Train, Treat and Rehabilitate

US Army Medical Research and Materiel Command
19 April 2016
Panel Members

- Lt Col Jennifer Hatzfeld
  - Combat Casualty Care Research Program
- Dr. Stephen Toth
  - US Army Medical Materiel Agency
- Dr. Tony Gover
  - Clinical and Rehabilitative Medicine Research Program
- Dr. Janet Harris – Panel Chair
  - Medical Simulation and Information Sciences Research Program
- COL Dan Irizarry
  - Joint Project Office for Medical Modeling and Simulation

The views expressed in this presentation are those of the author(s) and may not reflect the official policy or position of the Department of the Army, Department of Defense, or the U.S. Government.
Treat:
The Challenge & Privilege of Caring for Combat Casualties

Lt Col Jennifer Hatzfeld, PhD, RN
Combat Casualty Care Research Program

Stephen Toth PhD (CTR)
US Army Medical Materiel Agency

US Army Medical Research and Materiel Command

April, 2016
Excellence in Combat Casualty Care Requires Focused, Gap-Driven Research

Key Concepts:

- Current & Future Challenges
- Research Priorities
- Near-term and Long-term Approach
- Advanced Development Key Concepts
A Seamless Continuum of Care

Since Sep 2001
CY 2015*

Total Patients Moved 255,300 7,483
Critical Care (CCATT) 10,500 212
CENTCOM 107,800 1,672

* from AMC/SGK as of 31 Dec 2015
Combat Deaths

4,596 US Military Combat Deaths (2001-11)

Died of Wounds (Role II and above)
506 deaths

Killed in Action (Level I)
4,090 deaths

Total Pre-MTF Combat Deaths 4,090
Potentially Survivable Deaths 1,075 (26%)
Hemorrhage 984 (91.5)
Airway 69 (6.4)
Other 22 (2.0)
Potentially Survivable Hemorrhage 984 (24%)
Truncal 675 (17%)
Junctional 170 (4%)
Extremity 139 (3%)

Median Evacuation Time (first surgical capability)
2001-June 2009 90 min
June 2009-Present 43 min
Each Action Influences Future Decisions & Outcomes:

**Role 1-2S**
- Limited resources/blood
- Limited staff
- Limited holding/ICU/evac to next level
- Resources easily overwhelmed

**Role 3**
- Theater “hospital”
- Surgical specialties/CT scanner
- Resources overwhelmed with evacs from multiple Role 2s
- Consider ICU capacity

**Evacuation to Role 4/5**
- What is needed to enable move out of theater
DoD Numbers for Traumatic Brain Injury Worldwide – Totals

2000-2015 Q1-Q2

- Penetrating: 4,904
- Severe: 3,463
- Moderate: 28,192
- Mild: 274,568
- Not Classifiable: 22,042

Total - All Severities: 333,169

Up to 90% of mTBIs resolve

Source: Defense Medical Surveillance System (DMSS), Theater Medical Data Store (TMDS) provided by the Armed Forces Health Surveillance Center (AFHSC)

Prepared by the Defense and Veterans Brain Injury Center (DVBIC)
Future Challenges

New more complex scenarios

PROLONGED FIELD CARE WORKING GROUP POSITION PAPER

PROLONGED FIELD CARE CAPABILITIES

JUNE, 2014

A newly formed Prolonged Field Care Working Group (PFC WG), comprised of medical-specialty subject matter experts, has been tasked to evaluate the current training and preparedness of Special Operations Force (SOF) medics. The first formal position paper from the working group suggests that medical providers consider the below list of capabilities when preparing their medics to provide PFC in austere settings. It is presented in a “minimum, better, best” format. The intent is to demonstrate those basic skills, with adjunctive skills and equipment that may be employed when considering what to train for Prolonged Field Care (PFC).
Key Gaps in Combat Casualty Care

