

# MSMR

A publication of the Armed Forces Health Surveillance Center



## MEDICAL SURVEILLANCE MONTHLY REPORT

### INSIDE THIS ISSUE:

Causes of medical evacuations from Operations Iraqi Freedom (OIF), New Dawn (OND) and Enduring Freedom (OEF), active and reserve components, U.S. Armed Forces, October 2001-September 2010	2
Cruciate ligament injuries, active component, U.S. Armed Forces, 2000-2009	8
Surveillance snapshot: Acute myocardial infarction, active component, U.S. Armed Forces, 2000-2009	12
<i>Summary tables and figures</i>	
Deployment-related conditions of special surveillance interest	13

## Causes of Medical Evacuations from Operations Iraqi Freedom (OIF), New Dawn (OND) and Enduring Freedom (OEF), Active and Reserve Components, U.S. Armed Forces, October 2001- September 2010

There are numerous and varied threats to the health and safety of U.S. military members, regardless of the natures or locations of their assignments. In addition, there are unique health threats inherent to combat-related (e.g., battle injuries, psychological stress) and other deployment operations – particularly, in areas with significant endemic disease threats and minimal public health and public safety infrastructures.

Since October 2001, approximately 2 million U.S. service members have served one or more times in support of Operations Iraqi Freedom (OIF), New Dawn (OND) and/or Enduring Freedom (OEF), mainly in Iraq and Afghanistan. In the theaters of operations, most medical care is provided by deployed military medical personnel; however, some injuries and illnesses require medical management outside the operational theater. In such cases, affected individuals are usually transported by air to a fixed military medical facility in Europe or the United States. At the fixed facility, they receive the specialized, technically advanced, and/or prolonged diagnostic, therapeutic, and rehabilitative care required.

Medical air transports (“medical evacuations”) are costly and generally indicative of serious medical conditions. Some serious medical conditions are directly related to participation in, or support of, combat operations (e.g., battle wounds); many others are unrelated to combat and may be preventable. The objectives of this report are to compare the natures, numbers, and trends of conditions for which male and female military members were medically evacuated from the OIF/OND and OEF theaters during the past nine years.

### Methods:

The surveillance period was 1 October 2001 to 30 September 2010. The surveillance population included all members of the active and reserve components of the U.S. Army, Navy, Air Force, Marine Corps, and Coast Guard who were evacuated during the surveillance period from the U.S. Central Command (CENTCOM) area of responsibility (AOR) to a medical treatment facility outside the CENTCOM AOR. Evacuations were included in analyses if the affected service member had at least one inpatient or outpatient medical encounter in a U.S. military medical facility within ten days after the evacuation date. Records of all medical evacuations conducted by the U.S. Transportation Command (TRANSCOM) are routinely provided for health surveillance purposes to the Armed Forces Health Surveillance Center

(AFHSC) via the Office of the Assistant Secretary of Defense for Health Affairs.

Medical evacuations included in the analyses were classified by the causes and natures of the precipitating medical conditions (based on information reported in relevant evacuation and medical encounter records). First, all medical conditions that resulted in evacuations were classified as “battle injuries” or “non-battle injuries and illnesses” (based on entries in an indicator field of the TRANSCOM evacuation record). Evacuations due to non-battle injuries and illnesses were sub-classified into 18 illness/injury categories based on International Classification of Diseases (ICD-9-CM) diagnostic codes reported on records of medical encounters after evacuation. For this purpose, all records of hospitalizations and ambulatory visits from five days prior to ten days after the reported date of each medical evacuation were identified. The primary (first-listed) diagnosis for either a hospitalization (if one occurred) or the earliest ambulatory visit was considered indicative of the condition responsible for the evacuation; diagnostic codes that specified illnesses and injuries (ICD-9-CM 001-999) were prioritized over external cause of injury (“E”) and other (e.g., observation, medical examination, vaccination [“V”]) codes.

### Results:

During the nine-year surveillance period, 62,087 medical evacuations of service members from OIF/OND or OEF were followed by at least one medical encounter in a fixed medical facility outside the operational theater. During the period, there were approximately 3.5 times as many evacuations from OIF/OND as from OEF; overall, approximately seven times as many males as females were medically evacuated (**Table 1**).

Nearly one-fifth (18.9%) of all medical evacuations were considered battle injury-related (**Table 1**). Not surprisingly, evacuations for battle injuries varied in relation to the number of deployed service members (e.g., before and after troop surges) and the natures, locations, and intensity of ongoing combat operations (**Figure 1**). For example, there were spikes in battle-related evacuations from OIF in April 2003, April 2004, and November 2004 and a less sharp peak in May 2007; in contrast, numbers of battle injury-related medical evacuations from OEF were relatively low and stable from 2002 through 2006, sporadically higher in 2007 and 2008, and relatively highest following troop increases in 2009 and 2010 (**Figure 1**).

**Table 1.** Numbers of medical evacuations from CENTCOM, by major categories of illnesses and injuries, U.S. Armed Forces, October 2001-September 2010

Diagnostic category (ICD-9-CM)	Total			Female Total			Male Total		
	OEF	OIF/OND	Total	OEF	OIF/OND	Total	OEF	OIF/OND	Total
Battle injury (from TRAC2ES records)	2,906	8,805	11,711	33	174	207	2,873	8,631	11,504
Musculoskeletal system (710 - 739)	2,153	7,985	10,138	228	860	1,088	1,925	7,125	9,050
Non-battle injury and poisoning (800 - 999)	1,969	7,039	9,008	152	539	691	1,817	6,500	8,317
Mental disorders (290 - 319)	1,372	5,538	6,910	209	895	1,104	1,163	4,643	5,806
Signs, symptoms and ill-defined conditions (780 - 799)	1,599	4,727	6,326	268	822	1,090	1,331	3,905	5,236
Nervous system (320 - 389)	676	2,502	3,178	88	287	375	588	2,215	2,803
Digestive system (520 - 579)	693	2,420	3,113	73	274	347	620	2,146	2,766
Genitourinary system (580 - 629, except breast disorders)	734	1,675	2,409	155	513	668	579	1,162	1,741
Circulatory system (390 - 459)	474	1,411	1,885	36	112	148	438	1,299	1,737
Other (V01-V82, except pregnancy-related)	214	1,090	1,304	42	177	219	172	913	1,085
Neoplasms (140 - 239)	206	936	1,142	52	228	280	154	708	862
Skin and subcutaneous tissue (680 - 709)	200	904	1,104	26	118	144	174	786	960
Respiratory system (460 - 519)	234	812	1,046	30	140	170	204	672	876
Infectious and parasitic diseases (001 - 139)	145	710	855	23	63	86	122	647	769
Endocrine, nutrition, immunity (240 - 279)	144	593	737	35	118	153	109	475	584
Breast disorders (610-611)	104	452	556	80	348	428	24	104	128
Pregnancy and childbirth (630 - 679, relevant V codes)	61	257	318	61	257	318	.	.	.
Congenital anomalies (740 - 759)	37	154	191	5	19	24	32	135	167
Hematologic disorders (280 - 289)	45	111	156	10	36	46	35	75	110
Totals	13,966	48,121	62,087	1,606	5,980	7,586	12,360	42,141	54,501

During each month of the nine year period, in both OIF/OND and OEF, there were more medical evacuations for conditions unrelated to battle than for battle-related injuries; overall during the period, there were approximately four times as many medical evacuations for non-battle as for battle-related conditions (**Table 1, Figure 1**).

