Answering the Call: Combat Casualty Care Research

Joint Program Committee on Combat Casualty Care
Defense Health Agency

Professor of Surgery Uniformed Services
University
Moral Test

- Moral test of a nation’s character is how it prepares & cares for those ill or injured because of war
IN THE LAB,
ON THE
BATTLEFIELD

BAHRAIN
OMAN
IRAN
SAUDI ARABIA
ETHIOPIA
SUDAN
EGYPT
JORDAN
AFGHANISTAN
IRAQ
QATAR
KUWAIT
DJIBOUTI
PAKISTAN
KENYA
SOMALIA
YEMEN
UAE
ERITREA

Learn Lessons
(2001 – Current)

Wounded: 52,022
Deaths: 6,809

defense.gov/news/casualty
27 May 2014
But Look to Future Scenarios

• “…without resource constraints, strategy would be unnecessary. Limited resources thus create the need for strategy. As resources become more constrained strategy becomes more important.” – Todd Harrison
Schematic of US Military Medical Research

Current DoD Medical Research

- Service Core $
- 2008 GDF
- DHA DHP $

Combat Casualty Care Research Program

- Knowledge & Material Solutions for Joint Warfighter

Pre-hospital, Hospital & En-Route Care

Joint Trauma System (DCoE)

Joint Trauma System (DCoE)
Joint Force Health Protection (JFHP) Joint Capability Documents (JCDs) or Functional Needs Assessments (FNAs) were reviewed to identify capability gaps.

229 JFHP gaps identified and evaluated by user representatives on the GDF Assessment 4.16 Working Group to determine which required medical R&D.

Sixty-nine gaps found to require medical R&D to “provide biomedical information to change clinical procedures, guide policy and practice and enhance design and risk assessment”
• Gaps were assigned to specialty areas and categorized as priority 1, 2 or 3 by the 4.16 Working Group

• Of the 69 gaps requiring medical R&D, 28 (41%) fell within the purview of the Combat Casualty Care Research Program which plans, programs, budgets & executes R&D in an effort to resolve the gaps

• Gaps within the purview of the CCCRP are within two areas: Joint Casualty Management (24 gaps) and Joint Patient Movement (4 gaps)
Process from GDF Working Group to CCCR Gaps

Force Health Protection Gaps (n=229)

Gaps Requiring R&D (n=69)

Combat Casualty Care Research (n=27)

Joint Casualty Management (n=24)

Joint Patient Movement (n=3)
<table>
<thead>
<tr>
<th>Area</th>
<th>Priority</th>
<th>Gap</th>
</tr>
</thead>
<tbody>
<tr>
<td>JCM</td>
<td>1</td>
<td>JCM-1-1: Inadequate ability to diagnose, resuscitate, and stabilize casualties with survivable wounds</td>
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<tr>
<td>JCM</td>
<td>1</td>
<td>JCM-1-2: Inadequate initial emergent resuscitative surgery coupled with life- and limb-saving actions</td>
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<tr>
<td>JCM</td>
<td>1</td>
<td>JCM-1-2.1: Inadequate definitive, restorative, and rehabilitative medical care and surgery for life- and limb- and eyesight-saving actions</td>
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<tr>
<td>JCM</td>
<td>1</td>
<td>JCM-1-3: Inadequate ability to locate and evaluate casualties</td>
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<tr>
<td>JCM</td>
<td>1</td>
<td>JCM-1-4: Inability to stop internal bleeding and external bleeding</td>
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<tr>
<td>JCM</td>
<td>1</td>
<td>JCM-1-5: Poor ability to stop life-threatening extremity bleeding</td>
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<tr>
<td>JCM</td>
<td>1</td>
<td>JCM-1-6: Poor ability to ensure casualty airway</td>
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<tr>
<td>JCM</td>
<td>1</td>
<td>JCM-1-7: Inability to adequately monitor, evaluate, and triage casualties by combat medical personnel for early identification of life saving interventions</td>
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<tr>
<td>JCM</td>
<td>1</td>
<td>JCM-1-8: Inadequate therapy for shock and head injury</td>
</tr>
<tr>
<td>JCM</td>
<td>1</td>
<td>JCM-1-8.1: Inadequate definitive, restorative, and rehabilitative therapy for head injury and shock</td>
</tr>
<tr>
<td>JCM</td>
<td>1</td>
<td>JCM-1-9: Inadequate battlefield analgesia with minimal side effects</td>
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<tr>
<td>JCM</td>
<td>1</td>
<td>JCM-1-10: Inadequate integrated medical information systems across the taxonomy of casualty care</td>
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<tr>
<td>JCM</td>
<td>1</td>
<td>JCM-1-11: Inadequate ability to immediately recognize and correct coagulopathy</td>
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<tr>
<td>JCM</td>
<td>2</td>
<td>JCM-2-1: Inadequate stabilization of injuries and ability to monitor response to treatment</td>
</tr>
<tr>
<td>JCM</td>
<td>2</td>
<td>JCM-2-2: Poor ability to provide tissue oxygenation and compatible shelf-stable blood products</td>
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<tr>
<td>JCM</td>
<td>2</td>
<td>JCM-2-3: Poor ability to restore blood volume</td>
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<tr>
<td>JCM</td>
<td>2</td>
<td>JCM-2-4: Inability to prevent traumatic disconnect/removal of IVs</td>
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<tr>
<td>JCM</td>
<td>2</td>
<td>JCM-2-5: Inability to prevent bleeding problems associated with hypothermia</td>
</tr>
<tr>
<td>JCM</td>
<td>2</td>
<td>JCM-2-6: Inability to prevent vomiting due to pain or medications</td>
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## GDF Gaps in Combat Casualty Care: Appendix I

