

**EPIDEMIOLOGY AND OUTCOMES OF
TRAUMATIC HEMORRHAGIC SHOCK:
WHERE IS THE MONEY AND
HOW ARE WE GOING TO GET IT?**

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SUTTON'S LAW



- WHEN WILLIE SUTTON, A VERY SUCCESSFUL BANK ROBBER, WAS ASKED AFTER HE WAS CAUGHT
 - “WHY DID YOU ROB ALL THOSE BANKS?”
 - “BECAUSE THAT IS WHERE THE MONEY IS.”
- IMPACT – MAXIMAL EFFECT FOR EFFORT

Sutton W, Linn E: *Where the Money Was: The Memoirs of a Bank Robber*. Viking Press (1976), p. 160.

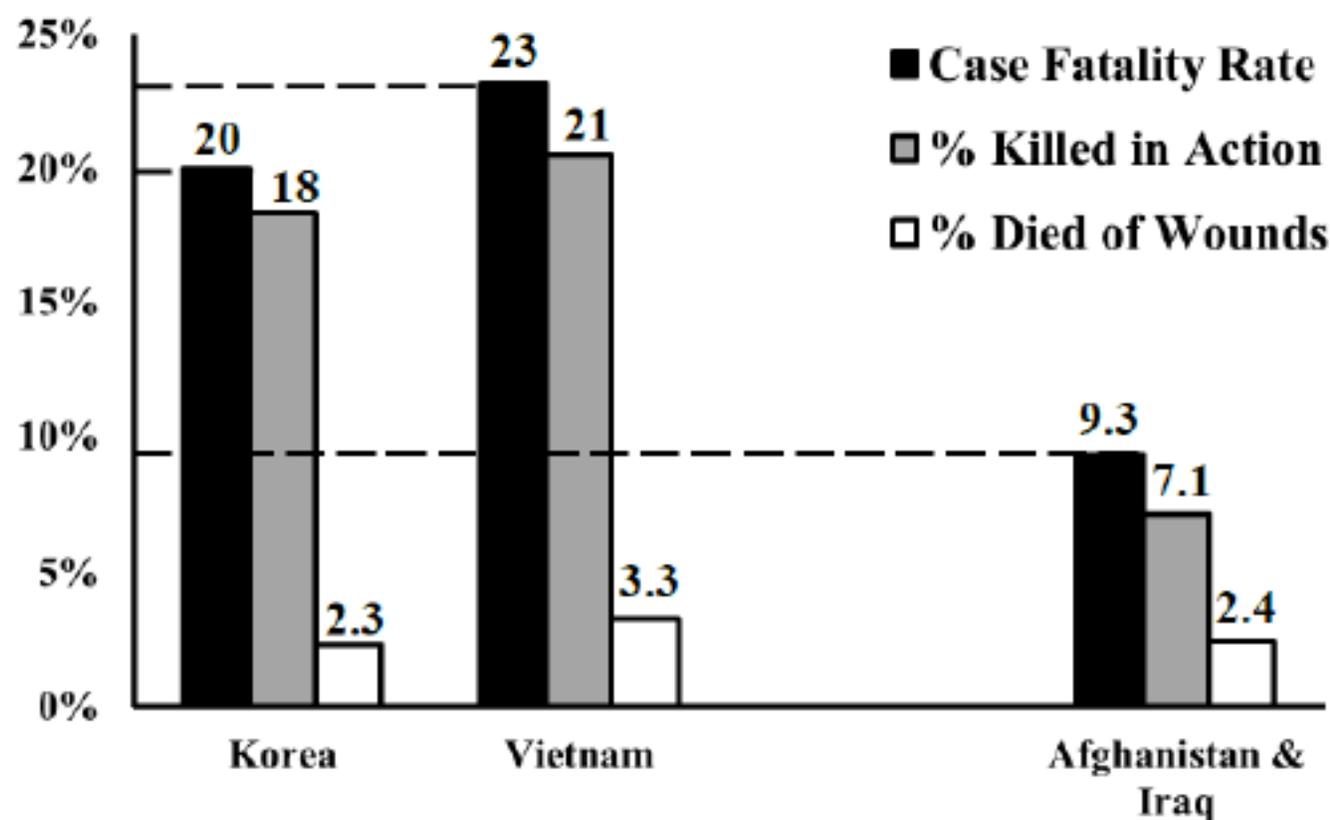
SUTTON'S LAW



- WHY DID I ROB BANKS? BECAUSE I ENJOYED IT. I LOVED IT.
- I WAS MORE ALIVE WHEN I WAS INSIDE A BANK, ROBBING IT, THAN AT ANY OTHER TIME IN MY LIFE.
- I ENJOYED EVERYTHING ABOUT IT SO MUCH THAT ONE OR TWO WEEKS LATER I'D BE OUT LOOKING FOR THE NEXT JOB.
- PASSION – DRIVES SUCCESS

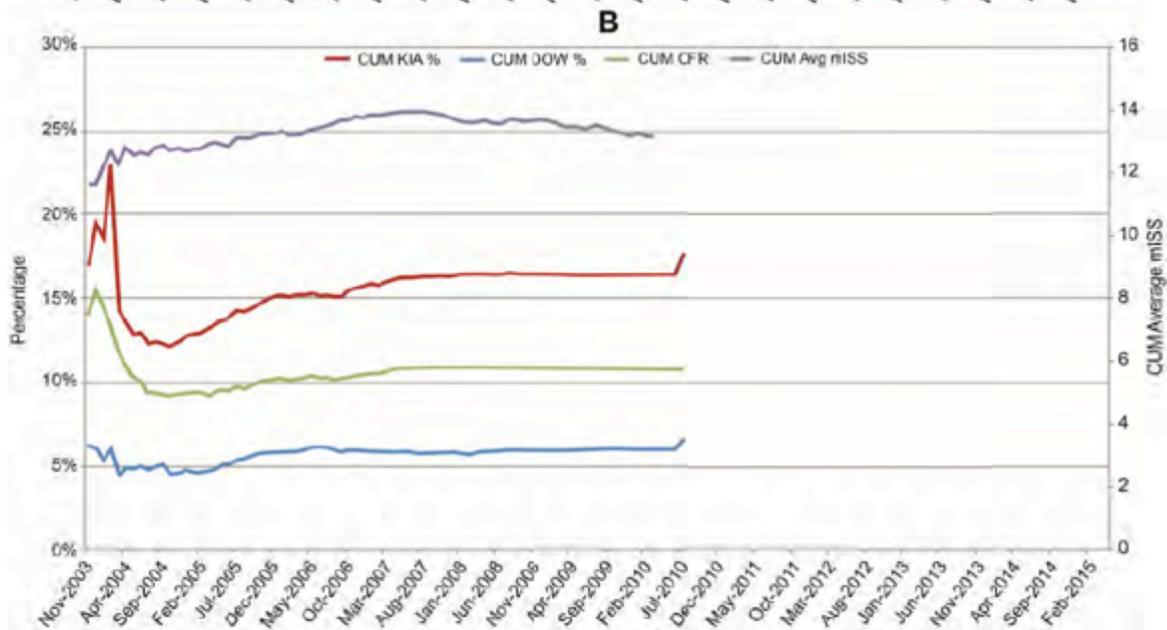
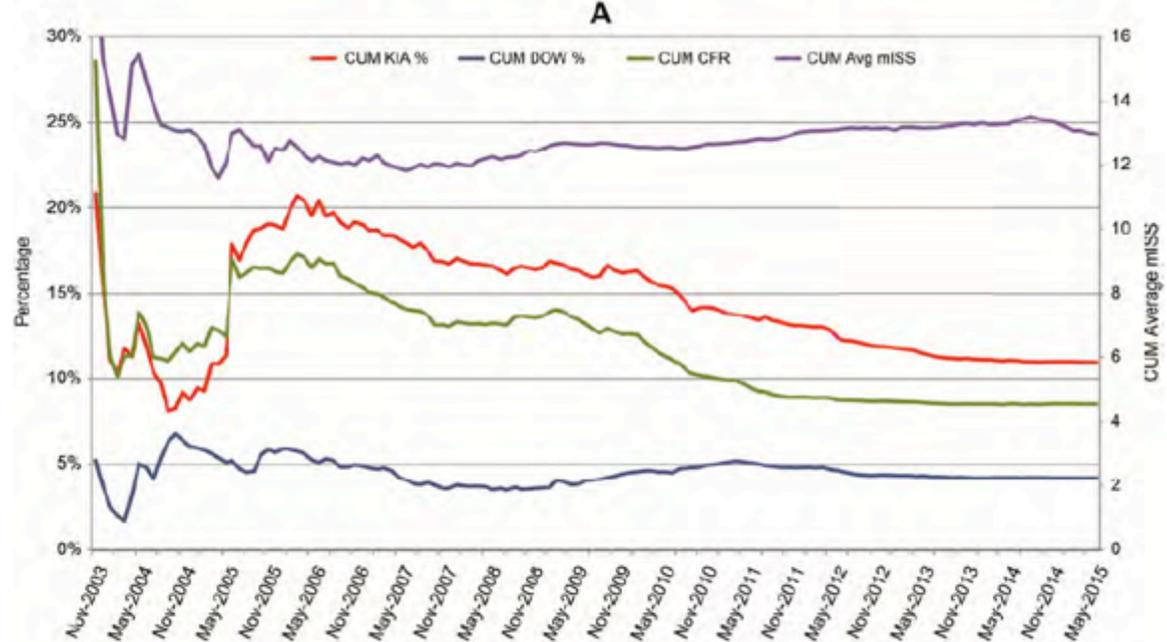
Sutton W, Linn E: *Where the Money Was: The Memoirs of a Bank Robber*. Viking Press (1976), p. 160.

