

Death on the Battlefield Implications for Prevention, Training, and Medical Care

US Army Institute of Surgical Research
and
Armed Forces Medical Examiner Service

Brian Eastridge
COL, MC, USA
Trauma Consultant
US Army Surgeon General



Disclaimer

The opinions or assertions contained herein are the private views of the author and are not to be construed as official or as reflecting the views of the Department of the Army or the Department of Defense.

JTTS Vision

That every soldier, marine, sailor, or airman injured on the battlefield or in the theater of operations has the optimal chance for survival and maximal potential for functional recovery.

Data Sources

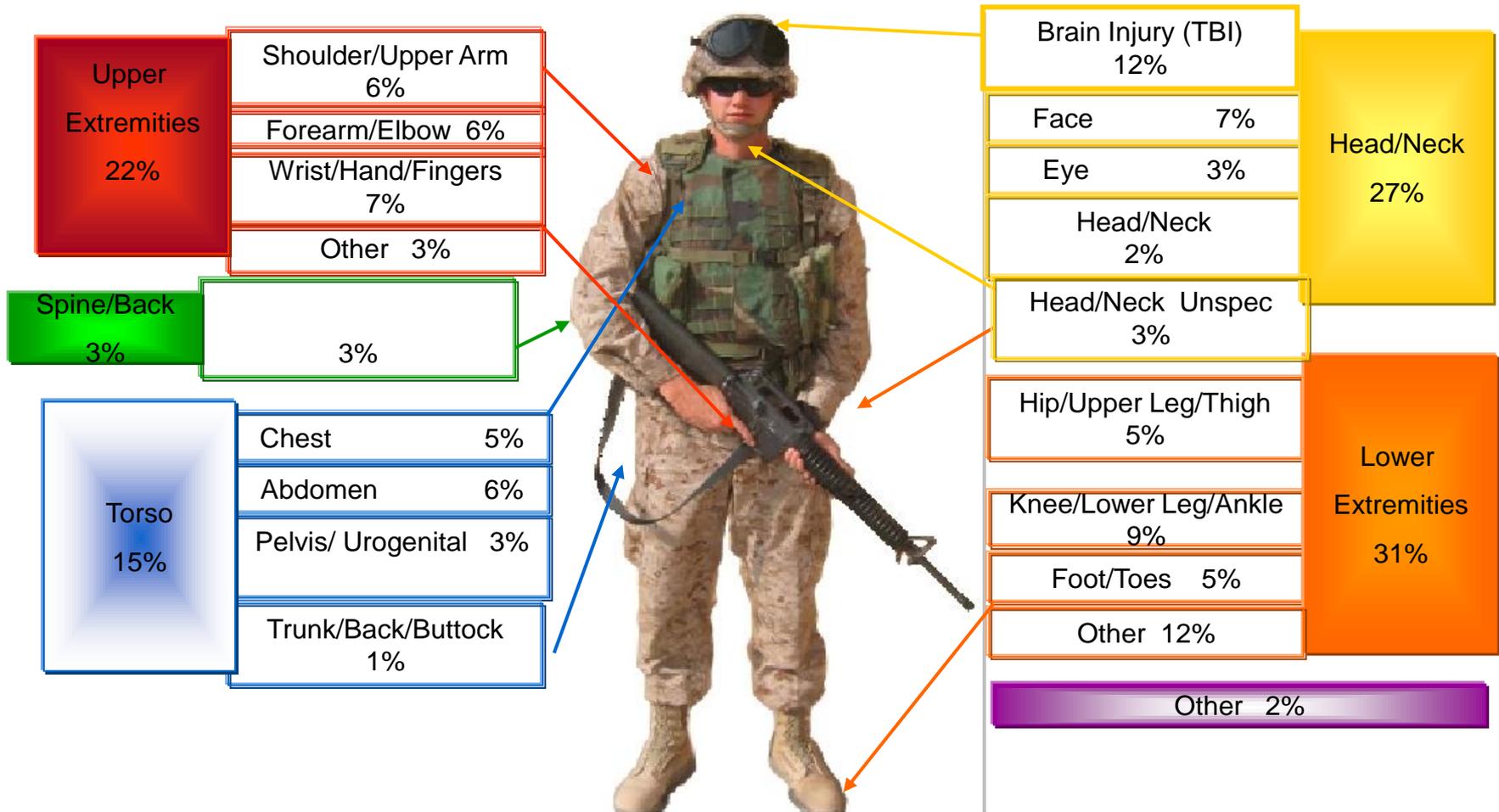
Joint Theater Trauma Registry (JTTR)

- Largest combat Injury database in existence
- All services injury data derived from level IIb, III, IV and V medical charts
 - Scoring of Injuries
 - Diagnosis and Procedures
 - Outcomes
- 60,000 US military injury patient records

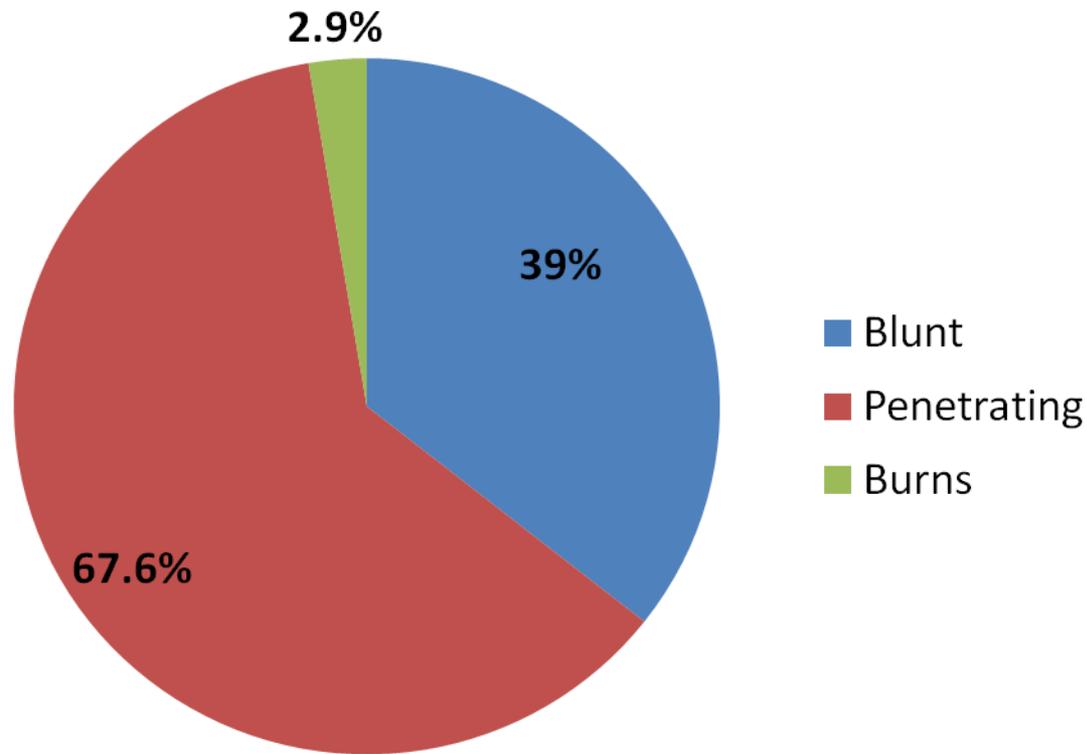
Armed Forces Medical Examiner System (AFMES)

- Maintaining the DoD Medical Mortality Registry. The registry component, which has the broader mission of analyzing all active duty deaths for trends and preventable or modifiable risk factors.

