Military trauma training at civilian centers: A decade of advancements

ARTICLE in THE JOURNAL OF TRAUMA · DECEMBER 2012
Impact Factor: 2.96 · DOI: 10.1097/TA.0b013e31827546fb

Available from: Peter Rhee
Retrieved on: 08 July 2015
Military trauma training at civilian centers: A decade of advancements

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ABSTRACT: In the late 1990s, a Department of Defense subcommittee screened more than 100 civilian trauma centers according to the number of admissions, percentage of penetrating trauma, and institutional interest in relation to the specific training missions of each of the three service branches. By the end of 2001, the Army started a program at University of Miami/Ryder Trauma Center, the Navy began a similar program at University of Southern California/Los Angeles County Medical Center, and the Air Force initiated three Centers for the Sustainment of Trauma and Readiness Skills (C-STARS) at busy academic medical centers: R. Adams Cowley Shock Trauma Center at the University of Maryland (C-STARS Baltimore), Saint Louis University (C-STARS St. Louis), and The University Hospital/University of Cincinnati (C-STARS Cincinnati). Each center focuses on three key areas, didactic training, state-of-the-art simulation and expeditionary equipment training, as well as actual clinical experience in the acute management of trauma patients. Each is integral to delivering lifesaving combat casualty care in theater. Initially, there were growing pains and the struggle to develop an effective curriculum in a short period. With the foresight of each trauma training center director and a dynamic exchange of information with civilian trauma leaders and frontline war fighters, there has been a continuous evolution and improvement of each center's curriculum. Now, it is clear that the longest military conflict in US history and the first of the 21st century has led to numerous innovations in cutting edge trauma training on a comprehensive array of topics. This report provides an overview of the decade-long evolutionary process in providing the highest-quality medical care for our injured heroes. (J Trauma Acute Care Surg. 2012;73: S483–S489. Copyright © 2012 by Lippincott Williams & Wilkins)

KEY WORDS: Army; Navy; Air Force; combat casualty care; trauma training.

Throughout history, many of the greatest innovations in medicine and surgery have originated during short periods of intense warfare rather than during longer intervening periods of peace. Thus, it is not surprising that many current military medical doctrines can be traced to two brief battles in the 1990s. The first was Operation Desert Storm (January 17 to February 28, 1991), which was waged by a US-led coalition force against Iraqi in response to the invasion and annexation of Kuwait. The second was the Battle of Mogadishu (October 3–4, 1993), which was fought between an assault force consisting of US Army Rangers, Navy SEALs, and Air Force Pararescue/Combat Controllers against Somali militia fighters loyal to a warlord.

During the next decade, the consequences of those battles were reviewed in depth by civilian and military thought leaders. Ultimately, in 1998, the Office of Naval Research commissioned the Institute of Medicine of the National Academy of Science to review published literature, conducted an international conference, and interviewed numerous authorities to formulate evidence-based recommendations for combat casualty care. It was published in 1999, resulting in funding for initiatives, which have shaped much of the current research agenda. Several innovations in trauma care within the past decade can be directly traced to that document and are discussed elsewhere within this Journal of Trauma supplement.

In addition, some questioned the military's capacity to provide care for the numbers and types of casualties expected on the modern asymmetrical battlefield. According to a report by the Congressional General Accounting Office, at the end of the 20th century, many military medical personnel had either never treated trauma patients or had no recent trauma experience. The purpose of this document was to review advances in military trauma training that have occurred as a result of that report.

JOINT TRAUMA TRAINING CENTER

Section 744 of the National Defense Authorization Act for fiscal year 1996 required a demonstration program to
evaluate the feasibility of providing trauma training for military medical personnel through public or nonprofit hospitals no later than April 1, 1996, and to submit annual reports to Congress.

In August 1996, the Office of the Assistant Secretary of Defense for Health Affairs, which is responsible for the health care system of the US Department of Defense (DOD), formed the Combat Trauma Surgical Committee to develop guidance on improving trauma training. In February 1997, this committee issued a report that defined trauma care training standards for military surgeons, which included both hands-on experience and continuing education. The surgeon generals of all three military branches approved the recommendations as a first step toward developing a comprehensive trauma care training program for military personnel.

