



Dr. Odette Harris, MD, MPH, Stanford Polytrauma Center

# **GENDER AND THE EFFECTS OF POLYTRAUMA**



# Gender and the Effects of Polytrauma

## A Retrospective Cohort Comparative Analysis (Quantitative and Qualitative Assessments)



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Director, Defense of Veterans Brain Injury Center, VAPAHCS



No Disclosures

# Acute Management to Rehabilitation to Reintegration



**VA PAHCS**  
Veterans Affairs Palo Alto Health Care System



Traumatic Brain Injury  
Polytrauma System of Care  
Department of Veterans Affairs

 **STANFORD**  
SCHOOL OF MEDICINE  
*Stanford University Medical Center*

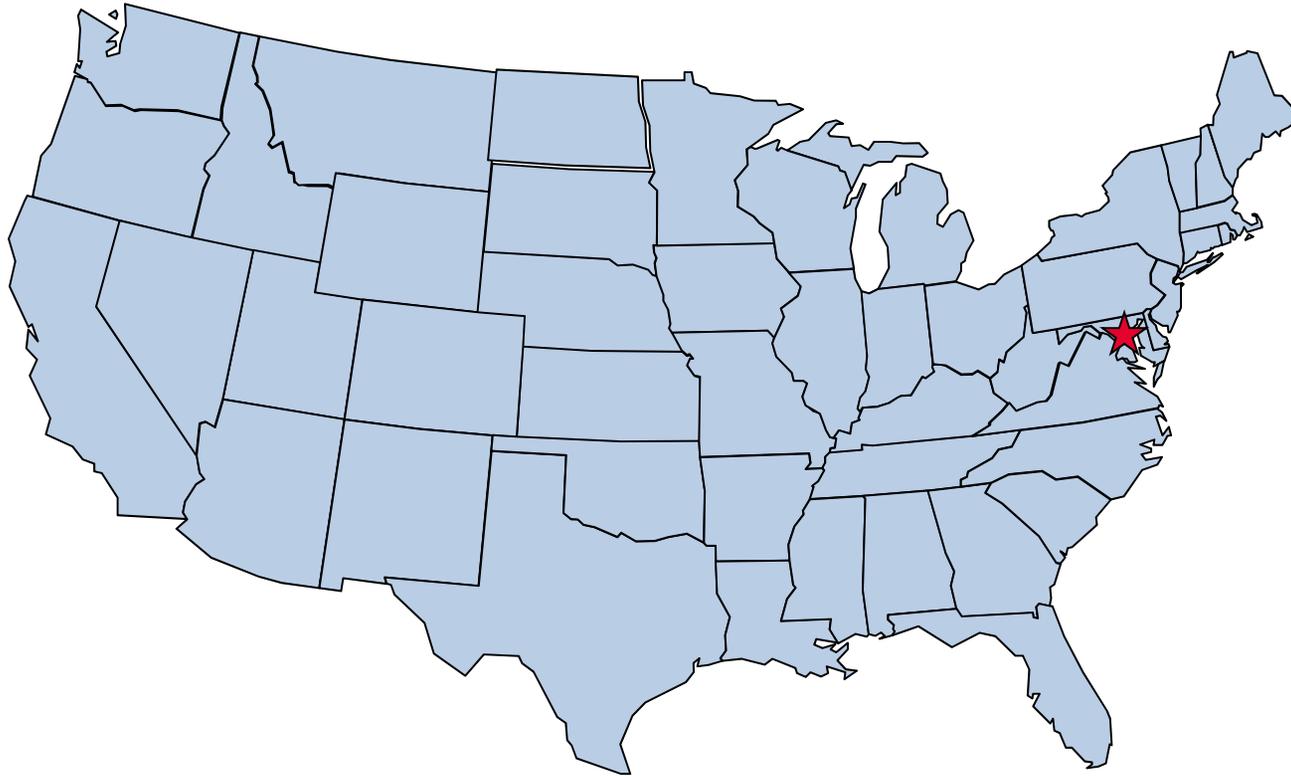




# Overview

- ❑ Polytrauma System of Care (PSC)
  
- ❑ Gender and the Effects of Polytrauma
  - Gendered Innovations
  - Institute of Medicine
  - Institutional Initiative

# The beginning





# General Rehabilitation Unit

## Diagnoses

- Stroke
- Orthopedic Injury
- Post Operative

- Brain Injury –Isolated

For Iraq war veterans, 'invisible wounds' that never heal  
Dan De Luce Aug 29, 2010



New Signature of Modern War: Traumatic Brain Injury  
HELEN BRANSWELL Thursday, Dec. 04, 2008 11:28AM EST

The Wounds Of War  
Daniel Schorn February 11, 2009 6:48 PM

The Wounded Return Home, and Another Battle Begins  
Neil Genzlinger June 6, 2007



The Aches of War: Some Iraq and Afghanistan Vets Suffer Frequent Headaches  
Katherine Harmon February 24, 2009

Counting The Wounded  
Mark Thompson Friday, March 4, 2011 2:48 pm

Iraq War's Signature Wound: Brain Injury  
Jordan Robertson Friday, September 15, 2006; 7:19 AM



Silent Wounds: The True Signature Wound of the War on Terror  
Tom Fox Tuesday, February 23rd, 2010



Key Iraq wound: Brain trauma  
Gregg Zoroya 3/3/2005 11:12 PM



# Evolution of Polytrauma/CRC Scope of Service

*The Polytrauma System of Care has greatly expanded its scope of service to include minimally conscious, outpatient, and transitional patients.*

- ❑ Comprehensive Rehabilitation Center (CRC) – 1980's
  - Acquired brain injury
  - Stroke/Neurological conditions
  - Amputee care: prosthetic and pre-prosthetic training
  - Joint replacement
- ❑ Defense and Veterans Brain Injury Center (DVBIC) – August 1992
- ❑ Polytrauma Rehabilitation Center (PRC) – February 2005
  - Traumatic brain injury (blast injuries)
  - Multiple physical and/or emotional injuries
- ❑ Polytrauma Transitional Rehabilitation Program (PTRP) – October 2006
- ❑ Emerging Consciousness Program (EC) – December 2006
- ❑ Polytrauma Network Site (PNS) – April 2007



# Our Mission

*The PSC offers a unique mission to care for recently injured returning active duty service members (ADSM) and veterans*

