



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



Emergency War Surgery

FOURTH UNITED STATES REVISION

2013

*Borden Institute
US Army Medical Department Center and School
Fort San Houston, Texas*

*Office of The Surgeon General
United States Army
Falls Church, Virginia*



- **Moral test of a nation's character is how it prepares & cares for those ill or injured because of war**



Learn Lessons

(2001 – Current)



Wounded: 52,022

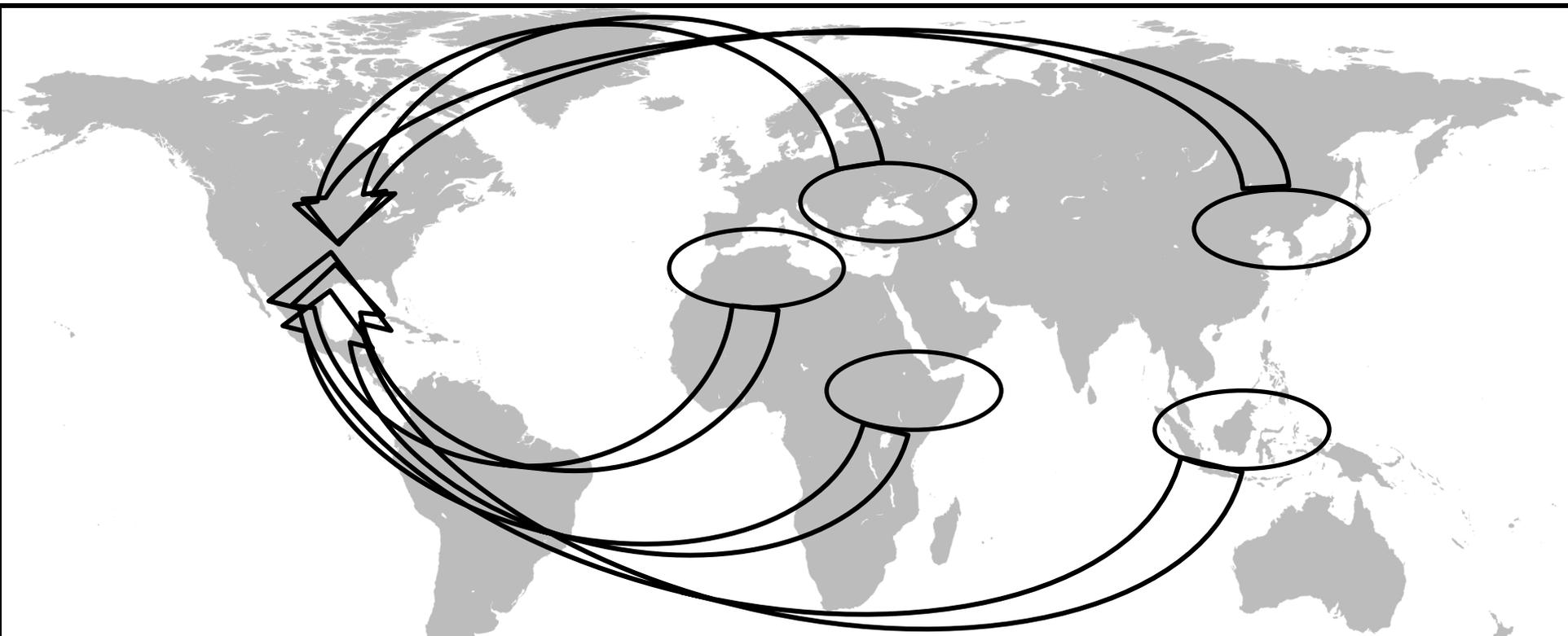
Deaths: 6,809

defense.gov/news/casualty

27 May 2014



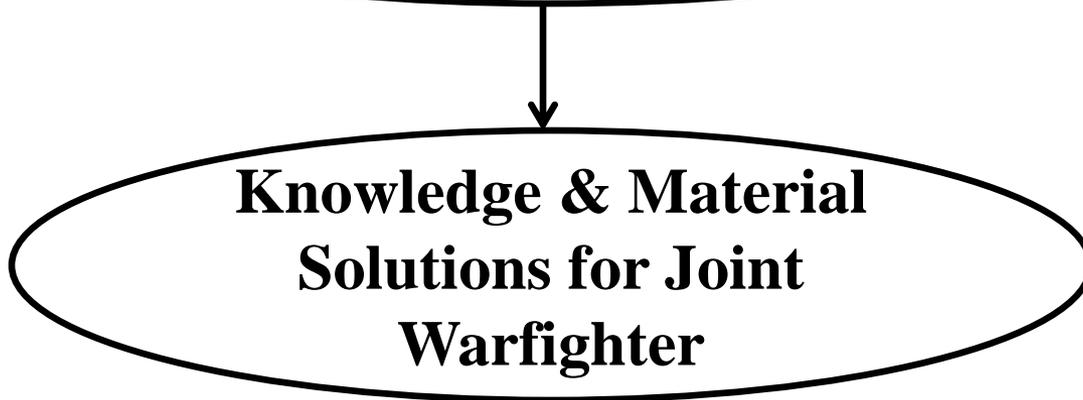
But Look to Future Scenarios



- **“...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



Joint Trauma System (DCoE)

Joint Trauma System (DCoE)

Pre-hospital, Hospital & En-Route Care



2008 Guidance for Development of the Force (GDF)



- **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”**



2008 Guidance for Development of the Force (GDF)



- **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 CCCRCP are within two areas: *Joint Casualty Management* (24 gaps) and *Joint Patient Movement* (4 gaps)**