In April 1997, the Naval Medical Center in Portsmouth, Virginia, developed a demonstration program and signed an agreement with Eastern Virginia Medical School to provide training for Navy surgeons at Sentara Norfolk General Hospital in Norfolk, Virginia.

Owing largely to the efforts of COL Cass Conaway, who described such a training program for his MPH thesis at Baylor University, the Joint Trauma Training Center (JTTC) led by then LTC John B. Holcomb was born at Ben Taub General Hospital in Houston, Texas. Working with Dr. Kenneth L. Mattox, and with support from MG Harold L. Timboe, LTG James Peake, and all three services, the JTTC was intended to provide medical personnel from all branches of the US military with the necessary medical experience for forward combat medical operations. However, the Texas State Medical Board would not accept the federal government's Title 10 authority concerning malpractice coverage. Despite its promise and success, the malpractice issue, in conjunction with other concerns, caused the program to disband after 2 years.

Meanwhile, the JTTC screened more than 100 civilian academic trauma centers nationwide concerning their interest in military trauma training. Of approximately 70 responders, the field was narrowed according to preset criteria, including number of admissions, trauma laparotomies, percentage of penetrating trauma, and faculty interest. After visiting a number of the sites, the Baltimore, Miami, and Los Angeles programs were chosen by the committee as the optimal forward surgical team training facilities. Despite its limited life, the JTTC served as an important template and “lessons learned” platform in the development of these future sites.

The Air Force acted first and developed a memorandum of understanding (MOU) with Baltimore Shock Trauma (September 2001), the University of Cincinnati (August 2001), and St. Louis University (December 2002). An Army forward surgical team from Fort Campbell had a favorable training experience at the University of Miami, so a pilot program was established at that site shortly thereafter. The Navy Trauma Training Center (NTTC) in Los Angeles followed approximately a year later.

Each of the MOUs addressed the issue of medical malpractice liability for uniformed service members in affiliated civilian medical facilities beyond the federal tort claims process. In addition, the ability of the affiliate civilian centers to submit Medicare claims for capture of military practitioner professional reimbursements posed a potential threat to the fiscal operability of these affiliations. Both of these issues were resolved based on mutually acceptable means for liability coverage and local interpretation of law as pertains to Medicare reimbursement.

**AIR FORCE CENTERS FOR THE SUSTAINMENT OF TRAUMA AND READINESS SKILLS**

At present, there are three Centers for the Sustainment of Trauma and Readiness Skills (C-STARS) sites in the US Air Force (USAF), each integrated with a busy university academic medical center partner. C-STARS Cincinnati, located at the University of Cincinnati and The University Hospital, conducts the primary mission of predeployment readiness training for critical care air transport teams (CCATTs). C-STARS St. Louis, partnered with St. Louis University, conducts training for Air National Guard, Air Force Reserve, and active-duty medical providers. C-STARS Baltimore, facilitated through a partnership with the R. Adams Cowley Shock Trauma Center at the University of Maryland Medical Center in Baltimore, conducts training for all USAF members, with emphasis on prehospital and field hospital conditions. To coordinate the efforts of the three platforms, particularly as applicable to best practices, they were formally aligned under the Air Force Expeditionary Medical Skills Institute in the International and Expeditionary Medicine Department of the USAF School of Aerospace Medicine in January 2004 under the leadership of COL William Beninati. In 2008, the Air Force formally required C-STARS predeployment training for trauma and critical care unit expeditionary assignments (AFI 41-106).

C-STARS Cincinnati began in August 2001 with the placement of the initial personnel at Cincinnati, although their first CCATT training course was not held until December 2002. The platform has greatly expanded in personnel and scope and currently is instrumental in critical care transport training, CCATT basic and clinical science research, and all personnel maintain regular deployments (mostly in support of CCATT). All members of the teaching cadre are also clinically active and hold volunteer appointments at the University of Cincinnati.

As of February 2012, there are two general surgeons, one orthopedic surgeon, three anesthesiologists, one pulmonologist/intensivist, four critical care nurses, four respiratory therapists, two civilian contracted critical care/emergency medicine nurses, one PhD, two administrative assistants, and numerous Army and Air Force Reserve personnel.

