



U.S. ARMY PUBLIC HEALTH COMMAND

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**Injury Prevention Report NO. 12-HF-0F71-12, 1March 2012
Epidemiology & Disease Surveillance Portfolio**

**Deployment Injury Surveillance Summary, U.S. Army Operation Iraqi
Freedom/Operation Enduring Freedom Calendar Year 2009 1 January–31 December
2009**

**Prepared by Bonnie Taylor, Keith Hauret, Shuva Dawadi and Bruce H. Jones
Injury Prevention Program**

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14. ABSTRACT The aims of this report on injuries to Soldiers engaged in Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF) are to: a. Describe the relative impact of injury compared to disease for calendar year (CY) 2009. b. Document non-battle injury (NBI) rates and trends from 2003-2009. c. Identify leading diagnoses and causes of non-battle injury for CY 2009. d. Make recommendations to improve Army injury prevention. e. Summarize key U.S. Army Public Health Command (USAPHC) CY 2009 analytic deployment surveillance projects on injuries among deployed Soldiers. 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 injury (NBI) was notably the most significant cause of medical evacuations. As previously seen in CY2008, NBI was second to digestive diseases for OIF hospitalizations and second to battle injuries for OEF hospitalizations. Of all battle fatalities, approximately two-thirds were due to explosives. The leading causes of non-fatal NBIs (sports, falls and jumps, self-inflicted injuries, land transport accidents) 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.								
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EXECUTIVE SUMMARY
INJURY PREVENTION REPORT NO. 12-HF-0F71-12
DEPLOYMENT INJURY SURVEILLANCE SUMMARY U.S. ARMY OPERATION IRAQI
FREEDOM/OPERATION ENDURING FREEDOM CALENDAR YEAR 2009
1 JANUARY–31 DECEMBER 2009

1. PURPOSE. The aims of this report on injuries to Soldiers engaged in Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF) are to:

- a. Describe the relative impact of injury compared to disease for calendar year (CY) 2009.
- b. Document non-battle injury (NBI) rates and trends from 2003–2009.
- c. Identify leading diagnoses and causes of non-battle injury for CY 2009.
- d. Make recommendations to improve Army injury prevention.
- e. Summarize key U.S. Army Public Health Command (USAPHC) CY 2009 analytic deployment surveillance projects on injuries among deployed Soldiers.

2. CONCLUSIONS.

a. Routine Deployment Injury Surveillance Summary 2009, Army OIF/OEF. 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 injury (NBI) was notably the most significant cause of medical evacuations. As previously seen in CY2008, NBI was second to digestive diseases for OIF hospitalizations and second to battle injuries for OEF hospitalizations. Of all battle fatalities, approximately two-thirds were due to explosives. The leading causes of non-fatal NBIs (sports, falls and jumps, self-inflicted injuries, land transport accidents) 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. Special Analytic Deployment Injury Surveillance Project Summaries 2009. NBI rates varied by service, but the overall impact and causes of NBI were similar for all four military services. Differing trends in NBI rates for OIF and OEF may reflect differences in the theaters of operation, including environmental exposures, facilities, availability of medical care, terrain, and vehicle use. The greatest numbers of air-evacuation patient movements were for Orthopedic Surgery, Neurosurgery, and General Surgery. These results have implications for injury prevention, as well as amounts and types of resources utilized or required for treatment.

3. RECOMMENDATIONS.

- a. Continue to improve surveillance of deployment-related injuries.
- b. Link new deployment data sources to provide greater insight into the nature and causes of injury.
- c. Conduct analyses to identify modifiable risk factors that contribute to the leading causes of injury.
- d. Devote additional study to falls/jumps, sports/physical training (PT), own weapon, toxic substances, and land transport injury prevention.
- e. Evaluate the effectiveness of injury prevention strategies/interventions (such as, vehicle exiting and suicide prevention).
- f. Use data to target leading causes for prevention or research.

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INJURY PREVENTION REPORT NO. 12-HF-0F71-12
U.S. ARMY OPERATION IRAQI FREEDOM/OPERATION ENDURING FREEDOM
DEPLOYMENT INJURY SURVEILLANCE SUMMARY CALENDAR YEAR 2009
1 JANUARY–31 DECEMBER 2009

1. REFERENCES. References are listed in Appendix A.
2. PURPOSE. The aims of this report on injuries to Soldiers engaged in Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF) are to:
 - a. Describe the relative impact of injury compared to disease for Calendar Year (CY) 2009.
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 - c. Identify leading diagnoses and causes of NBI for CY 2009.
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 - e. Summarize key U.S. Army Public Health Command (USAPHC) CY 2009 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. ROUTINE DEPLOYMENT INJURY SURVEILLANCE SUMMARY, ARMY OPERATION IRAQI FREEDOM (OIF) AND OPERATION ENDURING FREEDOM (OEF) 2009.

a. Background. Injuries are the biggest health problem confronting U.S. military forces in garrison and combat operations.^(1,2) For past conflicts, data on injuries were available only well after the fact. In current conflicts, there is timelier reporting of both battle injury (BI) and NBI. For present operations, OIF and OEF, NBIs were more frequently reported in medical air evacuation data than BI or any other individual disease diagnosis group.⁽³⁻⁹⁾ A problem this big requires a systematic approach. Knowledge of rates and trends of injuries is needed to determine priorities focusing on those injuries with the highest or increasing rates. To prevent injuries, knowledge of the causes of injuries is also needed. The data in this report are unique in that they identify the causes of NBI in addition to BI. This report provides a basis for setting deployment injury prevention priorities, based on the magnitude, severity, and causes of injuries.

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b. Method for Routine Deployment Surveillance.

(1) A number of data sources with nearly complete accounting for injuries occurring during deployments are now available. Injury data used for this report originate from several sources, the U.S. Transportation Command's Regulating and Command & Control Evacuation System (TRAC²ES), the Patient Administration Systems and Biostatistics Activity (PASBA), the Defense Casualty Information Processing System (DCIPS), and the Defense Manpower Data Center (DMDC).

(a) Injury data for air evacuated Soldiers were obtained from TRAC²ES. These data are routinely collected and used to request and coordinate medical air evacuation of Service members with serious injuries and diseases.

(b) Standard Inpatient Data Records (SIDR) for hospitalizations in the U.S. Central Command (CENTCOM) area of responsibility were obtained from PASBA, a component of the Decision Support Center, Office of the Surgeon General. 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.

(c) Data on fatalities were obtained from two sources, DCIPS and DMDC. Fatality data for cause of non-battle injury death and counts of disease deaths were obtained from DCIPS. These data are routinely collected and used for casualty tracking and mortuary affairs. Fatality data for cause of battle injury death and counts of battle and non-battle injury death were obtained from DMDC.

(2) Relative Importance of Injury and Disease can be determined from two primary sources; TRAC²ES air evacuation and SIDR hospitalization records.

(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 figures using out-of-CENTCOM medical air evacuation and in-CENTCOM hospitalization data. All injuries are identified from out-of-CENTCOM air evacuation patient movement or initial inpatient hospitalization records.

(b) To avoid double counting, a "30-day" hospitalization exclusion was used so that injury hospitalizations for the same diagnosis (3-digit ICD-9-CM code) within a 30-day timeframe of the initial event were not included in the analysis. This 30-day

timeframe accounts for distinct injuries considering that some injuries required multiple hospitalizations.

(c) All out-of-CENTCOM air evacuation patient movements are included.

(3) Non-Battle Injuries.

(a) All OIF/OEF deployed U.S. Army Soldiers, who met at least one of the following criteria for CY 2009, 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, or (3) an NBI that required air evacuation out-of-CENTCOM.

(b) The NBIs that required air evacuation only within CENTCOM (did not require further evacuation from CENTCOM) were excluded from air evacuation analyses.

(4) Injury Rate Calculations. The NBI rates calculated in this report were based on all NBIs as defined above. Information for number of deployed persons per year was unclassified data obtained from the Joint Chiefs of Staff, Manpower and Personnel Directorate.⁽¹⁰⁾ An annual injury rate was determined by dividing the number of Soldier injuries for the year by the total number of deployed Soldier years for that year.

(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.⁽¹¹⁾ 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 (battle, intentional non-battle, or unintentional non-battle). The second through fourth digits indicate the cause of injury, identifying the specific causative agent (for example, basketball, jump, bullet) and in some cases where the injury occurred.

(b) Causes of NBI during CY 2009 were summarized for the out-of CENTCOM air evacuations, in-CENTCOM hospitalizations, and in-CENTCOM fatalities.

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

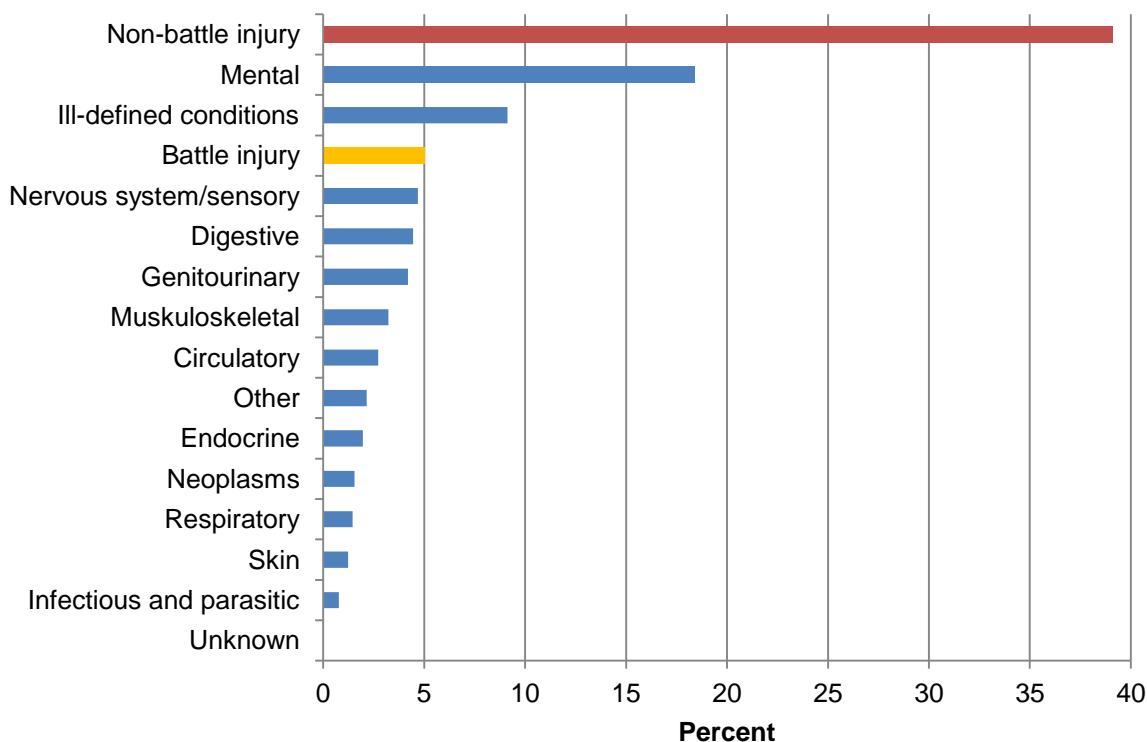
(a) For the matrices, NBIs were categorized into two groups by injury type (acute traumatic and injury related musculoskeletal conditions). The remainder of the NBIs (those that did not fit into these two categories) could not be classified into meaningful subgroups and were not included.

(b) The Barell⁽¹²⁾ injury matrix was used to display injury frequencies for traumatic NBIs (ICD-9-CM codes 800-995; see Appendix B) in a standardized format with the type of the injury listed horizontally, across the top of the table, and body region listed vertically along the left side of the table. Two Barell matrices are shown; one that included only NBIs that required air evacuation out-of-CENTCOM and another that included only NBIs that required in-theater hospitalization.

(c) A similar matrix format was used to display frequencies for injury-related musculoskeletal conditions (subset of ICD-9-CM codes 719-739; see Appendix C). Two musculoskeletal matrices are shown; one that included only NBIs that required air evacuation out-of-CENTCOM and another that included only NBIs that required in-theater hospitalization.

c. Results for Routine Deployment Surveillance.

(1) Medical air evacuation distribution, OIF.



Note: Includes injury and disease resulting in out-of-CENTCOM air evacuation for 4,140 Soldiers.