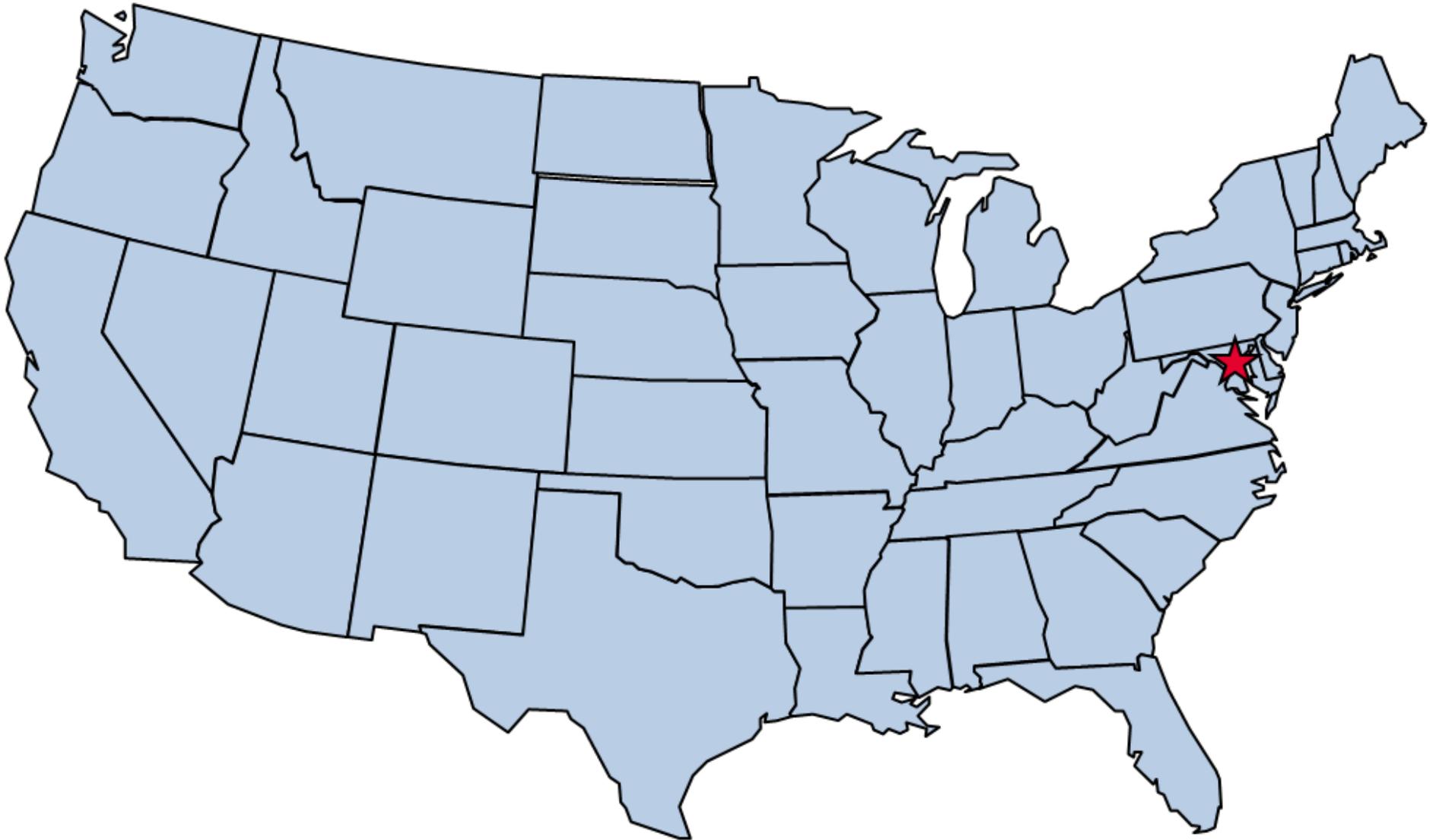
## ❑ Mission:

- The PSC is dedicated to providing rehabilitation services that restore physical, intellectual, communicative, psychosocial and vocational skills, and to facilitating the transfer of those skills from the hospital setting to daily life. Such services include, but are not limited to, inpatient rehabilitation, outpatient rehabilitation, emerging consciousness programs, transitional rehabilitation, day programs, and community re-entry programs.

## ❑ Polytrauma Defined:

- “...injury to the brain in addition to other body parts or systems resulting in physical, cognitive, psychological or psycho-social impairments and functional disability. Injury to the brain is the impairment which guides the course of rehabilitation. Traumatic Brain Injury frequently occurs in polytrauma and in combination with other disabling conditions, such as: amputation, auditory and visual impairments, spinal cord injury, post traumatic stress disorder (PTSD), and other mental health conditions.”

# Evolution





Polytrauma  
Rehabilitation  
Center

Regional  
Amputee  
Center

Comprehensive  
Rehabilitation  
Center

Diagnoses

- Stroke
- Orthopedic Injury
- Post Operative
- Brain Injury –Isolated

Assistive  
Technology  
Center

Polytrauma  
Transitional  
Rehabilitation  
Program

Polytrauma  
Network Site

Journal of the International Neuropsychological Society (2010), 16, 856–866.  
Copyright © INS. Published by Cambridge University Press, 2010.  
doi:10.1017/S1551771000743

Postconcussive Symptoms After Blast and Nonblast-Related Mild Traumatic Brain Injuries in Afghanistan and Iraq War Veterans

SARA M. LIPPA,<sup>1,2</sup> NICHOLAS J. PASTOREK,<sup>1,3</sup> JARED F. BENGE,<sup>1,4</sup> AND G. MATTHEW THORNTON<sup>1,2</sup>

Journal of Neurotrauma

### Blast Overpressure in Rats: Recreating a Battlefield Injury in the Laboratory

Joseph B. Long, Timothy L. Bentley, Keith A. Wessner, Carolyn Cerone, Sheena Sweeney and Richard A. Bannister

June 2009, 26(6): 827-840.

J Head Trauma Rehabil  
Vol. 21, No. 5, pp. 309-312  
© 2006 Lippincott Williams & Wilkins, Inc.

### Military TBI During the Iraq and Afghanistan Wars

Deborah Warden, MD

### Traumatic Brain Injury in Operation Enduring Freedom/Operation Iraqi Freedom: A Primer

Katherine S. Fabrizio, ne<sup>1</sup>, Norman L. Kellner, rso, dsw<sup>2</sup>

JRRD  
Journal of Rehabilitation Research & Development

Review of sports-related concussion: Potential for application in military settings

JRRD  
Department of Veterans Affairs  
Rehabilitation Research & Development Service

Volume 46 Number 6, 2009  
Pages 667–672

### Pathology of blast-related brain injury

Jeffery D. Kocsis, PhD,<sup>1,2\*</sup> Alan Tessier, MD

The Clinical Neuropsychologist

### Symptom Complaints Following Repeated Mild Traumatic Brain Injury: Does Mechanism of Injury Matter?

Heather G. Belanger PhD, D, Zoe Proctor-Weber, Tracy Kretz

# Polytrauma (OEF/OIF/OND)

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Disclosures:

Financial disclosure statements have been obtained, and no conflicts of interest have been reported by the authors or by any individuals in control of the content of this article.

0891-4122/09/2606-667-06

American Journal of Physical Medicine & Rehabilitation  
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DOI: 10.1097/PHM.0b013e3181d2121a

INVITED REVIEW

### The History and Evolution of Traumatic Brain Injury Rehabilitation in Military Service Members and Veterans

ABSTRACT

Cifu DS, Cohen SL, Law HL, Jaffee M, Siffers B. The history and evolution of traumatic brain injury rehabilitation in military service members and veterans. *Am J Phys Med Rehabil* 2010;29:667–684.  
The field of traumatic brain injury has evolved since the time of the Civil War in response to the needs of patients with injuries and disabilities resulting from war. The Department of Veterans Affairs and the Defense and Veterans Brain Injury Center have been in the forefront of the development of the interdisciplinary approach to the rehabilitation of soldiers with traumatic brain injury, particularly those injured from the recent conflicts in Iraq and Afghanistan. The objectives of this literature review are to examine how the conceptual model of traumatic brain injury in the past led to the establishment of the current model of evaluation and treatment of traumatic brain injury and to review how the field has expanded in response to the growing cohort of military service members and veterans with TBI.

Key Words: Rehabilitation, War, Veterans, Brain Injury

The essentials of rehabilitation therapies may be traced back millennia to the ancient Greeks and Romans, who used leeches, massage, electrical currents, heat, and cold to relieve pain.<sup>1</sup> As noted in the past, the field of rehabilitation has experienced advancements in the past century due to injuries and disability from large-scale wars and the concomitant advances in battlefield medicine that have dramatically increased survival rates. Traumatic brain injury (TBI) rehabilitation has historically lagged behind that of amputation and general orthopedic rehabilitation, but in the past decade, there has been a great expansion of TBI services provided to persons serving in the military.<sup>2,3</sup> This literature review examines the influence of major wars on the development of TBI rehabilitation services over the past two centuries, from the Civil War to the present day conflicts in Iraq and Afghanistan, and provides a glimpse into the future of TBI rehabilitation.