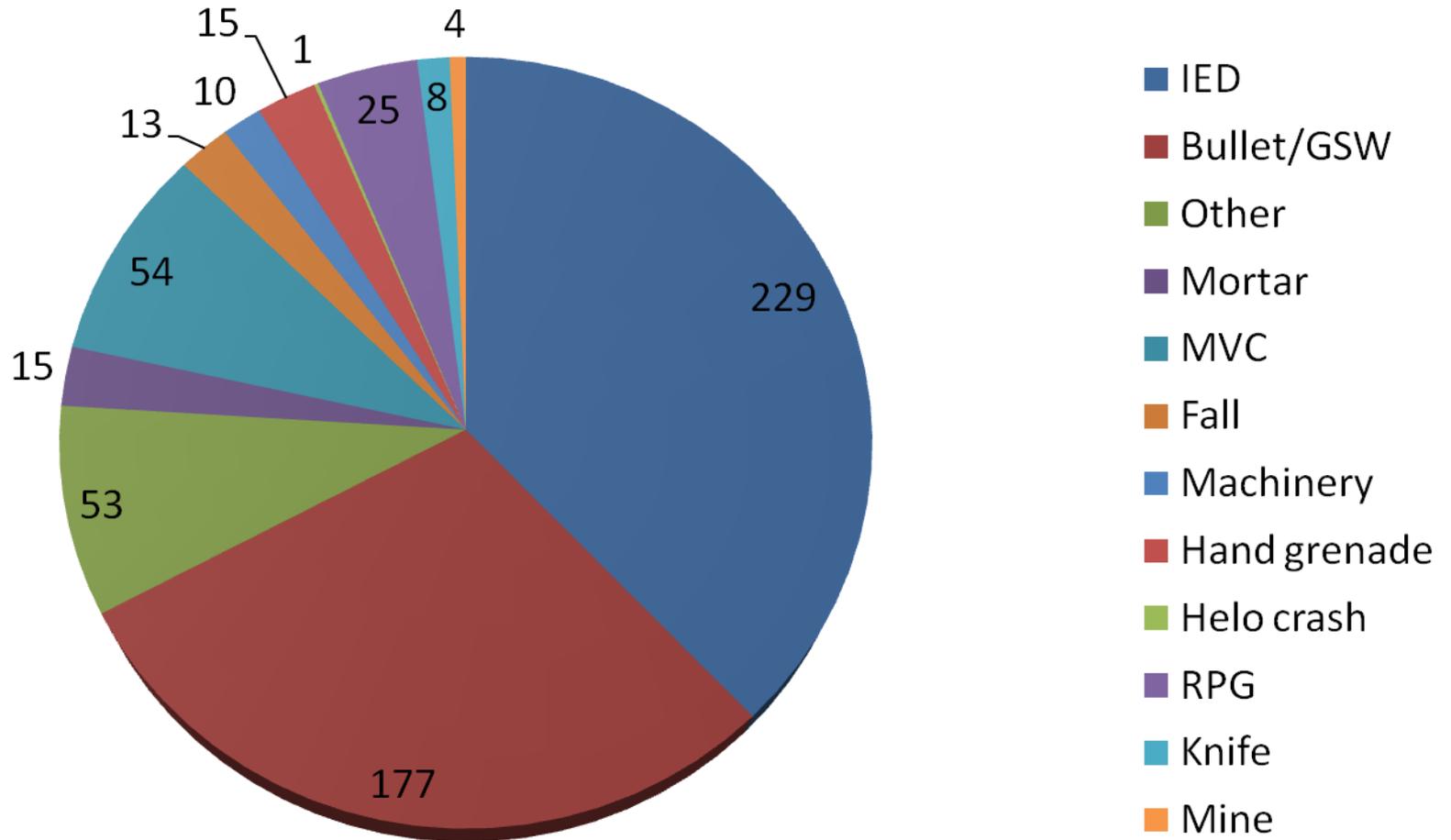
Battle Injuries by Body Region



Dominant Mechanism of Injury



Cause of Injury



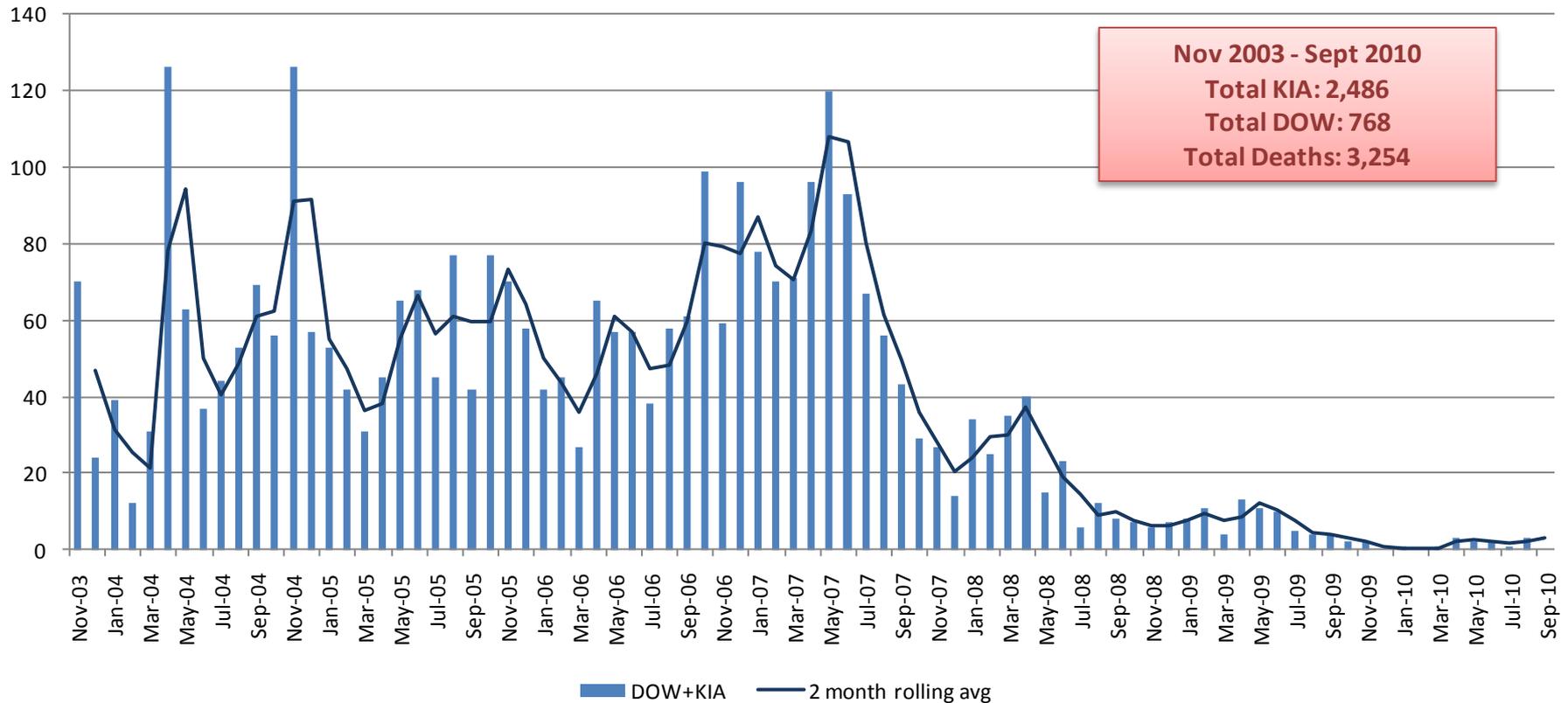
**Includes both battle and non-battle injury*

Combat Casualty Care Statistics

- $\%KIA = \frac{\text{Deaths before MTF}}{KIA + (WIA - RTD)} \times 100$
- $\%DOW = \frac{\text{Died after reaching MTF}}{WIA - RTD} \times 100$
- $CFR = \frac{KIA + DOW}{KIA + WIA} \times 100$

United States Army Institute of Surgical Research

U.S. Combat Deaths (DOW+KIA) sustained during OIF, November 2003 - September 2010 by month

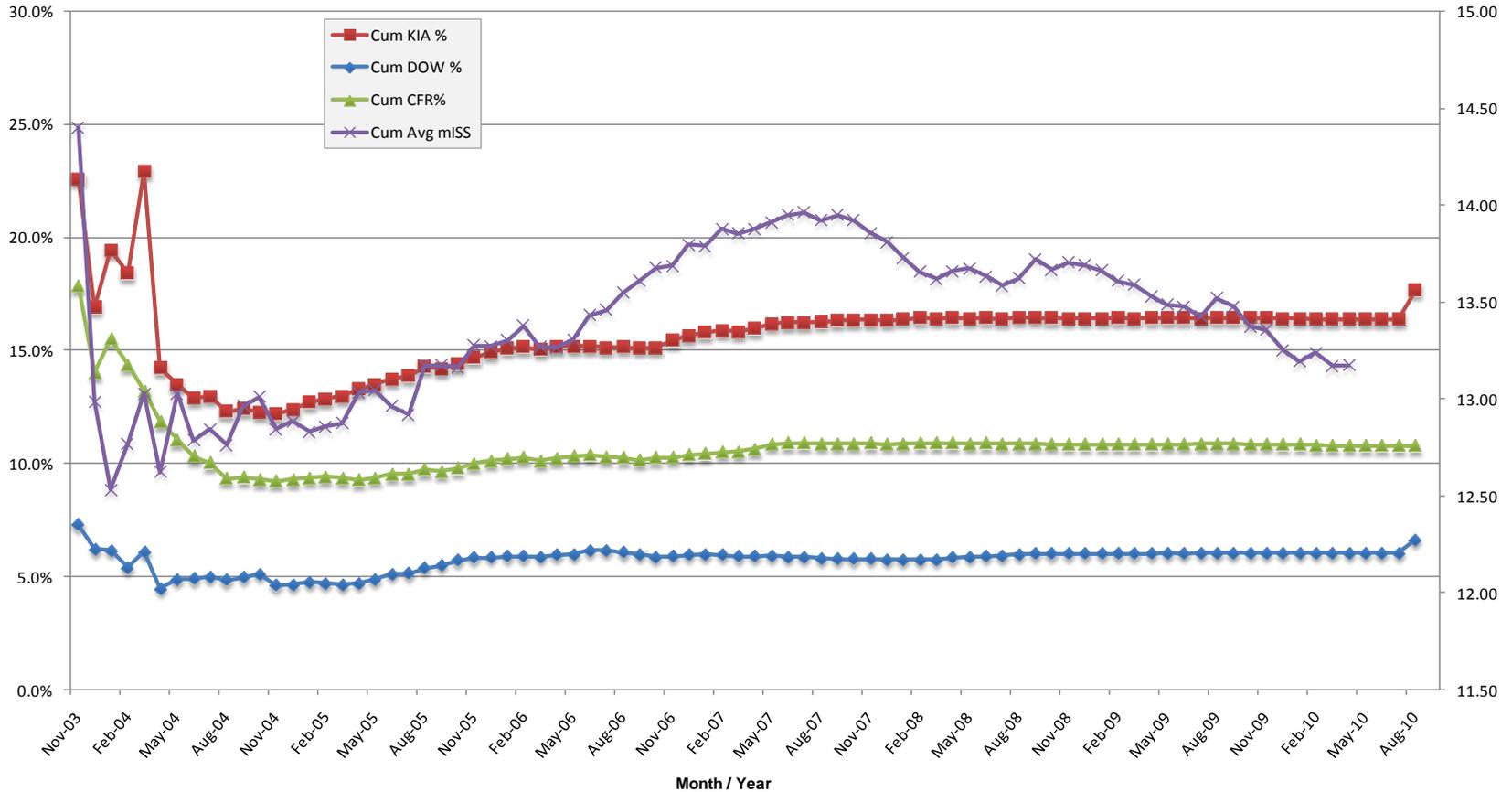


Produced by the Joint Theater Trauma Registry

Data Source: JTTR v.3 data extract supplemented by data provided by DMDC & US Pentagon

