



# Reconstruction and Restoration of the Genitourinary System after Contemporary Battlefield Urotrauma



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# Disclaimer



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- This presentation contains graphic pictures of injured genital organs which may be upsetting to some viewers.



# History of Battlefield GU Injury



- Battlefield genitourinary injury is not a new problem
- Published data has been limited:
  - ~65,000 published studies on “war,” “military medicine,” “military personnel,” or “battlefield” since 1947\*
    - 75 (0.11%) pertaining to GU trauma\*
  - U.S. military operations in Iraq and Afghanistan (2001-2014)
    - 2640 OIF/OEF articles in Medline\*
    - ~1% pertaining to GU trauma\*

\*Medline search, September 2015



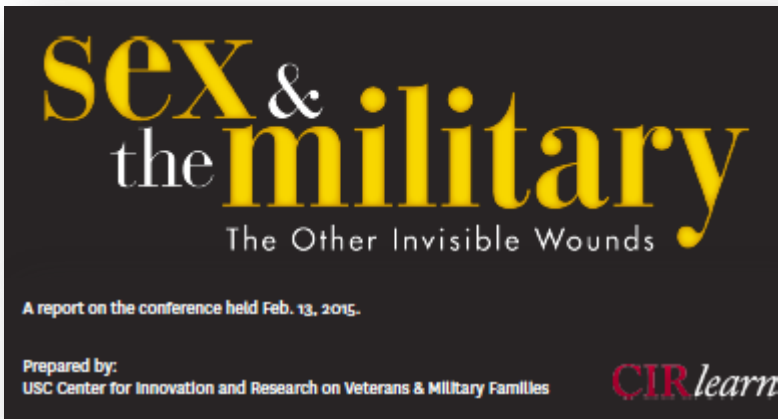
# Growing Interest and Support for Urotrauma Care and Research



Bob Woodruff Foundation  
High Impact Collaboration™

*Intimacy* after  
**INJURY**

Therapeutic advances to alleviate the devastating impact of war injury on fertility and on physical and emotional intimacy.





# Battlefield GU Injury in the Lay Media



## The New York Times

### *Penis Transplants Being Planned to Help Wounded Troops*

By DENISE GRADY DEC. 6, 2015



From left, Dr. W.P. Andrew Lee, Dr. Richard J. Redett and Dr. Gerald Brandacher at Johns Hopkins Hospital in Baltimore this month. They hope to perform what will be the first penis transplant in the United States within a year. Lexey Swall for The New York Times



Daily Mail .com

Now that's a miracle: The baby born to hero soldier who was too injured to be a dad after being blown up by the Taliban



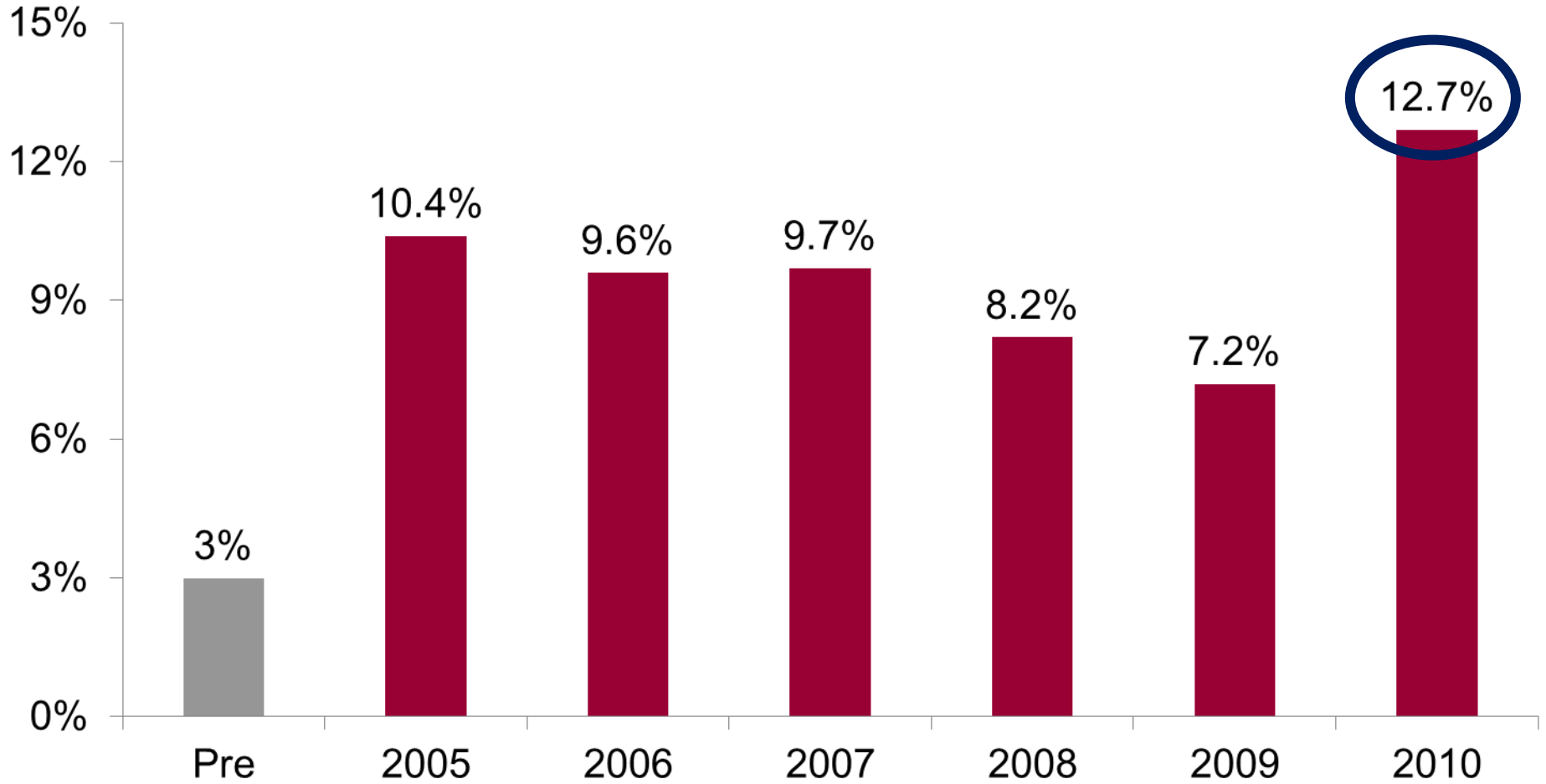
# Growing Interest in GU Injury: What has Changed?



