



# Joint Theatre Trauma System:

## Improving Injury Care on the Battlefield



**TBI External Advisory Subcommittee**

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# ***What is a Trauma System?***

- **Organized effort in a geographic region to deliver full range of trauma care**
- **Improves patient transition between phases of care**
- **System coordination improves patient outcomes**
  - **Reduces mortality by 15%**

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## ***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.**

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## ***JTTS Mission***

- **Improve organization and delivery of trauma care**
- **Improve communication among clinicians in the evacuation chain to ensure continuity of care and access to data**
- **Populate the Joint Theater Trauma Registry (JTTR) to evaluate care provided, document outcomes, and facilitate conduct of formal research**
- **Evaluate and recommend new equipment or medical supplies for use in theater to improve efficiency, reduce cost, improve outcomes**
- **Facilitate medical performance improvement to promote real-time, data-driven clinical process improvements and improved outcomes**

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# JTTS Concept of Operation

## Components Across the Continuum of Care

### Prevention

- ❖ Linkage with Material developers
- ❖ CHPPM and Safety Center

### Integrated Pre-Hospital and Hospital Care

- ❖ Integrated approach for MTFs and divisional medical units
- ❖ Coordinated divisional EVAC SOPs

### Research

- ❖ AOR research mechanism
- ❖ Deployed clinicians to conduct research
- ❖ Process for validating joint data/ research requirements

### Leadership

- ❖ Recognized lead facility and consulting assets
- ❖ Director/ Coordinators

### Clinical Practice Guidelines

- ❖ Adopt CPGs
- ❖ Communicate, train

### Information Systems

- ❖ Support for all other components
- ❖ Primarily=longitudinal health record
- ❖ Joint Theater Trauma Registry (JTTR)
- ❖ Joint Patient Tracking Application (JPTA)

### Communication

- ❖ Intra theater
- ❖ Inter theater

### QA/PI

- ❖ Feedback mechanism for all providers
- ❖ Uniform M&M process for MTFs, C2, including Level IV and V

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***Data***

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# ***Why is Data Important?***

***Data improves practice***

***Data drives doctrine and policy***

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# ***Historical Combat Epidemiology***

- **WEDMET database**
  - Analysis Vietnam era casualties
  - Disadvantage
    - Dated
- **Small series in isolation in literature**
  - Gulf War
  - Somalia

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# ***Joint Theater Trauma Registry***

- **Comprehensive initial database**
  - **Demographic**
  - **Mechanism**
  - **Anatomic**
  - **Physiologic**
  - **Acute outcomes**
- **Increased commitment tracked II/III through level V**

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# ***Theater Data Collection Sites***

- Iraq
  - 28<sup>th</sup> / 86<sup>th</sup> CSH, Baghdad
  - AFTH, Balad
  - 325<sup>th</sup> CSH, Al Asad
  - 28<sup>th</sup> / 86<sup>th</sup> CSH, Mosul
  - 325<sup>th</sup> CSH, Tikrit
- Afghanistan
  - CJTH, Bagram
  - Role 3, Kandahar
  - Salerno (IIb-)
  - 555<sup>th</sup> FST
  - 541<sup>st</sup> FST- Orgun-E
  - 541<sup>st</sup> FST- Qalat
  - 160<sup>th</sup> FST- Asadabad
  - 160<sup>th</sup> FST- Naray
  - Farah (IIb-)

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# ***Joint Theater Trauma Registry***

- **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**
- **Currently represents ~17,000 US injury patients**
- **DoD casualty websites currently report**
  - **>30,000 wounded in action**

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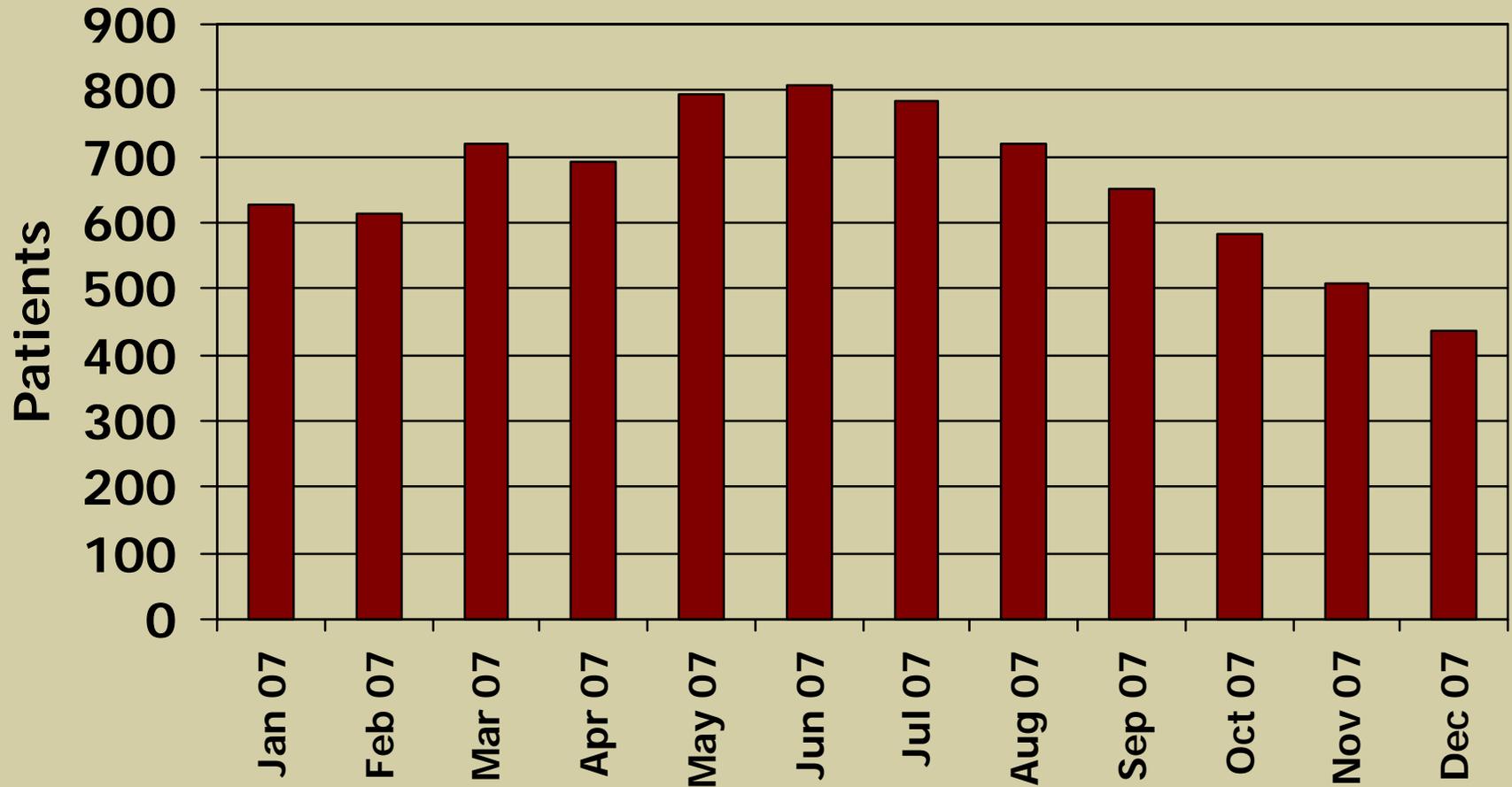
## ***Standard Reports***

- **Guide medical Command decision making**
  - **Resource allocation**
    - **Blood and blood products**
    - **Physician / nursing resources**
  - **Casualty trends**
    - **Acuity**
    - **Trauma patient numbers**
- **Pre-deployment education / familiarization**
- **Tailored to AOR, Theater, MTF**

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# Total Trauma Patients



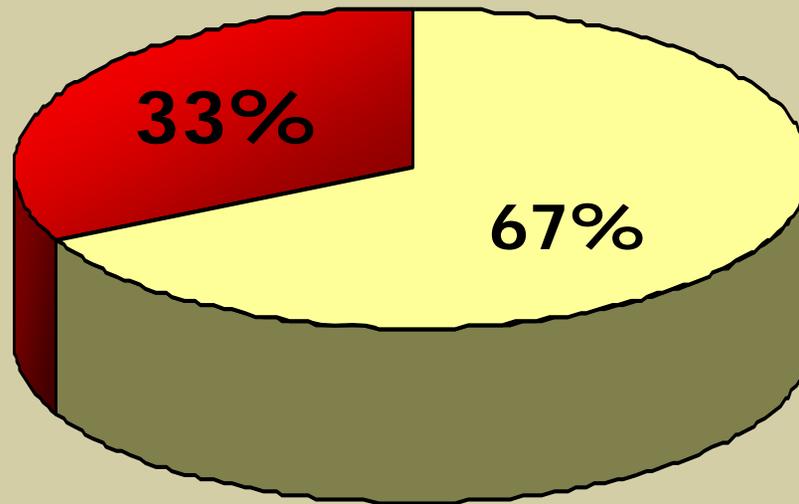
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# *Injuries by Type*

**Non-Battle**

**Battle**



Source: JTTR September 2001 - February 2008

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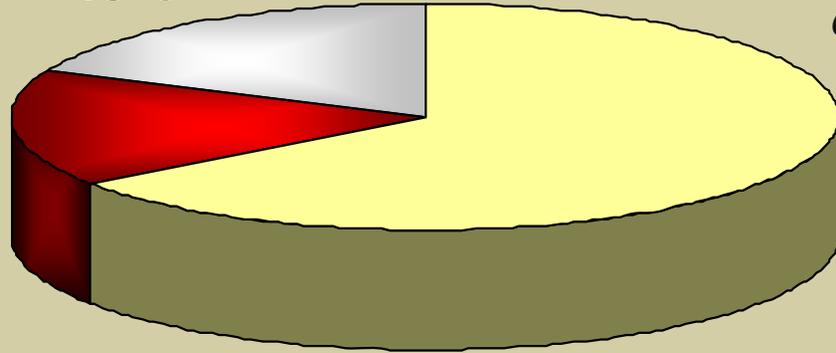