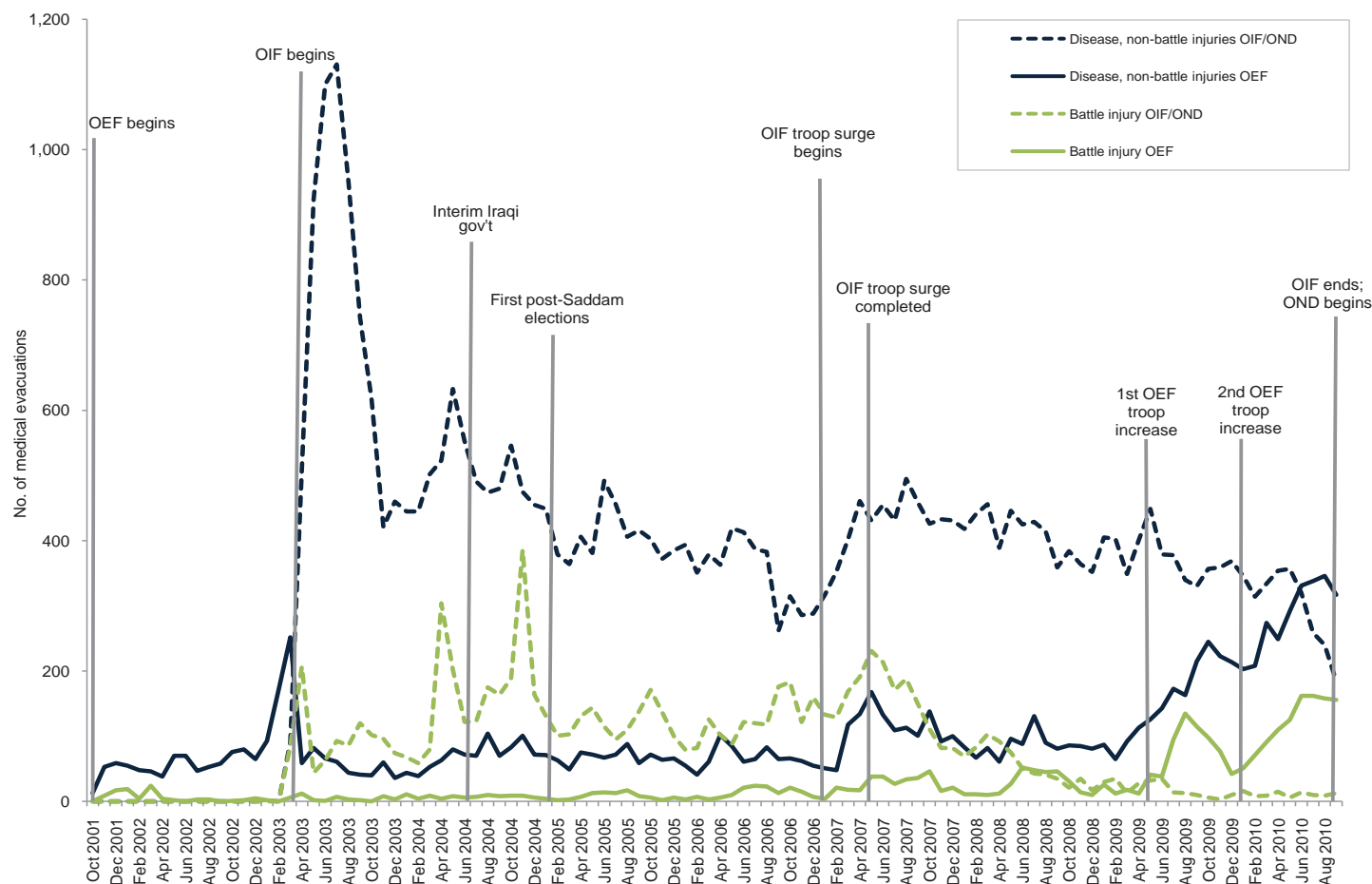
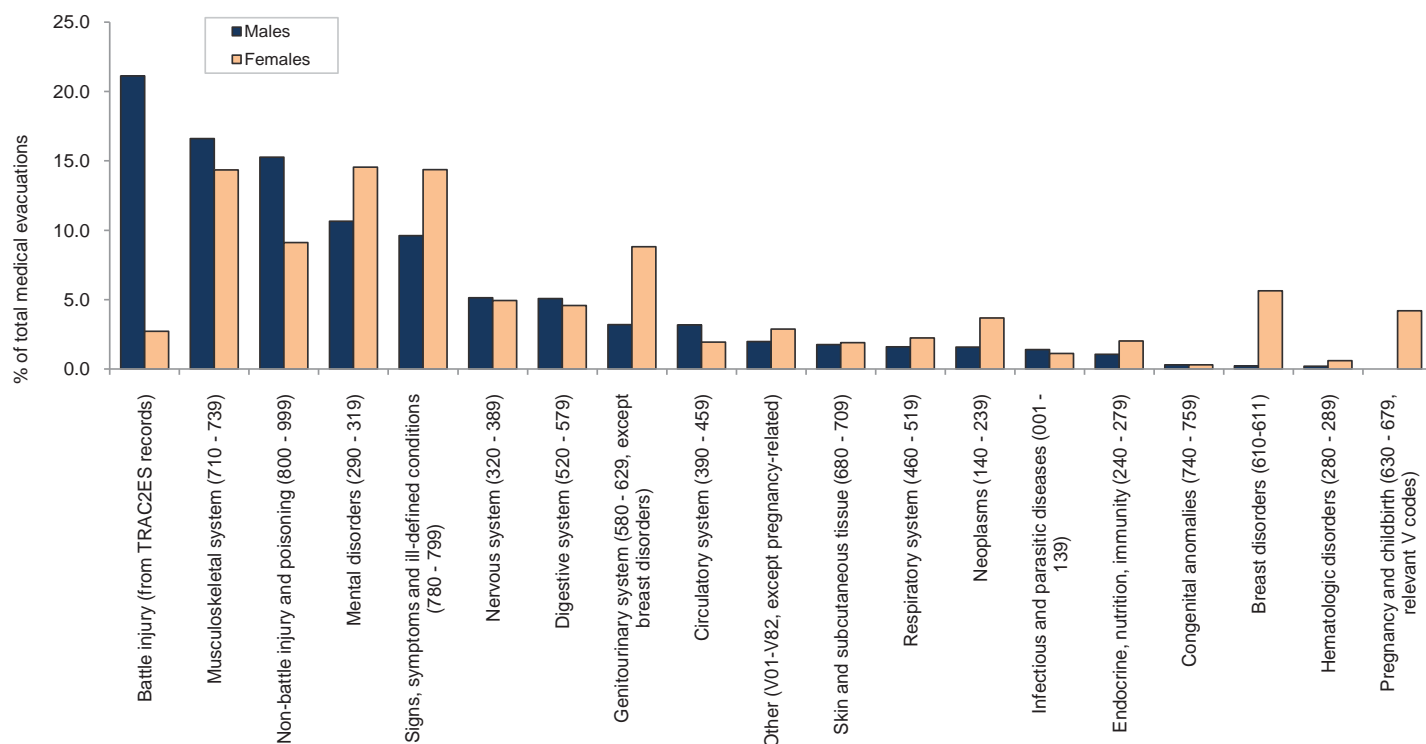
During the surveillance period, four categories of illnesses and injuries accounted for a majority (52.2%) of all evacuations. Musculoskeletal disorders, primarily affecting the back and knee, accounted for approximately one of every six (16.3%) evacuations; non-battle injuries, primarily sprains and fractures of extremities, accounted for approximately one of seven (14.5%) evacuations; “mental disorders,” most frequently adjustment reactions, mood disorders, and post-traumatic stress disorder (PTSD), accounted for approximately one of nine (11.1%) evacuations; and “signs, symptoms and ill-defined conditions” (more than one-fourth related to the respiratory system) accounted for approximately one of ten (10.2%) evacuations (**Table 1**).

There were differences in the conditions that resulted in medical evacuations of male and female deployers. Of all medical evacuations of males throughout the period (n=54,501), the most frequent causes were battle injuries (21.1%), musculoskeletal disorders (16.6%), and non-battle injuries (15.3%). In contrast, the most frequent causes of

medical evacuations of females during the period (n=7,586) were mental disorders (14.6%), “signs, symptoms, and ill-defined conditions” (14.4%), musculoskeletal disorders (14.3%), and non-battle injuries (9.1%) (**Table 1, Figure 2**).

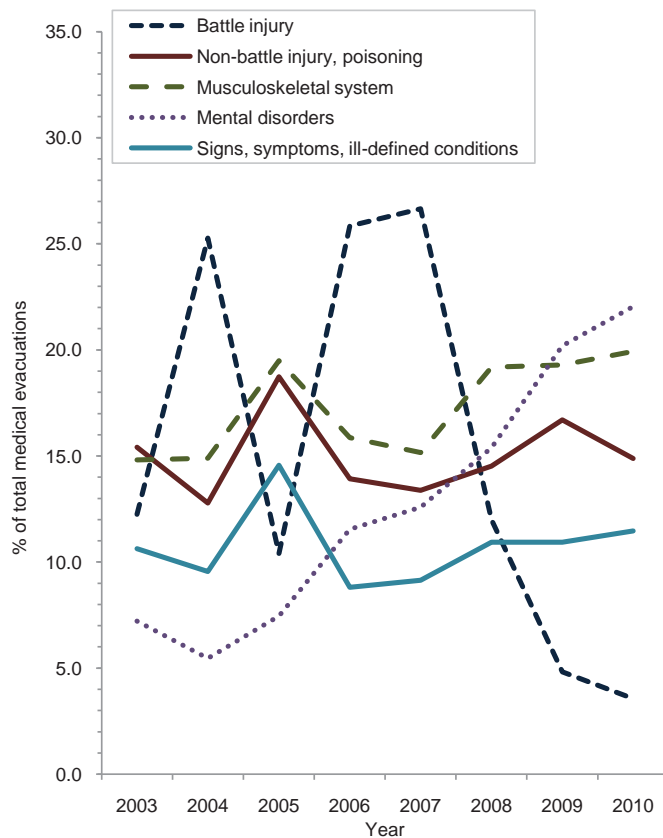
Among both males and females, “adjustment reaction” was the most frequent specific diagnosis (3-digit diagnosis code of ICD-9-CM) during initial medical encounters after evacuations. “Adjustment reaction” accounted for relatively more of the total evacuations of females (n=420; 5.5%) than males (n=2,350; 4.3%). Among males, joint and back-related conditions – specifically, “other and unspecified disorders of joint” (e.g., knee problems) (n=1,993; 3.7%), “intervertebral disc disorders” (n=1,897; 3.5%), and “other and unspecified disorders of back” (n=1,504; 2.8%) – were the next most frequent diagnoses among medical evacuees from OIF/OND or OEF. Among females, “other disorders of the breast” (n=374, 4.9%), “other and unspecified disorders of joint” (e.g., knee problems) (n=291, 3.8%) and “episodic mood disorders” (268, 3.5%) were the next most frequent diagnoses among medical evacuees (**data not shown**).

Among OIF/OND participants, the proportion of medical evacuations attributable to battle injuries declined from approximately 25 percent in 2004, 2006, and 2007 to less than 4 percent in 2010 (through September) (**Figure 3**). In contrast, among OEF participants, the proportion of

**Figure 1.** Medical evacuations of U.S. service members from OIF/OND and OEF, by month and operation, October 2001-September 2010**Figure 2.** Proportions of medical evacuations, by major categories of illness/injury (ICD-9-CM), by gender, U.S. Armed Forces, October 2001-September 2010



**Figure 3.** Proportions of medical evacuations from Operation Iraqi Freedom (OIF)/Operation New Dawn (OND) (n=48,121) attributed to major categories of illness/injury, U.S. Armed Forces, January 2003-September 2010

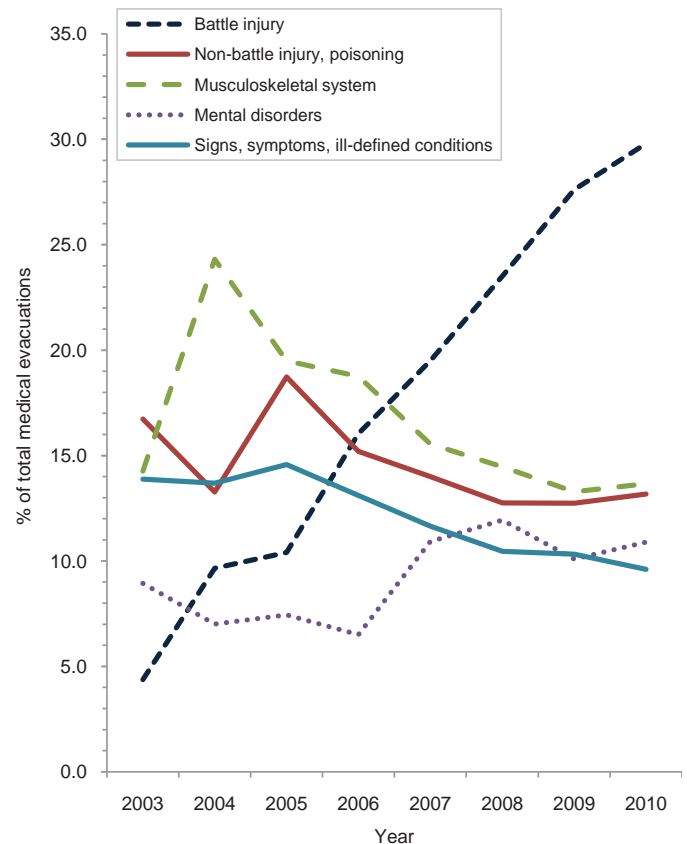


medical evacuations attributable to battle injuries steadily increased from less than 5 percent in 2003 to nearly 30 percent in 2010 (through September) (**Figure 4**). The increase in the proportion of OEF evacuations due to battle-injuries was mostly attributable to increased battle injuries among males (**Figures 5b, 6b**).