Process from GDF Working Group to CCCR Gaps

IN THE LAB,
ON THE
BATTLEFIELD



**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)**



GDF Gaps in Combat Casualty Care: Appendix I

IN THE LAB,
ON THE
BATTLEFIELD



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



GDF Gaps in Combat Casualty Care: Appendix I

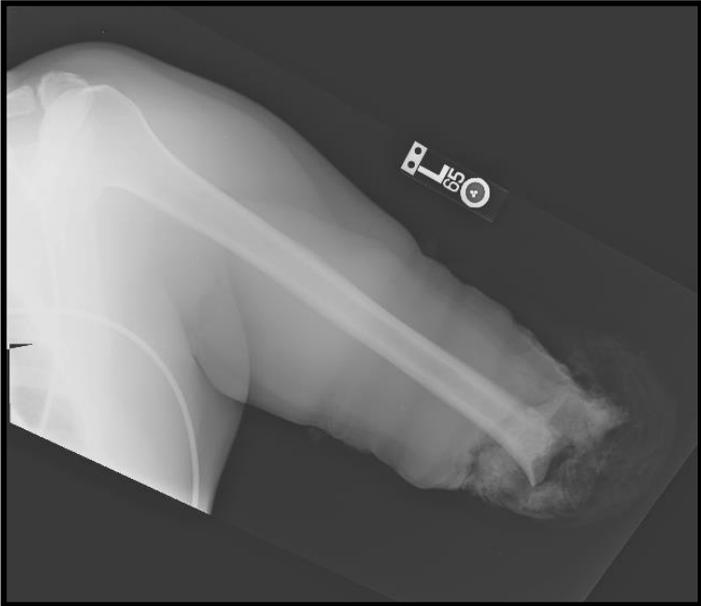


Area	Priority	Gap
JCM	2	JCM-2-8: Inadequate casualty evacuation (CASEVAC) by non-standard platforms, attended by combat lifesaver en route (refer to JPM JCD)
JCM	2	JCM-2-9: Inadequate ability to operate in a chemical, biological, radiological, and nuclear (CBRN) environment
JCM	2	JCM-2-10: Inadequate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

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

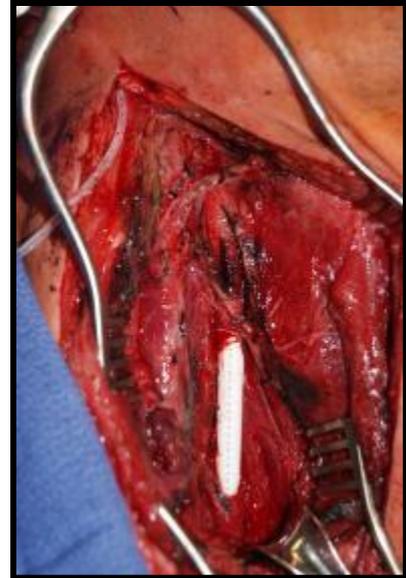


Speed Saves:
COMBAT MEDICINE REDEFINED

Some 42,300 GIs have been wounded in Iraq and Afghanistan. And they are beneficiaries of the most advanced medical care the services have to offer.

Who's to blame? It's unclear. "It's not that 80% of our troops survive, meaning the dead-to-wounded ratio is still about 8% to 10%, that it then make it a 100:1 facility... it's very likely they will survive to the States."

BY JEROME GREER CHANDLER Staff's Alive: Focus on Blood Flow





Cases Showing Relevance of the Gaps: Neck & Head Wound

IN THE LAB,
ON THE
BATTLEFIELD



- 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**

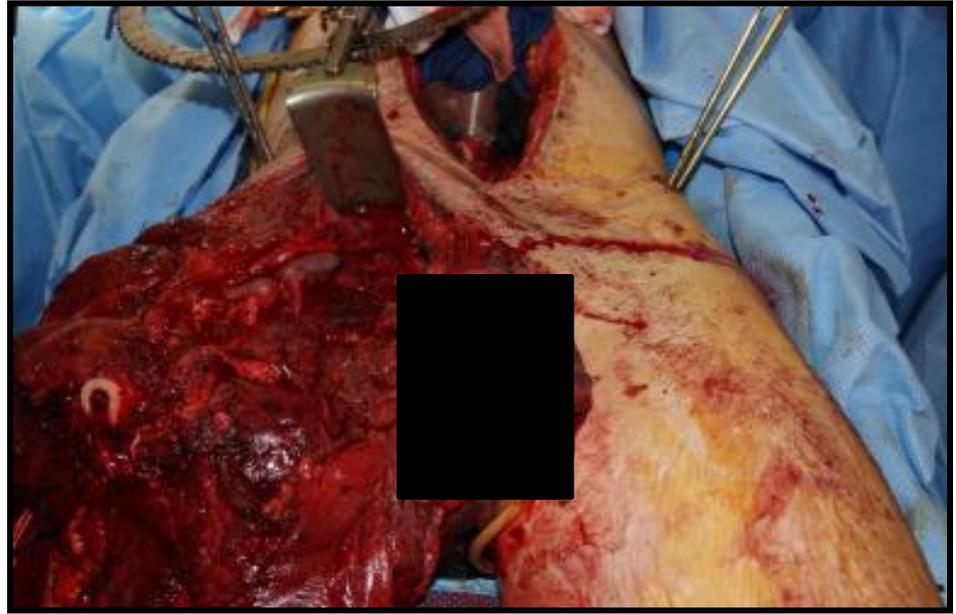




Cases Showing Relevance of the Gaps: Complex Dismounted Blast



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**

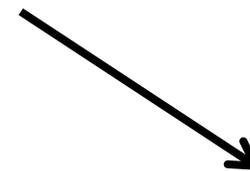
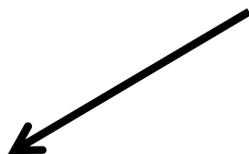




How to Tackle or Resolve Gaps?