Figure 1. Distribution Percentage (%) of Injury and Disease by Diagnosis Category among Air Evacuated U.S. Army Soldiers, OIF, CY 2009

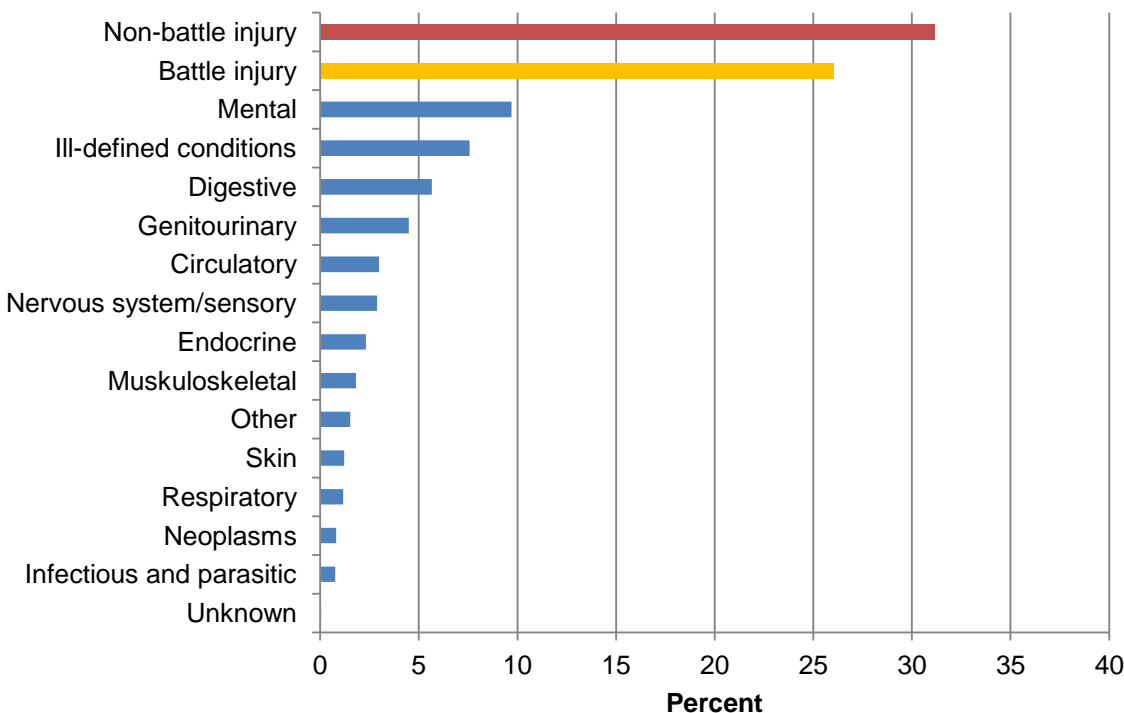
(a) Figure 1 shows the percentage of injuries and disease by primary diagnosis groups (ICD-9-CM code) for OIF out-of-CENTCOM medical air evacuations CY 2009.

(b) In 2009, 4,140 Soldiers were medically air evacuated out-of-CENTCOM.

(c) The NBIs accounted for 39 percent (n=1,618) of these air evacuations, more than twice as many as the leading disease diagnosis group, “mental illness” (n=761, 18 percent).

(d) BIs accounted for 5 percent (n=207) of the air evacuations from OIF.

(2) Medical air evacuation distribution, OEF.



Note: Includes injury and disease resulting in out-of-CENTCOM air evacuation for 1,980 Soldiers.

Figure 2. Distribution Percentage (%) of Injury and Disease by Diagnosis Category among Air Evacuated U.S. Army Soldiers, OEF, CY 2009

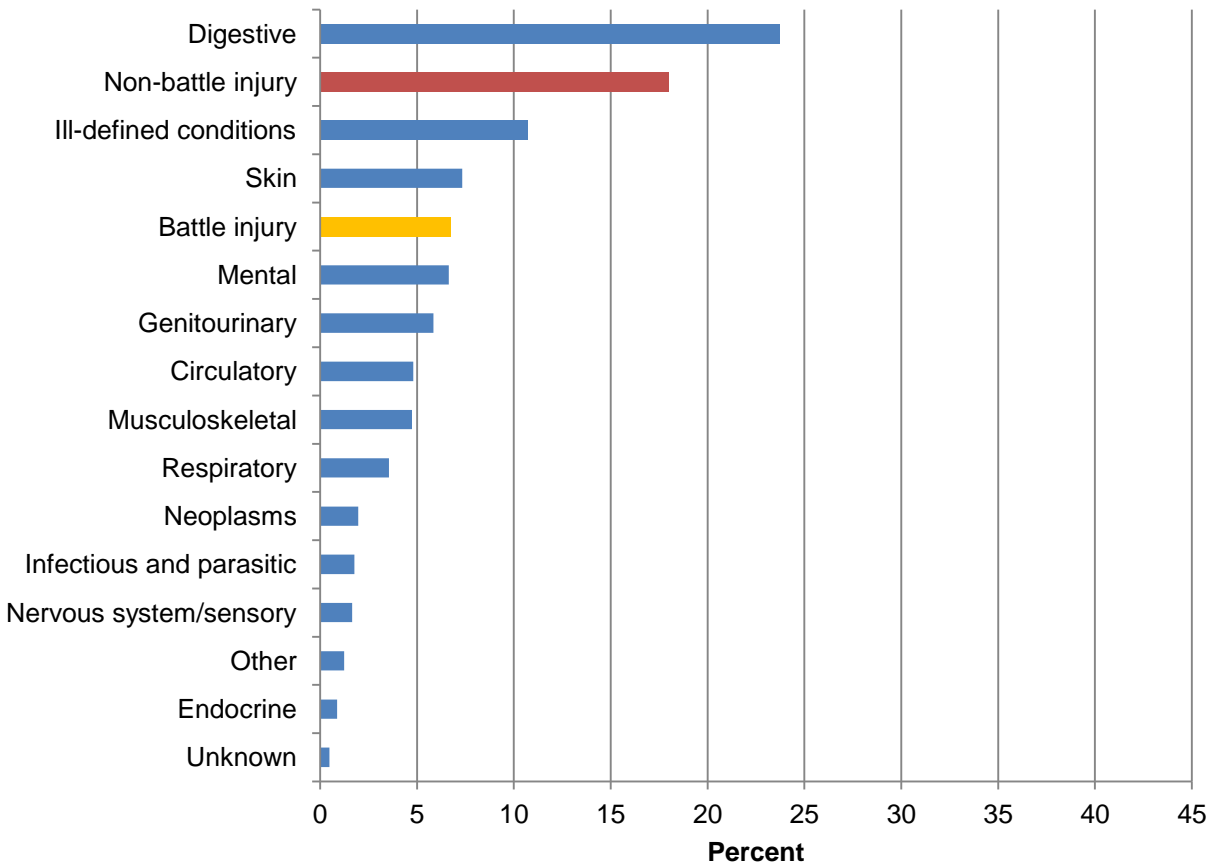
(a) Figure 2 shows the percentage of injuries and disease by primary diagnosis groups (ICD-9-CM code) for OEF out-of-CENTCOM medical air evacuations CY 2009.

(b) In 2009, there were 1,980 Soldiers medically air evacuated out-of-CENTCOM.

(c) The NBIs accounted for 31 percent (n=616) of these air evacuations, three times as many as the leading disease diagnosis group, “mental illness” (n=192, 10 percent).

(d) BI was the second leading category for OEF air evacuations (n=515, 26 percent). More Soldiers, and a larger proportion of the total (p<.001), were air evacuated for BI from OEF than from OIF in CY2009.

(3) In-theater inpatient hospitalization distribution, OIF.



Note: Includes injury and disease resulting in in-CENTCOM hospitalization (N=4,623).

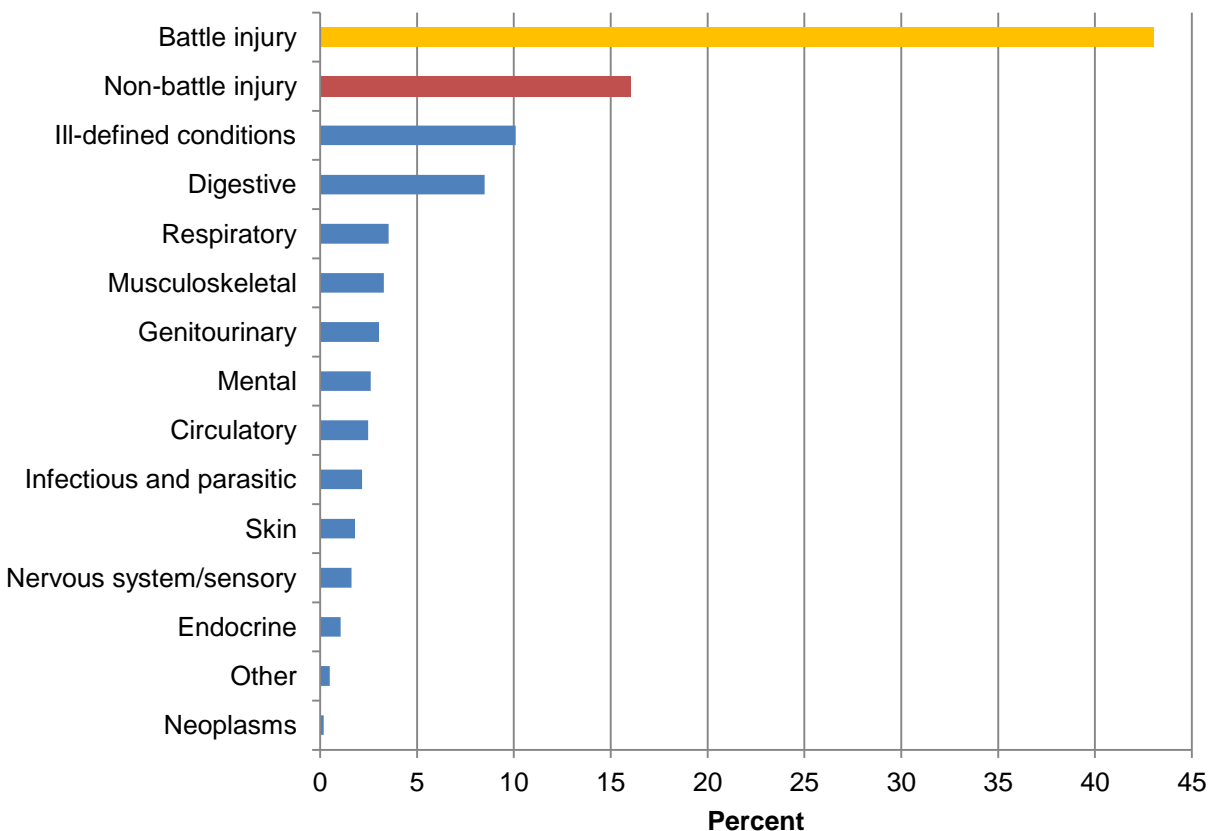
Figure 3. Distribution Percentage (%) of Injury and Disease by Diagnosis Category among Hospitalized U.S. Army Soldiers, OIF, CY 2009

(a) Figure 3 shows the percentage of injuries and disease by primary diagnosis groups (ICD-9-CM code) for OIF in-CENTCOM hospitalizations CY 2009.

(b) In 2009, a total of 4,623 OIF Soldiers were hospitalized in-CENTCOM.

(c) NBI was the second leading category (n=833, 18 percent). The leading disease diagnosis group was “digestive” (n=1,096, 24 percent). Total injuries (BI and NBIs combined) accounted for a slightly greater proportion (n=1,143, 25 percent) of OIF hospitalizations.

(4) In-theater inpatient hospitalization distribution, OEF.



Note: Includes injury and disease resulting in in-CENTCOM hospitalization (N=1,615).

Figure 4. Distribution Percentage (%) of Injury and Disease by Diagnosis Category among Hospitalized U.S. Army Soldiers, OEF, CY 2009

(a) Figure 4 shows the percentage of injuries and disease by primary diagnosis groups (ICD-9-CM code) for OEF in-CENTCOM hospitalizations CY 2009.

(b) In 2009, there were 1,615 OEF in-CENTCOM hospitalizations.

(c) The BI (43 percent) and NBIs (16 percent) combined accounted for 59 percent (n=952) of these hospitalizations. The leading specific disease category was digestive at 8%.

(d) OEF had a significantly greater proportion of BI hospitalizations ($p < .001$) than OIF. OIF had a significantly greater proportion of mental and digestive disease hospitalizations than OEF (both $p < .001$). The proportion of NBIs did not differ.

(5) Deaths, air evacuations, and hospitalizations, OIF.

Table 1. Injury and Disease¹ among U.S. Army Soldiers Deployed for OIF, CY 2009

	Battle Injury		Non-Battle Injury ²		Disease	
	Number (n)	Row Percent (%)	Number (n)	Row Percent (%)	Number (n)	Row Percent (%)
Air Evacuations (n=4140)	207	5	1618	39	2315	56
Hospitalizations (n=4623)	304	7	808	18	3511	75
Deaths³ (n=130)	68	52	58	45	4	3

Notes:

¹Death, air evacuation, and hospitalization categories are not mutually exclusive.