Concluding Casualty Statistics from Afghanistan & Iraq (2001-2014)* with Historical Context



* DoD Combat Casualty Care Research Program & Defense Casualty Analysis System

FIGURE 1-3 Case fatality rates during the Korean War, the Vietnam War, Operation Enduring Freedom, and Operation Iraqi Freedom.



Case fatality rate (CFR): The percentage of fatalities among all wounded.

$$CFR = [(KIA + DOW)/(KIA + WIA)] * 100$$

FIGURE 1-5 Cumulative percent killed in action (KIA), percent died of wounds (DOW), case fatality rate (CFR), and average military injury severity score (mISS), Operation Enduring Freedom (A) and Operation Iraqi Freedom (B).

SOURCE: Joint Trauma System. Data retrieved from the DoD Trauma Registry.

Death on the battlefield (2001–2011): Implications for the future of combat casualty care

Brian J. Eastridge, MD, Robert L. Mabry, MD, Peter Seguin, MD, Joyce Cantrell, MD, Terrill Tops, MD, Paul Uribe, MD, Olga Mallett, Tamara Zubko, Lynne Oetjen-Gerdes, Todd E. Rasmussen, MD, Frank K. Butler, MD, Russell S. Kotwal, MD, John B. Holcomb, MD, Charles Wade, PhD, Howard Champion, MD, Mimi Lawnick, Leon Moores, MD, and Lorne H. Blackbourne, MD

Died of Wounds on the Battlefield: Causation and Implications for Improving Combat Casualty Care

Brian J. Eastridge, MD, Mark Hardin, MD, Joyce Cantrell, MD, Lynne Oetjen-Gerdes, MS, Tamara Zubko, Craig Mallak, MD, Charles E. Wade, PhD, John Simmons, MD, James Mace, MD, Robert Mabry, MD, Rose Bolenbaucher, MD, and Lorne H. Blackbourne, MD

(*J Trauma.* 2011;71: S4–S8)

- 4,596 COMBAT DEATHS (2001-11) 90% ARE PREHOSPITAL
- PREHOSPITAL
 - 25% ARE PREVENTABLE
 - 90% OF THESE ARE DUE TO **HEMORRHAGE**

- 2001-2009, DOW REVIEWED (N=558)
- HOSPITAL
 - 50% ARE PREVENTABLE
 - 80% OF THESE ARE DUE TO **HEMORRHAGE**

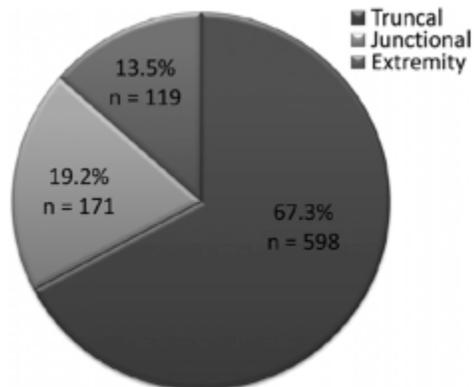


Figure 5. Anatomic focus of lethal PS hemorrhage.

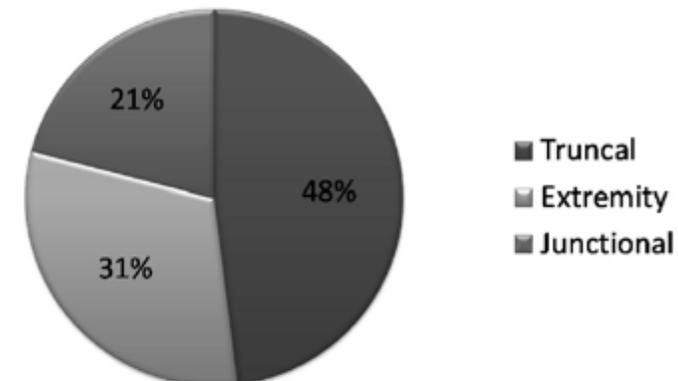


Figure 5. Main hemorrhage focus by anatomic region.

Original Investigation

The Effect of a Golden Hour Policy on the Morbidity and Mortality of Combat Casualties

Russ S. Kotwal, MD, MPH; Jeffrey T. Howard, PhD; Jean A. Orman, ScD, MPH; Bruce W. Tarpey, BS; Jeffrey A. Bailey, MD; Howard R. Champion, FRCS; Robert L. Mabry, MD; John B. Holcomb, MD; Kirby R. Gross, MD

JAMA Surgery January 2016 Volume 151, Number 1

- A RETROSPECTIVE DESCRIPTIVE ANALYSIS OF BATTLEFIELD DATA EXAMINED 21,089 US MILITARY CASUALTIES THAT OCCURRED DURING THE AFGHANISTAN CONFLICT
 - SEPTEMBER 11, 2001, TO MARCH 31, 2014.
- ANALYZED OUTCOMES PRE AND POST 2009 MANDATE FOR TRANSPORT TIME OF < 60 MIN

Original Investigation

The Effect of a Golden Hour Policy on the Morbidity and Mortality of Combat Casualties

Russ S. Kotwal, MD, MPH; Jeffrey T. Howard, PhD; Jean A. Orman, ScD, MPH; Bruce W. Tarpey, BS; Jeffrey A. Bailey, MD; Howard R. Champion, FRCS; Robert L. Mabry, MD; John B. Holcomb, MD; Kirby R. Gross, MD