Among OIF/OND participants, the proportion of medical evacuations attributable to mental disorders sharply increased from 7.2% in 2003 to 22.0% in 2010 (through September) (**Figure 3**). In contrast, among OEF participants, the proportion of medical evacuations attributable to mental disorders increased slightly during the period (range: 6.5% in 2006 to 11.9% in 2008) (**Figure 4**). The increase in the relative proportion of medical evacuations due to mental disorders among OIF/OND participants was most apparent among females (**Figures 5a, 6a**).

Throughout OIF/OND, the proportions of medical evacuations attributable to musculoskeletal disorders and injuries (not battle related) remained fairly stable (**Figure 4**). Among OEF participants, the proportions of medical evacuations attributable to musculoskeletal disorders and non-battle injuries slightly declined as the numbers and proportions of evacuations due to battle injuries increased (**Figure 4**).

**Figure 4.** Proportions of medical evacuations from Operation Enduring Freedom (OEF) (n=13,966) attributed to major categories of illness/injury, U.S. Armed Forces, January 2003-September 2010



#### Editorial comment:

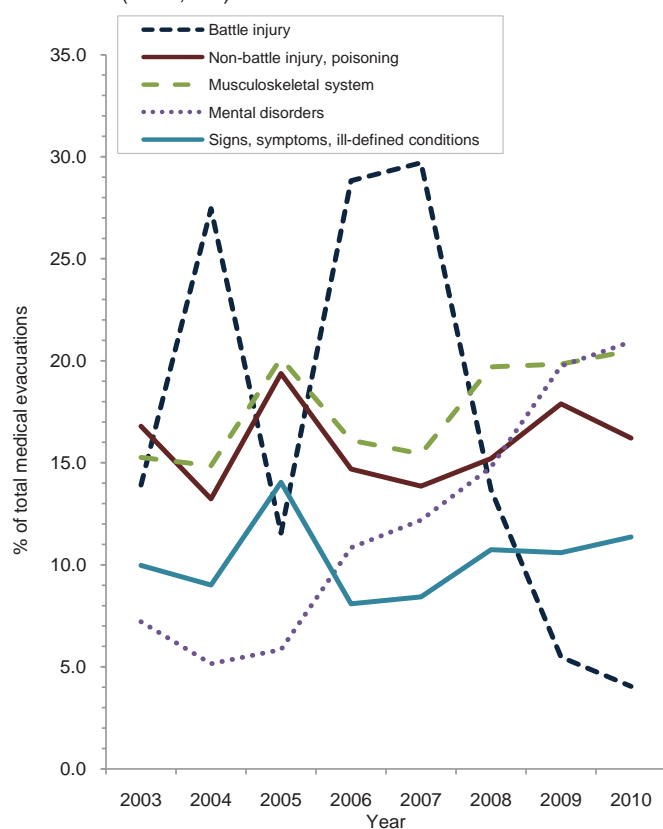
A previous *MSMR* report estimated that during a 12-month deployment to OIF or OEF, approximately 4 percent of Army, 2 percent of Marine Corps, and 1 percent of the other Services' members were medically evacuated for any reason.<sup>1</sup> The relatively low likelihood of medical evacuation suggests that most deployers were sufficiently healthy and fit, and received the medical care in theater necessary, to successfully complete their OEF/OIF/OND assignments.

This analysis extends the findings of the previous report. It documents significantly different numbers and underlying causes of medical evacuations from OIF/OND and OEF in relation to the numbers and characteristics of deployed service members and the locations and characteristics of ongoing military operations. The report also documents significantly different predominant causes of medical evacuations, from both OIF/OND and OEF, among male and female deployers.

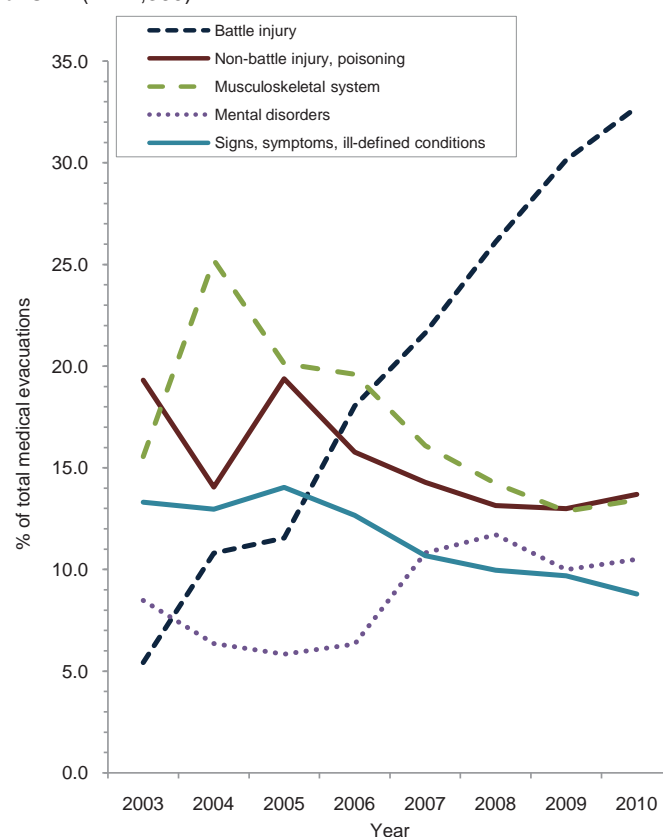
The findings enforce the need to tailor force health protection policies, training, supplies, equipment, and practices based on characteristics of the deployed force (e.g., combat versus support; male versus female) and operational theater

**Figure 5.** Proportions of medical evacuations by selected diagnostic categories among males, U.S. Armed Forces, January 2003–September 2010

a. OIF/OND (n=42,141)



b. OEF (n=12,360)



(e.g., endemic disease threats) and the nature of the military operations (e.g., combat versus humanitarian assistance).

There are limitations to the analysis reported here that should be considered when interpreting the results. For example, assessments of trends were based on numbers of medical evacuations per month or year; as such, variations in the numbers of deployed troops (i.e., the population at risk of medical evacuation) over time were not accounted for. Because the numbers of service members deployed to OIF/OND and OEF significantly varied during the period, trends of numbers of medical evacuations do not directly reflect changes in medical evacuation risk over time.

Also, direct comparisons of numbers and proportions of medical evacuations by cause, as between operational theaters or between males and females, can be misleading; for example, such comparisons do not account for differences between the groups in characteristics (e.g., age, grade, military occupation, locations and activities while deployed) that are significant determinants of medical evacuation risk. Also, for this report, most “causes” of medical evacuations were estimated from primary (first-listed) diagnoses that were recorded at the time of hospitalization discharge or initial outpatient encounters after evacuation. In some cases, clinical evaluations in fixed medical treatment facilities after medical evacuations may have “ruled out” serious conditions that were clinically suspected in

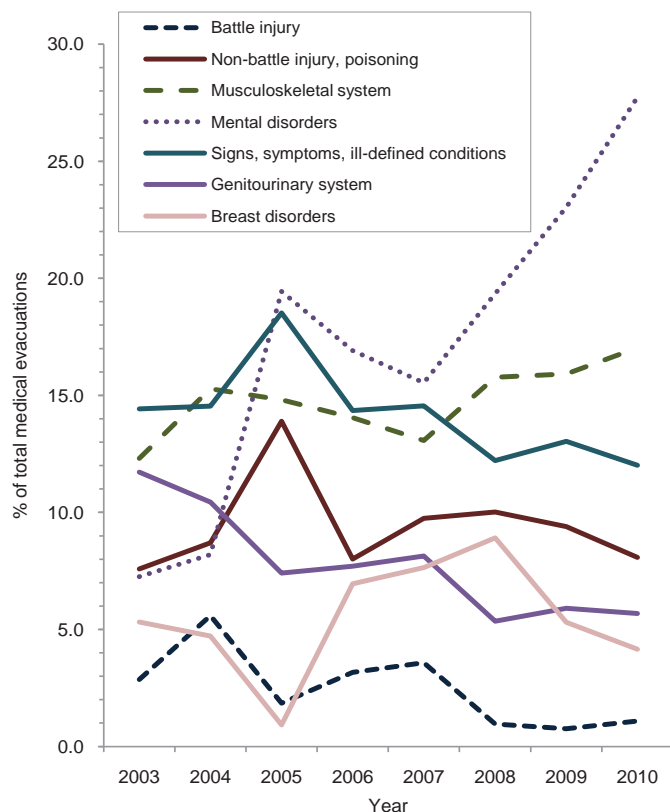
the theater. For this analysis, the “causes” of such evacuations reflect diagnoses that were determined after evaluations outside of the theater rather than diagnoses – perhaps of severe disease – that were clinically suspected in the theater. To the extent that this occurred, the “causes” of some medical evacuations may seem surprisingly minor.

This reports documents that, throughout OIF/OND and OEF (even during periods of the most intensive combat), most medical evacuations were not directly related to battle injuries. Overall, approximately four of every five medical evacuations were due to illnesses and non-battle injuries; and of these, more than one-half were due to musculoskeletal disorders (16.3%), non-battle injuries (14.5%), mental disorders (11.1%), and signs, symptoms, and ill-defined conditions (10.2%).