OIF Cumulative Rolling Monthly Averages

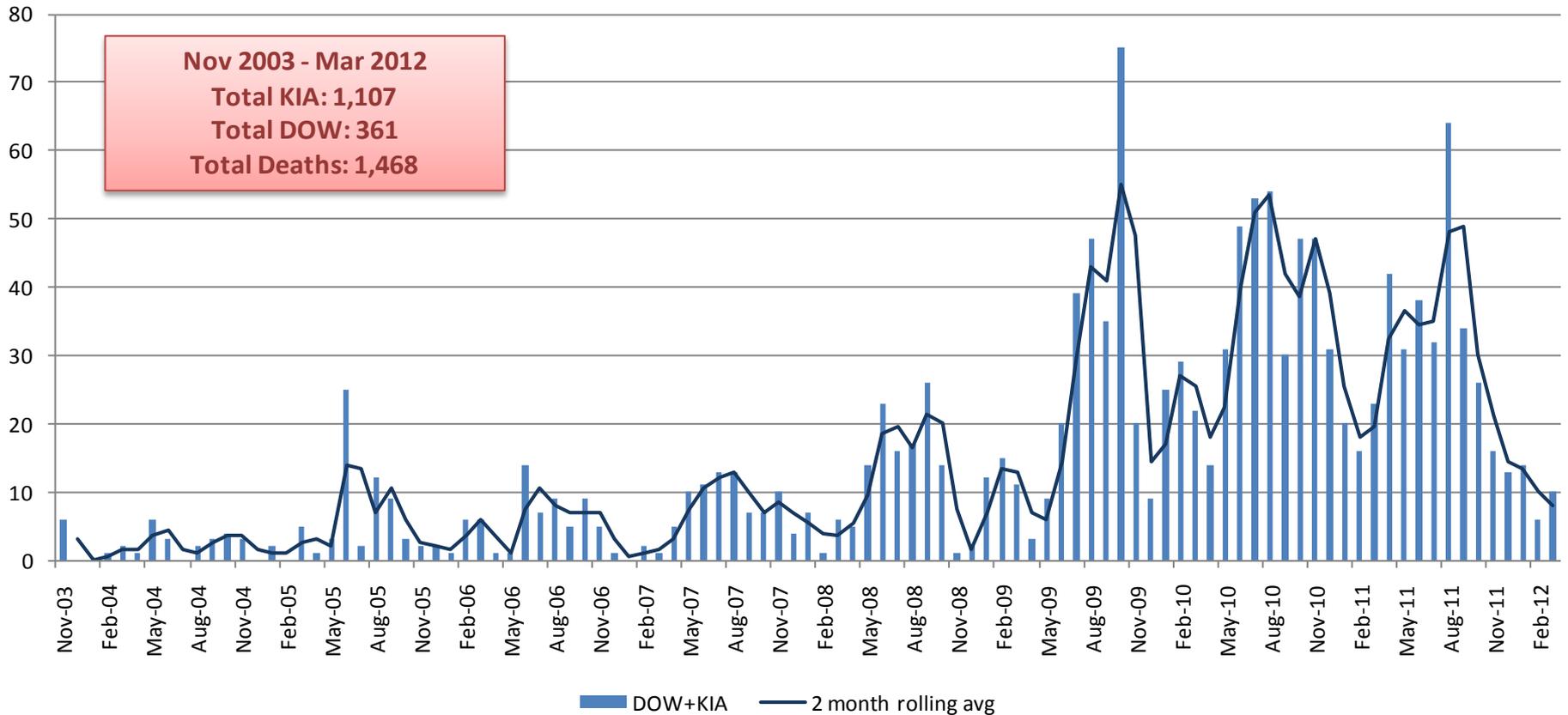
OIF Cumulative Rolling Monthly Averages: %KIA, %DOW, CFR and Avg mISS
November 2003 - September 2010



Produced by the Joint Theater Trauma Registry
Data Source: JTTR v.3 data extract supplemented by data provided by DMDC Statistical Analysis Division & US Pentagon OSD

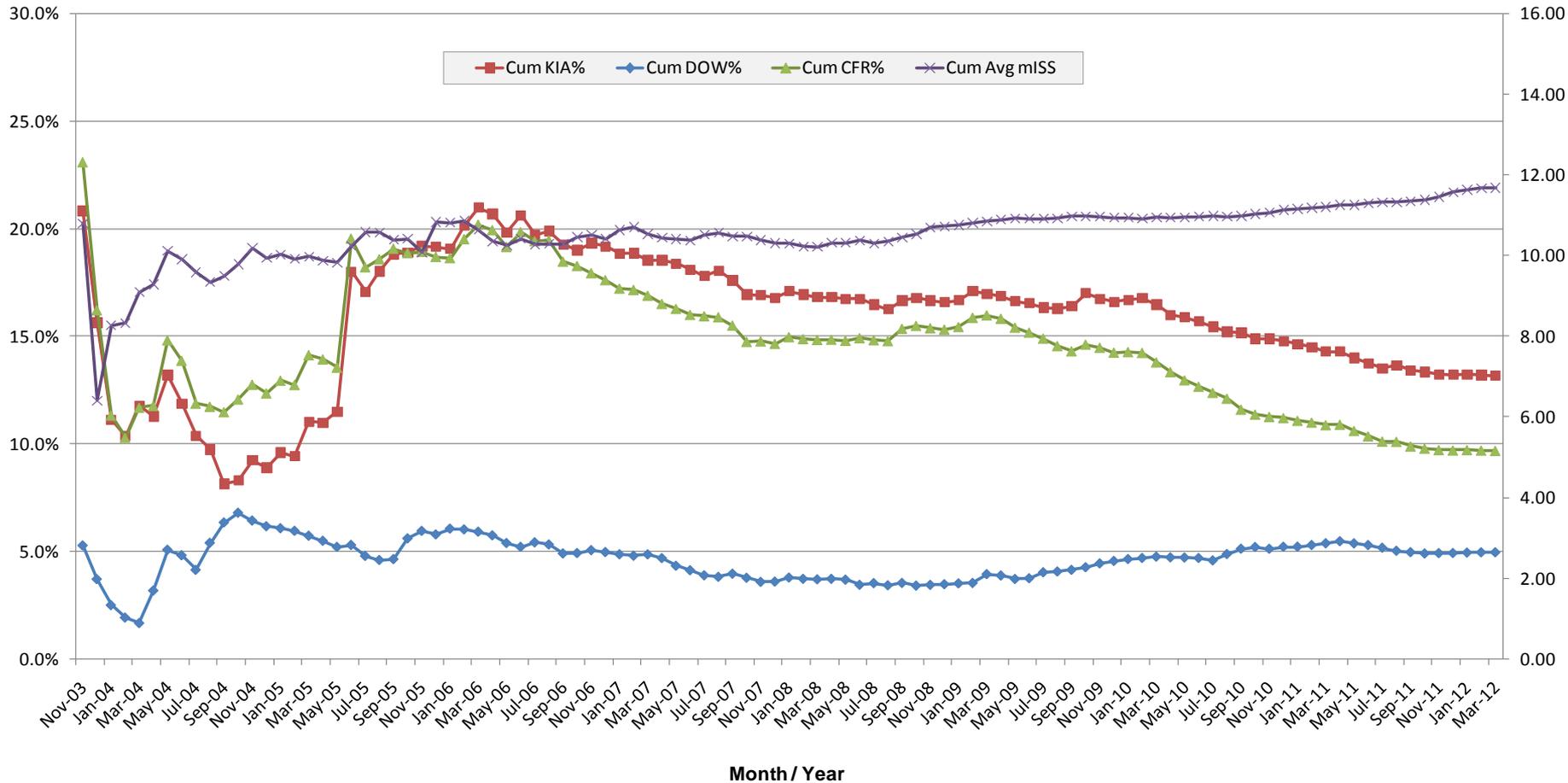
U.S. Combat Deaths Sustained during OEF

U.S. Combat Deaths (DOW+KIA) sustained during OEF,
November 2003 - March 2012 by month



OEF Cumulative Rolling Monthly Averages

OEF Cumulative Rolling Monthly Averages: %KIA, %DOW, CFR and Avg mISS
Nov 2003 - Mar 2012



Breakdown between WWII, Vietnam, and Iraq/Afghanistan Troops.