Combat Casualty Care Research investment



Military Labs



Academia



Industry



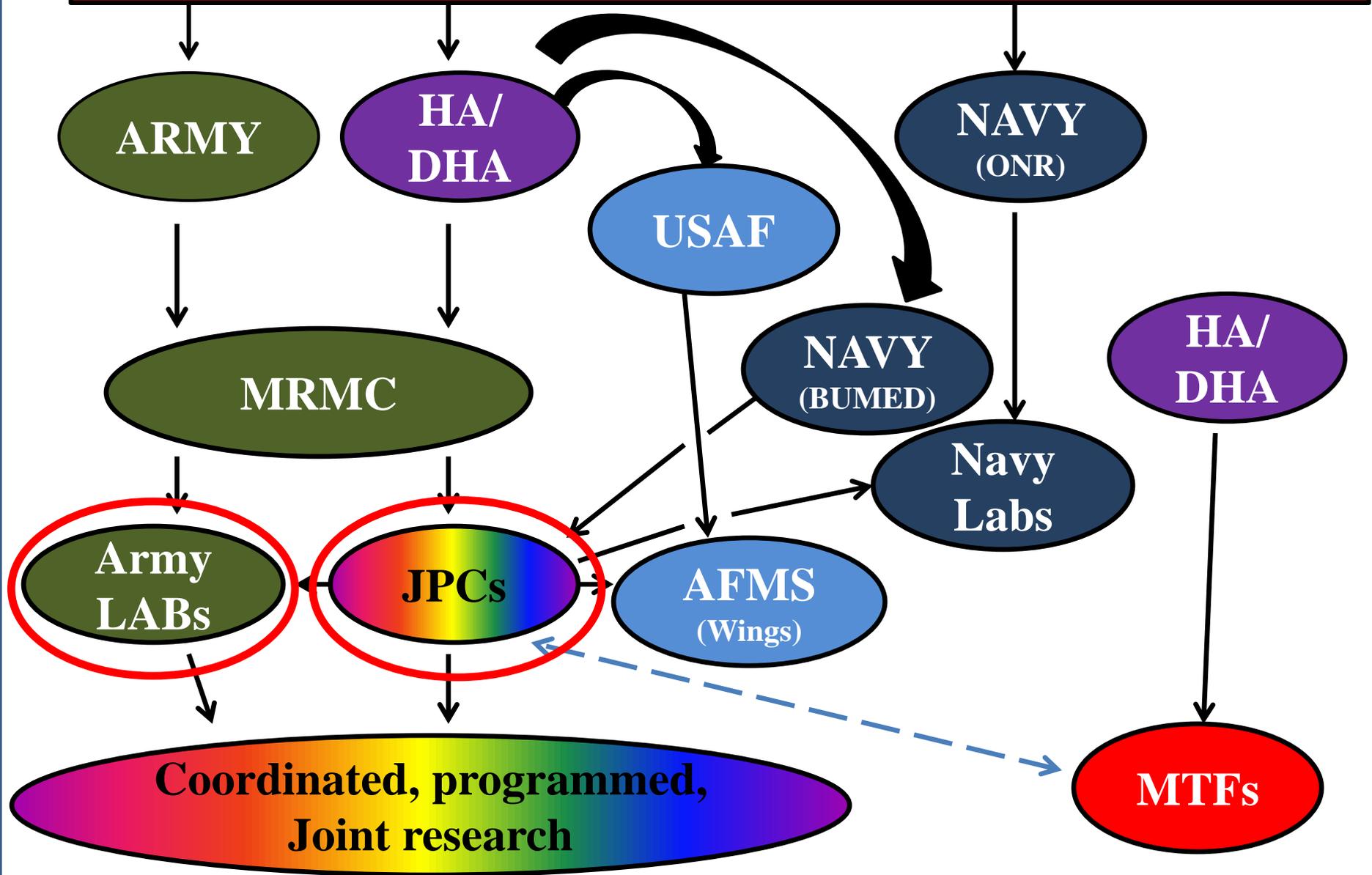
Combat Casualty Care Research



- 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

Schematic of US Military Medical Research

DoD Medical Research





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

IN THE LAB,
ON THE
BATTLEFIELD



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



DEPARTMENT OF THE ARMY
U.S. ARMY MEDICAL RESEARCH AND MATERIEL COMMAND
504 SCOTT STREET
FORT DETRICK, MD 21702-5012

MCMR-RTC

- 2 JAN 2013

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)**





The Joint Trauma System (JTS)



Military trauma system in Afghanistan: lessons for civil systems?

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



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...**
- CCCRP 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 CCCCRP investment...**



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



GAO Report Recommendations



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



▲
0%

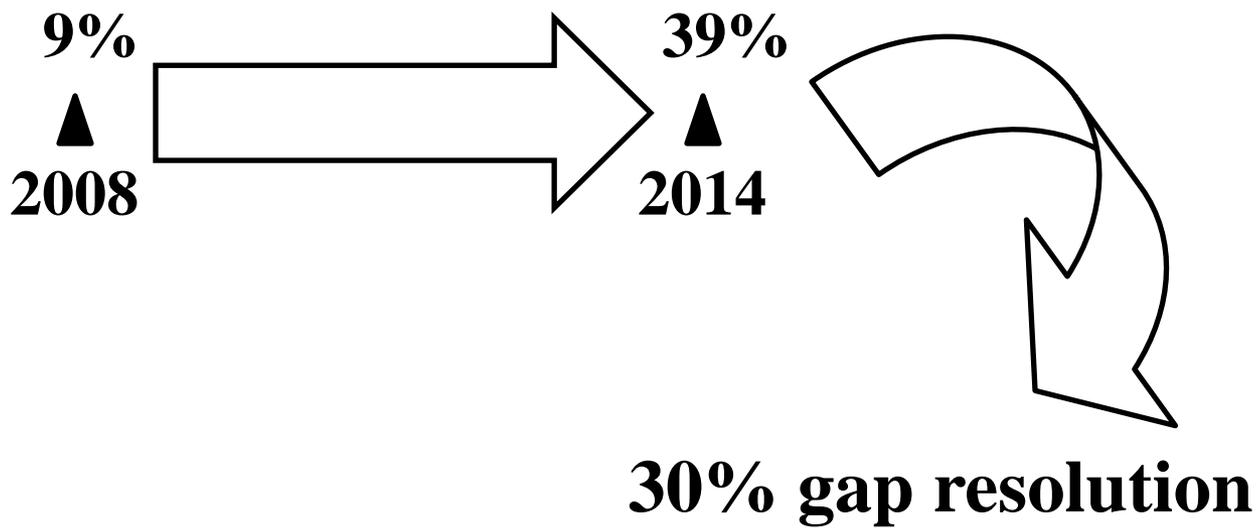
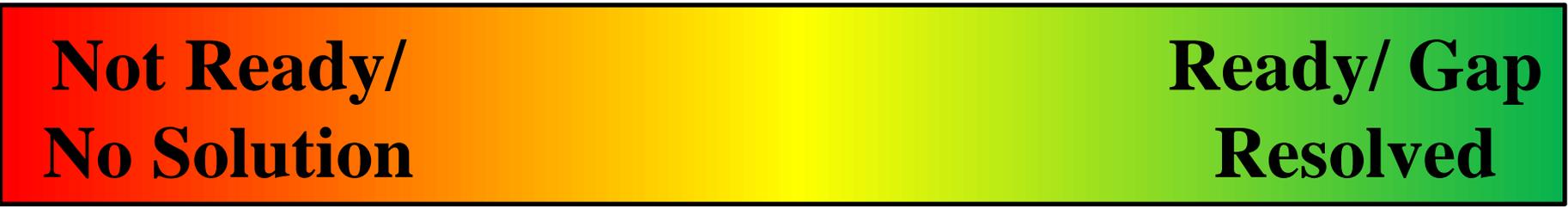
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100%