Historical Evolution of TBI Rehabilitation in the Military

Before the 20th century, severe TBI was generally considered fatal.<sup>4,5</sup> During the Civil War (1861–1865), gunshot wounds to the head were seen in

*Am. J. Phys. Med. Rehabil.* • Vol. 89, No. 6, August 2010

688

SCOTT R. SPONHEIM<sup>2,4</sup>

JRRD  
Journal of Rehabilitation Research & Development

Volume 46 Number 6, 2009

Pages 695–698

### Acute clinical care and care coordination for traumatic brain injury within Department of Defense

Michael S. Jaffee, MD;<sup>1</sup> Kathy M. Helmick, CRNP;<sup>1</sup> Philip D. Girard, MS;<sup>1,2\*</sup> Kim S. Meyer, APRN;<sup>1</sup> Kathy Dinegar, LICSW;<sup>2</sup> Karyn George, MS, CRC<sup>1</sup>

J Clin Psychol

### Assessing and treating veterans with traumatic brain injury.

French LM, Parkinson GW 2008 Aug;64(8):1004-13.

JAOA ORIGINAL CONTRIBUTION

Combat-Related Posttraumatic Headache: Diagnosis, Mechanisms of Injury, and Challenges to Treatment

CPT Matthew Kozminski, DO, MC, USA

Contents lists available at ScienceDirect

Journal of the Neurological Sciences

journal homepage: www.elsevier.com/locate/jns

ELSEVIER

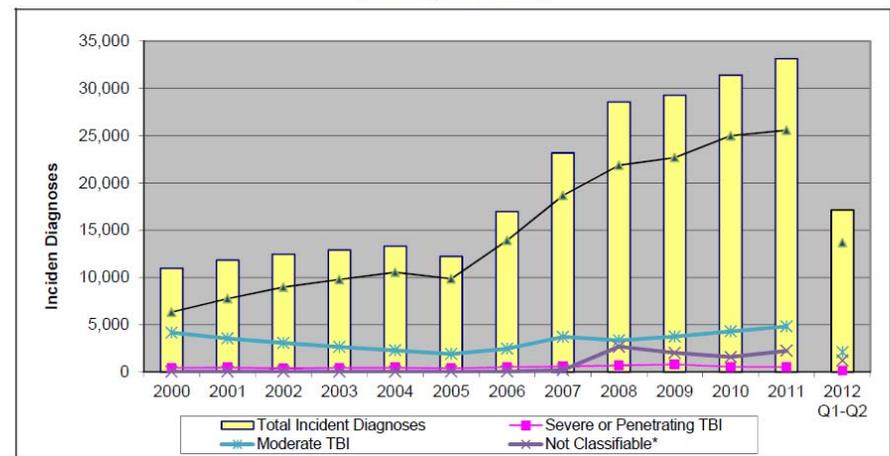
### Development of a rat model for studying blast-induced traumatic brain injury

Jingmin Cheng<sup>a,1</sup>, Jianwen Gu<sup>a,2</sup>, Yuan Ma<sup>a,2</sup>, Tao Yang<sup>a,2</sup>, Yongqin Kuang<sup>a,3</sup>, Bingcang Li<sup>b,4</sup>, Jianyi Kang<sup>b,5</sup>

# Polytrauma and Traumatic Brain Injury (TBI)

- 266,810 TBI since 2000\*
- Signature injury of OEF/OIF
- 12-20% of servicemembers returning from deployment

Figure 3. Traumatic Brain Injury (TBI) 2000-2012 Q2  
(as of August 20, 2012)

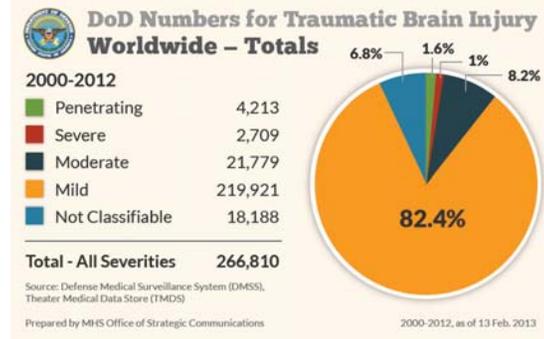


Source: CRS communication with Dr. Michael Carino, Army Office of the Surgeon General, December 13, 2012. Data source is the Defense Medical Surveillance System (DMSS), Defense and Veterans Brain Injury Center, <http://www.dvbic.org/dod-worldwide-numbers-tbi>.

Notes: \* Requires additional incident information and further investigation prior to TBI categorization.

# Who are the Polytrauma/TBI?

- Majority mild TBI
- 95% of those with a TBI dx in the VA are male<sup>2</sup>
- Most published research focus on a primarily male in cohort
  - Meta-analysis of 32 studies<sup>1</sup>
    - Consisted of descriptive characteristics of mTBI of U.S. military
    - Of the studies included, there was a predominance of men represented and thus evaluated, 80%-100%\*



<sup>1</sup>Evidence-Based Synthesis (ESP): Complications of Mild TBI in Veterans and Military Personnel

<sup>2</sup> Fiscal Year 2011 VA Utilization Report for Iraq and Afghanistan War Veterans Diagnosed with TBI (QIERI, Polytrauma/Blast-Related Injuries)

\*gender not reported in 4 studies

# What have we learned about those diagnosed as Polytrauma/TBI?

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- Prevalence of mTBI outcomes
  - Post-concussive symptoms lasting past 3 months (10-20%)<sup>1</sup>
    - Neurology headache referrals (33%)<sup>2</sup>
  - Axis I mental health disorders (50-78%)<sup>3</sup>
    - Comorbid PTSD (45%)<sup>3</sup>
    - Suicidal ideation (25%)<sup>3</sup>
    - Alcohol abuse/dependence (28%)<sup>4</sup>
  - Unemployment (20%)<sup>3</sup>

These studies provide a broad description of the needs of the polytrauma cohort and drive the treatment/services

1. Ruff, 2005

2. Patil, et al., 2011

3. Barnes, Walter, & Chard, 2012

4. Nelson, et al., 2012

# Concerns

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- Are these conclusions applicable to everyone?
- Are these conclusions applicable to women?

# Historical example

Home | Directions | Contact Info | Search  Go

## FRAMINGHAM HEART STUDY

A Project of the National Heart, Lung and Blood Institute and Boston University

About FHS | Participants | FHS Investigators | Risk Score Profiles | FHS Bibliography | For Researchers



- ✓ About FHS
- ✓ History
- ✓ Participating Institutions
- ✓ Ethics Advisory Board
- ✓ Friends of the Framingham Heart Study
- ✓ **Research Milestones**
- ✓ Additional Resources

### Research Milestones

1960 Cigarette smoking found to increase the risk of heart disease

1961 Cholesterol level, blood pressure, and electrocardiogram abnormalities found to increase the risk of heart disease

1967 Physical activity found to reduce the risk of heart disease and obesity to

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## Framingham Heart Study: The First 20 Years

Gerald M. Oppenheimer\*

*Brooklyn College and the Graduate Center, City University of New York  
Center for the History and Ethics of Public Health, Mailman School of Public Health, Columbia University*

### Abstract

The Framingham Heart Study remains the most famous and influential investigation in cardiovascular disease epidemiology. To generations of epidemiologists, it is a model for the cohort design. Here we revisit the origins of the Framingham Study before it became an accomplished and famous investigation whose existence and success are taken for granted.

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### Keywords:

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“Framingham was an ideal site for a cohort study. But these features also made it highly unrepresentative. In particular, the Framingham Study sample consisted almost entirely of white, middle class Euro-Americans. Despite its impulse to scientific universality, the study lacked Blacks, Latinos, or Asians.”

# “A new ‘Framingham’ Heart Study Focuses on Blacks”

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JACKSON, Miss. - Fifty-four years after medical researchers launched a landmark study in Massachusetts that revolutionized heart care, a corps of doctors has followed the trail of civil rights workers here to make up for a historic lapse - the absence of African- Americans in the original Framingham Heart Study.