How are we doing? Why?



	<u>WW II</u>	<u>Vietnam</u>	<u>Iraq/ Afghanistan</u>
% KIA	25.3 ^a	18.6 ^b	12.5 ^c
% DOW	3.5 ^a	3.0 ^b	4.1 ^c
CFR	19.1 ^a	16.1 ^b	10.1 ^c

a,b,c < 0.001

Right Patient, Right Place, Right Time, Right Care

United States Army Institute of Surgical Research

Improving Casualty Survivability

OEF: 7 October 2001—31 December 2010

OIF: 19 March 2003—31 December 2010

OEF percentage of survivability, October 2001-December 2010 and OIF percentage of survivability, March 2003-December 2010.



Equipment

Doctrine

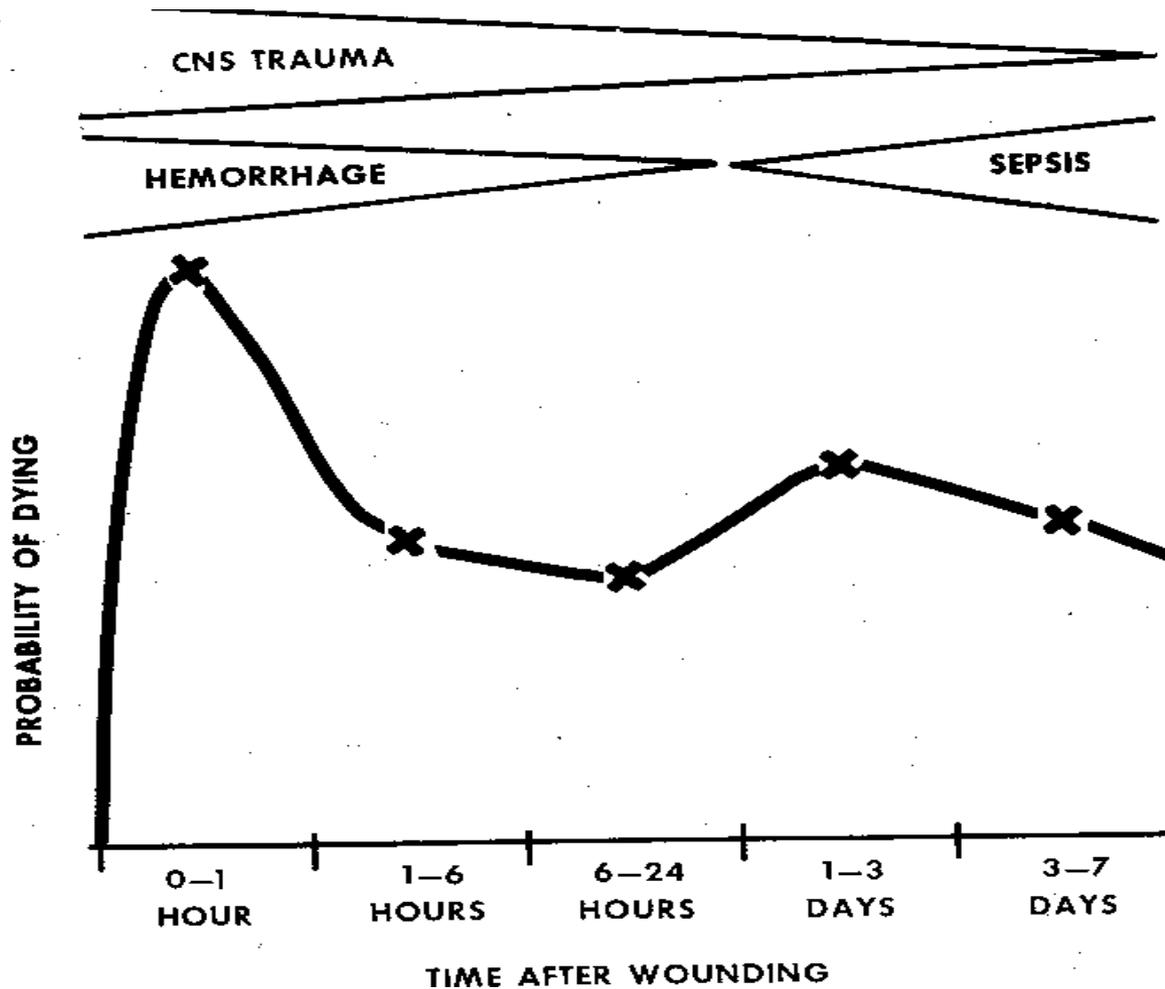
Tactics Techniques Procedures

Training

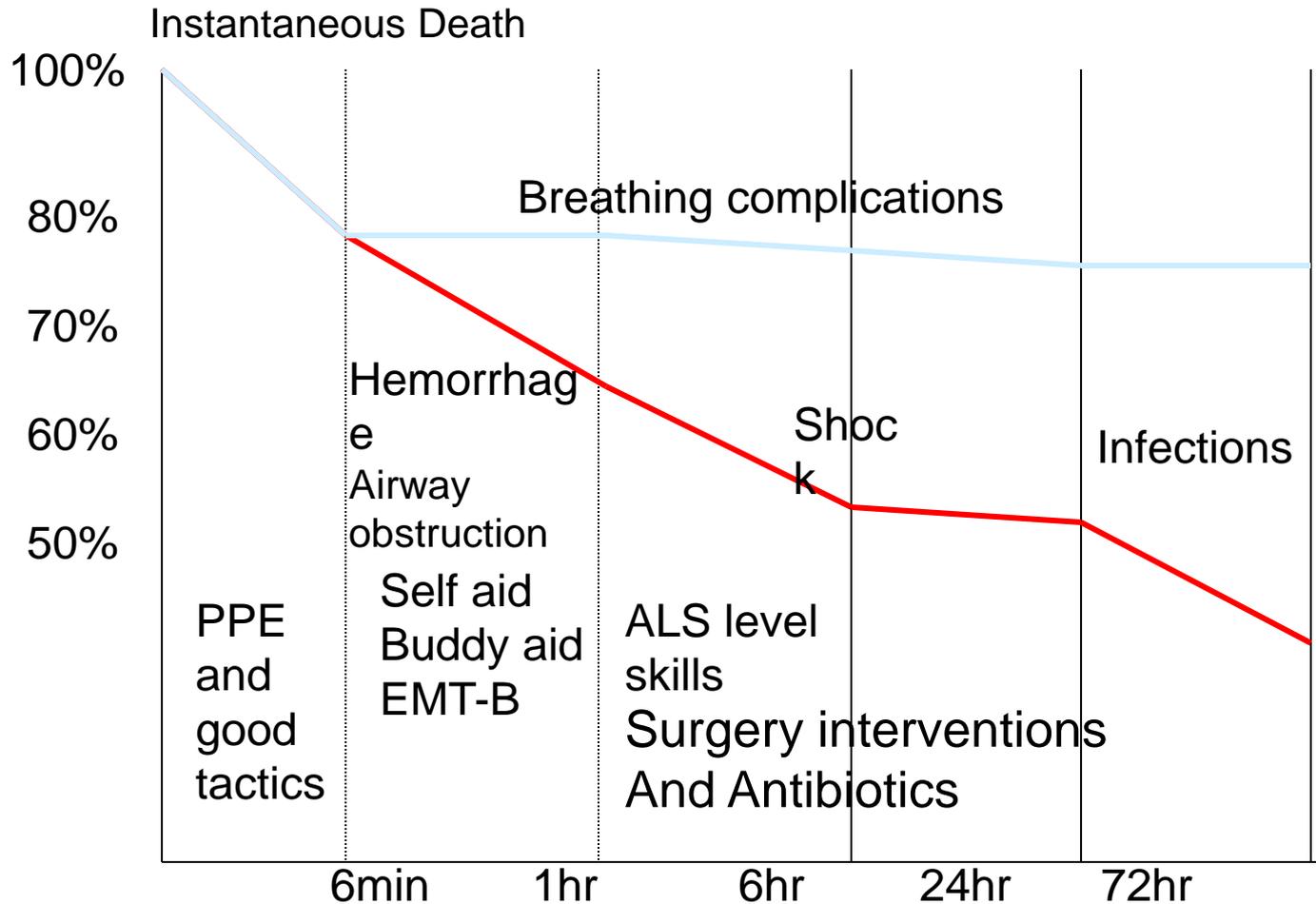
Battlefield Mortality Mechanism and Causation