- Increasing frequency of GU injury
- Improved survivability of comorbid injuries
- Recognition and acceptance



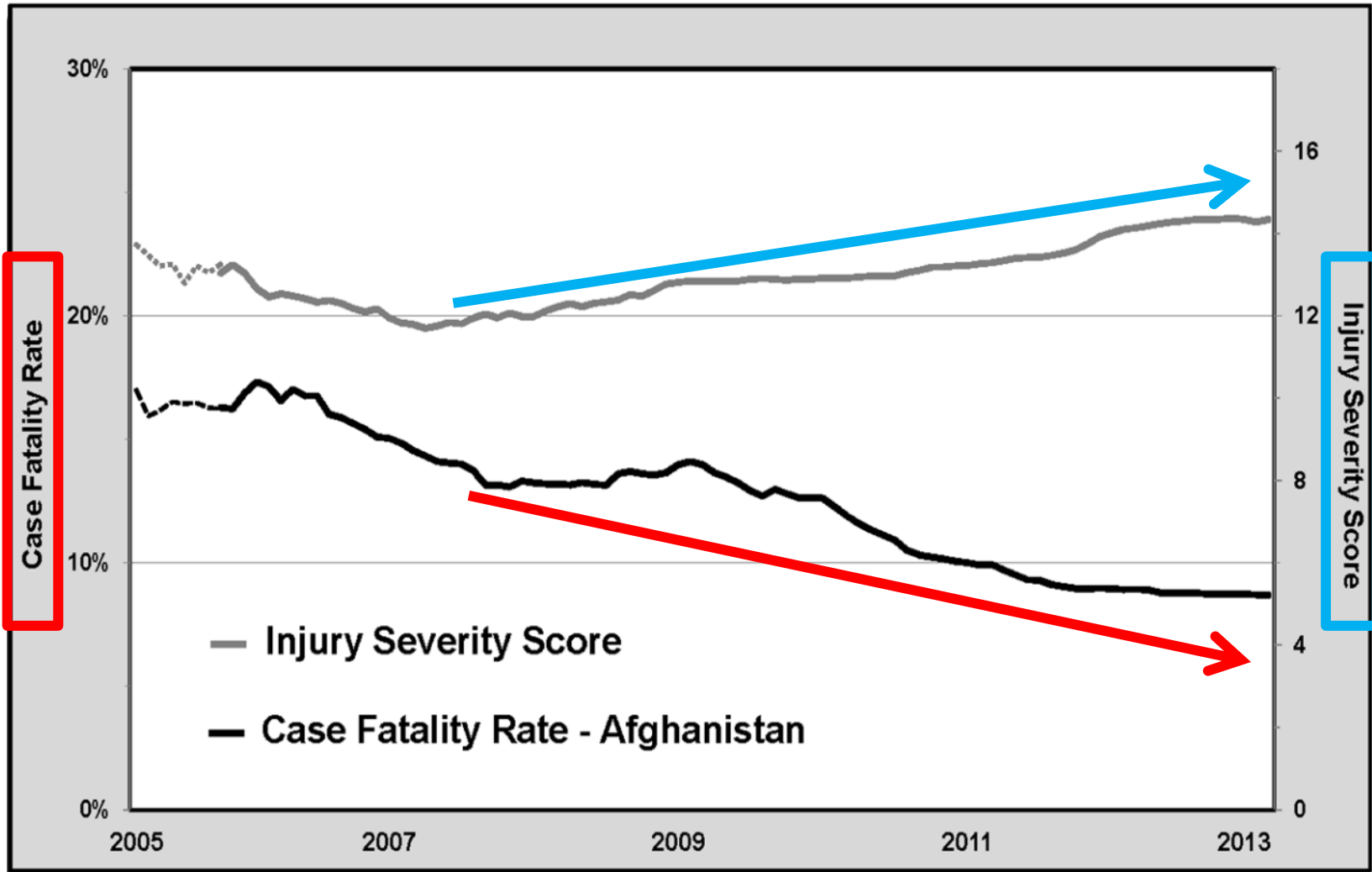
# Rising Proportion of US Casualties with GU Injury