The Jackson Heart Study is the largest research project ever undertaken of the heart condition of African-Americans, with the goal of solving one of medicine's great mysteries: Why do younger and middle-aged blacks die from cardiovascular diseases at twice the rate of whites?

"We must do something," said Dr. Herman Taylor, the Harvard-trained cardiologist



# How valid are treatment recommendations for women with TBI/Polytrauma?

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- Women's representation in the data ('noise')
- Demographics are not comparable
- Potential gender bias

# Women in the military

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- Women veterans >1.8 million
  - 8% of all living Veterans<sup>1</sup>
- Experiencing more combat than previous eras
- Over 250,000 women were deployed (12% of total deployed)<sup>4</sup>
- OEF/OIF women more likely to obtain VA health care than women vets of previous eras<sup>1</sup>
- Unique readjustment/stressors
  - Military mothers – 3x more likely to be single<sup>2</sup>
  - Harassment, sexual trauma, assault<sup>3</sup>

<sup>1</sup><http://www.mchb.hrsa.gov/whusa11/popchar/downloads/pdfs/110wv.pdf>

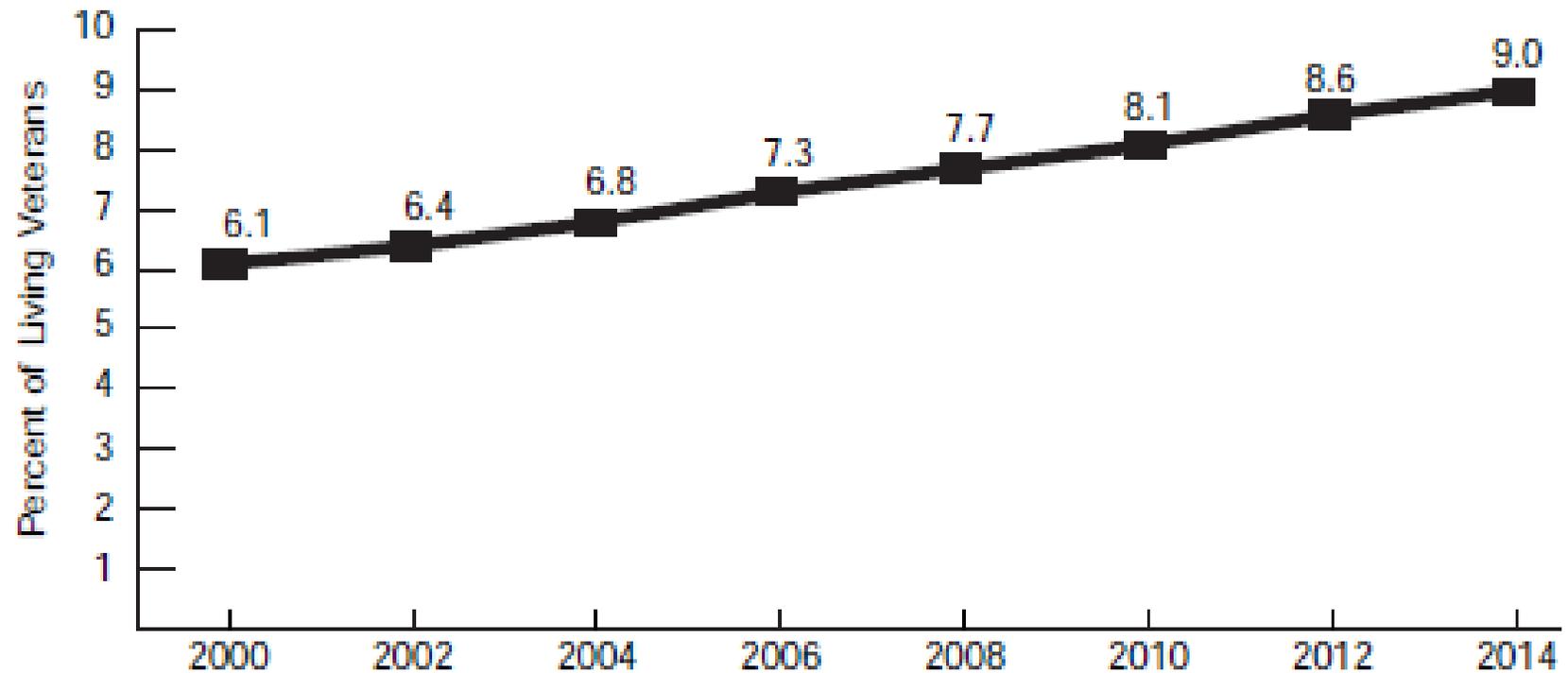
<sup>2</sup> <http://www.jec.senate.gov/archive/Documents/Reports/MilitaryMoms05.11.07Final.pdf>

<sup>3</sup> Street, AE, et al. "A new generation of women veterans: stressors faced by women deployed to Iraq and Afghanistan" Clin Psychol Rev 2009 Dec; 29(8)

<sup>4</sup> Returning Home from Iraq and Afghanistan: Assessment of Readjustment Needs of Veterans, Service Members, and Their Families, 2013, National Academy of Sciences

# Living Women Veteran Population, 2000–2014\*

Source I.15: Department of Veterans Affairs, Office of Policy & Planning

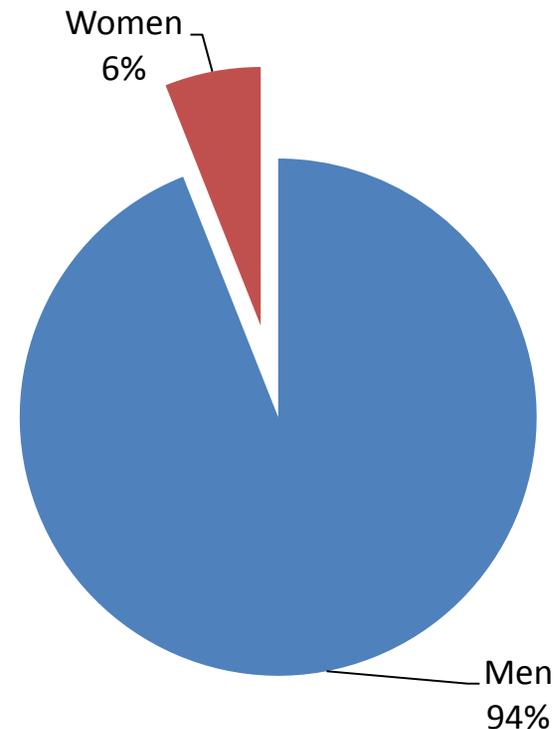


\*Historical data from 2000-2010; projected for 2011-2014.

