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# Medical Evacuations from Afghanistan during Operation Enduring Freedom, Active and Reserve Components, U.S. Armed Forces, 7 October 2001-31 December 2012

From October 7, 2001 to 31 December 2012, over 20,000 service members were medically evacuated from the Operation Enduring Freedom (OEF) theater of combat operations to a medical treatment facility outside of theater. During the period the numbers, rates, and underlying causes of medical evacuations sharply varied in relation to the natures of ongoing military operations. During every month of the period, medical evacuations for disease and non-battle injuries exceeded those for battle-related injuries. The majority of evacuations (88.7%) occurred among males; however, the rate of medical evacuations was 22 percent higher among females. The major causes of medical evacuations differed among male and female deployers; however, rates of battle injuries and mental health disorders increased in both sexes during the period. Rates of medical evacuations were highest among white, non-Hispanics, soldiers, and in service members in the reserve component, junior enlisted, and in combat-specific occupations. Most service members were discharged back to duty after medical evacuation. The findings enforce the need to tailor force health protection policies and practices to the characteristics of the deployed force and the nature of the military operation.

From 7 October 2001 to 31 December 2012, there were nearly 1.7 million deployments in support of Operation Enduring Freedom (OEF). In wartime theaters of operations such as Afghanistan, 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 rehabilitation care required.

Medical air transports ("medical evacuations") are costly and generally indicative of serious medical conditions. Some serious conditions (e.g., battle wounds) are directly related to participation in or support of combat operations; however, many others are unrelated to combat and may be preventable. The objectives of this report are to compare the natures, numbers, rates, and trends of conditions for which male and female military members were medically evacuated from the OEF theater from the start of the campaign through 31 December 2012.

## METHODS

The surveillance period was 7 October 2001 to 31 December 2012. 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 deployed as part of Operation Enduring Freedom. The outcomes of interest in this analysis reflected individuals who were medically evacuated during the surveillance period from the OEF theater of the U.S. Central Command (CENTCOM) area of responsibility (AOR) (i.e., Afghanistan) 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 permanent military medical facility in the U.S. or Europe from five days prior to ten days after the evacuation date. Records of all medical evacuations conducted by the U.S. Transportation Command (TRANSCOM) are routinely collected for health surveillance purposes by the Armed Forces Health Surveillance Center (AFHSC).

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. In most cases, the primary (first-listed) diagnosis for either a hospitalization (if one occurred) or the earliest ambulatory visit after evacuation was considered indicative of the condition responsible for the evacuation. However, if the first-listed diagnostic code specified the external cause (rather than the nature) of an injury (ICD-9-CM E-code) or an encounter for something other than a current illness or injury (e.g., observation, medical examination, vaccination [ICD-9-CM V-code]), then secondary diagnoses that specified illnesses and injuries (ICD-9-CM 001-999) were considered the likely reasons for the subject evacuations.

Denominators for rates of medical evacuations were calculated by determining the length of each individual's deployment and summing the person-time of all deployers. If the deployment end date was missing, the end date was imputed based upon average deployment times per service.

The disposition after each medical evacuation was determined from the disposition code associated with the medical encounter used for determining the category of the medical evacuation. Inpatient disposition categories were: returned to duty (code: 01), transferred/discharged to other facility (codes: 02-04, 09, 21-28, 43, 61-66), died (codes: 20, 30, 40-42, 50, 51), separated from service (codes: 10-15), and other/unknown. Outpatient disposition categories were: released without limitation (code: 1), released with work/duty limitation (code: 2), immediate referral (code: 4), sick at home/quarters (codes: 3, S), admitted/transferred to civilian hospital (codes: 7, 9, A-D, U), died (codes: 8,G), discharged home (code: F), and other/unknown.

## RESULTS

During the 11-year surveillance period, 23,719 medical evacuations of service members from OEF were followed by at least one medical encounter in a fixed medical facility outside the operational theater. Overall, there were more medical evacuations for battle injuries (n=5,647; 23.8 percent of all evacuations; rate: 9.2 per 1,000 deployed person-years [dp-yrs]) than for any other category of illnesses or injuries **(Table 1)**.

In general, numbers of evacuations for battle injuries varied in relation to the numbers of deployed service members; as such, numbers were generally higher during troop surges than other periods. Also, both the numbers and rates of evacuations for battle injuries varied in relation to the natures, locations, and intensities of ongoing combat operations **(Figure 1)**. This was most evident in the increased rates of battle injury-related evacuations from OEF during the warm weather months of the years 2005 through 2012 **(Figure 1)**.

During every month of the 11-year period, medical evacuations for disease and non-battle injuries exceeded those for battle-related injuries. Overall during the period, the rate of evacuations for disease and non-battle injuries was more than triple that of battle-related injuries **(Table 1, Figure 1)**.

Over the entire period, four categories of illnesses and non-battle injuries accounted for half (50.3%) of all evacuations. Musculoskeletal disorders, primarily affecting the back and knee, accounted for approximately one of every seven (14.4%) evacuations; non-battle injuries, primarily sprains and fractures of extremities, accounted for approximately one of seven

**TABLE 1.** Numbers and rates (per 1,000 deployed person-years) of medical evacuations from Operation Enduring Freedom (OEF)-Afghanistan by major categories of illnesses and injuries, 7 October 2001-31 December 2012

| | Total | | Males | | Females | | Rate Ratio | Rate difference |
|---|---|---|---|---|---|---|---|---|
| Diagnostic category (ICD-9-CM) | No. | Rate | No. | Rate | No. | Rate | Female:Male | Female-Male |
| Battle injuries (from TRAC2ES records) | 5,647 | 9.2 | 5,570 | 10.0 | 77 | 1.3 | 0.13 | -8.7 |
| Musculoskeletal system (710-739) | 3,427 | 5.6 | 3,074 | 5.5 | 353 | 6.1 | 1.10 | 0.6 |
| Non-battle injuries and poisonings (800-999) | 3,398 | 5.5 | 3,159 | 5.7 | 239 | 4.1 | 0.73 | -1.6 |
| Mental disorders (290-319) | 2,850 | 4.6 | 2,408 | 4.3 | 442 | 7.6 | 1.76 | 3.3 |
| Signs, symptoms, ill-defined conditions (780-799) | 2,265 | 3.7 | 1,856 | 3.3 | 409 | 7.0 | 2.11 | 3.7 |
| Digestive system (520-579) | 1,124 | 1.8 | 1,005 | 1.8 | 119 | 2.0 | 1.14 | 0.2 |
| Nervous system (320-389) | 1,105 | 1.8 | 959 | 1.7 | 146 | 2.5 | 1.46 | 0.8 |
| Genitourinary system (580-629, except breast disorders) | 1,028 | 1.7 | 800 | 1.4 | 228 | 3.9 | 2.73 | 2.5 |
| Circulatory system (390-459) | 735 | 1.2 | 675 | 1.2 | 60 | 1.0 | 0.85 | -0.2 |
| Respiratory system (460-519) | 342 | 0.6 | 296 | 0.5 | 46 | 0.8 | 1.49 | 0.3 |
| Neoplasms (140-239) | 338 | 0.5 | 249 | 0.4 | 89 | 1.5 | 3.43 | 1.1 |
| Skin and subcutaneous tissue (680-709) | 309 | 0.5 | 269 | 0.5 | 40 | 0.7 | 1.43 | 0.2 |
| Other (V01-V82, except pregnancy-related) | 255 | 0.4 | 204 | 0.4 | 51 | 0.9 | 2.40 | 0.5 |
| Infectious and parasitic diseases (001-139) | 232 | 0.4 | 199 | 0.4 | 33 | 0.6 | 1.59 | 0.2 |
| Endocrine, nutrition, immunity (240-279) | 227 | 0.4 | 174 | 0.3 | 53 | 0.9 | 2.92 | 0.6 |
| Breast disorders (610-611) | 214 | 0.3 | 55 | 0.1 | 159 | 2.7 | 27.74 | 2.6 |
| Pregnancy and childbirth (630-679, relevant V-codes) | 103 | 0.2 | . | . | 103 | 1.8 | . | . |
| Hematologic disorders (280-289) | 70 | 0.1 | 50 | 0.1 | 20 | 0.3 | 3.84 | 0.3 |
| Congenital anomalies (740-759) | 50 | 0.1 | 44 | 0.1 | 6 | 0.1 | 1.31 | 0.0 |
| Totals | 23,719 | 38.5 | 21,046 | 37.7 | 2,673 | 46.0 | 1.22 | 8.2 |

**FIGURE 1.** Rates (per 1,000 deployed person-years) of medical evacuations of U.S. service members from Operation Enduring Freedom (OEF) - Afghanistan, by month, 7 October 2001-31 December 2012