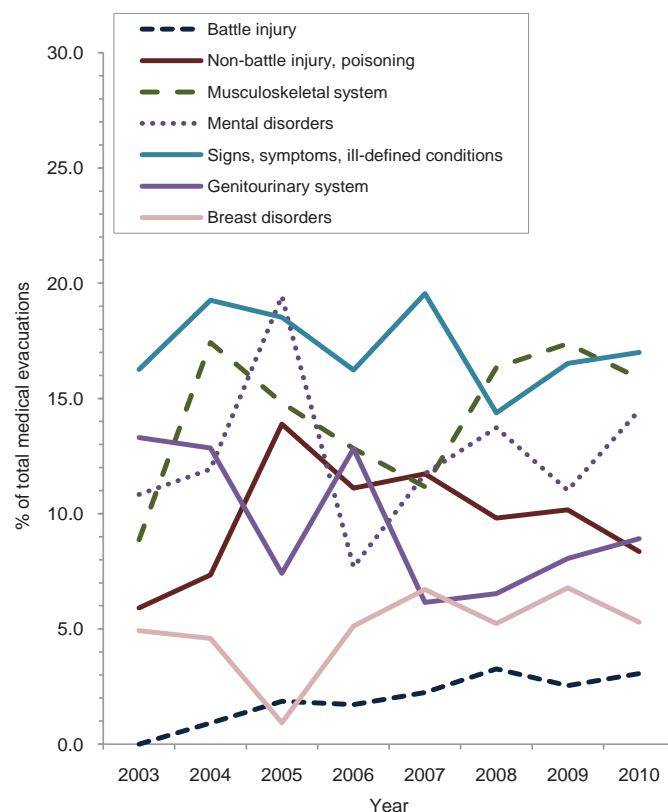
In addition, this report documents that the proportions of medical evacuations due to mental disorders and battle injuries were not closely temporally related. For example, since 2007 among OEF participants, the proportion of medical evacuations due to battle injuries sharply increased while the proportion due to mental disorders remained stable (**Figure 4**). Conversely, since 2007 among OIF/OND participants, the proportion of medical evacuations due to battle injuries sharply decreased while the proportion due to mental disorders increased (**Figure 3**). The recent increase in mental disorder-related evacuations from Iraq may reflect at least in

**Figure 6.** Proportions of medical evacuations by selected diagnostic categories, among females, U.S. Armed Forces, January 2003-September 2010

a. OIF/OND (n=5,980)



b. OEF (n=1,606)



part increased awareness of, concern regarding, and health care resources dedicated to detecting and clinically managing psychological and stress-related disorders (e.g., PTSD, depression, suicide ideation) among deployers.

In summary, in the past nine years, more than 60,000 U.S. service members were medically evacuated from Iraq and Afghanistan. Throughout the period, there were many more medical evacuations for illnesses and non-battle injuries than for battle injuries; also, the major causes of medical evacuations differed among male and female deployers. Previous reports have documented that relatively large proportions of service members who are evacuated for illnesses (including musculoskeletal and mental disorders) during deployments

had medical encounters for the same or closely related conditions shortly before deploying. Further analyses should identify conditions among male and female service members that are most likely to recur or worsen during, and require medical evacuation from, combat-related deployments.

#### References:

1. Armed Forces Health Surveillance Center. Medical evacuations from Operation Iraqi Freedom (OIF) and Operation Enduring Freedom (OEF), active and reserve components, U.S. Armed Forces, October 2001-September 2009. *Monthly Surveillance Medical Report (MSMR)*. 17(2): 2-7.

## Cruciate Ligament Injuries, Active Component, U.S. Armed Forces, 2000-2009

The anterior and posterior cruciate ligaments of the knee are short, fibrous cords that restrict forward and backward movements of the tibia with respect to the femur. When a cruciate ligament is torn, the knee loses stability. Cruciate ligament (CL) injuries are frequently repaired surgically. Some strenuous activities can resume after 6-8 weeks of recovery and rehabilitation.

Cruciate ligament tears are typically sustained during activities that require abrupt changes of direction, rapid deceleration, or jumping. As such, U.S. military members are at risk during physically rigorous operational, training, and leisure-time activities (e.g., basketball, skiing, soccer). In civilian populations, CL injury risk is associated with older age, increasing weight, female gender, and white race/ethnicity.<sup>1-6</sup>

This report summarizes numbers, incident rates, trends, and causes of CL injuries among active component U.S. military members from 2000 through 2009.

### Methods:

The surveillance period was 1 January 2000 to 31 December 2009. The surveillance population included all individuals who served in an active component of the Army, Navy, Air Force or Marine Corps any time during the surveillance period.

Cases were identified from standardized records of all hospitalizations and outpatient medical encounters of active component members during the surveillance period in fixed (e.g., not deployed, at sea) military and nonmilitary (purchased

**Table 1.** Incident diagnoses and incidence rates of cruciate ligament injuries, active component, U.S. Armed Forces, 2000-2009

	No.	Rate per 1,000 p-yrs	Incidence rate ratio <sup>a</sup>
Total	42,176	3.12	
<b>Service</b>			
Army	16,629	3.42	referent
Navy	9,379	2.69	0.79
Air Force	9,645	2.83	0.83
Marine Corps	6,523	3.68	1.08
<b>Sex</b>			
Male	37,338	3.24	referent
Female	4,838	2.43	0.75
<b>Race/ethnicity</b>			
White, non-Hispanic	26,305	3.09	referent
Black, non-Hispanic	7,824	3.21	1.04
Other	8,047	3.132	1.01
<b>Military occupation</b>			
Combat	8,995	3.25	referent
Health care	3,423	3.04	0.94
Other	29,785	3.09	0.95

<sup>a</sup>For each characteristic, the referent rate is specified

care) medical facilities. CL injury-related medical encounters were considered those with diagnostic codes indicative of a CL injury (ICD-9-CM codes: 717.83, 717.84, 844.2) in any diagnostic position. For surveillance purposes, a case of CL injury was defined as an active component member with two or more CL injury-related medical encounters on separate days within any 180-day period.

For each case, the date of the first case-defining CL injury-related medical encounter was considered the incident date; each individual could be considered an incident case only once during the surveillance period. Rates were calculated as incident CL injuries per 1,000 person-years (p-yrs) of active component service.

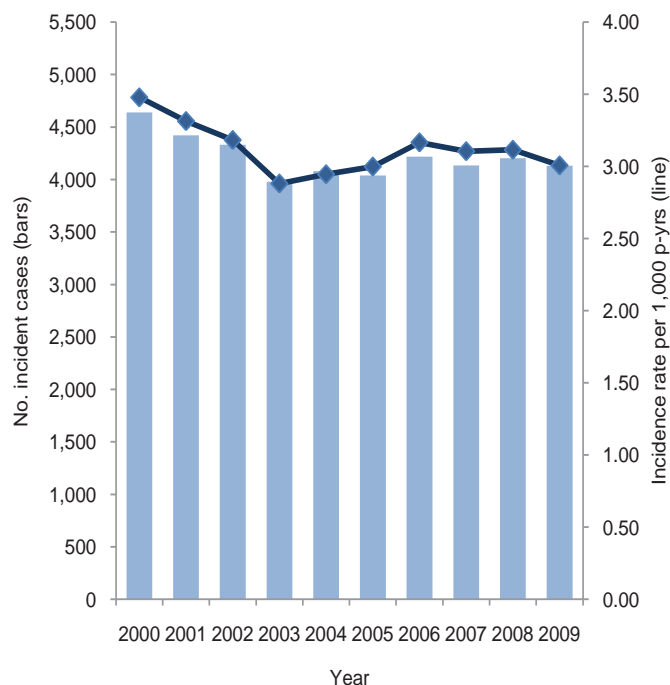
For each case, the record of the first CL-injury-related medical encounter that included an ICD-9-CM external cause of injury code (E codes) or NATO Standard Agreement (STANAG) code was considered informative regarding the cause of the respective CL injury.

### Results:

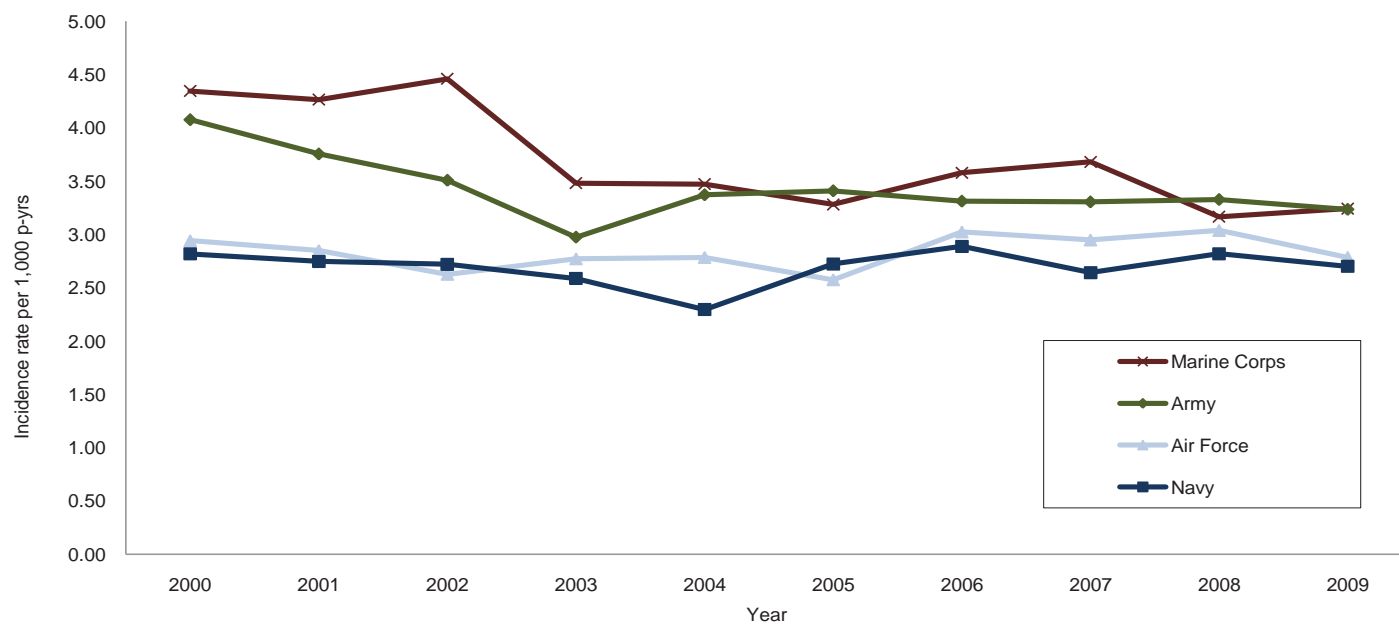
#### Rates and trends

During the 10-year surveillance period, there were 42,176 incident diagnoses of CL injuries among active component military members; the overall incidence rate during the period

**Figure 1.** Incident diagnoses and incidence rates of cruciate ligament injury, active component, U.S. Armed Forces, 2000-2009





**Figure 2.** Annual incidence rates of cruciate ligament injuries, by service, active component, U.S. Armed Forces, 2000-2009

was 3.12 injuries per 1,000 p-yrs (**Table 1**). Annual incidence rates declined slightly from 2000 through 2003 and then were stable through 2009 (**Figure 1**). In each year of the period, crude (unadjusted) incidence rates were higher in the Marine Corps and Army than the Air Force and Navy. In all of the Services, annual rates have been stable since at least 2005 (**Figure 2**).