# Cause of Injuries

## Battle

Firearms  
17%

All Other  
18%

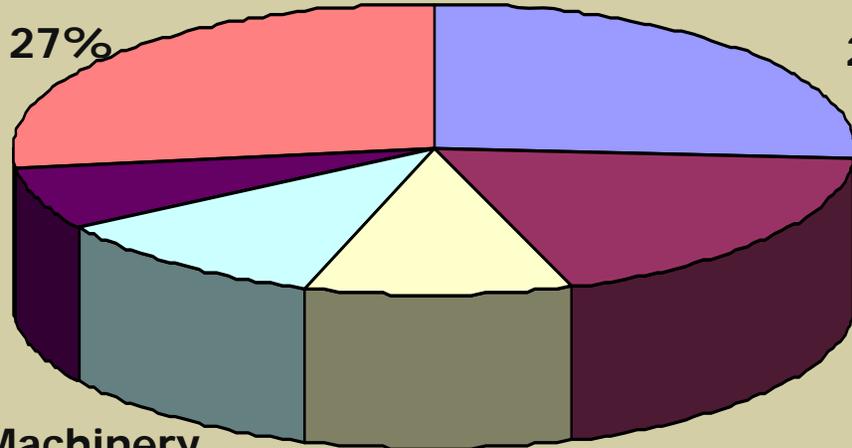


Munitions/  
Explosive Devices

## Non-Battle

Struck By / Against  
7%

All Other  
27%



MVC  
26%

Falls  
19%

Machinery  
11%

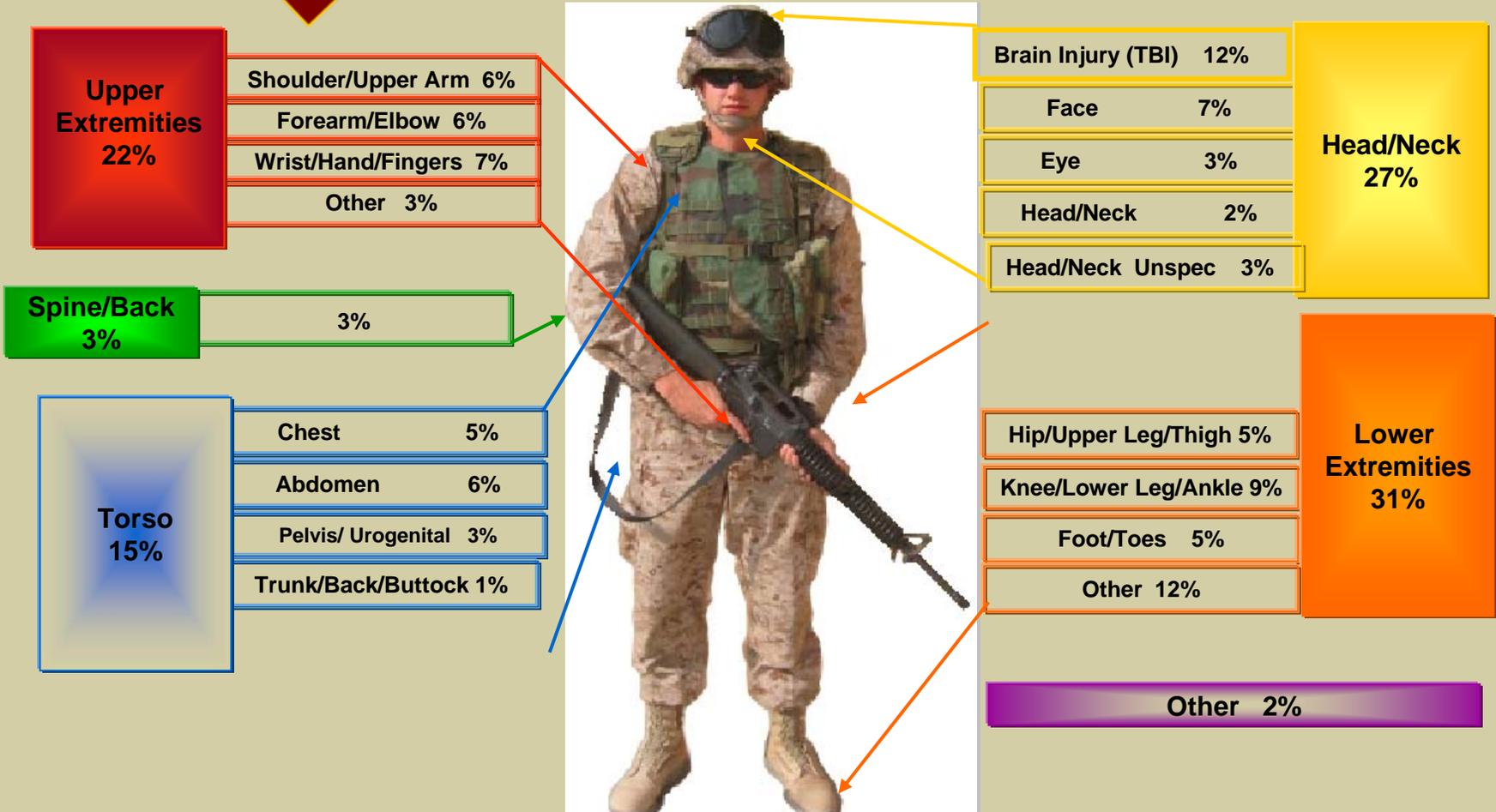
Overexertion  
10%

Source: Joint Theater Trauma Registry (JTTR), September 2001 - February 2008

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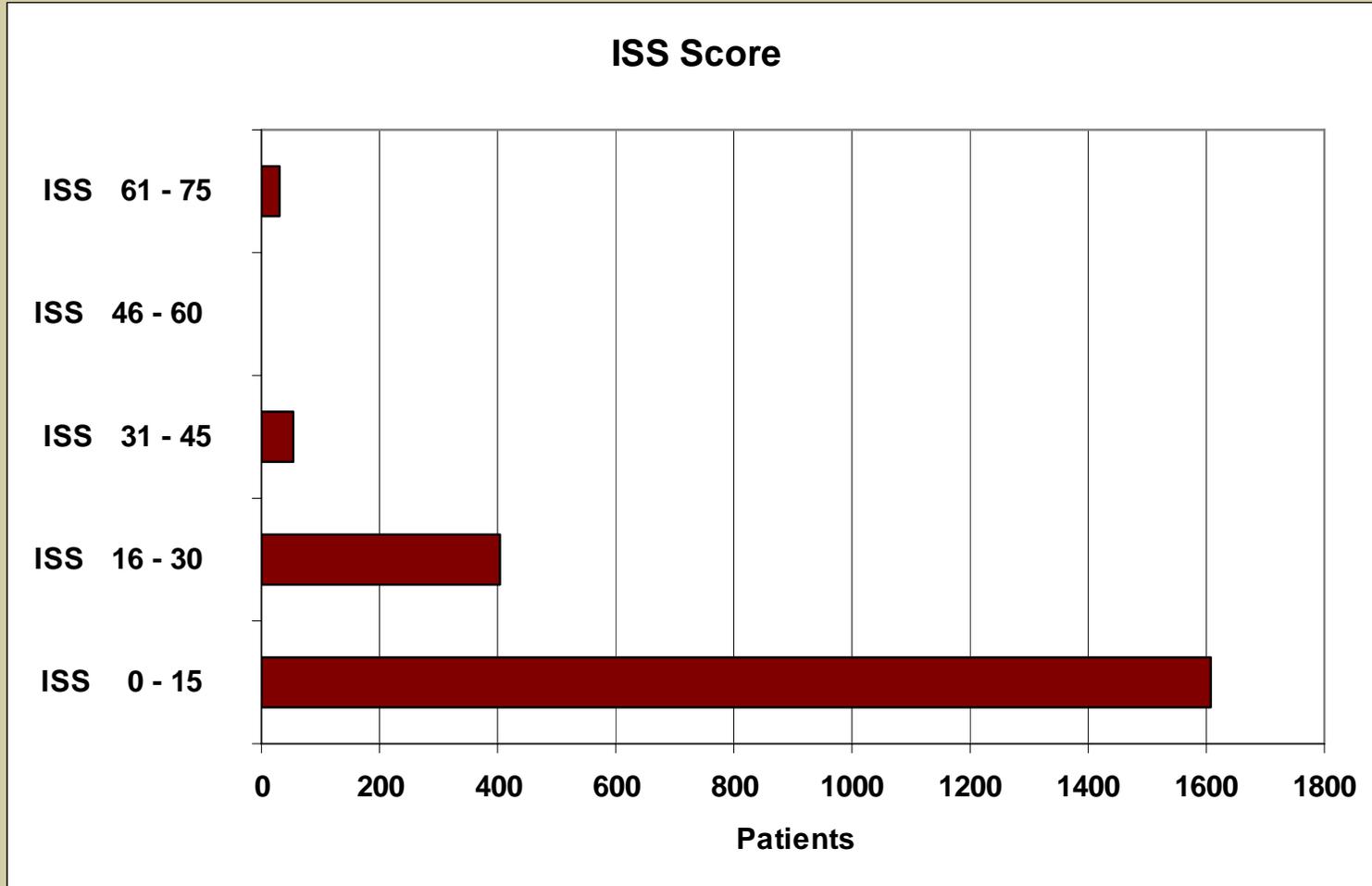
# OIF & OEF Battle Injuries by Body Region