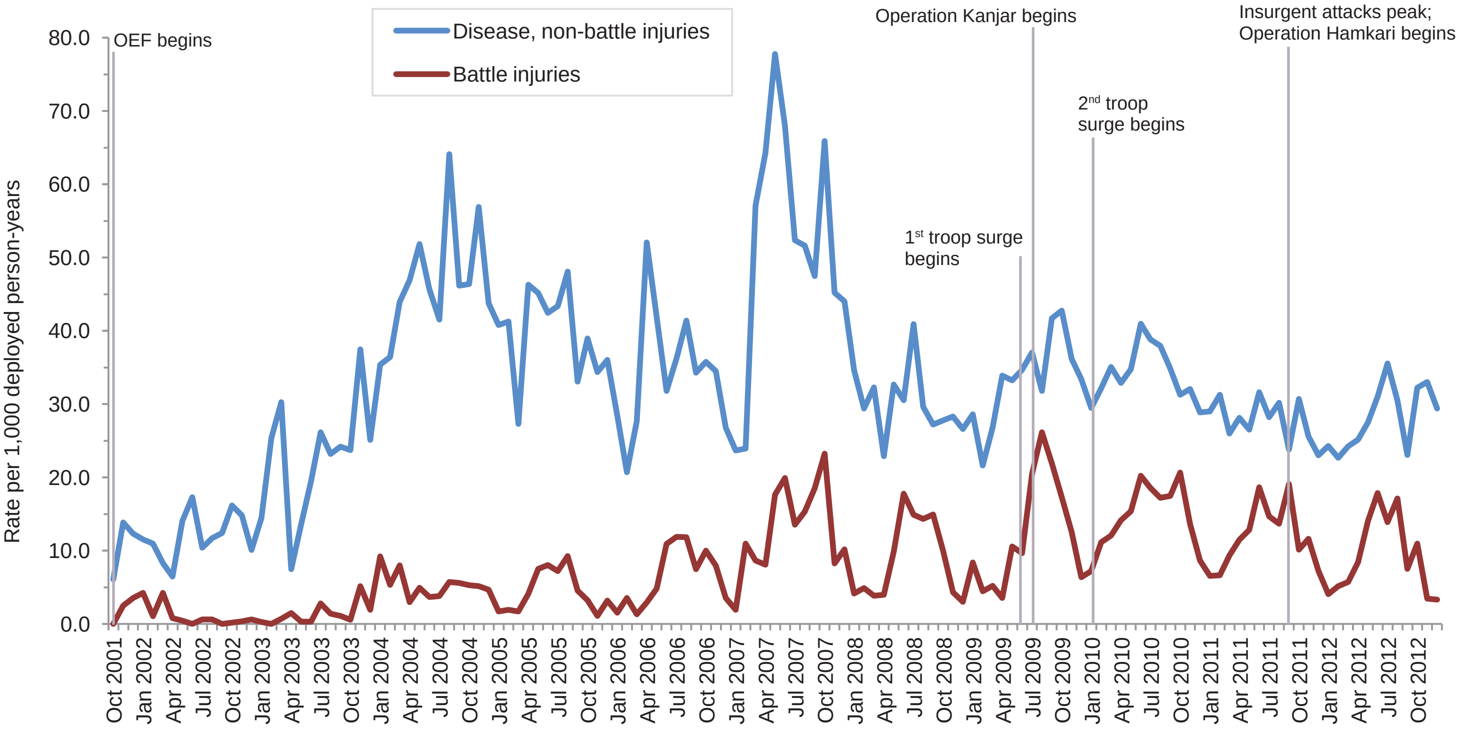



**FIGURE 2.** Rates (per 1,000 deployed person-years) of medical evacuations for selected diagnostic categories among males, Operation Enduring Freedom (OEF) - Afghanistan, U.S. Armed Forces, 07 October 2001-31 December 2012

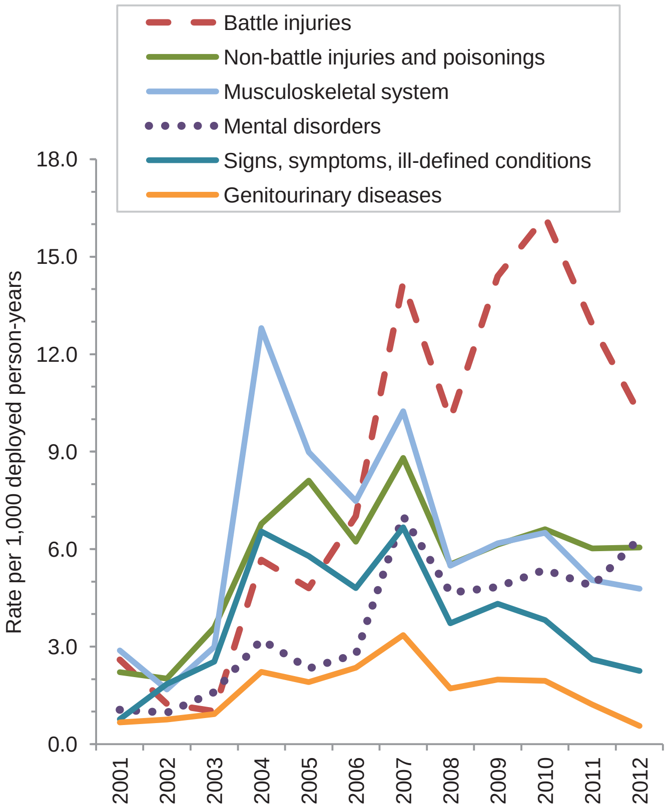
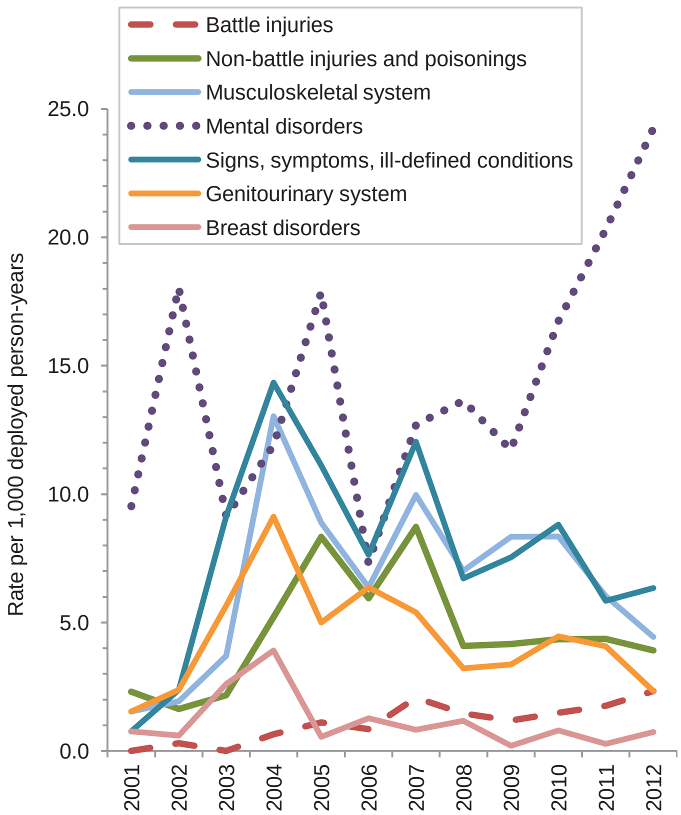



**FIGURE 3.** Rates (per 1,000 deployed person-years) of medical evacuations for selected diagnostic categories among females, Operation Enduring Freedom (OEF) - Afghanistan, U.S. Armed Forces, 7 October 2001-31 December 2012



(14.3%) evacuations; mental disorders, most frequently adjustment reactions, mood disorders, anxiety disorders, and post-traumatic stress disorder (PTSD), accounted for approximately one of eight (12.0%) evacuations; and "signs, symptoms, and ill-defined conditions" (more than one-fifth related to the respiratory system) accounted for approximately one of eleven (9.5%) evacuations **(Table 1)**.

## Demographic and military characteristics

Overall, nearly eight times as many males (n=21,046) as females (n=2,673) were medically evacuated; however, the rate of medical evacuations was 22.0 percent higher among females (46.0 per 1,000 dp-yrs) than males (37.7 per 1,000 dp-yrs) **(Table 2)**. Of all medical evacuations of males throughout the period (n=21,046), the most frequent associated diagnoses were battle injuries (26.5%), non-battle injuries (15.0%), musculoskeletal disorders (14.6%), and mental disorders (11.4%). In contrast, the most frequent diagnoses among evacuated females during the period (n=2,673) were mental disorders (16.5%), "signs, symptoms, and ill-defined conditions" (15.3%), musculoskeletal disorders (13.2%), and non-battle injuries (8.9%) **(Table 1)**.