JAMA Surgery January 2016 Volume 151, Number 1

- AMONG 4542 CASUALTIES THERE WAS A DECREASE IN MEDIAN TRANSPORT TIME AFTER THE MANDATE
 - 90 MIN VS 43 MIN, (P < .001)
- INCREASE PERCENT OF PREHOSPITAL HELICOPTER TRANSPORT OF < 60 MINUTES
 - 24.8% vs 75.2%, (P < .001)
- WHEN ADJUSTED FOR INJURY SEVERITY SCORE AND TIME PERIOD, (COCHRANE-MANTEL-HAENSZEL TEST)
- THE KILLED IN ACTION % WAS LOWER POST-MANDATE
 - PREHOSPITAL BLOOD TRANSFUSION, 6.8% vs 51.0%, (P < .001)
 - TRANSPORTED IN 60 MINUTES OR LESS, 25.7% vs 30.2%, (P < .01),

ONLINE FIRST

Eliminating Preventable Death on the Battlefield

Russ S. Kotwal, MD, MPH; Harold R. Montgomery, NREMT; Bari M. Kotwal, MS; Howard R. Champion, FRCS; Frank K. Butler Jr, MD; Robert L. Mabry, MD; Jeffrey S. Cain, MD; Lorne H. Blackbourne, MD; Kathy K. Mechler, MS, RN; John B. Holcomb, MD

Arch Surg. 2011;146(12):1350-1358.

- 75TH RANGER REGIMENT COMMAND DIRECTIVE TO FOLLOW TCCC GUIDELINES
- RANGERS HAD LOWER KIA AND DOW RATES COMPARED TO ALL OTHERS IN DOD
 - KIA: 10.7% vs 16.4, $p=0.04$
 - DOW: 1.7% vs 5.8%, $p=0.02$
- OF 32 FATALITIES INCURRED BY THE REGIMENT, NONE DIED OF WOUNDS FROM INFECTION, NONE WERE POTENTIALLY SURVIVABLE, AND 1 WAS POTENTIALLY SURVIVABLE IN THE HOSPITAL SETTING.

US Military at Risk of Exsanguination Iraq / Afghanistan 2001-2014

- 58,831 = Killed in Action + all wounded
- 53,724 = survivors + died of wounds
- 8,836 transfused, ≈50% Massive transfusion

Frequency of life-threatening bleeding

- 4000 requiring massive transfusion
- 1,300 KIA, died of hemorrhage with survivable injuries

These 5,300 casualties would have been the most likely to **benefit from Blood Far Forward**.

10% of injured soldiers are at very high risk of death due to hemorrhage.

**This at-risk group represents, on average, one soldier per day of war
or 1 out of 10 wounded!**

Original Investigation

Transfusion of Plasma, Platelets, and Red Blood Cells in a 1:1:1 vs a 1:1:2 Ratio and Mortality in Patients With Severe Trauma The PROPPR Randomized Clinical Trial

John B. Holcomb, MD; Barbara C. Tilley, PhD; Sarah Baraniuk, PhD; Erin E. Fox, PhD; Charles E. Wade, PhD; Jeanette M. Podbielski, RN; Deborah J. del Junco, PhD; Karen J. Brasel, MD, MPH; Eileen M. Bulger, MD; Rachael A. Callcut, MD, MSPH; Mitchell Jay Cohen, MD; Bryan A. Cotton, MD, MPH; Timothy C. Fabian, MD; Kenji Inaba, MD; Jeffrey D. Kerby, MD, PhD; Peter Muskat, MD; Terence O'Keeffe, MBChB, MSPH; Sandro Rizoli, MD, PhD; Bryce R. H. Robinson, MD; Thomas M. Scalea, MD; Martin A. Schreiber, MS; Deborah M. Stein, MD; Jordan A. Weinberg, MD; Jeannie L. Callum, MD; John R. Hess, MD, MPH; Nena Matijevic, PhD; Christopher N. Miller, MD; Jean-Francois Pittet, MD; David B. Hoyt, MD; Gail D. Pearson, MD, ScD; Brian Leroux, PhD; Gerald van Belle, PhD; for the PROPPR Study Group

JAMA. 2015;313(5):471-482.

- 680 PATIENTS PREDICTED TO REQUIRE MASSIVE TRANSFUSION
 - 24 HOUR MORTALITY: APPROXIMATELY 15%
 - 30 DAY MORTALITY: APPROXIMATELY 24%
 - HEMORRHAGE AS CAUSE OF DEATH: APPROXIMATELY 50%

An analysis of prehospital deaths: Who can we save?

James S. Davis, MD, Shevonne S. Satahoo, MD, Frank K. Butler, MD, Harrison Dermer, Daniel Naranjo, MD, Katherina Julien, Robert M. Van Haren, MD, MSPH, Nicholas Namias, MD, MBA, Lorne H. Blackbourne, MD, and Carl I. Schulman, MD, PhD, MSPH, Miami, Florida

- 512 PATIENT DEATHS IN 2011 FROM MIAMI-DADE COUNTY
- AUTOPSY REPORTS REVIEWED BY EXPERT PANEL
- BLUNT 53% AND PENETRATING 47%
- 29% OF PRE-HOSPITAL DEATHS DETERMINED TO BE POTENTIALLY PREVENTABLE
 - HEMORRHAGE CAUSE FOR 64% OF PREVENTABLE DEATHS
 - 20% OF ALL DEATHS POTENTIALLY PREVENTABLE DUE TO HEMORRHAGE

Pooled preventable death rates in trauma patients

Meta analysis and systematic review since 1990

A. M. Kwon · N. C. Garbett · G. H. Kloecker

- 27 MANUSCRIPTS FROM 14 COUNTRIES
- PREVENTABLE DEATHS DETERMINED BY PANEL REVIEW AND STATISTICAL METHODS
- POOLED ESTIMATE OF PREVENTABLE DEATHS 20% (95% CI, 16-25)

TOOLS TO REDUCE DEATH FROM HEMORRHAGE

- RAPID EVACUATION
- HYPOTENSIVE RESUSCITATION - IF RAPID TRANSPORT
- TOURNIQUETS/TOPICAL HEMOSTATIC AGENTS/REBOA
- BLOOD BASED RESUSCITATION STRATEGY
 - WHOLE BLOOD
 - RBCs, PLASMA, PLATELETS
 - DRIED PLASMA, DRIED PLATELET DERIVED AGENTS, OXYGEN CARRIERS
- TRANEXAMIC ACID AND FIBRINOGEN CONCENTRATES/CRYOPRECIPITATE
 - PCC'S LATER IN RESUSCITATION POTENTIALLY
- HIBERNATION/SUSPENDED ANIMATION/CONTROLLED HYPOTHERMIA/SURVIVAL GENE ACTIVATION
- OTHERS

DR. SUTTON'S LAW



- THE MOST EFFECTIVE WAY TO IMPROVE OUTCOMES FOR PATIENTS WITH TRAUMATIC INJURY IS TO PREVENT DEATH FROM HEMORRHAGE
- **WE MUST THEN PRIORITIZE THE IMPLEMENTATION AND DEVELOP TRAUMA SYSTEMS THAT AIM TO ACHIEVE ZERO PREVENTABLE DEATHS, ESPECIALLY IN THE PRE-HOSPITAL SETTING.**

Sutton W, Linn E: *Where the Money Was: The Memoirs of a Bank Robber*. Viking Press (1976), p. 160.

A NATIONAL TRAUMA CARE SYSTEM

**Integrating Military and Civilian
Trauma Care Systems to Achieve
Zero Preventable Deaths After Injury**

Committee on Military Trauma Care's Learning Health System and Its Translation to the Civilian Sector

Donald Berwick (*Chair*), Institute for Healthcare Improvement

Ellen Embrey, Stratitia, Inc., and 2c4 Technologies, Inc.