• Decrease preventable deaths
  ➢ Hemorrhage and Resuscitation

• Improve long-term outcomes
  ➢ Brain and Spinal Cord Injuries
  ➢ Surgical Management Capability
  ➢ Safe Patient Transport

• Develop the ability to provide medical care in future complex scenarios
<table>
<thead>
<tr>
<th>Tier 1</th>
<th>Tier 2</th>
<th>Tier 3</th>
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<tbody>
<tr>
<td>Manage blood circulation/</td>
<td>Maintain psychological functioning</td>
<td>Identify and manage fractures/wounds</td>
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<td>control hemorrhage</td>
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<tr>
<td>Treat for shock</td>
<td>Recognize signs of psychological trauma</td>
<td>Identify/manage infectious &amp; contaminated</td>
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<td></td>
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<td>patients</td>
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<tr>
<td>Preserve life</td>
<td>Treat disease</td>
<td>Evaluate for return to duty</td>
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<tr>
<td>Manage breathing/airway</td>
<td>Maintain tissue viability</td>
<td>Mental rehabilitation</td>
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<tr>
<td>Maintain brain function</td>
<td>Manage head and spine</td>
<td>Patient documentation and communication</td>
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<tr>
<td>Pain management</td>
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<td></td>
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<tr>
<td>Repair physical injuries</td>
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<tr>
<td>throughout the body</td>
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<td></td>
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<tr>
<td>Maintain sensory systems</td>
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<tr>
<td>Triage Initial Injuries</td>
<td></td>
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<tr>
<td>Prevent loss of/</td>
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<tr>
<td>use of limb(s)</td>
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Vision: Optimize survival and recovery from combat related injury in current and future operational scenarios

Mission: To drive medical innovation through development of knowledge and materiel solutions for the acute and early management of combat-related trauma; including point-of-injury, en-route, and facility-based care
The Combat Casualty Care Research Program is separated into Five Portfolios:

- Hemorrhage Control & Resuscitation
- Neurotrauma / Traumatic Brain Injury
- Forward Surgical Intensive Critical Care
- En-route Care
- Military Medical Photonics
Question: How does the MHS “win in a complex world”?

Answer: 1) Create simplified solutions for complex problems
2) Push solutions forward on the battlefield

Present Day | Near-term (2-5yrs) | Mid/Long-term (5-10yrs+)

- Combat Casualty Care Research Investment
  - Capitalize on current investment

WIN in Near-term with CCC gap closure

WIN in CCC for FF2025 and beyond

“Leap-forward” knowledge and material products
DRIVE Research, Development, Acquisition of Knowledge and Materiel Solutions...

**Near Term:**
- Capitalize on current RDA efforts
- Develop solutions for prolonged DCR scenarios (pDCR)

Role 3  Role 2  Role 1/POI

MHS/AMEDD postured to WIN in a Complex World
Mid/Long Term:
- Invest in “leap forward” S&T
- Simplify products so that capabilities can be PUSHED FORWARD
Origin of Solutions

S&T

Military Infectious Diseases Research Program (MIDRP) RAD 1 - IIPT/JPC-2 (ICD)

Combat Casualty Care Research Program (CCCRP) RAD 2 - IIPT/JPC-6 (ICD)

Military Operational Medicine Research Program (MOMRP) RAD 3 - IIPT/JPC-5 (ICD)

Clinical & Rehabilitative Medicine Research Program (CRMRP) RAD 5 - IIPT/JPC8 (ICD)

Armed Forces Institute of Regenerative Medicine (AFIRM)

Medical Chemical Biological Defense Research IIPT/JPC-1 – (ICD)

Congressionally Directed Medical Research Program (CDMRP)

DoD Blast Injury Research Program Coordinating Office

Telemedicine Advanced Technology Research Center (TATRC)

COTS evaluation for Army’s best-value

COTS ready to be used

Industry / Commercial off-the-Shelf

MS A Advance Development is engaged as Co-Chair to PLRC/IPT (ICD)

MS B Advance Development is Chair of Program of Record (CDD)

MS C Production & Deployment (CPD)

MDD Enter Into Decision Gate (ICD)
Understanding the Limitations, Recognizing the Risks, Implementing Appropriate Interventions:

• Particularly during prolonged care environment

The Tool is Important however:

• Knowledge on How, When, Where, When not to, etc. is equally critical to successfully save lives and wholeness of the individual soldier

• Each soldiers wound is unique
Lessons Learned Include (Cont.)

