DEPARTMENT OF THE ARMY
US ARMY CENTER FOR HEALTH PROMOTION AND PREVENTIVE MEDICINE
5158 BLACKHAWK ROAD
ABERDEEN PROVING GROUND MD 21010-5403

MCHB-TS-DI

12 August 2009

MEMORANDUM FOR Office of the Assistant Secretary of the Army (I & E), 110 Army Pentagon, (DASA-ESOH/Mr. Tad Davis), Washington, DC 20310

SUBJECT: Injury Prevention Report No. 12-HF-0AN7A-09, US Army Deployment Injury Surveillance Summary, CY 2007.

1. We are enclosing a copy of the subject report with an Executive Summary. The ASA(I&E) provided initial funding in 2004 for the USACHPPM to conduct deployment injury surveillance. A primary objective was to identify causes of non-battle injury and to monitor these causes during the on-going deployments (Operations Iraqi Freedom and Enduring Freedom). This report summarizes the non-battle injury incidence and causes for calendar year 2007. This is the latest report to be produced from the analyses.

2. Please contact us if you have any comments or questions regarding this report.

3. The point of contact at the US Army Center for Health Promotion and Preventive Medicine is Dr. Bonnie J. Taylor, Injury Prevention Program, commercial (410) 436-5481 or DSN 584-5481. Dr. Taylor may also be reached by electronic mail at bonnie.taylor4@us.army.mil.

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U.S. Army Center for Health Promotion and Preventive Medicine

INJURY PREVENTION REPORT NO. 12-HF-0AN7A-09
U.S. ARMY DEPLOYMENT INJURY SURVEILLANCE SUMMARY
CY 2007
1 JANUARY 2007–31 DECEMBER 2007

Approved for public release; distribution is unlimited.

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14. ABSTRACT
The U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM) maintains an injury surveillance system for deployed Soldiers. U.S. Transportation Command's Regulating and Command & Control Evacuation System (TRAC^{2}ES) data for Soldiers medically air evacuated from U.S. Central Command while deployed for Operation Iraqi Freedom (OIF; March 2003-December 2007) and Operation Enduring Freedom (OEF; October 2001-December 2007) was coded for cause of injury. Additional sources of injury data were the Standard Inpatient Data Records and Defense Casualty Information Processing System data. Descriptive statistics were used to show non-battle injury (NBI) rates over time, the frequencies of NBIs and fatalities, all injuries compared to disease diagnosis groups, and causes of NBIs. Injury matrices were used to describe the frequency of NBIs by body region and nature of injury. For OIF, NBI rates decreased over time from a high in 2003. The OEF NBI rates increased over time. For OIF and OEF combined, injuries (battle and non-battle combined) comprised 52% of all battle/non-battle/disease incidents. Leading causes of NBIs were sports/physical training, falls/jumps, and motor vehicle accidents. Recommendations are to continue surveillance of deployment injuries and identify modifiable risk factors that contribute to the leading causes of injury to inform injury prevention practice and policy.

15. SUBJECT TERMS
Army, injuries, NBIs, surveillance, OIF, and OEF

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EXECUTIVE SUMMARY
INJURY PREVENTION REPORT NO. 12-HF-0AN7A-09
U.S. ARMY DEPLOYMENT INJURY SURVEILLANCE SUMMARY 2007
1 JANUARY 2007–31 DECEMBER 2007

1. PURPOSE. The aims of this report are to—

a. With respect to Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF) deployed Soldiers—

(1) Describe the relative impact of injury compared to disease for calendar year (CY) 2007.

(2) Provide non-battle injury (NBI) rates and trends from 2003–2007.

(3) Identify leading diagnoses and causes of non-battle injury for CY 2007.

b. Draw conclusions and make recommendations to advance Army injury prevention.

c. Provide summaries of key U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM) CY 2007 analytic deployment surveillance projects on injuries among deployed Soldiers.

2. CONCLUSIONS.

a. Army OIF/OEF Deployment Injury Surveillance Summary 2007. Routinely collected air evacuation, inpatient hospitalization, and casualty data provide the basis for deployment injury surveillance during current Army deployments in support of OIF and OEF. Non-battle injuries are notably the most significant cause of medical evacuations and inpatient hospitalizations. The leading causes of these NBIs indicate that they are likely preventable. Timely reporting of injury rates, types, and causes should allow Commanders and Army leaders to focus attention on prevention strategies and policies while the operations are ongoing.

b. Results of Analytic Deployment Injury Surveillance Projects, CY 2007. The leading causes of NBIs in OIF and OEF were falls/jumps, sports/physical training, and motor vehicle accidents (MVAs). Fall and jump injuries from one level to another were more prevalent than those on the same level or from a ladder/stairs. Basketball, football, physical fitness training, and weight lifting were the primary sports involved in medically air-evacuated sports injuries from OIF. Motor vehicle collisions were more common than rollovers for OIF; however, that was not the case for OEF. The MVAs, self-inflicted injuries, and air transportation accidents were leading causes of non-battle fatalities. Ninety-one percent of self-inflicted deaths were caused by the use of the victim's own weapon.

3. RECOMMENDATIONS.

a. Continue timely surveillance of deployment injury.

b. Link additional data sources to provide an enhanced description of deployment injury.

c. Conduct further research to identify modifiable risk factors that contribute to the leading causes of injury.

d. Devote additional study to falls/jumps, sports/physical training (PT), and land transport injury prevention.

e. Investigate the use and effectiveness of the following injury prevention strategies/interventions:

(1) Rollover accident: vehicle exiting.

(2) Seatbelt use compliance.

(3) Signs of suicide.

(4) Fall prevention and jumping with full load/personal protective equipment.

(5) Weight lifting safety.

f. Explore the relationship of mental health-care utilization and self-inflicted injury.

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REPORT 12-HF-0AN7A-09
U.S. ARMY OIF/OEF DEPLOYMENT INJURY SURVEILLANCE SUMMARY
CY 2007 1 JANUARY–31 DECEMBER 2007

1. REFERENCES. References are listed in Appendix A.

2. PURPOSE. The aims of this report are to—

a. With respect to Operation Iraqi Freedom (OIF) and Operation Enduring Freedom (OEF) deployed Soldiers:

(1) Describe the relative impact of injury compared to disease for Calendar Year (CY) 2007.

(2) Provide non-battle injury (NBI) rates and trends from 2003–2007.

(3) Identify leading diagnoses and causes of NBI for CY 2007.

b. Draw conclusions and make recommendations to advance Army injury prevention.

c. Provide summaries of key U.S Army Center for Health Promotion and Preventive Medicine (USACHPPM) CY 2007 analytic deployment surveillance projects on injuries among deployed Soldiers.

3. AUTHORITY. Army Regulation (AR) 40-5 (25 May 2007), Section 2-19, Preventive Medicine.

4. ARMY OPERATION IRAQI FREEDOM (OIF) AND OPERATION ENDURING FREEDOM (OEF) DEPLOYMENT INJURY SURVEILLANCE SUMMARY 2007.

a. Background. Injuries are the biggest health problem confronting U.S. military forces in garrison and combat operations, resulting in over 1.8 million medical encounters annually for the Services and affecting more than 800,000 Service members.[1] During military deployments, NBIs have become a major cause of morbidity and mortality. As morbidity and mortality from infectious disease decreased over time from World War I to the Vietnam War, injury replaced disease as the leading category of hospital admissions for all disease and NBIs.[2] This same pattern held true for Operations Desert Shield and Storm (Southwest Asia, 1990–1991) and Operation Joint Endeavor (Bosnia, 1995–1996).[3] For present operations OIF and OEF, NBIs were more frequently reported in medical air–evacuation and hospitalization data than battle injuries or any other individual disease diagnosis group.[4,5,6]

(1) The study of injury diagnoses, which encompasses the nature of the injury and body region, is of interest due to the significance of the injuries to longer term Soldier health and operational readiness. Studies often look at the breakdown of diagnoses within a specific diagnosis category. Adjustment disorders were shown to be the most common psychiatric diagnosis category of OIF/OEF military personnel air–evacuated out of theater between 2001 and 2004.[7] Studies will also look at the breakdown of battle/non-battle/disease origin within a specific diagnosis category. Head and neck injuries are of immediate interest due to the fundamental nature (that is, exposure to explosions and blasts) of the present operations[8] The frequency of recurrent headaches [9] and traumatic brain injuries (TBIs)[9,10] are included in this category. Eye injuries have been shown to be more frequently battle-related [11], whereas, orthopedic injuries have been shown to be more frequently non-battle-related[12].

