The views expressed in this presentation are those of the author and do not reflect the official policy or position of the Department of Defense or US Government, except where specifically indicated.

No conflict of interest.
DOD JTS:
INTRODUCTION AND OVERVIEW
“...the signature military medical advance of our decade-plus of war is the decision to create and implement a military trauma system.”

“An effective military trauma system must advocate organization, communication, and standardization, each of which supports and reinforces the others.”
MISSION:

- provide evidence-based Performance Improvement (PI) of trauma and combat casualty care
- reduce morbidity and mortality to lowest possible levels
- provide evidence-based recommendations on trauma care and trauma systems across the Department of Defense (DoD)

http://jts.amedd.army.mil/
Performance Improvement vs Research

- **PERFORMANCE IMPROVEMENT (PI):** Systematic data-guided activity designed to effect health care delivery in **near real-time**.
  - **Indicators:** includes monitoring, data collection and assessment, evaluation of metrics, procedures, and/or standard clinical practices intended for modification or correction of deficiencies in a designated population.

- **RESEARCH:** Systematic investigation designed to develop or contribute to generalizable knowledge – includes development, testing, and evaluation; follows a highly structured federal regulatory process.
  - **Indicators:** includes testing of issues that go beyond current knowledge based on science and experience, random allocation of patients into different intervention groups, and deliberate delay of feedback of data from those monitoring the implementation, especially if done to avoid bias.

*A well-designed health care system should have PI activities that ultimately prompt and prioritize Research initiatives.*
1. **External Environment**: direct, indirect factors
2. **Mission & Strategy**: mission, vision
3. **Leadership**: leadership structure, role models
4. **Culture**: values, how people work together, influence on greater good
5. **Structure**: hierarchy, communication, decision making
6. **Mgmt Practices**: implementation of vision
7. **Systems**: policies & procedures that govern day-to-day work
8. **Climate**: what your people think and feel about each other, hopes and expectations
9. **Tasks & Skills**: individual abilities, positional requirements
10. **Motivation**: needed for change
11. **Values & Needs**: importance, job satisfaction
12. **Performance**: productivity, quality, efficiency, customer satisfaction

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### Timeline

**1996** – Concept of collecting combat trauma data for gap and trend analysis born from U.S. GAO report addressing shortcomings from Operation Desert Storm.

*COL Holcomb sees tactical, operational, and strategic need to deploy a trauma system.*

**2002** – U.S. Army Surgeon General approved JTTR as a demonstration project.

**2003** – LTC Eastridge deployed as first JTTS Trauma Medical Director, USCENTCOM.

**2004** – ASD (HA) directs all Service medical departments to work together to establish a single centralized trauma registry.

**2006** – JTTS formalized & modeled after civilian trauma system principles in ACS CoT “Resources for the Optimal Care of the Trauma Patient”, Dr Spott first Director.

**2010** – JTTS renamed JTS to signify operations beyond deployment and combat theater

**2011** – S&F JTTR revamped into a robust, real-time, web-accessible system, the DoDTR.

**2013** – ASD designates JTS as the DoD Center of Excellence for Trauma

**2018** – JTS aligned under the Defense Health Agency
Memos, Policies, and Law

**Memos:**

- **ASD (HA) Policy Memo 04-031**, 22 Dec 04: Coordination of Policy to Establish a Joint Theater Trauma Registry
- **Health Affairs Action Memo**, 14 Dec 05: Joint Theater Trauma Records
- **US Army Institute of Surgical Research Memo**, 10 May 07: Collection of Trauma Registry Performance Improvement Data from all Level IV and V MTFs into the Joint Theater Trauma Registry
- **Office of the Surgeon General (OTSG) Memo**, 11 May 07: Improvements to the Joint Theater Trauma Registry (JTTR)

**Policies and Law:**

- **DoDI 6040.47**, Joint Trauma System (JTS), issued 28 Sep 2016
- **DoDI 1322.24**, Medical Readiness Training (MRT), issued 16 Mar 2018
Purpose: In accordance with the authority in DoD Directive 5124.02, this issuance:

- Establishes policy, assigns responsibilities, and provides procedures to develop and maintain an enduring global trauma care capability that supports a full range of military operations, including a comprehensive DoD Trauma Registry (DoDTR).

- Establishes the Secretary of the Army as the Military Health System (MHS) Lead Agent for trauma care and recognizes the JTS as a DoD Center of Excellence (DCoE).