Empiric Probability Combat Death

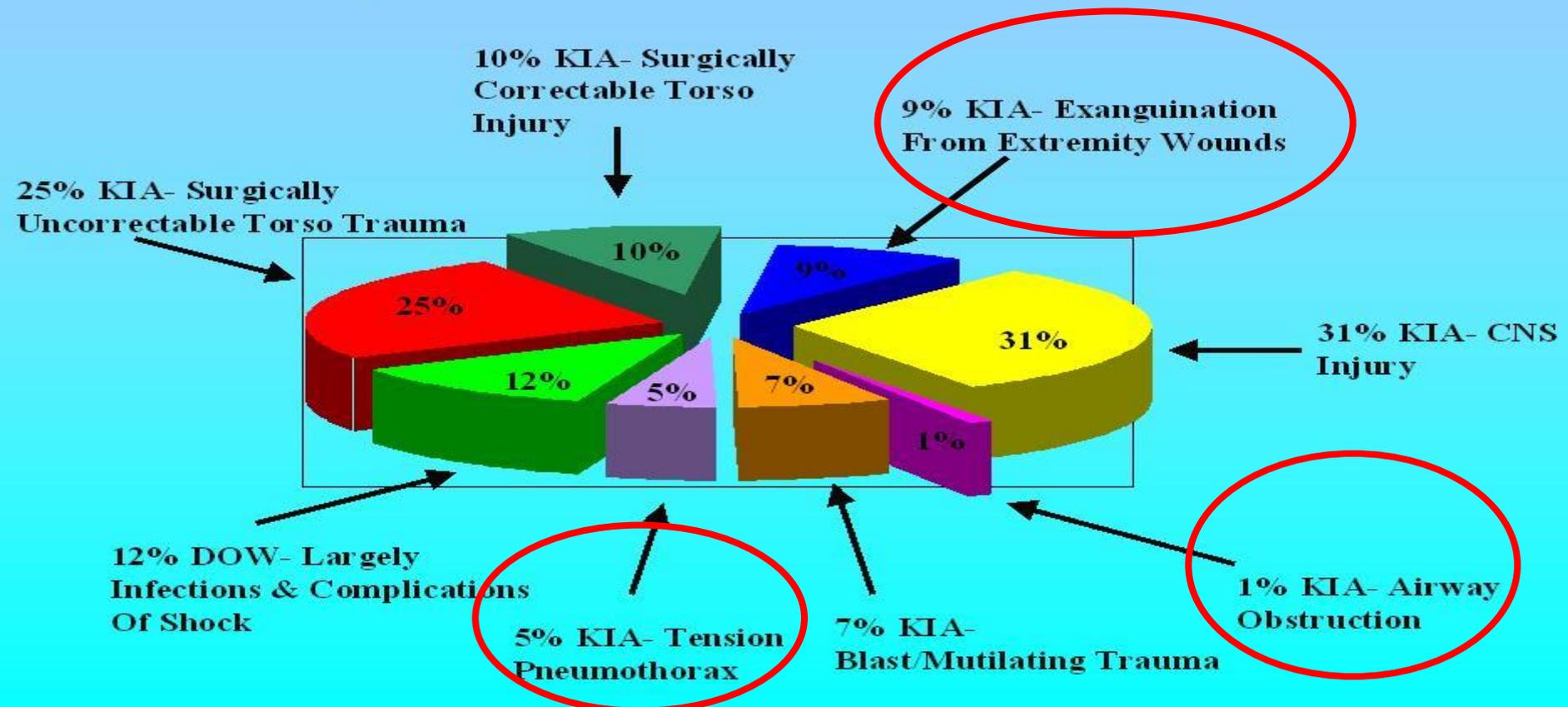


Mortality Penetrating Trauma

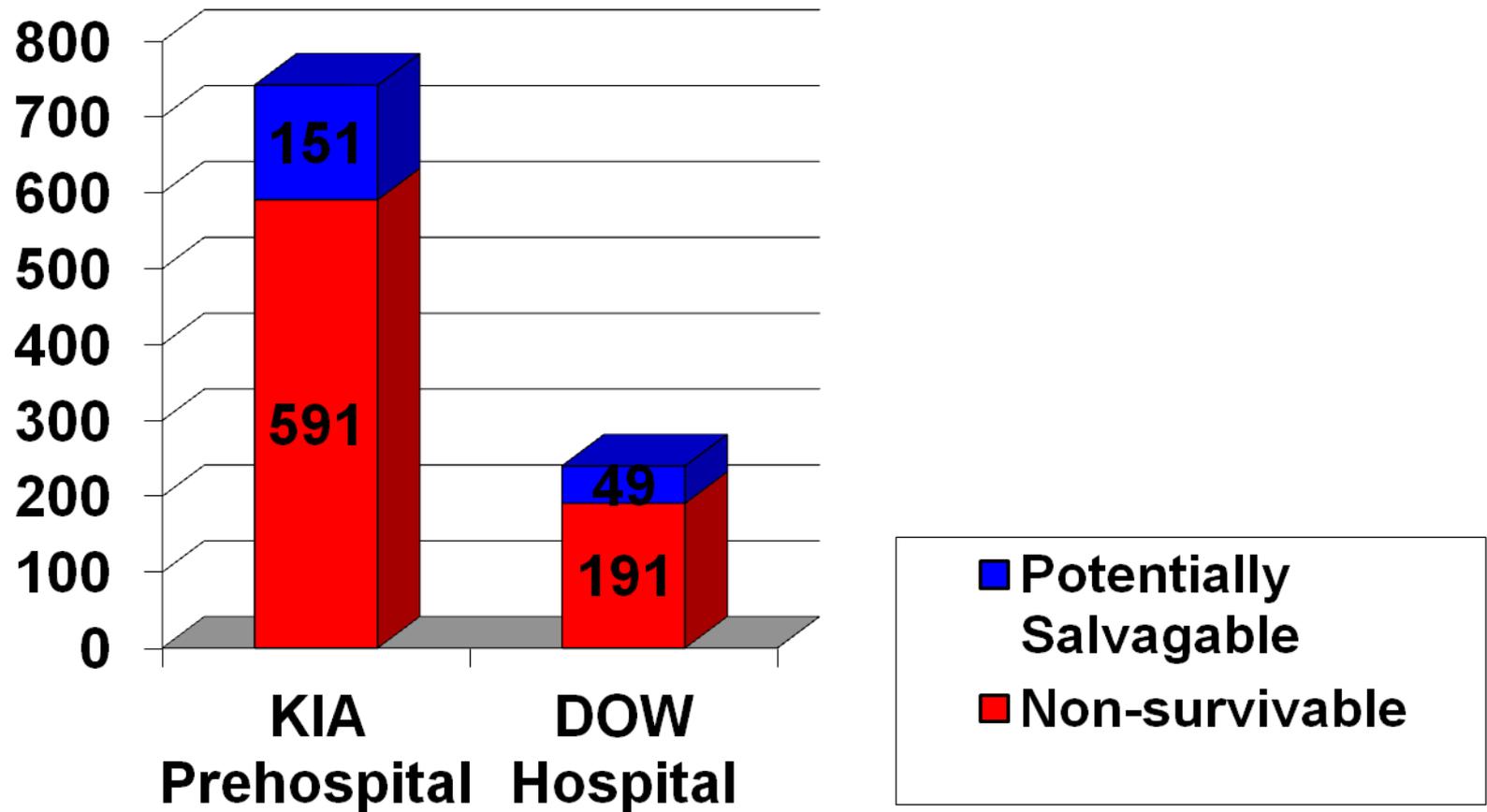


How People Die in Ground Combat

How People Die In Ground Combat (From COL Ron Bellamy)



Where can we save the most lives?



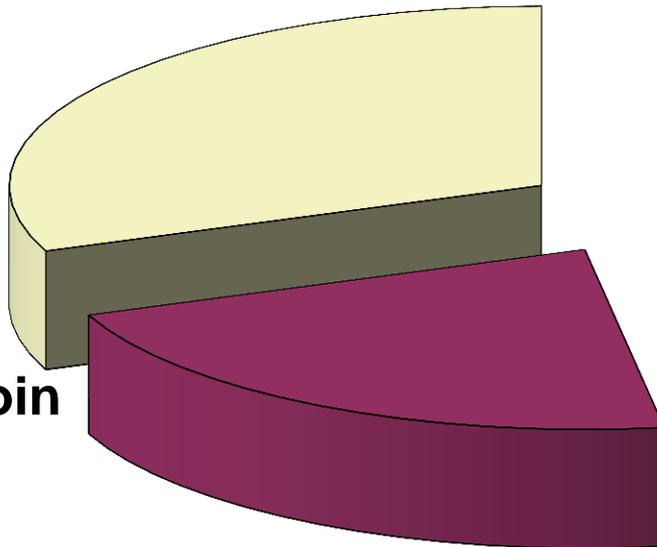
Kelly JF, et.al. Injury severity and causes of death from Operation Iraqi Freedom and Operation Enduring Freedom: 2003-2004 versus 2006. J Trauma

Potentially Survivable Hemorrhagic Deaths on the Battlefield

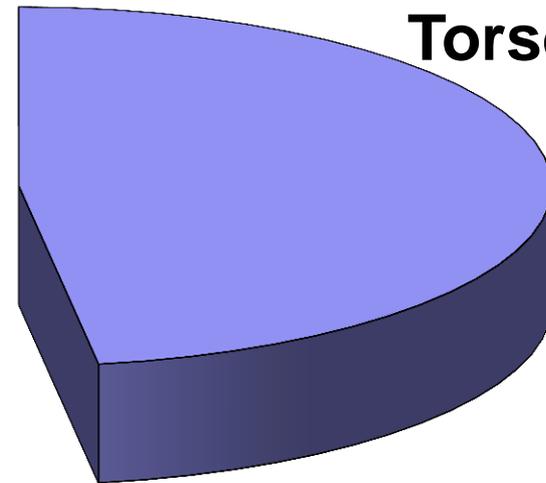
Of PS deaths, 79% secondary to hemorrhage