Compared to females, males had higher rates of evacuations for battle injuries (females:males, rate ratio [RR]: 0.13; rate difference [RD]: 8.7 per 1,000 dp-yrs), non-battle injuries/poisonings (RR: 0.73; RD: 1.6 per 1,000 dp-yrs), and disorders of the circulatory system (RR: 0.85; RD: 0.2 per 1,000 dp-yrs). Females had higher evacuation rates for all other illness and injury categories. The largest relative differences in evacuation rates among females versus males were for breast disorders (RR: 27.74), hematologic disorders (RR: 3.84), and neoplasms (RR: 3.43); however, the largest absolute differences in evacuation rates among females compared to males were for "signs, symptoms, and ill-defined conditions" (RD: 3.7 per 1,000 dp-yrs) and mental disorders (RD: 3.3 per 10,00 dp-yrs) **(Table 1)**.

Among OEF male participants, annual rates of medical evacuations attributable to battle injuries increased from a low of 1.0 per 1,000 dp-yrs (n=47) in 2003 to a high of 16.2 per 1,000 dp-yrs (n=1,472) in 2010 and then declined to 10.2 per 1,000 dp-yrs (n=912) in 2012. Annual rates of medical evacuations attributable to mental disorders more than tripled from 2003 (1.9 per 1,000 dp-yrs) to 2007 (7.0 per 1,000 dp-yrs), then remained relatively stable from 2008 to 2012 (range, annual rates, 2008-12: 4.7 to 6.3 per 1,000 dp-yrs). Evacuation rates for musculoskeletal disorders, non-battle injuries/poisonings, "signs, symptoms, ill-defined conditions," and genitourinary disorders generally increased from 2001 to 2007 and then decreased through 2012 **(Figure 2)**.

Among female OEF participants, annual rates of medical evacuations due to mental disorders were variable from 2001 to 2009, and then steadily increased through 2012 (24.2 per 1,000 dp-yrs). Over the period, relatively few females required medical evacuations for battle injuries; annual numbers of battle injury-related evacuations of females ranged from zero (in 2001 and 2003) to 22 in 2012. Annual evacuation rates among females for non-battle injuries/poisonings, musculoskeletal disorders, "signs, symptoms, ill-defined conditions," disorders of the genitourinary system, and breast disorders increased from 2001 to 2007 and then decreased through 2012 **(Figure 3)**.

Overall, medical evacuation rates were higher among white, non-Hispanics (40.7 per 1,000 dp-yrs) and lower among Asian/Pacific Islanders (24.6 per 1,000 dp-yrs) than among deployers of other racial/ethnic identities. In relation to age, overall evacuation rates were lowest among the youngest (<20 years: 25.2 per 1,000 dp-yrs), highest among the oldest (≥45 years: 58.0 per 1,000 dp-yrs), and intermediate and fairly similar across age groups from 20 to 44 years old (range, age group-specific rates, 20-44 years: 36.6 to 41.9). Compared to their respective counterparts, rates of evacuation were higher among deployers who were in the Army or Marine Corps, in the reserve component, junior enlisted, and in combat-specific or armor/motor transport occupations **(Table 2)**.

**TABLE 2.** Number and rate (per 1,000 deployed person-years) of medical evacuations from Operation Enduring Freedom (OEF) - Afghanistan by demographic and military characteristics, 7 Oct 2001-31 Dec 2012

| | No. | Rate |
|---|---|---|
| Total | 23,719 | 38.5 |
| Sex | | |
| Male | 21,046 | 37.7 |
| Female | 2,673 | 46.0 |
| Race/ethnicity | | |
| White, non-Hispanic | 16,780 | 40.7 |
| Black, non-Hispanic | 3,312 | 37.1 |
| Hispanic | 2,197 | 34.3 |
| Asian/Pacific Islander | 580 | 24.6 |
| Other/Unknown | 850 | 31.6 |
| Age | | |
| <20 | 810 | 25.2 |
| 20-24 | 8,626 | 38.3 |
| 25-29 | 5,384 | 38.9 |
| 30-34 | 3,194 | 37.3 |
| 35-39 | 2,491 | 36.6 |
| 40-44 | 1,690 | 41.9 |
| 45+ | 1,524 | 58.0 |
| Service | | |
| Army | 17,440 | 49.9 |
| Navy | 960 | 11.0 |
| Air Force | 2,167 | 23.2 |
| Marine Corps | 3,149 | 36.9 |
| Coast Guard | 3 | 48.6 |
| Component | | |
| Active | 17,877 | 36.6 |
| Reserve/Guard | 5,842 | 46.1 |
| Rank | | |
| Junior enlisted | 12,074 | 41.3 |
| Senior enlisted | 9,145 | 39.7 |
| Junior officer | 1,546 | 25.6 |
| Senior officer | 954 | 29.4 |
| Occupation | | |
| Combat-specific[a] | 8,266 | 57.4 |
| Armor/motor transport | 1,483 | 52.2 |
| Repair/engineering | 4,551 | 28.0 |
| Comm/intel | 4,359 | 33.3 |
| Healthcare | 1,506 | 42.1 |
| Other | 3,554 | 31.1 |
| Precedence[b] | | % medical evacs |
| Routine | 18,501 | 78.0 |
| Priority | 4,465 | 18.8 |
| Urgent | 752 | 3.2 |
| Transport type | | % medical evacs |
| Military | 22,310 | 94.1 |
| Commercial | 87 | 0.4 |
| Other | 7 | 0.0 |
| Unknown | 1,315 | 5.5 |

[a]Infantry, artillery, combat engineering
[b]Data field within TRAC2ES; one unknown

**TABLE 3.** Most frequent 3-digit ICD-9-CM diagnoses from medical evacuations, by gender, Operation Enduring Freedom (OEF) - Afghanistan, 7 Oct 2001-31 Dec 2012

| Males | | | | Females | | | |
|---|---|---|---|---|---|---|---|
| 3-digit ICD-9 | Description | No. | Rate | 3-digit ICD-9 | Description | No. | Rate |
| 309 | Adjustment reaction | 1,090 | 2.0 | 309 | Adjustment reaction | 178 | 3.1 |
| 719 | Other/unspecified disorders of joint | 747 | 1.3 | 611 | Other disorders of breast | 141 | 2.4 |
| 724 | Other/unspecified disorders of back | 583 | 1.0 | 719 | Other/unspecified disorders of joint | 109 | 1.9 |
| 722 | Intervertebral disc disorders | 554 | 1.0 | 789 | Other symptoms involving abdomen/pelvis | 93 | 1.6 |
| 780 | General symptoms | 492 | 0.9 | 780 | General symptoms | 83 | 1.4 |
| 897 | Traumatic amputation of leg(s) | 458 | 0.8 | 296 | Episodic mood disorders | 80 | 1.4 |
| 786 | Respiratory system/other chest symptoms | 442 | 0.8 | 724 | Other/unspecified disorders of back | 67 | 1.2 |
| 824 | Fracture of ankle | 437 | 0.8 | 311 | Depressive disorder not elsewhere classified | 63 | 1.1 |
| 823 | Fracture of tibia and fibula | 421 | 0.8 | 786 | Respiratory system/other chest symptoms | 62 | 1.1 |
| 296 | Episodic mood disorders | 409 | 0.7 | 722 | Intervertebral disc disorders | 50 | 0.9 |
| 825 | Fracture tarsal/metatarsal bones | 399 | 0.7 | 300 | Anxiety, dissociative, somatoform disorders | 45 | 0.8 |
| 813 | Fracture of radius and ulna | 353 | 0.6 | 625 | Pain/other symptoms of with female genital organs | 39 | 0.7 |
| 592 | Calculus of kidney and ureter | 350 | 0.6 | 787 | Symptoms involving digestive system | 39 | 0.7 |
| 805 | Fracture of vertebral column without spinal cord injury | 339 | 0.6 | V22 | Normal pregnancy | 38 | 0.7 |
| 789 | Other symptoms involving abdomen/pelvis | 264 | 0.5 | 795 | Other/nonspecific abnormal histological/immunological findings | 36 | 0.6 |
| 300 | Anxiety, dissociative, somatoform disorders | 258 | 0.5 | 620 | Noninflammatory disorders of ovary fallopian tube | 34 | 0.6 |
| 850 | Concussion | 252 | 0.5 | 626 | Disorders of menstruation/other abnormal bleeding from female genital tract | 32 | 0.6 |
| 816 | Fracture of phalanges of hand | 249 | 0.4 | 592 | Calculus of kidney and ureter | 29 | 0.5 |
| 723 | Other disorders of cervical region | 240 | 0.4 | 785 | Symptoms involving cardiovascular system | 29 | 0.5 |
| 844 | Sprains/strains of knee and leg | 233 | 0.4 | 729 | Other disorders of soft tissues | 28 | 0.5 |

A majority of all medical evacuations (78.0%) were characterized as having routine precedence. The remaining 22 percent had priority (18.8%) or urgent (3.2%) precedence. Most medical evacuations (94.1%) were accomplished through military transport **(Table 2)**.