- Establishes an integrated Combatant Command (CCMD) Trauma System (CTS) modeled after the Joint Theater Trauma System (JTTS), and a requirement to input data into the DoDTR to support unique CCMD mission requirements.
Purpose: This issuance:

- In accordance with the authority in DoD Directive (DoDD) 5124.02, establishes policy, assigns responsibilities, and provides procedures for governing MRT for Service members and the DoD expeditionary civilians (DoD-EC).
- In accordance with Section 708 of Public Law 114-328, develops a standardized combat casualty care instruction for all Service members, including the use of standardized trauma training platforms.
- Establishes a requirement to record tactical combat casualty care (TCCC) certification in Service-designated training tracking systems.
Registry vs Electronic Health Record

- **REGISTRY:** Database system that uses observational methods to collect clinical and other relevant data, and is oriented around the **systematic analysis** of exposures, interventions and outcomes.
  - **Analysis:** Registries are designed and structured for analysis of medical and non-medical patient data, information, metrics, and outcomes, and are used in scientific research, performance improvement, and policy analysis.

- **ELECTRONIC HEALTH RECORD:** A patient health care management system that enables the delivery of care, and is oriented around the **transactional** details of patient care.
  - **Patient Management:** EHRs are designed and structured for the efficient management of patient care delivery through the recording of patient/provider interactions/transactions.

A well-designed health care system should have Registries that ultimately prompt and prioritize EHR data to be collected.
# The DoD Trauma Registry Versus the Electronic Health Record


<table>
<thead>
<tr>
<th>Registry</th>
<th>Health Record</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monitor and observe the course of injuries and treatment in individuals and populations</td>
<td>Document a patient’s injuries and treatment</td>
</tr>
<tr>
<td>Understand variations in treatments and outcomes</td>
<td>Facilitate communication between providers</td>
</tr>
<tr>
<td>Examine factors that influence prognosis and quality of life</td>
<td>Support care of patient</td>
</tr>
<tr>
<td>Describe patterns of care, appropriateness of care, and disparities in the delivery of care</td>
<td>Collect health statistics</td>
</tr>
<tr>
<td>Assess effectiveness</td>
<td>Research of specific injuries and treatment</td>
</tr>
<tr>
<td>Monitor safety and harm</td>
<td></td>
</tr>
<tr>
<td>Measure quality of care</td>
<td></td>
</tr>
<tr>
<td>Study quality improvement</td>
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Joint Trauma System

The Department of Defense Center of Excellence for Trauma

- JTS Director (O-6 TS)
- Deputy Director (GS 15)
- Chief Nurse (O-5)
- Chief Financial Officer/Chief of Staff

**DoD Trauma Registry**

- QA Data Validators
- Acquisition
- Data Release
- Modules
  - COCOM
  - CONUS
  - Backlog

- Data Fixer

- Operations Security/Privacy Action Officer
  - Agreements (MOU/MOA)
  - Sr. Tech. Writer

- NCOIC

- Trauma Care Operations (O-6 Op Med)
  - Prehospital
  - ERC
  - MTF

- Performance Improvement (GS or Military)
  - Concurrent
  - AFMES Liaison

- Analysis

- Education

- Information Management/Technology

- CoTCCC
- CoERCCC
- CoSCCC

- SETD Curriculum Development
- CE Coord.
- EDO

- CENTCOM
- PACOM
- EUCOM
- Other/TBD

QA: Quality Assurance
EDO: Epidemiology Determination Officer
MOA/MOU: Memorandum of Agreement/Memorandum of Understanding
ERC: En route Care
CoTCCC: Committee on Tactical Combat Casualty Care
CoERCCC: Committee on Combat Casualty Care
CoSCCC: Committee on Surgical Combat Casualty Care
MTF: Military Treatment Facilities
CE Coord: Continuing Education Coordination
SETD: Staff Education Training Department

03 November 2017
Cost of JTS and DoDTR

**Personnel:**
- Approx. 80 (MIL, GS, CTR); trauma care leaders and providers, abstractors, coders, PI, epidemiologists and statisticians, information technology, education, etc.