Sara F. Goldkind, Goldkind Consulting, LLC

Adil Haider, Brigham and Women's Hospital, and Harvard University

COL (Ret) John Bradley Holcomb, University of Texas Health Science Center

Brent C. James, Intermountain Healthcare

Jorie Klein, Parkland Health & Hospital System

Douglas F. Kupas, Geisinger Health System

Cato Laurencin, University of Connecticut

Ellen MacKenzie, Johns Hopkins University School of Hygiene and Public Health

David Marcozzi, University of Maryland School of Medicine

C. Joseph McCannon, The Billions Institute

Norman McSwain, JR., (until July 2015), Tulane Department of Surgery

John Parrish, Consortia for Improving Medicine with Innovation and Technology (CIMIT); Harvard Medical School

Rita Redberg, University of California, San Francisco

Uwe E. Reinhardt, (until August 2015), Princeton University

James Robinson, Denver Health EMS-Paramedic Division

Thomas Scalea, R. Adams Cowley Shock Trauma Center, University of Maryland

C. William Schwab, University of Pennsylvania

Philip C. Spinella, Washington University in St. Louis School of Medicine



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- Trauma Center Association of America
- U.S. Department of Defense's U.S. Army Medical Research and Materiel Command
- U.S. Department of Homeland Security's Office of Health Affairs
- U.S. Department of Transportation's National Highway Traffic Safety Administration



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Charge to the Committee

- Identify and describe the **key components of a learning health system** necessary to **optimize care** of individuals who have sustained traumatic injuries **in military and civilian settings**.
- **Characterize the military's** Joint Trauma System (JTS) and Defense Health Program research investment and their integrated role as a **continuous learning and evidence-based process improvement models**.
- Examine opportunities to **ensure that advances in trauma care are sustained and built on** for future combat operations.
- **Consider strategies necessary to more effectively translate,** sustain, and build upon elements of knowledge and practice from the military's learning health system into the civilian health sector and **lessons learned** from the civilian sector into the military sector.

Timeline

- **May 2015** **1st committee meeting**
- **July 2015** **2nd committee meeting and public workshop**
- **September 2015** **3rd committee meeting and public workshop**
- **November 2015** **4th committee meeting**
- **January 2016** **5th committee meeting**
- **June 2016** **Report release**
- **Ongoing** **Report dissemination**

In addition to in-person committee meetings, the committee gathered information through Web-based meetings held in October 2015, December 2015, January 2016, and February 2016.

Definitions

- **Preventable deaths after injury:** Those casualties whose lives could have been saved by appropriate and timely medical care, irrespective of tactical, logistical, or environmental issues.
- **Focused empiricism:** An approach to process improvement under circumstances in which: (1) high-quality data are not available to inform clinical practice changes, (2) there is extreme urgency to improve outcomes because of high morbidity and mortality rates, and (3) data collection is possible.

A key principle of focused empiricism is using the best data available in combination with experience to develop clinical practice guidelines that, through an iterative process, continue to be refined until high-quality data can be generated to further inform clinical practice and standards of care.

Context

- **The Imperative**

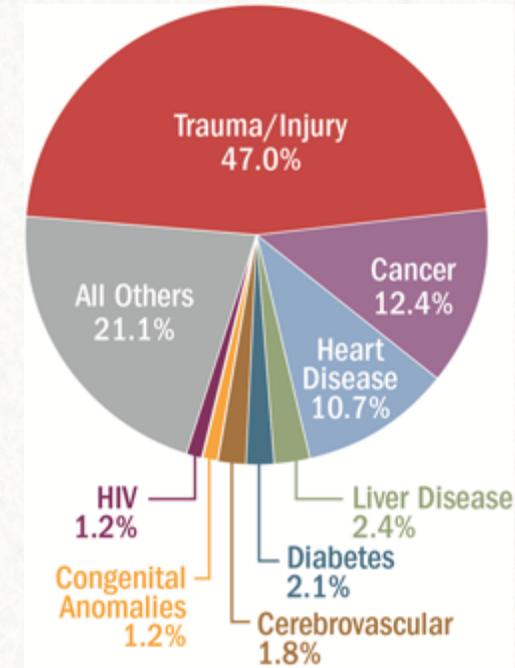
- The U.S. service members the nation sends into harm's way and every American should have the **best possible chance for survival and functional recovery** after injury.

- **The Urgency**

- **Military burden:** ~6,850 service member deaths in Iraq and Afghanistan. **Nearly 1,000 from potentially survivable injuries.**
- **Civilian burden:** 147,790 U.S. trauma deaths in 2014 - as many as **30,000 may have been preventable with optimal trauma care.**
- Threats from active shooter and other mass casualty incidents.
- As wars end and service members leave the military, the knowledge, experience and advances in trauma care gained over past decade are being lost.

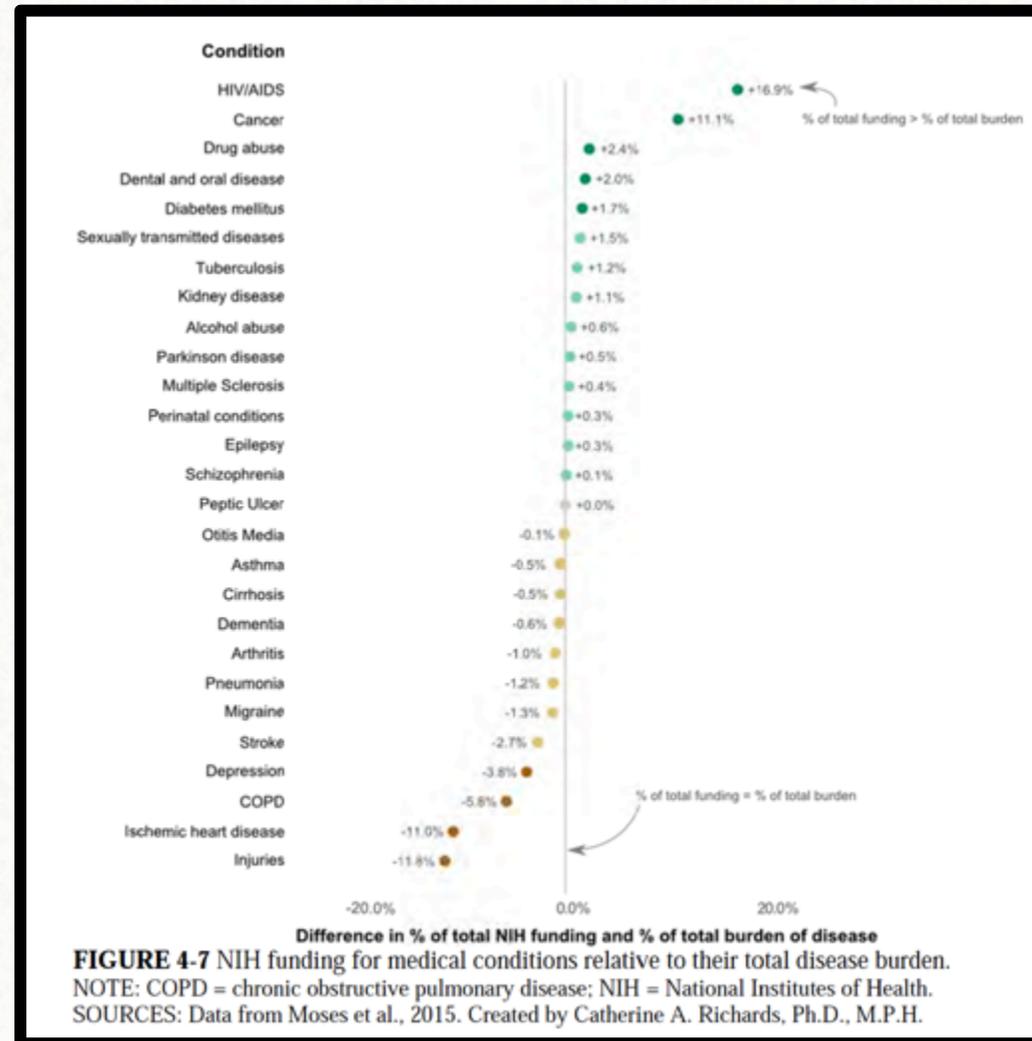
- **The Opportunity**

- Existence of a **military trauma system** built on a learning system framework that has achieved unprecedented survival rates for casualties.
- Organized **civilian trauma system** that is well positioned to assimilate recent wartime trauma lessons learned and serve as a repository and incubator for innovation during the interwar period.