(2) This report uses injury data that has been coded from incident narratives for cause of injury. Standardized coding of injury causes is not typically included in administrative, medical, casualty, or safety collections of information (data records). Therefore, causes are not analyzed and reported universally. One previous study looked specifically at the causes of oral-facial injuries. Of the oral-facial medical air–evacuations due to NBI, the nature of injury was primarily fractures of the jaw, largely caused by motor vehicle accidents and fighting.[13] Cause of injury is also being described in the literature in a more general, ad–hoc fashion. Risk factors for snake, scorpion, and spider bite and sting injuries have been described among military deployed in OIF/OEF.[14] The leading causes of fatal injury for coalition forces in OIF/OEF in 2006–2007 were identified as air–transport accidents and improvised explosive device (IED) incidents. Both of these cause categories are likely to result in multiple deaths per incident.[15]

(3) Rates are an important part of surveillance data analysis. Battle, non-battle, and disease rates can differ within a particular operation over time[16] and between operations[5]. Rates may also vary by type of outcome (such as, hospitalization, air evacuation, death). Determining the factors that are related to these differences in rates is as important as knowing the rates themselves. Also, tracking the trends for injury and disease over time highlights areas in need of intervention due to the magnitude of the problem, undesirable changes over time, or undesirable differences between locations and operations.

b. Methods.

(1) Injury Data Sources.

(a) Injury data for air–evacuated Soldiers were obtained from the U.S. Transportation Command's Regulating and Command & Control Evacuation System (TRAC^{2}ES). These data are routinely collected and used to request and coordinate medical air evacuation of Service members with serious injuries and diseases. Fatality data were obtained from the Defense Casualty Information Processing System (DCIPS). These data are routinely collected and used for casualty tracking and mortuary affairs. Standard Inpatient Data Records (SIDR) were

obtained from the Patient Administration Systems and Biostatistics Activity (PASBA). These electronic records were created from medical records that were forwarded to PASBA after Soldiers were hospitalized during deployments. These SIDR records are the official electronic record of a hospitalization in a Department of Defense (DOD) medical facility. The DCIPS and SIDR data were linked with TRAC^{2}ES data prior to analysis.

(b) Injury data for yearly rate calculations were obtained for the same population from the same sources for the 2003–2007 CY.

(2) Relative Importance of Injury and Disease Information.

(a) Primary Diagnosis Groups from the International Classification of Diseases, 9th Revision, Clinical Module (ICD-9-CM) and Battle Injury (BI)/NBI/Disease indicators were used to create the relative importance of injury and disease figure using in-Central Command (CENTCOM) fatality, out-of-CENTCOM medical air evacuation, and in-CENTCOM hospitalization data. All injuries are based on the fatal casualty report, out-of-CENTCOM air evacuation patient movement, or initial inpatient hospitalization record. This approach was used to avoid double-counting Soldiers who were both hospitalized in-CENTCOM and air evacuated out-of-CENTCOM. In such cases, only the initial event contributed to the injury count.

(b) A "30–day" hospitalization and air evacuation exclusion were used so that injury hospitalizations or medical air evacuations for the same diagnosis within a 30–day timeframe of the initial event were not included in the analysis.

(3) Non-Battle Injuries.

(a) All OIF/OEF deployed U.S. Army Soldiers, who met at least one of the following criteria for CY 2007, were included in the NBI category and analyses–

(1) Death from an NBI that occurred within the CENTCOM theater.

(2) An NBI that required hospitalization in-CENTCOM.

(3) An NBI that required air evacuation out-of-CENTCOM.

(b) The NBIs that required air evacuation only within CENTCOM were excluded from these analyses.

(4) Injury Rate Calculations. The NBI rates calculated in this report were based on all NBIs as defined above. Data for person-years (PY) of deployment were obtained from the Statistical Information Analysis Division of the Defense Manpower Data Center (DMDC).[17]

(5) Causes of Non-Battle Injury.

(a) Causes of NBIs were identified from narrative patient histories in the air–evacuation and fatal casualty records. Trained coders used the coding scheme from the North Atlantic Treaty Organization (NATO) Standardization Agreement (STANAG) No. 2050, 5th Edition (Military Agency for Standardization, 1989) to categorize the cause of injury.[18] The STANAG coded causes of injury were already present in the in CENTCOM hospitalization records (SIDR) from PASBA. The STANAG codes are four-digit codes describing the intent/situation of the injury incident, injury cause, and where the injury occurred. The first digit is the trauma code indicating the type of injury that occurred (that is, battle, intentional non-battle, or unintentional non-battle). The second through fourth digits indicate the cause of injury, identifying the specific causative agent and in some cases where the injury occurred.

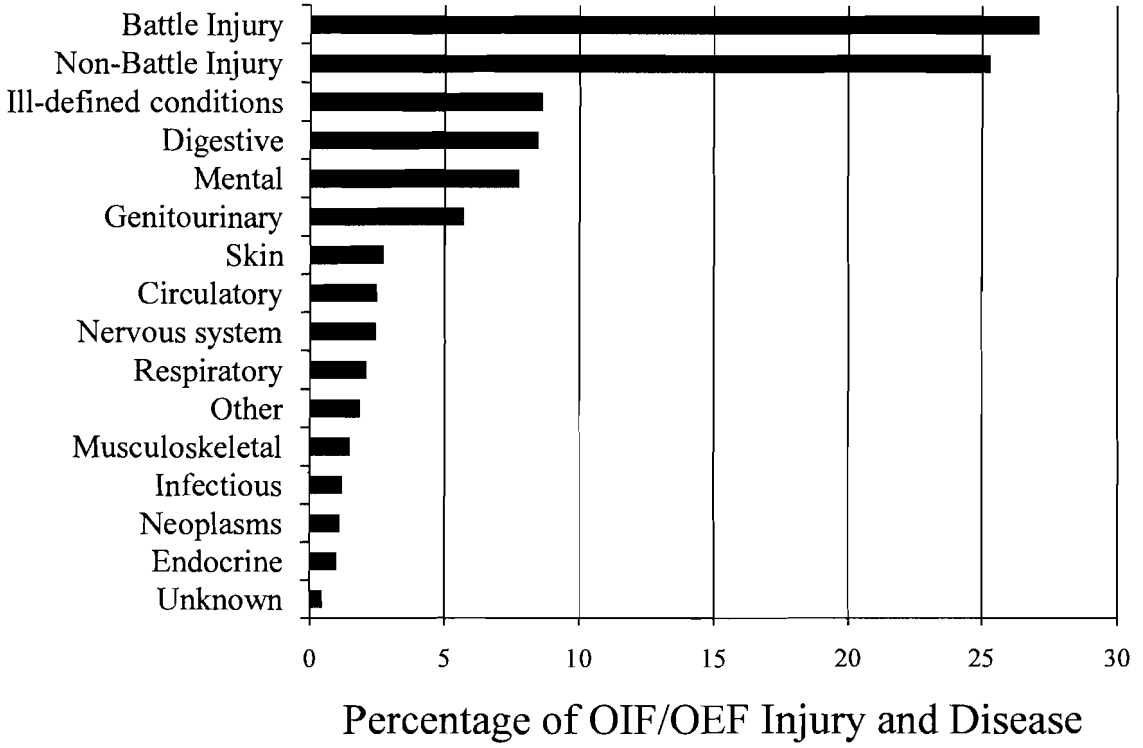
(b) Causes of NBI during CY 2007 were summarized for the in-CENTCOM fatalities, in CENTCOM hospitalizations, and out-of CENTCOM air evacuations.

(6) Nature of Injury by Body Region Matrices for NBIs.

(a) The Barell[(19)] injury matrix was used to display injury frequencies for traumatic NBIs (ICD-9-CM codes 800-995) in a standardized format with the nature of the injury listed horizontally, across the top of the table, and body region listed vertically along the left side of the table.

(b) A similar matrix format was used to display frequencies for injury-related musculoskeletal conditions (subset of ICD-9-CM codes 719-739). Data used for these matrices included only NBIs that required air evacuation out-of-CENTCOM or in-CENTCOM hospitalizations.

c. Results.



Note: Includes injury and disease resulting in in-CENTCOM fatality, in-CENTCOM hospitalization, or out-of CENTCOM air evacuation.

Figure 1. Distribution Percentage (%) of Injury and Disease by Diagnosis Category among U.S. Army Soldiers, OIF/OEF, CY 2007

- Figure 1 shows the percentage of injuries (battle and non-battle) and disease by primary diagnosis groups (ICD-9-CM code) for CY 2007.

- In 2007, there were 11,822 in-CENTCOM fatalities, in-CENTCOM hospitalizations and out-of-CENTCOM medical air evacuations.

- The BI and NBIs combined accounted for 52.4 percent (n=6,200) of these deployment events, more than 6 times as many as the second leading diagnosis group, "symptoms, signs, and ill-defined conditions" (n=1,023, 8.7 percent).

- A Soldier could experience more than one injury within the year. Of the 6,200 BIs and NBIs, 6030 Soldiers were affected. Injured Soldiers comprised 53 percent of the individuals who died, or were hospitalized, or air evacuated.