²Includes acute injury and injury-related musculoskeletal conditions.

³Death count data was obtained from Defense Manpower Data Center (DMDC).⁽¹³⁾

(a) Table 1 provides a summary of OIF deployment NBI casualties for 2009.

(b) For every 1 deployment NBI death, there were 14 NBI hospitalizations and 28 NBI medical air evacuations.

(c) Conservatively assuming no overlap among BI air evacuations (n=207), hospitalizations (n=304), and deaths (n=68), at least 36 percent of BIs (total n=579) resulted in out-of-CENTCOM air evacuation, 53 percent in-theater hospitalizations, and 12 percent deaths.

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

(6) Deaths, air evacuations, and hospitalizations, OEF.

Table 2. Injury and Disease¹ among U.S. Army Soldiers Deployed for OEF, CY 2009

	Battle Injury		Non-Battle Injury ²		Disease	
	Number (n)	Row Percent (%)	Number (n)	Row Percent (%)	Number (n)	Row Percent (%)
Air Evacuations (n=1980)	515	26	616	31	849	43
Hospitalizations (n=1615)	691	43	259	16	665	41
Deaths³ (n=221)	196	89	22	10	3	1

Notes:

¹Death, air evacuation, and hospitalization categories are not mutually exclusive.

²Includes acute injury and injury-related musculoskeletal conditions.

³Death count data was obtained from Defense Manpower Data Center (DMDC).

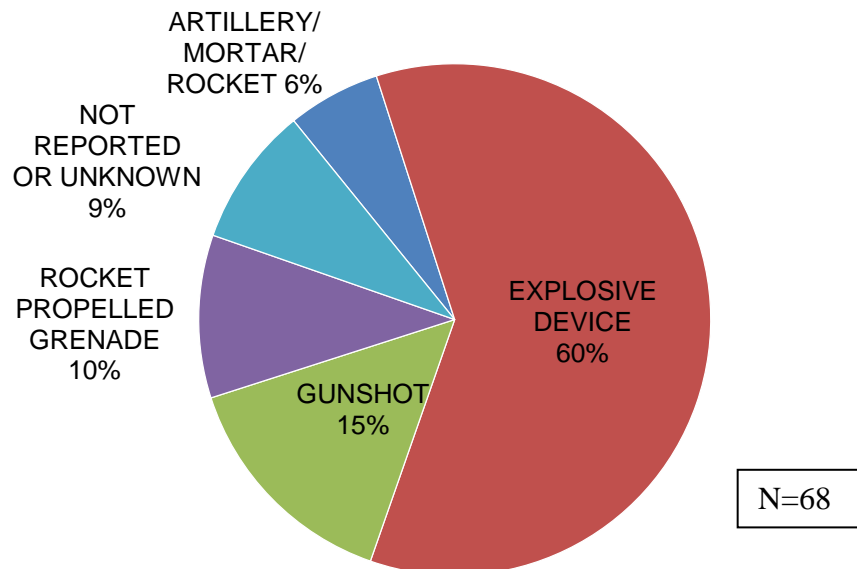
(a) Table 2 provides a summary of OEF deployment NBI casualties for 2009.

(b) For every 1 deployment NBI death, there were 12 NBI hospitalizations and 28 NBI medical air evacuations.

(c) Conservatively assuming no overlap among air evacuations (n=515), hospitalizations (n=691), and deaths (n=196), at least 37 percent of BIs (total n=1,402) resulted in out-of-CENTCOM air evacuation, 49 percent in in-theater hospitalization, and 14 percent in death.

(d) Again, these data show there are far more non-fatal injuries that result in medical-air evacuation or hospitalization than fatal injuries. These non-fatal outcomes result in significant lost-duty time and decreased operational readiness for the Army.

(7) Causes of battle injury death, OIF.

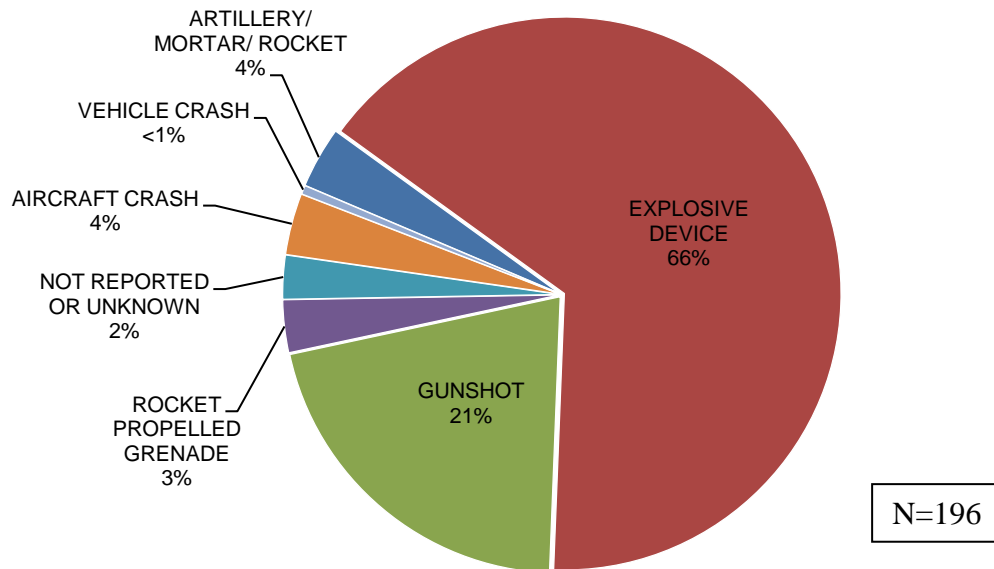


Note: Data obtained from Defense Manpower Data Center (DMDC).

Figure 5. Distribution (%) of Causes of Battle Injury Deaths among U.S. Army Soldiers Deployed for OIF, CY 2009

- (a) Figure 5 illustrates causes of OIF Army battle injury deaths for CY 2009.
- (b) 60 percent of battle fatalities were due to explosive devices.
- (c) 15 percent of battle fatalities were due to gunshots.
- (d) 10 percent of battle fatalities were due to rocket propelled grenades.

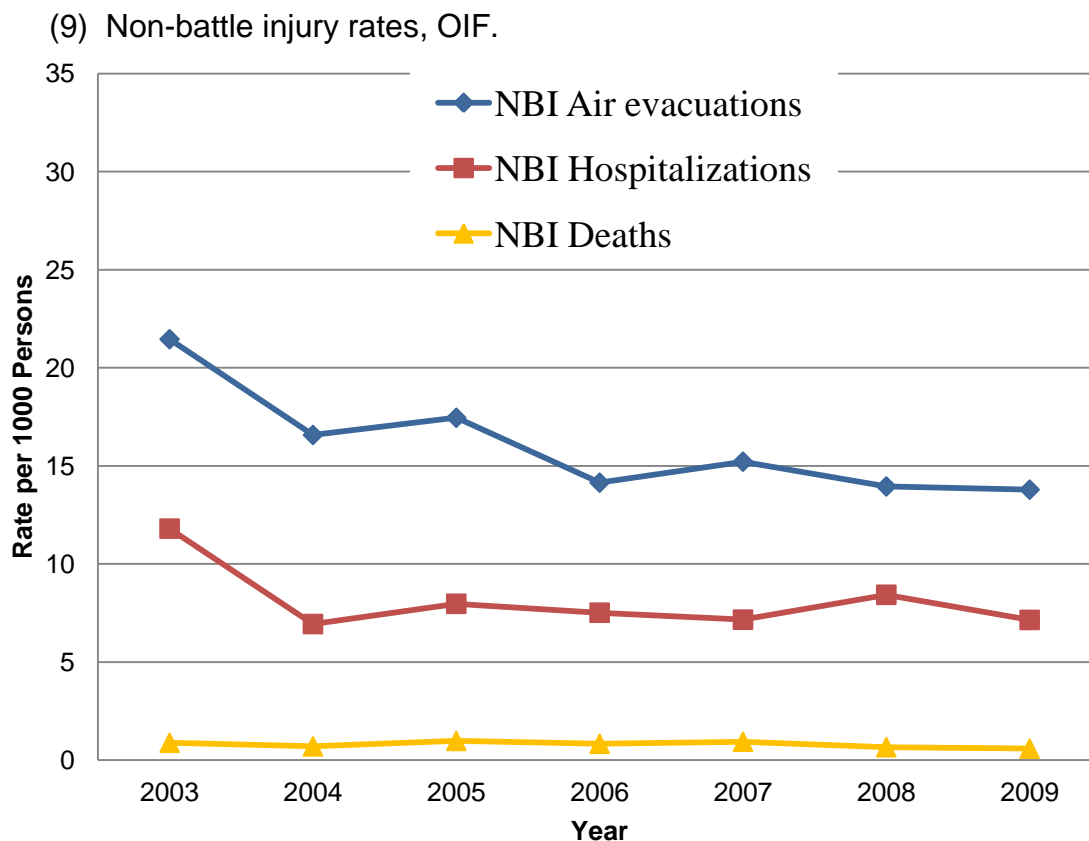
(8) Causes of battle injury death, OEF.



Note: Data obtained from Defense Manpower Data Center (DMDC).

Figure 6. Distribution (%) of Causes of Battle Injury Deaths among U.S. Army Soldiers Deployed for OEF, CY 2009

- (a) Figure 6 illustrates causes of OEF Army battle injury deaths for CY 2009.
- (b) 66 percent of battle fatalities were due to explosive devices.
- (c) 21 percent of battle fatalities were due to gunshots.
- (d) Unlike OIF, some battle fatalities for OEF were due to air and land vehicle crashes.



Notes:

¹ Denominators for the rates were unclassified data obtained from the Joint Chiefs of Staff, Manpower and Personnel Directorate.

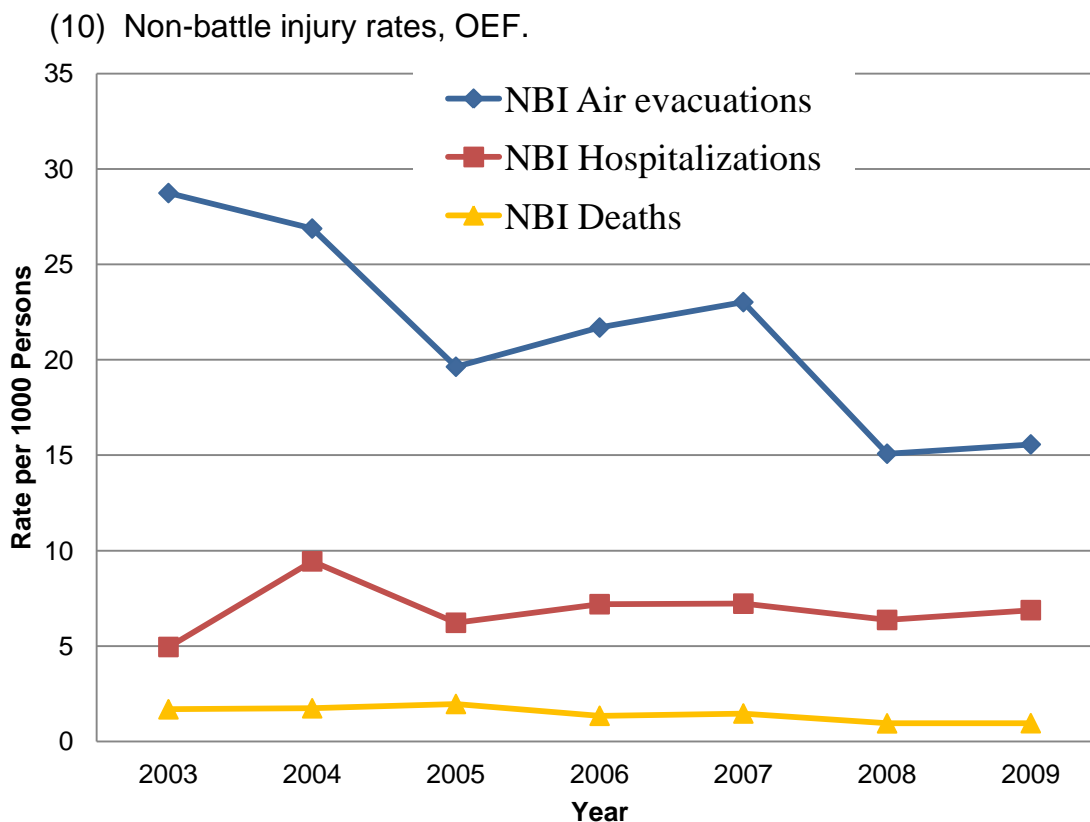
Figure 7. Non-Battle Injury Rates¹ among U.S. Army Soldiers Deployed for OIF, CYs 2003-2009

(a) Figure 7 illustrates OIF NBI rates for air evacuations, hospitalizations, and deaths from 2003–2009.