**Training:**
- Abstraction, coding, analysis, software, HIPAA, etc.

**Equipment**
- Servers, computers, software, infrastructure

**Budget:**
- Approx. $10M/year annual operating budget

**DoDTR:**
- Digital Innovation report writer database, Oracle database, SAS and Stata statistical/analytical software programs
JTS Operational Cycle

Operational Cycle

TRAUMA CARE DELIVERY

BEST PRACTICE GUIDELINES

DATA ABSTRACTION

DATA ANALYSIS

PERFORMANCE IMPROVEMENT

DOD TRAUMA REGISTRY

BOLD, RESPONSIBLE PRACTICE OF BATTLEFIELD MEDICINE
JTS Global Continuum of Care

Role 1 (POI, BAS)
- CASEVAC
- MEDEVAC
- 1 Hour

Role 2 (FSTs)
- MEDEVAC
- 1-24 Hours

Role 3 (CSH, EMEDS, EMF)
- STRATEGIC AE
- 24-72 Hours

Role 4 - OCONUS
- (Definitive Care)
- 72 Hours Plus

Role 4 - CONUS
- (Definitive Care)
- Post Acute Care

VA

Balad to LRMC = 2114 miles
Bagram to LRMC = 3174 miles
LRMC to WRAMC = 4108 miles
Where do the data come from?

Camp Bastion
KAF
BAF
MEDEVAC TEAM
Out of Hospital TNC
In Hospital Care TNCs
Role 4 OCONUS
Role 4 CONUS
WISPR
TMDS
DEERS
TRAC2ES
ISR Archive

“S&F”
“Web”
10% QA

Camp Bastion  KAF  BAF
JTS and Research:

❖ Research Priorities Driven by PI Data, Capability Gaps, Clinicians

❖ JTS optimally positioned physically and operationally at BHTRI / SAMMC
  ➢ Support and infrastructure well established and highly productive
  ➢ Center of mass for CCC research
  ➢ Clinical CoE: Level I Trauma Center, Burn Center, Center for the Intrepid

Battlefield Health and Trauma Research Institute
JTS and DoDTR

As of 10/04/2018:

- First Casualty, 1/12/2002
- Last Casualty, 10/04/2018

- 84,746 separate casualty events
- 847 separate data fields to find for each casualty.
Results

- More than 40 Clinical Practice Guidelines
- More than 600 journal articles, posters, and podium presentations published from DoDTR data:
  - Death on the Battlefield (2012)
  - Golden Hour Study (2016)
- USCENTCOM Reports (2012-14): SLB I, II
  - 1) Pay and retirement; 2) Health benefits; and 3) Quality of life programs
DOD JTS:
SYSTEM EXAMPLES
Joint Trauma System Operational Cycle

Personnel Training Equipment

Best Practice Guidelines

Performance Improvement

Data Analysis

Trauma Registry

Data Abstraction

Documentation

Trauma Care Delivery

Right Patient Right Place Right Time Right Care

Joint Trauma System
Battlefield Epidemiology and Biostatistics

• Epidemiology
  – Study of health and disease in human populations

• Biostatistics
  – Application of statistics in the health-related fields
  – Statistics = the process of analyzing data!

• PI Data – should be “system-based”, not restricted to a facility

  POI → Tactical Evacuation (CASEVAC & MEDEVAC) → Role 2
  → Intratheater Evacuation → Role 3 → Intertheater Evacuation → Role 4
  → Role 4 → Intertheater Evacuation → Role 4
Definitions standardize numbers and allow comparisons and trends.

**Killed in Action (KIA)**
KIA refers to the number of combat deaths that occur before reaching an MTF (battalion aid station, forward surgical, combat support and higher levels of hospital care), expressed as a percent of the Wounded in Action minus the RTDs.

\[
\% \text{KIA} = \frac{\text{Deaths before MTF}}{\text{KIA} + (\text{WIA} - \text{RTD})} \times 100
\]

**Died of Wounds (DOW)**
DOW is the number of all deaths that occur after reaching an MTF, expressed as a percentage of total wounded minus the RTDs.

\[
\% \text{DOW} = \frac{\text{Died after reaching MTF}}{(\text{WIA} - \text{RTD})} \times 100
\]

**Case Fatality Rate (CFR)**
CFR refers to the fraction of an exposed group—all those wounded in action including all those who die (at any level), expressed as a percent.

\[
\text{CFR} = \frac{\text{KIA} + \text{DOW}}{\text{KIA} + \text{WIA}} \times 100
\]