Table 1. Non-Battle Injuries among U.S. Army Soldiers Deployed for OIF/OEF, CY 2007

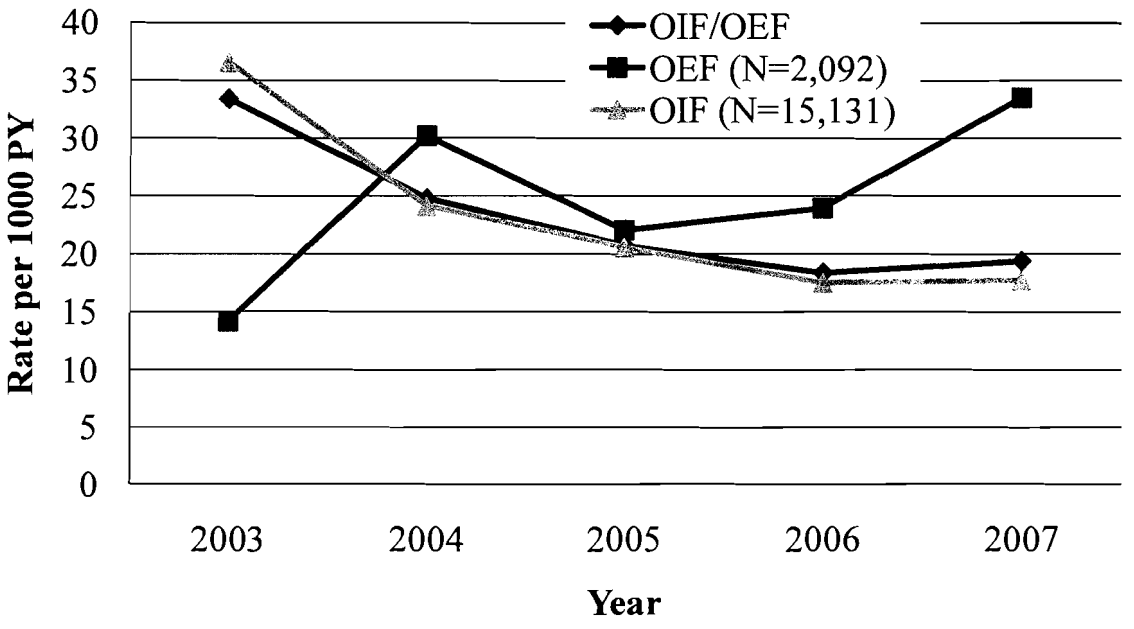
	Frequency[1]		**Percentage of NBIs (N=2992)**
Deaths[2]	120		4.0
Inpatient Hospitalization[3]	1,004		33.6
	With Air Evacuation	460	
	Without Air Evacuation	544	
Air Evacuation without Inpatient Hospitalization	1,868		62.4

Notes:
[1]Includes acute injury and injury-related musculoskeletal conditions.
[2]Death count was obtained from DCIPS data.
[3]Hospitalization data were obtained from SIDR. Air–evacuation data were obtained from TRAC[2]ES

- Table 1 provides a summary of deployment NBI casualties for 2007.

- For every 1 deployment injury-related death, there were 8 hospitalizations (4.5 without medical air evacuation and 3.8 with medical air evacuations) and 16 medical air evacuations without hospitalization (ambulatory patients).

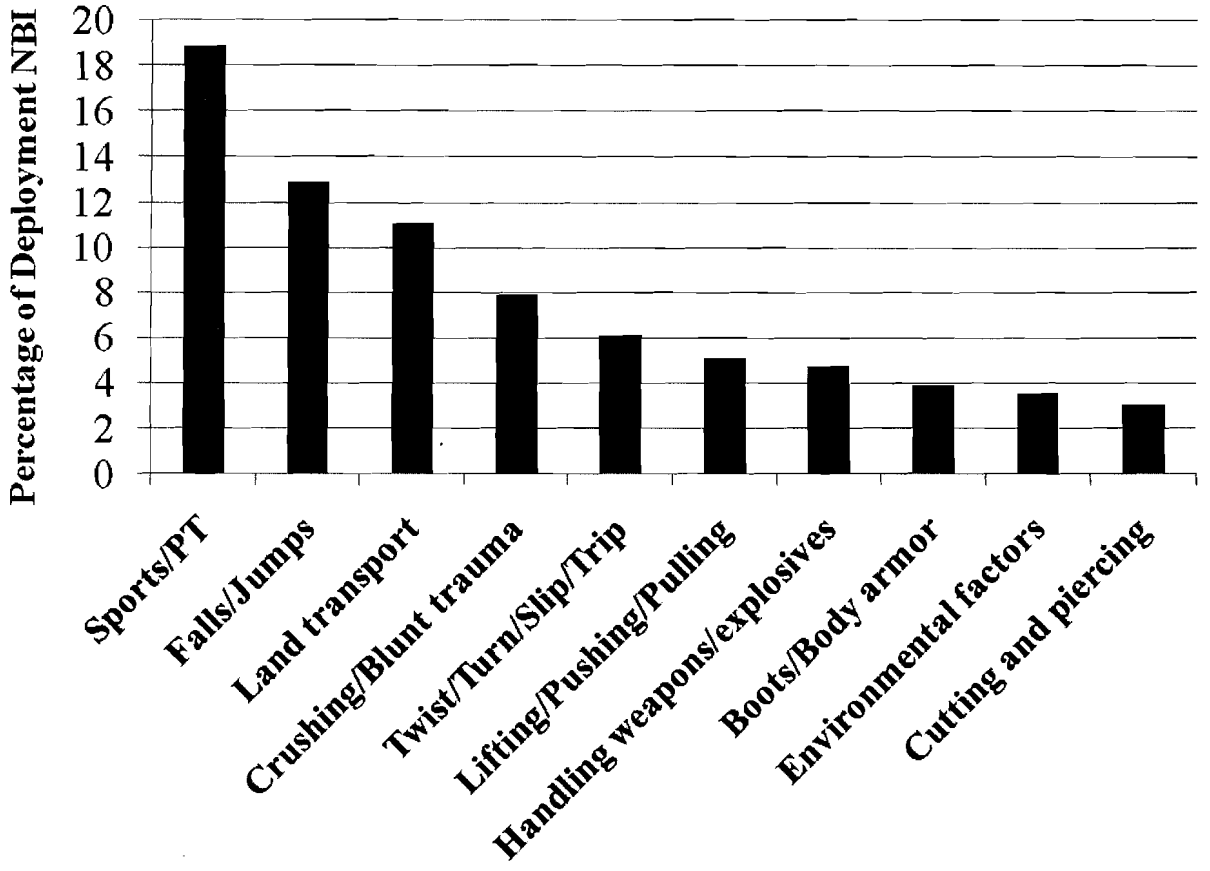
- Fatalities have been a major focus of prevention resources in the past. However, as shown by these data, there are far more injuries that result in medical-air evacuation or hospitalization than result in death. These non-fatal outcomes result in significant lost-duty time and decreased operational readiness for the Army.



Notes:
[1] Includes NBIs that resulted in in-CENTCOM fatality, in-CENTCOM hospitalization, or out-of-CENTCOM air evacuation.
[2] Denominators for the rates were unclassified data obtained from the Statistical Information Analysis Division of the DMDC.

Figure 2. Non-Battle Injury Rates among U.S. Army Soldiers Deployed for OIF/OEF, CYs 2003-2007[1,2]

- Figure 2 illustrates OIF/OEF Army NBI rates from 2003–2007.
- The OIF/OEF NBI rates have decreased over time.
- The OIF NBI rates have decreased over the period and have been consistently greater than 15 injuries per 1,000 person-years.
- The OEF NBI rates have increased over the years, rising from 14 to over 34 injuries per 1,000 person-years.



Note: Percentages are of the portion of 2007 deployment NBIs that were cause coded (N=2,184). The NBIs include fatal casualty, hospitalization, and air–evacuation data

Figure 3. Causes of Non-Battle Injury among U.S. Army Soldiers Deployed for OIF/OEF, CY 2007

- Figure 3 illustrates the distribution of the leading NBI causes by STANAG 2050 injury causes code groups.

- In 2007, cause of injury was identified for 2,184 of the NBIs (73 percent).

- 19 percent of cause coded NBIs were due to sports and PT. The leading causes of sports-related NBIs were: basketball (30 percent), football (15 percent), PT (15 percent), and weightlifting (14 percent).

- Another 19 percent of cause coded NBIs were caused by falls and jumps (13 percent) or near-falls (6 percent), which are categorized as twists, turns, slips, or trips, in the STANAG coding scheme.

- The third leading cause was accidents involving land transport vehicles (11 percent).