## Most frequent specific diagnoses

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; the rate of adjustment disorder evacuations was 56.9 percent higher among females (3.1 per 1,000 dp-yrs) than males (2.0 per 1,000 dp-yrs). Of the 20 diagnoses most frequently associated with evacuations of males, six were fractures (extremities and spine) and five were musculoskeletal conditions (back and joints). In addition to

**TABLE 4.** Disposition after inpatient or outpatient encounter post-medical evacuation, Operation Enduring Freedom (OEF) - Afghanistan, 7 Oct 2001-31 Dec 2012

| Disposition | Total | | Battle injuries | | Disease, non-battle injuries | |
|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % |
| Inpatient[a] | 9,510 | | 4,293 | | 5,217 | |
| Returned to duty | 4,782 | 50.3 | 1,258 | 29.3 | 3,524 | 67.5 |
| Transferred/discharged to other facility | 4,595 | 48.3 | 2,998 | 69.8 | 1,597 | 30.6 |
| Other | 72 | 0.8 | 22 | 0.5 | 50 | 1.0 |
| Died | 16 | 0.2 | 12 | 0.3 | 4 | 0.1 |
| Unknown | 45 | 0.5 | 3 | 0.1 | 42 | 0.8 |
| Outpatient[b] | 14,209 | | 1,354 | | 12,855 | |
| Released without limitation | 9,244 | 65.1 | 818 | 60.4 | 8,426 | 65.5 |
| Released with work/duty limitation | 2,997 | 21.1 | 341 | 25.2 | 2,656 | 20.7 |
| Other | 18 | 0.1 | 1 | 0.1 | 17 | 0.1 |
| Immediate referral | 824 | 5.8 | 80 | 5.9 | 744 | 5.8 |
| Sick at home/quarters | 122 | 0.9 | 11 | 0.8 | 111 | 0.9 |
| Admitted/transferred to civilian hospital | 51 | 0.4 | 8 | 0.6 | 43 | 0.3 |
| Unknown | 953 | 6.7 | 95 | 7.0 | 858 | 6.7 |

[a]No individuals were separated from service
[b]No individuals with outpatient encounters died

"adjustment reactions," two other mental disorders, "episodic mood disorders" and "anxiety, dissociative, and somatoform disorders," were among the 20 diagnoses most frequently associated with evacuations of males **(Table 3)**.

Of the 20 diagnoses most frequently associated with evacuations of females, four were mental disorders ("adjustment reaction," "episodic mood disorders," "depressive disorder," "anxiety, dissociative, and somatoform disorders"); five were conditions that exclusively or primarily affect women (e.g., "pain/other symptoms associated with female genital organs," "other disorders of the breast"); and three were musculoskeletal conditions (back and joints) **(Table 3)**.

## Disposition

Of the 23,719 medical evacuations reported here, 9,510 (40.1%) resulted in inpatient encounters. Half (50.3%) of all service members who were hospitalized after medical evacuations were discharged back to duty. Nearly one-half (48.3%) of service members who were hospitalized after medical evacuations were transferred or discharged to other facilities.

Return to duty dispositions were much more likely after hospitalizations for diseases/non-battle injuries (67.5%) than for battle injuries (29.3%). Also, more than two-thirds (69.8%) of battle injury-related hospitalizations, but less than one-third of disease/non-battle injury-related hospitalizations, resulted in transfers/discharges to other facilities **(Table 4)**.

Of the 23,719 medical evacuations reported, 14,209 (59.9%) resulted in outpatient encounters only. Of all service members treated exclusively in outpatient settings after evacuations, nearly two-thirds (65.1%) were discharged back to duty, 21.1 percent were released with work/duty limitations, 5.8 percent were immediately referred, and less than 1 percent each were discharged to "home sick" for recuperation or admitted/transferred to a civilian hospital. Service members treated as outpatients after battle injury-related evacuations were slightly less likely to be released without limitations (60.4%) and slightly more likely to have work/duty limitations (25.2%) than medical evacuees treated as outpatients for diseases/non-battle injuries (65.5% and 20.7%, respectively) **(Table 4)**.

## EDITORIAL COMMENT

This study documented that less than one fourth of all medical evacuations from OEF were associated with battle injuries. Rates of evacuations for battle injuries were considerably higher in the last six years than in the first six years of the surveillance period.

Most evacuations overall were associated with diseases and non-battle injuries, two thirds of which were due to musculoskeletal disorders, non-battle injuries, mental disorders, and "signs, symptoms, and ill-defined conditions." Overall rates of evacuation were higher among females than males. Among the major illness and injury-related diagnostic categories (per the ICD-9-CM), rates of evacuations were higher among males than females only for battle injuries, non-battle injuries/poisonings, and disorders of the circulatory system. Examination of more specific illnesses and injuries (3-digit level, ICD-9-CM) revealed that evacuations for back and joint disorders and mental disorders were relatively common among deployers of both genders, and fractures of extremities and vertebrae were frequent among males but not among females. The majority of service members who were evacuated were returned to normal duty status following their post-evacuation hospitalizations or outpatient encounters in Europe or the United States. However, fewer than half of those evacuated for battle injuries were returned to duty immediately after their initial healthcare encounters.

A previous *MSMR* report estimated that during a 12-month deployment to combat operations in Iraq and Afghanistan, approximately 4 percent of Army, 2 percent of Marine Corps, and 1 percent of the other Services' members were medically evacuated for any reason.[1] This report documents that the rates of medical evacuations by Service from OEF were comparable to the percentages cited in the earlier *MSMR* report. The relatively low likelihood of medical evacuation suggests that most deployers were sufficiently healthy and fit, and most received the necessary medical care in theater to complete their OEF assignments successfully.

This analysis extends the findings of previous reports on medical evacuations from OEF. It documents that the numbers and underlying causes of medical evacuations from OEF varied in relation to the numbers of deployed service members and the natures of ongoing military operations, the tempo of which was usually dependent upon the favorable weather conditions of the spring and summers in Afghanistan. The report also documents differences in the predominant causes of medical evacuations 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 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. Direct comparisons of numbers and rates of medical evacuations by cause, as between males and females, can be misleading; for example, such comparisons do not account for differences between the groups in other 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 during hospitalizations 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.

Additionally, because the calculation of person-time was based upon OEF as a whole, service members who deployed to countries outside of the CENTCOM AOR (i.e., Afghanistan) were included in the person-time denominator. However, only evacuations from Afghanistan were used to calculate rates, which could result in an underestimation of true evacuation rates. Since a very small proportion of OEF deployers served outside of Afghanistan, the effects on estimation of evacuation rates is likely minor.

In summary, during the entirety of the campaign in Afghanistan through 31 December 2012, more than 23,000 U.S. service members were medically evacuated. This report documents that, throughout OEF (even during periods of the most intense combat), most medical evacuations were not directly related to battle injuries. Overall, approximately three of every four medical evacuations were due to illnesses and non-battle injuries. Since 2003 the proportion of battle injuries has increased in both males and females. The proportions of medical evacuations due to mental disorders also increased in both genders particularly after 2009. The recent increase in mental disorder-related evacuations from Afghanistan may reflect, at least in part, increased awareness of, concern regarding, and healthcare resources dedicated to detecting and managing psychological, stress-related disorders (e.g., PTSD, depression, suicide ideation) among deployers.

Finally, 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.[1] For example, a recent *MSMR* analysis showed that two-thirds of service members diagnosed with degenerative disk disease (DDD) prior to deployment experienced exacerbations of their condition while deployed.[2]

## 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. *MSMR*. Feb 2010;17(2): 2-7.

2. Mydlarz D. Degenerative disc disease, active component, U.S. Armed Forces, 2001-2011. *MSMR*. May 2012;19(5):6-9.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# Incident Diagnoses of Common Symptoms ("Sequelae") Following Traumatic Brain Injury, Active Component, U.S. Armed Forces, 2000-2012

Many individuals who suffer traumatic brain injuries (TBI) experience subsequent physical, neurocognitive, or psychological symptoms. This analysis examined the occurrence of 14 such symptoms in service members stratified by severity into three groups of TBI and also in two comparison groups (controls) of service members who had no documented TBI diagnosis. For members of each of the five groups, the proportion who had experienced the 14 symptoms of interest was captured for the first 3 month and 12 month periods after the relevant diagnosis. Service members in the group "TBI, non-current injury" differed considerably from the four other groups by demographic characteristics and by previous history of deployment. In general, individuals with diagnoses indicative of TBI, regardless of severity, had higher proportions of the post-TBI diagnoses than either control group. The most common post-TBI diagnoses were headache disorders, alcohol and substance abuse, post-traumatic stress disorder, and sleep disorders. Proportions with diagnosed symptoms increased from the earliest (2000-2002) to the most recent part (2007-2012) of the surveillance period. Probable reasons for this observation are discussed.