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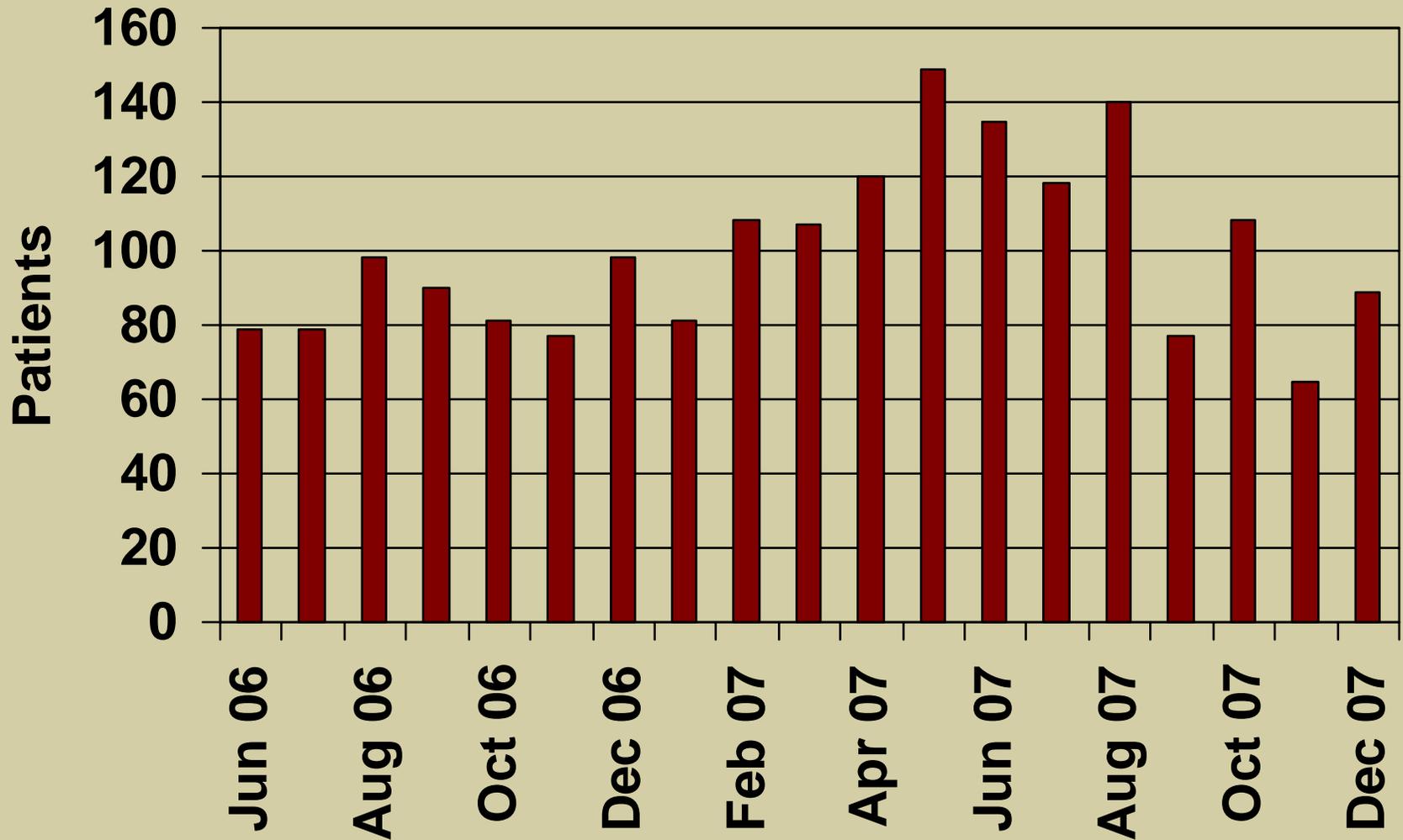
# ISS Scoring



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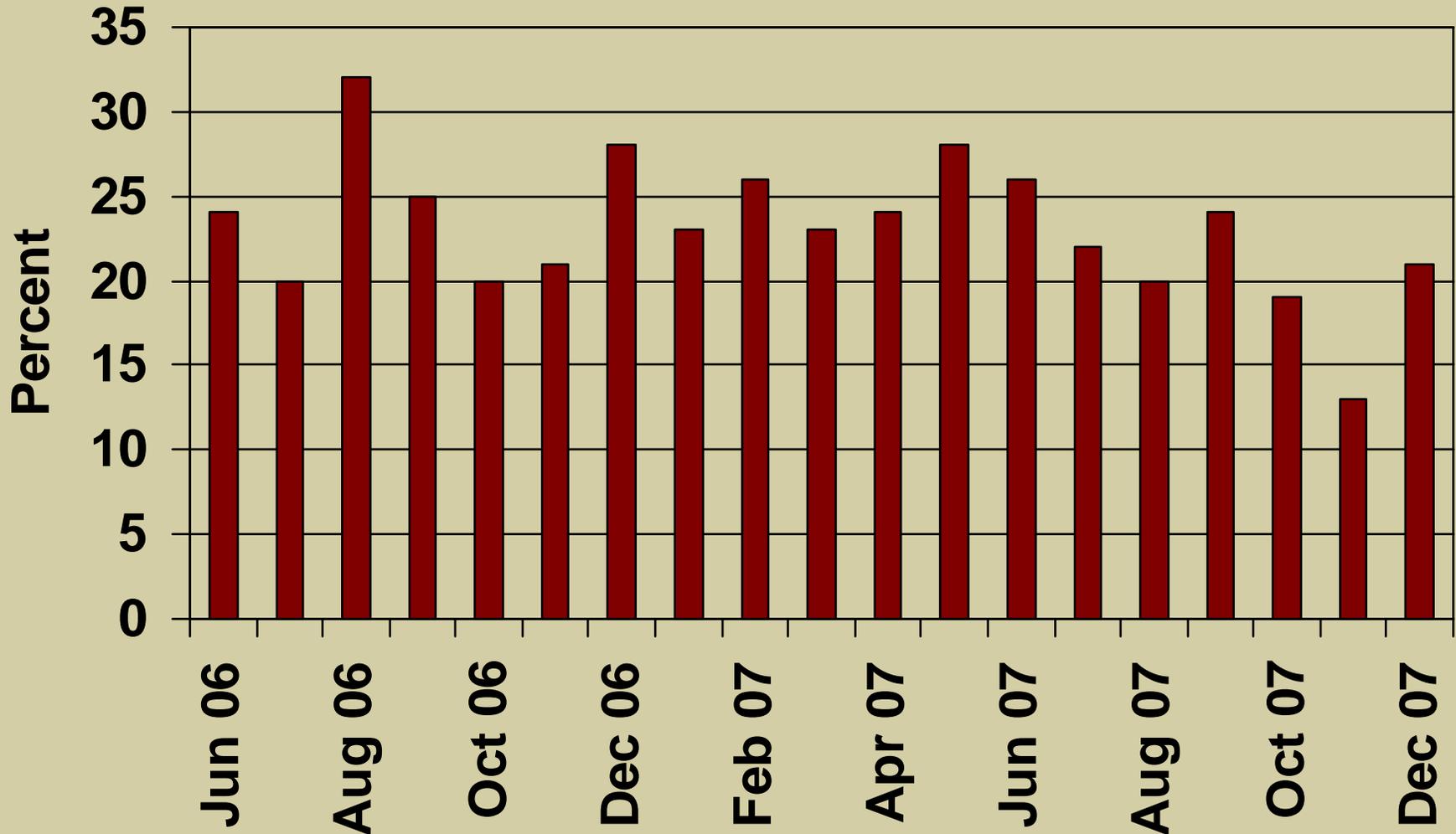
# Shock on Admission Base Deficit $\geq 5$



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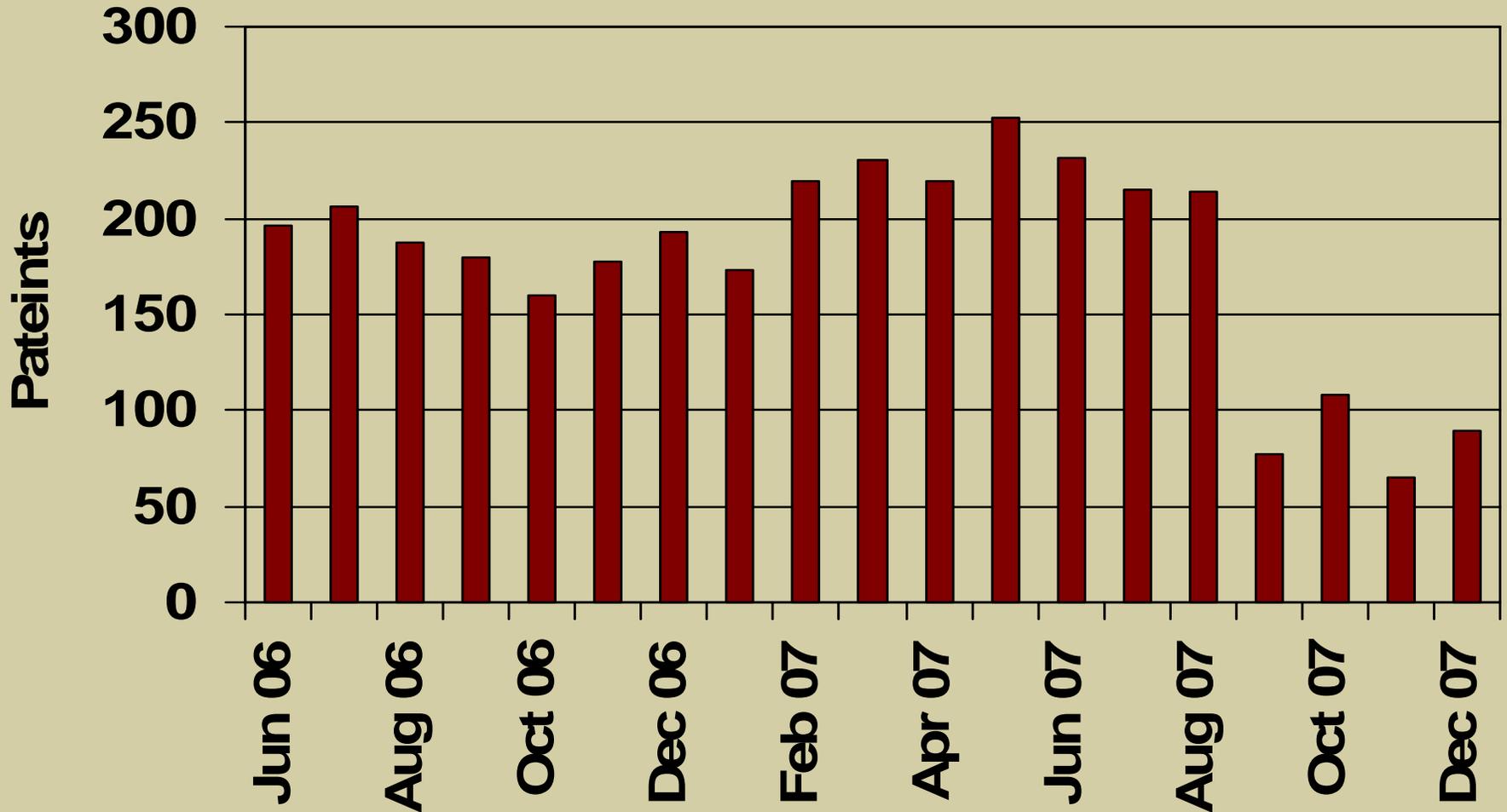
# Shock on Admission (%)