“Accurate understanding of the epidemiology and outcome of battle injury is essential to improving combat casualty care.”
Understanding Combat Casualty Care Statistics

<table>
<thead>
<tr>
<th>%KIA – Potential measure of:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. weapon lethality</td>
</tr>
<tr>
<td>2. effectiveness of prehospital care</td>
</tr>
<tr>
<td>3. availability of tactical evacuation</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>%DOW – Potential measure of:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. precision of initial prehospital triage and care</td>
</tr>
<tr>
<td>2. optimization of evacuation procedures</td>
</tr>
<tr>
<td>3. application of a coordinated trauma system</td>
</tr>
<tr>
<td>4. effectiveness of MTF care</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CFR – Potential measure of: overall battlefield lethality in a battlefield population</th>
</tr>
</thead>
</table>
# Battlefield Epidemiology and Biostatistics

<table>
<thead>
<tr>
<th></th>
<th>WW II</th>
<th>Vietnam</th>
<th>Iraq</th>
<th>Afghanistan</th>
</tr>
</thead>
<tbody>
<tr>
<td>% KIA</td>
<td>20.2</td>
<td>20.0</td>
<td>16.6</td>
<td>11.1</td>
</tr>
<tr>
<td>% DOW</td>
<td>3.5</td>
<td>3.2</td>
<td>5.9</td>
<td>4.3</td>
</tr>
<tr>
<td>CFR</td>
<td>19.1</td>
<td>15.8</td>
<td>10.0</td>
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</tr>
</tbody>
</table>

Death on the Battlefield (2001-2011): Implications for the Future of Combat Casualty Care

≈ 87% Prehospital

≈ 25% PS
Death on the Battlefield (2001-2011): Implications for the Future of Combat Casualty Care

Physiologic Cause

- Hemorrhage: 91% (n=888)
- Airway Obstruction: 7.9% (n=77)
- Tension Pneumothorax: 1.1% (n=11)

- Truncal: 67.3% [598/888]
- Junctional: 19.2% [171/888]
- Extremity: 13.5% [119/888]

Death on the Battlefield (2001-2011): Implications for the Future of Combat Casualty Care
<table>
<thead>
<tr>
<th>Priorities for treatment?</th>
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<tbody>
<tr>
<td><strong>Hemorrhage Control</strong> (Non-Surgical, Prehospital)</td>
</tr>
<tr>
<td><strong>Blood</strong> (DCR, Prehospital/Hospital)</td>
</tr>
<tr>
<td><strong>Hemorrhage Control</strong> (DCS, Hospital)</td>
</tr>
</tbody>
</table>
OEF Cumulative Rolling Monthly Averages:
%KIA, %DOW, and CFR (Nov 2003 – Sep 2013)
Extremity Hemorrhage Control

Maughon – *Mil Med* 1970 – Vietnam:
• 193 Extremity Hemorrhage Deaths / 2600 Battlefield Deaths = 7.4%

Kelly – *J Trauma* 2008 – Afghanistan and Iraq:
• 77 Extremity Hemorrhage Deaths / 982 Battlefield Deaths = 7.8%

Eastridge – *J Trauma* 2012 – Afghanistan and Iraq:
• 119 Extremity Hemorrhage Deaths / 4596 Battlefield Deaths = 2.6%

Mandate & Enforce!
The Effect of a Golden Hour Policy on the Morbidity and Mortality of Combat Casualties


Figure 1. Case Fatality Rate and Transport Time

Trend in case fatality rate (CFR) based on linear model where CFR = 0.183 + (-0.002 x quarterly time period). Model $R^2 = 0.625$. Linear model projections (dashed line) surrounded by 95% CIs (dotted lines) predict a CFR of 10.3 (95% CI, 8.7-11.9) at the end of the study period compared with the CFR of 8.6 actually observed, for a difference of 1.7, which equates to potentially 359 lives saved. Logarithmic and higher-order polynomial models had inferior model fit characteristics compared with the linear model. Stratified regression analysis of transport time and CFR trends conducted separately for the periods before and after the mandate showed no association between transport time and CFR in the period before the mandate (regression coefficient, 0.058; $P = .48$), but they showed a highly significant association in the period after the mandate (regression coefficient, $-0.141; P < .001$) and an overall correlation coefficient of $-0.96 (P < .001)$ for the association between transport time in 60 minutes or less and CFR.
Table 1. US Military Combat Casualty Care Statistics in the Afghanistan Conflict and Historical Conflicts