The Department of Defense (DoD) definition of traumatic brain injury (TBI) is a "traumatically induced structural injury and/or physiological disruption of brain function as a result of an external force that is indicated by new onset or worsening of at least one of the following clinical signs immediately following the event: any period of loss of or decreased level of consciousness; any loss of memory for events immediately before or after the injury; any alteration in mental state at the time of the injury (confusion, disorientation, slowed thinking, etc.); neurological deficits (weakness, loss of balance, change in vision, praxis, paresis/plegia, sensory loss, aphasia, etc.) that may or may not be transient; intracranial lesion."[1]

TBI is a significant public health issue in the civilian population; an estimated 1.7 million TBIs occur each year in the U.S. civilian population.[2] The published estimate of the cumulative number of TBI cases in U.S. military members since 2000 is 273,859.[3] DoD TBI surveillance statistics categorize summary data on incident TBI into five levels of severity: mild, moderate, severe, penetrating, and unclassifiable. Mild TBI (mTBI), also known as concussion, is the most common TBI diagnosis in active component military members.[3]

The occurrence of physical, neurocognitive, and psychological symptoms after TBI is not uncommon; both the incidence of these symptoms (sometimes referred to as TBI sequelae), as well as the prognoses after TBI, have been shown to vary according to severity of the initial injury. While the symptoms of mTBI usually resolve within hours to days, many individuals who suffer a TBI have symptoms that persist post-injury.[4-7]

This analysis examines proportions of service members who were diagnosed with 14 common TBI-related symptoms or conditions within 3 months and within 12 months after incident TBI diagnoses stratified by level of severity. Similar proportions of the diagnoses were examined in two comparison groups: an "injury" group (composed of service members with limb fractures but no TBI), and a "non-injury" group (composed of service members without any recorded injuries). This is the first in a series of *MSMR* articles reporting on these analyses; this report focuses on preliminary findings.

## METHODS

The surveillance period was January 2000 through December 2012. The surveillance population was comprised of service members who served in an active component of the U.S. Armed Forces at any time during the surveillance period. Medical encounters that included diagnoses of traumatic brain injury and selected post-injury conditions were ascertained from electronic records of hospitalizations and ambulatory visits in U.S. military medical facilities and in civilian facilities (contracted/purchased care through the Military Health System); and from standardized records of in-theater medical encounters of deployed service members (Theater Medical Data Store [TMDS]).

Service members whose electronic record contained at least one TBI-related diagnosis **(Table 1)** during the surveillance comprised the "TBI group." For summary purposes, the earliest TBI-related encounter was considered the incident encounter for each individual. Service members with TBI-related medical encounters prior to the start of the surveillance period (i.e., prevalent TBI cases) were excluded.

The TBI group was divided into three subgroups according to the incident diagnosis: "severe TBI," "mild TBI," or "TBI history." The "severe TBI" group included individuals with diagnoses of injuries classified as "severe," "moderate," or "penetrating" by the Department of Defense classification system based on the type of injury and length of loss of consciousness as indicated by the ICD-9-CM diagnosis code (Table 1). The "mild TBI" group comprised those with TBI diagnoses classified as "mild." "TBI history" was applied to those with a diagnosis of either "history of TBI" or "post-concussion syndrome" and no other diagnosis indicating a TBI during the surveillance period.

The three TBI groups were compared to an "injured group" of controls with diagnoses of upper or lower limb fracture (those with multiple fractures were excluded) and to a "non-injured group" of controls with neither TBI nor limb fracture. Members of the injured comparison group were randomly selected from all service members who met the following criteria: 1) A single diagnosis of a fracture of an upper limb (ICD-9: 810.xx-816.xx) or of a lower limb (ICD-9: 820.xx-826.xx) in the first diagnostic position of an inpatient or outpatient medical encounter during the surveillance period, and 2) no TBI qualifying diagnoses prior to or during the surveillance period. Members of the non-injured control group were randomly selected from service members in service at any time during the surveillance period who had no medical encounters with a diagnosis of limb fracture during the surveillance period and no TBI diagnosis prior to or during the surveillance period. Injury controls were matched 1:1 to TBI cases based on service, age group, and gender, and clinical setting of their case qualifying diagnosis (i.e., inpatient vs. outpatient). The pool of injury controls did not yield a match for every case. Non-injury controls were matched 2:1 to TBI cases based on service, age, group, and gender.

For each individual, post-injury diagnoses of each of the 14 selected conditions potentially related to TBI (Table 2) were recorded for the 3-month and 12-month periods beginning on the day of the index event (TBI or fracture). For non-injured controls, surveillance for the 14 conditions began on the day of the incident TBI diagnosis of the TBI case to which they were matched. For each of the five groups compared (severe, mild, and non-current TBI and the two control groups), the proportions of service members in each group with each of the selected conditions at 3 and 12 months were summarized over the entire surveillance period and during each of three subperiods: Period 1: 2000-2002, Period 2: 2003-2006 and Period 3: 2007-2012. Note that some TBI cases and

**TABLE 1.** ICD-9-CM codes used for traumatic brain injury (TBI) classification

| TBI group classification | ICD-9-CM codes |
|---|---|
| TBI, severe (includes moderate, penetrating, and severe) | 800.03-800.05, 800.1x-800.4x, 800.53-800.59, 800.6x-800.9x, 801.03-801.05, 801.1x-801.4x, 01.53-801.59, 801.6x-801.9x, 803.03-803.05, 803.1X-803.4x, 803.53-803.59, 803.6x-803.9x, 804.03-804.05, 804.1X-804.4x, 804.53-804.59, 804.6x-804.9x, 850.12, 850.2, 850.3, 850.4, 851.xx-854.xx |
| TBI, mild (includes mild and unclassifiable) | 905.0, V80.01, 800.00-800.02, 800.06, 800.09, 800.50-800.52, 801.00-801.02, 801.06, 801.09, 801.50-801.52, 803.00-803.02, 803.06, 803.09, 803.50-803.52, 804.00-804.02, 804.06, 804.09, 804.50-804.52, 850.0, 850.01, 850.11, 850.5, 850.9, 851.0, 950.1-950.3,950.01 |
| TBI, non-current | 310.2, 907.0, V15.5x |

**TABLE 2.** ICD-9-CM codes for symptoms or outcomes of traumatic brain injury (TBI)

| Symptom or outcome | ICD-9-CM codes |
|---|---|
| Death | Any death (all causes) during the surveillance period |
| Mental disorders | |
| Post-traumatic stress disorder (PTSD) | 309.81 |
| Depressive disorder | 296.20-296.35, 296.50-296.55, 296.9, 300.4, 311 |
| Anxiety disorder | 300.00-300.09, 300.20-300.29,300.30-300.39 |
| Alcohol/substance abuse related disorder | 303.xx, 304.xx, 305.xx (excludes tobacco use disorder) |
| V-coded psychosocial and behavioral health problems | V61.0x, V61.1, V61.10 (exclude V61.11, V61.12), V61.2, V61.23, V61.24, V61.25, V61.29, V61.8X, V61.9, V61.11, V61.12, V61.21, V61.22, V62.83, 995.80-995.85, V62.xx (exclude V62.6, V62.83), V40.xx (exclude V40.0, V40.1), V65.42 |
| Nervous/sensory | |
| Sleep disorders | 327.0x Organic insomnia<br>327.1x Organic hypersomnia<br>327.2x Organic sleep apnea<br>327.3x Circadian rhythm sleep disorder<br>327.4x Organic parasomnia<br>327.5x Organic sleep related movement disorders<br>780.5x Sleep disturbances |
| Epilepsy/seizure | 345.xx Epilepsy and recurrent seizures<br>780.33 Post-traumatic seizures<br>780.39 Other convulsions |
| Visual disturbance | 368.xx |
| Hearing loss, unspecified | 389.9 |
| Tinnitus | 388.3x |
| Other | |
| Headache | 307.81 Tension headache<br>339.1x Tension type headache<br>339.2x Post-traumatic headache<br>346.xx Migraine<br>784.0x Headache |
| Memory loss | 780.93 |
| Dizziness, vertigo | 780.4 |