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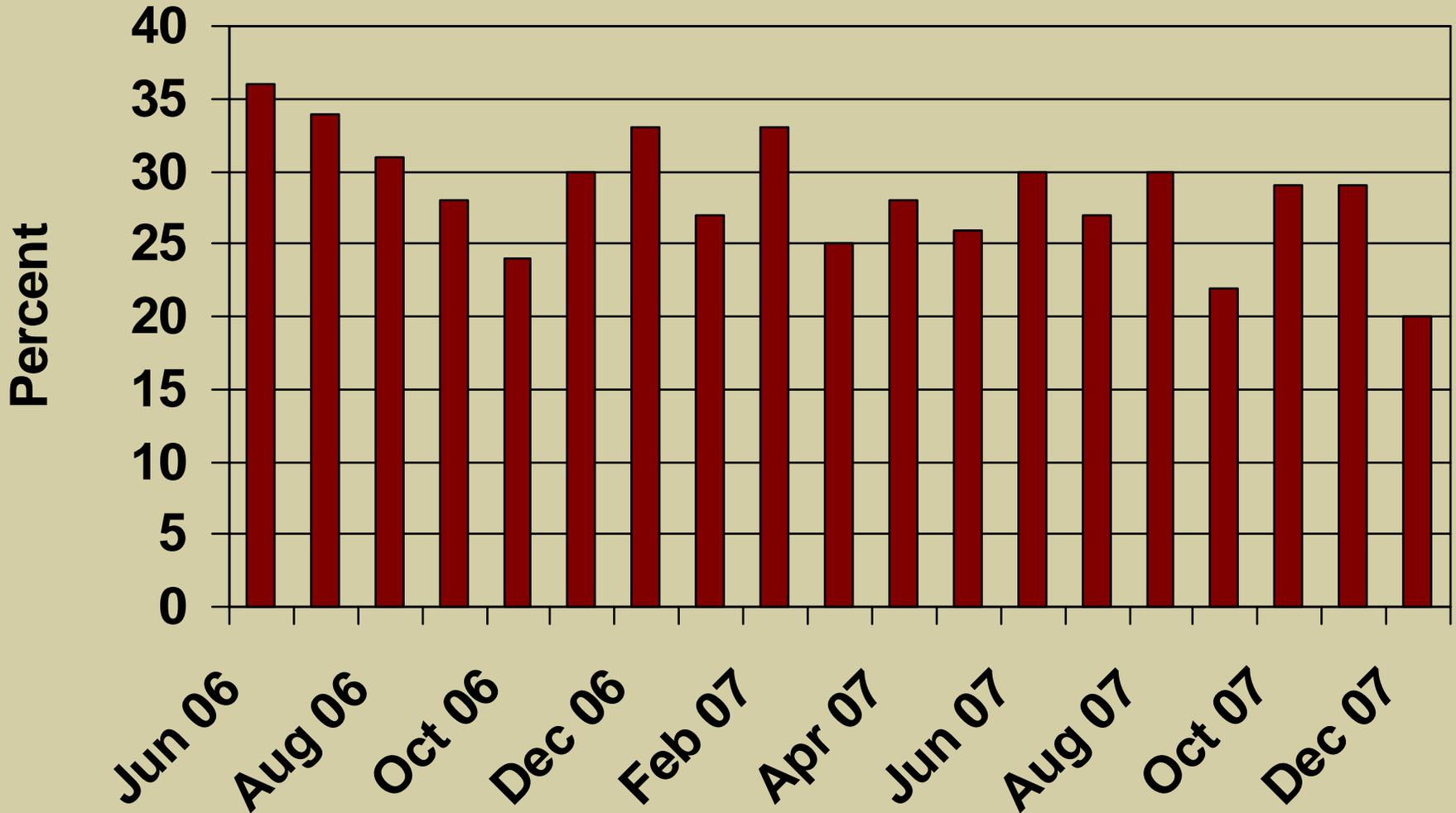
# Casualties Requiring Blood



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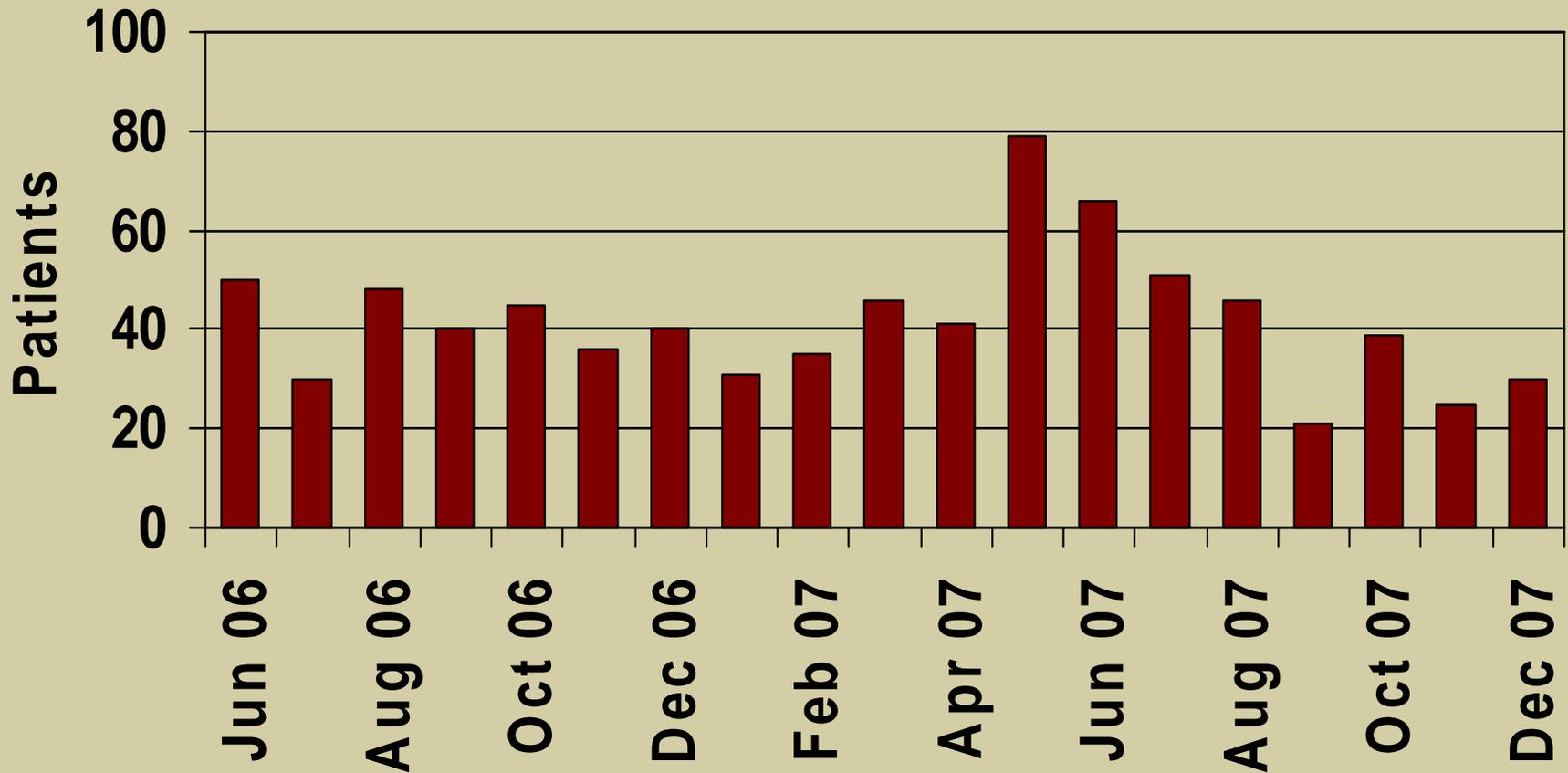
# Casualties Requiring Blood (%)



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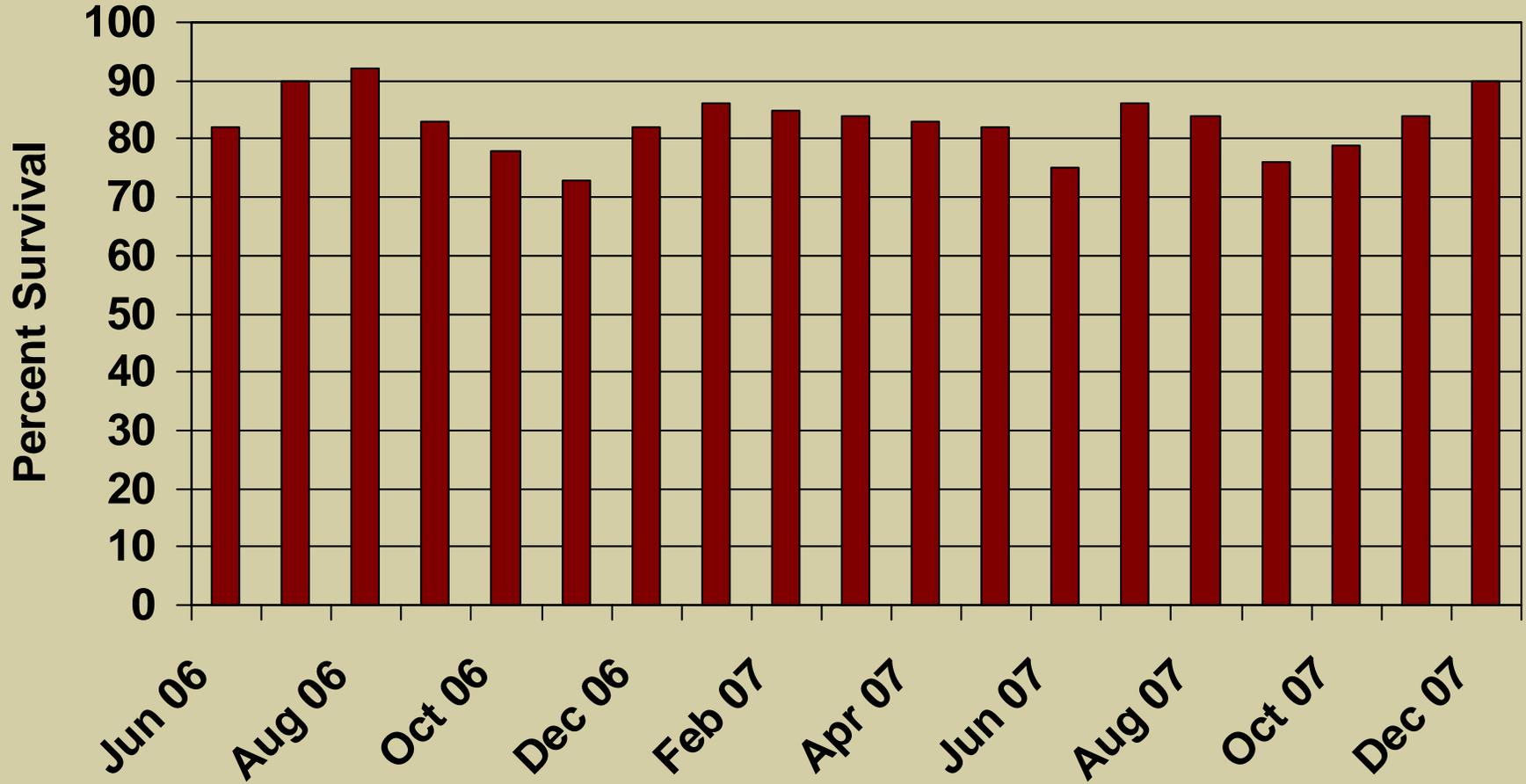
# Massive Transfusion > 10 u RBC / 24 hours