Table 2. Frequency of Traumatic Non-Battle Injuries by Location and Nature of Injury, U.S. Army, OIF/OEF, CY 2007

			Fracture	Dislocation	Sprains/ Strains	Internal	Open Wound	Amputations	Blood Vessel	Contusion/Superficial	Crush	Burns	Nerves	Unspecified	System-wide & late effects	Total	Percent	Percent by Body Region
Head and Neck	Traumatic Brain Injury (TBI)	Type 1 TBI	19			17				1			0			25	1.5	
		Type 2 TBI	3			63										66	4.0	
		Type 3 TBI	0													0	0.0	5.5
	Other Head, Face, Neck	Other head					6					0	0	22		28	1.7	
		Face	43	0	0		12					4				60	3.6	
		Eye					3			6		0	0			9	0.5	
		Ear	2		0		0				0	0	4			6	0.4	
		Head, Face, Neck Unspec.							0	7	0	4	0	3		14	0.9	7.1
Spine and Back	Spinal Cord (SCI)	Cervical SCI	2			0										2	0.1	
		Thoracic/Dorsal SCI	1			0										1	0.1	
		Lumbar SCI	0			3										3	0.2	
		Sacrum Coccyx SCI	0			0										0	0.0	
		Spinal Back Unspec. SCI	1			2										3	0.2	0.5
	Vertebral Column (VCI)	Cervical VCI	8	1	8											17	1.0	
		Thoracic/Dorsal VCI	6	0	1											7	0.4	
		Lumbar VCI	8	0	12											20	1.2	
		Sacrum Coccyx VCI	1	1	0											2	0.1	
		Spine, Back Unspec. VCI	5	0												5	0.3	3.1
Torso	Torso	Chest (Thorax)	4	0	2	4	0		0	1	1	1	0			13	0.8	
		Abdomen				7	1		0	1		0	4			13	0.8	
		Pelvis, Groin/Genital	15	0	4	1	4		0	1	0	1	1			27	1.6	
		Trunk	0				0			0	0	0	0	6		6	0.4	
		Back, Buttock			17		1			1	0	1		4		24	1.5	4.4
Extremities	Upper	Shoulder, Upper Arm	28	54	78		0	2		1	1	1		9		174	10.6	
		Forearm, Elbow	45	3	2		6	1		1	0	2				60	3.6	
		Wrist, Hand, Fingers	134	10	11		59	26		7	17	4		16		284	17.3	
		Other & Unspec.	0		0		2	0	1	1	0	5	33	3		45	2.7	34.2
	Lower	Hip	6	4	2					3	0					15	0.9	
		Upper Leg, Thigh	8	1	2			0		1	1	1				12	0.7	
		Knee	2	153	24					2	0	0				181	11.0	
		Lower leg, Ankle	125	8	29		1	1		1	0	0				162	9.9	
		Foot, toes	46	2	3		13	0		4	2	1				71	4.3	
		Other & Unspec.	8		19		31	0	2	2	0	1	1	31		93	5.7	32.5
Unclass. by Site	Other, Unspecifie	Other/Multiple	0						0			0	4			4	0.2	
		Unspecified	21	2	9	0	2		0	1	1	10	0	8		55	3.4	3.6
	System-wide & late effects														147	147	8.9	
Total			531	237	214	97	140	30	3	41	23	36	47	98	147	1644		
Percent			32.3	14.4	13.0	5.9	8.5	1.8	0.2	2.5	1.4	2.2	2.9	6.0	8.9			

NOTES:

ICD-9-CM 800-995 CODES. Includes only injury resulting in out-of-CENTCOM air evacuation or in-CENTCOM hospitalization. Fatal NBIs from DCIPS are not included because DCIPS does not have ICD-9-CM diagnosis codes.

- Table 2 uses the Barell[19] injury matrix to categorize traumatic NBIs that required medical air evacuation or hospitalization by nature of injury and body region.

- In 2007, there were 1,644 NBIs that required medical air evacuation or inpatient hospitalization (coded in the 800-900 ICD-9-CM code series).

- The most common types of injury leading to medical air evacuation or hospitalization were fractures (32 percent), dislocations (14 percent), and sprains/strains (13 percent).

- Injured body regions most commonly leading to hospitalization or medical air evacuation were upper extremities (34 percent); lower extremities (32 percent); and head, face, and neck injuries (13 percent).

- Leading specific reasons for medical air evacuation or hospitalization included dislocation of the knee (9 percent), fracture of the wrist, hand, and/or fingers (8 percent), fractures of the lower leg and/or ankle (8 percent).

Table 3. Frequency of Non-Battle Injury-Related Musculoskeletal Conditions by Location and Nature of Injury, U.S. Army, OIF/OEF, CY 2007

			Inflammation and Pain (Overuse)	Joint Derangement	Joint Derangement with Neurological	Stress Fracture	Sprains/ Strains/ Rupture	Dislocation	Total	Percent	Percent by Body Region
Spine and Back	Vertebral Column (VCI)	Cervical VCI	42	15	22				79	9.5	49.1
		Thoracic/Dorsal VCI	0	0	27				27	3.2	
		Lumbar VCI	132	48	10				190	22.9	
		Sacrum-Coccyx VCI	1	0	0				1	0.1	
		Spine, Back Unspec. VCI	73	25	13	0			111	13.4	
Extremities	Upper	Shoulder	50	9			16	5	80	9.6	12.9
		Upper Arm, Elbow	7	0		0		0	7	0.8	
		Forearm, Wrist	3	0	1	0	3	0	7	0.8	
		Hand	0	2			14	1	17	2.0	
	Lower	Pelvis/Hip, Thigh	18	0	1	2	2	0	22	2.6	28.4
		Lower leg, Knee	42	67		6	46	0	161	19.4	
		Ankle, Foot	99	11	5	3	3	0	53	6.4	
Unclass. by Site	Other, Unspecified	Other specified/Multiple	1	1		0	0	0	2	0.2	9.6
		Unspec. Site	16	5	38	1	9	0	78	9.4	
Total			423	183	110	19	90	6	831		
Percent			50.9	22.0	13.2	2.3	10.8	0.7			

Note:
ICD-9-CM 710-739 CODES. Includes only injury resulting in out-of-CENTCOM air evacuation or in-CENTCOM inpatient hospitalization. Fatal NBIs from DCIPS are not included because DCIPS does not have ICD-9-CM diagnosis codes.

- Table 3 categorizes NBIs-related musculoskeletal conditions that required medical air evacuation or hospitalization by nature of injury and body region affected.

- In 2007, 831 NBIs required medical air evacuation or hospitalization (coded in the 719-739 ICD-9-CM series).

- The most common types of musculoskeletal conditions leading to medical air evacuation or hospitalization were inflammation and pain (overuse) (51 percent), joint derangement (22 percent), and joint derangement with nerve pain (13 percent).

- The spine/back (49 percent) was the body region most affected by injury-related musculoskeletal conditions, followed by lower extremities (28 percent), and upper extremities (13 percent).

- The leading specific injury-related musculoskeletal conditions were inflammation and pain (overuse) involving the lumbar spine (16 percent), inflammation and pain (overuse) involving the spine, unspecified location (9 percent), and joint derangement to the lower leg and/or knee (8 percent).

d. Discussion.

(1) For CY 2007, NBI was the second largest single diagnosis category that resulted in in-CENTCOM death or hospitalization or out-of-CENTCOM air– evacuation. Twenty-five percent of the air evacuated and hospitalized Soldiers had an NBI and 27 percent had a BI . Each of the disease categories accounted for a smaller proportion of these casualties.

(2) During military deployments, the distributions of NBI and disease are often reported as a combined disease and non-battle injury (DNBI) category. In this report for CY 2007, 73 percent of hospitalized or air–evacuated Soldiers were DNBI. A previous description of medical air evacuations from OIF by Harman showed 6 times more DNBIs than battle injuries, and 41 percent of all cases were evacuated for injuries or injury-related musculoskeletal conditions.[4] Sanders et al. reported that 35 percent of surveyed military personnel deployed to OIF/OEF during 2003-2004 self-reported having experienced an NBI.[6] According to Wojcik et al., NBI was the leading diagnosis group within DNBI for hospital admissions of OEF and OIF Soldiers from operation start dates through December 2004, accounting for 21 percent and 28 percent of admissions respectively.[5] These previous studies support our present findings showing the magnitude of the relative importance of NBIs. Describing the impact of the consequences of these injuries is being pursued.[20]

(3) The annual NBI rates for OIF and OEF combined gradually decreased over time from a high in 2003. Injury rates and trends for OIF and OEF were previously reported or suggested by other descriptive studies. During OIF-1 (21Mar-30Apr 2003) and OIF-2

(1Mar 2004–30Apr 2005), the majority of casualties were DNBI (75.0 percent).[16] There was a higher proportion of wounded in action (WIA) casualties during OIF-1 than OIF-2. Injuries and mental disorders were notably higher during OIF-1. During OIF-2, infectious and parasitic diseases and diseases of the musculoskeletal (includes injury-related musculoskeletal conditions), digestive, and nervous systems were more common. The DNBI hospitalization admission rates for OIF and OEF Soldiers from operation start dates through 2004 (0.14 and 0.14 per 1,000 Soldier-days, respectively) were lower than those of Operations Desert Shield and Storm (0.24 per 1,000 Soldier-days).[5] For OIF over time, there was an initial increase in admissions from the build-up (0.14 per 1,000 Soldier-days) to ground combat phase (0.18 per 1,000 Soldier-days), after which the admission rate stabilized (0.14 per 1,000 Soldier-days). Generally, the decrease in NBI rates in this report from a high in 2003 agrees with these previous studies; however, since our NBI rates included deaths, hospitalizations, and air evacuations, an exact comparison is not possible.