**TABLE 3.** Demographic and military characteristics of service members at the time of injury, by injury group, active component, U.S. Armed Forces, January 2000-December 2012

| | TBI, severe | | TBI, mild | | TBI, non-current injury | | Injury | | Non-injury | |
|---|---|---|---|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % | No. | % | No. | % |
| Total | 32,761 | 100.0 | 150,125 | 100.0 | 28,765 | 100.0 | 186,659 | 100.0 | 423,301 | 100.0 |
| Service | | | | | | | | | | |
| Army | 15,573 | 47.5 | 75,152 | 50.1 | 22,870 | 79.5 | 74,058 | 39.7 | 227,190 | 53.7 |
| Navy | 6,082 | 18.6 | 23,644 | 15.7 | 1,453 | 5.1 | 37,573 | 20.1 | 62,357 | 14.7 |
| Air Force | 4,575 | 14.0 | 23,659 | 15.8 | 1,308 | 4.5 | 38,534 | 20.6 | 59,084 | 14.0 |
| Marine Corps | 5,768 | 17.6 | 24,022 | 16.0 | 3,014 | 10.5 | 31,813 | 17.0 | 65,608 | 15.5 |
| Coast Guard | 763 | 2.3 | 3,648 | 2.4 | 120 | 0.4 | 4,681 | 2.5 | 9,062 | 2.1 |
| Sex | | | | | | | | | | |
| Male | 29,772 | 90.9 | 131,253 | 87.4 | 26,445 | 91.9 | 162,876 | 87.3 | 374,940 | 88.6 |
| Female | 2,989 | 9.1 | 18,872 | 12.6 | 2,320 | 8.1 | 23,783 | 12.7 | 48,361 | 11.4 |
| Age | | | | | | | | | | |
| <25 | 18,518 | 56.5 | 84,621 | 56.4 | 11,270 | 39.2 | 99,894 | 53.5 | 216,329 | 51.1 |
| 25-34 | 9,976 | 30.5 | 47,851 | 31.9 | 11,944 | 41.5 | 60,946 | 32.7 | 146,744 | 34.7 |
| 35+ | 4,267 | 13.0 | 17,653 | 11.8 | 5,551 | 19.3 | 25,819 | 13.8 | 60,228 | 14.2 |
| Military occupation | | | | | | | | | | |
| Combat | 9,395 | 28.7 | 34,986 | 23.3 | 10,828 | 37.6 | 39,302 | 21.1 | 98,268 | 23.2 |
| Healthcare | 1,760 | 5.4 | 8,853 | 5.9 | 1,946 | 6.8 | 12,619 | 6.8 | 30,872 | 7.3 |
| Admin/supply | 6,343 | 19.4 | 30,182 | 20.1 | 5,673 | 19.7 | 41,389 | 22.2 | 97,526 | 23.0 |
| Other | 15,263 | 46.6 | 76,104 | 50.7 | 10,318 | 35.9 | 93,349 | 50.0 | 196,635 | 46.5 |
| Deployed to OIF/OEF[a] | | | | | | | | | | |
| Yes | 13,161 | 40.2 | 68,043 | 45.3 | 23,465 | 81.6 | 80,126 | 42.9 | 209,338 | 49.5 |
| No | 19,600 | 59.8 | 82,082 | 54.7 | 5,300 | 18.4 | 106,533 | 57.1 | 213,963 | 50.5 |
| Hospitalized with TBI[b] | | | | | | | | | | |
| Yes | 6,707 | 20.5 | 6,651 | 4.4 | na | na | na | na | na | na |
| No | 26,054 | 79.5 | 143,474 | 95.6 | na | na | na | na | na | na |

[a]Deployment record prior to or concurrent with incident injury event
[b]Inpatient diagnosis (any diagnostic position) of "TBI, current injury" during the surveillance period

their matched controls, if ascertained in 2012, may not have had a complete period of follow-up.

## RESULTS

During the thirteen year surveillance period, 211,651 service members had a diagnosis qualifying them as a TBI case; 150,125 (71%) of these TBI cases were classified as "mild"; these individuals were matched to 186,659 "injury" and 423,301 non-injury" controls **(Table 3)**.

Service members in the "severe" and "mild" TBI groups had demographic characteristics generally similar to injury controls. In contrast, service members whose only TBI indicator diagnosis was "post-concussion syndrome" or "history of TBI" (non-current TBI) were more likely to be 25-34 years old (42%), in the Army (80%) and in combat occupations (38%) as compared to those with mild and severe TBI diagnoses. Approximately 82 percent of the "non-current TBI" group had deployed in support of Operation Iraqi Freedom (OIF), Operation New Dawn (OND), or Operation Enduring Freedom (OEF) prior to their incident injury diagnosis; this proportion was much lower in the other TBI and control groups **(Table 3)**.

In general, individuals with diagnoses indicative of TBI, regardless of severity, had higher proportions of post-TBI diagnoses than injury or non-injury controls.

Among those with TBI, proportions with subsequent diagnoses ("sequelae") were generally highest among those with severe TBI or history of TBI and lowest among those with mild TBI. Among cases diagnosed in the last period (2007-2012), proportions were highest in the severe TBI groups for every condition except sleep disorders and tinnitus **(Figures 1,2)**.

Among TBI cases of similar severities, proportions with subsequent diagnoses ("sequelae") varied in relation to the period in which the TBI was diagnosed; for most conditions, proportions increased from the first period (2000-2002) through the last (2007-2012) **(Figures 1,2)**.

### Mental health conditions

In each subperiod, at both 3 months and 12 months post injury, more service members had diagnoses of alcohol/substance abuse than any other selected condition except headache **(Figures 1a-2c)**.

The largest increases from the 3 month follow-up period in proportions of subsequent diagnoses were for mental disorders and these increases were consistently larger in the comparison than the TBI groups.

Among TBI cases, PTSD was the condition with the largest increase from the first period (2000-2002) through the third period (2007-2012) and this increase was largest in the "history of TBI" group.

### Nervous/sensory conditions

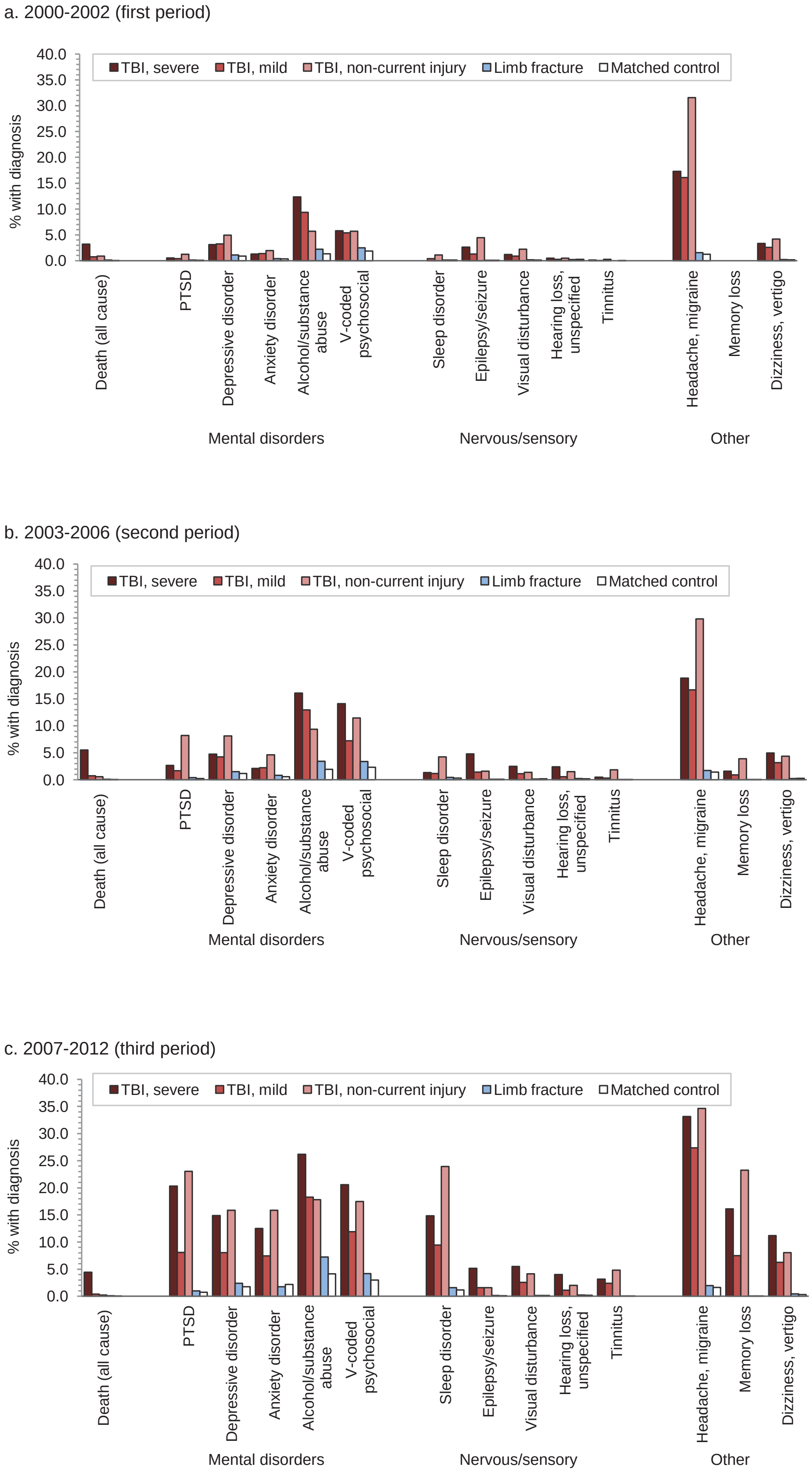
Sleep disorder was the sequela with the second largest increase in proportion from the first though the third period. The relative increase in sleep disorder proportions was highest in the severe TBI group.