Source: DCBI Report



# Increased Severity → Lower Mortality



Source: J Trauma Acute Care Surg 2013





# GU Injury: The Burden of Survival



Fleming et al. *J Urol*, 2009



# Recognition of Genitourinary Trauma as an Emerging Problem



- Medical community
  - Society of GU Reconstructive Surgeons
  - Fellowship training programs
- Military
  - Subspecialists at most MEDCENs
  - Pelvic protective equipment
- Public
  - Media
  - Marketing





# **Defining the Magnitude of the Problem:**

## **Initial Data from the Trauma Outcomes and Urogenital Health (TOUGH) Project**



# TOUGH Study Objectives



- Initial:
  - How many GU injuries during OIF/OEF?
  - What are the predominant GU organs injured?
  - How severe are the injuries?
- Ongoing collaborative study (SAMMC-ISR-UCD-UTHSCSA):
  - How were the injuries ultimately managed?
  - What are the long term outcomes?
    - Sexual function
    - Urinary function
    - Reproductive function
    - Psychological/emotional
  - What reconstructive and rehabilitative needs remain?



# TOUGH Data Source



- Department of Defense Trauma Registry
  - Largest combat injury database in existence
  - All U.S. Military services represented
  - Injury data from in-theatre and CONUS medical records
  - Includes
    - Diagnoses and procedures
    - Injury Severity Scores (ISS)





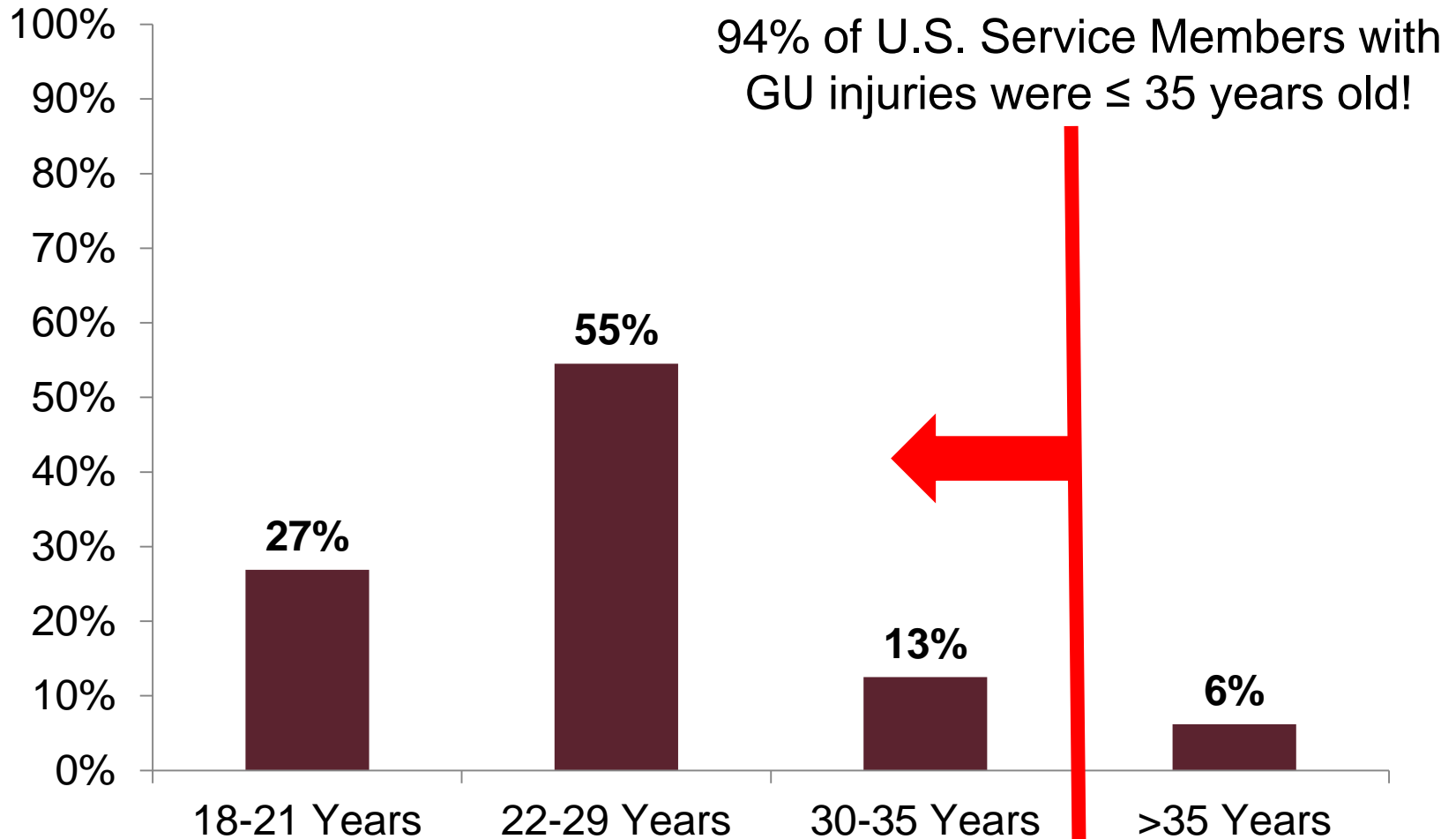
# OIF/OEF GU Injury (2001-2013)