Training emphasis at Cincinnati is on critical care transport in primarily fixed, but also in rotary, wing aircraft. A CCATT is made up of a critical care trained physician, a critical care–trained nurse, and a respiratory therapist. Before attending C-STARS Cincinnati, these members must attend a 2-week initial CCATT course at Wright Patterson Air Force Base and have a training background with recent clinical experience in critical care. Once selected for advanced training, members attend the Cincinnati 12-day course, which includes precourse and postcourse testing, 21 didactic sessions, 6 small group training sessions, 4 to 5 high-fidelity simulation scenarios with postsimulation review, a preflight training exercise, equipment and allowance standard training, a cadaver laboratory, four full clinical days in the surgical intensive care unit (ICU) (for
nonphysician members), and weekly teleconferencing with deployed medical teams and members of the Joint Theater Trauma System. The experience culminates with a C-130 training flight with medical simulation aboard a Kentucky Air National Guard 123rd AW (Louisville).

In October 2007, the USAF initiated a unique clinical validation program at C-STARS Cincinnati, which requires every member of a deploying CCATT to meet a clinical standard. This program has been instrumental in assuring that quality clinical expertise is aboard every CCATT mission. To date, more than 1,100 USAF physicians, nurses, and respiratory therapists have received CCATT training before deployments in Iraq, Afghanistan, and other locations around the globe. Open to all US military personnel and increasingly international military medical providers, C-STARS Cincinnati benefits not only from a very successful partnership with the University of Cincinnati but also from intense involvement, support, and pride of the local community.

C-STARS Baltimore (established in June 2001) had an original footprint of six people and has continued to expand. Present staff consists of 16 individuals from various career fields, including medical technicians, nurses, certified registered nurse anesthetists (CRNAs), 3 trauma surgeons, 1 orthopedic trauma surgeon, 1 emergency critical care physician, and a medical service corps officer.

Originally designed to serve the needs of critical care, trauma, and orthopedic surgery providers, C-STARS Baltimore has matured into a contingency training platform for surgeon and nonsurgeon physician providers as well as trauma nurses in the disciplines of critical care, emergency medicine, operating room services, and trauma anesthesia. Enlisted medical technician training capabilities are also included in each rotation, focusing on specific areas of specialization and intensive management skills for independent duty medical technicians, pararescue providers, and USAF Special Operations Command medical personnel. Professional certification courses supporting quality trauma care practices are also provided, including Prehospital Trauma Life Support, Advanced Trauma Life Support, Advanced Trauma Care for Nurses, and Tactical Combat Casualty Care. Each class is highly variable in composition. For example, a recent class had independent duty medics, three technicians (operating room [OR], ward, and ICU), three nurses (ward, ICU, and emergency department [ED]), two CRNAs, one orthopedic surgeon, and one general surgeon. The 19-day program includes didactic lectures, cutting-edge trauma management simulations, cadaver procedure laboratories in lifesaving interventions, and a capstone mass casualty (MASCAL) exercise conducted at Fort Detrick, Maryland.

During the Baltimore C-STARS course, each rotator gains 80 hours to 100 hours of hands-on clinical experience, providing care alongside active-duty cadre and civilian mentors for civilian victims of trauma admitted to R. Adams Cowley Baltimore Shock Trauma Center. Additional rotation elements conducted through a mature partnership with Johns Hopkins Medical Center provide critical training in both pediatric trauma and burn care. Rotators who will act in a first-responder or rotary-wing transport capacity during their deployment tasking are also scheduled to join inner-city ambulance transports or civilian helicopter missions through established partnerships with civilian Emergency Medical Services personnel from the Baltimore City Fire Department and the Maryland State Police. During these transports, rotators gain practical experience in delivering traumatically injured patients from point of injury to Baltimore Shock Trauma.