<table>
<thead>
<tr>
<th>Area</th>
<th>Priority</th>
<th>Gap</th>
</tr>
</thead>
<tbody>
<tr>
<td>JCM</td>
<td>2</td>
<td>JCM-2-8: Inadequate casualty evacuation (CASEVAC) by non-standard platforms, attended by combat lifesaver en route (refer to JPM JCD)</td>
</tr>
<tr>
<td>JCM</td>
<td>2</td>
<td>JCM-2-9: Inadequate ability to operate in a chemical, biological, radiological, and nuclear (CBRN) environment</td>
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<tr>
<td>JCM</td>
<td>2</td>
<td>JCM-2-10: Inadequate ability to diagnose, treat, and prevent dental injury and disease</td>
</tr>
<tr>
<td>JCM</td>
<td>3</td>
<td>JCM-3-1: Lack of therapeutics to combat infection</td>
</tr>
<tr>
<td>JCM</td>
<td>3</td>
<td>JCM-3-2: Inadequate medical intelligence</td>
</tr>
</tbody>
</table>

| JPM  | 1        | JPM-TER-ER2: Interoperability between C4 systems in support of reception/staging operations is lacking. A single joint medical C4 system does not exist. Joint medical C4 systems do not provide operational and clinical situational awareness to nonmedical C4 systems. PM and personnel tracking systems do not interact and are labor intensive. |
| JPM  | 1        | JPM-TRA-AE2: En route care lacks standardization. Standardized joint medical equipment for transport of critical patients is lacking. Joint critical care transport capability and training platforms do not exist. There is no adequate joint directive/authority to ensure standardized PMI program compliance. |
| JPM  | 1        | JPM-TRA-AE3: Interoperability between C4 systems supporting en route care is lacking. A single joint medical C4 system does not exist. Joint medical C4 systems do not provide operational and clinical situational awareness to nonmedical C4 systems. PM and personnel tracking systems do not interact and are labor intensive. |
| JPM  | 3        | JPM-TER-EC3: JPM training platforms and skill-identification tracking systems are lacking. Models to replicate medical processes in joint exercise are lacking. Programs to establish JPM leadership development and education are inadequate. |
Cases Showing Relevance of the Gaps: Mangled Extremity

1. Control bleeding & assure airway
2. Vital signs assessment & monitoring
3. Replacement of lost blood
4. Injury & management data collection
5. MEDEVAC
6. Damage control surgery
Cases Showing Relevance of the Gaps: Mangled Extremity

7. Management of associated TBI
8. Management of infection
9. Hemorrhage control
10. Transcontinental evacuation
11. Final surgery and recovery
Cases Showing Relevance of the Gaps: Neck & Head Wound

1. Locate casualty
2. Control bleeding establish airway
3. Communicate injury & location
4. Replace oxygen carrying capacity
5. Enhanced en-route care capability
6. Damage control & vascular surgery
Cases Showing Relevance of the Gaps: Neck & Head Wound

7. Reduce inflammation
8. Lower intracranial pressure
9. Reduce risk of and treat infection
10. Critical Care Air Transport (en-route ICU)
11. Repeat operations closure of wounds
12. Recovery and rehabilitation
Cases Showing Relevance of the Gaps: Complex Dismounted Blast

1. Locate, diagnose resuscitate casualty
2. Stop external and internal bleeding
3. Initiate therapy for shock and TBI
4. Recognize and correct coagulopathy
5. Initiate emergent resuscitative surgery
Cases Showing Relevance of the Gaps: Complex Dismounted Blast

7. Prevent bleeding from hypothermia
8. Restore blood volume (treat shock)
9. Advanced CASEVAC capability
10. Initiate therapies to combat infection
11. Restorative & rehabilitative therapy
How to Tackle or Resolve Gaps?