(4) In this report, the leading NBI types for 2007 were fracture, inflammation and pain (overuse), dislocation, and sprain/strain. The back was most commonly involved (17-18 percent), followed by the knee, wrist/hand, ankle/foot, and shoulder. In general, previous studies have focused on specific body regions or diagnosis categories when describing injury or disease type. According to Enad and Headrick, one treatment facility reported treating three times as many non-battle orthopedic injuries as battle orthopedic injuries during the combat phase of OIF (March to May 2003).[12] In reference to this previous study, the high proportion of non-battle orthopedic injuries to battle orthopedic injuries agrees with our findings of fractures and dislocations as leading NBI types.

(5) Head injuries are an area of interest for the present conflicts in Iraq and Afghanistan. Forty-one percent of Soldiers being evaluated for recurrent headaches following a tour in Iraq reported head or neck trauma while deployed. The majority of these injuries were attributed to exposure to blast.[9] Of over 2,500 Soldiers surveyed upon returning from Iraq, 15 percent reported injuries with either loss of consciousness or altered mental state. Of these Soldiers reporting mild TBI, 33 percent also met criteria for Post-Traumatic Stress Disorder (PTSD).[10] According to Ari, for all Soldiers air evacuated out of OIF/OEF (2003-2004), 16 percent were for battle eye injuries, and an additional 2 percent were for non-battle eye injuries.[11] The low percentage of non-battle eye injuries is consistent with our results. However, the head and neck injuries reported were categorized as mostly battle injuries and are not comparable to our study.

(6) This report identified the top three causes of NBI in 2007 as sports/physical training (19 percent), falls/jumps (13 percent), and motor vehicle-related incidents (11 percent). In a previous study looking specifically at the leading causes of injury for Soldiers air evacuated out of OIF to one of two pain treatment centers, motor vehicle accidents accounted for 12 percent of the injuries and another 15 percent were exacerbations of a previous pain condition treated with surgery (no cause of exacerbation given).[21] Specific to NBI, the leading causes of military patient non-battle burns (2003-2005) were described in Kauvar et al. as the burning of waste,

ammunition accidents, the misuse of gasoline, electrical injuries, and scalds.[22] Unlike our analysis, these previous studies did not use standardized (STANAG) coding for cause of injury and reported only a subset of NBIs. In general, the results of these studies are not comparable by sampled population to this combined theater NBI analysis.

(7) The U.S. Army uses surveillance data to identify cause of injury and potentially modifiable risk factors for injury to develop comprehensive injury prevention programs (such as, Jones and Knapik, 1991[23]). Current intervention studies and strategies (civilian and military) to address deployment NBI include:

(a) Upper extremity–battle injuries sustained by Army Soldiers during a specified period of OIF and OEF were reviewed for the use of protective gear, its efficacy, and the need for improvements or modification. Limited recommendations were provided, but larger studies were suggested.[24]

(b) Researchers reviewed 107 records of Soldiers with ocular DNBIs treated during OEF and OIF over a 33-month period. Reinforcing preventive measures such as hygiene, contact lens restriction, and eye protection was suggested.[25]

(c) Drowning deaths associated with motor vehicle accidents occurring in OIF and OEF were described and examined for factors that were potentially modifiable for the prevention of such deaths. Recommendations included training and equipment modifications to prevent rollover accidents and improved compliance for seatbelt use. These prevention strategies are being addressed by the military.[26]

(d) Motor vehicle accidents—

(1) The risk of fatality was 6 times greater for Soldiers who were not wearing a seat belt during a high mobility multipurpose wheeled vehicle (HMMWV) accident compared to Soldiers who were wearing a seat belt. The risk of fatality due to a rollover was 3 times greater for Soldiers who were not wearing a seat belt compared to Soldiers who were wearing a seat belt. Seat–belt use was recommended where the tactical situation permits. Acquiring BI data to assess how seat–belt use impacts combat situations was also recommended.[27]

(2) In a sample of non-deployed Soldiers, drinking and driving, speeding, and low seat belt use were significantly associated with motor vehicle injury. Seat belt use of 50 percent or less versus 100 percent was also associated with risk for hospitalization. Low seat–belt use is a modifiable risk factor associated with motor vehicle injuries for which young, at-risk Soldiers can be targeted for intervention.[28]

(e) Sports injuries—

(1) Use of ankle braces (stabilizers) significantly reduced ankle injuries.[29,30,31]

(2) Sliding into base was shown to be the most common mechanism for softball injuries. Countermeasures to prevent these injuries include breakaway bases, recessed bases, and teaching proper sliding techniques.[32]

(3) Meta-analyses indicated that the risk of an orofacial sports injury was 1.6–1.9 times higher when a mouthguard was not worn. It was recommended that mouthguards should be used in sport activities where there is significant risk of orofacial injury.[33]

(4) The use of protective eyewear during participation in various sports significantly reduced eye injuries.[34,35,36] The use of protective eye wear is recommended for racquet sports and other contact sports.

(f) Parachuting Injuries. Using an outside the boot ankle brace can significantly reduce inversion ankle injuries during parachute training. The use of the ankle brace does not increase the risk of other injuries.[37,38,39]

e. Conclusions. Routinely collected air evacuation, inpatient hospitalization, and casualty data provided the basis for deployment injury surveillance during Army deployments in support of OIF and OEF during CY 2007. The NBIs were notably the most significant cause of medical evacuations and inpatient hospitalizations and have a big impact on readiness. The leading causes of these NBIs indicate that many are likely preventable. Timely reporting of injury rates, types, and causes, should allow commanders and Army leaders to focus attention on prevention strategies and policies while the operations are on-going.

f. Recommendations.

(1) Continue routine surveillance of deployment injuries.

(2) Link additional data sources, such as level IV and V hospitalizations, and disability records to provide an enhanced description of deployment injuries and their outcomes.

(3) Conduct further research to identify modifiable risk factors that contribute to the leading causes of injury.

(4) Devote additional study to sports/PT, falls/jumps, and land transport injury prevention.

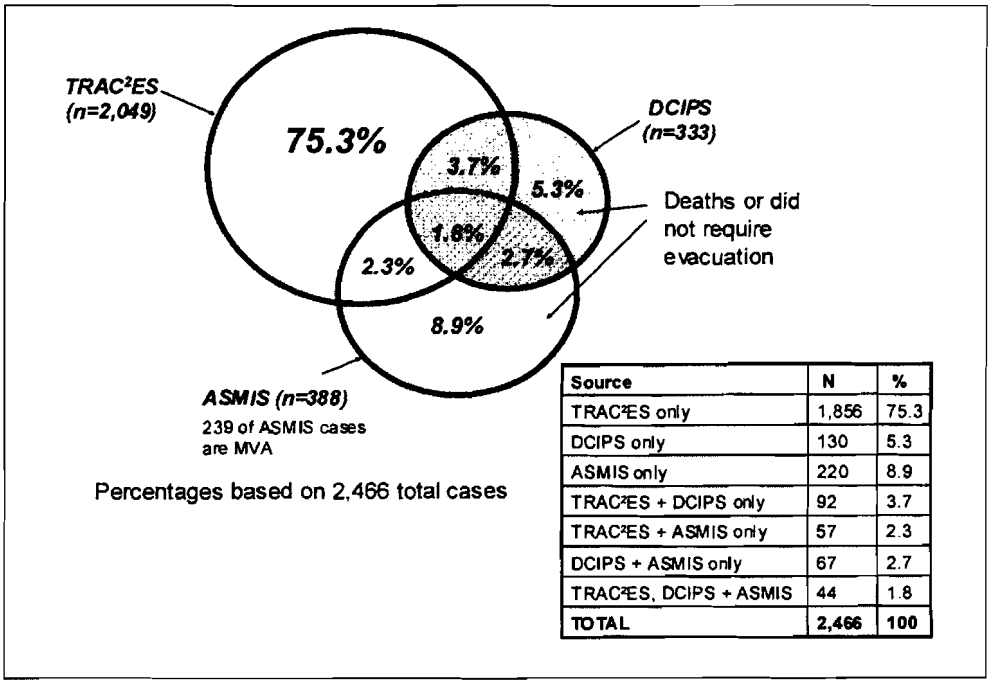
5. RESULTS OF ANALYTIC DEPLOYMENT INJURY SURVEILLANCE PROJECTS, CY 2007

a. Project Summaries.

(1) Development of a Deployment Injury Surveillance System Using Medical Air Evacuation Data

(a) In May 2005, U.S. Army CHPPM was tasked by the Deputy Assistant Secretary of the Army for Environment, Safety and Occupational Health to develop an injury surveillance system for deployed Army Soldiers. A primary objective was to develop a system capable of identifying types and potentially preventable causes of injuries requiring medical air evacuation. The primary data source for air evacuated injured Soldiers was the U.S. TRAC^{2}ES, which included standardized diagnosis codes and a free-text patient history from which details for injury causes could be obtained.