Extremity
31%

Axilla/Groin
21%



Torso 48%



Nearly 50% of deaths not amenable to field control

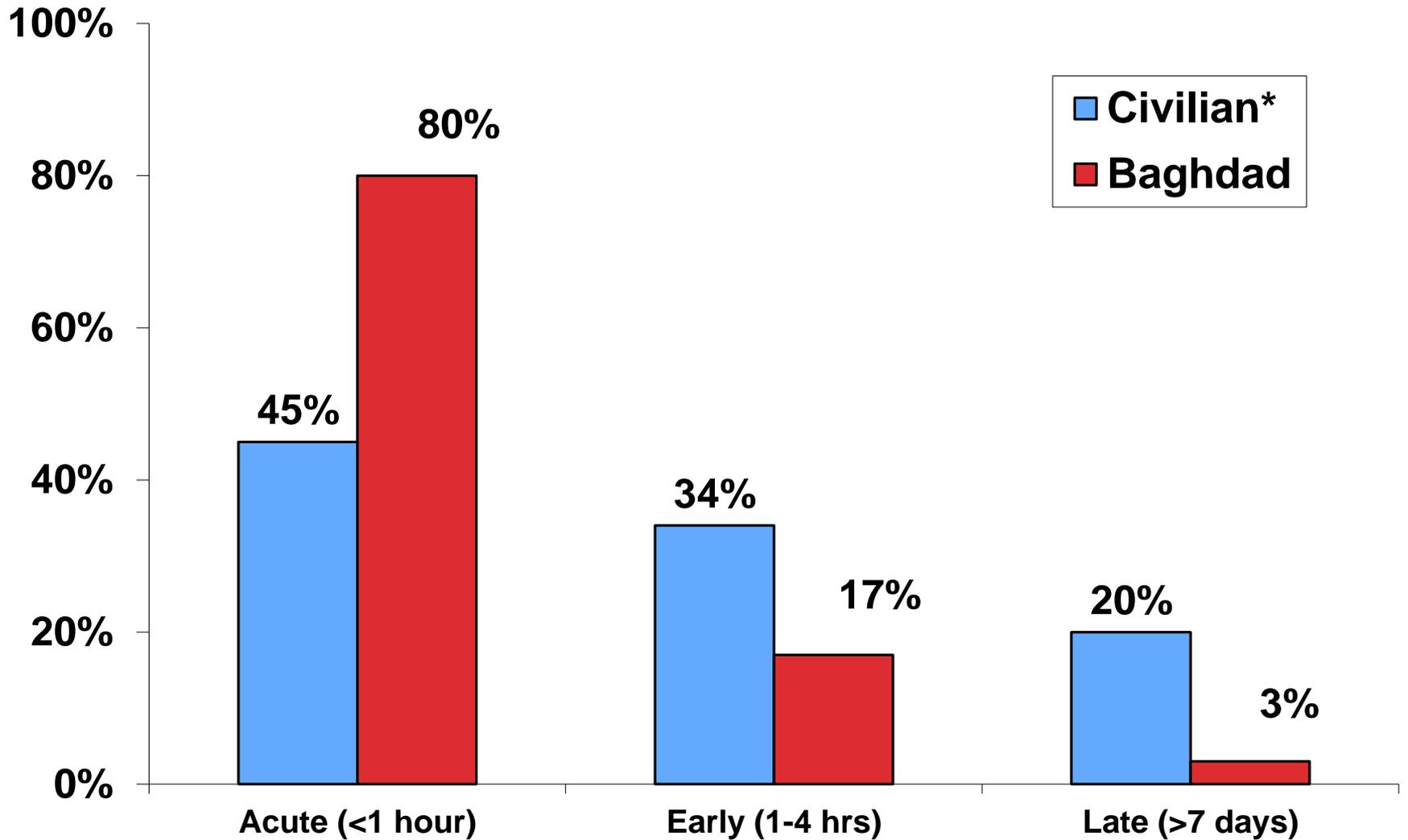
Battlefield Killers

Table 4 Causes of Death Among Potentially Survivable Casualties

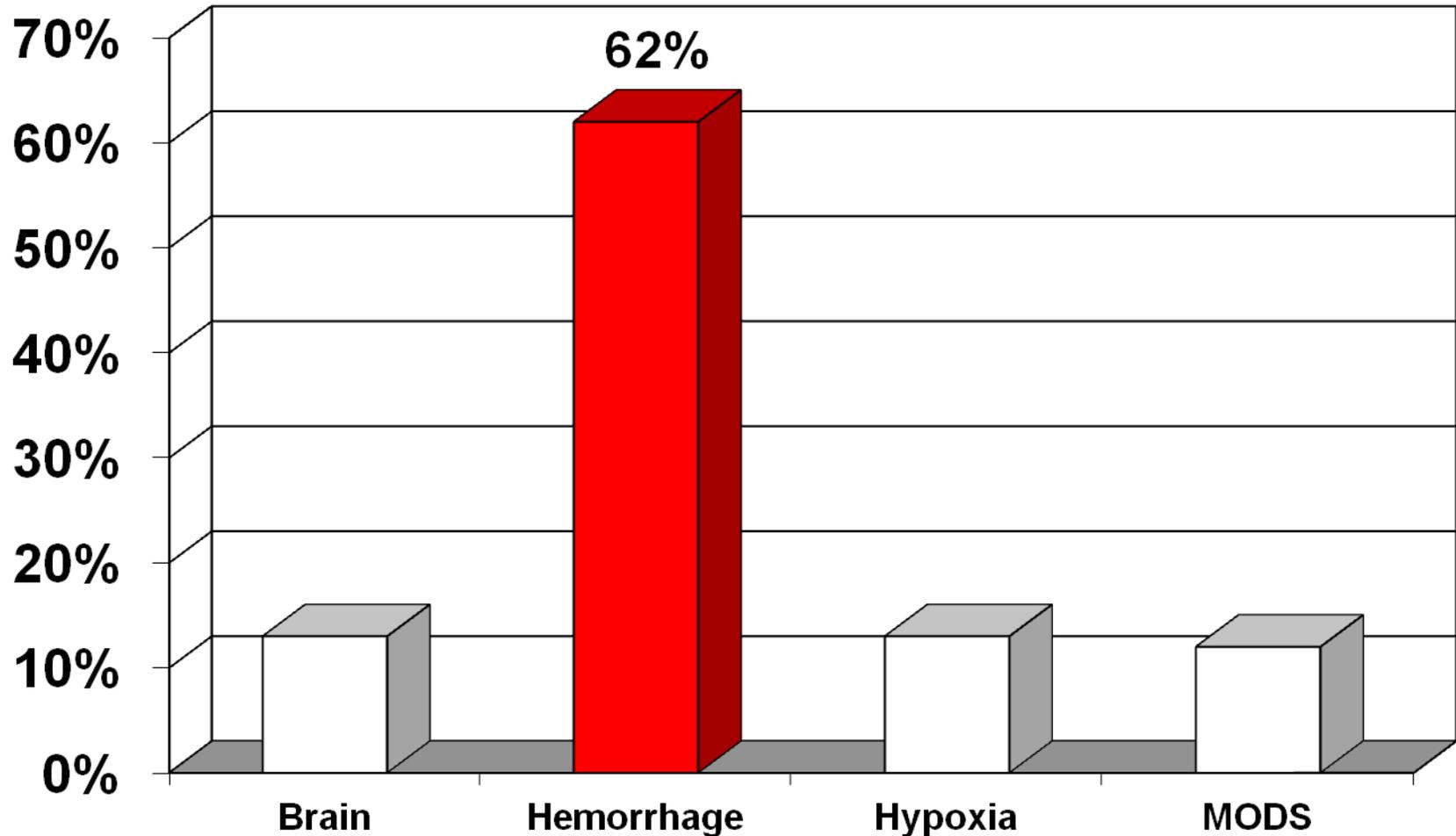
Cause of Death*	Group 1 (n = 93) (% Total of PS)	Group 2 (n = 139) (% Total of PS)
CNS	12 (13)	8 (6)
Head	11 (12)	6 (4) ($p < 0.04$)
Neck	1 (1)	0 (0)
Spinal cord	1 (1)	3 (2)
Hemorrhage	81 (87)	116 (83)
Tourniquetable (ext)	31 (33)	46 (33)
Noncompressible (torso)	47 (51)	68 (49)
Nontourniquetable (ax/neck/groin)	19 (20)	29 (21)
Airway	14 (15)	14 (10)
Sepsis/MSOF	2 (2)	9 (6)
Total causes of death identified	219	299

* Casualties could have 1 or more cause of death.
MSOF indicates multisystem organ failure.