All cadres of Baltimore C-STARS remain active deployers who are engaged in regular communication with lead elements of the Joint Theater Trauma System and forward deployed providers, providing them the opportunity to maintain a dynamic curriculum that adequately reflects real-time care issues and required skill sets as they evolve in theaters of conflict. Through collaborations with the medical corps of other US Armed Services as well as with those of coalition partners, cooperation within the joint care environment is also stressed. To date, more than 3,000 USAF physicians, nurses, and medics have received C-STARS training before deployments in Iraq and Afghanistan. Open to all military medical service personnel and international military medical providers, C-STARS Baltimore serves as a successful partnership with the civilian community to provide state-of-the-art trauma management in a live-patient environment.

C-STARS St Louis is somewhat unique because state legislation was passed to provide professional license and practice reciprocity to DOD health care providers and staff formally assigned to train in the sustainment of trauma care skills. The St. Louis program was developed in partnership with a Missouri Air National Guard training program when the USAF Surgeon General assigned four active-duty members (general surgeon, critical care nurse, medical technician, and administrative technician) to the platform in the summer of 2001. The program was then operated from a suburban Level II trauma center. Because of the relatively low volume of trauma patient admissions (overwhelmingly blunt mechanism), the program was formally transferred to the inner city, bistate Level I trauma center affiliated with St. Louis University in November 2002. To serve the requirement of liability coverage, the C-STARS program was designated as a formal curriculum in the St. Louis University Department of Surgery. As such, its faculty, staff, and trainees were able to enter the St. Louis University affiliate medical treatment facilities under the general umbrella and liability protection of the university academic affiliation agreements.

The initial St. Louis University–based C-STARS staff consisted of four active-duty and four active Missouri Air National Guard members. A 2-week course was chosen to match the reserve component annual tour. The curriculum, focused on didactic, simulation, and hands-on patient care; it was designed to train physicians, surgeons, physician extenders, nurses, and medical technicians. Each course includes up to 22 trainees; 19 courses are held each year. The program was developed as a total force curriculum, highly adaptable to the needs of its trainees with emphasis on mentored hands-on prehospital and in-hospital patient care. Like C-STARS Cincinnati, this platform developed a robust team-based human patient simulation program with emphasis on deployed medical skills and use of expeditionary equipment. This matured from a single-team, single-patient scenario into a capstone simultaneous multiple-team, multiple-patient scenario with the construction of a highly advanced simulation center.
in cooperation with St. Louis University and the Missouri Air National Guard. Also akin to C-STARS Baltimore, St. Louis trainees have the opportunity to participate in formal courses offered at the health sciences center including Advanced Trauma Life Support, Advanced Trauma Care for Nurses, and Pediatric Advanced Life Support.

From its initial cadre of eight, this program expanded into a larger, fully integrated and interoperable unit of active-duty, Air National Guard, and USAF Reserve personnel including trauma surgeons, general surgeons, orthopedic surgeons, physician assistants, nurse specialists, and medical technicians. The Air Guard remained highly invested in St. Louis; one half of the annual training positions have been allocated to Air National Guard Units. In 2008, a pediatric module was added to the curriculum with the assignment of a neonatologist. The pediatric module includes hands-on care in the St. Louis University affiliate Level I trauma center located on the health sciences center campus. In 2009, USAF Special Operations Command assigned a forward surgical team (FST) and forward critical care team to St. Louis University for professional skills sustainment. These teams integrated well in the trauma center and serve as augmentation faculty for the C-STARS program. All members of C-STARS professional and nursing staff are appointed as full-time faculty of St. Louis University with promotion parity with their civilian colleagues. This parity was extended to include administrative promotion potential when the director of the USAF C-STARS program was selected to serve as the director of the St. Louis University Division of Trauma and St. Louis University Hospital trauma medical director. This serves as a testament of the degree to which the St. Louis C-STARS program, its faculty, and its trainees have become incorporated, accepted, and valued by its host academic center.