At 3 and 12 months following TBI, proportions of both epilepsy/seizure and visual disturbances were highest in the severe TBI group, except in the first period (2000-2002) where "history of TBI" cases had the highest proportions. Post-injury hearing loss proportions were consistently highest among service members with severe TBI, while proportions of tinnitus were generally highest in the "history of TBI" group.

### Other signs/symptoms

Headache was by far the most common of the 14 selected symptoms; proportions were consistently higher in the

**FIGURE 1.** Diagnoses of symptoms within 3 months of incident event, by group and period of observation, active component, U.S. Armed Forces, 2000-2012




TBI history group at 3 months regardless of time period. This was also true at 12 months except for the third period (2007-2012) in which the "TBI, severe" group had the highest proportion.

## EDITORIAL COMMENT

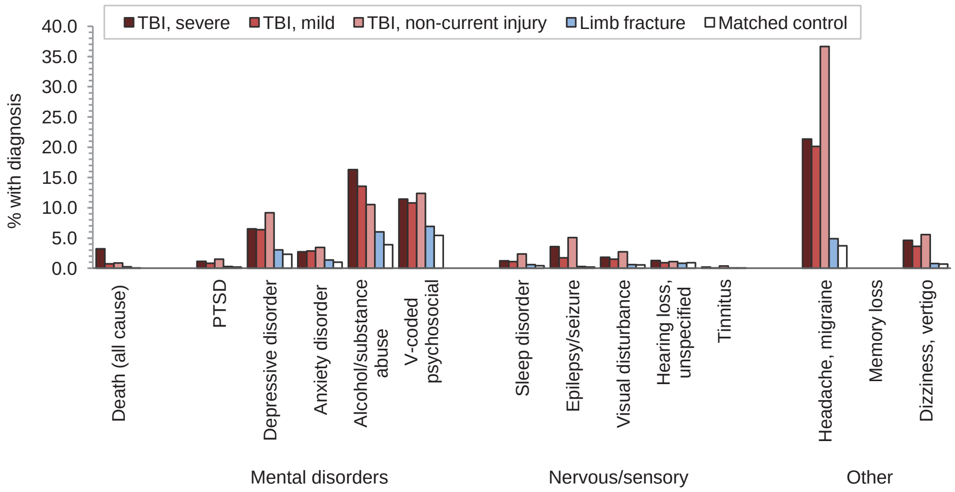
Given that the majority of traumatic brain injuries sustained by service members were not war-related (most service members in this analysis had no history of deployment at the time of their injury), it seems unlikely that the observed increases in the proportion of individuals with diagnosed symptoms in the three time periods can be attributed to changes in combat operations. The sharp increase in the percentage of injured service members with post-TBI symptoms undoubtedly reflects increased awareness, more complete ascertainment, and broader reporting of current and past TBI cases. Significant and increasing attention has been focused on the diagnosis and management of TBI in the military health system (MHS) in the latter part of the surveillance period for this analysis. This has also been the case for individuals exposed to potentially concussive events in the deployed setting.

This analysis considered only incident TBI diagnoses and did not attempt to characterize individuals who may have had multiple TBIs during the surveillance period.

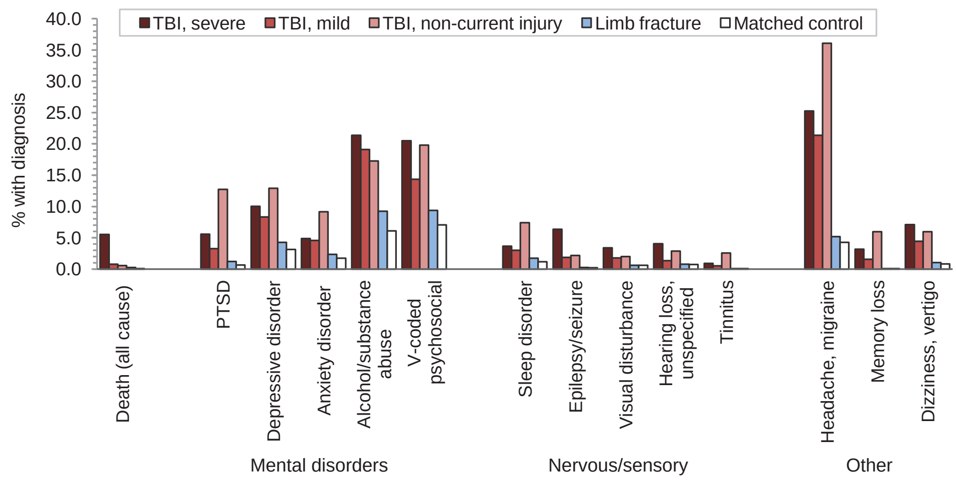
In order to qualify as a member of any of the TBI groups, an individual had to have seen a medical provider and been assigned one of the qualifying TBI diagnoses in a medical encounter. It is likely that some service members who suffer a TBI, including those suffering an injury resulting in mTBI, do not seek medical attention. Such individuals could not be captured in this analysis. In addition, some service members included in one of the comparison groups ("injury" and "non-injury") may have suffered a TBI at some point during their surveillance period but not sought medical care for their TBI. Thus, these individuals may have been misclassified in one of the control groups.

**FIGURE 2.** Diagnoses of symptoms within 12 months of incident event, by group and period of observation, active component, U.S. Armed Forces, 2000-2012

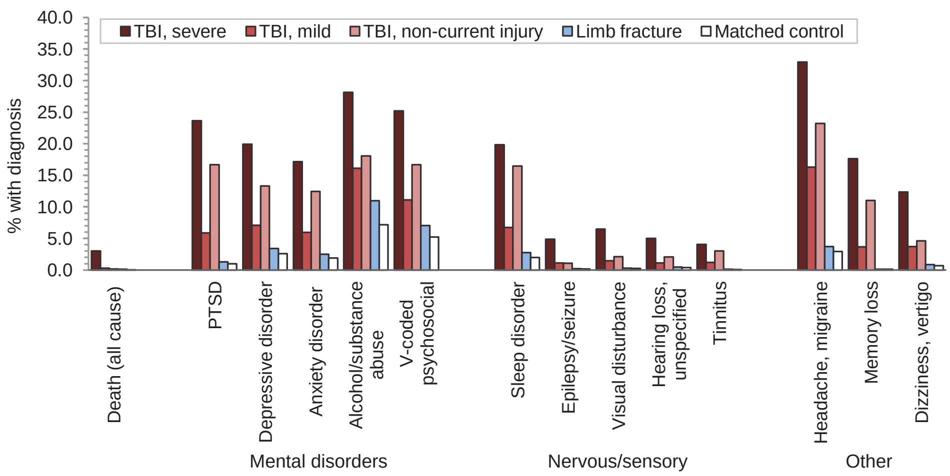
a. 2000-2002 (first period)




b. 2003-2006 (second period)




c. 2007-2012 (third period)




In this analysis, "mild TBI" may not be synonymous with concussion. Concussions with a loss of consciousness of more than one hour are classified by the DoD as "moderate" and thus were placed in the severe TBI group for analysis purposes. Also, some injuries other than concussion (e.g., closed skull fracture) are classified as "mild."

The diagnosis "history of TBI" is a code often received during medical visits related to post-deployment screening and is used to indicate exposure to TBI during deployment. It would be easy to dismiss the high rates of post-TBI symptoms among this group as the result of thorough post-deployment screening. However, the "history of TBI" diagnosis code (and the screening program) came into use only in the last subperiod of the analysis (2007-2012). Thus, individuals in the "history of TBI" group in the first two periods were those with "postconcussion syndrome." It is not surprising that such individuals would have high rates of symptoms consistent with mTBI, as one of the diagnostic criteria for post concussion syndrome is the persistence of symptoms for more than three months after the original injury.