Combat Casualty Care Research investment

Military Labs ↔ Academia ↔ Industry
Combat Casualty Care Research

• Unlike investigator-initiated research which is of interest to general scientific community without priority or urgency, military trauma research is....

• gap-driven, programmed or “top-down” with urgency for solutions (material or knowledge) to the warfighter

• Military research consists of Joint Defense Health Program (DHP) and service $ (Army, Navy & Air Force)

• Joint Trauma System (JTS) provides insight to clinical need (i.e. “bedside”) & takes results into clinical practice

• To deliver solutions, research must begin with tend in mind & consider translation & development throughout
IN THE LAB, ON THE BATTLEFIELD

DoD Medical Research

Schematic of US Military Medical Research

ARMY

HA/DHA

MRMC

NAVY (ONR)

NAVY (BUMED)

USAF

Navy Labs

AFMS (Wings)

Army LABs

JPCs

Coordinated, programmed, Joint research

MTFs
Joint Program Committees

- JPC-1: Medical Training and Health
- JPC-2: Military Infectious Disease
- JPC-5: Military Operational Medicine
- **JPC-6: Combat Casualty Care**
- JPC-7: Radiological Health Effects
- JPC-8: Clinical & Regenerative/Rehabilitative Medicine
Joint Program Committee-6

- Chartered, Joint entity designed to advise leadership on planning, programming, budgeting and execution of DHP investment...

MEMORANDUM FOR COL Dallas Hack, Joint Program Committee - 6, Building 722, Fort Detrick, Maryland 21702-5012

SUBJECT: US Army Medical Research and Materiel Command (USAMRMC) Department of Defense (DoD) Joint Program Committee - 6 (JPC) Charter for the Combat Casualty Care JPC

- Military and civilian experts (transparent)
- *Advanced development* expertise to advise translation
Joint Program Committee-6

JPC Chair

- Neuro-trauma
- En-route Care
- Forward Surgical
- Extremity & Tissue Injury
- Hemorrhage & Resuscitation

- Each portfolio has a Manager & Steering Committee
- Program announcements
- Requests for proposals (RFPs)
- Broad agency announcement (BAA)
Military trauma system in Afghanistan: lessons for civil systems?

Col. Jeffrey A. Bailey\textsuperscript{a,b,c}, Maj. Jonathan J. Morrison\textsuperscript{d,e}, and Col Todd E. Rasmussen\textsuperscript{a,c}

\textit{Curr Opin Crit Care 2013;19:569-577}

- Joint Trauma System provides insight to clinical need (i.e. the “bedside”) & then takes results from the research investment into clinical practice

- More than 30 dynamic CPG’s & DoD Trauma Registry
Gao Initiated Review of Combat Casualty Care Research Program

- Combat Casualty Care Research Program (CCCRP), (initially service core $ driven), operated in conjunction with nascent Joint Trauma System until 2009-2010 when DHP became available...

- CCCRPP then brought in the DHP investment in 2010 in response to the GDF and the clinical gaps identified therein...

- In 2012, the Government Accountability Office (GAO) performed a review of the CCCCRRP investment...
IN THE LAB, ON THE BATTLEFIELD

Review of Combat Casualty Care Research Program

United States Government Accountability Office

GAO
Report to Congressional Committees

February 2013

DEFENSE HEALTH

Actions Needed to Help Ensure Combat Casualty Care Research Achieves Goals
2. To improve DOD’s ability to assess the overall performance of its combat casualty care research portfolio, we recommend that the Secretary of Defense direct the Under Secretary of Defense for Personnel and Readiness to direct the Assistant Secretary of Defense for Health Affairs to develop and implement a plan to assess the extent to which combat casualty care research and development fills gaps in DOD’s capability to provide combat casualty care and achieves DOD’s other goals for this portfolio of research.
CCCRP Performed Assessment in Response to GAO Report

• Objective: To assess extent to which research has resolved the gaps in Combat Casualty Care identified by 2008 GDF (i.e. achieving goals?)