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

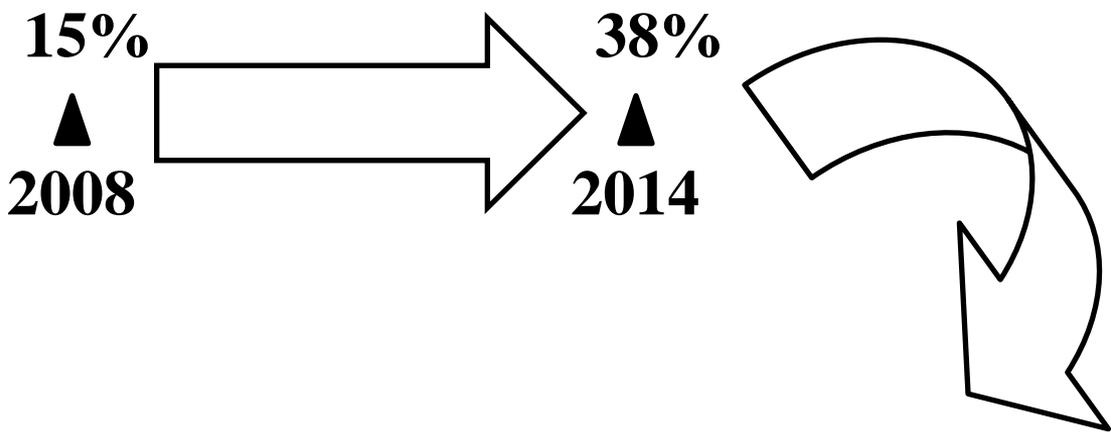
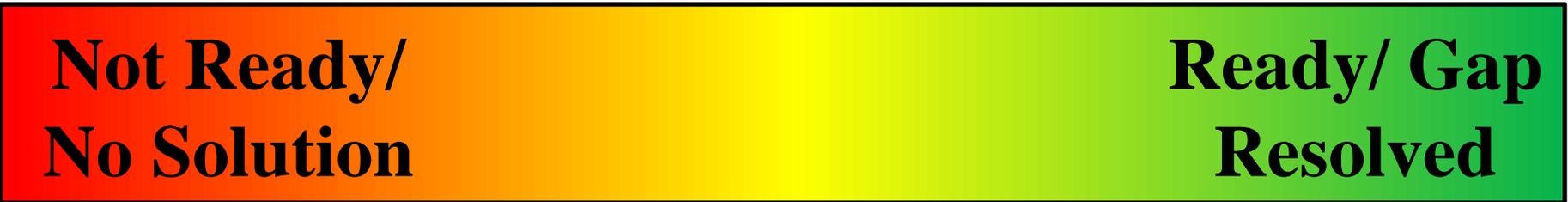




Results from Consensus Panel: Progress on Priority 2 Gaps



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



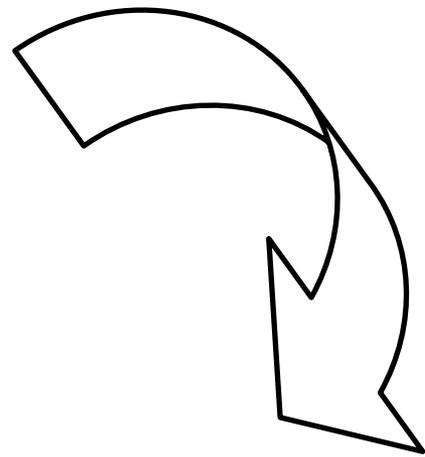
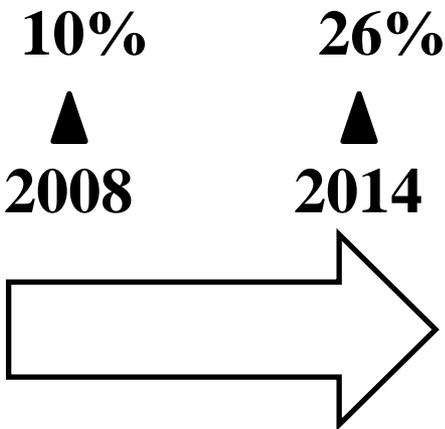
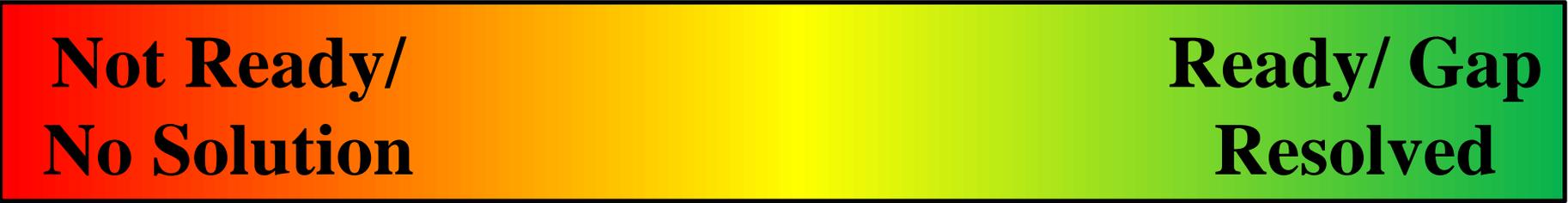
23% gap resolution