(b) The TRAC^{2}ES data were linked to data from the DCIPS and the Army Safety Management Information System (ASMIS) to obtain additional details for the injury causes and circumstances. (See Figure 4 for the degree of overlap in cases from different sources.) Since information on injury causes was in free-text fields, coders reviewed each air evacuation case and applied a standardized coding scheme (STANAG) to classify causes of injury. The final enhanced air evacuation data system included (1) linked data from TRAC2ES, DCIPS, and ASMIS, and (2) coded causes and types of injuries. This system provided high quality, analysis-ready data and is well suited for deployment injury surveillance.



Source	N	%
TRAC²ES only	1,856	75.3
DCIPS only	130	5.3
ASMIS only	220	8.9
TRAC²ES + DCIPS only	92	3.7
TRAC²ES + ASMIS only	57	2.3
DCIPS + ASMIS only	67	2.7
TRAC²ES, DCIPS + ASMIS	44	1.8
TOTAL	**2,466**	**100**

Figure 4. Non-battle injuries found in TRAC^{2}ES, DCIPS and ASMIS: Jan-Sept 2004

(2) Causes of Non-battle Fatalities in Army Soldiers during OEF and OIF.

(a) As with previous conflicts, NBIs have caused a significant number of fatalities in OEF and OIF. The purpose of this study was to identify causes of injury for non-battle fatalities in the DCIPS. From October 2001 through June 2006, 463 non-battle fatalities were identified in DCIPS. The leading causes of death were motor vehicle accidents (MVA 39 percent), self-inflicted injuries (19 percent) and air transportation accidents (18 percent). (See Figure 5)

(b) Over half of MVAs were rollovers (64 percent), of which an unexpected 30 percent were drowning. Most self-inflicted deaths were caused by the Soldier's own weapon (91 percent). A greater number of aviation-related fatalities occurred in OEF than OIF (47 vs. 36, respectively) and overall, it was the number one cause of death in OEF. The present study shows that MVAs, self-inflicted injuries, and air transportation accidents continue to be leading causes of non-battle fatalities.

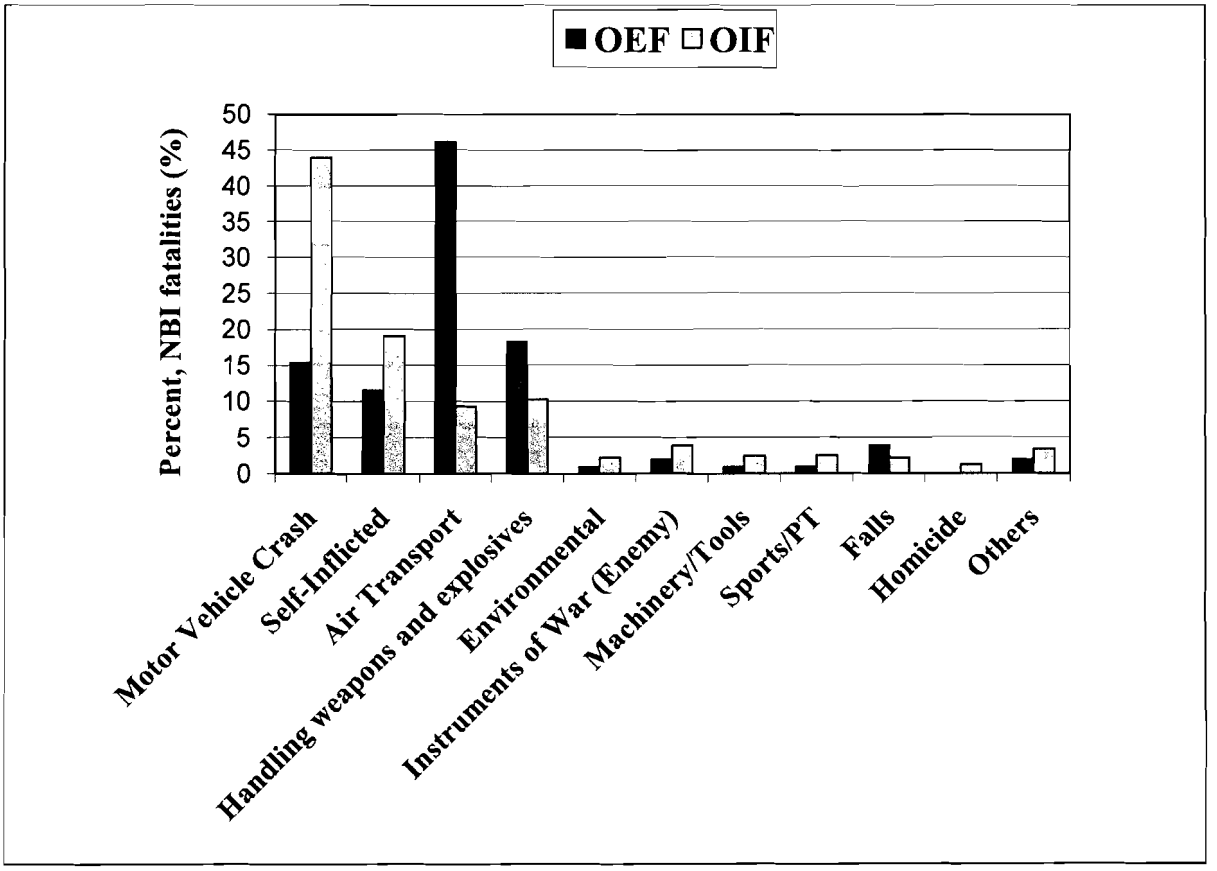


Figure 5. Causes of Non-Battle Injury Fatalities OEF vs. OIF, 2001-2006

(3) Cause of NBIs among U.S. Army Soldiers in OIF and OEF.

(a) The objective of our on-going injury surveillance effort was primarily to determine the causes of all injuries that required medical air-evacuation from OIF and OEF, respectively, which is now complete through 2006. The TRAC2ES database was used to identify these medically air-evacuated injuries, of which only NBIs are the subject of this presentation. The review of history fields allowed for the assignment of a STANAG injury cause code for 66 percent and 61 percent of all cases in OIF and OEF, respectively.

(b) The top 3 causes of NBIs in OIF were falls/jumps (17.9 percent; see Table 4 for more detail on falls), sports/physical training (17.8 percent; see Figure 3 for more detail) and motor vehicle accidents (16.4 percent). In OEF, sports/PT was the leading injury cause (20.7 percent), followed by falls/jumps and motor vehicle accidents (17.9 percent and 11.4 percent, respectively). Medical air-evacuation data is again shown to provide complete information for an important category of moderate-to-severe NBIs.

Table 4. Types of Fall and Jump Injuries in OIF and OEF: 2001-June 2006

Fall/Jump Type	**OIF**	**OEF**
Fall	**Percent (%) (n=897)**	**Percent (%) (n=137)**
On the same level	**12.8**	**14.6**
From one level to another	**40.0**	**38.0**
From stairs/ladder	**10.8**	**8.8**
Unspecified level	**36.3**	**38.7**
Jump	**% (n=164)**	**% (n=10)**
On the same level	**4.9**	**10.0**
From one level to another	**85.8**	**80.0**
From stairs/ladder	**1.8**	**0**
Unspecified level	**8.5**	**10.0**