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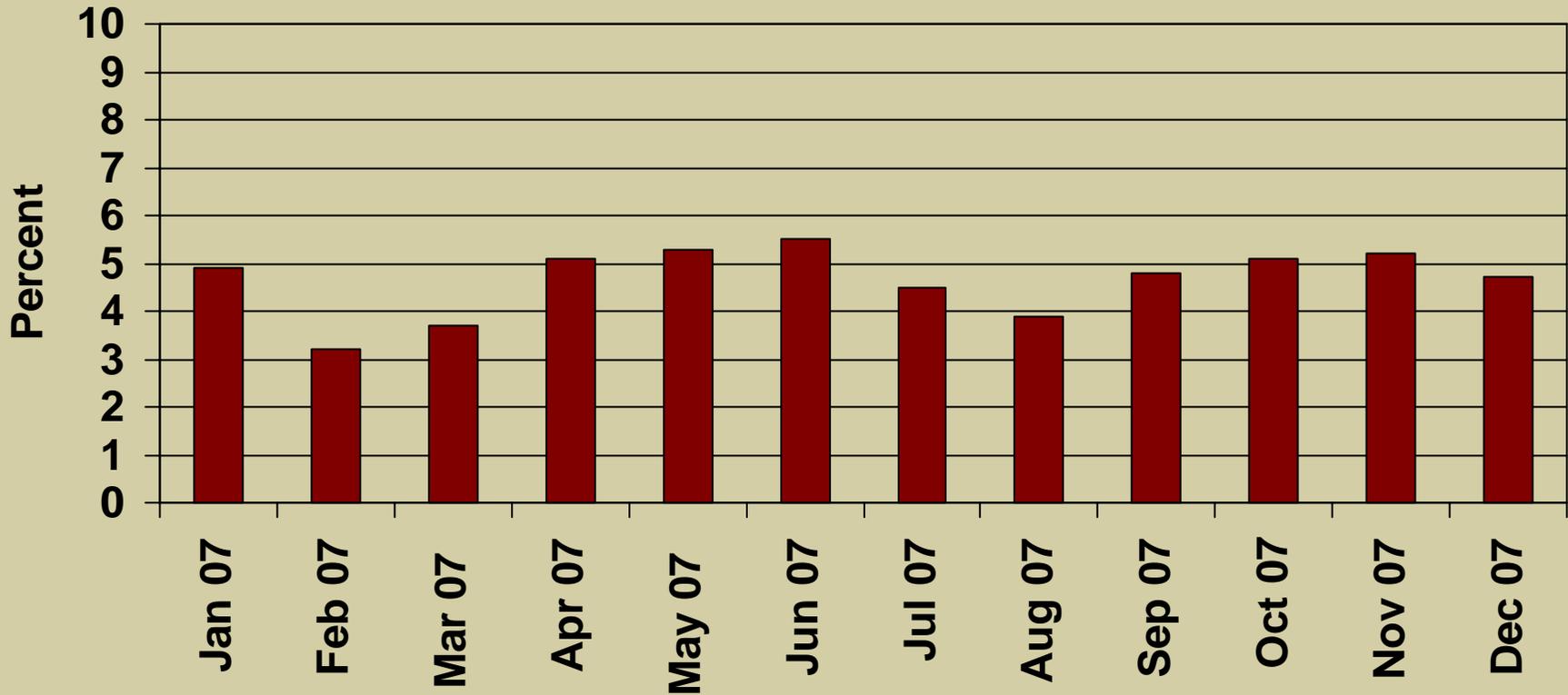
# Massive Transfusion Outcomes



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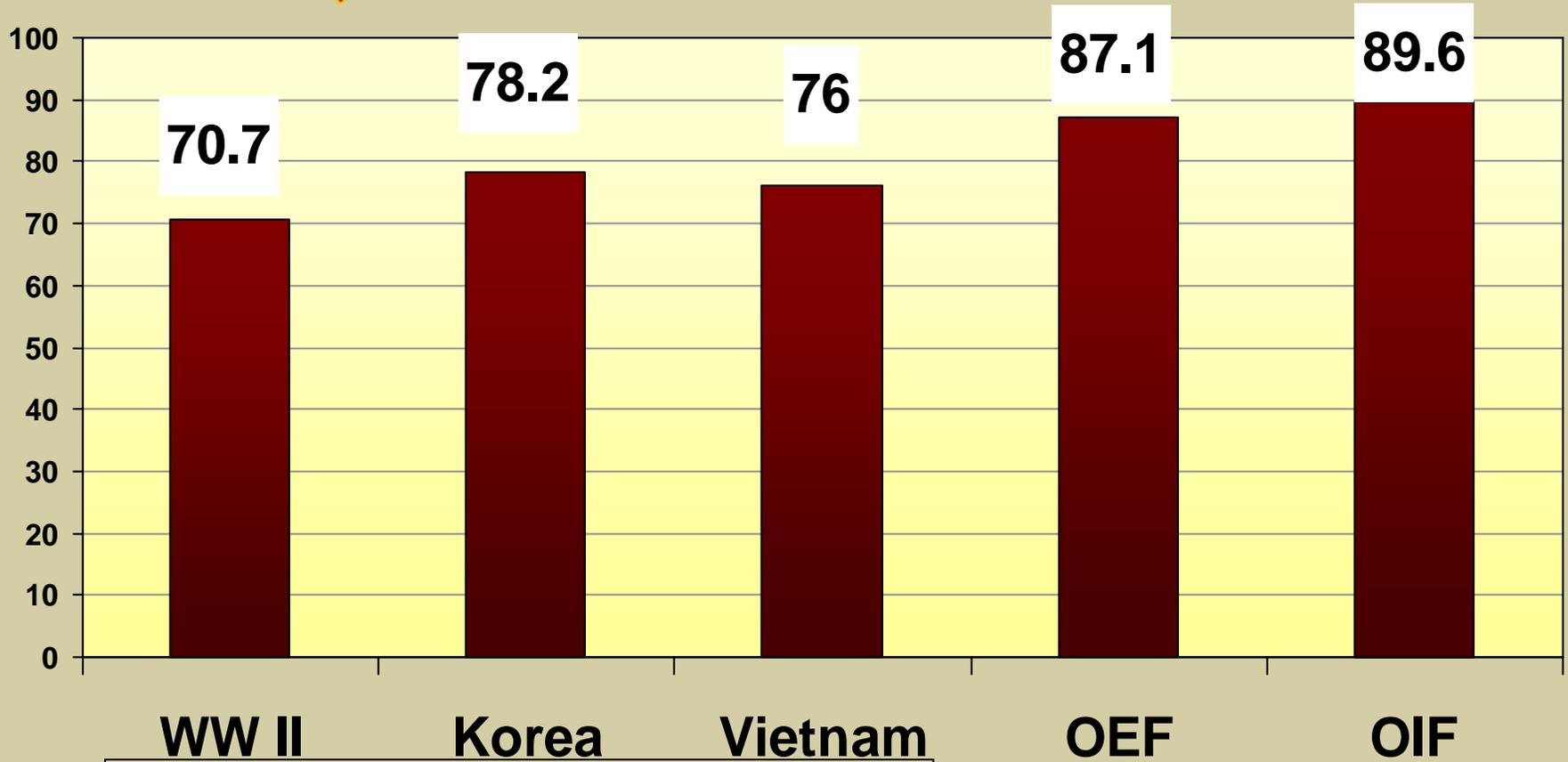
# *Died of Wounds*



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# Improved Combat Survival



- Body Armor
- Enhanced Trauma Skills of the 68W
- Far Forward Resuscitative Surgical Care
- Rapid Evacuation

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# ***Specialty Modules***

- Orthopedics
- Infectious diseases
- Ophthalmology
- Traumatic brain injury
- Vascular
- Metal fragments
- Thoracic
- Burn

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# ***Database Capabilities***

- **Data can be stratified:**
  - **AO (Iraq vs. Afghanistan)**
  - **Medical treatment facility**
  - **U.S. vs host nation**
  - **BI vs NBI**
  - **Period / date**
- **Virtually limitless potential**

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# ***Performance Improvement***



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# ***Performance Improvement***

- **Data driven process**
- **Involved multidisciplinary staff**
- **Inclusive of entire continuum of care**
- **Evaluate system response**
- **Improve patient outcomes**
- **Ensure competent & current providers**

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# ***JTTS Performance Improvement Clinical Practice Guidelines***