(b) The OIF NBI air evacuation rates decreased over this time, from 22/1000 person-years to 14/1000 person-years.

(c) The OIF NBI hospitalization rates remained relatively constant at 7 or 9 per 1000 since 2004.

(d) The OIF NBI death rates remained constant over the period, consistently less than 1 death per 1,000 persons per year.



Notes:

¹ Denominators for the rates were unclassified data obtained from the Joint Chiefs of Staff, Manpower and Personnel Directorate.

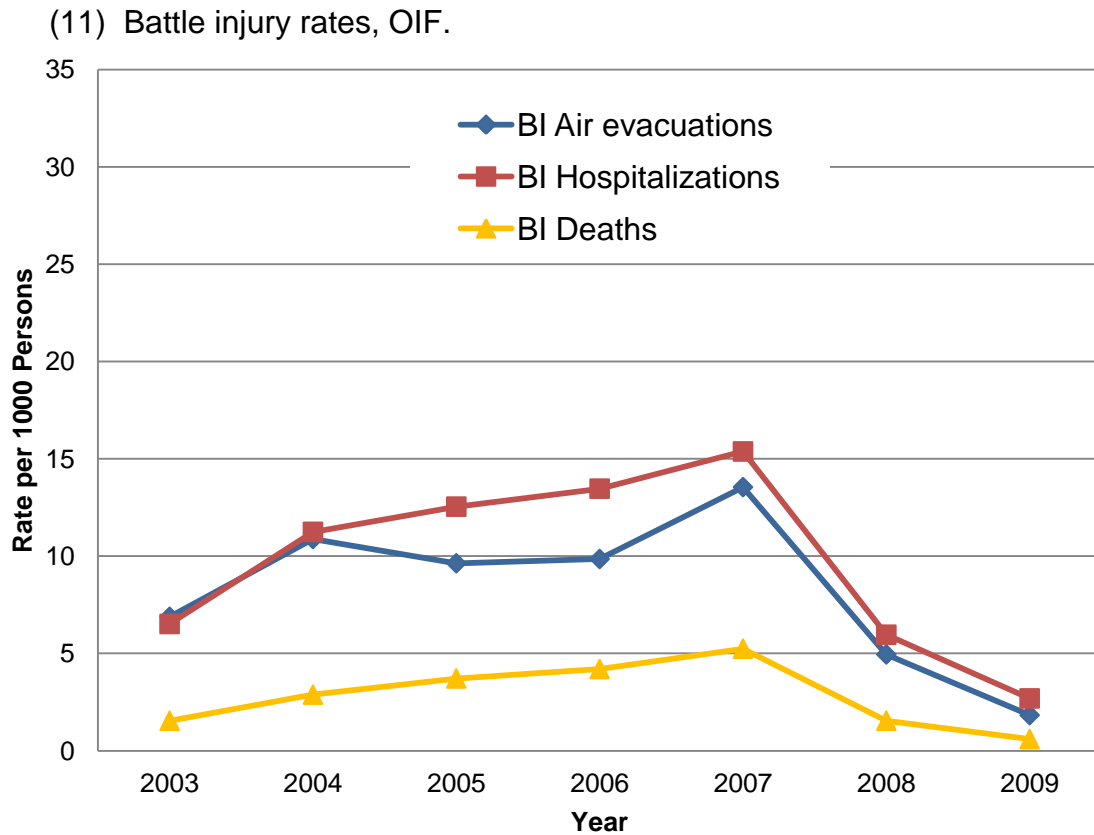
Figure 8. Non-Battle Injury Rates¹ among U.S. Army Soldiers Deployed for OEF, CYs 2003-2009

(a) Figure 8 illustrates OEF NBI rates for air evacuations, hospitalizations, and deaths from 2003–2009.

(b) The OEF NBI air evacuation rates decreased between 2003 and 2009, from 28/1000 person-years to 15/1000 person-years.

(c) The OEF NBI hospitalization rates remained relatively constant from 2005 to 2009, at approximately 6 to 7 per 1000 person-years.

(d) The OEF NBI death rates remained constant over the period, consistently less than 2 deaths per 1,000 persons per year.



Notes:

¹ Denominators for the rates were unclassified data obtained from the Joint Chiefs of Staff, Manpower and Personnel Directorate.

Figure 9. Battle Injury Rates¹ among U.S. Army Soldiers Deployed for OIF, CYs 2003-2009

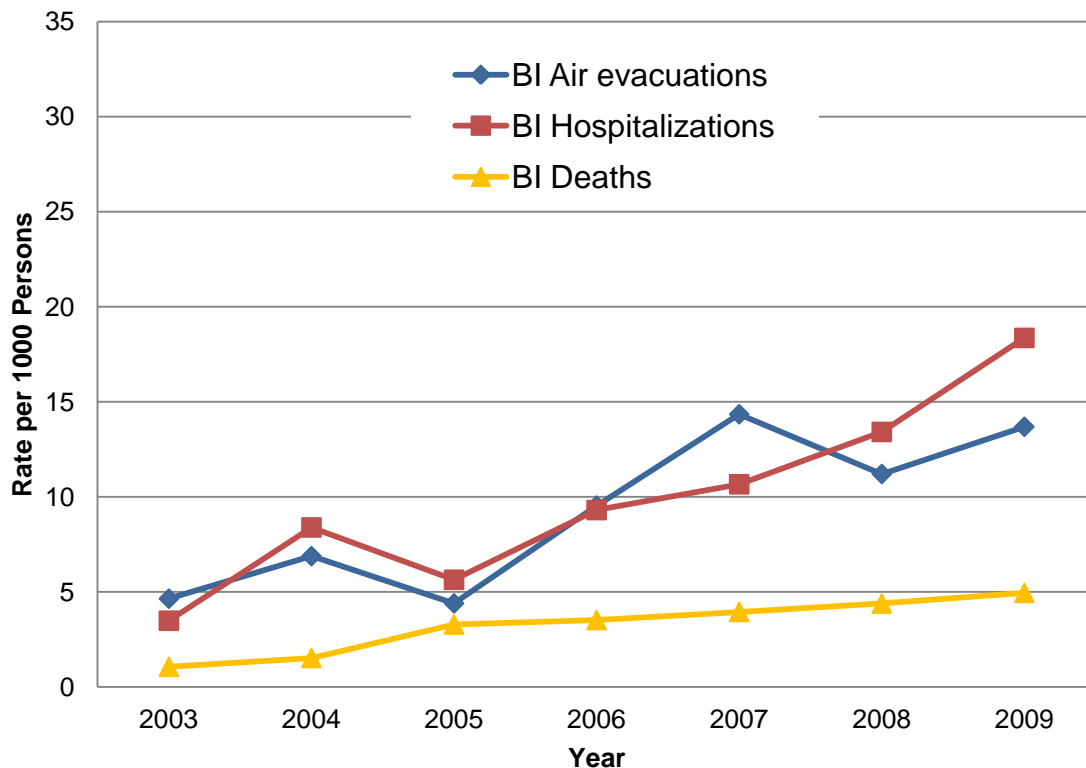
(a) Figure 9 illustrates OIF BI rates for air evacuations, hospitalizations, and deaths from 2003–2009.

(b) The OIF BI air evacuation and hospitalization rates increased up to 2007 and decreased thereafter.

(c) The OIF BI death rates followed the same pattern, reaching a peak of 5 deaths per 1,000 persons per year.

(d) The ratios of BI air evacuations and hospitalizations to deaths averaged about 3:1 and 4:1, respectively.

(12) Battle injury rates, OEF.



Notes:

¹ Denominators for the rates were unclassified data obtained from the Joint Chiefs of Staff, Manpower and Personnel Directorate.

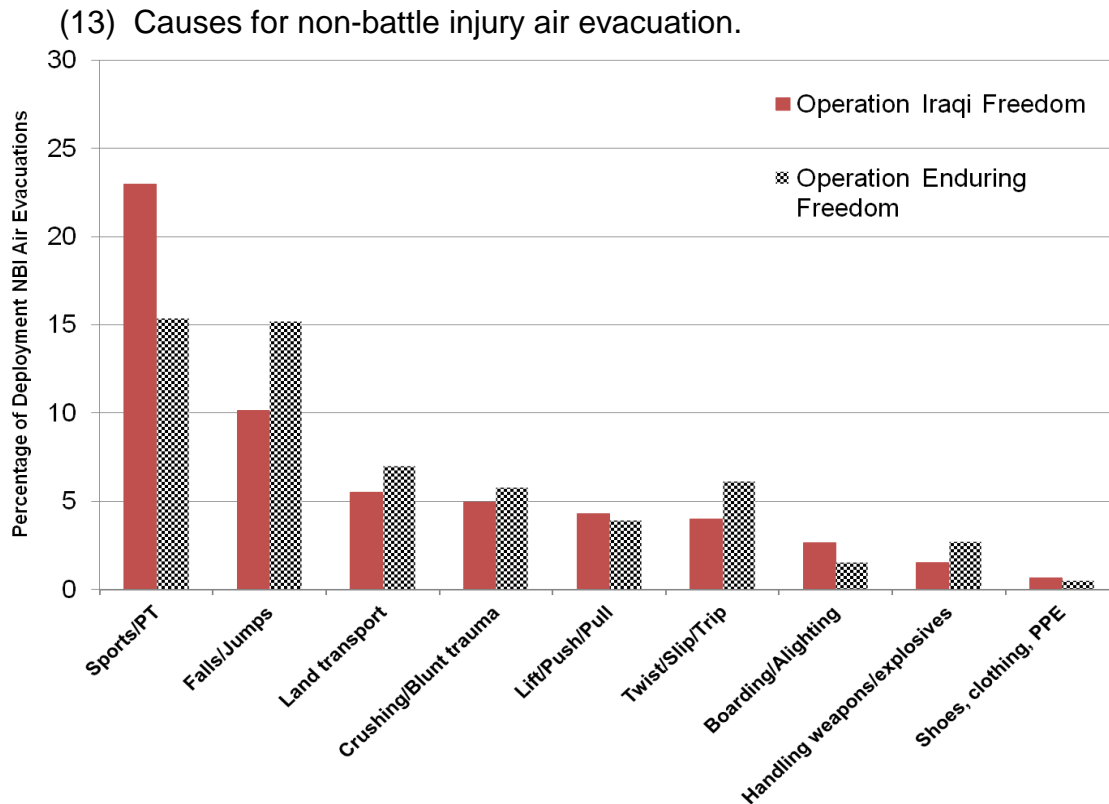
Figure 10. Battle Injury Rates¹ among U.S. Army Soldiers Deployed for OEF, CYs 2003-2009

(a) Figure 10 illustrates OEF BI rates for air evacuations, hospitalizations, and deaths from 2003–2009.

(b) The OEF BI air evacuation and hospitalization rates increased over time.

(c) The OEF BI death rates increased steadily from 2003 to 2006, reaching 5 deaths per 1,000 persons per year in 2009.

(d) The ratios of both BI air evacuations and hospitalizations to deaths averaged about 3:1.

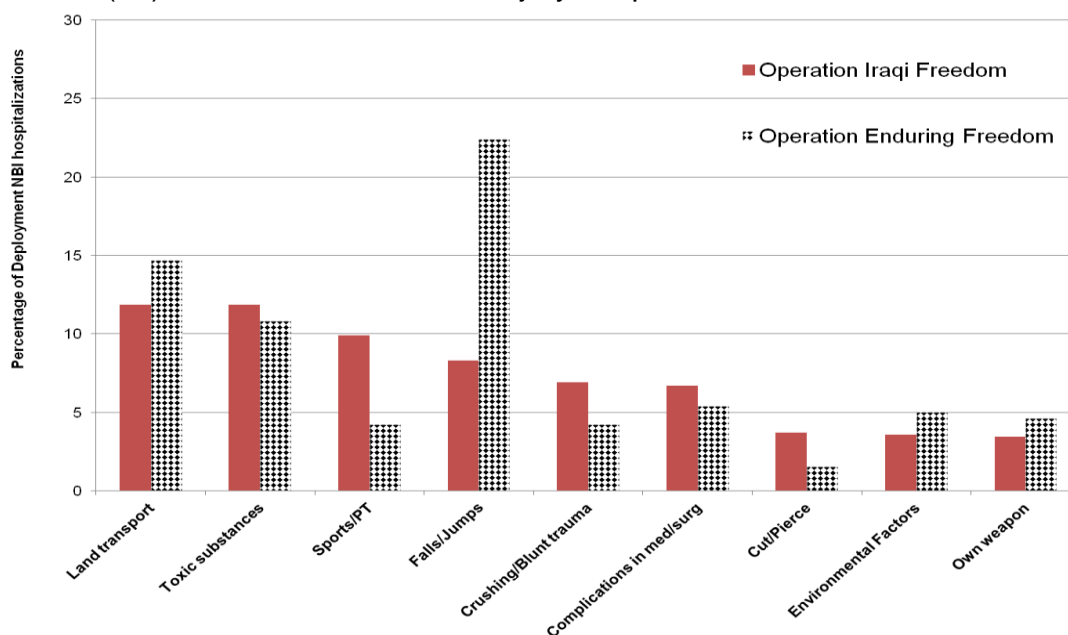


Note: Percentages are of the portion of total 2009 deployment NBI air evacuations for each operation (OIF: N=1,618; OEF: N=616).