- 1,387 U.S. service members with GU injury
  - Gender:
    - Male: 98.6%
    - Female: 1.4%
  - Injury Category
    - Battle: 88.6%
    - Non-battle: 11.4%
  - Mean Age: 25 years



# Age at Time of Injury





# GU Injury Characteristics

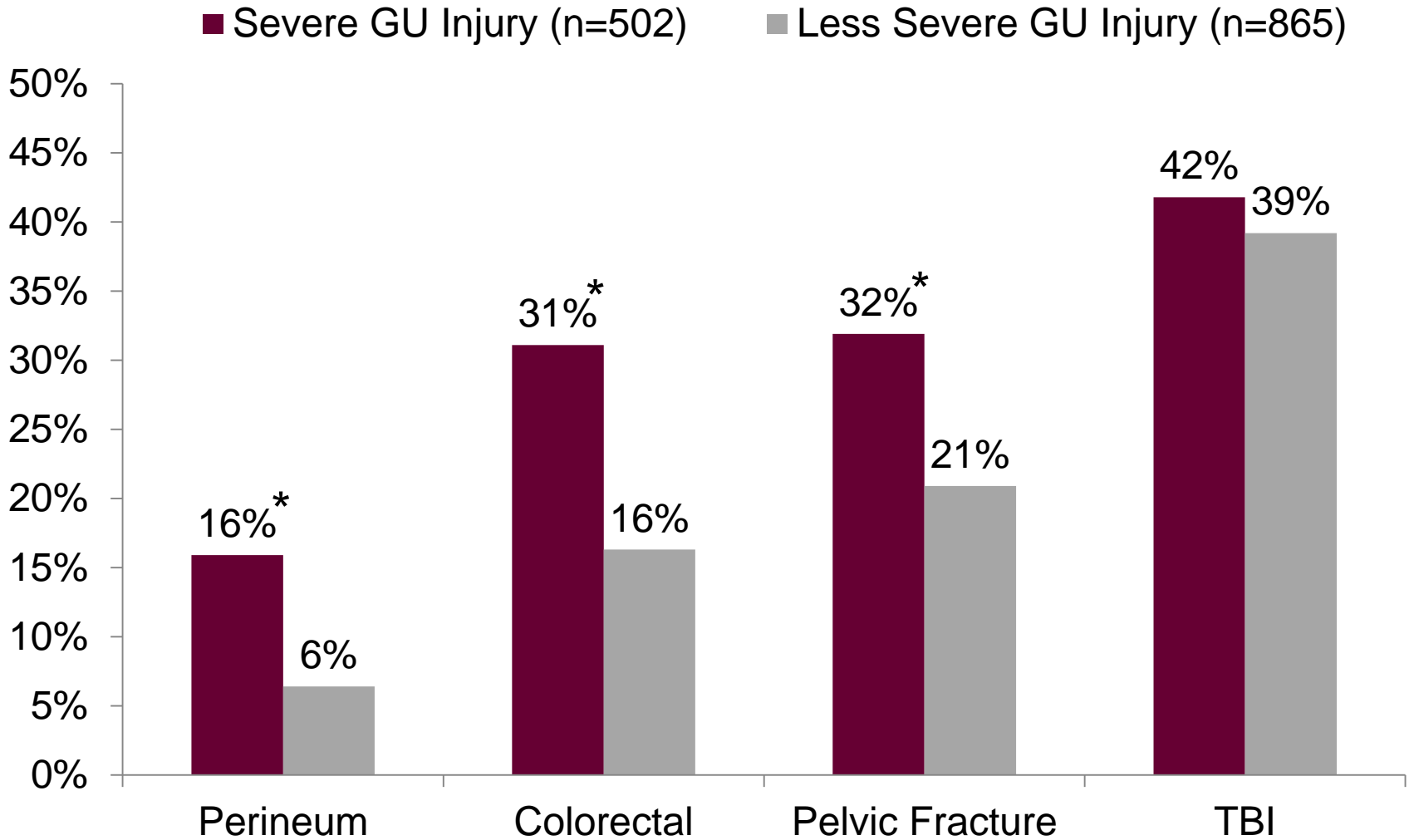


- Branch of Service
  - Army: 68%
  - Marines: 27%
  - Air Force/Navy: 5%
- Injury Mechanism
  - Explosive: 74.1%
  - Non-explosive: 25.9%
- Severe GU Injury: 36.7%
- Died of Wounds: 5.3%