- Ventilator Associated Pneumonia Prophylaxis
- Vascular Injury
- Urologic Trauma
- Trauma Airway Management
- Recombinant Factor VIIa Use
- Pelvic Fracture
- **mTBI Screening**
- **Management of Patients with Severe Head Trauma**
- Intratheater Transfer and Transport
- Inhalation Injury and Toxic Industrial Chemicals
- Hypothermia
- Fresh Whole Blood
- Fasciotomy of the Burned Extremity
- Extremity Soft Tissue Wound and Amputation Management
- EMT Thoracotomy
- Deep Vein Thrombosis
- Damage Control Resuscitation
- Burn Care
- Abdominal Blunt Trauma

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- **Dedicated trauma research team fielded to theater**
- **CENTCOM approved process for IRB approved research protocols in theater**

**Director, Trauma Research Team**

**Baghdad, Iraq**

- **MEDCOM approved process for retrospective IRB approved protocols from the JTTR**



# **Joint Theater Trauma System Successes**

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# ***Hypothermia Prevention and Management***

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# Hypothermia



Hypothermia

Acidosis

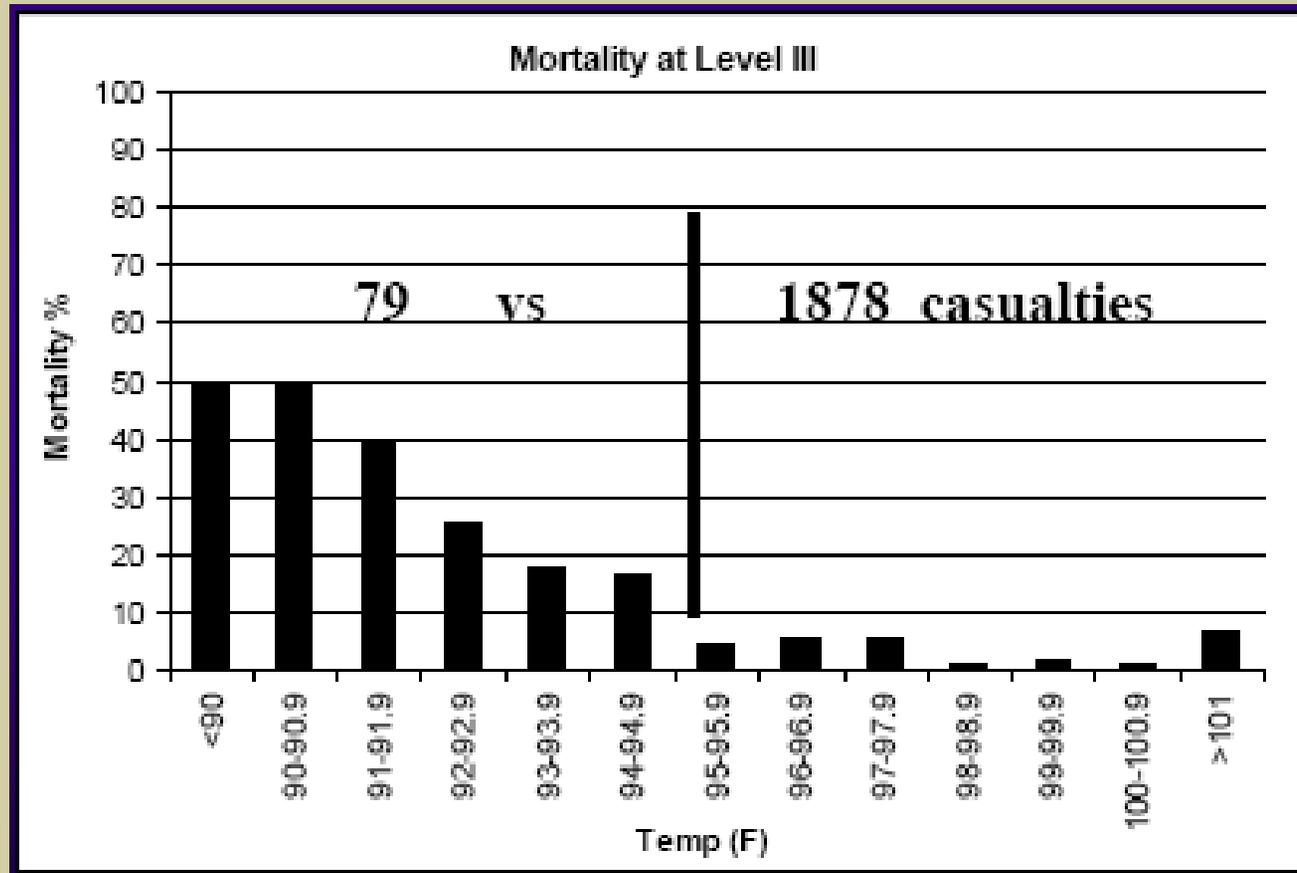
Death

Coagulopathy

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# Hypothermia Impact



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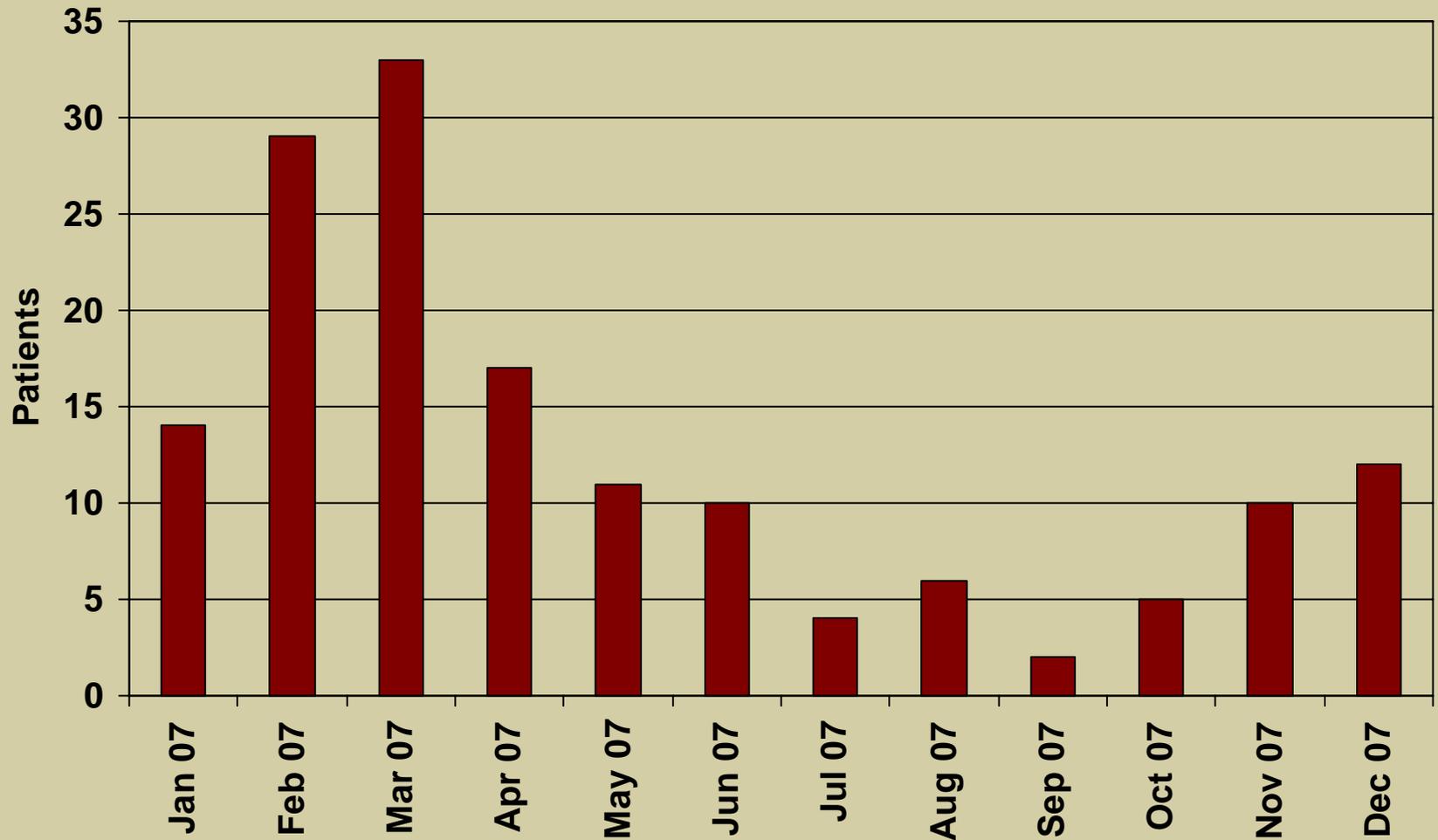
# Hypothermia Prevention Tools

- Body Bags
- Bair Huggers
- Blankets
- Foley Temp Monitors
- Warm environment in OR and ER
- New Hypothermia Prevention Kits





# Admission Hypothermia $T < 96^{\circ}$



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# ***Extremity Hemorrhage / Tourniquets***

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# ***Extremity Hemorrhage***

- **Extremity hemorrhage identified as potentially survivable cause of death after battlefield wounding**
- **Possible solutions**
  - Tourniquets
  - Hemostatic dressings

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# ***Tourniquet Use***



- Tourniquets placed properly before inception of shock save lives 91% of the time
- Tourniquets placed ineffectively or placed in the EMT for the first time have a death rate of 40%