Figure 11. Distribution of Leading Causes of Non-Battle Injury Air Evacuations among U.S. Army Soldiers Deployed for OIF and OEF, CY 2009

- (a) Figure 11 illustrates the distribution of the leading NBI causes for air evacuation by STANAG 2050 injury cause code groups.
- (b) In 2009, cause of injury was identified for 1,473 of the NBIs reported for OIF and OEF air evacuations (70 percent of the total NBI air evacuations).
- (c) The three leading causes of NBI air evacuations for both OIF and OEF were sports/PT, falls/jumps, and land transport.
- (d) For OIF/OEF combined, the leading causes of sports-related NBIs were: basketball (23 percent), PT (20 percent), weightlifting (19 percent), and football (15 percent).

(14) Causes for non-battle injury hospitalization.



Note: Percentages are of the portion of total 2009 deployment NBI hospitalizations for each operation (OIF: N=808; OEF: N=259).

Figure 12. Distribution of Leading Causes of Non-Battle Injury Hospitalizations among U.S. Army Soldiers Deployed for OIF and OEF, CY 2009

(a) Figure 12 illustrates the distribution of the leading NBI causes for hospitalization by STANAG 2050 injury causes code groups.

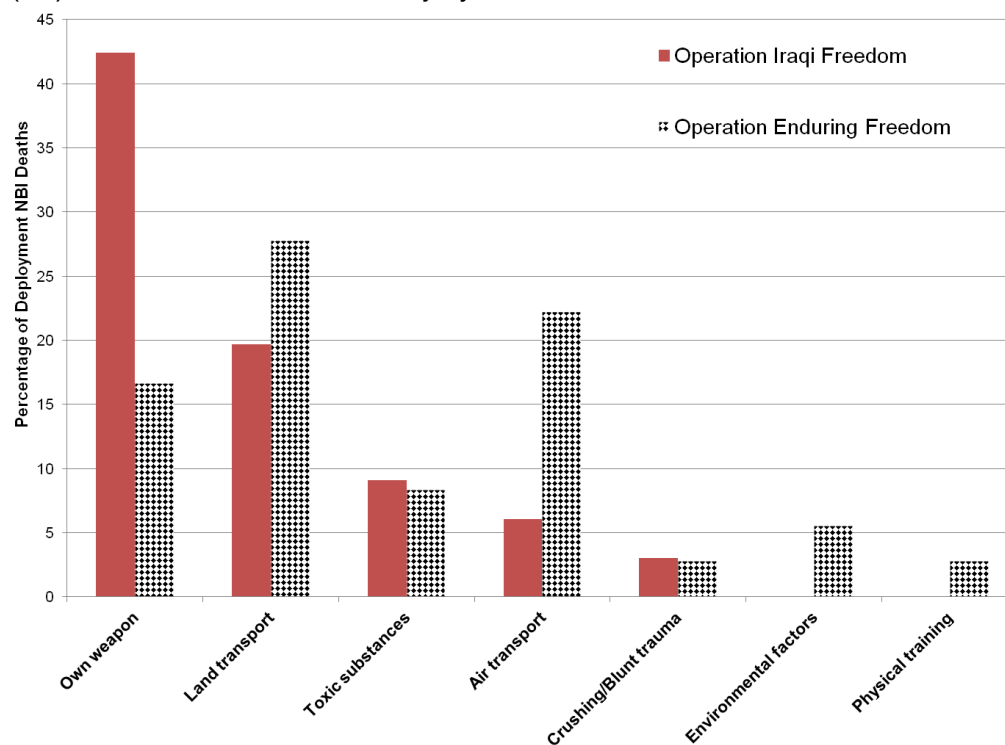
(b) The three leading causes of NBI hospitalization for OIF were land transport (12%), toxic substances (12%), and sports/pt (10%), while the three leading causes for OEF were falls/jumps (22%), land transport (15%), and toxic substances (11%).

(c) For OIF and OEF combined, 46 percent of toxic substance cases (poisonings) were intentionally self-inflicted.

(d) While injuries due to "own weapons" were only the ninth and fifth leading causes for OIF and OEF respectively, it should be noted that for OIF and OEF combined, 17 percent of "own weapon" hospitalizations were intentionally self-inflicted.

(e) The causes of hospitalization that differed in percentage between OIF and OEF were Falls/Jumps ($p < .01$) and Sports/PT ($p < .01$).

(15) Causes for non-battle injury death.



Note: Deaths for cause of injury coding were obtained from DCIPS (OIF: N=66; OEF: N=36).

Figure 13. Distribution of Causes of Non-Battle Injury Deaths among U.S. Army Soldiers Deployed for OIF/OEF, CY 2009

(a) Figure 13 illustrates the distribution of the leading NBI causes of death by STANAG 2050 injury causes code groups as a percentage of total NBI deaths.

(b) The three leading causes of death for OIF were “own weapon” (42%), land transport (20%), and toxic substances (9%), while the three leading causes for OEF were land transport (28%), air transport (22%), and “own weapon” (17%).

(c) “Own weapon” was the leading cause of NBI deaths for OIF and the third leading cause for OEF. For OIF/OEF combined, 88 percent of “own weapon” deaths were intentionally self-inflicted (n=25) or intentionally inflicted by another (n=5).

(d) Land transport (motor vehicle accidents) was the leading cause of NBI deaths for OEF and the second leading cause for OIF.

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(16) Frequency of non-battle injury air evacuations by type of injury and location.

Table 3. Frequency of Traumatic Air Evacuated Non-Battle Injuries by Type of Injury and Location, U.S. Army, OIF/OEF, CY 2009

			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	0			29							0			29	2.6	4.6	
		Type 2 TBI	3			19										22	2.0		
		Type 3 TBI	0													0	0.0		
	Other Head, Face, Neck	Other head					1						0	0	10		11	1.0	3.7
		Face	16	0	0		0						2	0			18	1.6	
		Eye					4				3		0	0			7	0.6	
Neck		0		0		0					0	0	2			2	0.2		
Head, Face, Neck Unspec.									0	0	0	2	0	1		3	0.3		
Spine and Back	Spinal Cord (SCI)	Cervical SCI	0			1										1	0.1	0.7	
		Thoracic/Dorsal SCI	1			0										1	0.1		
		Lumbar SCI	0			3										3	0.3		
		Sacrum Coccyx SCI	0			0										0	0.0		
		Spine, Back Unspec. SCI	0			3										3	0.3		
	Vertebral Column (VCI)	Cervical VCI	6	1	7												14	1.3	3.0
		Thoracic/Dorsal VCI	0	0	0												0	0.0	
		Lumbar VCI	5	1	7												13	1.2	
		Sacrum Coccyx VCI	1	2	0												3	0.3	
		Spine, Back Unspec. VCI	3	0													3	0.3	
Torso	Torso	Chest (thorax)	5	0	0	3	0		0	0	0	1	0			9	0.8	3.1	
		Abdomen				3	1		0	0	0	0	3			7	0.6		
		Pelvis, Urogenital	7	0	1	0	3		0	0	0	0	0			11	1.0		
		Trunk	0				0				0	0	1	0	2	3	0.3		
		Back, Buttock			5		0			0	0	0				5	0.4		
Extremities	Upper	Shoulder, Upper Arm	21	55	95		2	0		2	0	0		2		177	15.9	38.2	
		Forearm, Elbow	41	1	1		0	1		0	1	0				45	4.0		
		Wrist, Hand, Fingers	87	12	19		15	8		4	10	7		17		179	16.1		
		Other & Unspec.	0				0	0	3	1	0	1	19	0		24	2.2		
	Lower	Hip	4	4	3					0	0	0					11	1.0	38.0
		Upper leg, Thigh	3						0	1	0	0					4	0.4	
		Knee	6	113	42					4	1	0					166	14.9	
		Lower leg, Ankle	116	4	21			0		0	3	0					144	12.9	
		Foot, toes	24	2	7		4	0		1	4	0					42	3.8	
		Other & Unspec.	1		34		10	0	2	0	0	0		9			56	5.0	
Unclass. by Site	Other, Unspecified	Other/Multiple	1						0			0	5			6	0.5	6.0	
		Unspec. Site	34	5	9	0	3		0	1	1	6	2	0		61	5.5		
	System-wide & late effects														31	31	2.8		
Total			385	200	251	61	43	9	5	17	20	20	31	41	31	1114			
Percent			34.6	18.0	22.5	5.5	3.9	0.8	0.4	1.5	1.8	1.8	2.8	3.7	2.8		100.0	100.0	

NOTE: ICD-9-CM 800-995 CODES. Includes the first listed injury diagnosis for injuries resulting in out-of-CENTCOM air evacuation.

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(a) Table 3 uses the Barell injury matrix to categorize traumatic NBIs that required medical air evacuation from OIF and OEF by type of injury and body region.

(b) In 2009, there were 1,114 NBIs that required medical air evacuation (coded in the 800-995 ICD-9-CM code series).

(c) The most common types of injury leading to medical air evacuation were fractures (35 percent), sprains/strains (23 percent), and dislocations (18 percent).

(d) Injured body regions most commonly leading to medical air evacuation were upper extremities (38 percent); lower extremities (38 percent); and head, face, and neck injuries (8 percent).

(e) Leading specific reasons for medical air evacuation included fractures of the lower leg and/or ankle (10 percent), dislocation of the knee (10 percent), and strain/sprain of the shoulder/upper arm (9 percent).

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(17) Frequency of non-battle musculoskeletal injury air evacuations by type of injury and location.

Table 4. Frequency of Air Evacuated Non-Battle Injury-Related Musculoskeletal Conditions by Type of Injury and Location, U.S. Army, OIF/OEF, CY 2009

			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	53	19	12				84	11.4	50.4
		Thoracic/Dorsal VCI		0	22				22	3.0	
		Lumbar VCI	1	11	138				150	20.3	
		Sacrum Coccyx VCI	31						31	4.2	
		Spine, Back Unspec. VCI	51	16	18	0			85	11.5	
Extremities	Upper	Shoulder	63	5			32	3	103	14.0	17.1
		Upper Arm, Elbow	5	1		0		0	6	0.8	
		Forearm, Wrist	6	1		0		0	7	0.9	
		Hand	2	0			8	0	10	1.4	
	Lower	Pelvis, Hip, Thigh	11	2		0	2	0	15	2.0	26.3
		Lower leg, Knee	39	41		4	64	0	148	20.1	
		Ankle, Foot	26	3		1	1	0	31	4.2	
Unclass. by Site	Other, Unspecified	Other specified/Multiple	2	0		0	2	0	4	0.5	6.2
		Unspecified Site	17	2	9	4	10	0	42	5.7	
		Total	307	101	199	9	119	3	738		
			Percent	41.6	13.7	27.0	1.2	16.1	0.4	100.0	100.0

Note: ICD-9-CM 710-739 CODES. Includes the first listed injury diagnosis for injuries resulting in out-of-CENTCOM air evacuation.

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(a) Table 4 categorizes NBI-related musculoskeletal conditions (a subset of musculoskeletal conditions coded in the 719-739 ICD-9-CM series) that required medical air evacuation from OIF and OEF by type of injury and body region affected.

(b) In 2009, 738 NBI-related musculoskeletal conditions required medical air evacuation.

(c) The most common types of musculoskeletal conditions leading to medical air evacuation were inflammation and pain (overuse) (42 percent), joint derangement with neurological involvement (27 percent), and strains/sprains/rupture (16 percent).

(d) The spine/back (50 percent) was the body region most affected by injury-related musculoskeletal conditions, followed by lower extremities (26 percent), and upper extremities (17 percent).

(e) The leading specific injury-related musculoskeletal conditions were joint derangement with neurological involvement involving the lumbar spine (19 percent), strains/sprains/rupture to the lower leg and/or knee (9 percent), and inflammation and pain (overuse) involving the shoulder (9 percent).