Training Critical:

- Developing the appropriate training needs for the expected application of product in various theaters and roles – particular military roles and scenarios

Planning – particularly incorporate Regulatory Considerations Early in the Development process:

- Efficient and cost effective development
- Effective stewardship of tax payer dollars
Purpose

To increase understanding of the Clinical & Rehabilitative Medicine Research Program (CRMRP), the CRMRP Program Areas, and the Program Areas’ objectives.

• Outline

  ➢ CRMRP Overview
  ➢ CRMRP Program Areas
  ➢ Pain Management
  ➢ Regenerative Medicine
  ➢ Neuromusculoskeletal Injury
  ➢ Sensory Systems

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Mission

To implement long-term strategies to develop knowledge and materiel products to reconstruct, rehabilitate, and provide definitive care for injured Service Members. The ultimate goal is to return the Service Member to duty and restore their quality of life.
CRMRP Program Areas

**Pain Management:** Management of pain ranging from the point of injury to chronic pain management

**Regenerative Medicine:** Extremity and craniomaxillofacial injuries, burns and scarless wound healing, hand and face transplants, genitourinary lower abdominal reconstruction

**Neuromusculoskeletal Injury:** Prosthetics, orthotics, spinal cord injury, and orthopedic injury rehabilitation

**Sensory Systems:** Visual, auditory, and vestibular dysfunction associated with traumatic injury
Pain Management includes research (applied science to advanced development) for the management of pain ranging from point of injury to chronic pain management.

**Purpose:** Provide products and information solutions for the diagnosis and alleviation of battlefield, acute and chronic pain and sequela.

**Top PMT Objectives:**

1. Investigate battlefield pain management strategies
2. Investigate precision medicine/personalized pain management strategies
3. Investigate treatment approaches for chronic pain in complex patients
4. Validate non-pharmacological approaches to pain management
Regenerative Medicine includes research (applied science to advanced development) in repair, reconstruction or regeneration of tissue lost or damaged from traumatic injury in the areas of: extremity injury, craniomaxillofacial injury, burns/scarring, composite tissue transplantation, and genitourinary/lower abdomen reconstruction.

**Purpose:** Restoration of form and function to injured bone and soft tissues.

**Top RM Objectives:**

1. Identify/evaluate technologies that increase speed and completeness of healing following volumetric muscle loss, peripheral nerve and vascular injury
2. Identify/evaluate technologies that increase speed and completeness of skin healing following burn injuries
3. Identify/evaluate technologies to generate and integrate functional composite tissues
Neuromusculoskeletal Injury includes research (applied science to advanced development) in rehabilitation/reintegration in the areas of amputation/prosthetics, limb trauma/orthotics, spinal cord injury, and other service-related neuromusculoskeletal injury.

**Purpose:** Maximized rehabilitation after service-related neuromusculoskeletal injuries.

**Top NMS Objectives:**

1. Development/evaluation/validation of new and existing reintegration interventions
2. Evaluation of afferent/efferent systems toward enhanced and intuitive control of prosthetics
3. Identifying biomarkers of secondary health deficits
4. Evaluation/validation of dose, timing, frequency, and duration of rehabilitation
Sensory Systems includes research (applied science to advanced development) focused on understanding the mechanisms of and developing treatment strategies for traumatic injuries resulting in visual, auditory, and vestibular dysfunction.