# Women with TBI/Polytrauma Represent small numbers

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- Of VA Polytrauma, women represent :
  - Nationally 3%<sup>1</sup> – 5%<sup>2</sup>
  - VA Palo Alto 6% served since 2006



<sup>1</sup> Sayer, Rehab Needs, 2009

<sup>2</sup> Iverson, women's Health Issues, 2011

# Women with TBI/Polytrauma

## Noise in the system?

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- Study on referrals at the VAPAHCS PSC
  - Validity Assessment study (study sample from 2009-2011)
  - Of the 906 referrals, 7% were women
    - 7% accepted to PSC were women
    - 12% alternatively redirected were women
- Sub analysis of those women who were alternatively redirected
  - Women had higher rates of co-morbidities than men:
  - Spinal cord injury: 18% of women vs. 6% of men
  - Acute mental health issues: 45% of women vs. 9% of men

# Women with TBI/Polytrauma

## Literature Review

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- Women tend to fare worse than men for psychiatric and neurobehavioral symptoms after TBI <sup>1,3</sup>
- Among OEF/OIF women patients seen at VA, 11% screen positive for TBI (compared to 23% of men)<sup>2</sup>
- Women with TBI were likely to be diagnosed with<sup>3</sup>:
  - Depression (2x)
  - Anxiety disorder other than PTSD (1.3x)
  - PTSD and depression (1.5x)

Impact of TBI on women largely unknown

<sup>1</sup>Colvin et al., 2009; Fann et al., 2004; Jensen & Nielsen, 1990; McCarthy et al., 2006,

<sup>2</sup> Hendricks et al., 2013

<sup>3</sup> Iverson, 2011



Clayman Institute  
*for the Study of Gender Research*

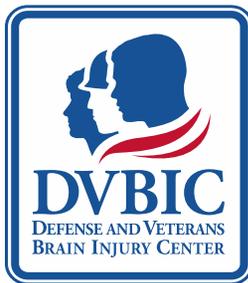


VA Palo Alto Health Care System



Traumatic Brain Injury  
Polytrauma System of Care  
Department of Veterans Affairs

Polytrauma System of Care



Defense and Veterans Brain Injury  
Center (DVBIC)

# Gender and the Effects of Polytrauma: A Retrospective Cohort Comparative Analysis (Quantitative and Qualitative Assessments)



Odette A. Harris, MD, MPH  
Associate Professor, Department of Neurosurgery  
Director, Brain Injury  
Stanford University School of Medicine  
Associate Chief of Staff, Polytrauma VA Palo Alto Health Care System

# Hypothesis

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As women represent such small numbers in the general Polytrauma patient cohort, their experience is not wholly represented in the published outcomes that inform data-driven decisions regarding treatment, management and care of the Polytrauma population

# Study Design

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- Retrospective cohort analysis of all women treated in the Palo Alto PSC clinics since 2006 with a diagnosis of TBI
- VA medical records abstraction – lifelong care management

# Methodology

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- Data collected:
  - Demographics and Injury Etiology
    - Social characteristics and changes since injury
      - Housing, marital status, job, children, military status, substance abuse
    - Injury characteristics
      - mechanism, severity, location
- Outcomes Domains Evaluated:
  - Psychiatric Diagnoses and Substance Abuse
  - Post-concussive Symptoms
  - Neurobehavioral Symptoms

# VAPAHCS Polytrauma Women with TBI

	General OEF/OIF mTBI <sup>1</sup>	VAPAHCS PSC Women with TBI <sup>5</sup>	Significance
<b>Participant Demographics</b>			
Mean Age	30.9 years	27.7 years	0.053 <sup>†††</sup>
Ethnicity	77% Caucasian, 18% Latino, 17% African American <sup>2</sup>	73.1% Caucasian, 11.5% Latino, 11.5% African American	0.69 <sup>††</sup>
Married	48.9%	34.6%	0.43 <sup>†</sup>
Education	High school or less (56.5%)	<b>High school or less (19.2%)</b>	<b>0.007<sup>†</sup></b>
Working	62.3%	<b>19.2%</b>	<b>0.001<sup>†</sup></b>
Unemployed	20% <sup>3</sup>	<b>53.9%</b>	<b>0.015<sup>†</sup></b>
Homeless	1.7% <sup>4</sup>	<b>11.5%</b>	<b>0.004<sup>†</sup></b>
<b>Injury Etiology</b>			
Blast	82.7%	<b>50.0%</b>	<b>0.013<sup>†</sup></b>
Fall	25.4%	34.6%	0.78 <sup>†</sup>
Vehicular	27.3%	34.6%	0.78 <sup>†</sup>
Assault	33.8%	23.1%	0.57 <sup>†</sup>

1. Iverson et al., 2011 (5.2% Female, N=12,605)

3. Barnes, Walter & Chard, 2012

5 VA Palo Alto Healthcare System – Polytrauma Network Site

2. Committee on the Assessment of Readjustment

4. Blackstock, et al., 2012

8/30/2006 – 5/18/2012 (100% Female, N=60)

Needs of Military Personnel, Veterans, and Their Families, 2013

†. Fisher's exact, ††. Chi-square, †††. t-test

# 1. Psychiatric Diagnoses and Substance Abuse

OEF/OIF mTBI compared to Women with TBI

Diagnosis	General Cohort with TBI <sup>1</sup>	Women with TBI <sup>4</sup>	Significance <sup>††</sup>
PTSD	67.8% <sup>1</sup>	<b>88.5%</b>	<b>0.016</b>
Depression	32.9% <sup>1</sup>	<b>92.3%</b>	<b>0.0001</b>
Anxiety Disorder	16.3% <sup>1</sup>	<b>46.2%</b>	<b>0.0001</b>
Adjustment Disorder	9.6% <sup>1</sup>	15.4%	0.32
Substance Abuse	8.1% <sup>1</sup>	<b>30.1%</b>	<b>0.0001</b>
Alcohol Abuse	27% <sup>1</sup>	30.1%	0.87
Cognitive Disorder <sup>*</sup>	~1-15% <sup>2</sup>	<b>50.0%</b>	<b>0.0001</b>
Cognitive Impairments <sup>*</sup>	~10-44% <sup>3</sup>	<b>100.0%</b>	<b>0.0001</b>
> Two Diagnoses	48.7% <sup>1</sup>	<b>80.1%</b>	<b>0.001</b>

\* *Cognitive Disorder* = patients given a DSM-IV diagnosis of *Cognitive Disorder (NOS)* by their attending physician, clinical psychologist, psychiatrist, or neuropsychologist; *Cognitive Impairments* = one or more clinically significant impairments in cognitive domains (e.g. memory, executive, etc)

1. Iverson et al., 2011  
 2. McCrea, 2008; Alexander, 1995; Rutherford, 1979  
 3. Dikmen et al., 2010; Ruff, 2005

4. VA Palo Alto Healthcare System – Polytrauma Network Site (PNS) Admissions 8/30/2006 – 5/18/2012 (100% Female, N=60)

†. Fisher's exact, ††. Chi-square

## 2. Post-concussive Symptoms

### OEF/OIF mTBI compared to Women with TBI

Symptom	General Cohort with TBI	Women with TBI <sup>7</sup>	Significance <sup>†</sup>
Chronic Pain	43.1% <sup>1</sup>	<b>84.6%</b>	<b>.0001</b> †
Any Headaches	90% <sup>2</sup>	88.5%	.99 †
Chronic Headaches	20-23% <sup>3</sup>	<b>42.3%</b>	<b>.0001</b> †
Episodic Headaches	78% <sup>3</sup>	<b>46.2%</b>	<b>.015</b> †
Headache Rating	4.33 / 10 <sup>4</sup>	3.62 / 10	<b>.04</b> ††
Vision Impairment Rating	1.62 / 4 <sup>5</sup>	1.63 / 4	.96 ††
Hearing Impairment Rating	2.00 / 4 <sup>5</sup>	<b>1.60 / 4</b>	<b>.049</b> ††
Nausea/Appetite Rating	1.50 / 4 <sup>5</sup>	1.17 / 4	.08 ††
Neurological Problem Rating	1.50 / 4 <sup>5</sup>	<b>2.15 / 4</b>	<b>.004</b> ††
Sleep Disturbance	13-23% <sup>6</sup>	<b>88.5%</b>	<b>.0001</b> †

1. Nampiaparampil, 2008

2. Lew et al., 2006

3. Theeler, Flynn, & Erickson, 2012

4. Ruff, Ruff & Wang, 2008

5. Benge, Pastorek, & Thornton, 2009

6. Coldren et al, 2012; Kelly et al, 2012

7. VA Palo Alto Healthcare System – Polytrauma Network Site (PNS) Admissions  
8/30/2006 – 5/18/2012 (100% Female, N=60)

†. Chi-square, ††. t-test

# 3. Neurobehavioral Symptoms Self-Reported Severity

5-point scale: 0 – 4 (none – very severe)

Domain	Men with TBI <sup>1</sup>	Women with TBI <sup>†</sup>	Significance
Affective	2.43 (34.4%)	2.58 (37.5%)	0.39 <sup>††</sup>
Somatosensory	1.55 (4.4%)	<b>1.83 (16.7%)</b>	<b>0.04</b> <sup>††</sup>
Cognitive	2.16 (28.3%)	2.47 (29.2%)	0.10 <sup>††</sup>
Vestibular	1.28 (4.8%)	<b>1.76 (8.3%)</b>	<b>0.002</b> <sup>††</sup>

Domain Ratings represent the mean rating for each symptom domain on a 5-point likert scale.