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



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

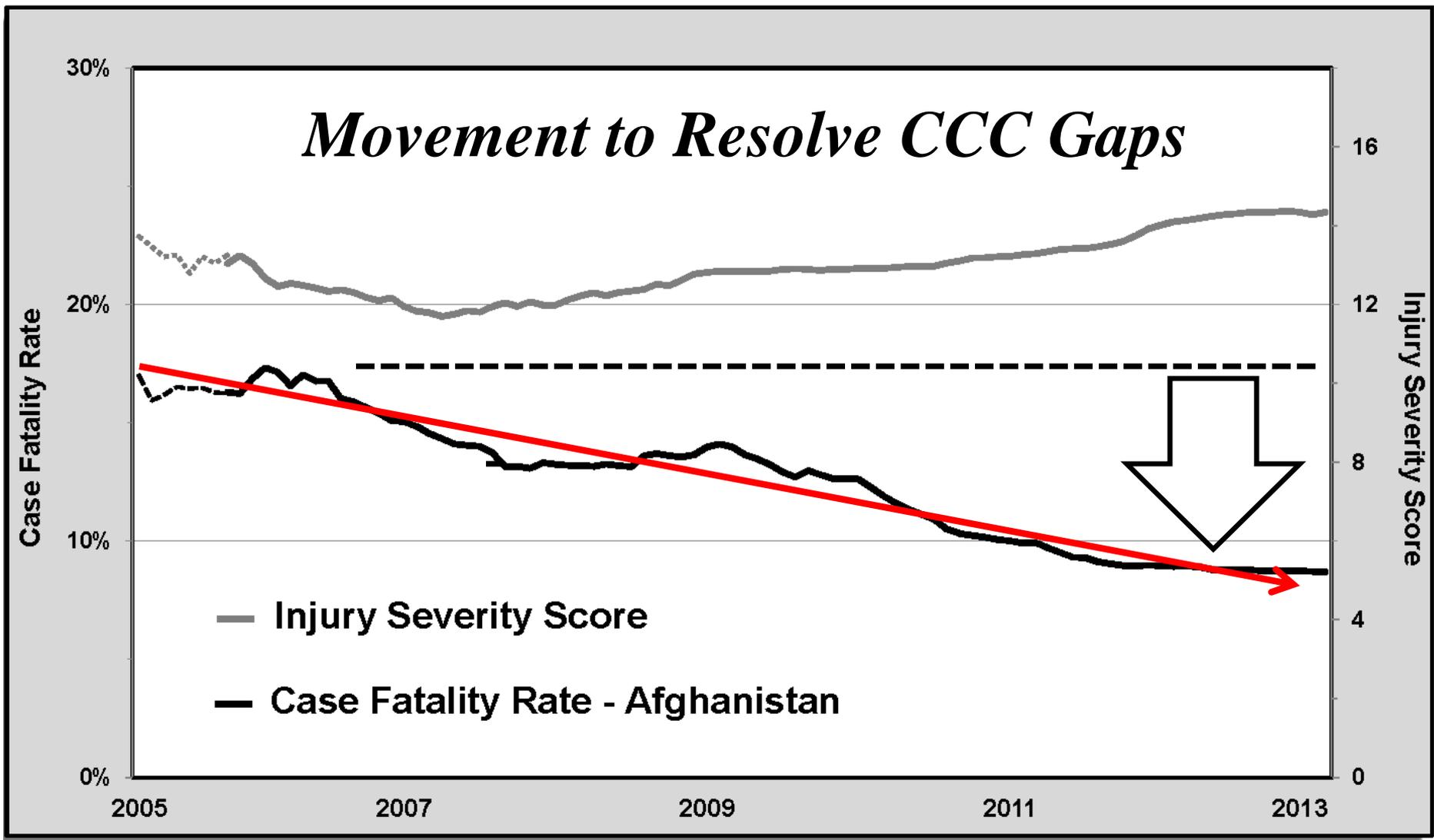
Resolved

▲
0%

▲
100%



Saved Lives on the Battlefield (National Security)



Narrowing Gaps Saves Civilian Lives (Homeland Security)

IN THE LAB,
ON THE
BATTLEFIELD



VIEWPOINT

Implications of Combat Casualty Care for Mass Casualty Events



JAMA 2013;310(5):475

Eric A. Elster, MD
Norman M. Rich
Department of Surgery,
Uniformed Services
University of the Health
Sciences, Bethesda,
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Base San Antonio, Ft
Sam Houston, Texas.

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 response 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.

dence 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



Narrowing Gaps Saves Civilian Lives (Homeland Security)

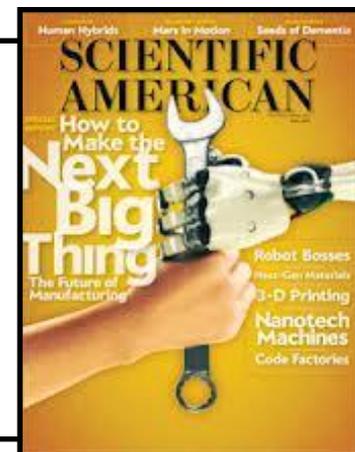


THE NEW REPUBLIC

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

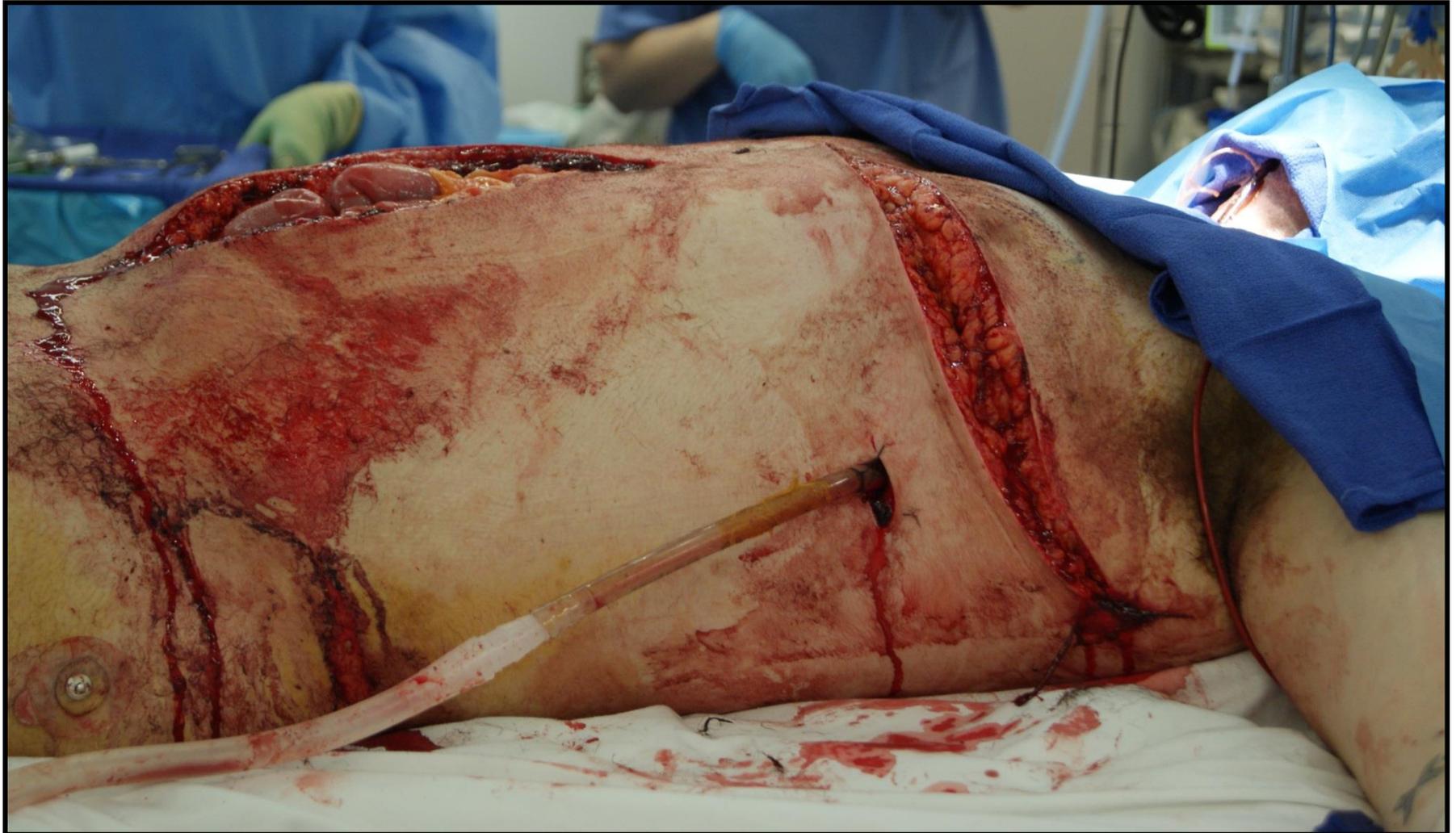




Who Does this Type of Research?