**Purpose:** Restore and rehabilitate sensory systems (vision, hearing and balance) following traumatic injury.

**Top SS Objectives:**

1. Identify/evaluate optimal corneal treatment options
2. Identify/evaluate regenerative and pharmaceutical therapies for restoring and treating optical nerve injuries
3. Quantify impacts of TBI on multisensory integration and balance to aid diagnosis and treatment post-injury
Medical Simulation and Information Sciences Research Program

Janet R. Harris, RN, PhD
Director, Medical Simulation and Information Sciences Research Program

COL Dan Irizarry, MC
Clinical Advisor, Joint Project Office for Medical Modeling and Simulation

US Army Medical Research & Materiel Command
Program Executive Office for Simulation, Training, & Instrumentation
19 April 2016
To increase understanding of the Medical Simulation and Information Sciences Research Program (MSISRP), the MSISRP Program Areas and objectives, and transition processes

• Outline

- **MSISRP Overview**
- **MSISRP Program Areas and Objectives**
- **Joint Project Office for Medical Modeling and Simulation**
Mission

To responsively and responsibly coordinate emerging military medical simulation and health information technologies/informatics research across all stakeholder communities and transfer research solutions and knowledge to meet MHS goals.

Medical Simulation & Training

Health Informatics Technology Research
Medical Simulation & Training

Combat Casualty Training Initiative: Examine the efficacy of modern simulation system technology vs. current models for advancing pre-hospital trauma training

Medical Readiness Initiative: Focuses on medical provider training systems and assessment of competence for sustained military medical readiness

Health Focused Initiative: Advanced user interface and interactive technologies for healthy living, patient education, increased compliance & rehabilitation

Tools for Medical Education: Effort to promote medical simulation related technologies by providing tools for providers to easily develop new products and content. This is done by promoting software development kits and open architecture tools for widespread developer community use

Health IT/ Informatics

Theater/Operational Medicine: Provide services to the Armed Forces to promote, improve, conserve or restore personnel mental or physical well-being through improved information management and use of emerging technologies

Military Health Care Services: Directly impact the way patient care is provided and improve medical provider ability to treat patients and promote health

Infrastructure & Data Management: Improve IT and communications infrastructure, architecture and management structure

Medical Resourcing: Improve delivery of healthcare support, personnel, and training resources around the globe
Combat Casualty Training includes research (applied science to advanced development) for advancing material properties and virtual models to close the gap between training systems and the real thing (human tissue).

**Purpose:** To advance combat casualty training tools in simulation, virtual and augmented reality.

**Top CCT Objectives:**

1. R&D material property and VR models to represent appropriate/dynamic tissue response
2. Investigate multi-trauma and mass causality scenarios
3. Deliver more efficient and effective methodologies for team training and joint en route care
Medical Readiness Initiative includes research (applied science to advanced development) focusing on skill acquisition / skill maintenance learning curves and minimizing skill decay (degradation) to reduce harmful effects of decay in all roles of military medical care.

**Purpose:** To focus on medical provider training systems and assessment of competence to sustain military medical readiness.

**Top MRI Objectives:**

1. Research/develop predicative models to accelerate to proficiency or mastery level
2. Research/develop simulation system tools that will improve decision making and provide more predicable pre-surgical/intervention rehearsal
3. Research/develop potential predictors of how training transitions to the clinic/theatre
4. RDT&E of assessment (Tutoring) Systems
Tools for Medical Education includes research (applied science to advanced development) to maximize system and organization-level return on investment, increase available training opportunities, and minimize training burden to the medical modeling, simulation, training, and education community.