COL Kraugh USA, 2006

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# Field Tourniquet Testing

CAT



**>80% Effective\***



SOFTT

EMT



\*Effectiveness-determined by Doppler

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# ***Tourniquet Use***

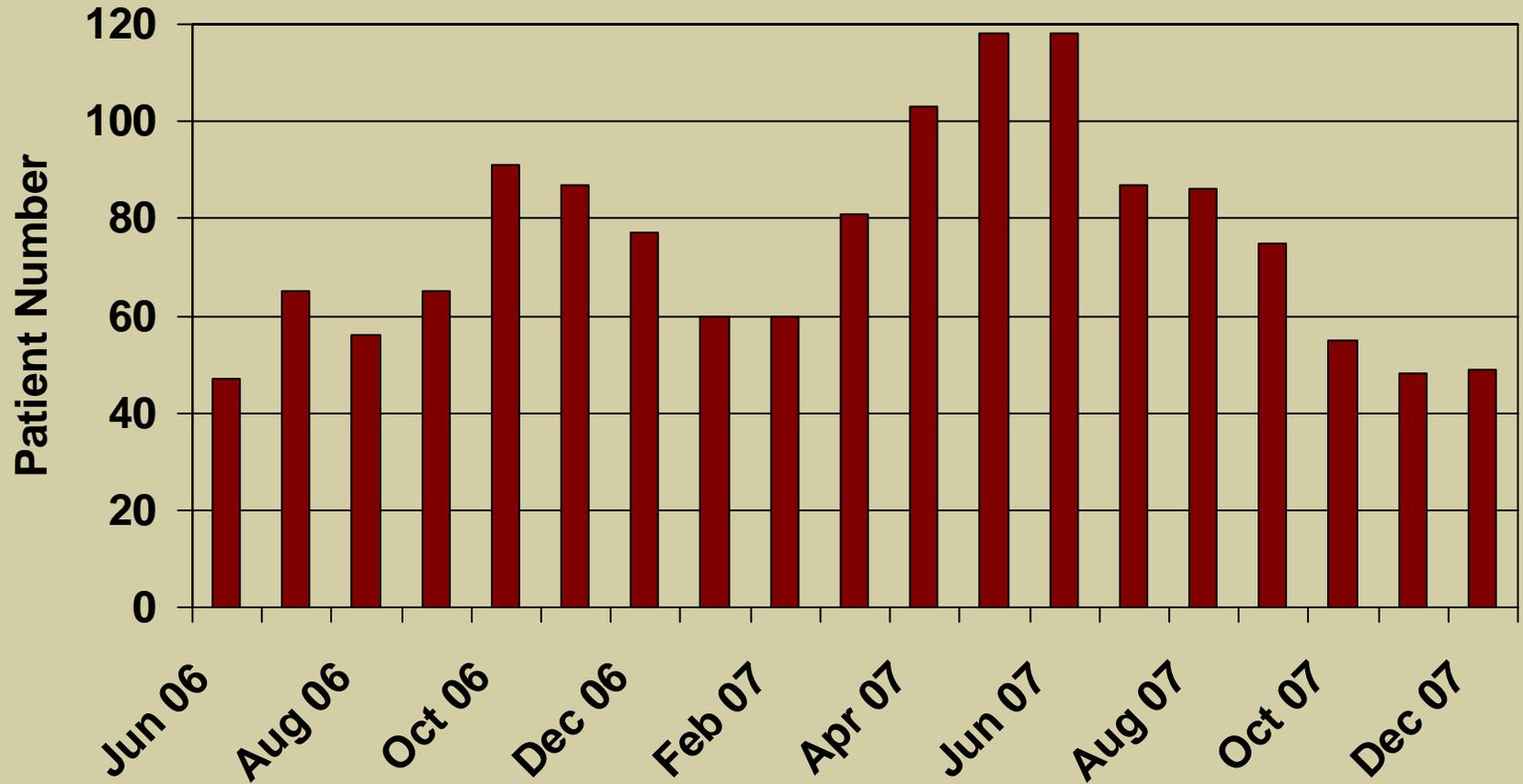
- Tourniquet use in theater has increased
- Tracked by JTTR
- CAT (Combat Application Tourniquet) is given to all soldiers being deployed with training



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# Tourniquet Use



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# ***Resuscitation / Massive Transfusion***

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# ***Damage Control Resuscitation Overarching Goals***

- Avoid dilution of coagulation factors by standard serial escalation resuscitation practices
  - LR (3:1) → PRBC (10 units) → FFP → platelets → cryo
- New paradigm
  - Parallel resuscitation rather than serial
- Early administration of the beneficial elements in fresh whole blood
  - Plasma and platelets, rFVIIa, cryoprecipitate
- Provide necessary volume
- Correct metabolism
- Early identification massive transfusion candidates

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# ***Risk Factors Massive Transfusion***

- **Pattern recognition ~ coagulopathy during major trauma resuscitation?**
  - **Physical injury pattern: bilateral amputation, amputation + torso injury**
  - **Hypotensive from blood loss**
  - **Base Deficit >6**
  - **Hypothermic**
  - **Coagulopathic (INR>1.5)**
  - **Transfusion >4u PRBC in ED**

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# ***Massive Blood Transfusion***

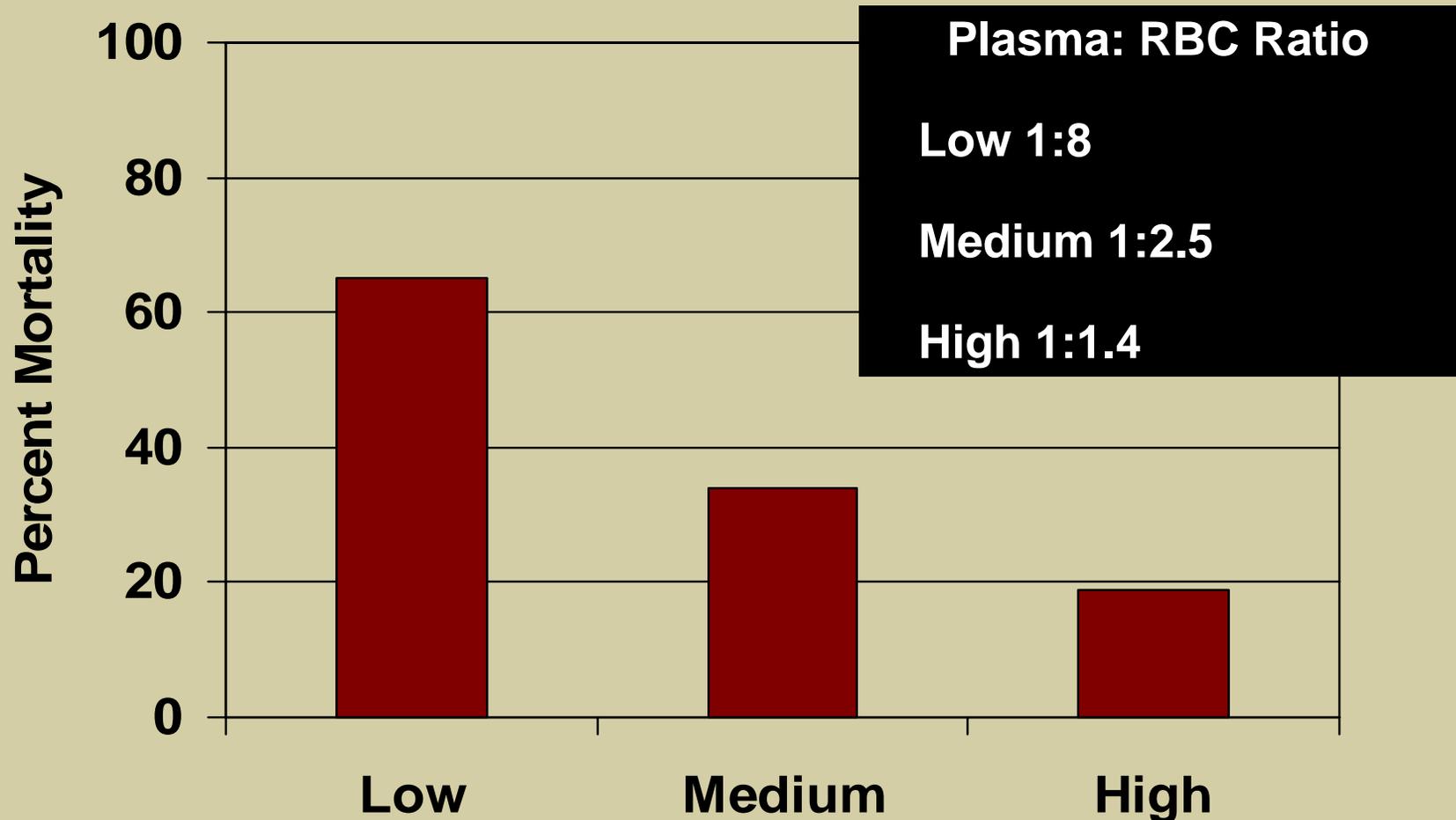


- **When starting PRBCs, start plasma**
- **1:1 ratio of PRBC to FFP**
- **Minimize dilution of factors**
- **Early transfusion of platelets and cryoprecipitate are indicated**

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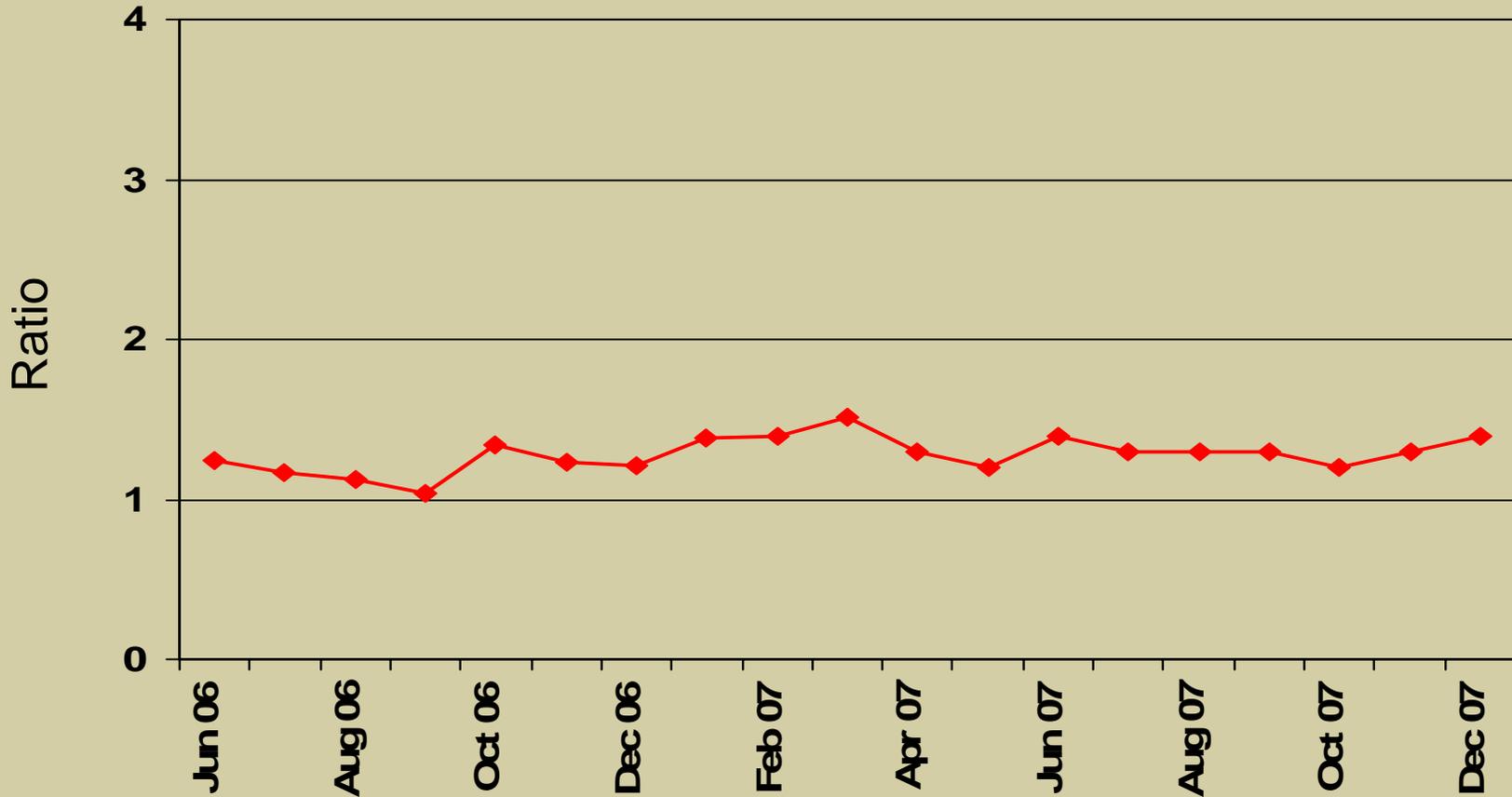
# Damage Control Resuscitation Plasma:RBC Ratio



