.

The AMEDDC&S and the Health Readiness Center of Excellence Capabilities Development Integration Division is conducting ongoing analysis and study in the areas identified above to improve medical capabilities in support of entry operations in the future.

Conclusion

If history is any guide, making significant interwar advancements in battlefield medical readiness will be difficult. As major combat operations 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.

Evolving the current paradigm of military medicine from an organizational 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 medical readiness as its essential core mission will be difficult. However, 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. It is the reason we exist.