# Relevant Comorbid Injury: Male Survivors



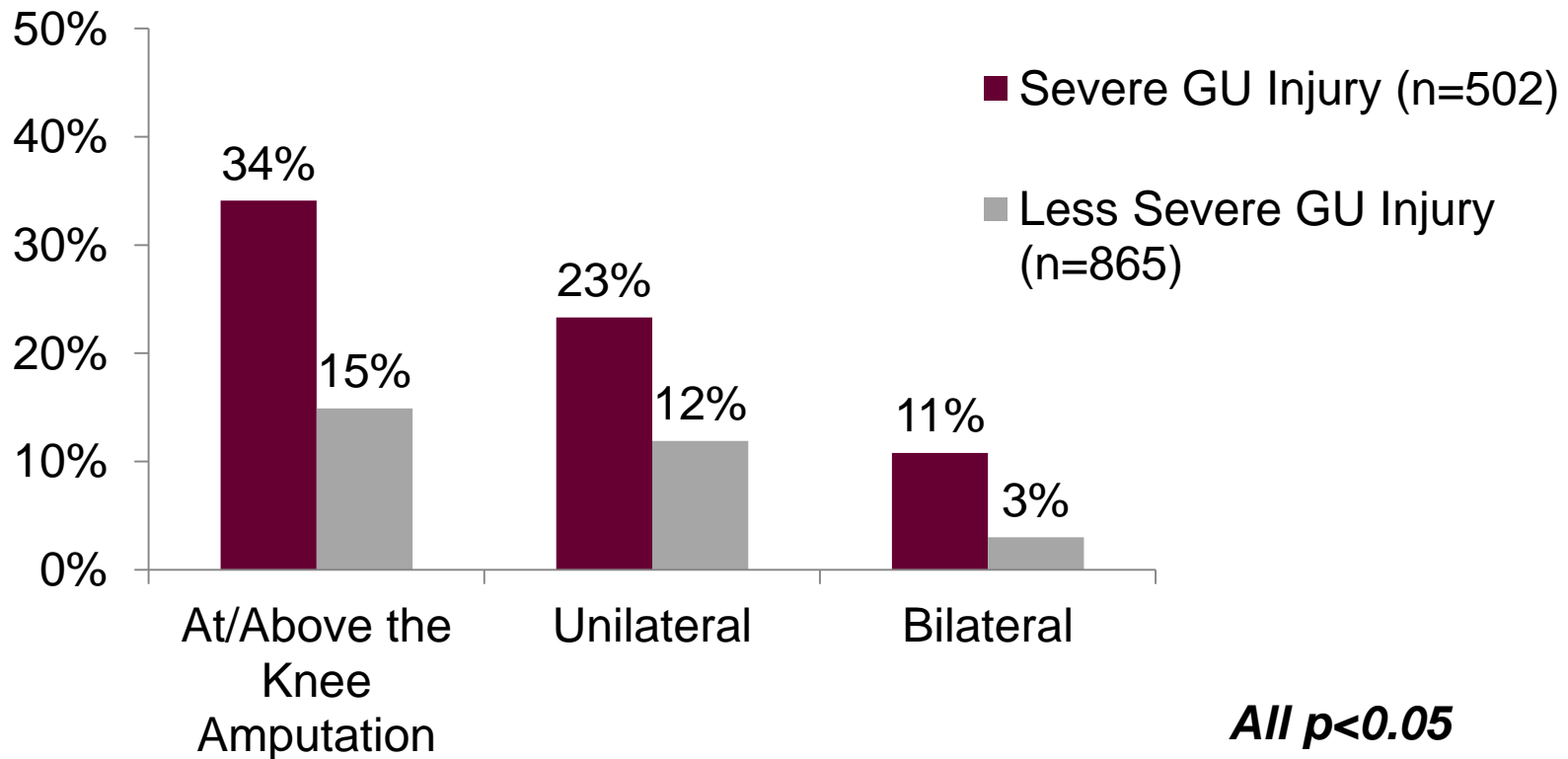
**\*Chi-square test  $p < 0.05$**



# Comorbid Amputation(s): Male Survivors

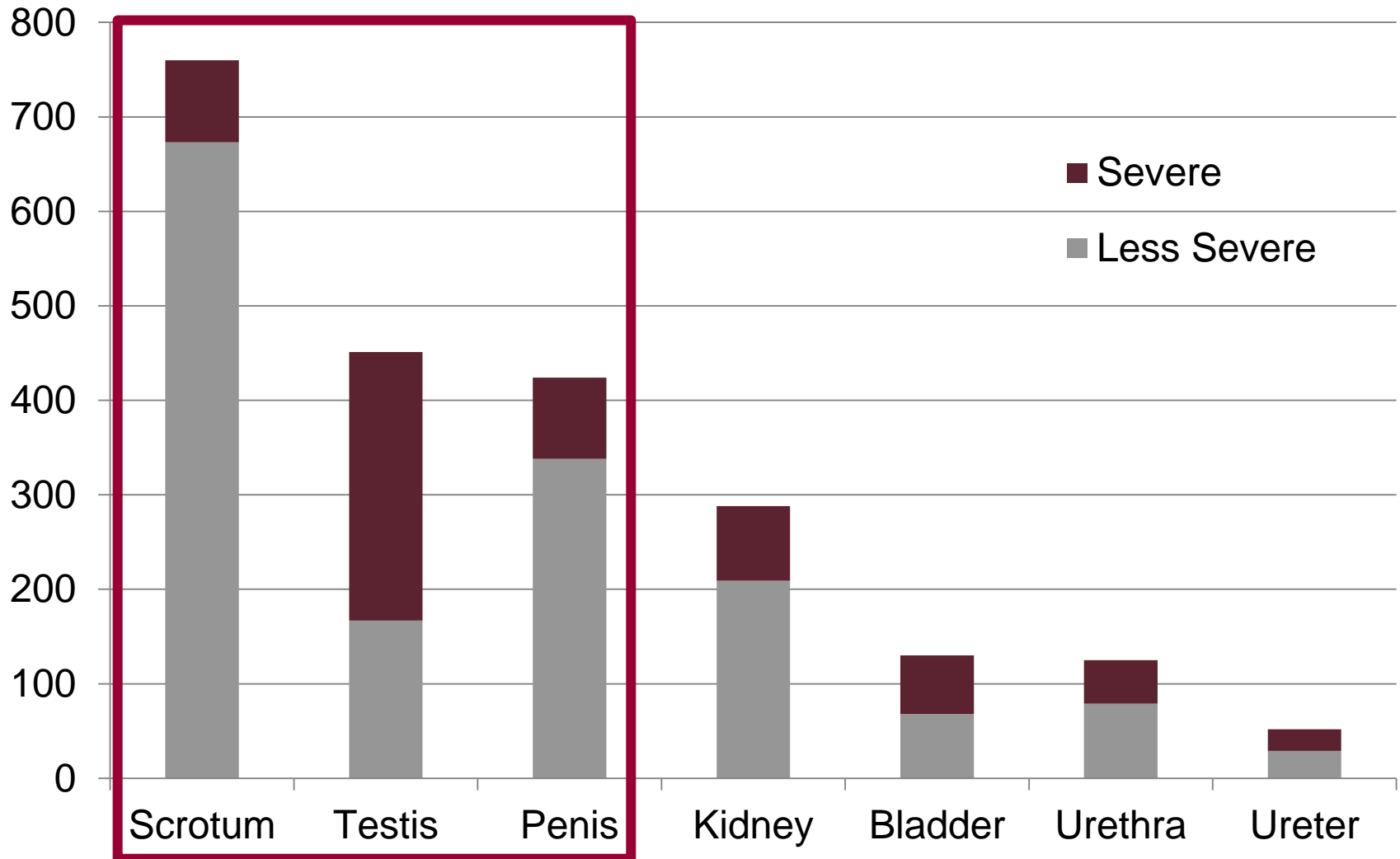


- 32% with any limb amputation (407 of 1,291)
  - 30% lower extremity (nearly 75% at/above the knee)
  - 12% upper extremity





# GU Organs Injured: Male Survivors





# Severe Genital Injury



- Higher overall injury severity
- Higher rate of comorbid injuries
  - Lower extremity amputation(s)
    - 41% vs. 21%
  - Colorectal injury
    - 31% vs. 16%
  - Massive transfusion
    - 54% vs. 30%
- Impact of injury severity on recovery/rehabilitation is poorly defined

Fleming et al., 2011



# Summary of TOUGH Cohort



- ~1,300 surviving service members with GU injury
  - Mostly male
- Genital injury most common
  - 75% of males with GU injury
- ~500 SMs with severe GU injury
  - Group at highest risk for urinary, sexual, and fertility complications
    - Direct effects of anatomical GU injury
    - Indirect effects of amputation, TBI, etc.