3) hemoperitoneum 4) hemothorax

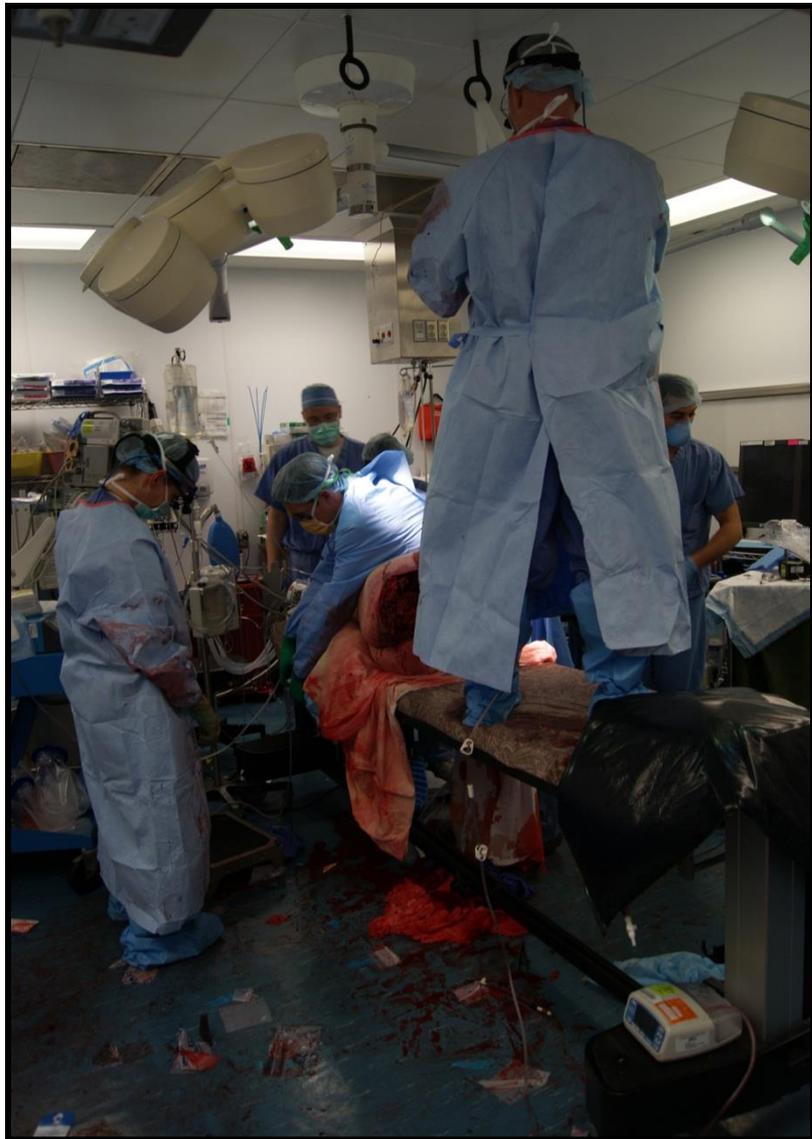




Who Does this Type of Research?



- **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**

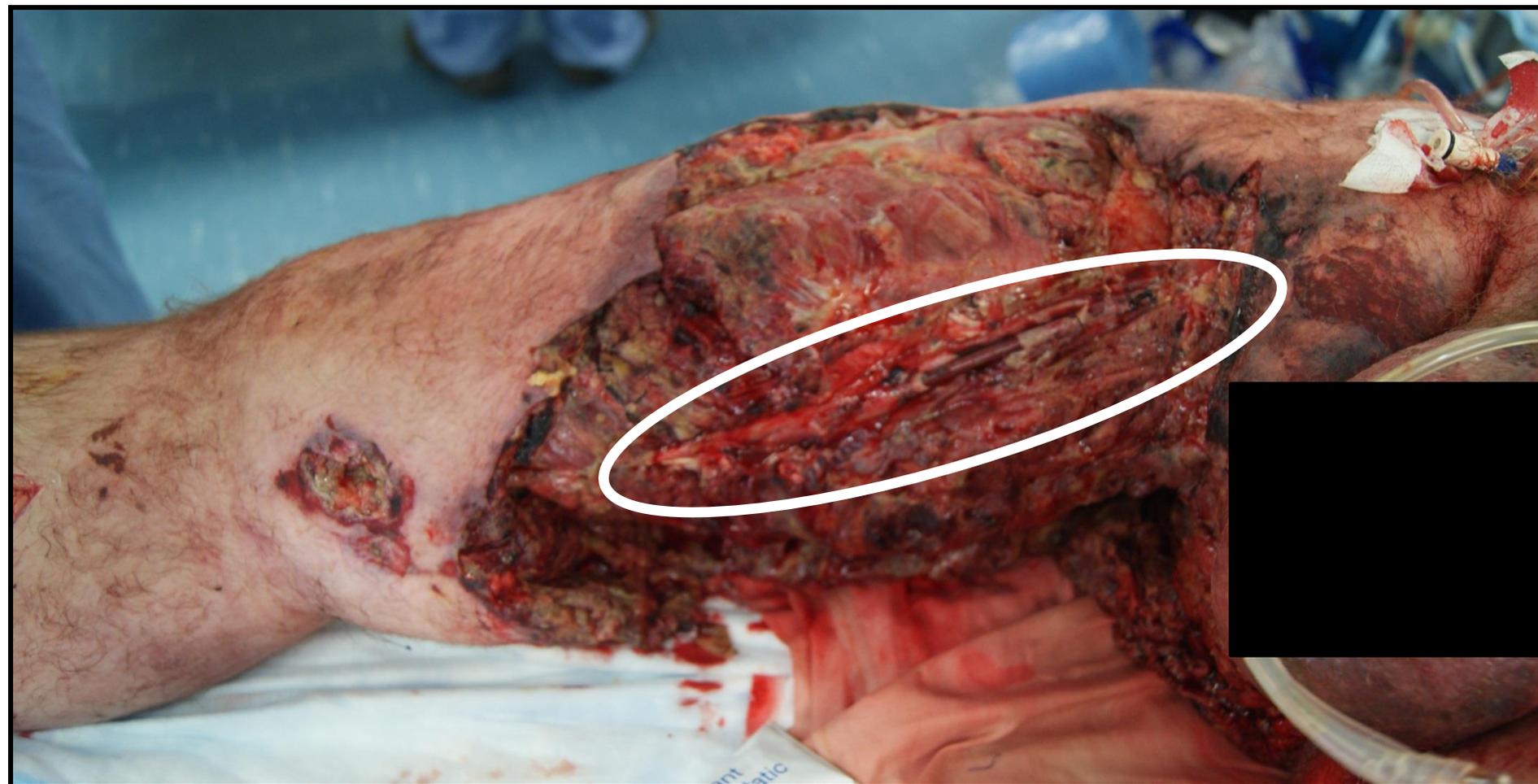




Who Does this Type of Research?