Timing of Trauma Death



Combat Hospital Killers



Died of Wounds Analysis



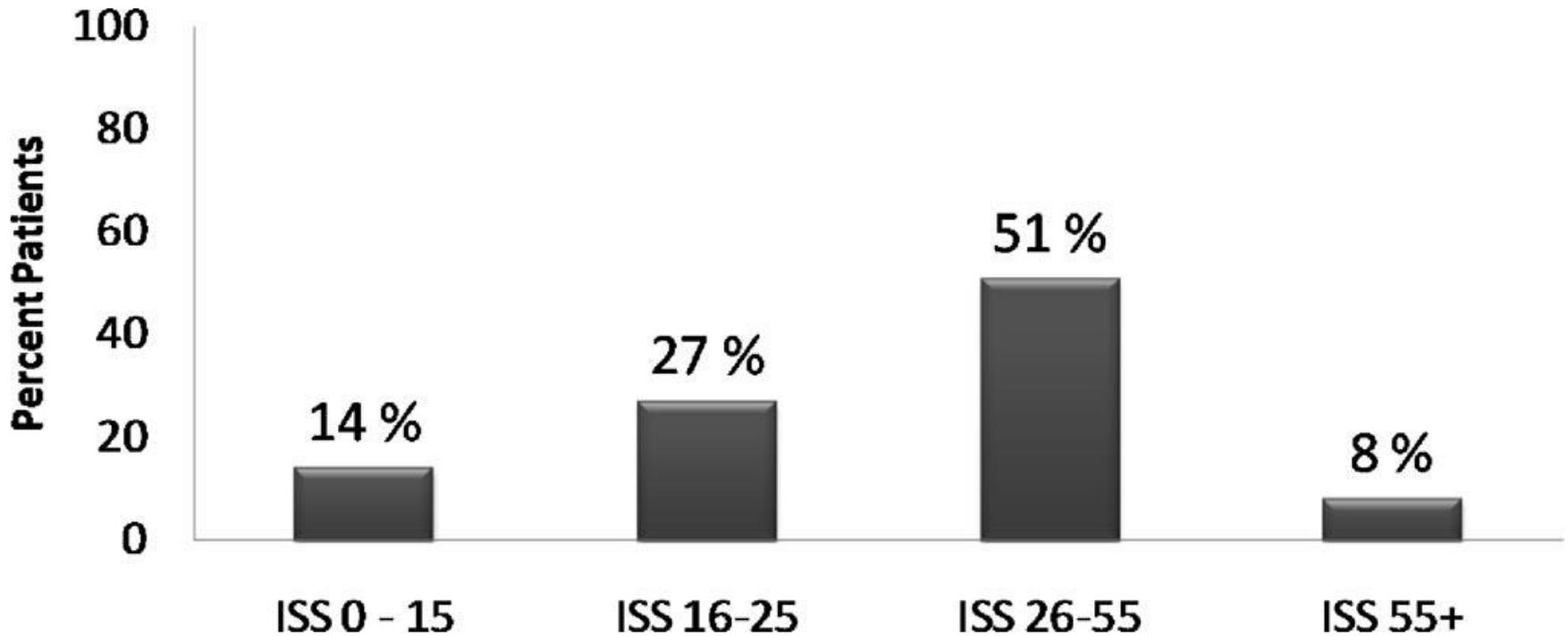
DOW Analysis

- Review died of wounds (DOW) deaths n=558
- Variables
 - Demographics
 - Mechanism and cause
 - Injury severity
- Expert panel trauma surgeons, emergency physician, neurosurgeon, and forensic pathologist graded deaths as non survivable or potentially survivable.
- Goal: Identify areas for improved training, medical care, material, research and development

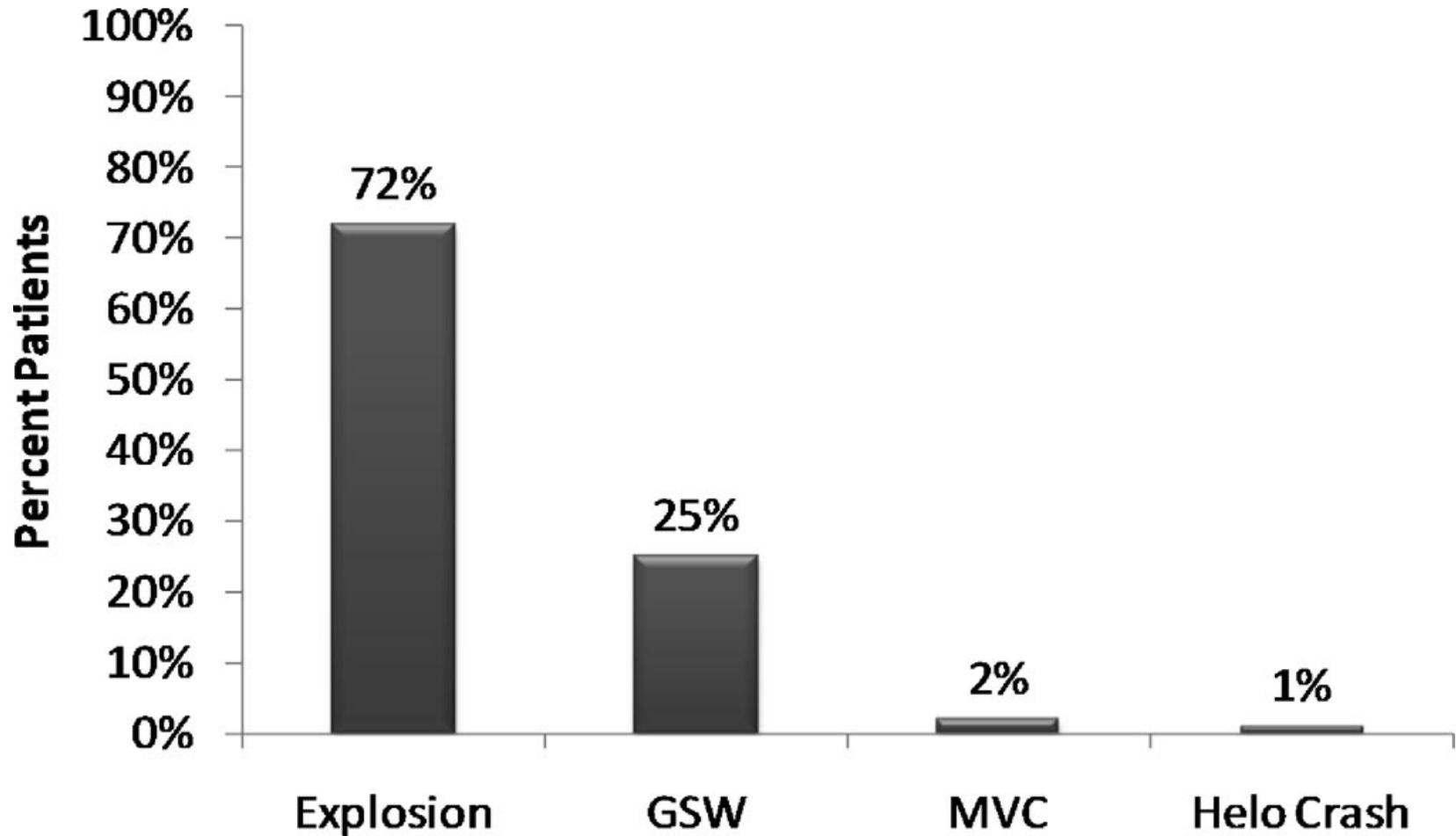
DOW Analysis

- DOW rate 4.6%
- NS in 271 (48.6%) and PS in 287 (51.4%)
- 51% presented in extremis with CPR on admission