**Purpose:** To develop and test trans-disciplinary, open source training platforms, toolkits, and models.

**Top TME Objectives:**

1. Resource sharing by advocating open source/open architecture
2. Leverage collaborative research projects through medical models and libraries
3. Democratization of knowledge and products through training platforms and tools that deliver healthcare content
Theater/Operational Medicine (TOM): includes research (applied science to advanced development) to provide services for Armed Forces to promote, improve, conserve or restore personnel mental or physical well-being through improved information management and emerging technologies

**Purpose:** To provide comprehensive health services to deployed forces in an operating environment characterized by highly distributed operations and minimal, if any, pre-established health service infrastructure

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Top JPC1-TOM Objectives:

1. Development of Common Joint C2 systems user Interface
2. Evaluate of Passive Identification methods (i.e. sensors) to solve Equipment tracking, inventory and other equipment Management Issues
3. Validation of Joint synchronous/ asynchronous Teleconsultation for deployed healthcare professionals at all levels of care
Theater/Operational Medicine (TOM): includes research (applied science to advanced development) to provide services for Joint Armed Forces to promote, improve, conserve/restore warfighter mental or physical well-being through improved information management and emerging technologies

Purpose: Theater treatment facilities must be task organized, with a minimized footprint and proportionally supported by patient evacuation and medical logistics assets

(CONT’D) Top JPC1-TOM Objectives:

4. Demonstration of Data interoperability/transfer/storage and management requirements for use of medical devices and patient data in a closed loop to deliver medical care during unmanned evacuation

5. Demonstration and validation of Hands-free medical data entry at point-of-care in disruptive environments

6. R&D medical devices’ data interoperability, integration and availability to supply autonomous clinical workflow solutions
Military Health Care Services (MHCS): includes research (applied science to advanced development) on healthcare services that directly impact the way patient care is provided and improve medical provider ability to treat patients and promote health.

**Purpose:** Lack of integrated interoperable processes and systems to execute logistics, health care delivery, and research and development

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**Top JPC-1 MHCS Objectives:**

1. Medical Device Plug-and-Play (MD PnP) Interoperability Standardization Program
2. Development Integrated Clinical Environment (ICE) Supervisor - Medical Device Simulator
3. Enhancing mHealth Technology in the PCMH Environment to Activate Chronic Care Patients: A Feasibility Study
Infrastructure & Data Management (IDM): includes research (applied science to advanced development) to explore improved IT and communications infrastructure, architecture and management structure.

**Purpose:** to manage the specialized medical products and services necessary to ensure their availability when and where needed to support JFHP in support of all military activities.

**Top [JPC-1 IDM] Objectives:**

1. Legacy Program Integration (LPI) – handling legacy CHCS/AHLTA data for new Cerner system
2. Integrated Public/ Private Cloud Management – researching cloud migration for MHS systems
3. Interactive Visualization Framework to Support Exploration and Analysis of TBI/PTSD Clinical Data
Vision

Deliver premier Live, Virtual, Constructive and Gaming material solutions across the Military Health System (MHS) as the DOD leader in medical Integrated Training Environments (ITE)

Mission

Develop, Acquire and Sustain Medical Training Aids, Devices, Simulators and Simulations to achieve Medical Readiness
### MANAGING PATIENTS

#### BETTER IN ALL ENVIRONMENTS

<table>
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<tr>
<th>MODELING</th>
<th>SIMULATION</th>
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<tr>
<td>- Deployed Healthcare Resource Management</td>
<td>- Point of Injury</td>
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<tr>
<td>- Patient Movement and Tracking</td>
<td>- Transport (Ground, Air)</td>
</tr>
<tr>
<td>- Deployed Environment Nodes of Care (Role I, II, III)</td>
<td>- Deployed Environment Nodes of Care (Role I, II, III)</td>
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#### PRE-HOSPITAL

- Healthcare Business Processes
- Contingency Planning (Ebola, H1N1)

#### HOSPITAL

- Graduate Medical Education (Residency-Based Simulation)
- Hospital Education Program (ACLS, PALS, Infection Control)
- Hospital Response
- Surgical Skills Development
The Military Healthcare training environment
Unified in purpose and method
For additional questions after the conclusion of the conference, send an email message to usarmy.detrick.medcom-usamrmc.mbx.mmpd@mail.mil