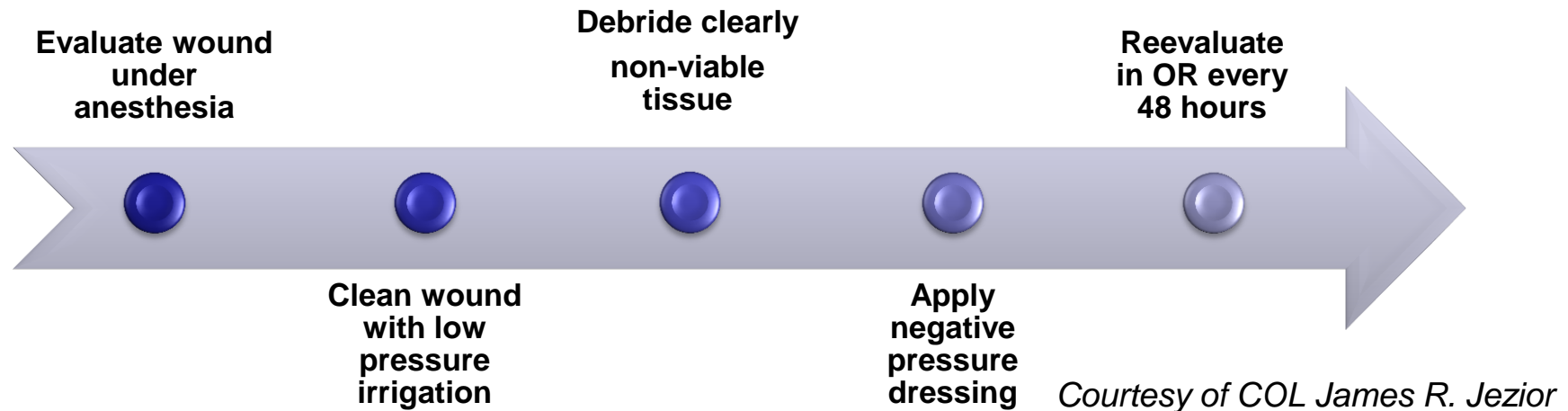


# Management of Battlefield Genitourinary Injury





# Initial Management of GU Injury



ARMY.MIL MEDCOM MRMC

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U.S. ARMY INSTITUTE OF SURGICAL RESEARCH

*"Optimizing Combat Casualty Care"*

HOME ABOUT PARTNERING SCIENCE BURN CENTER JOINT TRAUMA SYSTEM PUBLICATIONS

JTS Clinical Practice Guidelines

<http://www.usaisr.amedd.army.mil/cpgs.html>





# Management of Battlefield GU Injury



- Initial (hours to weeks):
- Delayed (weeks to years):
  - Heal wounds
  - Preserve tissue
  - Return of function → reconstructive/restorative surgery
- Long term (years +):



# Complex Genital Injury



- Heterogeneity of wounds
- Algorithmic guidelines not feasible
- Overarching surgical principles:
  - Preserve native tissue
  - Restore function
  - Optimize cosmesis



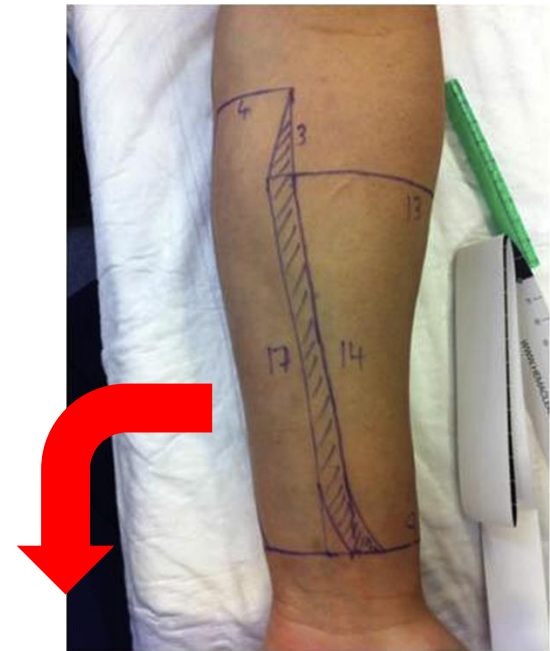
- 10 slides removed due to graphic, sensitive content



# Total Phallic Loss



- Rare, <1% of DoDTR series
- Conventional phallic replacement:
  - Forearm phalloplasty
- Limitations of autologous phalloplasty:
  - Multi-stage operation
  - Need for penile prosthesis
- Limited data in blast injury population
  - Largest series → 3 patients
  - Prior forearm injury/amputation