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(18) Frequency of non-battle injury hospitalizations by type of injury and location.

Table 5. Frequency of Traumatic Hospitalized Non-Battle Injuries by Type of Injury and Location, U.S. Army, OIF/OEF, CY 2009

			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	17			26								0		43	4.7	13.7	
		Type 2 TBI	2			75										77	8.5		
		Type 3 TBI	4													4	0.4		
	Other Head, Face, Neck	Other head					4						0	0	3		7	0.8	8.6
		Face	35	1	0		13						4	0			53	5.8	
		Eye					4				4		0	0			8	0.9	
Neck		0		0		0					0	0	0			0	0.0		
Head, Face, Neck Unspec.									0	5	0	1	0	4		10	1.1		
Spine and Back	Spinal Cord (SCI)	Cervical SCI	1			2										3	0.3	0.4	
		Thoracic/Dorsal SCI	1			0										1	0.1		
		Lumbar SCI	0			0										0	0.0		
		Sacrum Coccyx SCI	0			0										0	0.0		
		Spine, Back Unspec. SCI	0			0										0	0.0		
	Vertebral Column (VCI)	Cervical VCI	1	0	6												7	0.8	2.9
		Thoracic/Dorsal VCI	4	0	2												6	0.7	
		Lumbar VCI	8	0	5												13	1.4	
		Sacrum Coccyx VCI	0	0	0												0	0.0	
		Spine, Back Unspec. VCI	0	0													0	0.0	
Torso	Torso	Chest (thorax)	7	0	1	4	2		0	4	4	1	0			23	2.5	5.8	
		Abdomen				9	0		1	2		0	0			12	1.3		
		Pelvis, Urogenital	7	0	0	0	2		0	0	1	0	0			10	1.1		
		Trunk	0				1			0	0	0	0	3		4	0.4		
		Back, Buttock			2		0			1	0	1				4	0.4		
Extremities	Upper	Shoulder, Upper Arm	14	4	5		1	1		2	0	0		0		27	3.0	31.0	
		Forearm, Elbow	24	0	0		6	0		0	1	2				33	3.6		
		Wrist, Hand, Fingers	108	9	7		31	16		2	23	11		2		209	23.0		
		Other & Unspec.	1				0	0	4	0	0	1	5	1		12	1.3		
	Lower	Hip	4	2	0					0	0						6	0.7	19.8
		Upper leg, Thigh	2					0		4	0	0					6	0.7	
		Knee	2	11	5					1	0	0					19	2.1	
		Lower leg, Ankle	71	3	8					0	0	1					83	9.2	
		Foot, toes	18	0	0		3	1		0	3	0					25	2.8	
		Other & Unspec.	1		9		24	0	3	2	0	1		1			41	4.5	
Unclass. by Site	Other, Unspecified	Other/Multiple	0						0			0	0			0	0.0	0.8	
		Unspec. Site	0	1	4	0	0		0	1	0	0	0	1		7	0.8		
System-wide & late effects															154	154	17.0	17.0	
Total			332	31	54	116	91	18	8	28	32	23	5	15	154	907			
Percent			36.6	3.4	6.0	12.8	10.0	2.0	0.9	3.1	3.5	2.5	0.6	1.7	17.0		100.0	100.0	

NOTE: ICD-9-CM 800-995 CODES. Includes the first listed injury diagnosis for injuries resulting in in-CENTCOM hospitalization.

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(a) Table 5 uses the Barell injury matrix to categorize traumatic NBIs that required in-theater hospitalization in OIF and OEF by type of injury and body region.

(b) In 2009, there were 907 NBIs that required in-theater hospitalization (coded in the 800-995 ICD-9-CM code series).

(c) The most common types of injury leading to in-theater hospitalization were fractures (37 percent), internal injuries (13 percent), and open wounds (10 percent).

(d) Injured body regions most commonly leading to in-theater hospitalization were upper extremities (31 percent), head, face, and neck injuries (22 percent), and lower extremities (20 percent).

(e) Leading specific reasons for in-theater hospitalization included fracture of the wrist, hand, and/or fingers (12 percent), internal head injuries (11 percent), and fractures of the lower leg and/or ankle (8 percent).

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(19) Frequency of non-battle musculoskeletal injury hospitalizations by type of injury and location.

Table 6. Frequency of Hospitalized Non-Battle Injury-Related Musculoskeletal Conditions by Type of Injury and Location, U.S. Army, OIF/OEF, CY 2009

			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	17	0	4				21	14.3	48.3
		Thoracic/Dorsal VCI		0	8				8	5.4	
		Lumbar VCI	1	2	17				20	13.6	
		Sacrum Coccyx VCI	11						11	7.5	
		Spine, Back Unspec. VCI	11	0	0	0			11	7.5	
Extremities	Upper	Shoulder	3	7			1	2	13	8.8	19.7
		Upper Arm, Elbow	13	0		0		0	13	8.8	
		Forearm, Wrist	1	0		0		0	1	0.7	
		Hand	0	1			1	0	2	1.4	
	Lower	Pelvis, Hip, Thigh	3	0		2		0	7	4.8	29.3
		Lower leg, Knee	6	21		0		3	30	20.4	
		Ankle, Foot	3	2		1		0	6	4.1	
Unclass. by Site	Other, Unspecified	Other specified/Multiple	0	0		0	0	0	0	0.0	2.7
		Unspecified Site	2	0	2	0	0	0	4	2.7	
Total			71	33	31	3	7	2	147		
Percent			48.3	22.4	21.1	2.0	4.8	1.4	100.0		100.0

Note: ICD-9-CM 710-739 CODES. Includes the first listed injury diagnosis for injuries resulting in in-CENTCOM hospitalization.

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(a) Table 6 categorizes NBI-related musculoskeletal conditions (a subset of musculoskeletal conditions coded in the 719-739 ICD-9-CM series) that required in-theater hospitalization in OIF and OEF by type of injury and body region affected.

(b) In 2009, 147 NBI-related musculoskeletal conditions required in-theater hospitalization.

(c) The most common types of musculoskeletal conditions leading to in-theater hospitalization were inflammation and pain (overuse) (48 percent), joint derangement (22 percent), and joint derangement with neurological involvement (21 percent).

(d) The spine/back (48 percent) was the body region most affected by injury-related musculoskeletal conditions, followed by lower extremities (29 percent), and upper extremities (20 percent).

(e) The leading specific injury-related musculoskeletal conditions were joint derangement to the lower leg and/or knee (14 percent), joint derangement with neurological involvement to the lumbar spine (12 percent), and inflammation and pain (overuse) involving the cervical spine (12 percent).

d. Discussion for Routine Deployment Surveillance.

(1) For CY 2009, NBI was the largest single diagnosis category that resulted in out-of-CENTCOM air evacuation for OIF and OEF. NBI was second to digestive diseases for OIF hospitalizations and second to battle injuries for OEF hospitalizations. Our present findings are consistent with previous studies showing the relative importance of NBIs as a cause of morbidity and mortality.^(2-9,14) In previous annual reports for OIF and OEF, there were 6 times more disease and non-battle injuries (DNBIs) than battle injuries and 35 percent of air evacuations were for non-battle injuries. For OIF, in CY 2009, there were 20 times more disease and non-battle injuries (DNBIs) than battle injuries and 38 percent of those evacuated were for non-battle injuries. For OEF, in CY 2009, there were almost 4 times more disease and non-battle injuries (DNBIs) than battle injuries and 31 percent of those evacuated were for non-battle injuries. The digestive disease diagnosis category is slightly greater than NBI for OIF hospitalizations.

(2) The annual NBI air evacuation rates for OIF decreased over time from a high in 2003. The annual hospitalization rates for OIF decreased from 2003 to 2004 and have remained relatively constant since that time. The annual NBI death rate for OIF has remained constant. OEF has had greater fluctuation in rates of air evacuation and hospitalization than OIF with 2004 and 2007 being peak years. Injury rates and trends for OIF and OEF were previously reported by other descriptive studies.^(6,15-16) These studies showed peak rates in 2003, but did not cover the 2007 time period.

(3) In this report, the leading NBI types for 2009 air evacuations were fracture, inflammation and pain (overuse), sprain/strain, and dislocation. The back was most commonly involved, followed by the knee, shoulder, ankle/foot, and wrist/hand. In general, previous studies have focused on specific body regions or diagnosis categories when describing injury or disease type. In reference to one previous study, our finding of fractures and dislocations as leading NBI types for both hospitalizations and air evacuations was consistent with the burden of non-battle orthopedic injuries treated at one facility during the combat phase of OIF.⁽¹⁷⁾

(4) Head injuries are of interest for the present conflicts in Iraq and Afghanistan. In this report for 2009, only NBIs are included in the frequencies of air evacuations by body region. Eight percent of NBI air evacuations involve injury to the head and neck, 50-60 percent of these being traumatic brain injuries. Overall for the Operations, the majority of head injuries are attributed to battle blast exposure.⁽¹⁸⁻²⁰⁾

(5) 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. This report identified the top three causes of NBI air evacuations in 2009 as

sports/physical training, falls/jumps, and land transport accidents. Leading causes of NBI hospitalizations differed from air evacuations, with the top three being toxic substances, land transport-related accidents, and falls/jumps. The leading causes of fatalities were own weapon (gunshot wounds), land transport-related accidents, and air transport accidents. Self-inflicted injuries became a significant cause of in-theater hospitalizations in OIF and OEF (positive trend for rate, $p < .01$; data not shown). Also, self-inflicted injury fatalities rose from 2004-2008.⁽²¹⁾ Although sports/physical training and falls/jumps continue to be leading causes of NBIs, the rates of these injuries have been decreasing over time.

(6) This 2009 report follows the 2008 report.⁽⁹⁾ The impact of injuries and causes, type, and body region of injuries were similar from 2008 to 2009 with minor changes. In CY 2009, compared to 2008:

(a) Operation Iraqi Freedom had a lower percentage of air evacuations and hospitalizations from battle injuries. Operation Enduring Freedom had a slightly greater percentage of air evacuations from battle injuries.

(b) Operation Iraqi Freedom had half as many deaths overall. Operation Enduring Freedom had twice as many deaths overall.

(c) For 2009 the leading NBI types were back, knee, shoulder, ankle/foot, and wrist/hand, while in 2008 they were back, knee, wrist/hand, ankle/foot, and shoulder.

(d) In 2009, land transport accidents surpassed crush/blunt trauma injuries as the third leading cause of NBI air evacuations and toxic substances as the leading cause of NBI hospitalizations. Otherwise, the leading causes of NBI fatalities remained the same.

(7) Current intervention studies and strategies (civilian and military) to address deployment NBI include:

(a) Use of ankle braces (stabilizers) to reduce ankle injuries.⁽²²⁻²⁴⁾

(b) Ocular preventive measures such as hygiene, contact lens restriction, and protective eyewear use during participation in racquet and contact sports.⁽²⁵⁻²⁸⁾

(c) Rollover drowning prevention training, rollover simulator training, equipment modifications to prevent rollover accidents, and improved compliance for seatbelt use⁽²⁹⁻³¹⁾

(d) Breakaway bases, recessed bases, and proper sliding technique education for softball sliding injuries.⁽³²⁾

(e) Mouthguard use in sport activities where there is significant risk of orofacial injury.⁽³³⁾

e. Conclusions for Routine Deployment Surveillance. 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 2009. As in previous years, the proportion of air evacuated NBIs is larger than BI and any other single category of disease and has a big impact on readiness. Similar to previous reports, 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 for Routine Deployment Surveillance.

(1) Continue routine surveillance of deployment injuries and yearly updates of a deployment injury surveillance report.

(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) Continue investigation to identify modifiable risk factors that contribute to the leading causes of injury.

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

5. SPECIAL ANALYTIC DEPLOYMENT INJURY SURVEILLANCE PROJECT SUMMARIES 2009.

a. Special Analytic Project Summaries.

(1) Cause of Air Evacuated Nonbattle Injuries among Service Members (Air Force, Army, Marines, and Navy) Deployed for OIF/OEF–October 2001 to May 2008.

(a) The NBIs accounted for 34% of air evacuations for Soldiers from OIF/OEF (2001-2007) (NBI rate: =17/1000 p-yrs); a higher proportion than any disease category. Leading Army NBI causes are sports/PT, falls, and military vehicle accidents (MVA).

(b) The purpose of this analysis was to determine the relative impact and causes of NBIs in OIF/OEF for the Air Force, Army, Marines and Navy (October 2001 to May 2008).