• Joint Casualty Management (JCM) area
  Priority 1: 13 gaps
  Priority 2: 9 gaps
  Priority 3: 2 gaps

• Joint Patient Movement (JPM) area
  Priority 1: 2 gaps
  Priority 3: 1 gap
Method of Gap Assessment

- Evidence-based, qualitative assessment of gaps by senior subject matter experts in combat casualty care (NTI, JTS, DHB, CCRP)

- Experts graded each gap using a scale of 0-100 (0 = no solution and 100 = gap resolution)

- Each gap was provided a 2008 and a 2013 grade to allow a temporal (over time) assessment of progress towards resolution
  - Original gap baseline at trajectory to provide technologies by 2025

- Grades were averaged and then depicted on a schematic
Results from Consensus Panel: Progress on Priority 1 Gaps

- Aggregate of starting (2008) and ending (2013) points for Priority 1 gaps within Combat Casualty Care Research

<table>
<thead>
<tr>
<th>Not Ready/ No Solution</th>
<th>Ready/ Gap Resolved</th>
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<tbody>
<tr>
<td>9%</td>
<td>39%</td>
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30% gap resolution
Results from Consensus Panel: Progress on Priority 2 Gaps

- Aggregate of starting (2008) and ending (2013) points for Priority 2 gaps within Combat Casualty Care Research

<table>
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<tr>
<th>Not Ready/ No Solution</th>
<th>Ready/ Gap Resolved</th>
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<tbody>
<tr>
<td>15% 2008</td>
<td>38% 2014</td>
</tr>
</tbody>
</table>

23% gap resolution
Results from Consensus Panel: Progress on Priority 3 Gaps

- Aggregate of starting (2008) and ending (2013) points for Priority 3 gaps within Combat Casualty Care Research

Not Ready/ No Solution

<table>
<thead>
<tr>
<th>Year</th>
<th>Not Ready/ No Solution</th>
<th>Ready/ Gap Resolved</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>10%</td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td>26%</td>
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16% gap resolution
Conclusions from Panel Reported to SASC Staff Feb 2014

- Evidence-based, qualitative assessment demonstrates movement to the right in resolution of combat casualty care gaps as a result of military research investment.

- Medical research is centerpiece of military’s continuously learning trauma system (i.e. bridging chasm that otherwise exists between clinical need & evidence based, best trauma care).

- Priority 1 gaps remain less than 50% resolved (i.e. the job is not finished…)

No Solution  Partial Solution  Resolved
Saved Lives on the Battlefield (National Security)

**Movement to Resolve CCC Gaps**

- **Injury Severity Score**
- **Case Fatality Rate - Afghanistan**

Graph showing downward trend in Case Fatality Rate and Injury Severity Score from 2005 to 2013.
Implications of Combat Casualty Care for Mass Casualty Events

Violence from explosives and firearms results in mass casualty events in which the injured have multiple penetrating and soft tissue injuries. Events such as those in Boston, Massachusetts; Newtown, Connecticut; and Aurora, Colorado, as well as those in other locations, such as Europe and the Middle East, demonstrate that civilian trauma may at times resemble that seen in a combat setting. As the civilian sector prepares for and responds to these casualty scenarios, research and trauma practices that have emerged from the wars in Afghanistan and Iraq provide a valuable foundation for responding to civilian mass casualty events. Several lessons learned by the US military were implemented during the responses to the bombings in Boston in April of this year.

Military research has found that approximately 25% of persons who die as a result of explosive or gunshot wounds have potentially survivable wounds.1 These individuals have injuries that are not immediately or necessarily lethal and have a chance to survive if appropriate care is rendered in a timely fashion. The military has learned that implementation of evidence-based, clinical practice guidelines can reduce potentially preventable death.2 Certain aspects of these lessons also apply to multiple casualty scenarios in civilian settings.

Evidence of preventable death. Moreover, none of the regiment’s 32 fatalities died of preventable causes during the out-of-hospital phase of care. The critical elements of the protocol include early control of hemorrhage using tourniquets for extremity bleeding and hemostatic dressings for bleeding not amenable to tourniquets.