ARMY TRAUMA TRAINING CENTER AT RYDER TRAUMA CENTER/UNIVERSITY OF MIAMI MILLER SCHOOL OF MEDICINE

Initially, there were growing pains and a struggle to develop an effective curriculum to train and evaluate each member of US Army’s (USA) FSTs within a short period. A USA FST consists of three general surgeons, one orthopedic surgeon, two CRNAs, three nurses (OR, ICU, and ED), an executive officer (Medical Service Corps), four OR technicians, one noncommissioned officer in charge (usually a licensed practical nurse), and five medics. However, the initial groups were often lacking several personnel, and those present had highly variable experience and backgrounds, including active duty and reservists, some with little trauma experience. Many team members had never worked together or had never been deployed. With the foresight of its first director, COL Thomas E. Knuth, and a dynamic exchange of information with civilian thought leaders and front line soldiers, there has been a continuous evolution and improvement of the Army Trauma Training Center (ATTC) curriculum. The initial program was centered on hands-on clinical experience for active duty units. Whereas the USAF platforms are primarily focused on individual experience and skills sustainment with the structured inclusion of team training in some areas of the curriculum, from the outset, the USA and US Navy (USN) were primarily interested in developing team-based training platforms, likely owing to differences in how the services deploy members. At the ATTC, participants were paired with seasoned civilian providers until they earned independence, followed by assembly of teams, which were evaluated on performance measures such as knowledge, judgment, attention to detail, and organizational skills. The first rotations had highly variable durations, ranging from 7 days to 28 days. Teamwork was the major emphasis of the training, which was underscored during a simulated MASCAL exercise.\(^1\)\(^2\)

The MASCAL was initially conducted in a large animal physiology laboratory and was a combination of the Advanced Trauma Operative Management course developed by the American College of Surgeons and trauma resuscitation experiments. Operative exposures for intra-abdominal, cardiothoracic, and extremity vascular injuries were demonstrated on anesthetized swine. Over time, the MASCAL had matured into a standardized training protocol with multiple casualties/arrival patterns to facilitate consistent objective evaluation. Eventually, more complex injury patterns, attempted security breeches, and battlefield noises were added to further elevate the sense of realism of the MASCAL (Table 1). This was combined with a series of classroom lectures complemented with clinical skills training.\(^1\)\(^2\)

In 2009, under current director, LTC GD Garcia, the experience of FSTs at the MASCAL has been supplemented with a variety of additional training tools. The training period is now 14 days and is divided into three phases. Phase I begins by reviewing principles of trauma resuscitation and shock, teamwork concepts, and management of operative trauma in formal lectures during the first 4 days (Table 2). Didactics are supplemented with the use of a mobile curriculum developed for an iPod touch (Apple, Cupertino, CA). The operating room staff participates in the Advanced Surgical Skills for Exposure in Trauma course, where human cadavers are used to teach complex surgical exposures. Simulated patient scenarios using the SimMan 3G (Laerdal, Wappingers Falls, NY) and volunteer mock patients give the opportunity for FSTs to develop communication and designate treatment teams. The first phase concludes with the MASCAL exercise discussed previously.

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**TABLE 1. Standardized Injuries Encountered During the MASCAL Training Exercise**

<table>
<thead>
<tr>
<th>Casualty</th>
<th>Injury</th>
</tr>
</thead>
<tbody>
<tr>
<td>Able</td>
<td>Airway compromise, 50% TBS burn (simulated), inhalational injury (simulated)</td>
</tr>
<tr>
<td>Baker</td>
<td>Transmediastinal penetrating cardiac injury, right-sided thoracoabdominal penetrating wound</td>
</tr>
<tr>
<td>Charles</td>
<td>Abdominal wall laceration with evisceration, IED (undetonated) within wound</td>
</tr>
<tr>
<td>David</td>
<td>Scalp laceration, right lower-extremity traumatic amputation</td>
</tr>
<tr>
<td>Edgar</td>
<td>Airway compromise, anterior and posterior shrapnel wounds, penetrating injury to Zone II neck (carotid/jugular injury)</td>
</tr>
<tr>
<td>Frank</td>
<td>Recycled; injuries determined by skill of FST</td>
</tr>
</tbody>
</table>