Traumatic injury accounts for nearly half of all deaths for Americans under 46 years of age and cost the nation \$670B in 2013.

Funding Gap

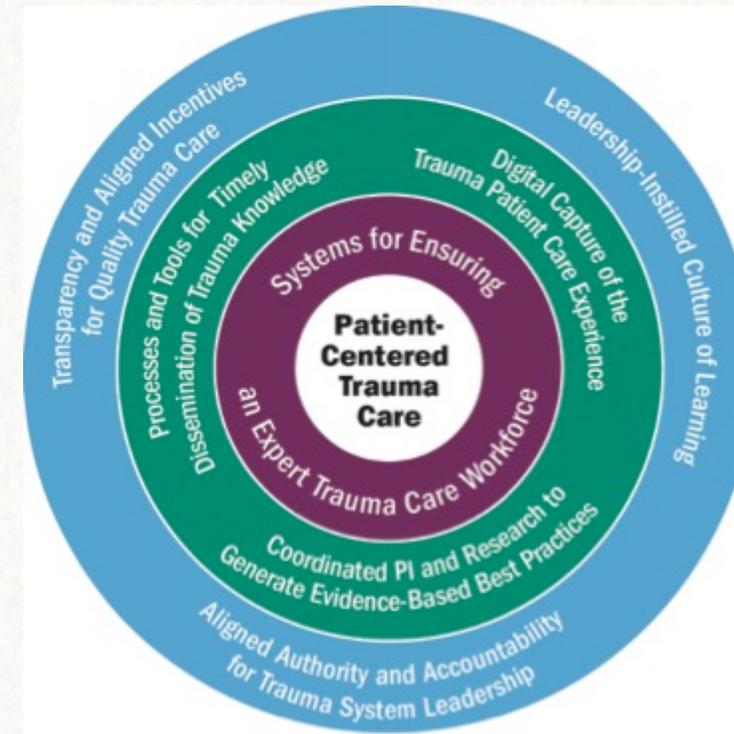


Framework for a Learning Trauma Care System

Committee built upon the components of a continuously learning health system articulated by IOM (2013) report *Best Care at Lower Cost*.

Components of a **continuously learning trauma care system**:

- Digital capture of the patient care experience
- Coordinated performance improvement and research to generate evidence-based best trauma care practices
- Processes and tools for timely dissemination of trauma knowledge
- Systems for ensuring an expert trauma care workforce
- Patient-centered trauma care
- Leadership-instilled culture of learning
- Transparency and incentives aligned for quality trauma care
- Aligned authority and accountability for trauma system leadership



Patient centeredness is the core of a learning trauma care system.

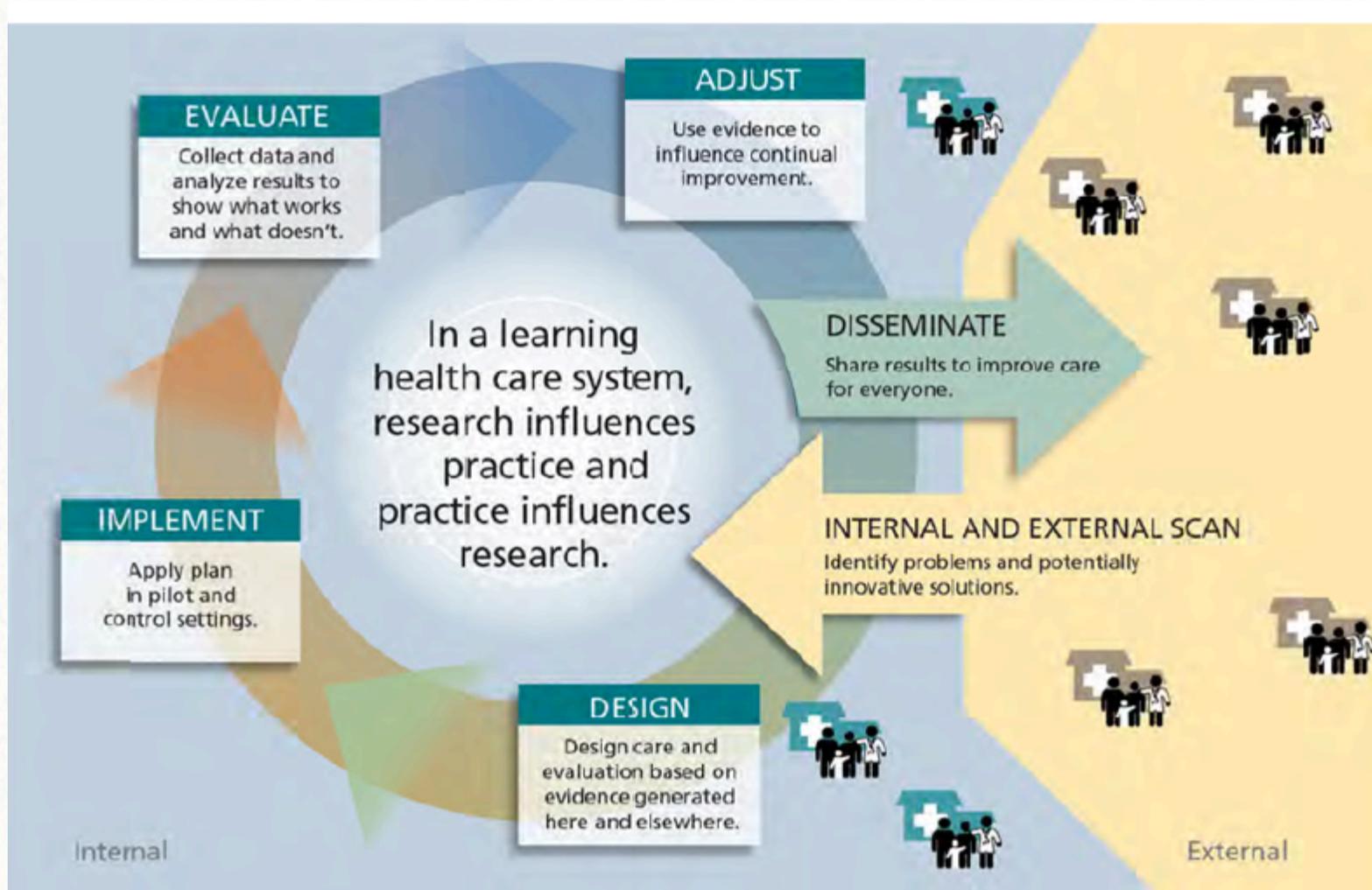
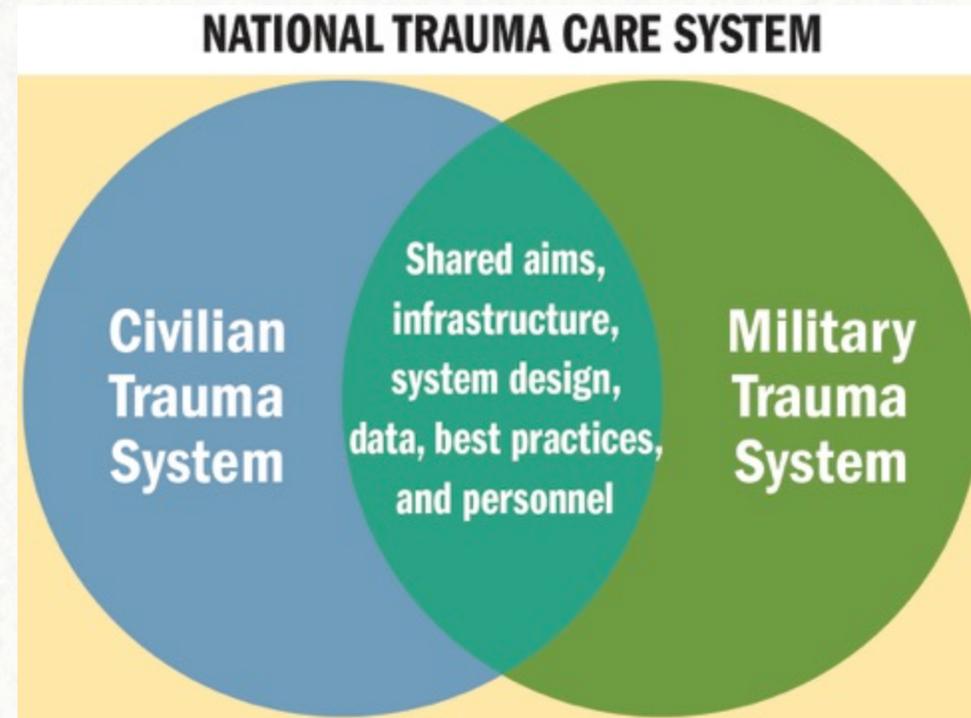