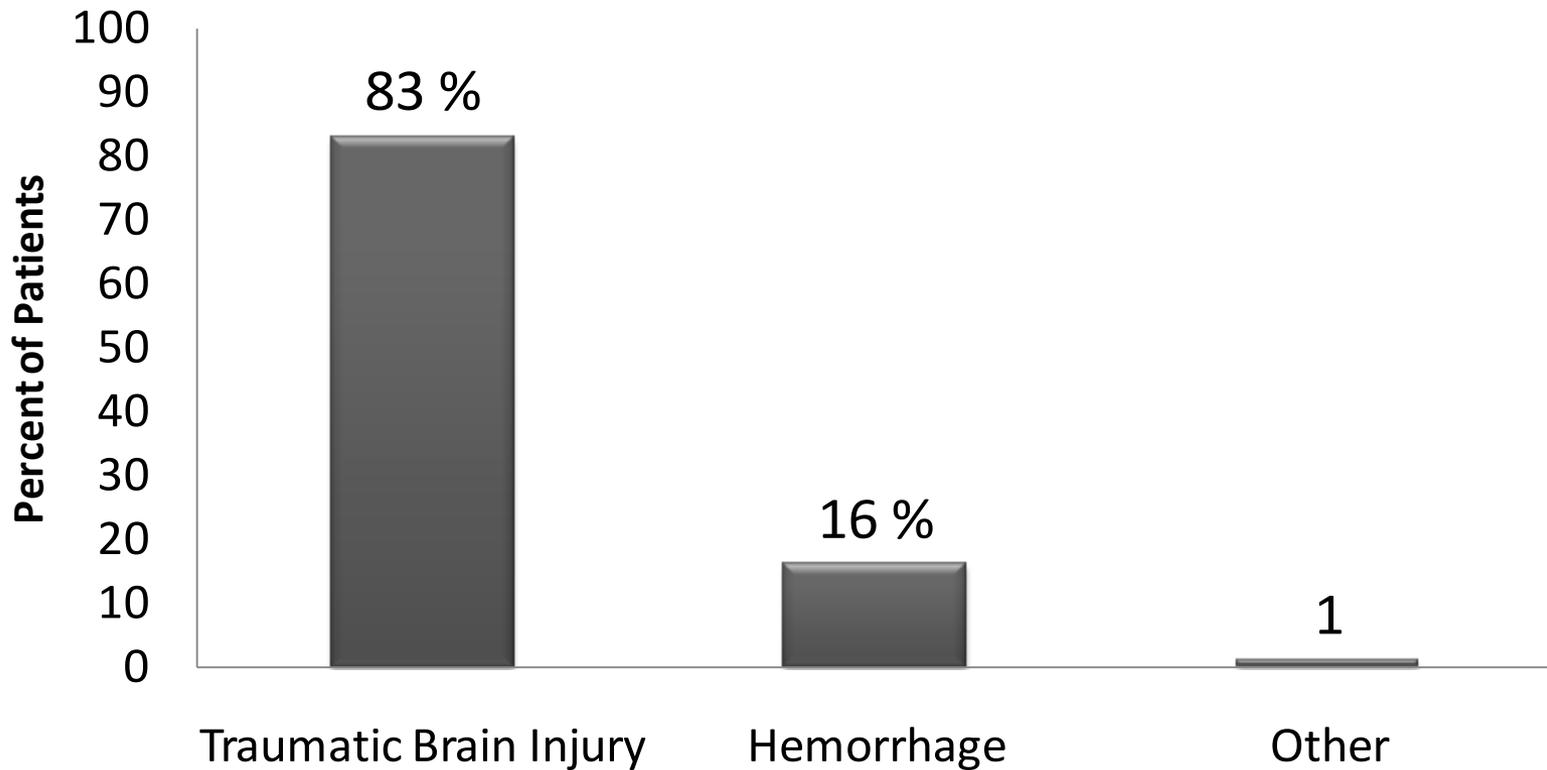
DOW ISS



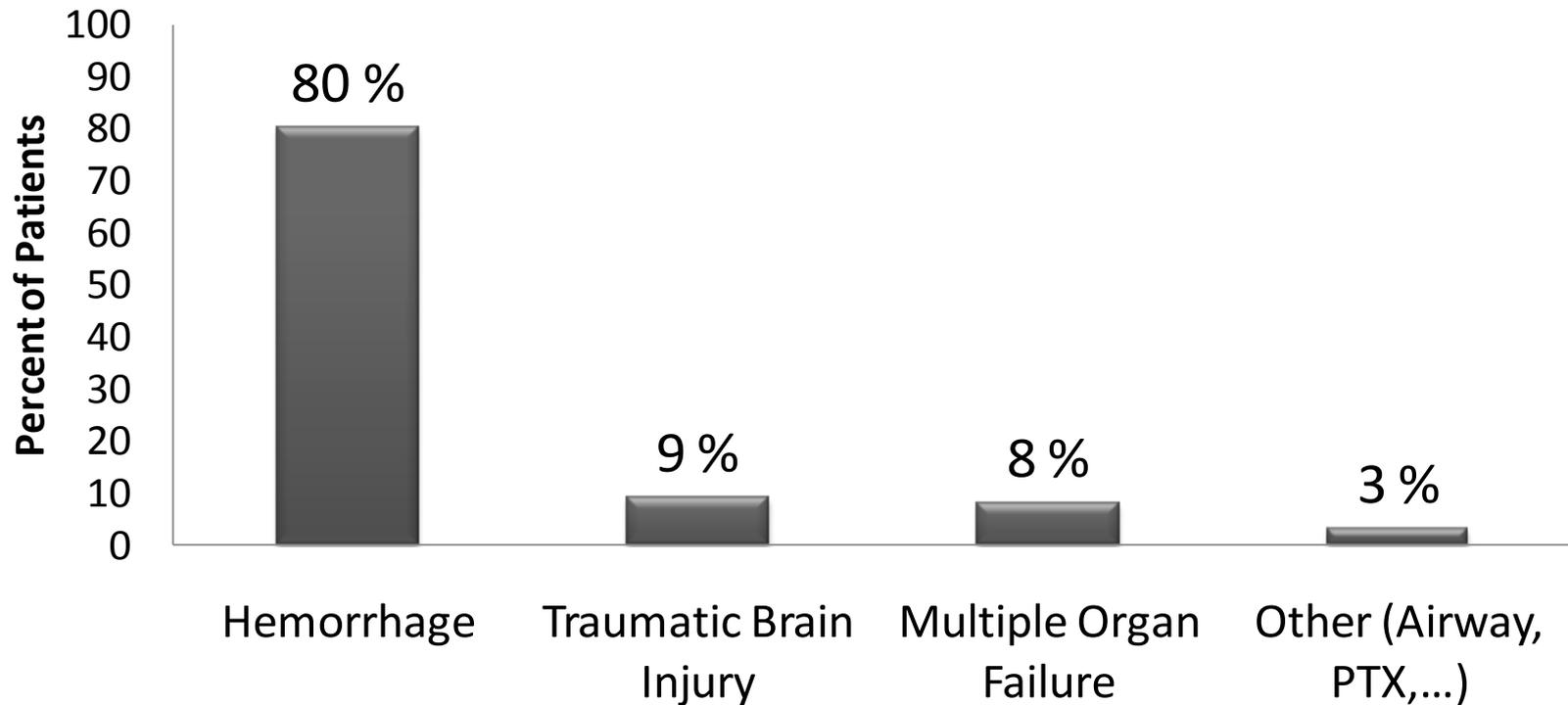
DOW Cause



DOW Non-Survivable Etiology

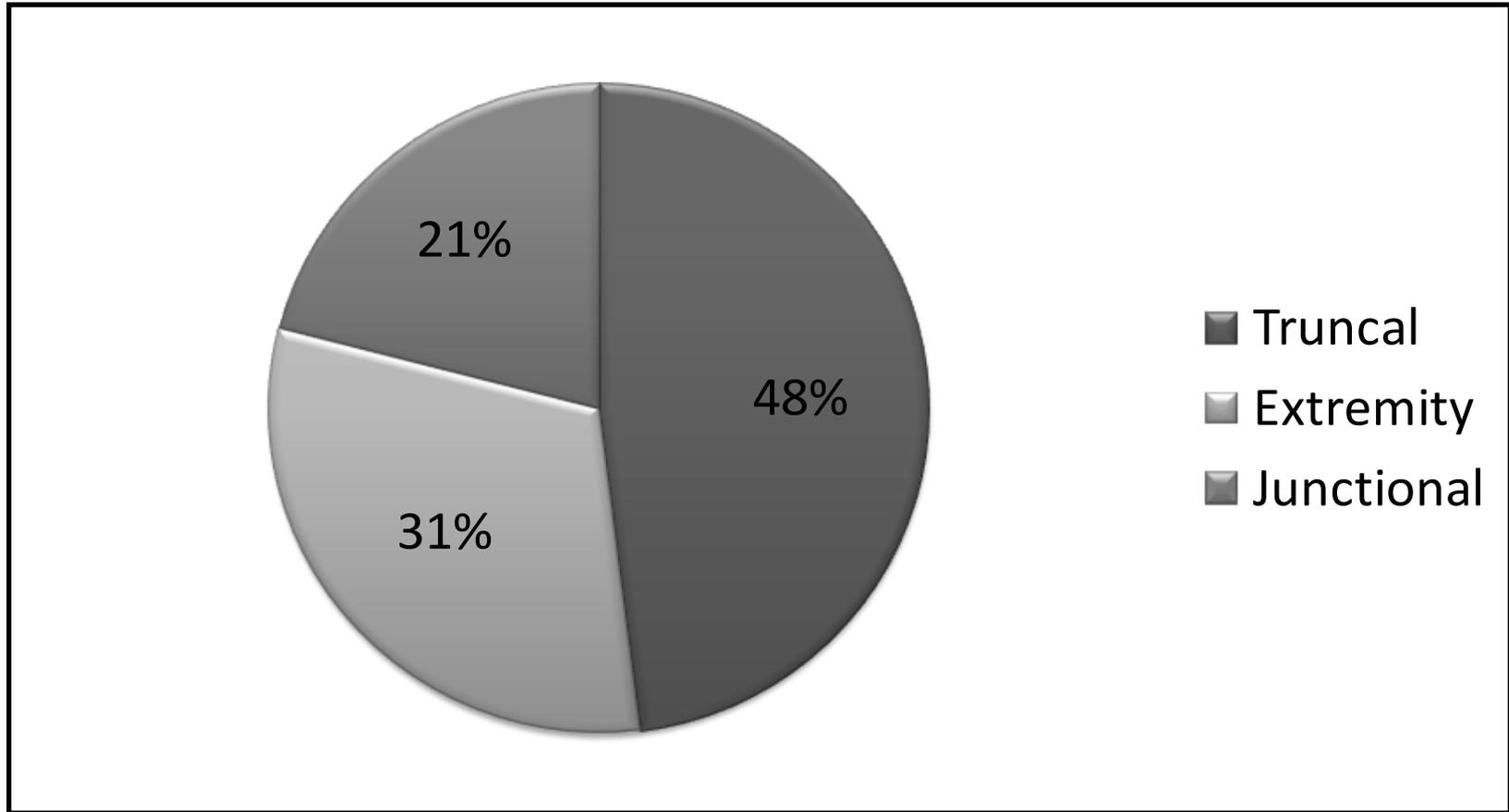


DOW **Potentially Survivable Etiology**



Eastridge et al, J Trauma 2011

DOW (Potentially Survivable) Hemorrhage Focus



Killed in Action Analysis