Percentages in parentheses represent the proportion of patients with mean domain ratings in the severe or very severe range (M >= 3).

1. Iverson et al., 2011

† VA Palo Alto Healthcare System – Polytrauma Network Site (PNS) Admissions 8/30/2006 – 5/18/2012 (100% Female, N=60)

††. t-test

# Summary of results

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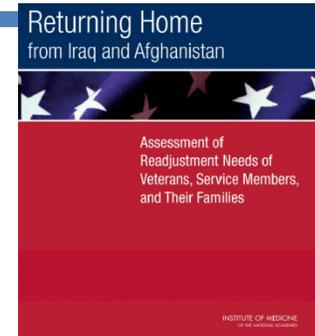
- Community re-integration
  - Lower percentage of women with TBI working (19% vs. 62% TBI pop)
  - More homelessness among the women with TBI (11% vs. 2% TBI pop)
- Women are diagnosed more often with\*:
  - Depression (92%)
  - PTSD (89%)
  - Anxiety (46%)
  - Substance abuse (30%)
  - Cognitive disorders/impairments (100%)
  - More than 2 diagnoses (80%)
- Women report more chronic pain (85%), chronic headaches (42%), sleep disturbances (89%), and neurological problems.\*
- Women suffer more severe somatosensory and vestibular symptoms\*

\* Statistically significant,  $p < 0.05$

# “Women in the military face some unique stressors”

## IOM Report: Returning Home From Iraq and Afghanistan

Released March 2013

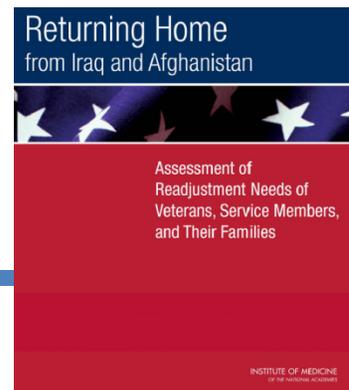


Women now constitute 14% of deployed forces in the US military, and an unprecedented number of female soldiers are deployed to combat areas. Although all service members are exposed to high levels of workplace stress, women in the military face some unique stressors, such as MST, which may affect their mental health and emotional well-being. Female veterans report a higher burden of medical illness and worse quality-of-life outcomes than do men who are exposed to the same levels of trauma. MST appears to be an important risk factor for the development of PTSD.

**The committee recommends that the Department of Defense and the Department of Veterans Affairs consider ways to remove barriers and improve women’s access to and use of health care in their systems. The two departments should examine issues related to women’s circumstances and stressors—such as military workplace stress, sexual harassment and assault, posttraumatic stress disorder, and premilitary trauma—in an effort to reduce disparities and to provide health care that is sensitive to their needs and preferences.**

# Recommendations for DoD and VA specific to women:

---



- Pay attention to whether outcomes of TBI depend on severity, #injuries, sex and ethnicity
- Examine issues related to women's circumstances and stressors  
(workplace sexual harassment & assault, PTSD, premilitary trauma)
- Oversample female populations
- Develop policy to eliminate MST due to association with poor readjustment when returning home

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Sex-Specific Reporting of Scientific Research: A Workshop Summary

# SEX-SPECIFIC REPORTING OF SCIENTIFIC RESEARCH

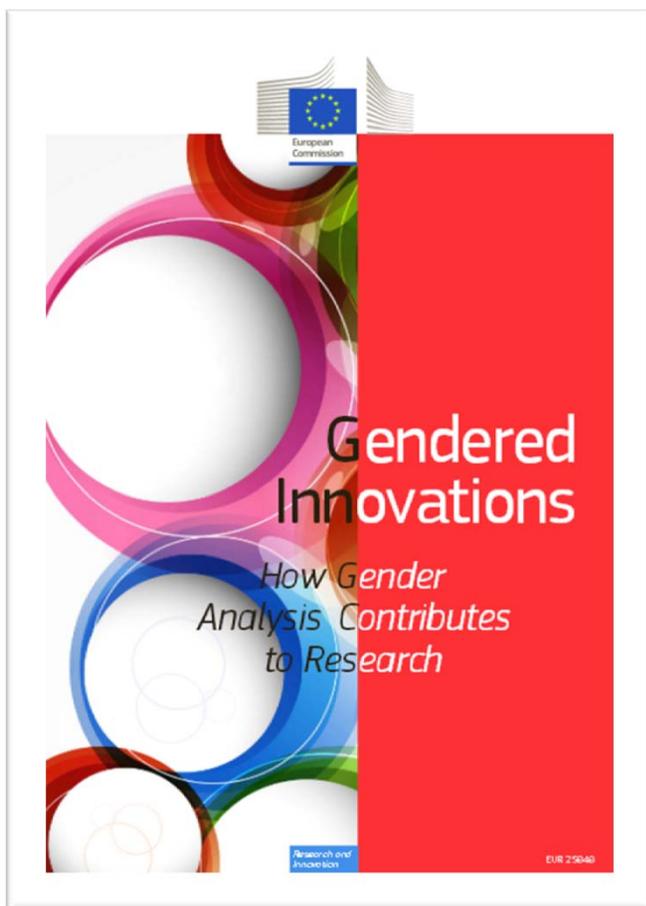
A WORKSHOP SUMMARY

Theresa M. Wizemann, Ph.D.  
*Rapporteur*

Board on Population Health and Public Health Practice

INSTITUTE OF MEDICINE  
OF THE NATIONAL ACADEMIES

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[www.nap.edu](http://www.nap.edu)



### Postconcussive Symptoms After Blast and Nonblast-Related Mild Traumatic Brain Injuries in Afghanistan and Iraq War Veterans

SARA M. LIPPA,<sup>1,2</sup> NICHOLAS J. PASTOREK,<sup>1,3</sup> JARED F. BENGE,<sup>1,4</sup> AND G. MATTHEW THORNTON<sup>1,2</sup>



Journal of Rehabilitation Research & Development  
Volume 46 Number 6, 2009  
Pages 667–672

### Pathology of blast-related brain injury

Jeffery D. Kocsis, PhD,<sup>1,2\*</sup> Alan Tessier, MD<sup>3</sup>

### Blast Overpressure in Rats: Recreating a Battlefield Injury in the Laboratory

Joseph B. Long, Timothy L. Benfley, Keith A. Wessner, Carolyn Cerone, Sheena Sweeney and Richard A. Baum  
June 2009, 26(6): 827-840.

J Head Trauma Rehabil  
Vol. 21, No. 5, pp. 338-402  
© 2006 Lippincott Williams & Wilkins, Inc.

### Military TBI During the Iraq and Afghanistan Wars

Deborah Warden, MD

### Traumatic Brain Injury in Operation Enduring Freedom/Operation Iraqi Freedom: A Primer

Katherine S. Fabrizio, ne<sup>1\*</sup>, Norman L. Keltner, ce, csw<sup>2</sup>

KEYWORDS  
• Brain injury • Blast • Military • Veterans

Approximately 1.64 million service members have been deployed as a part of Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF) 2001.<sup>1</sup> Fortunately, improvements in trauma care in the battlefield protective equipment have resulted in higher numbers of service members able to survive injuries that would have been fatal in the past.<sup>2,3</sup> In warfare through the increased use of explosive devices have members who are at increased risk for injury when compared with conflicts.<sup>4,5</sup> It is estimated that approximately 19.5% of the service have served as part of OEF/OIF. It is estimated that approximately 19.5% of the service (TBI) during deployment, which is equivalent to approximately



Review of sports-related concussion: Potential for application in military settings

Henry L. Lew, MD, PhD,<sup>1-3\*</sup> Darryl Thomander, PhD,<sup>2</sup> Kelvin T. L.