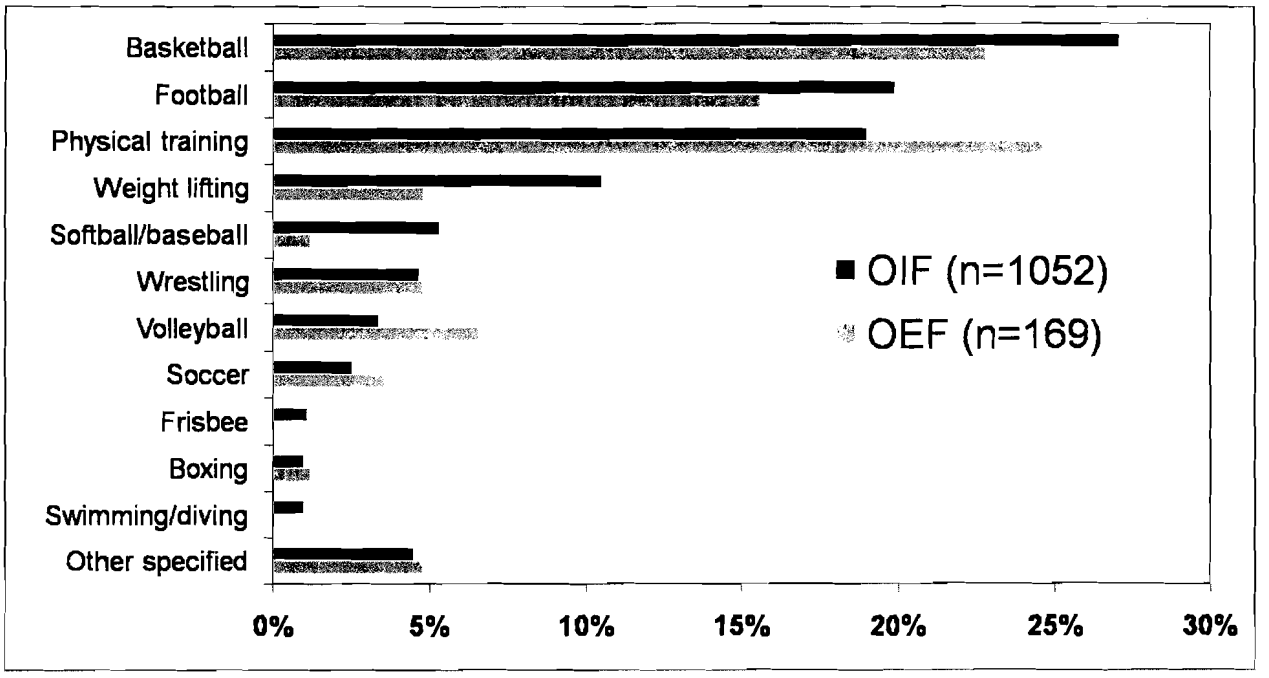


Figure 6. Sports and Physical Training injuries, OIF and OEF through June 2006

(4) Sports Injuries among U.S. Army Soldiers Deployed for OIF.

(a) Background. Sports participation is the fourth leading cause of non-combat injury among non-deployed U.S. Army Soldiers comprising 11 percent of injury hospitalizations and 35 percent–75 percent of injuries treated in ambulatory clinics. Basketball (23 percent), football (22 percent), softball (8 percent), and physical fitness training (6 percent) are the leading sports activities resulting in injury hospitalizations. Little is presently known about the incidence of sports injuries among Soldiers deployed for military operations such as OIF.

(b) Purpose. To determine the incidence of sports-related injuries that required medical air evacuation of U.S. Army Soldiers deployed for OIF and to describe the distribution of sports, injury type, and anatomical site for these injuries.

(c) Methods. Soldiers air evacuated from OIF with non-combat injuries between March 19, 2003 and June 30, 2006 were identified from an administrative database that tracks all air evacuations. In addition to demographic and administrative data for each case, this database included medical information such as patient history and diagnosis. These fields were reviewed for each injury case to identify the injury cause, diagnosis, and anatomical site of injury. Descriptive statistics were used to describe the distribution of sports-related injuries by sport, diagnosis, and anatomical location of injury.

(d) Results. A total of 8,908 Soldiers required medical air evacuation from OIF to receive specialty care for a non-combat injury. Table 2 shows the distribution of causes of injury. Of cases with a known injury cause, sports-related activities comprised 18 percent (rate: 22/10,000 person-year). Mean (± SD) age was 30 ± 8 years and gender was predominantly male (94 percent). Basketball (27 percent), football (20 percent), PT (19 percent), and weight lifting (11 percent) were the primary sports involved. The leading injury types were fracture (26 percent), dislocation (21 percent), disorder of muscle/tendon (15 percent), and sprain/strain (11.9 percent). Injuries primarily involved the knee (28 percent), wrist/hand (15 percent), ankle/foot (13 percent), shoulder (12 percent), and lower leg (7 percent).

(e) Conclusion. Injuries from sports and physical fitness training comprised 18 percent of non-combat, medically air evacuated injuries from OIF. This proportion, as well as the particular sports involved, is similar to that reported for injury hospitalizations among non-deployed Soldiers.

Table 5. Distribution of Cause of Injury for Non-Combat Injuries Air Evacuated from OIF (March 2003 –June 2006)

CAUSE OF INJURY	FREQUENCY (n=5845)	PERCENT (%)
Falls/Jumps	1047	17.9
Sports and PT	1042	17.8
Motor vehicle-related crashes	958	16.4
Crushing or blunt trauma	503	8.6
Lifting, pushing, pulling	484	8.3
Twisting, turning, slipping	399	6.8
Shoes and clothing	234	4
Cutting and piercing	183	3.1
Handling weapons/ammunition	174	3
Environmental	167	2.9
Other specified	654	11.2

b. Conclusions.

(1) Air-evacuation records can be used to identify and code causes of injury during military deployments. When available, accident and casualty reports provide additional details that are useful in identifying preventable causes of injury.

(2) Motor vehicle crashes, self-inflicted injuries, and air–transportation accidents were leading causes of non-battle fatalities.

(3) A total of 91 percent of self-inflicted deaths were caused by the use of the victim's own weapon.

(4) The top 3 causes of NBIs in OIF (2003–2006) were falls/jumps (18 percent), sports/PT (18 percent) and motor vehicle accidents (16 percent).

(5) In OEF (2001–2006), sports/PT was the leading injury cause (21 percent), followed by falls/jumps and motor vehicle accidents (18 percent and 11 percent, respectively).

(6) Basketball, football, physical fitness training, and weight lifting were the primary sports for medically air–evacuated sports injuries from OIF.

c. Recommendations.

(1) Investigate the use and effectiveness of the following injury prevention trainings/interventions.

(a) Rollover accident: vehicle exiting.

(b) Seatbelt use compliance.

(c) Signs of suicide.

(d) Fall prevention and jumping with full load/PPE.

(e) Weight lifting safety.

(2) Explore mental health care use and self-inflicted injury relationships.