#### Demographic characteristics

During the period, CL injury rates were higher among males 25-29 years old and in the Marine Corps than in any other demographic or military subgroups (**Figure 3**). The crude overall incidence rate was one-third (33%) higher among males than females; rates were markedly higher among males than females in every age group except the youngest (<20 years). Among males, rates were lowest among the youngest (1.96 per 1000 p-yrs) and highest among the 25-29 year olds (3.72 per 1000 p-yrs); among females, rates were similar across all age groups (**Figure 3**). Also, crude overall rates were similar across racial/ethnic subgroups (**Table 1**).

#### Basic trainees

Basic trainees accounted for a very small proportion (n=622; 1.4%) of all military members with CL injuries. The overall incidence rate of CL injuries among trainees (2.21 per 1,000 p-yrs) was similar to that among teenaged service members overall (**Table 2**, **Figure 3**). Of the trainees in the various Services, those in the Army (2.94 per 1,000 p-yrs) and Air Force (0.70 per 1,000 p-yrs) had the highest and lowest CL injury rates, respectively. Among trainees overall, the CL injury rate was 26 percent higher among females than males and 13 percent higher among white, non-Hispanic than black, non-Hispanic individuals (**Table 2**).

#### Causes of injury

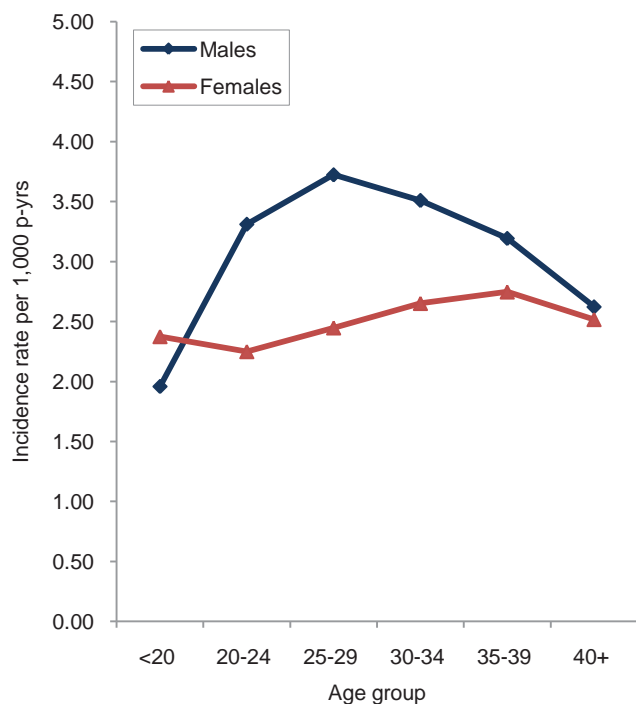
Accidental slips and falls (n=1,215; 42.8%) and sports-related injuries (n=913; 32.2%) accounted for three-fourths of all CL injuries that were documented (n=2,839) with hospitalization records with cause of injury codes (per NATO Standard Agreement [STANAG] 2050). The most frequent specific causes of CL injuries reported on hospitalization records were twisting, turning, slipping, on land (n=356, 12.5%), late complications or late effects of old injuries (n=342, 12.1%), basketball (n=288, 10.1%), other causes, on land (n=239, 8.4%), and American football (n=161, 5.7%) (**Table 3**).

**Table 2.** Cruciate ligament injuries among basic trainees, active component, U.S. Armed Forces, 2000-2009

	No.	Rate per 1,000 p-yrs	Incidence rate ratio <sup>a</sup>
Total trainees	622	2.21	.
<b>Service</b>			
Army	317	2.94	referent
Navy	76	1.35	0.46
Air Force	33	0.70	0.24
Marine Corps	196	2.82	0.96
<b>Gender</b>			
Male	504	2.13	referent
Female	118	2.68	1.26
<b>Race/ethnicity</b>			
White, non-Hispanic	438	2.39	referent
Black, non-Hispanic	86	2.12	0.89
Other	98	1.71	0.72

<sup>a</sup>For each characteristic, the referent rate is specified

**Figure 3.** Incidence rates of cruciate ligament injury by sex and age group, active component, U.S. Armed Forces, 2000-2009



Of 5,590 CL injuries with causes documented with ICD-9-CM E ("external cause of injury") codes (predominately ambulatory visit records), the most frequently reported causes were "overexertion and strenuous and repetitive movements or loads" (n=1,960, 35.1%), "other and unspecified accidental causes" (n=1002, 17.9%), sports-related accidents (n=931, 16.7%), accidental falls (n=741, 13.3%) and motor vehicle/land transportation accidents (n=264, 4.7%) (data not shown).

#### Editorial comment:

This report documents that numbers and rates of CL injuries among active component service members have been remarkably stable since 2002. Each year since 2002, there have been from 3,980 to 4,331 incident cases of CL injuries among military members; annual incidence rates during the period were consistently in the narrow range between 2.88 and 3.17 per 1,000 service members per year.

Studies among civilian athletes often document higher rates of cruciate ligament injuries among females than males.<sup>3, 5, 7, 8</sup> However, in this analysis, incidence rates of CL injuries were higher among males than females in every age group except those younger than 20 years; of note, CL injury rates were higher among female than male basic combat trainees/recruits.

Throughout the period, CL injury rates were consistently higher among Marine Corps and Army than Air Force and Navy members. The findings may reflect differences in the natures, intensities, durations, and timing of both military occupation-specific and leisure time activities among male and female service members and across the military services. For

**Table 3.** Ten most frequent causes of injury (per NATO Standard Agreement [STANAG] 2050 cause of injury codes) reported on hospitalization records (n=2,910) of service members with incident cruciate ligament injuries, active component, U.S. Armed Forces, 2000-2009

Cause of injury	No.	%
Twisting/turning/slipping, NEC	365	12.5
Late complications, late effects of old injuries	342	12.0
Basketball	288	10.1
Other specified agents, on land	239	8.4
Football	161	5.7
Other athletics and sports	129	4.5
Complications of surgical treatment	114	4.0
Soccer	107	3.8
Different level fall or jump, on land	90	3.2
Injury to motocyclist	71	2.5

example, when stresses on knee ligaments are similar among males and females (e.g., recruit training), injury rates may be higher among females than males (as among civilian athletes). However, when stresses on knees vary because of different military occupational activities (e.g., ground combat, aviation, administration) or off-duty activities (e.g., basketball, skiing, weight training), CL injury rates by gender may reflect the differences.

The findings of this report should be interpreted cautiously due to several limitations. For example, the surveillance case definition was designed to be conservative; i.e., the case definition required CL injury-specific diagnoses during at least two medical encounters on different days in a 180 day period. If an affected military member left service after receiving a CL injury-specific diagnosis (e.g., retirement examination), the individual would not have been included as a "case" for this report. In addition, for temporal trend analyses, the date of the first CL injury-specific medical encounter was considered the date of the injury; however, because CL injuries are not always incapacitating, some diagnoses may have been delayed from the times when the injuries occurred. Also, in this analysis, the causes of CL injuries were assessed based on codes that were reported on hospitalization and ambulatory visit records. Of CL injuries that were documented with relevant information, the most frequent causes were falls/accidents and sports activities. However, the causes of many CL injuries were not specified; and even among those with relevant information, it is difficult to determine specific causes because of the numerous acceptable coding options in two different reporting systems (STANAG and ICD-9-CM E codes). Thus, for example, an injury that occurred during an athletic event could reasonably be reported as an injury from twisting on land. Finally, this analysis only considered CL injuries among members of the active component. Undoubtedly, there were many CL injuries

among reserve component members; thus, the findings in this report may not be generalizable to U.S. military members overall.

Because they require relatively long convalescence and rehabilitation periods, CL injuries significantly degrade the health, fitness, readiness, and operational capabilities of affected service members and their units. Over the past ten years, there have been more than 42,000 incident diagnoses of cruciate ligament injuries among active component members and many more than 20,000 surgical repairs of CL injuries in U.S. military medical facilities (and likely more in non-military facilities through purchased care) (**data not shown**). Clearly, CL injuries demand considerable health care resources for diagnosis, treatment, and rehabilitation.<sup>9,10</sup> Researchers are investigating interventions, e.g., core proprioception and neuromuscular control training, to reduce CL injury risk in female athletes. The findings may be informative and useful in relation to prevention of such injuries in young, healthy, and physically active U.S. military populations.<sup>11, 12, 13</sup>

*Reported by: Jennifer A. Cockrill, MS, MPH, Jr. Epidemiologist, Armed Forces Health Surveillance Center.*

#### References:

1. Sulsky SI, Mundt KA, Bigelow C, Amoroso, PJ. Case-control study of discharge from the U.S. Army for disabling occupational knee injury. *Am J Prev Med.* 2000 Apr;18(3S):103-111.
2. Uhorchak JM, Scoville CR, Williams GN, et al. Risk factors associated with non-contact injury of the anterior cruciate ligament. A prospective four-year evaluation of 859 West Point cadets. *Am J Sports Med.* 2003 Nov-Dec;31(6):831-42.
3. Arendt EA, Agel J, Dick R. Anterior cruciate ligament injury patterns among collegiate men and women. *J Athl Training.* 1999 Apr-Jun;34(2):86-92.
4. Hashemi J, Mansouri H, Chandrashekar N, et al. Age, sex, body anthropometry, and ACL size predict the structural properties of the human anterior cruciate ligament. *J Orthop Res.* 2011.(e-pub ahead of print).
5. Gwinn DE, Wilckens JH, McDevitt ER, et al. The relative incidence of anterior cruciate ligament injury in men and women at the United States Naval Academy. *Am J Sports Med.* 2000 Jan-Feb;28(1):98-102.
6. Trojan TH and Collins S. The anterior cruciate ligament tear rates vary by race in professional women's basketball. *Am J Sports Med.* 2006 Jun;34(6):893-898.
7. Renstrom P, Ljungqvist A, Arendt E, Beynnon B, et al. Non-contact ACL injuries in female athletes: an International Olympic Committee current concepts statement. *Br J Sports Med.* 2008;42:394-412.
8. Ireland ML. Anterior cruciate ligament injury in female athletes: epidemiology. *J Athl Training.* 1999 Apr-Jun;34(2):150-154.
9. Blusfield BT, Kharrazi FD, Lombardo SJ, Seegmiller J. Performance outcomes of anterior cruciate ligament reconstruction in the National Basketball Association. *Arthroscopy.* 2009;25(8):825-830.
10. Roi GS, Nanni G, Tencone F. Time to return to professional soccer matches after ACL reconstruction. *Sport Sci Health.* 2006;1(4):142-145.
11. Gilchrist J, Mandelbaum BR, Melancon H, et al. A randomized controlled trial to prevent noncontact anterior cruciate ligament injury in female collegiate soccer players. *Am J Sports Med.* 2008;36(8):1476-1483.
12. Mandelbaum BR, Silvers HJ, Watanabe DS, et al. Effectiveness of a neuromuscular and proprioceptive training program in preventing the incidence of anterior cruciate ligament injuries in female athletes. *Am J Sport Med.* 2005 Jul;33(7):1003-1010.
13. Hewett TW, Myer GD, Ford KR, Slauterbeck JR. Dynamic neuromuscular analysis training for preventing anterior cruciate ligament injury in female athletes. *Instr Course Lect.* 2007;56:397-406.