### Rehabilitation Needs of Combat-Injured Service Members Admitted to the VA Polytrauma Rehabilitation Center: The Role of PM&R in the Care of Wounded Warriors

Nino A. Sayer, PhD, David E. Calk, MD, Shane McKinnis, MD, Christine L. Chene, PhD, Barbara J. Siskind, MD, PhD, Steve Scott, MD,

### Giving Context to Post-Deployment Post-Concussive-Like Symptoms: Blast-Related Potential Mild Traumatic Brain Injury and Comorbidities

Laura L. S. Howe

### Symptom Complaints Following Reports of Blast Versus Non-Blast Mild TBI: Does Mechanism of Injury Matter?

Heather G. Belanger Ph.D., Zoe Proctor-Weber, Tracy Kretzmer, Michelle Kim, Louis M. French & Rodney D. Vanderploeg

Brain Injury, May 2011; 25(5): 511–525

### Neuropsychological evaluation of blast-related concussion: Illustrating the challenges and complexities through OEF/OIF case studies

NATHANIEL W. NELSON<sup>1,2</sup>, JAMES B. HOELZLE<sup>3</sup>, KATHRYN A. MCGUIRE<sup>2,4</sup>, AMANDA G. FERRIER-AUERBACH<sup>2,4</sup>, MOLLY J. CHARLESWORTH<sup>5</sup>, & SCOTT R. SPONHEIM<sup>2,4</sup>

who sustained combat-related TBIs will be presented.

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<sup>2</sup> University of Alabama School of Nursing, University of Alabama University Boulevard, Birmingham, AL 35294, USA  
<sup>3</sup> Corresponding author  
E-mail address: Katherine.Fabrizio@va.gov  
Nurs Clin N Am 45 (2010) 569-580  
doi:10.1016/j.ncl.2010.06.003  
0279-5665/10/\$ - see front matter. Published by Elsevier Inc.



Journal of Rehabilitation Research & Development  
Volume 46 Number 6, 2009  
Pages 655–666

### Acute clinical care and care coordination for traumatic brain injury within Department of Defense

Michael S. Jaffee, MD,<sup>1</sup> Kathy M. Helmick, CRNP,<sup>1</sup> Philip D. Girard, MS,<sup>1,2</sup> Kim S. Meyer, APRN,<sup>1</sup> Kathy Dinegar, LICSW,<sup>3</sup> Karyn George, MS, CRC<sup>1</sup>

Authors:  
David S. Cifu, MD  
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Barbara Sigford, MD, PhD

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From the PM&R Service (31C), Hunter Holmes McCann VA Healthcare System and Department of Physical Medicine and Rehabilitation, Virginia Commonwealth University (VCMU), Richmond, Virginia; the VA System Healthcare System (51C) and Harvard Medical School, Boston, Massachusetts; Defense and Veterans Brain Injury Center (DVIC), Washington, DC.

### INVITED REVIEW

### The History and Evolution of Traumatic Brain Injury Rehabilitation in Military Service Members and Veterans

**ABSTRACT**  
Cifu DX, Cohen SL, Lew HL, Jaffe M, Sigford B. The history and evolution of traumatic brain injury rehabilitation in military service members and veterans. *Am J Phys Med Rehabil* 2010;89:658–664.  
The field of traumatic brain injury has evolved since the time of the Civil War in response to the needs of patients with injuries and disabilities resulting from war. The Department of Veterans Affairs and the Defense and Veterans Brain Injury Center have been in the forefront of the development of the interdisciplinary approach to the rehabilitation of soldiers with traumatic brain injury, particularly those injured from the recent conflicts in Iraq and Afghanistan. The objectives of this literature review are to examine how the casualties resulting from major wars in the past led to the establishment of the current model of evaluation and treatment of traumatic brain injury and to review how the field has expanded in response to the growing cohort of military service members and veterans with TBI.

**Key Words:** Rehabilitation, War, Veterans, Brain Injury

### Assessing and treating veterans with traumatic brain injury.

French LM, Parkinson GW 2008 Aug;64(8):1004-13.



ORIGINAL CONTRIBUTION

Combat-Related Posttraumatic Headache: Diagnosis, Mechanisms of Injury, and Challenges to Treatment

GPT Matthew Kozminko, DO, MC, USA

Journal of the Neurological Sciences

journal homepage: www.elsevier.com/locate/jns



### Development of a rat model for studying blast-induced traumatic brain injury

Jingmin Cheng<sup>a,1</sup>, Jianwen Gu<sup>a,\*</sup>, Yuan Ma<sup>a,2</sup>, Tao Yang<sup>a,2</sup>, Yongqin Kuang<sup>a,3</sup>, Bingcang Li<sup>b,4</sup>, Jianyi Kang<sup>b,5</sup>

# Draft: Funding in TBI - 2012-2013

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- Department of Veterans Affairs budget up 10.5% (\$140.3B)<sup>2</sup>
  - ✓ • Focus areas: Disability Comp&Pensions (\$76.3B), unemployment (\$1B), homelessness programs (\$1.35B)
- Collaboration DoD and VA
  - ✓ • PTSD and TBI study (\$100M)<sup>4</sup>
  - Track Alzheimer's in Veterans with head injuries<sup>5</sup>
- Other Initiatives
  - ✓ – Affordable Care Act: increase in mental health funding for military personnel, veterans and families living in remote areas (\$9.8M)<sup>3</sup>
- Obama Administration Spending Plan
  - Programs cut within Substance Abuse and Mental Health Services Administration<sup>1</sup>

1. [http://www.washingtonpost.com/blogs/44/post/hhs-budget-to-remain-flat/2012/02/13/gIQAUnABBR\\_blog.html](http://www.washingtonpost.com/blogs/44/post/hhs-budget-to-remain-flat/2012/02/13/gIQAUnABBR_blog.html)  
2. [http://www.washingtonpost.com/blogs/44/post/obamas-2013-budget-would-boost-veterans-affairs-funding-105percent/2012/02/13/gIQAUnGBR\\_blog.html](http://www.washingtonpost.com/blogs/44/post/obamas-2013-budget-would-boost-veterans-affairs-funding-105percent/2012/02/13/gIQAUnGBR_blog.html)  
3. [http://www.upi.com/Health\\_News/2012/09/25/Healthcare-reform-funds-mental-health-help/UPI-54481348622750/](http://www.upi.com/Health_News/2012/09/25/Healthcare-reform-funds-mental-health-help/UPI-54481348622750/)  
4. <http://www.va.gov/opa/pressrel/pressrelease.cfm?id=2386>  
5. <http://www.research.va.gov/currents/#.UXGvkGd6KSq>

## *Themselves:*

# Quotes from women in Polytrauma with mTBI

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- "[I'm] overwhelmed with everything..."
- "[My] headache pain makes everyday things difficult..."
- "[I'm] no longer able to paint and play softball professionally..."
- "I'm losing hope [and] not how I used to be..."
- "Everything in life is going wrong. [I'm] not happy anymore..."
- "[I'm] trying to keep it together. [The] last year of life has been a living hell..."
- "I'm not the most mentally sound person..."
- "I would flip out with drop of a hat"
- "I have lots of problems"