- **Temporary plastic shunt in right femoral artery (right medial thigh) in attempt to save right lower extremity**

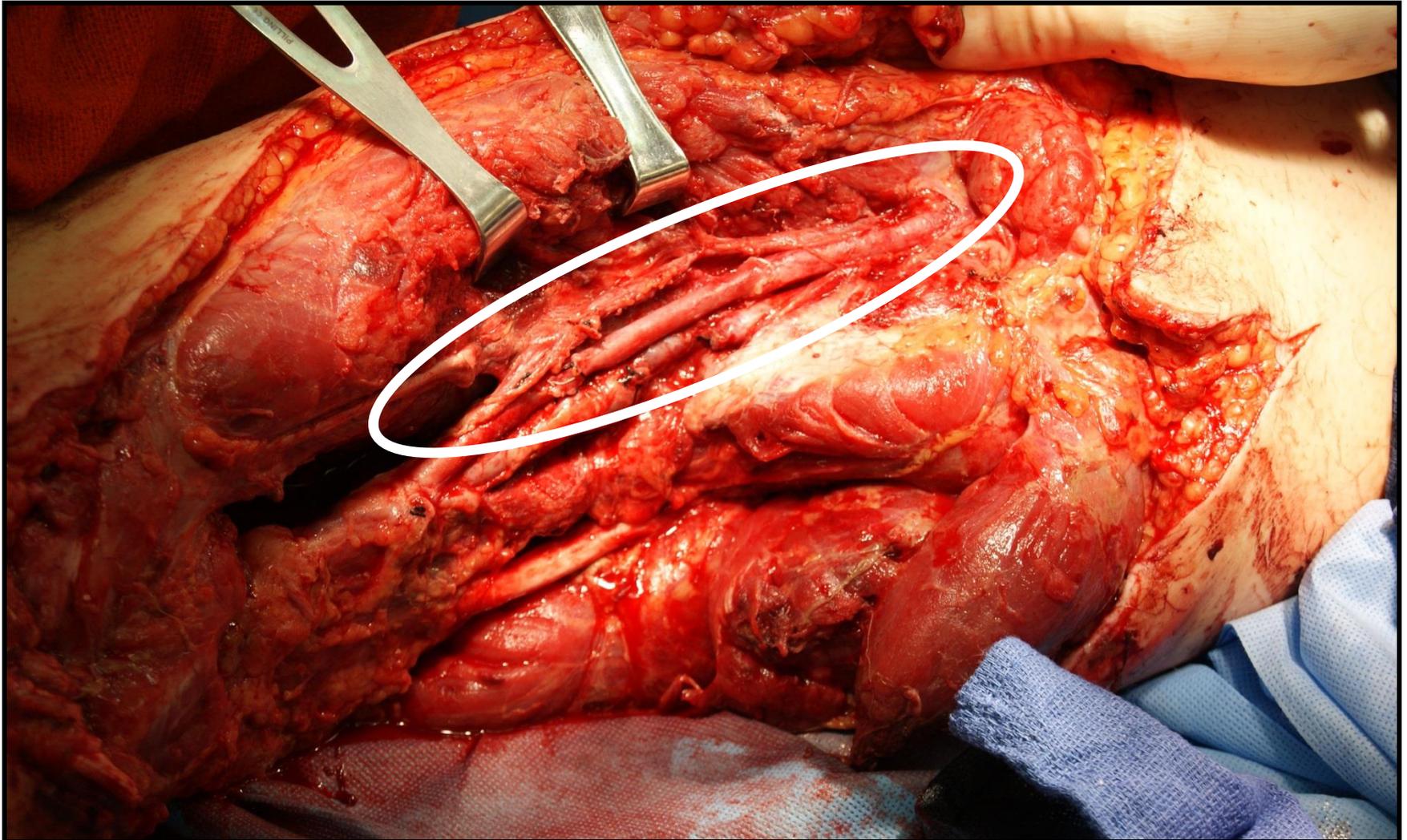




Who Does this Type of Research?



- **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

DIVISION OF MEDICAL SCIENCES
NATIONAL ACADEMY OF SCIENCES NATIONAL RESEARCH COUNCIL

RD
93.8

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...