## Notice to Readers:

### Sentinel reportable medical events, active component, U.S. Armed Forces, cumulative numbers through December 2009 and December 2010

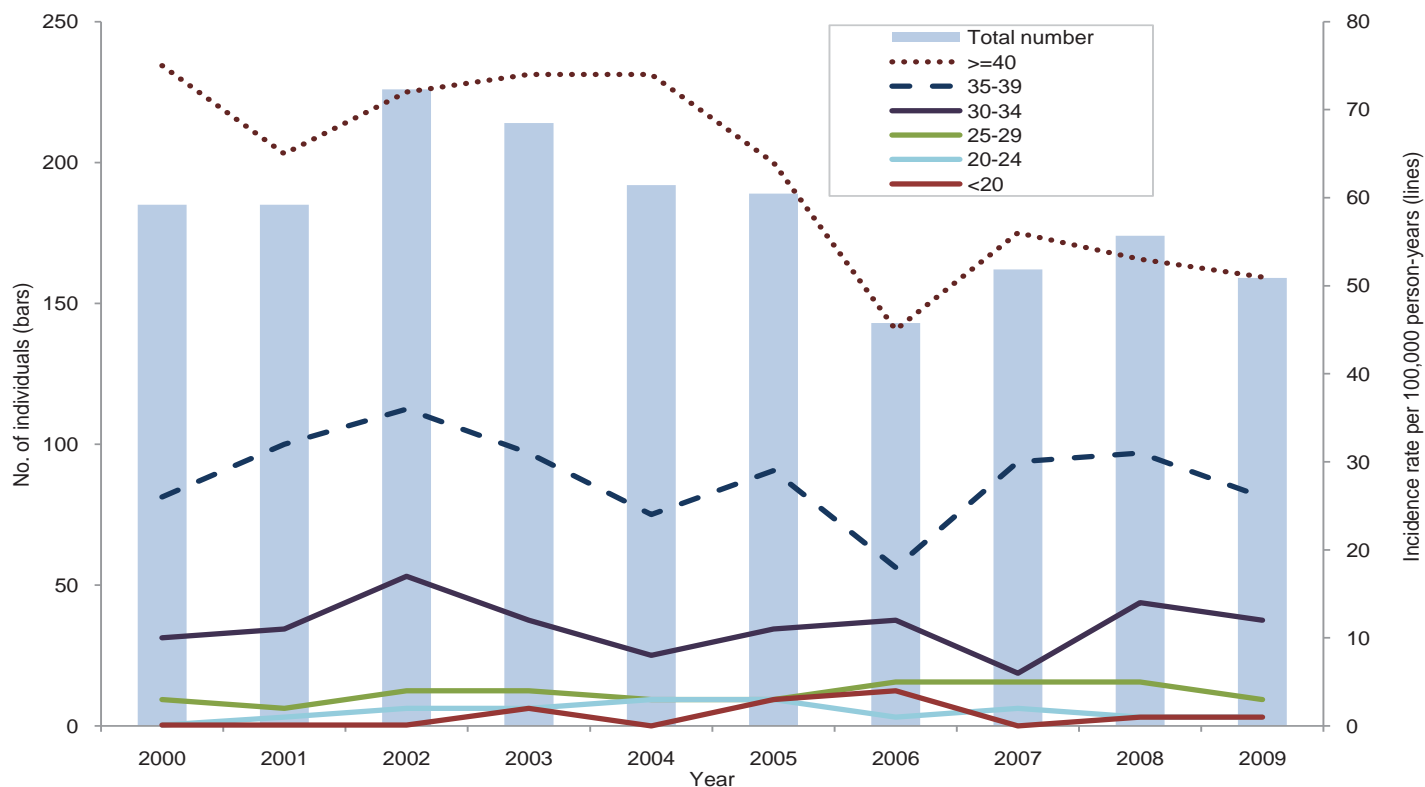
Annual summaries of reportable medical events in CY 2010 will be published in a future MSMR issue.

## Surveillance Snapshot: Acute Myocardial Infarction, Active Component, U.S. Armed Forces, 2000-2009

Acute myocardial infarctions (AMIs), or “heart attacks”, occur when there is partial or complete occlusion of coronary arteries and deprivation of oxygen to the heart muscle, resulting in cell death. The most common cause of blockage is atherosclerosis, the deposition of cholesterol plaques over time, which is exacerbated by high blood pressure, elevated cholesterol, diabetes mellitus, and cigarette smoking.

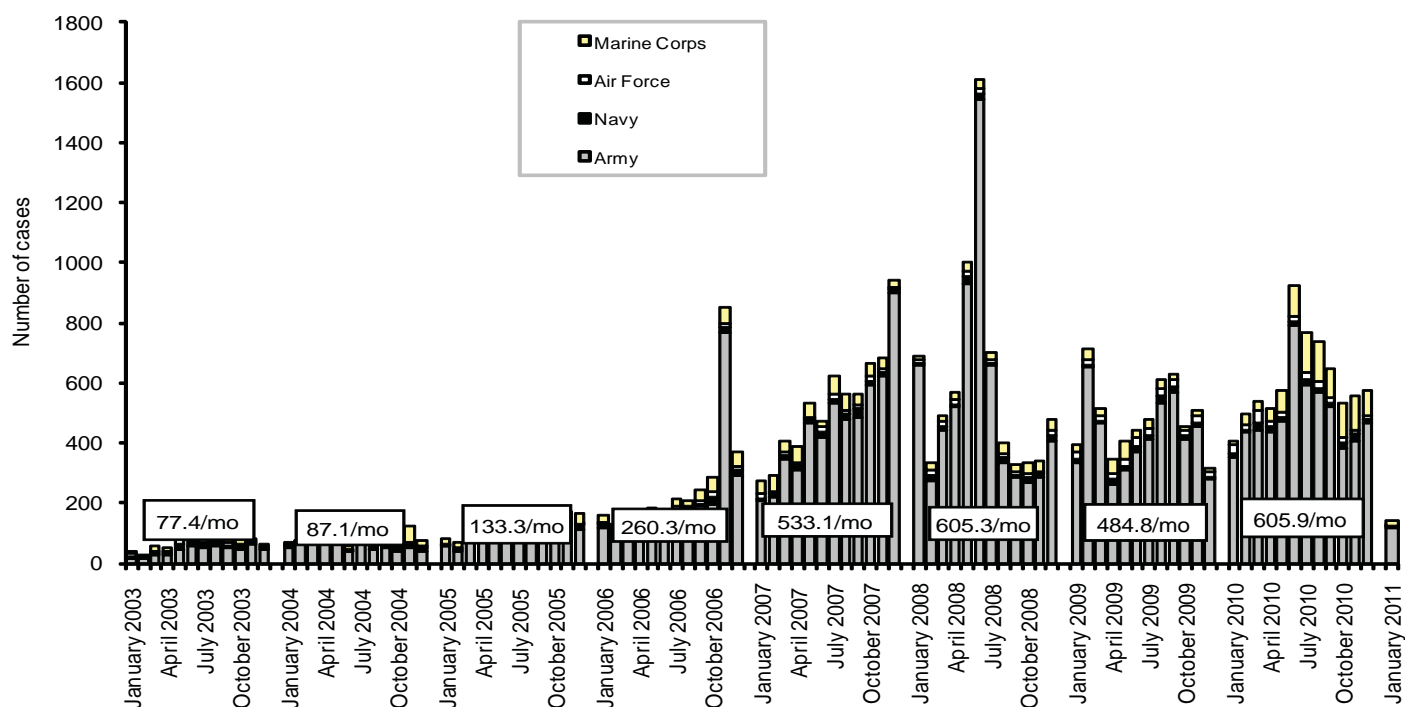
During the 10-year surveillance period, there were 3,448 incident hospitalizations for AMI among active component U.S. military members. The numbers of AMIs per year decreased from 2002 (n=226) to 2006 (n=143) and remained relatively stable from 2007 (n=162) through 2009 (n=159). AMIs were highly correlated with age, with the highest rates among service members older than 40 years.

Incident cases and incidence rates of acute myocardial infarction by age category, active component, U.S. Armed Forces, 2000-2009



## Deployment-related conditions of special surveillance interest, U.S. Armed Forces, by month and service, January 2003 - January 2011 (data as of 01 March 2011)

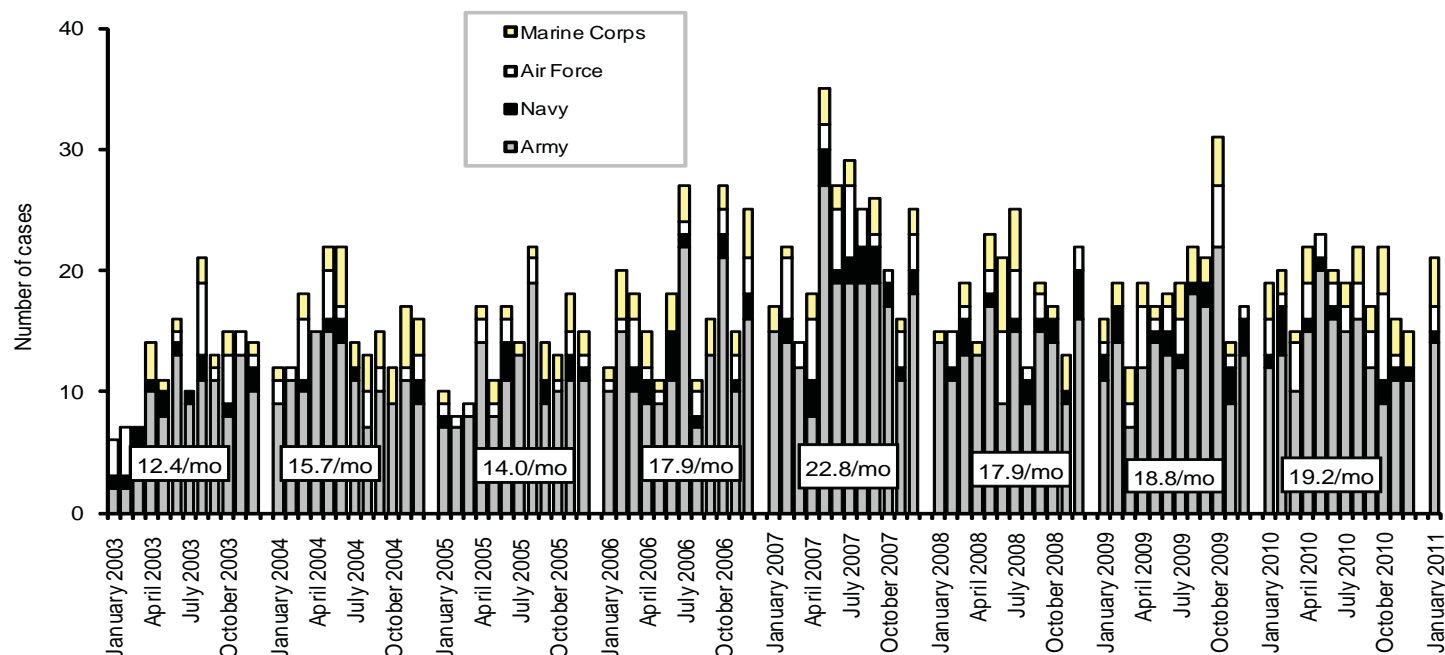
Traumatic brain injury (ICD-9: 310.2, 800-801, 803-804, 850-854, 907.0, 950.1-950.3, 959.01, V15.5\_1-9, V15.5\_A-F, V15.59\_1-9,