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# Theater Plasma:RBC Ratio



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# ***Damage Control Resuscitation: Outcomes***

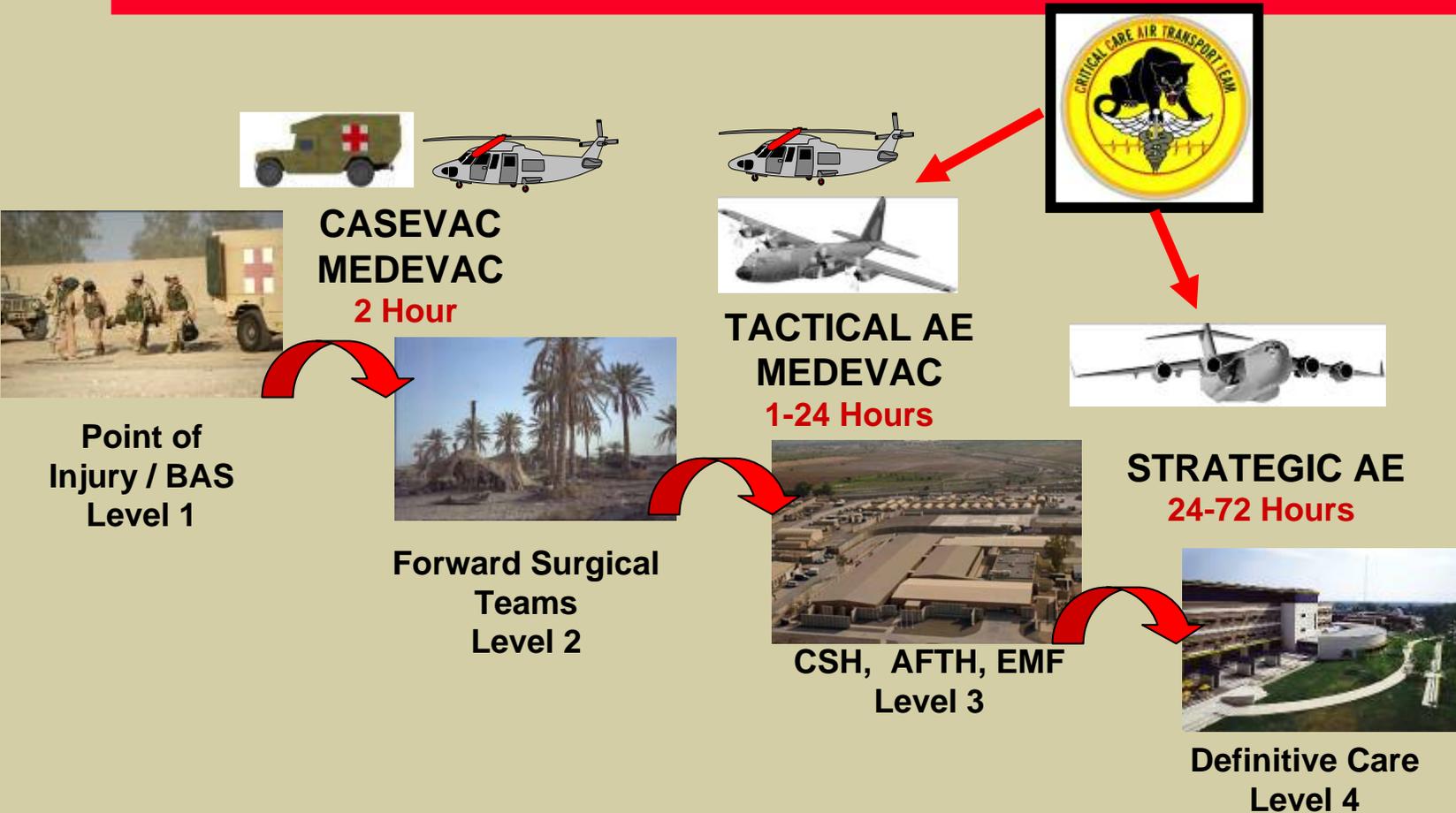
- **Fewer Early Deaths**
- **Fewer Medical Complications**
  - Fewer late deaths (ARDS, MOF, sepsis)
  - Reduced ventilator days, ICU days, LOS
  - Reduced blood product use
- **Better overall outcome to save soldiers' lives**

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# Joint Enroute Care System

Current Route from Injury to Definitive Care

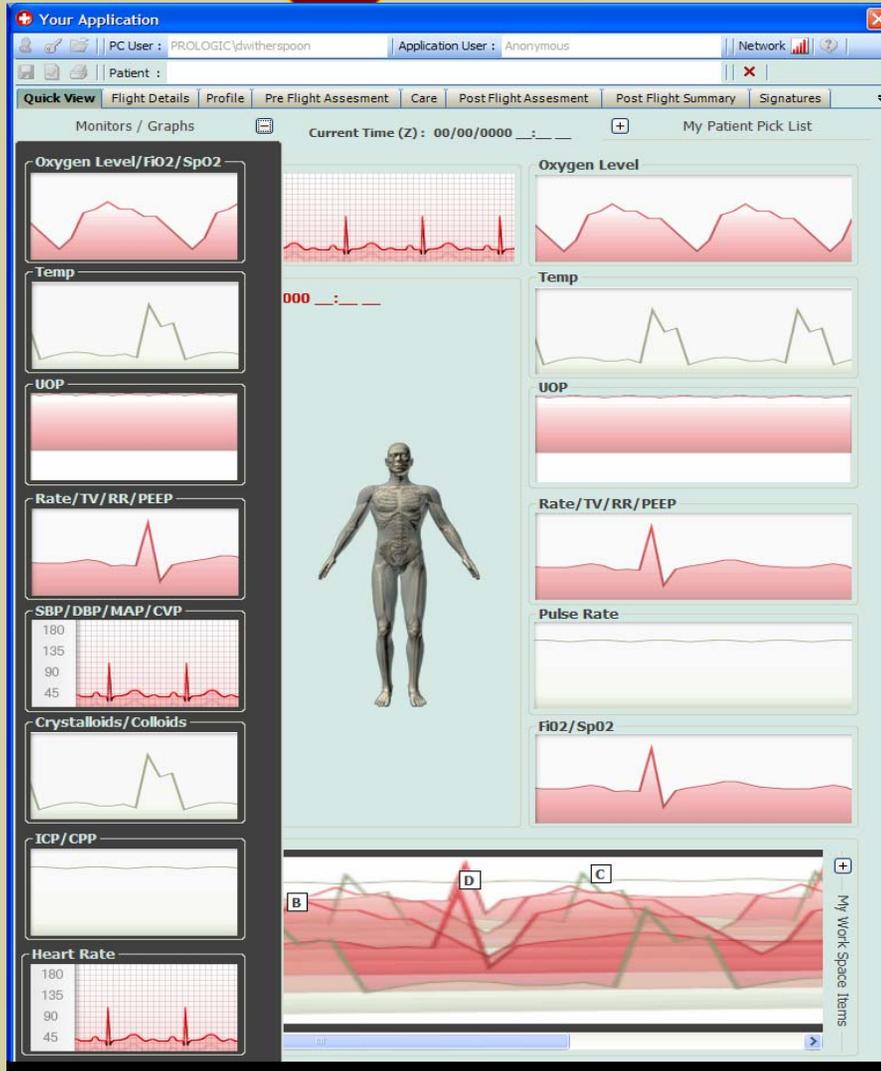


**SURGICAL CAPABILITY PUSHED FAR FORWARD**

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# Physiologic Data Capture



- Increasing documentation costs time
- In many missions time is severely limited
- Automated data capture offers a way to give back time to the caregivers and make documentation more useful!

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# ***Current Project – ICP monitoring***

- Monitor the natural history of ICP/ CPP during CCATT transport in TBI patients
- Data Logger with accelerometer
- IRB approved
- Initiated March 08



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## ***JTTS Future***

- **Continued evolution of medical performance improvement initiatives**
- **Integration of medical, operational, and training data to mitigate combat casualties (JTAPIC)**
- **Dissemination of trauma system concepts to NATO and Pacific coalition partners**

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## ***Conclusions***

- **JTTS is the “Standard of Care” on the battlefield**
- **Data driven, real-time implementation clinical platform**
- **JTTS initiatives have improved outcomes of soldiers injured on the battlefield**
- **Template for a world-wide DOD trauma system**

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