**TBS**, total body surface area.
TABLE 2. Didactic Curriculum at the ATTC

<table>
<thead>
<tr>
<th>Content Modules</th>
<th>Procedural Animations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Management of shock</td>
<td>1. Airway intubation</td>
</tr>
<tr>
<td>2. Initial assessment—ABCs of trauma</td>
<td>2. Central venous catheter insertion</td>
</tr>
<tr>
<td>4. Trauma laparotomy</td>
<td>4. Diagnostic peritoneal lavage</td>
</tr>
<tr>
<td>5. Essentials of burns</td>
<td>5. Emergency thoracotomy</td>
</tr>
<tr>
<td>6. Penetrating neck and chest injuries</td>
<td>6. Pulmonary artery catheter placement</td>
</tr>
<tr>
<td>7. Penetrating abdominal trauma</td>
<td>7. Cardiac tamponade and pericardiocentesis</td>
</tr>
<tr>
<td>8. Liver, spleen, and urinary injury</td>
<td>8. Abdominal wound exploration</td>
</tr>
<tr>
<td>10. ATTC, critical team concepts</td>
<td>10. Tracheostomy</td>
</tr>
<tr>
<td>11. ATTC, trauma teamwork</td>
<td>11. Lower-extremity fasciotomy</td>
</tr>
</tbody>
</table>

Phase II of the training is the clinical phase, conducted entirely at the Ryder Trauma Center/University of Miami, Miller School of Medicine, the only Level I trauma center in Miami-Dade County (serving a population of 2.5 million). The FST is divided into two teams, a day and a night shift, who care for incoming traumatic injuries alongside university faculty, house staff, and nurses. After this week of clinical experience, the training culminates in Phase III, also known as the capstone exercise. During this phase, the entire 20-person FST resides in the hospital and assumes control of all patients arriving at the trauma center during a 48-hour period, with oversight from host hospital staff.

Since the inception of the program, more than 95 FSTs (>2,300 personnel) have rotated through the ATTC. Objective survey data provided by participants rotating through the ATTC show that through clinical exposure and simulation, the performance of the FST is improved, particularly in the areas of communication and definition of roles. The MASCAL training exercise is a vital component of predeployment training that participants think is valuable in preparing them for the challenges on the battlefield. The combination of didactic, simulation, and clinical exposure at the ATTC represents a unique and valuable training modality for those providing medical care to our soldiers. This training and evaluation has been accomplished with a cadre of 10: a trauma surgeon (director), orthopaedic surgeon, nurses, CRNAs, and noncommissioned officers (NCOs) that turn over every 2 years.

### NTTC AT LOS ANGELES COUNTY/UNIVERSITY OF SOUTHERN CALIFORNIA KECK SCHOOL OF MEDICINE

In July 2002, 10 active-duty medical personnel under the command of then CDR Peter M. Rhee were assigned to design, develop, and implement a training program for the USN. CDR Rhee was assisted by an emergency physician, CDR Karry King, orthopaedic surgeon LCDR Mathew Camuso, anesthesiologist LCDR Orlando Ricci, OR nurse LCDR Lester Whitley, ED nurse CDR Terry Gee, critical care nurse CDR Mary Nunly, OR technician HM2 Carl Savard, independent duty Corpsman HMC Jess Fender, and medical staff corps administrator LCDR Michael Duszynski. The key promoter of the idea was RDML James A. Johnson, also a surgeon.

Within 3 months, the initial cadre of USN personnel had fully integrated into the Los Angeles County Medical Center and had prepared themselves to take on up to 30 trainees per month. It was essential that the USN personnel assigned to Los Angeles County be viewed as a part of the staff for them to effectively treat trauma patients. This was mutually beneficial because Los Angeles County Medical Center is perpetually underfunded and therefore understaffed. This relationship established under MOU would benefit the trauma center, the citizens of Los Angeles, as well as the entire military. The permanent staff deployed to Los Angeles did so under 2-year or 3-year permanent change of station orders. They obtained California license, practiced under the rules of the medical center, and were fully credentialed as well as faculty appointed. In contrast, the only requirement for the rotating staff under temporary duty orders was to obtain practice licenses in any state. The malpractice coverage for the permanent staff and rotating students were handled under the tort law.