Reference: Armed Forces Health Surveillance Center. Deriving case counts from medical encounter data: considerations when interpreting health surveillance reports. *MSMR*. Dec 2009; 16(12):2-8.

<sup>a</sup>Indicator diagnosis (one per individual) during a hospitalization or ambulatory visit while deployed to/within 30 days of returning from OEF/OIF. (Includes in-theater medical encounters from the Theater Medical Data Store [TMDS] and excludes 2,590 deployers who had at least one TBI-related medical encounter any time prior to OEF/OIF).

Deep vein thrombophlebitis/pulmonary embolus (ICD-9: 415.1, 451.1, 451.81, 451.83, 451.89, 453.2, 453.40 - 453.42 and 453.8)<sup>b</sup>



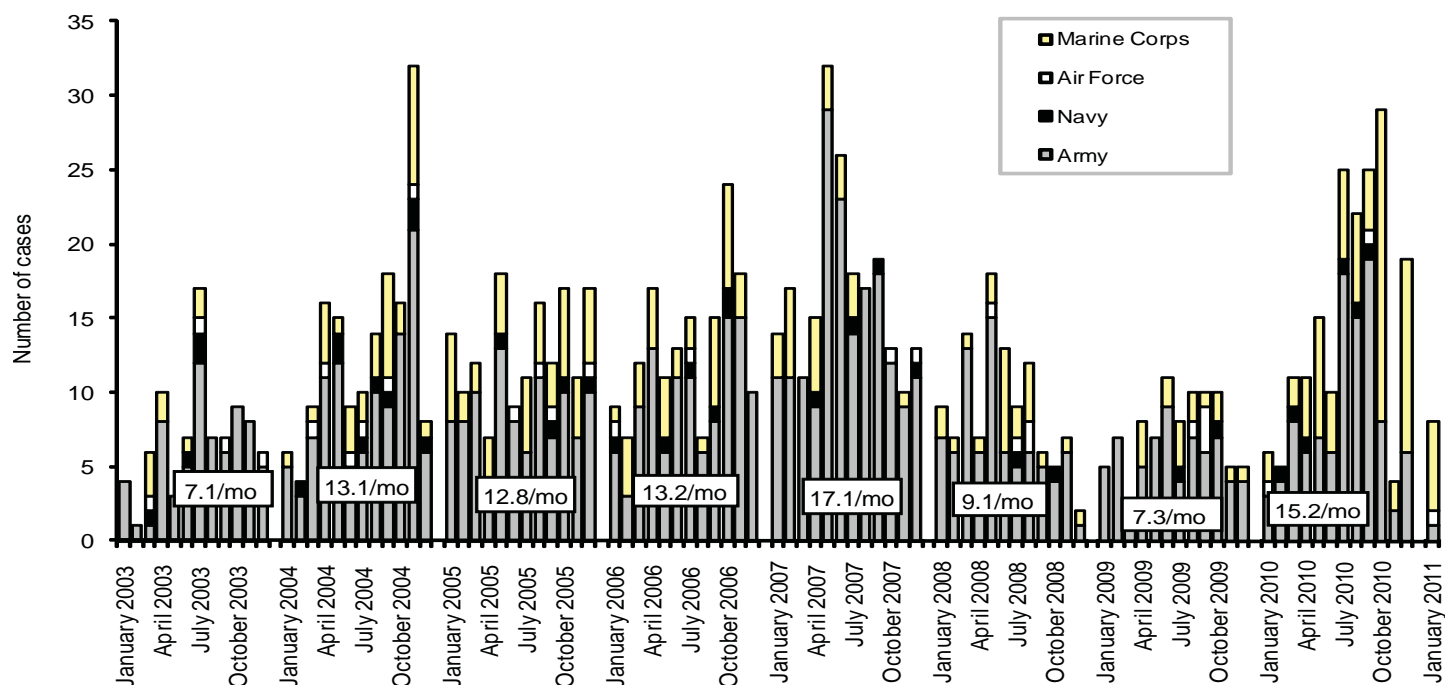
Reference: Isenbarger DW, Atwood JE, Scott PT, et al. Venous thromboembolism among United States soldiers deployed to Southwest Asia. *Thromb Res*. 2006;117(4):379-83.

<sup>b</sup>One diagnosis during a hospitalization or two or more ambulatory visits at least 7 days apart (one case per individual) while deployed to/within 90 days of returning from OEF/OIF.



## Deployment-related conditions of special surveillance interest, U.S. Armed Forces, by month and service, January 2003 - January 2011 (data as of 01 March 2011)

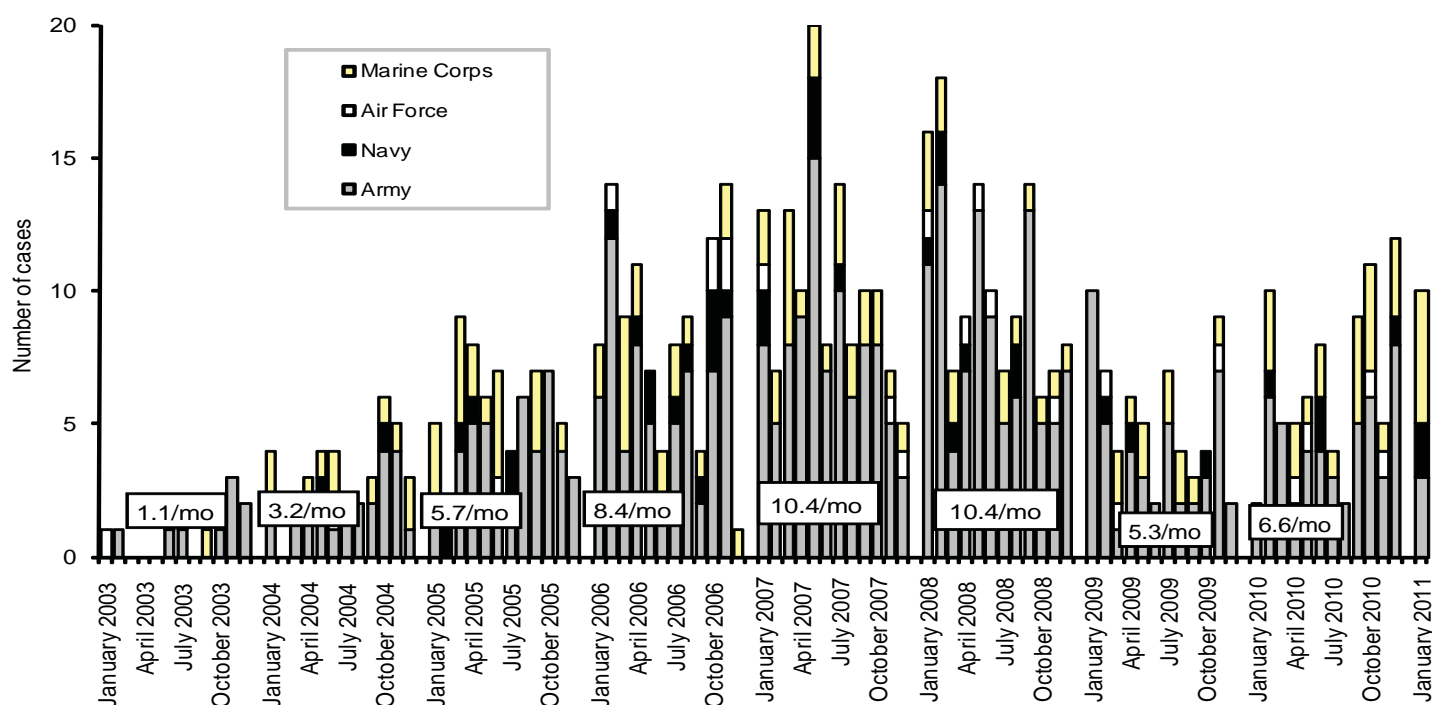
Amputations (ICD-9: 887, 896, 897, V49.6 except V49.61-V49.62, V49.7 except V49.71-V49.72, PR 84.0-PR 84.1, except PR 84.01-PR 84.02 and PR 84.11)<sup>a</sup>



Reference: Army Medical Surveillance Activity. Deployment-related condition of special surveillance interest: amputations. Amputations of lower and upper extremities, U.S. Armed Forces, 1990-2004. *MSMR*. Jan 2005;11(1):2-6.

<sup>a</sup>Indicator diagnosis (one per individual) during a hospitalization while deployed to/within 365 days of returning from OEF/OIF.