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APPENDIX A

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APPENDIX B

BARELL INJURY DIAGNOSIS MATRIX AND ASSOCIATED ICD-9-CM 800-995 CODES

Region	Body part	ICD-9-CM codes	FRACTURE 800-829	DISLOCATION 830-839	SPRAINS & STRAINS 840-848	INTERNAL 850-854, 860-869, 952, 995.55	OPEN WOUND 870-884, 890-894	AMPUTATIONS 885-887, 895-897	BLOOD VESSELS 900-904	CONTUSION / SUPERFICIAL 910-924	CRUSH 925-929	BURNS 940-949	NERVES 950-951, 953-957	UNSPECIFIED 959
Head and Neck – Traumatic Brain Injury	1 Type 1 TBI	800,801,803,804(.1-.4,.6-.9),(.03-.05,.53-.55) 850(.2-.4), 851-854, 950(.1-.3), 995.55	800,801,803,804(.1-.4,.6-.9) 800,801,803,804(.03-.05,.53-.55)	/	/	850(.2-.4) 851-854*, 995.55	/	/	/	/	/	/	950.1-.3	/
	2 Type 2 TBI	800,801,803,804(.00,.02,.06,.09) (.50,.52,.56,.59), 850(.0,.1,.5,.9)	800,801,803,804(.00,.02,.06,.09), 800,801,803,804(.50,.52,.56,.59)			850(.0,.1,.5,.9)								
	3 Type 3 TBI	800,801,803,804(.01,.51)	800,801,803,804(.01,.51)	/	/	/	/	/	/	/	/	/	/	/
Head and Neck – Other head, face and neck	4 Other Head	873(.0-.1,.8-.9), 941.x6, 951, 959.01	/	/	/	/	873.0-.1,.8-.9	/	/	/	/	941.x6	951	959.01
	5 Face	802, 830, 848.0-.1, 872, 873.2-.7, 941(.x1,.x3-.x5,.x7)	802	830	848.0-.1	/	872, 873.2-.7	/	/	/	/	941.x1,.x3-.x5,.x7	/	/
	6 Eye	870-871, 918, 921, 940, 941.x2, 950(.0,.9)	/	/	/	/	870-871	/	/	918, 921	/	940, 941.x2	950(.0,.9)	/
	7 Neck	807.5-.6, 848.2, 874, 925.2, 941.x8, 953.0, 954.0	807.5-.6	/	848.2	/	874	/	/	/	925.2	941.x8	953.0, 954.0	/
	8 Head, Face and Neck Unspecified	900, 910, 920, 925.1, 941.x0, .x9, 947.0, 957.0, 959.09	/	/	/	/	/	/	900	910, 920	925.1	941.x0,.x9, 947.0	957.0	959.09
Spine and back – Spinal Cord (SCI)	9 Cervical SCI	806(.0-.1), 952.0	806.0-.1	/	/	952.0	/	/	/	/	/	/	/	/
	10 Thoracic/Dorsal SCI	806(.2-.3), 952.1	806.2-.3	/	/	952.1	/	/	/	/	/	/	/	/
	11 Lumbar SCI	806(.4-.5), 952.2	806.4-.5	/	/	952.2	/	/	/	/	/	/	/	/
	12 Sacrum Coccyx SCI	806(.6-.7), 952(.3-.4)	806.6-.7	/	/	952.3-.4	/	/	/	/	/	/	/	/
	13 Spine+Back unspecified SCI	806(.8-.9), 952(.8-.9)	806.8-.9	/	/	952.8-.9	/	/	/	/	/	/	/	/
Spine and back – Vertebral Column (VCI)	14 Cervical VCI	805(.0-.1), 839(.0-.1), 847.0	805.0-.1	839.0-.1	847.0	/	/	/	/	/	/	/	/	/
	15 Thoracic/Dorsal VCI	805(.2-.3), 839(.21,.31), 847.1	805.2-.3	839.21,.31	847.1	/	/	/	/	/	/	/	/	/
	16 Lumbar VCI	805(.4-.5), 839(.20,.30), 847.2	805.4-.5	839.20,.30	847.2	/	/	/	/	/	/	/	/	/
	17 Sacrum Coccyx VCI	805(.6-.7), 839(.41-.42), 839(.51-.52), 847.3-.4	805.6-.7	839(.41-.42, .51-.52)	847.3-.4	/	/	/	/	/	/	/	/	/
	18 Spine+Back unspecified VCI	805(.8-.9), 839(.40,.49), 839(.50,.59)	805.8-.9	839(.40,.49,.50,.59)	/	/	/	/	/	/	/	/	/	/
Torso	19 Chest (thorax)	807(.0-.4), 839(.61,.71), 848(.3-.4), 860-862, 875, 879(.0-.1), 901, 922(.0-.1,.33), 926.19, 942.x1-.x2, 953.1	807.0-.4	839.61,.71	848.3-.4	860-862	875, 879.0-.1	/	901	922(.0,.1,.33)	926.19	942.x1-.x2	953.1	/
	20 Abdomen	863-866, 868, 879(.2-.5), 902(.0-.4), 922.2, 942.x3, 947.3, 953(.2,.5)	/	/	/	863-866, 868	879.2-.5	/	902.0-.4	922.2	/	942.x3, 947.3	953.2, 953.5	/
	21 Pelvis & Urogenital	808, 839(.69,.79), 846, 848.5, 867, 877-878, 902(.5,.81-.82), 922.4, 926(.0,.12), 942.x5, 947.4, 953.3	808	839.69,.79	846, 848.5	867	877-878	/	902(.5, .81-.82)	922.4	926(.0,.12)	942.x5, 947.4	953.3	/
	22 Trunk	809, 879(.6-.7), 911, 922(.8-.9), 926(.8-.9), 942(.x0,.x9), 954(.1,.8-.9), 959.1	809	/	/	/	879.6-.7	/	/	911, 922.8-.9	926.8-.9	942.x0, 942.x9	954.1, .8-.9	959.1
	23 Back and Buttock	847.9, 876, 922(.31-.32), 926.11, 942.x4	/	/	847.9	/	876	/	/	922.31-.32	926.11	942.x4	/	/
Extremities – Upper	24 Shoulder & upper arm	810-812, 831, 840, 880, 887(.2-.3), 912, 923.0, 927.0, 943(.x3-.x6), 959.2	810-812	831	840	/	880	887.2-.3	/	912, 923.0	927.0	943.x3-.x6	/	959.2
	25 Forearm & elbow	813, 832, 841, 881(.x0-.x1), 887(.0-.1), 923.1, 927.1, 943(.x1-.x2)	813	832	841	/	881.x0-.x1	887.0-.1	/	923.1	927.1	943.x1-.x2	/	/
	26 Wrist, hand & fingers	814-817, 833-834, 842, 881.x2, 882, 883, 885-886, 914-915, 923(.2-.3), 927(.2-.3), 944, 959(.4-.5)	814-817	833, 834	842 /	/ /	881.x2, 882, 883	885-886	/ /	914-915, 923.2-.3	927.2-.3	944 /	/ /	959.4-.5
	27 Other & unspecified	818, 884, 887(.4-.7), 903, 913, 923(.8-.9), 927(.8-.9), 943(.x0,.x9), 953.4, 955, 959.3	818	/	/	/	884	887.4-.7	903	913, 923.8,.9	927.8-.9	943.x0,.x9	953.4, 955	959.3
Extremities – Lower	28 Hip	820, 835, 843, 924.01, 928.01	820	835	843	/	/	/	/	924.01	928.01	/	/	/
	29 Upper leg & thigh	821, 897(.2-.3), 924.00, 928.00, 945.x6	821			/	/	897.2-.3	/	924.00	928.00	945.x6	/	/
	30 Knee	822, 836, 844(.0-.3), 924.11, 928.11, 945.x5	822	836	844.0-.3	/	/	/	/	924.11	928.11	945.x5	/	/
	31 Lower leg & ankle	823-824, 837, 845.0, 897(.0-.1), 924(.10,.21), 928(.10,.21), 945(.x3-.x4)	823-824	837	845.0	/		897.0-.1	/	924.10,.21	928.10,.21	945.x3-.x4	/	/
	32 Foot & toes	825-826, 838, 845.1, 892-893, 895-896, 917, 924(.3,.20), 928(.3,.20), 945(.x1-.x2)	825-826	838	845.1	/	892-893	895-896	/	917, 924.3,.20	928.3,.20	945.x1-.x2	/	/
	33 Other & unspecified	827, 844(.8-.9), 890-891, 894, 897(.4-.7), 904(.0-.8), 916, 924(.4-.5), 928(.8-.9), 945(.x0,.x9), 959.6-.7	827	/	844.8,.9	/	890-891, 894	897.4-.7	904.0-.8	916, 924.4-.5	928.8,.9	945.x0-.x9	/	959.6-.7
Unclassifiable by site – Other & unspecified	34 Other, multiple	819, 828, 902(.87,.89), 947(.1-.2), 953.8, 956	819, 828	/	/	/	/	/	902.87,.89	/	/	947.1-.2	953.8, 956	/
	35 Unspecified site	829, 839(.8-.9), 848(.8-.9), 869, 879(.8,.9), 902.9, 904.9, 919, 924(.8,.9), 929, 946, 947(.8,.9), 948, 949, 953.9, 957(.1,.8,.9), 959(.8,.9)	829	839.8-.9	848.8-.9	869	879(.8-.9)	/	902.9, 904.9	919, 924.8,.9	929	946, 947.8,.9 948, 949	953.9, 957.1,.8,.9	959.8,.9
System-wide	36 System-wide & late effects	930-939, 958(.0,.1,.2,.4,.5), 960-994, 995(.50-.54,.59), 995(.80-.85)	Foreign body (930-939), Early complications of trauma (958), Poisoning (960-979), Toxic Effects (980-989), Other and unspecified effects of external cause (990-994) Child and adult maltreatment(995.50-.54,.59, 995.80-.85) Late effects of injuries, poisonings, toxic effects and other external causes (905-909) excluding 905(.3,.9)											

APPENDIX C

INJURY-RELATED MUSCULOSKELETAL CONDITION MATRIX AND ASSOCIATED ICD-9-CM 710-739 CODES

Injury Location			Inflammation and Pain (Overuse)	Joint Derangement	Joint Derangement with Neurological Involvement	Stress Fracture	Sprains/Strains/ Rupture	Dislocation
	Vertebral Column	Cervical	723.1	722.0	722.71, 723.4			
		Thoracic/Dorsal	724.1	722.10	722.72, 724.4			
		Lumbar	724.2	722.10	722.73, 724.3			
		Sacrum, Coccyx	720.2					
		Spine, Back Unspecified	721.7, 724.5	722.2	722.70, 724.9	733.13		
Extremities	Upper	Shoulder	716.11, 719(.01,.11,.41), 726(0,.1,.2)	718(.01,.11,.81,.91)			727(.61,.62)	718.31
		Upper arm, Elbow	716.12, 719(.02,.12,.42), 726.3	718(.02,.12,.82,.92)		733.11		718.32
		Forearm, Wrist	716.13, 719(.03,.13,.43), 726.4	718(.03,.13,.83,.93)		733.12		718.33
		Hand	716.14, 719(.04,.14,.44)	718(.04,.14,.84,.94)			727(.63-.64)	718.34
	Lower	Pelvis, Hip, Thigh	716.15, 719(.05,.15,.45), 726.5	718(.05,.15,.85,.95)		733(.14,.15)	727.65	718.35
		Knee, Lower leg	716.16, 717.7, 719(.06,.16,.46), 726.6	717(.0-.6,.9), 718(.06,.16,.86,.96)		733(.16,.93-.94)	717.8, 727(.66-.67)	718.36
		Ankle, Foot	716.17, 719(.07,.17,.47), 726.7, 728.71-.734	718(.07,.17,.87,.97)			727.68	718.37
Unclassified by Site	Others and Unspecified	Other specified/Multiple	716(.18-.19), 719(.08-.09,.18-.19,.48-.49), 726.8, 727.2	718(.08,.09,.18,.19,.88,.89,.98,.99)		733.19	727.69	718(.38,.39)
		Unspecified Site	716.10, 719(.00,.10,.40), 726.9, 727.3, 729.1	718(.00,.10,.80,.90)	729.2	733(.10,.95)	727.60, 728.83	718.30