# Novel Approaches to Phallic Loss



- Techniques in development:
  - Regenerative medicine
  - Penile transplant
    - Risks of immunosuppression
- Significant barriers created by devastating effects of DCBI
  - Traumatic brain injury: 42%
  - Massive transfusion: 54%
  - High LE amputation: 34%
- Very few military candidates

## South Africans perform first 'successful' penis transplant

By James Gallagher  
Health editor, BBC News website

13 March 2015 | Health



News & Analysis

Medical News & Perspectives

## US Hospitals Prepare for Penis Transplants

Bridget M. Kuehn, MSJ

JAMA Published online March 16, 2016 E1

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# Consequences of Devastating Testicular Injury



- More common than penile loss
  - Unilateral: 129 (9.4%)
  - Bilateral: 17 (1.2%)
  - Underestimate?
- Lifelong pharmacologic replacement
  - Costly. Risks?
- Loss of sperm production:
  - Cannot replace!
  - Pre-deployment sperm banking
  - Post-injury sperm salvage
  - Regenerative Medicine
- All show promise for fertility preservation after injury

**ArmyTimes** A TEGNA Company

**Military's new fertility benefit will let troops freeze their sperm and eggs**

By Patricia Kime, Military Times 4:53 p.m. EST January 29, 2016

Daily **Mail**.com

**Now that's a miracle: The baby born to hero soldier who was too injured to be a dad after being blown up by the Taliban**



# Unique Considerations during GU Reconstruction in Polytrauma Patients



- Rigorous rehabilitation schedule
  - Convalescence after any surgery
  - Challenges with prosthesis fit after perineal/genital surgery
  - Post-injury rehab can take months→years!
    - Any interruption is a delay
- Coordinate with other surgeries (orthopedic, plastics, CRS)
- Limited donor skin
- Restoration of sexual function:
  - Patient at peak sexual performance pre-injury
  - Hand injury/amputation?
  - Narcotics, antidepressants, etc.
  - Colorectal injury, LE amputation, depression, PTSD, etc.
  - Partner support?



# Management of Battlefield GU Injury



- Initial (hours to weeks):
- Delayed (weeks to years):
- Long term (years +):
  - Sexual rehabilitation
    - Medical, device, and/or surgical assistance
    - Psychological, spousal, and interpersonal support
  - Fertility treatment → costly!
    - DoD/TRICARE coverage for wounded warriors
    - Limited VA support
  - Revision surgery for recurrent functional or cosmetic problems
    - Lifetime follow up with GU reconstructive surgeons





# **Outcomes Following Battlefield Genitourinary Injury**



# Long Term Impact of Battlefield GU Injury



- ~65,000 published studies on “war,” “military medicine,” “military personnel,” or “battlefield” since 1947\*
  - 75 (0.11%) pertaining to GU trauma\*
- None have examined long-term impact of GU injury on sexual, urinary, reproductive, and psychological outcomes
  - Civilian
  - Military

\*Medline search, September 2015

# The impact of genital trauma on wounded servicemen: Qualitative study

P.A. Lucas <sup>a,\*</sup>, P.R.J. Page <sup>a</sup>, R.D. Phillip <sup>a</sup>, A.N. Bennett <sup>a,b</sup>

<sup>a</sup> Defence Medical Rehabilitation Centre, Headley Court, Surrey KT18 6JW, UK

<sup>b</sup> Leeds Institute of Molecular Medicine, University of Leeds, UK

*Injury, Int. J. Care Injured* 45 (2014) 825–829

- Qualitative study, 13 British soldiers with GU injuries
  - All with at least 1 limb amputation (11 w/ multiple)
  - 5 men with loss of both testicles
  - 10 men with penile injuries
- High importance of sexual function prior to injury
- Negative impact of GU injury:
  - 8 of 13: GU injury was “more important than losing their legs.”
  - 5 of 13: fertility concerns creating a strain on relationships
  - 9 of 13: GU injury negatively impacted sexual function
  - 2 of 13: Totally unable to have sex



# The TOUGH Project



- Multi-institutional, multi-national collaborative effort
- First ever longitudinal study of long-term effects of GU injury
  - Largest GU injury database
  - Collect patient reported outcomes (GU, non-GU, overall QOL)
  - Post-injury care needs and gaps
- Recently awarded DoD funding (~ \$3 million)
- Ultimate Goals:
  - Improve the care of future GU injured patients in peacetime and in war

# Post Traumatic Sexual, Urinary, and Fertility Problems

Genitourinary Injury

## Severe non-GU injury:

- Colorectal
- Extremity
- Head/face

## Neuropsychiatric Problems:

- TBI
- PTSD
- Chronic pain
- Substance abuse



# Collaborators



- Department of Epidemiology, USA Institute of Surgical Research
- Deputy Commander, USAISR
- Urology Consultant to the U.S. Army Surgeon General
- Deputy Commander for Surgical Services, SAMMC

**The Department of Defense Trauma Registry (DoDTR)**