### Heterotopic ossification (ICD-9: 728.12, 728.13, 728.19)<sup>b</sup>

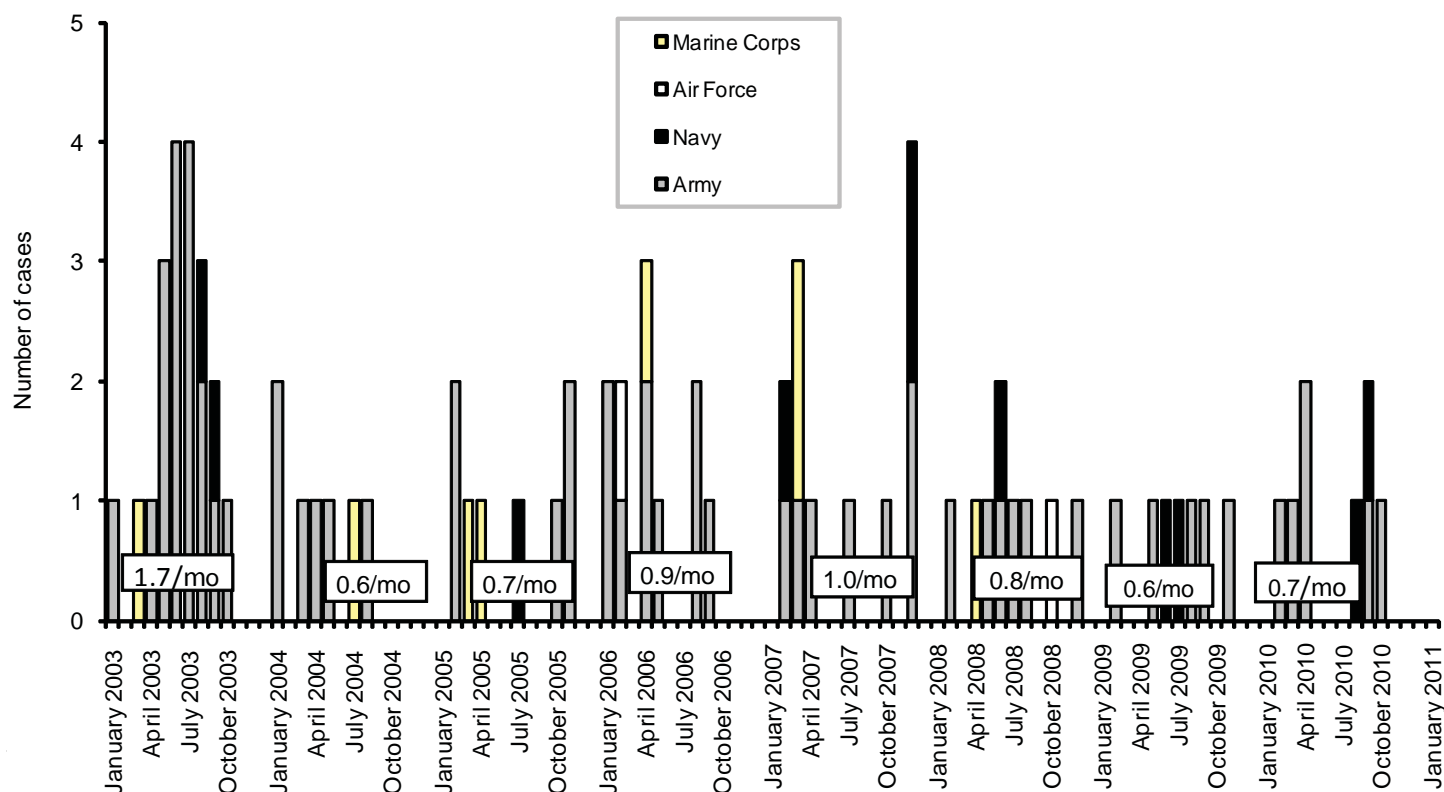


Reference: Army Medical Surveillance Activity. Heterotopic ossification, active components, U.S. Armed Forces, 2002-2007. *MSMR*. Aug 2007; 14(5):7-9.

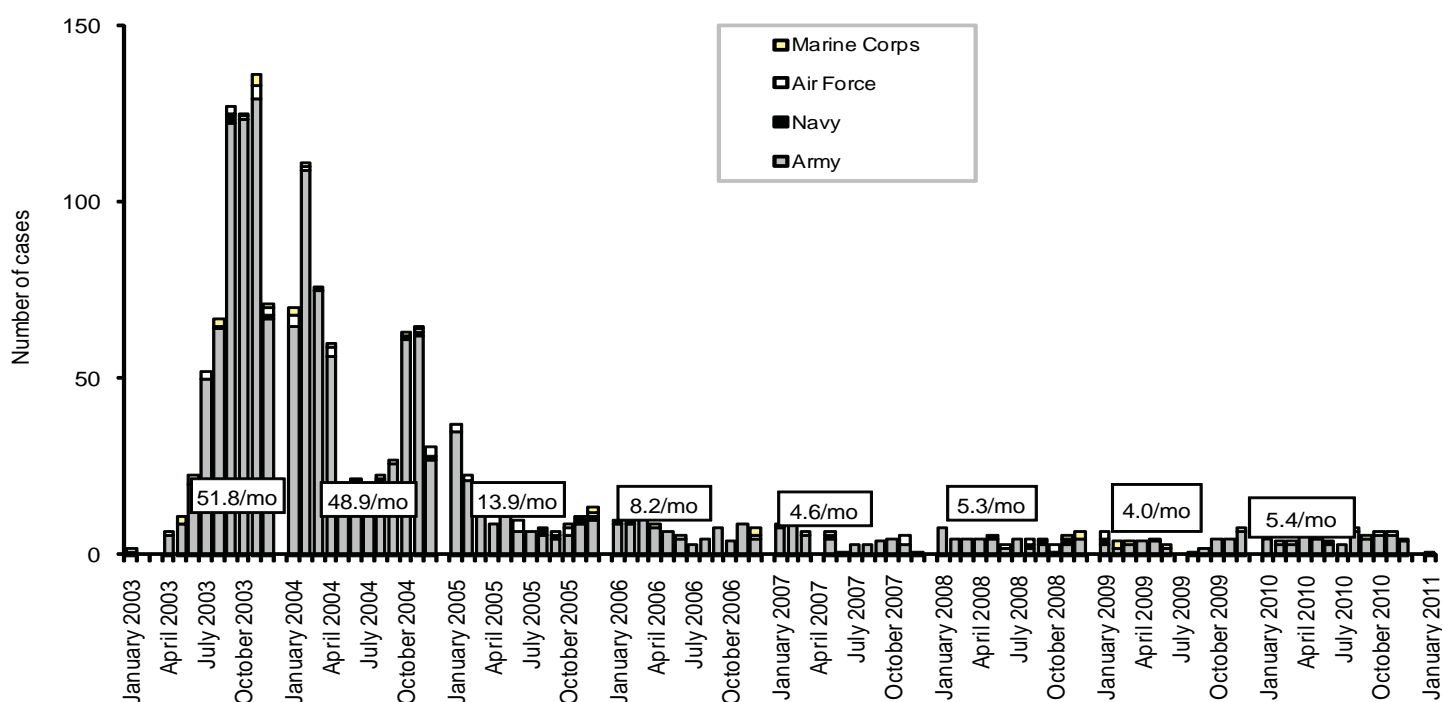
<sup>b</sup>One diagnosis during a hospitalization or two or more ambulatory visits at least 7 days apart (one case per individual) while deployed to/within 365 days of returning from OEF/OIF.

## Deployment-related conditions of special surveillance interest, U.S. Armed Forces, by month and service, January 2003 - January 2011 (data as of 01 March 2011)

Severe acute pneumonia (ICD-9: 518.81, 518.82, 480-487, 786.09)<sup>a</sup>



Leishmaniasis (ICD-9: 085.0 to 085.9)<sup>b</sup>



Reference: Army Medical Surveillance Activity. Deployment-related condition of special surveillance interest: leishmaniasis. Leishmaniasis among U.S. Armed Forces, January 2003-November 2004. *MSMR*. Nov/Dec 2004;10(6):2-4.

<sup>a</sup>Indicator diagnosis (one per individual) during a hospitalization, ambulatory visit, and/or from a notifiable medical event during/after service in OEF/OIF.

Commander  
U.S. Army Public Health Command (Provisional)  
MCHB-IP-EDM  
5158 Blackhawk Road  
Aberdeen Proving Ground, MD 21010-5403

STANDARD  
U.S. POSTAGE  
PAID  
APG, MD  
PERMIT NO. 1

OFFICIAL BUSINESS

Director, Armed Forces Health Surveillance Center  
COL Robert F. DeFraites, MD, MPH (USA)

Editor  
John F. Brundage, MD, MPH

Writer-Editor  
Ellen R. Wertheimer, MHS  
Denise S. Olive, MS

Contributing Editor  
Leslie L. Clark, PhD, MS

Visual Information Specialist  
Jennifer L. Bondarenko

Data Analysis  
Gi-Taik Oh, MS  
Stephen Taubman, PhD

Editorial Oversight  
COL Robert J. Lipnick, ScD (USA)  
Francis L. O'Donnell, MD, MPH  
Mark V. Rubertone, MD, MPH  
Maj Cecili K. Sessions, MD, MPH (USAF)  
Joel C. Gaydos, MD, MPH

Service Liaisons  
MAJ Christopher L. Perdue, MD, MPH (USA)  
Maj Cecili K. Sessions, MD, MPH (USAF)  
CDR Annette M. Von Thun, MD, PhD (USN)

The *Medical Surveillance Monthly Report (MSMR)*, in continuous publication since 1995, is produced by the Armed Forces Health Surveillance Center (AFHSC). The *MSMR* provides evidence-based estimates of the incidence, distribution, impact and trends of illness and injuries among United States military members and associated populations. Most reports in the *MSMR* are based on summaries of medical administrative data that are routinely provided to the AFHSC and integrated into the Defense Medical Surveillance System for health surveillance purposes.

All previous issues of the *MSMR* are available online at [www.afhsc.mil](http://www.afhsc.mil). Subscriptions (electronic and hard copy) may be requested online at [www.afhsc.mil/msmr](http://www.afhsc.mil/msmr) or by contacting the Armed Forces Health Surveillance Center at (301) 319-3240. E-mail: [msmr.afhsc@amedd.army.mil](mailto:msmr.afhsc@amedd.army.mil)

Submissions: Suitable reports include surveillance summaries, outbreak reports and cases series. Prospective authors should contact the Editor at [msmr.afhsc@amedd.army.mil](mailto:msmr.afhsc@amedd.army.mil)

All material in the *MSMR* is in the public domain and may be used and reprinted without permission. When citing *MSMR* articles from April 2007 to current please use the following format: Armed Forces Health Surveillance Center. Title. *Medical Surveillance Monthly Report (MSMR)*. Year Month; Volume(No): pages. For citations before April 2007: Army Medical Surveillance Activity. Title. *Medical Surveillance Monthly Report (MSMR)*. Year Month; Volume(No): pages.

Opinions and assertions expressed in the *MSMR* should not be construed as reflecting official views, policies, or positions of the Department of Defense or the United States Government.

ISSN 2158-0111 (print)  
ISSN 2152-8217 (online)  
Printed on acid-free paper