Care During Transport
Evacuation is the next step in the continuum. Findings from military research have shown improved survival associated with the use of more advanced en route care capability. Mabry et al4 demonstrated a 66% reduction in mortality among patients evacuated by critical care flight paramedic teams (16 deaths among 202 patients) compared with casualties transported by basic emergency medical technicians (71 deaths among 469 patients). The survival benefit was attributed to higher levels of training and experience among flight paramedics. Morrison et al5 extended these observations in a study of injured military personnel evacuated by the United Kingdom’s physician-led platform (aircraft or airframe used to transport patients) referred to as the medical emergency response team-extended (MERT-E). In this report, there was a 33% reduction in mortality in the
Return of the Tourniquet: What we learned from war saved lives in Boston
Lydia DePillis
April 17, 2013

From Baghdad to Boston: War Lessons on Amputations Help Blast Victims Walk Again
Tara Haelle, April 16th, 2013
Where Do We Go From Here?

- Historic burden of injury from more than a decade of war has provided evidence that requirements-driven, programmed research in trauma saves lives in the military & civilian setting.

- Military trauma research investment through JPC-6 delivers demonstrable progress (i.e. “answers the call”)

- But who else does or who will do this type of rigorous, military relevant (across the spectrum of CCC) research?
Who Does this Type of Research?

1) left leg amputation, 2) mangled right lower extremity
Who Does this Type of Research?

3) hemoperitoneum 4) hemothorax
Who Does this Type of Research?

- Positioning (suspending right leg from ceiling) to even expose/operate on the wound
Who Does this Type of Research?

- Positioning (suspending right leg from ceiling) to even expose & operate on right buttock & peroneal wound
Who Does this Type of Research?

- Temporary plastic shunt in right femoral artery (right medial thigh) in attempt to save right lower extremity
Who Does this Type of Research?

- Shunt removed, artery repaired with saphenous vein
Who Funds This Type of Research?

ACCIDENTAL DEATH AND DISABILITY: THE NEGLECTED DISEASE OF MODERN SOCIETY

NATIONAL ACADEMY OF SCIENCES NATIONAL RESEARCH COUNCIL
Washington, D. C., September, 1966

RESEARCH IN TRAUMA
Increased federal and voluntary financial support of basic and applied research in trauma.
Long-term financial support of specialized centers for clinical research in shock and trauma.
Expansion of clinical research in war wounds.
Expansion within the U.S. Public Health Service of research in shock, trauma, and emergency medical conditions, with the goal of establishing a National Institute of Trauma.
Who Funds this Type of Research?

• The recommendations of the 1966 National Academy of the Sciences report & recommendations from similar NIH (1994) and Institute of Medicine (1999, 2006) reports calling for federal trauma funding have *not* been followed..

• There is no federal funding dedicated to trauma (i.e. no “National Institute of Trauma”)…

• While federal and private foundations fund life and society-saving research, none fund trauma research or investigation into the injury or logistical challenges encountered when caring for combat wounded…
Who Funds this Type of Research?

• Although NIH has budget of $30B, none of its 20 institutes are designed to fund research in trauma or the type of injury observed in combat.

• No Although CDC has budget of $12B, none of its work is focused on severe injury or trauma…
Who Funds this Type of Research?

Where does research funding dedicated & programmed to address needs of uniformed personnel in combat originate? …the DoD
The Risk

- Diversion of these limited DoD research dollars away from Combat Casualty Care risks re-exposing previously identified gaps...why?
The Risk

• Unlike non-trauma related conditions there is little redundancy in the federal research enterprise for Combat Casualty Care

• In other words, while there exists redundancy in the federal system for research related to non-trauma conditions there’s no such overlap for military-relevant Combat Casualty Care

• If the DoD drops the ball on trauma research, there’s no net to catch & address the unique needs of the injured Joint warfighter
The Risk

• While none can argue the priority of a healthy, resilient & fit-to-fight force, to the extent that achieving this is even amenable to R&D, it should not come at expense of CCC research

• This is relevant when considered in context of future combat scenarios involving dispersed troops, remote locations, limited aerial access and/or long-distance CASEVAC

• After 13 years in Afghanistan with aerial access & optimal positioning of medical resources CCC will only become more challenging
“...without resource constraints, strategy would be unnecessary. Limited resources thus create the need for strategy. As resources become more constrained, strategy becomes more important.”

— Todd Harrison, Defense Strategist
Strategy

- Sustain DoD focus on & fiscal commitment to Joint military trauma research; sacrifices of a generation merit sustained focus; the job is not done...

- Build redundancy in effort & leverage partnership with federal entities & civilian trauma organizations such as American College of Surgeons, National Trauma Institute & American Association for the Surgery of Trauma
Conclusions

“Moral test of a nation’s character is how it prepares & cares for those ill or injured because of war”
• Progress made but gaps remain unresolved