The specific goals of the NTTC were to provide didactic training, state-of-the-art simulation training, and actual hands-on training in the care of trauma patients. An additional component was to promote teamwork. Modern day trauma is a team event, so it is important that team members get an opportunity to work together before deployment. The logistics of how to identify educational deficits and conduct training in a timely manner was challenging. Although all military personnel that were to deploy would benefit, the priority was to train those deploying with the units supporting the Marines. Specifically those that were assigned to the forward resuscitating surgical suites (FRSS) were targeted as the trainees. The FRSS teams were composed of approximately 12 individuals that needed to be able to function well immediately upon deployment. It is a duty to those who serve in a theater of war to have fully trained and capable medical personnel. In addition, the USN sent fleet surgical teams, the personnel who support US Marines on board ships, because they had the highest likelihood of treating trauma patients. Each class consisted of approximately 28 to 30 members, and the training period was 30 days.

The members of the team were given temporary duty orders and brought to Los Angeles. They were housed in a trailer near the hospital to promote camaraderie. On the day of arrival, a surprise simulated MASCAL drill on the housing compound was conducted. The teams experienced the challenge in providing care outside of the hospital setting, using suboptimal equipment, and with people that they had never worked with before. This simulated a situation frequently encountered upon deployment and demonstrated the importance of realistic training. “In my 28 years in the US Navy, I have never seen a single gunshot wound.” These were the type of statements made by many active-duty personnel who came to Los Angeles to be trained in battlefield medicine. During their 4-week rotation, they would be bombaraded with intense, realistic training scenarios. The core rotators were fully integrated into the Los Angeles County system, working side by side...
side with the civilian trauma staff, and were continually chal-
enged in the care of trauma patients.

Since the inception of the program in 2002, approxi-
mately 2,500 service members have been trained at the NTTC. 
During this 10-year war, despite many service members 
having real-time combat casualty care experience, having an 
opportunity to refresh one’s skills and to meet team mem-
bers before deploying has been crucial. Although the course 
has been refined during the years, the key component for op-
timal training has been bringing teams together before de-
ployment and allowing them to treat actual trauma patients. 
Anything less would be a disservice to those who serve their 
country.

DISCUSSION

The longest military conflict in US history and the first 
of the 21st century has offered numerous innovations in the 
training of military personnel, but the key element is the suc-
cess of the civilian-military partnerships.

Most importantly, outcomes with small task-oriented sur-
gical units can provide trauma care that is comparable to 
civilian standards. From March 1, 2004, to February 28, 2005, 
two FRSS teams and a shock trauma platoon were colo-
cated in a unit designated the Surgical Shock Trauma Platoon.14 
Outcome data were compared with those at Los Angeles County 
Medical Center. There were 895 trauma admissions to the 
Surgical Shock Trauma Platoon, excluding 25 patients pulse-
less on arrival and 291 minimally injured patients; 559 (97%) 
of 579 combat casualties survived. There were 79 operative 
patients sustaining severe injuries with 10 deaths (12.7%), 
while 43 (12.8%) of 337 deaths were seen with comparable 
cases treated at the civilian center.14

Dubose et al.15 reviewed traumatic brain injuries from 
the Joint Trauma Theater Registry and civilian counterparts 
from the National Trauma Databank from 2003 to 2007 using 
propensity score matching. When compared with matched 
civilian National Trauma Databank counterparts, Joint Trauma 
Teather Registry patients were seven times more likely to 
undergo intracranial pressure monitoring and three times more 
likely to receive operative neurosurgical intervention. Mor-
tality was 2.5 times lower among military casualties overall 
(8%), particularly after penetrating mechanisms of injury.15 It 
seems that the higher rates of neurosurgical intervention per-
formed after penetrating injuries lead to improvements in 
survival.15 This may be multifactorial, but one likely expla-
nation is the military trauma teams’ adherence to protocols 
and evidence-based guidelines for the management of trau-
matic brain injury.16

In addition to excellent outcome data with combat ca-
sualty care, the current training programs have been shown to 
be effective. Schulman et al.15 surveyed 135 USA personnel 
who participated in the ATTC program between January 2005 
and June 2007 on the training quality after deployment. Most 
participants agreed or strongly agreed that the training expe-
rience in the resuscitation area was beneficial (>90%), was 
sufficient (78%), was a good learning opportunity (90%), and 
was helpful to apply their classroom training (>80%).15 Sugges-
ted improvements included clearly defined roles between 
the ATTC trainees and the civilian house staff, longer training 
duration, and more injuries replicating improvised explosive 
devices (IEDs).13