**VA Palo Alto Polytrauma System of Care and  
Center for Digital Storytelling**

**Women Veterans with TBI: Digital Storytelling Workshop**



Inability to Cope

**Suicide ideation**

**Blurred Vision**

Substance Use/Dependence

Chronic Headaches

Fatigue

Disorientation

*Hopelessness*

Homelessness

Sleep Disturbances

Transgenerational trauma

**Depression**

*Forgetfulness*

NAUSEA

Cognitive Disorder

**PTSD**

**Assault**

*Irritability*

Anxiety

Dizziness/Vertigo

DISENFRANCHISED GRIEF

Military Sexual Trauma

Balance Problems

**Confusion**

**Chronic Pain**

Low Self Esteem

# *“In Her Own Words”*

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- These women represent about 7% of the VA Palo Alto Polytrauma women cohort.
- Diagnoses, symptoms and experiences include:

<b>Psychiatric</b>	<b>Post-concussive</b>	<b>Neurobehavioral</b>	<b>Other</b>
Suicidal Ideation	Chronic Headaches	Dizziness/Vertigo	Military Sexual Trauma
Depression	Chronic Pain	Lightheadedness	Low Self Esteem
PTSD	Hearing Impairments	Confusion	Assault
ETOH Dependence	Nausea	Disorientation	Disenfranchised Grief
Cognitive Disorder NOS	Sleep Disturbance	Irritability	Inability to Cope
Anxiety Disorder NOS	Balance Problems	Forgetfulness	Transgenerational Trauma
Hopelessness	Blurred Vision	Fatigue	Homelessness

# Storytelling Workshop

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- Invited women veterans with TBI
- Women themselves = storytellers
- Wrote their story, edited, chose images/music, technical production
- Three days



Do you have a personal story to tell about your brain injury? Get the support of other women with TBI and tell your story, using the power of digital storytelling. In this free, three-day workshop you will create a video of your story using images, music and your voice.

Get a copy of your story on DVD!

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***Tell us your story  
in your own words***

Journal of the International Neuropsychological Society (2010), 16, 856–866.  
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doi:10.1017/S1551280710000743

Postconcussive Symptoms After Blast and Nonblast-Related Mild Traumatic Brain Injuries in Afghanistan and Iraq War Veterans

SARA M. LIPPA,<sup>1,2</sup> NICHOLAS J. PASTOREK,<sup>1,3</sup> JARED F. BENGE,<sup>1,4</sup> AND G. MATTHEW THORNTON<sup>1,2</sup>

Journal of Neurotrauma

### Blast Overpressure in Rats: Recreating a Battlefield Injury in the Laboratory

Joseph B. Long, Timothy L. Bentley, Keith A. Wessner, Carolyn Cerone, Sheena Sweeney and Richard A. Bannister

### Traumatic Brain Injury in Operation Enduring Freedom/Operation Iraqi Freedom: A Primer

Katherine S. Fabrizio, ne<sup>a,\*</sup>, Norman L. Keltner, ne<sup>a,b</sup>

KEYWORDS

JRRD  
Journal of Rehabilitation Research & Development

Review of sports-related concussion: Potential for application in military settings

Henry L. Lew, MD, PhD,<sup>1,2,3</sup> Darryl Thomander, PhD,<sup>2</sup> Kelvin T. L.

### Military TBI During the Iraq and Afghanistan Wars

Deborah Warden, MD

### Rehabilitation Needs of Combat-Injured Service Members Admitted to the VA Polytrauma Centers

John A. Warden, MD, PhD, Steve Scott, MD, PhD

JRRD  
Department of Veterans Affairs  
Rehabilitation Research & Development  
Journal of Rehabilitation Research & Development  
Volume 46 Number 6, 2009  
Pages 667–672

### Pathology of blast-related traumatic brain injury

Jeffery D. Kocsis, PhD,<sup>1,2\*</sup> Alan Tessier, PhD,<sup>1,2</sup>

The Clinical Neuropsychologist

### Symptom Complaints Follow Injury Mechanism: Does Mechanism of Injury Matter?

Heather G. Belanger PhD, Zoe Proctor-Weber, Tra

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Disclosures:

Financial disclosure statements have been obtained, and no conflicts of interest have been reported by the authors or by any individuals in control of the content of this article.

0891-4122/09/4606-667-10  
American Journal of Physical Medicine & Rehabilitation  
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DOI: 10.1097/PHM.0b013e3181d2d2d2

INVITED REVIEW

### The History and Evolution of Traumatic Brain Injury in Military Service Members and Veterans

ABSTRACT

Cifu DS, Cohen GL, Lew HL, Joffe M, Stifford D. The history of traumatic brain injury rehabilitation in military service members and veterans. *Am J Phys Med Rehabil* 2010;46:667–684. The field of traumatic brain injury has evolved since the time of the Civil War in response to the needs of patients with injuries and disabilities resulting from war. The Department of Veterans Affairs and the Defense and Veterans Brain Injury Center have been in the forefront of the development of the interdisciplinary approach to the rehabilitation of soldiers with traumatic brain injury, particularly those injured from the recent conflicts in Iraq and Afghanistan. The objectives of this literature review are to examine how the knowledge resulting from major wars in the past led to the establishment of the current model of evaluation and treatment of traumatic brain injury and to review how the field has expanded in response to the growing cohort of military service members and veterans with TBI.

Key Words: Rehabilitation, War, Veterans, Brain Injury

The essentials of rehabilitation therapies may be traced back millennia to the ancient Greeks and Romans, who used leeches, massage, electrical currents, heat, and cold to relieve pain.<sup>1</sup> As noted in the past, the field of rehabilitation has experienced vicissitudes in the past century due to injuries and disability from war and the concomitant advances in battlefield medicine that have dramatically increased survival rates. Traumatic brain injury (TBI) rehabilitation has historically lagged behind that of amputation and general orthopedic rehabilitation, but in the past decade, there has been a great expansion of TBI services provided to persons serving in the military.<sup>2,3</sup> This literature review examines the influence of major wars on the development of TBI rehabilitation services over the past two centuries, from the Civil War to the present day conflicts in Iraq and Afghanistan, and provides a glimpse into the future of TBI rehabilitation.

Historical Evolution of TBI Rehabilitation in the Military

Before the 20th century, severe TBI was generally considered fatal.<sup>4,5</sup> During the Civil War (1861–1865), gunshot wounds to the head were seen in

*Am. J. Phys. Med. Rehabil.* • Vol. 89, No. 6, August 2010

# Summary

- Methodology
- Subpopulation
- Gendered Innovations

Volume 46 Number 6, 2009

Pages 665–666

### Acute clinical care and care coordination for traumatic brain injury within Department of Defense

Michael S. Jaffee, MD,<sup>1</sup> Kathy M. Helmick, CRNP,<sup>1</sup> Philip D. Girard, MS,<sup>1,2\*</sup> Kim S. Meyer, APRN,<sup>1</sup> Kathy Dinegar, LICSW,<sup>2</sup> Karyn George, MS, CRC<sup>1</sup>

J Clin Psychol

### Assessing and treating veterans with traumatic brain injury.

French LM, Parkinson GW 2008 Aug;64(8):1004-13.

JAOA ORIGINAL CONTRIBUTION

Combat-Related Posttraumatic Headache: Diagnosis, Mechanisms of Injury, and Challenges to Treatment

CPT Matthew Kozminski, DO, MC, USA

Contents lists available at ScienceDirect

Journal of the Neurological Sciences

journal homepage: www.elsevier.com/locate/jns

ELSEVIER

### Development of a rat model for studying blast-induced traumatic brain injury

Jingmin Cheng<sup>a,1</sup>, Jianwen Gu<sup>a,2\*</sup>, Yuan Ma<sup>a,2</sup>, Tao Yang<sup>a,2</sup>, Yongqin Kuang<sup>a,3</sup>, Bingcang Li<sup>b,4</sup>, Jianyi Kang<sup>b,5</sup>



Thank you