(c) For these services combined, NBI was the leading diagnosis category (33%). NBI rates varied by service: 12/1000 p-yrs (Marines), 7.4/1000 p-yrs (Air Force), and 6.4/1000 p-yrs (Navy) and by operation (see Table 7). The overall leading causes were sports/PT (23%), falls (17%), and MVA (16%), although there were differences in rank order and proportions between services for NBI causes.

Table 7. Annual Rates of Air Evacuated NBIs, OIF/OEF: 2001 - 2008^{1,2}

Service	OIF		OEF	
	Frequency (n)	Annual Rate ³ (Injuries/1,000 p-yrs)	Frequency (n)	Annual Rate ³ (Injuries/1,000 p-yrs)
Air Force ⁴	536	3.9	386	6.1
Marines ⁴	1,465	9.6	189	9.2
Navy ⁴	477	3.3	150	2.5
Army ^{1,4}	13,077	16.4	2,307	17.5

Notes:

¹Includes all NBIs air evacuation cases from CENTCOM, 1 October 2001 through 31 May 2008 (USAF, USMC and USN) (USA: 1 October 2001 through 31 December 2008)

²Eighty-one cases were air evacuated from CENTCOM, but operation was not specified in the air evacuation records. Cases air evacuated before 19 March 2003 (n=73) were included in OEF. Cases air evacuated after 19 March 2003 (n=8) were included in OIF

³Annual injury rate is the number of air evacuated injuries per 1,000 deployed person-years (p-yrs).

⁴Deployed person-time was provided by the Armed Forces Health Surveillance Center (May 2009).

(d) NBI rates varied by service, but the overall impact and causes of NBI were similar for all four military services. Further investigation is required to evaluate reasons for inter-service differences.

(2) Comparison of Air Evacuated Non-Battle Injury Rates for Operations OIF/OEF.

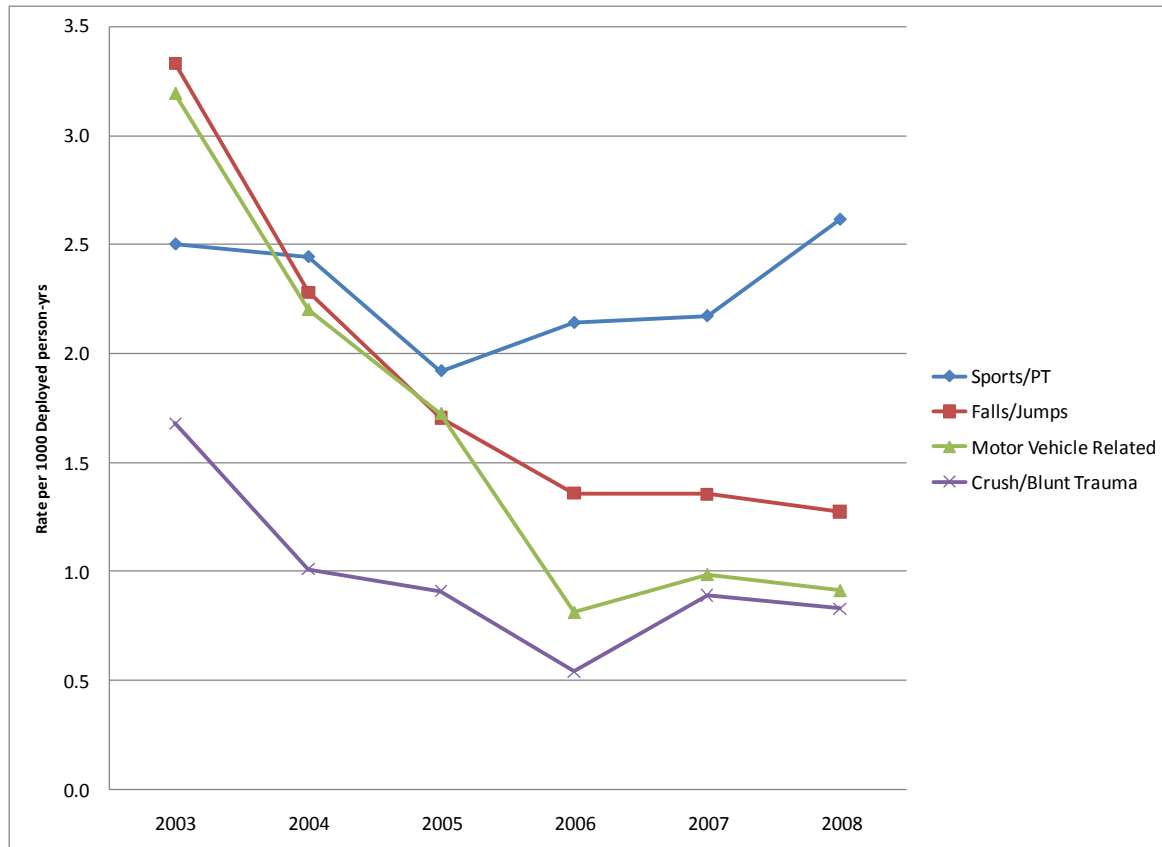


Figure 14. Causes of Army Non-Battle Injuries: Annual Rates for OIF: 2003-2008

(a) The USAPHC has monitored the incidence, causes, and types of NBIs requiring air evacuation (AE) from OIF and OEF since 2001.

(b) The purpose of this investigation was to describe trends in annual rates for all NBIs and NBIs related to the three leading NBI causes (sports/PT, falls/jumps, vehicle accidents).

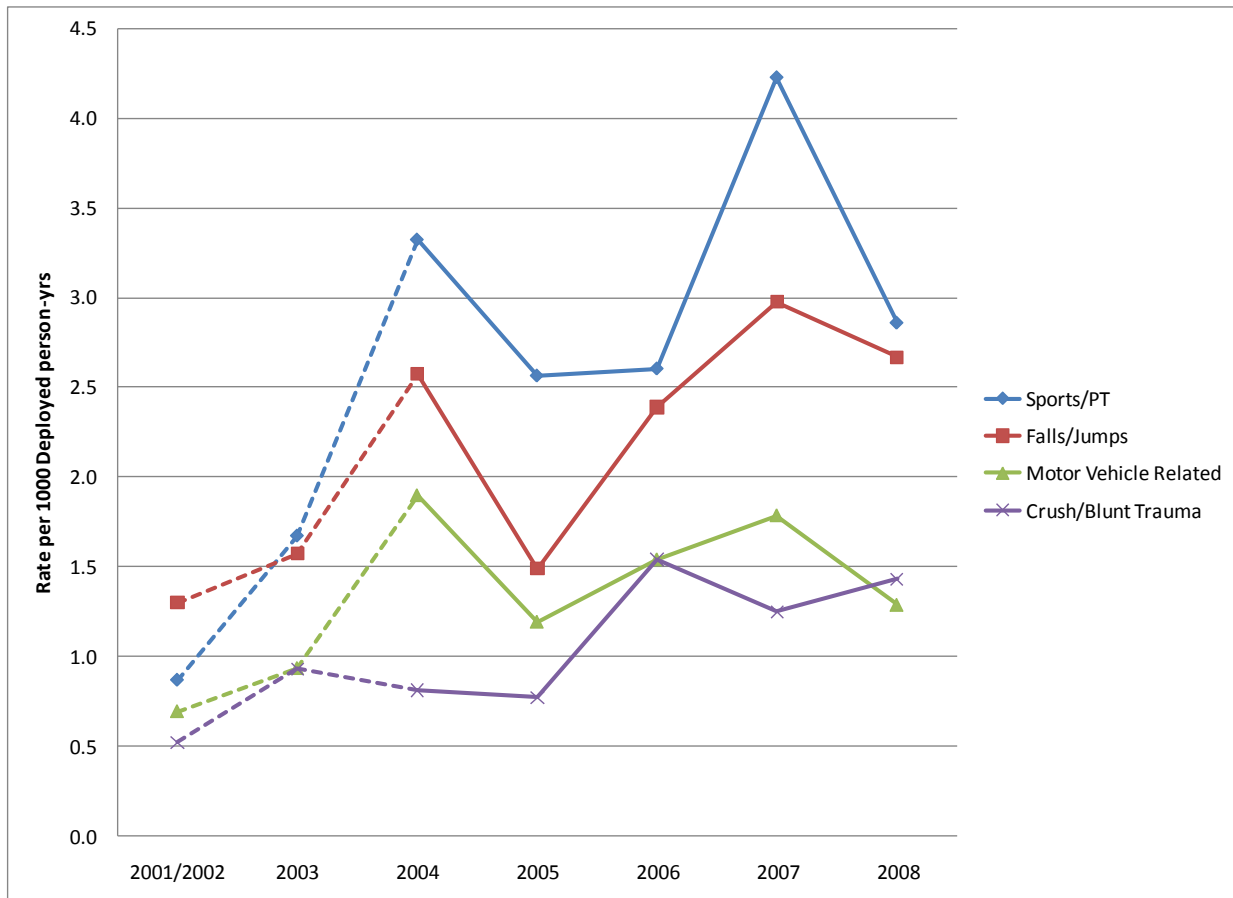


Figure 15. Causes of Army Non-Battle Injuries: Annual Rates for OEF: 2001-2008

(c) The OIF Army NBI rate decreased from 27/1000 p-yrs (2003) to 14/1000 person-yrs (2007). Figure 14 shows that the OIF rates for falls/jumps and vehicle accidents similarly decreased. The OEF NBI annual rates fluctuated widely from 9/1000 p-yrs (2002) to 28/1000 p-yrs (2007). Rates for each of the leading causes similarly fluctuated widely with peaks in 2003 and 2007 (see Figure 15).

(d) These differing trends in Army NBI rates for OIF and OEF may reflect differences in the theaters of operation, including environmental exposures, facilities, availability of medical care, terrain, and vehicle use. Further evaluation is required to understand these differences and how they affect injury risk for NBI.

(3) External Cause of NBIs by Out-of-Theater Medical Specialties, Army, 2001-2008.

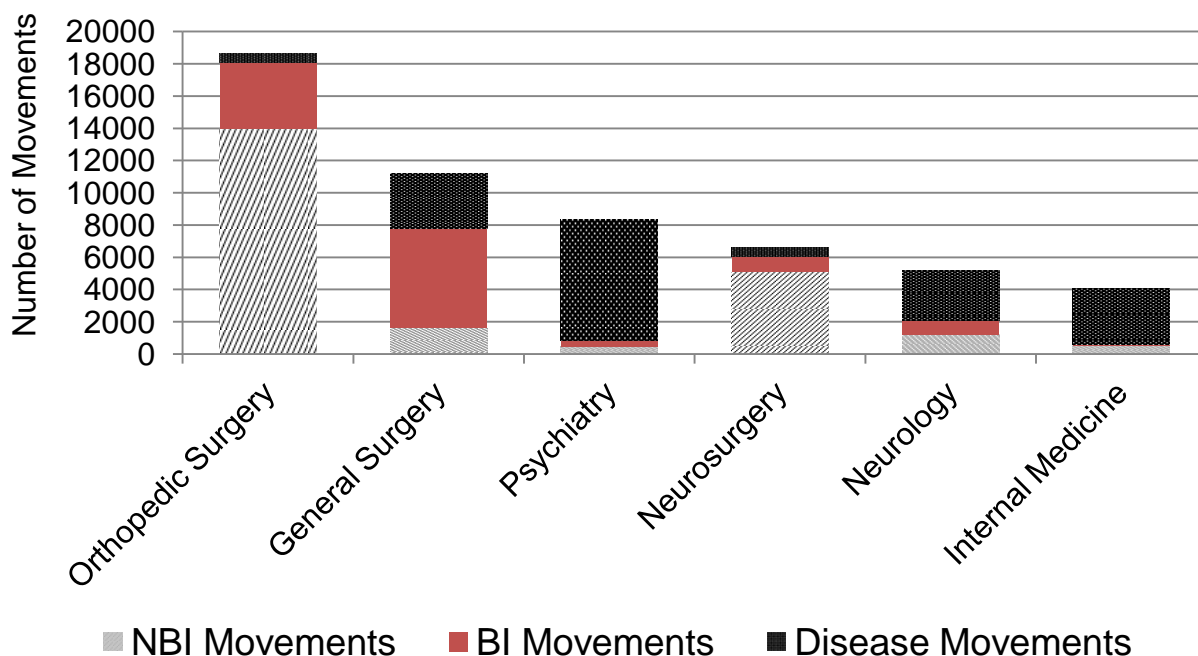


Figure 16. Leading Medical Specialty Movement Frequencies: OIF/OEF, 2001-2008

(a) For each Soldier medically air-evacuated within or out of the CENTCOM Theater, there may be one or more subsequent patient movements to attain a higher level of specialty medical care.