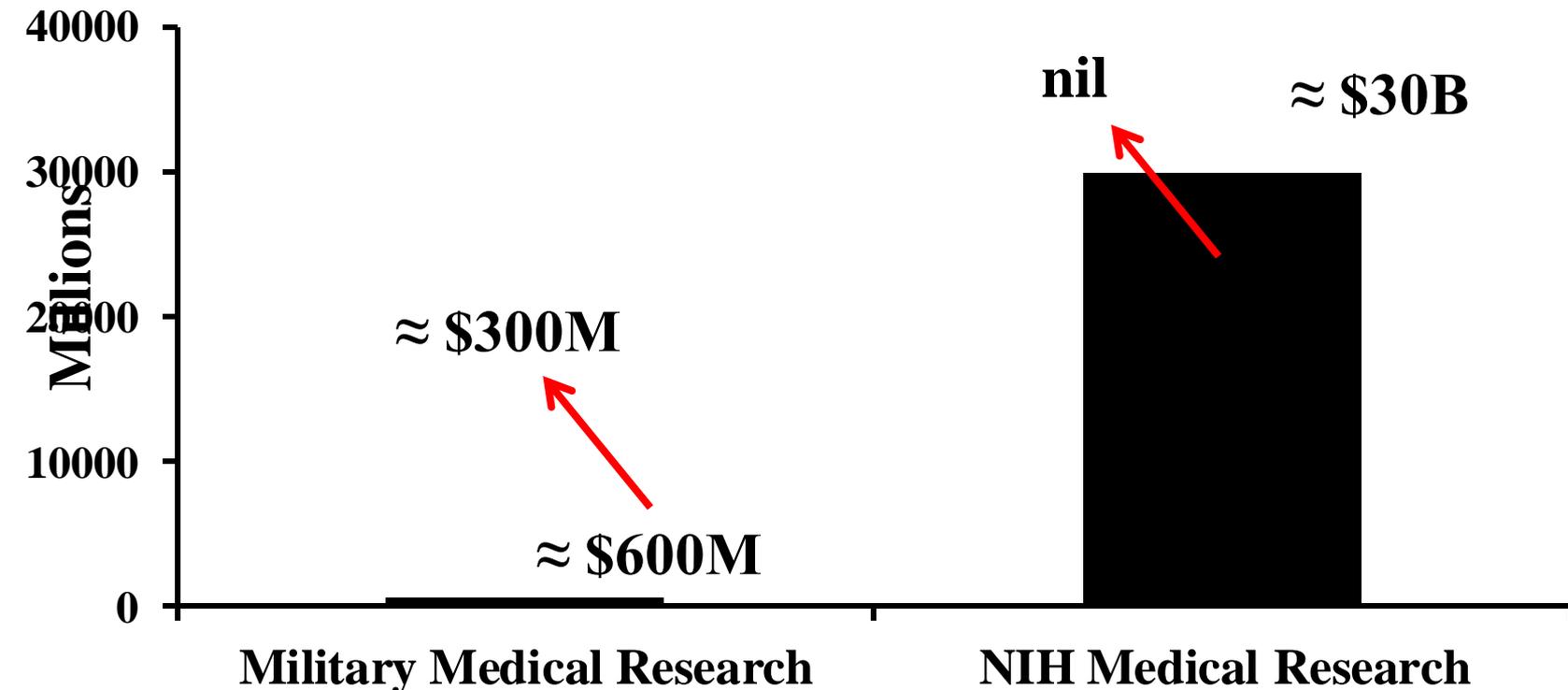




Who Funds this Type of Research?



Where *does* research funding dedicated & programmed to address needs of uniformed personnel in combat originate? ...*the DoD*

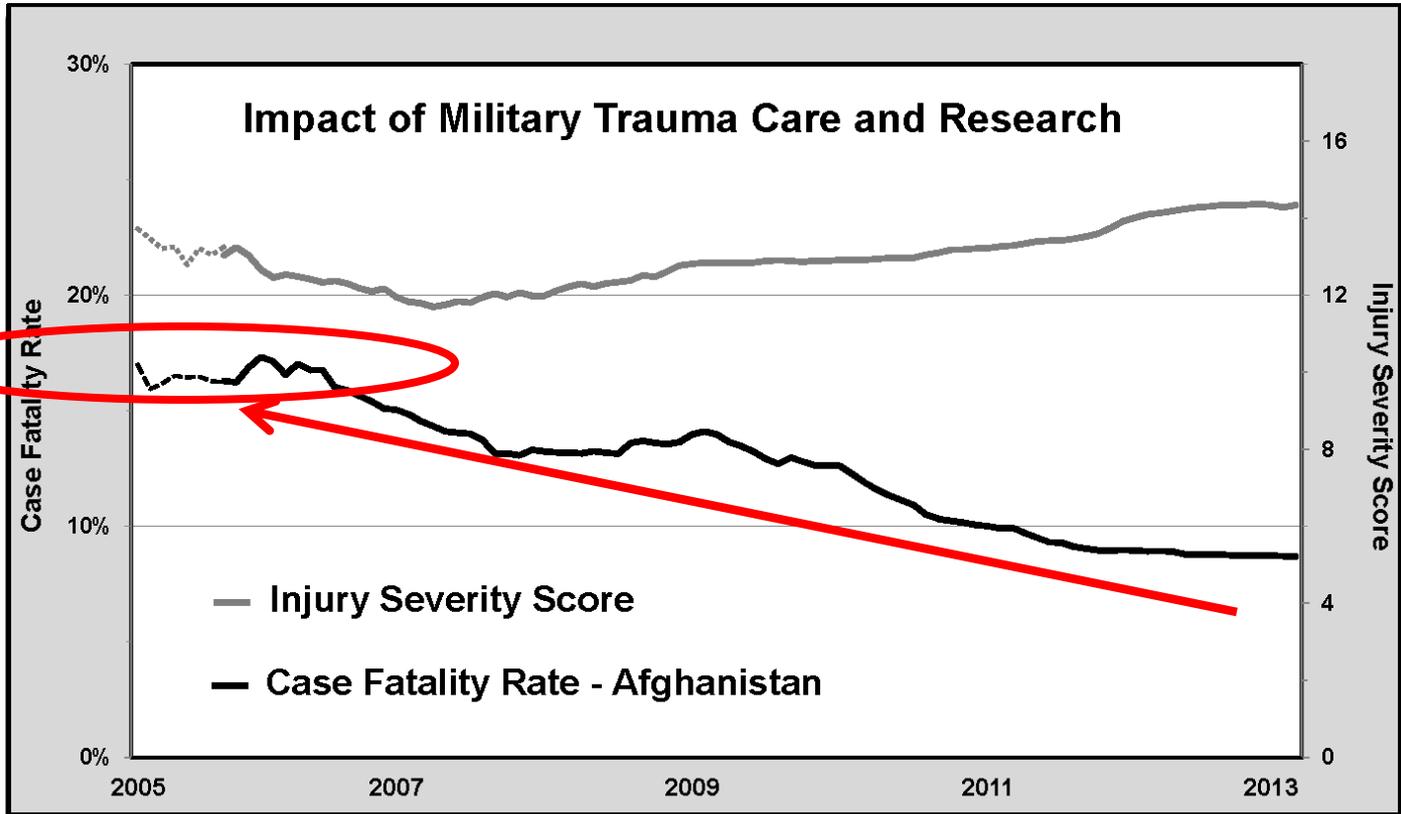




The Risk

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

**Pre-2005
Case Fatality
Rate**





The Risk

IN THE LAB,
ON THE
BATTLEFIELD



- **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

IN THE LAB,
ON THE
BATTLEFIELD



- **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**



Strategy



18th

DEVELOP JOINT FORCE 2020

“...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

Chairman’s 2nd term Strategic Direction to the Joint Force



Strategy



VIEWPOINT

No Drift

JAMA Surg January 2014

Todd E. Rasmussen, MD
The US Army Institute of Surgical Research,
Joint Base Fort Sam
Houston (San Antonio),

Drift: deviation from a true representation, or reading; especially: a gradual change in the zero reading in any quantitative characteristic that is supposed to remain constant
Merriam-Webster Unabridged Dictionary

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



AMERICAN COLLEGE OF SURGEONS
*Inspiring Quality:
Highest Standards, Better Outcomes*

- 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

IN THE LAB,
ON THE
BATTLEFIELD



“Moral test of a nation’s character is how it prepares & cares for those ill or injured because of war”



Back Up Slide/Illustration



- Progress made but gaps remain unresolved