FIGURE 3-1 How a continuously learning health system works.

The Vision: A National Trauma Care System

A national strategy and joint military–civilian approach for improving trauma care is lacking. **A unified effort is needed** to ensure the delivery of optimal trauma care **to save the lives of Americans** injured within the United States and on the battlefield.

A national learning trauma care system would **ensure continuous improvement of trauma care best practices** in military and civilian sectors.



“Military and civilian trauma care will be optimized together, or not at all.”

Findings and Recommendations

The Aim (Rec 1)

The Role of Leadership

- National-Level Leadership (Rec 2)
- Military Leadership (Rec 3)
- Civilian Sector Leadership (Rec 4)

An Integrated Military–Civilian Framework for Learning to Advance Trauma Care

- Improving the Collection and Use of Data (Recs 5 and 9)
- A Collaborative Research Infrastructure in a Supportive Regulatory Environment (Recs 7 and 8)
- Systems and Incentives for Improving Prehospital Trauma Care Quality (Rec 10)
- Developing Expertise (Recs 6 and 11)

The Aim

Without an aim, there is no system (Deming).

Recommendation 1: The White House should set a national aim of achieving zero preventable deaths after injury and minimizing trauma-related disability.

- The 75th Ranger Regiment demonstrated that achieving zero preventable deaths is **an achievable goal** when leadership takes ownership of trauma care and data is used for continuous reflection and improvement.

The Role of Leadership

National-Level Leadership

Findings:

- The **absence of any higher authority to encourage coordination, collaboration, standardization, and alignment in trauma care** across and within the military and civilian sectors has resulted in **variations in practice, suboptimal outcomes for injured patients**, and a lack of national attention and funding directed at trauma care.
- **Previous non-trauma White House-led national initiatives have helped unify and ensure collaboration** among existing efforts and points of authority spread across military and civilian federal agencies, state and local governments, and professional organizations.

National-Level Leadership

Recommendation 2: The White House should lead the integration of military and civilian trauma care to establish a national trauma care system. This initiative would include assigning a locus of accountability and responsibility that would ensure the development of common best practices, data standards, research, and workflow across the continuum of trauma care.

The White House should:

- Convene federal agencies and other governmental, academic, and private-sector stakeholders to agree on the aims, design, and governance of a national trauma care system.
- Ensure appropriate funding and the reduction of regulatory barriers
- Strategically communicate the value of a national trauma care system that can respond domestically to mass casualty incidents.

Military Leadership

Findings:

- Within the military leadership structure, there is **no overarching authority** responsible for ensuring medical readiness to deliver combat casualty care.
- **Responsibility, authority, and accountability** for battlefield care **are diffused** across central and service-specific medical leadership, as well as line leadership.
- An **inconsistent level of understanding** by senior medical and line leadership of the value of a learning trauma care system **impedes continuous learning and improvement.**

Military Leadership

Recommendation 3: The Secretary of Defense should ensure combatant commanders and the Defense Health Agency (DHA) Director are responsible and held accountable for the integrity and quality of the execution of the trauma care system in support of the aim of zero preventable deaths after injury and minimizing disability.

- The Secretary of Defense also should ensure the DHA Director has the responsibility and authority and is held **accountable for defining the capabilities necessary** to meet the requirements specified by the combatant commanders with regard to expert combat casualty care personnel and system support infrastructure.
- The Secretary of Defense should hold the Secretaries of the military departments accountable for fully supporting DHA in that mission.
- The Secretary of Defense should direct the DHA Director to **expand and stabilize long-term support for the Joint Trauma System** so its functionality can be improved and utilized across all combatant commands, giving actors in the system access to timely evidence, data, educational opportunities, research, and performance improvement activities.

Civilian Sector Leadership

Findings:

- Authority and accountability for civilian trauma care capabilities are fragmented and vary from location to location, resulting in a patchwork of systems for trauma care in which **mortality varies twofold between the best and worst trauma centers in the nation.**
- There is **no federal civilian health lead for trauma** care (including prehospital, in-hospital, and post-acute care) to support a learning health system for trauma care, despite past recommendations that such a lead agency be established.