(b) Among deployed OIF or OEF Soldiers from 2001–2008, there were 38,149 patient movements (for 20,658 injuries) that initially originated from CENTCOM. Of these movements, 23,781 were related to NBIs (NBIs; N=13,316). The majority of these NBI patients were moved out of CENTCOM resulting in 23,692 patient air movements. Figure 16 shows the primary medical specialty codes, assigned to these Soldiers' conditions. The specialties treating the air-evacuation patients who were moved the most were Orthopedic Surgery, Neurosurgery, and General Surgery. The leading external causes of injury for the Soldiers requiring these medical specialties were sports and physical training, military motor vehicle accidents, and lifting/pushing/pulling (see Figure 17).

(c) These results have implications for areas in need of injury prevention, as well as amount and types of resources utilized or required.

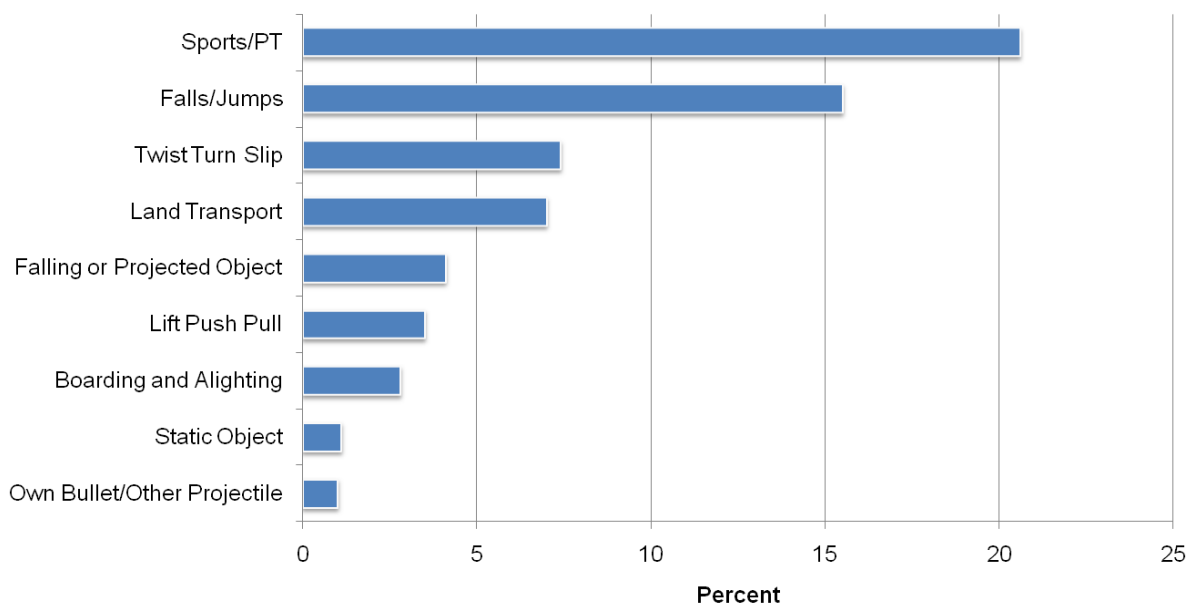


Figure 17. Non-battle Injury Orthopedic Surgery Movements Leading Causes of Injury: OIF/OEF, 2001-2008

b. Special Analytic Project Conclusions.

(1) The NBI rates varied by Service, possibly reflecting the intensity of involvement in conflict, but causes of NBI were similar for all four military Services.

(2) Differing trends in NBI rates for OIF and OEF may reflect differences in the theaters of operation, including environmental exposures, facilities, availability of medical care, terrain, and vehicle use.

(3) The greatest numbers of air-evacuation patient movements were for specialty care by Orthopedic Surgery, Neurosurgery, and General Surgery. These results have implications for areas in need of injury prevention, as well as amount and types of resources utilized or required.

c. Special Analytic Project Recommendations.

(1) Further investigation is required to evaluate reasons for inter-Service differences in rates of NBI.

(2) Further evaluation is required to understand between-operation differences in trends for NBIs.

6. POINT OF CONTACT. The point of contact at USAPHC is Epidemiology and Disease Surveillance Portfolio, Injury Prevention Program, commercial 410-436-4655 or DSN 584-4655.



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APPENDIX A

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APPENDIX B

TABLE B-1. BARELL INJURY DIAGNOSIS MATRIX AND ASSOCIATED ICD-9-CM 800-995 CODES

Type of injury	ICD-9-CM codes	FRACTURE	DISLOCATION	SKIN LACERATION	INTERNAL ORGANS	INTERNAL	OPEN WOUND	AMPUTATION	BLOOD	CONTUSION	CRUSH	BURN	HEAVY	UNSPECIFIED					
															800-809	810-819	820-829	830-839	840-849
Head and Neck	Type 1 Hit	800.801,800.804,1,4,6,9, (10,15,53,56) 800(2-4), 851-854, 950(1-3), 955-56	800.801,800.804,1,4,6,9 800.801,800.804,10,15,53,56	800.218	800.218	800.218	800.218	800.218	800.218	800.218	800.218	800.218	800.218	800.218					
	Type 2 Hit	800.801,800.804(10,15,53,56), 800(1-3), 955-56	800.801,800.804(10,15,53,56), 800(1-3), 955-56																
	Type 3 Hit	800.801,800.804(10,15,53,56)	800.801,800.804(10,15,53,56)																
	Other Head	873(D-1,2-5),941x6,951,959-01	/	/	/	/	873(D-1,2-5)	/	/	/	/	941x6	951	959-01					
	Face	802,800,948(D-1,872,873,2-7,941x1,x3-x5,x7)	802	800	848(D-1)	/	872,873,2-7	/	/	/	/	941x1,x3-x5,x7	/	/					
	Eye	870-871,918,921,940,941x2,950(D,5)	/	/	/	/	870-871	/	/	918,921	/	940,941x2	950(D,5)	/					
Other head, face and neck	Neck	807,5-6,848,2,874,925,2,941x5,953(D,5)4	807,5-6		848,2	/	874	/	/	/	925,2	941x5	953(D,5)4	/					
	Head, face and neck Unspecified	800,910,920,925,1,941x0,x5,947(D,9)7(D,9)9	/	/	/	/	/	/	900	910,920	925,1	941x0,x5,947(D)	947(D)	959-09					
	Cervical SCI	806(D-1),952(D)	806(D-1)	/	/	952(D)	/	/	/	/	/	/	/	/					
	Thoracic/Thoracic SCI	806(2-3),952,1	806(2-3)	/	/	952,1	/	/	/	/	/	/	/	/					
	Lumbar SCI	806(4-5),952,2	806(4-5)	/	/	952,2	/	/	/	/	/	/	/	/					
	Sacrum/Coccyx SCI	806(6-7),952(3-4)	806(6-7)	/	/	952(3-4)	/	/	/	/	/	/	/	/					
Spinal Cord SCI	Spinal Cord SCI Unspecified	806(2-9),952(3-9)	806(2-9)	/	/	952(3-9)	/	/	/	/	/	/	/	/					
	Cervical SCI	806(D-0),806(D-1),847(D)	806(D-1)	806(D-1)	847(D)	/	/	/	/	/	/	/	/	/					
	Thoracic/Thoracic SCI	806(2-3),806(2,1,3),847,1	806(2-3)	806(2,1,3)	847,1	/	/	/	/	/	/	/	/	/					
	Lumbar SCI	806(4-5),806(20,30),847,2	806(4-5)	806(20,30)	847,2	/	/	/	/	/	/	/	/	/					
	Sacrum/Coccyx SCI	806(6-7),806(41-42),806(51-52),847(3-4)	806(6-7)	806(41-42),806(51-52)	847(3-4)	/	/	/	/	/	/	/	/	/					
	Spinal Cord SCI Unspecified	806(2-9),806(40,49),806(50,59)	806(2-9)	806(40,49),806(50,59)	/	/	/	/	/	/	/	/	/	/					
Musculoskeletal	Chest/Thoracic	807(D-4),806(61,71),848(3-4),930-962,875,879(D-0),801,922(D-1,3),925,19,942x1-x2,953,1	807(D-4)	806(61,71)	848(3-4)	930-962	875,879(D-1)	/	901	922(D-1,3)	925,19	942x1-x2	953,1	/					
	Abdomen	803-996,988,876(2-5),902(D-4),922,2,942x3,947(3),953(2,5)	/	/	/	983-996,988	876(2-5)	/	902(D-4)	922,2	/	942x3,947(3)	953(2,5)	/					
	Hand	808,808(69,79),846,846,8,967,877-878	808	808(69,79)	846,846,8	967	877-878	/	902(5,21-22)	922,4	908(D,12)	942x5,947,4	953(3)	/					
	Wrist & Ankle	802(5,21-22),922,4,908(D,12),942x5,947,4,953,3	/	/	/	/	/	/	/	/	/	/	/	/					
	Foot	809(6-7),911,922(2-5),929(2-9),940(x0,x9),954(1,2,9),959,1	809	/	/	/	879(6-7)	/	/	911,922(2-5)	929(2-9)	940(x0,x9)	954(1,2,9)	959,1					
	Back and Neck	847(9),876,922(31-32),925,11,942x4	/	/	847(9)	/	876	/	/	922(31-32)	925,11	942x4	/	/					
Upper Limb	Shoulder & upper arm	810-812,831,840,880,887(2-3),912,923(D),927(D),943(x3-x6),959,2	810-812	831	840	880	887(2-3)	/	912,923(D)	927(D)	943(x3-x6)	/	959,2						
	Forearm & wrist	813,882,841,881(x0-x1),887(D-1),923,1,927,1,943(x1-x2)	813	882	841	/	881(x0-x1)	887(D-1)	/	923,1	927,1	943(x1-x2)	/						
	Hand	814-817,830-834,842-851(x2),882,883,885-886,914-915,923(2-3),927(2-3),944,958(4-5)	814-817	830,834	842	/	881(x2),882,883	885-886	/	914-915,923(2-3)	927(2-3)	944	/	958(4-5)					
	Other & unspecified	818,884,887(4-7),903,913,923(2-9),927(2-9),943(x0,x9),953,4,956,959,3	818	/	/	/	884	887(4-7)	903	913,923(2-9)	927(2-9)	943(x0,x9)	953,4,956	959,3					
	Elbow	820,836,843,924(D),928(D)	820	836	843	/	/	/	924(D)	928(D)	/	/	/						
	Upper leg & thigh	821,887(2-3),924(D),928(D),945x6	821	/	/	/	887(2-3)	/	924(D)	928(D)	945x6	/	/						
Lower Limb	Knee	822,836,844(D-3),924-11,928,11,945x5	822	836	844(D-3)	/	/	/	924-11	928,11	945x5	/	/						
	Lower leg & ankle	823-824,837,845(D),887(D-1),924(D,2),928(D,2),945(x3-x4)	823-824	837	845(D)	/	887(D-1)	/	924(D,2)	928(D,2)	945(x3-x4)	/	/						
	Foot & toe	825-826,838,845,1,882-883,885-886,917,924(3,21),928(3,20),945(x1-x2)	825-826	838	845,1	/	882-883	885-886	/	917,924(3,20)	928(3,20)	945(x1-x2)	/	/					
	Other & unspecified	827,844(2-5),850-851,854,857(4-7),904(D-2),916,924(4-5),923(2-9),945(x0,x9),959(6-7)	827	/	844(2-5)	850-851,854	857(4-7)	904(D-2)	916,924(4-5)	923(2-9)	945(x0,x9)	/	959(6-7)						
	Other multiple	819,823,802,87,889,947(1-2),953(3,9)6	819,823	/	/	/	/	/	802,87,889	/	947(1-2)	953(3,9)6	/						
	Unspecified	825,806(2-9),848(2-9),969,879(2,5),902(5),904(9),919,924(2,5),902	825	806(2-9)	848(2-9)	969	879(2-5)	/	902(5),904(9)	919,924(2,5)	902	904(9)	919,924(2,5)	969(2,9)					
Type A Other	Other	846,94(2,5),948,949,953(9),957(1,2,5),959(2,9)	/	/	/	/	/	/	/	/	/	/	/						
	Unspecified	805-902,906(D,1,2,4-5),900-909,968,960-964,965-90(54-59),966(80-85)	805-902,906(D,1,2,4-5),900-909,968,960-964,965-90(54-59),966(80-85)	/	/	/	/	/	/	/	/	/	/						

Foreign body (800-809), Body complications of trauma (950), Poisoning (860-879), Toxic Effects (880-889), Other and unspecified effects of external cause (900-994) CHM and initial treatment (950-54-59, 950-50-59) Late electric strikes, poisonings, toxic effects and other external causes (905-909) excluding 903(3,5)

APPENDIX C

TABLE C-1. 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		722.11	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)	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)		733.94	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)		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