Another important aspect of training is treating civilian 
trauma patients with injuries relevant to combat scenarios. 
From September 2006 to August 2007, data from the Air 
Force Theater Hospital in Balad were compared with those 
from Baltimore Shock Trauma. Severity of injury and massive 
transfusions were higher at Air Force Theater Hospital, and 
soft tissue wound care represented approximately 25% of 
cases; however the volume of major soft tissue debridement 
cases at the civilian center may offer the closest approximation 
of high-energy battlefield wound care. Others have shown ci-
villian experience with gunshot wounds often focuses on 
thoracoabdominal trauma, yet the military data show a need 
for more knowledge and understanding of injuries to the 
extremity.18

Staying current with changes in injury patterns and 
mechanism of injury is also critical for effective training. 
Operation Iraqi Freedom was the first military operation in 
which the team concept of health care delivery was tested. 
During the assault phase of Operation Iraqi Freedom (March 
21 to April 13, 2003), one USA FST evaluated 154 patients, 
including 52 enemy prisoners of war, 79 US soldiers, and 
23 Iraqi civilians.9 Upper- and lower-extremity injuries were 
most common in the civilian and US soldier groups, whereas 
enemy prisoners of war had more thoracoabdominal injuries 
and life-threatening injuries.9 However, by 2005, the injury 
pattern had shifted. Another USA FST deployed to Afghan-
istan treated 614 patients, but medical disease (9%) and non-
combat-related injuries (42%) accounted for half.10 Combat 
casualties were mostly Afghan National Army or Police (56%) 
and US military (21%). Predominant wounding instruments 
were small arms (34%), IEDs (33%), and rocket-propelled 
grenades (15%).10 Anatomic sites of battle injury were extre-
mities (38%), external soft tissue (35%), and the head/neck/ 
torso (28%).

The civilian-military partnerships formed out of a shared 
sense of mission and have succeeded based on mutual benefit. 
Early in the development, the benefit to the host civilian centers 
was primarily from the embedded military cadre augmenting 
the labor force and reimbursement revenue stream. More re-
cently, the promise of cross-pollination of ideas and practices 
has been realized in the transfer of relevant combat casualty 
care experience learned, including massive transfusion proto-
cols, emergency tourniquets for exsanguinating hemorrhage, 
hemostatic dressings, and coagulation monitoring with throm-
boelastography. In addition, civilian centers have been suc-
cessful in leveraging their unique relationships to participate 
in relevant DOD-sponsored research. The DOD has benefited 
reciprocally by leveraging the research infrastructure of the af-
filiate civilian organizations to address casualty care research 
requirements. Perhaps the most valuable aspect these platforms 
have provided, beyond the training resource, is the capability 
to maintain a group of highly experienced and skilled military 
trauma care providers assigned to the platforms as cadre who 
participate in the expeditionary and homeland response mis-
sions. This ultimately provides the means by which the plat-
forms have matured and adapted to maintain relevance,
currency, and credibility with the casualty care mission. The survival of these platforms beyond the current conflict has been questioned, although it is recognized that the need to maintain trauma and critical care skills in the homeland and expeditionary medical forces transcends any particular contingency or region.

In conclusion, the longest military conflict in US history and the first of the 21st century has offered numerous challenges and corresponding innovations in military trauma training. Each of the three service branches has developed state-of-the-art training on a comprehensive range of topics pertaining to combat casualty care before deployment. The curriculum at each center will continue to evolve and improve to provide the highest quality care for our injured heroes.

AUTHORSHIP

C.M.T., M.L.R., and K.G.P. proposed the original idea to the editor. P.R., J.J.D., W.C.D., J.A.B., T.E.K., and G.D.G. each contributed sections describing the history and curriculum for their respective training centers for each of the three uniformed service branches. These sections were then combined into a manuscript draft generated by C.M.T., M.L.R., R.M.V., and K.G.P. That draft was then reviewed for accuracy and edited by each of the authors.

DISCLOSURE

This study was supported in part by grant #N140610670 from the Office of Naval Research and by grant #09078015 from US Army Medical Research and Materiel Command.

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