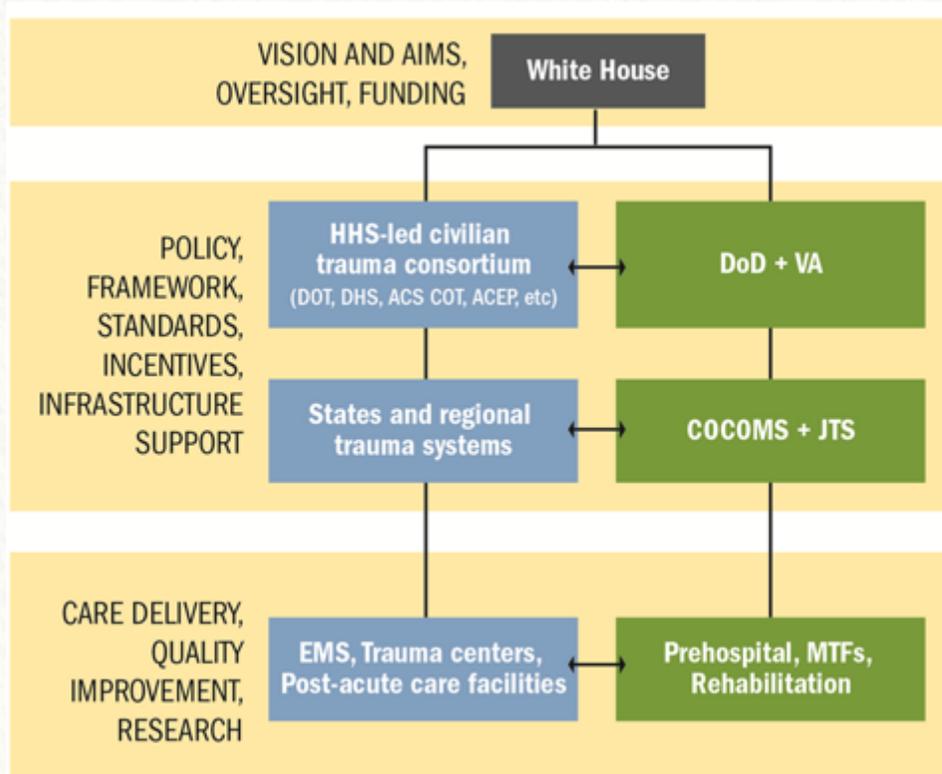
Civilian Sector Leadership

Recommendation 4: The Secretary of HHS should designate and fully support a locus of responsibility and authority within HHS for leading a sustained effort to achieve the national aim of zero preventable deaths after injury and minimizing disability. This leadership role should include coordination with governmental (federal, state, and local), academic, and private-sector partners and should address care from the point of injury to rehabilitation and post-acute care.

The designated locus of responsibility should:

- Convene a consortium of federal and other governmental, academic, and private-sector stakeholders, including trauma patient representatives, to jointly define a framework for the recommended national trauma care system, including the designation of stakeholder roles and responsibilities, authorities, and accountabilities.
- Develop and implement guidelines for establishment of the appropriate number, level, and location of trauma centers within a region based on the needs of the population.

Organizing and Demonstrating Effectiveness



Tiered roles and responsibilities for military and civilian stakeholders in a national trauma care system.

Bidirectional exchange occurs at all levels.

Both sectors need to demonstrate the effectiveness of the learning trauma care system by each year **diffusing across the entire system** one or two deeply **evidence-based interventions** (such as tourniquets) known to improve the quality of trauma care.

An Integrated Military – Civilian Framework for Learning to Advance Trauma Care

Improving the Collection and Use of Data

Findings:

- The **collection and integration of trauma data** across the care continuum **is incomplete** in both the military and civilian sectors.
- Military and civilian trauma management information systems rely on inefficient and error-prone manual data abstraction to populate registries.
- **Data are fragmented** across existing trauma registries and other data systems, and **data sharing** within and across the military and civilian sectors **is impeded** by political, operational, technical, regulatory, and security-related barriers.
- In both the military and civilian sectors, **performance transparency** at the provider and system levels **is lacking**.
- Providers lack real-time access to their performance data.
- No process exists for benchmarking trauma system performance across the entire continuum of care within and between the military and civilian sectors.
- **Military participation** in national trauma quality improvement collaboratives **is minimal**; only a single military hospital participates in an ACS TQIP.

Improving the Collection and Use of Data

Recommendation 5: The Secretary of HHS and the Secretary of Defense, together with their governmental, private, and academic partners, should work jointly to ensure that military and civilian trauma systems collect and share common data spanning the entire continuum of care. Measures related to prevention, mortality, disability, mental health, patient experience, and other intermediate and final clinical and cost outcomes should be made readily accessible and useful to all relevant providers and agencies.

- Congress and the White House should hold DoD and the VA accountable for enabling the linking of patient data stored in their respective systems.
- ACS, NHTSA, and NASEMSO should work jointly to enable patient-level linkages across the NEMSIS National EMS Database and the National Trauma Data Bank.
- HHS, DoD, and their professional society partners should jointly engage the National Quality Forum in the development of measures of the overall quality of trauma care. These measures should be used in trauma quality improvement programs, including ACS TQIP.

Recommendation 9: All military and civilian trauma systems should participate in a structured trauma quality improvement process.

- ACS should expand TQIP to encompass measures from point-of-injury/prehospital care through long-term outcomes, for its adult as well as pediatric programs.
- CMMI should pilot, fund, and evaluate regional, system-level models of trauma care delivery.

A Collaborative Military–Civilian Research Infrastructure

Findings:

- **Despite its significant societal burden, civilian investment in trauma research is not commensurate with the importance of injury.**
- Sustainment of DoD’s trauma research program is threatened though gaps identified in DoD’s Guidance on Development of the Force remain less than 50 percent resolved.
- Trauma care practices developed through a focused empiricism approach need to be validated by higher quality collaborative research studies.
- In the civilian sector, no mechanism exists for directing research investments toward identified gaps, a problem exacerbated by the absence of a centralized institute dedicated to trauma and emergency care research.

A Collaborative Military–Civilian Research Infrastructure

Recommendation 7: To strengthen trauma research and ensure that the resources available for this research are commensurate with the importance of injury and the potential for improvement in patient outcomes, the White House should issue an executive order mandating the establishment of a National Trauma Research Action Plan requiring a resourced, coordinated, joint approach to trauma care research across DoD, HHS (NIH, AHRQ, CDC, FDA, PCORI), DOT, the VA, and others (academic institutions, professional societies, foundations).

The National Trauma Research Action Plan should:

- Direct the performance of a gap analysis to identify clinical and system research gaps, considering needs specific to mass casualty incidents and special patient populations.
- Develop the appropriate requirements-driven and patient-centered research strategy and priorities for addressing the gaps with patient input.
- Specify an integrated military–civilian strategy with short, intermediate and long-term steps for ensuring appropriate resources are directed toward the identified gaps.
- Promote military–civilian research partnerships.

A Supportive Regulatory Environment

Findings:

- The ambiguity between quality improvement and research slows and even impedes quality improvement and research activities.
- FDA and DoD requirements for informed consent **impede needed trauma research**; ironically, these regulations make minimal risk research the most difficult to perform.
- Common misperceptions about HIPAA regulations present **barriers to using and sharing data** across systems for both direct patient care and research purposes.
- **Greater flexibility in evidentiary standards** (within legal constraints) could enable better leveraging of large bodies of clinical data for critically needed life-saving products.
- More systematic **interface between FDA and DoD** is needed to facilitate more timely fielding of diagnostic and therapeutic products.

A Supportive Regulatory Environment

Recommendation 8: To accelerate progress toward the aim of zero preventable deaths after injury and minimizing disability, regulatory agencies should revise research regulations and reduce misinterpretation of the regulations through policy statements (i.e., guidance documents).

Points of consideration:

- Allow the FDA to develop criteria for waiver or modification of the requirement of informed consent for minimal-risk research.
- For nonexempt human subjects research that falls under HHS or FDA human subjects protections, DoD should consider eliminating the need to also apply 10 U.S.C. 980, “Limitation on Use of Humans As Experimental Subjects” to the research.
- HHS’s Office for Civil Rights should consider providing guidance on the scope and applicability of HIPAA with respect to trauma care and trauma research.
- The FDA should consider establishing an internal Military Use Panel that can serve as an interagency communication and collaboration mechanism to facilitate more timely fielding of urgently needed medical therapeutic and diagnostic products for trauma.
- HHS, when considering revisions to the Common Rule, should consider whether the distinction between QI and research permits active use of pragmatic learning methods. Whatever distinction is ultimately made, the committee believes that it needs to support a learning health system.