<table>
<thead>
<tr>
<th>Combat Casualty Care Statistics</th>
<th>Afghanistan Before Mandate</th>
<th>Afghanistan After Mandate</th>
<th>Total</th>
<th>Iraq</th>
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<th>World War II</th>
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<tbody>
<tr>
<td>% RTD(^b)</td>
<td>33.5</td>
<td>47.3(^c)</td>
<td>45.2</td>
<td>58.0</td>
<td>34.9</td>
<td>19.9</td>
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<td>16.0</td>
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<tr>
<td>Non-DOW + non-RTD</td>
<td>1942</td>
<td>8411</td>
<td>10353</td>
<td>12623</td>
<td>148323</td>
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<tr>
<td>DOW</td>
<td>83</td>
<td>380</td>
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<td>798</td>
<td>4983</td>
<td>20810</td>
</tr>
<tr>
<td>Total WIA</td>
<td>3043</td>
<td>16696</td>
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<td></td>
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WIA + KIA, No.

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Re-Examination of a Battlefield Trauma Golden Hour Policy

The “Cost” of Time

Cumulative Percent of Deaths by Time-to-Death

- 45 Minutes = 32% of all Deaths
- 90 Minutes = 60% of all Deaths

Median Transport Time Before Mandate = 90 min
Median Transport Time After Mandate = 43 min

Opportunity to prevent up to 30% of all deaths
Estimated KIA Deaths and Lives Saved Attributable to Each Factor

If nothing had changed in period after mandate... …597 more KIA deaths would have occurred in Afghanistan.
Medically evacuated US military combat casualties in Afghanistan

24-hr mortality significantly decreased for recipients of transfusions within 36 minutes

PH transfusion associated with greater 24-hr and 30-day survival than delayed or no transfusion
The Effect of Prehospital Transport Time, Injury Severity, and Blood Transfusion on Survival of US Military Casualties in Iraq

- Avg time, injury to MTF, < hour (mean[SD]=54.4 [26.1]; median[IQR]=50 [36-66])
- 67.6% transported within 60 min
- Early blood transfusion was associated with battlefield survival in Iraq, as it was in Afghanistan.
The Effect of Prehospital Transport Time, Injury Severity, and Blood Transfusion on Survival of US Military Casualties in Iraq

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</table>

Total = 221,720

5,287  43,264  173,169
How does this translate to US civilian sector?

**PUTTING TRAUMA ON THE MAP**

**BRIDGING MILITARY AND CIVILIAN SECTORS TO IMPROVE TRAUMA CARE**

You may not think of it as a public health issue, but did you know that trauma—a potentially disabling or life-threatening injury that results from an event such as a motor vehicle crash, gun violence, or fall—is the **leading cause of death** in the United States for those ages 46 and under?

**200,000**

Number of American lives—a population the size of the city of San Bernardino, CA—that could have been saved over the past decade if all U.S. trauma centers had achieved outcomes similar to those at the highest-performing centers.

**2 MILLION**

Approximate number of Americans who have **died from trauma** since 2001.

Trauma is the **number one cause of years of productive life lost** before age 75—greater than either cancer or heart disease.

**$670 BILLION**

Amount lost in productivity and medical care expenses due to trauma.

Of the 147,790 U.S. deaths from trauma in 2014, roughly **20% might have been preventable** if appropriate and timely medical care had been delivered after injury. This equates to nearly **30,000 preventable deaths in a single year.**

2001-2016 = 450,000

**HOSPITAL**

**SAN BERNARDINO**

POP. 200,000

**Current Landscape**

**State of Trauma Care**

**Cancer**

**Heart Disease**

**Military survival rate** for casualties arriving at a treatment facility since the start of the wars in Afghanistan and Iraq. Innovations such as redesigned tourniquets have helped the military achieve this rate.

Given the military’s success in reducing trauma deaths, the benefits of **closing the gap** between civilian and military trauma care may be enormous if such trauma care innovations and best practices can be thoroughly and rapidly translated into the civilian sector.
How does this translate to US civilian sector?

https://www.facs.org/about-acs/hartford-consensus


https://www.dhs.gov/stopthebleed
Out of the Crucible

HOW THE US MILITARY TRANSFORMED COMBAT CASUALTY CARE IN IRAQ AND AFGHANISTAN

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