Systems and Incentives for Improving Prehospital Trauma Care Quality

Findings:

- The greatest opportunity to save lives after injury is in the prehospital setting.
- Prehospital care is not currently linked to health care delivery reform efforts.
- **Variable standards of care, a paucity of universal protocols and current reimbursement practices for civilian EMS (i.e., pay-for-transport) are major impediments to the seamless integration of prehospital care into the trauma care continuum.**



Prehospital care needs to be a seamless component of the trauma care chain of survival.

Systems and Incentives for Improving Prehospital Trauma Care Quality

Recommendation 10: Congress, in consultation with HHS, should identify, evaluate, and implement mechanisms that ensure the inclusion of prehospital care (e.g., emergency medical services) as a seamless component of health care delivery rather than merely a transport mechanism.

Possible mechanisms that might be considered include:

- Amendment of the Social Security Act such that EMS is identified as a provider type.
- Modification of CMS’s ambulance fee schedule to better link the quality of prehospital care to reimbursement and health care delivery reform efforts.
- Establishing responsibility, authority, and resources within HHS to ensure that prehospital care is an integral component of health care delivery
- Supporting and appropriately resourcing an EMS needs assessment to determine the necessary EMS workforce size, location, competencies, training, and equipping needed for optimal prehospital medical care.

Developing Expertise: Timely Dissemination of Knowledge

Findings:

- The military’s teleconsultation programs in theater are jeopardized by a lack of funding and institutionalization.
- While best practices in telemedicine exist within the United States (e.g., Project ECHO), this tool is not used to its full potential in military or civilian trauma care.
- Expansion of the scope of the Senior Visiting Surgeons program to providers other than surgeons could broaden its impact and improve the exchange of tacit knowledge between military and civilian providers.
- More formal methods for military-civilian collaboration could better translate military best practices and its agile approach into civilian guideline development processes.

Developing Expertise: Timely Dissemination of Knowledge

Recommendation 6: To support the development, continuous refinement, and dissemination of best practices, the designated leaders of the recommended national trauma care system should establish processes for real-time access to patient-level data from across the continuum of care and just-in-time access to high-quality knowledge for trauma care teams and those who support them.

- Military and civilian trauma management information systems should be designed for the purpose of improving the real-time front-line delivery of care.
 - The greater trauma community as well as EMR and trauma registry vendors should lead the development of a bottom-up data system design around focused processes for trauma care.
- Military and civilian trauma system leaders should employ a multipronged approach to ensure the adoption of guidelines and best practices by trauma care providers.
 - This should encompass clinical decision support tools, PI programs, mandatory pre-deployment training, and continuing education.
 - DoD and civilian partners should collaboratively develop guidelines and guideline information should be included in national certification testing at all levels.

Developing Expertise: Ensuring an Expert Workforce

Findings:

- Policy and operational barriers—variable trauma workload, beneficiary care responsibilities, and the lack of defined trauma care career paths—**impede the military’s ability to recruit, train and retain** an expert trauma care workforce.
- DoD lacks validated, standardized trauma training and skill sustainment programs.
- The military’s reliance on just-in-time (e.g., trauma courses, short-duration predeployment training programs) and on-the-job training **does not provide the experience necessary** to ensure an expert trauma care workforce. Providers need to regularly care for trauma patients.
- Officer and enlisted leadership courses attended by senior line and medical leaders do not provide education and training on trauma system concepts, resulting in a **lack of understanding** of such concepts **by those who are responsible** for the execution of the theater trauma system.
- **Promotion incentives** for military medical personnel **are misaligned**; current promotion structures do not encourage or reward the growth of clinical trauma-focused expertise.

Developing Expertise: Ensuring an Expert Workforce

Recommendation 11: To ensure readiness and to save lives through the delivery of optimal combat casualty care, the Secretary of Defense should direct the development of career paths for trauma care. Furthermore, the Secretary of Defense should direct the Military Health System to pursue the development of integrated, permanent joint civilian and military trauma system training platforms to create and sustain an expert trauma workforce.

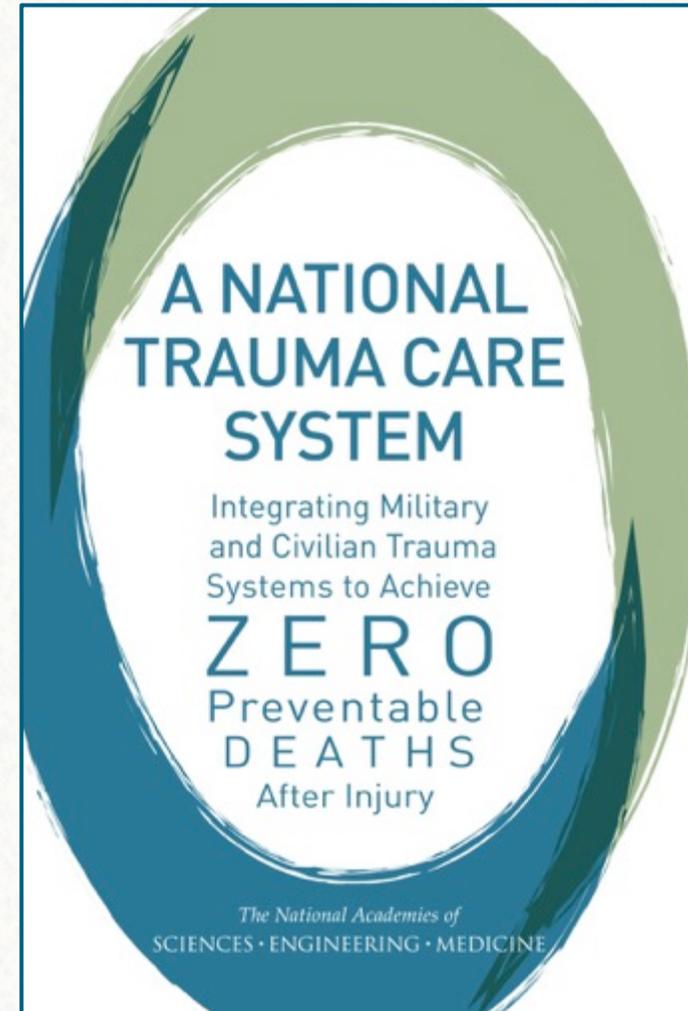
- Ensure the verification of a subset of MTFs by ACS as Level I, II, or III trauma centers that will participate in civilian regional trauma systems.
- Assign military trauma teams representing the full spectrum of providers of prehospital, hospital, and rehabilitation-based care to civilian trauma centers.
- Develop and sustain a research portfolio focused on optimizing mechanisms by which all (active duty, Reserve, and National Guard) military medical personnel acquire and sustain expert-level performance in combat casualty care.
- Hold the DHA accountable for standardizing the curricula, skill sets, and competencies for all physicians, nurses, and allied health professionals (e.g., medics, technicians, administrators).

Thank you!

Free PDF of the report available at:
nationalacademies.org/TraumaCare

Additional materials available on
the Academies website

- 4-page report in brief
- Recommendation list
- Infographic
- Slide set



CONCLUSIONS

- WHERE IS THE MONEY?
 - PREVENTABLE DEATHS FROM HEMORRHAGE IN PREHOSPITAL PHASE
- HOW TO GET THE MONEY?
 - ROBUST TRAUMA LEARNING HEALTH CARE SYSTEMS
 - EDUCATION/TRAINING
 - RAPID DATA COLLECTION/ANALYSIS
 - TRANSPARENCY OF OUTCOMES
 - RESEARCH
 - CAREER DEVELOPMENT/SUPPORT
 - PATIENT CENTERED
 - LEADERSHIP WITH ACCOUNTABILITY OF THE ENTIRE SYSTEM