## REFERENCES


1. Memorandum, from Assistant Secretary of Defense, subject: Traumatic brain injury: definition and reporting, dated 1 Oct 2007. U.S. Department of Defense, Washington, DC.
2. Faul M, Xu L, Wald MM, Coronado VG. Traumatic brain injury in the United States: emergency department visits, hospitalizations, and deaths. Atlanta (GA): Centers for Disease Control and Prevention, National Center for Injury Prevention and Control; 2010.
3. http://www.dvbic.org/sites/default/files/u9/dod-tbi-worldwide-2000-2013Q1-as-of-130509.pdf
4. Office of Communications and Public Liaison, National Institute of Neurological Disorders and Stroke, National Institutes of Health. *Traumatic Brain Injury: Hope Through Research*. Bethesda, MD: National Institutes of Health; 2002. NIH publication 02-2478.
5. Facts about concussion and brain injury. Centers for Disease Control and Prevention Web site. http://www.cdc.gov/ncipc/tbi/default.htm. 1999. Accessibility verified June 26, 2013.
6. NIH Consensus Development Panel on Rehabilitation of Persons With Traumatic Brain Injury. Rehabilitation of persons with traumatic brain injury. *JAMA*. 1999;282(10):974-983.
7. Corrigan JD, Selassie AW, Orman JA. The epidemiology of traumatic brain injury. *J Head Trauma Rehabil*. 2010 Mar-Apr;25(2):72-80.

# Outbreak of Group A Beta Hemolytic *Streptococcus* Pharyngitis in a Peruvian Military Facility, April 2012

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Group A *Streptococcus* (GAS), or *Streptococcus pyogenes,* is a common cause of acute pharyngitis as well as other diseases. Closed populations such as those living on military bases, nursing homes, and prisons, are particularly vulnerable to GAS outbreaks due to crowding that facilitates person-to-person transmission. This report details a large outbreak of GAS pharyngitis at a Peruvian military training facility near Lima, Peru, in April 2012. Initial findings showed 145 cases. However, as the investigation continued it was revealed that some trainees may have concealed their illness to avoid real or perceived negative consequences of seeking medical care. A subsequent anonymous survey of all trainees revealed at least 383 cases of pharyngitis among the facility's 1,549 trainees and an attack rate of 34 percent among the 1,137 survey respondents. The epidemic curve revealed a pattern consistent with routine person-to-person transmission, although a point-source initiating event could not be excluded. Laboratory results showed GAS *emm* type 80.1 to be the culprit pathogen, an organism not commonly implicated in outbreaks of GAS in the Americas. Various unique and illustrative features of outbreak investigation in military facilities and populations are discussed.

Group A *Streptococcus* (GAS), or *Streptococcus pyogenes*, is a common cause of acute pharyngitis as well as other diseases.[1] The incubation period is one to three days. The most common mode of GAS transmission is by respiratory droplets from close contacts, although food-borne transmission has also been reported.[2-4] There are millions of cases of GAS pharyngitis every year causing billions of dollars in medical expenses and work stoppage in the United States alone.[1,5]

Closed populations, such as those living on military bases, nursing homes, and prisons, are particularly vulnerable to outbreaks of respiratory disease due to crowding that facilitates person-to-person transmission because of many close contacts for each person.[6-10] The risk of infection may be further enhanced in developing countries where lack of resources often leads to poor sanitation and lack of infection control measures. This report details a large GAS outbreak in a Peruvian military training facility near Lima, Peru, and highlights unique aspects of outbreak control in military settings.

## SETTING

On April 4, 2012, an increased incidence of febrile illness was reported at a military training facility on the outskirts of Lima, Peru, through an electronic disease surveillance system employed by the Peruvian Navy (Alerta DISAMAR) in collaboration with the U.S. Naval Medical Research Unit No. 6 (NAMRU-6).[11] The same day, health authorities from the Epidemiology Department of the Peruvian Armed Forces requested support from the NAMRU-6 Outbreak Investigation and Response Team.

At the training facility, the 1,549 trainees were divided into 1st, 2nd, and 3rd year-classes (42.6%, 27.6%, and 29.8%, respectively). Trainees shared common academic and physical activities and slept at the facility from Sunday through Friday with Saturday leave, with the exception of persons assigned to guard duty or under movement restrictions imposed due to illness or disciplinary measures. The facility and training program were designed such that members of each class generally lived and ate with other members of their same class.

## METHODS

A first response team comprised of infectious disease physicians and epidemiologists from NAMRU-6 and the Peruvian Naval Epidemiology Office arrived at the training facility to investigate on April 4th, the same day as the request for support. Tonsillar swab samples were taken from 20 cases as well as from six asymptomatic controls and three food handlers and sent to NAMRU-6 for bacterial culture and subsequently to the Naval Health Research Center in San Diego, California, for M-protein gene sequencing of *S. pyogenes* isolates. No samples from food or the environment were collected.

In an attempt to discover the risk factors of disease in the outbreak, a case-control study was conducted using a case definition of fever and/or sore throat, using a 1:1 case-control ratio. Because in the initial investigation it was noted that all cases were in the 2nd and 3rd year classes who were confined to base the previous weekend (March 31-April 1) for disciplinary reasons, the study was restricted to this group of persons. Sixty four cases and an equal number of unmatched controls were enrolled but 20 controls were subsequently excluded when found to have left the base the weekend in question. Variables evaluated included age, gender, class year, contact with sick persons, hand washing/cough etiquette habits, and a detailed history of food consumption. Unadjusted and adjusted odds ratios (OR) and 95% confidence intervals (CI) were calculated by logistic regression analysis in STATA 12.0.

In the course of the investigation, it was later found that there were cases in persons who left the base the weekend of March 31 to April 1 and also that some persons may have concealed their illness to avoid real or perceived negative consequences of seeking medical care. In addition, all trainees were released for a 4-day Easter vacation on April 5. Therefore, three weeks after the onset of the outbreak and initial investigation, an anonymous general survey of all trainees was conducted, using a self-administered questionnaire designed to collect demographic, clinical, and epidemiological data. The same case definition was used, but with expanded dates of illness onset of March 26 to April 16.

## RESULTS

Preliminary data and physical examination of the 20 available cases on April 4 showed fever, malaise, and sore throat to be the predominant symptoms, along with physical findings of suppurative plaques on the tonsils with pharyngeal erythema, all suggestive of GAS **(Figure 1)**. Culture results showed 15 (75%) of the 20 sampled cases to be positive for GAS sensitive to routinely tested antibiotics, confirming the initial clinical suspicion. M-protein gene sequencing showed the same *emm* type 80.1 in all 15 isolates. Culture results from the remaining five cases, the six controls, and three food workers revealed only normal flora. Cases continued to be seen over the next nine days, eventually totaling 145 cases between March 30 and April 13 for an attack rate of 93.6 per 1,000 trainees **(Figure 2)** . The initial findings showed extreme temporal clustering of the laboratory-confirmed cases, leading to suspicion of a point source outbreak, perhaps foodborne – as has been reported on occasion for GAS – or possibly related to a superspreader (i.e., a highly infectious person who spreads a pathogen to many other people).[2-4,12-16]

In the case-control study, cases were more likely to be 3rd year trainees, but otherwise there were no demographic differences between the two groups **(Table 1)**. Bivariate analysis revealed contact with another case (OR: 6.9, 95%CI: 3.6-13.3) **(Table 2)** and eating a variety of foods at lunch and dinner on April 1 to be associated with illness (OR range: 1.7-3.6, 95%CI range: 1.0-7.7) **(data not shown)**. However, statistical dependence (i.e., a relationship between the variables to be tested) was found among all components of the April 1 lunch and dinner, and contact with another case, thus precluding multivariate analysis. Cases and controls were not significantly different in their practice of cough etiquette and handwashing **(Table 2)**. Hand washing after coughing was affirmed by only 36 percent of cases and 43 percent of controls. Similarly, cough etiquette (covering one's mouth when coughing) was observed by 55 percent of cases and 61 percent of controls **(data not shown)**.

On the follow-up survey conducted three weeks after the outbreak was first reported, 1,137 (73%) of the facility's 1,549 trainees completed the questionnaire, and 383 (pharyngitis attack rate of 34%) reported an illness meeting the case definition. The first case was noted on March 23 (this person wrote in this date, which was outside the period defined in the survey), but no sample was taken from this person for laboratory testing, so it remains unknown whether or not this was indeed a case of GAS.

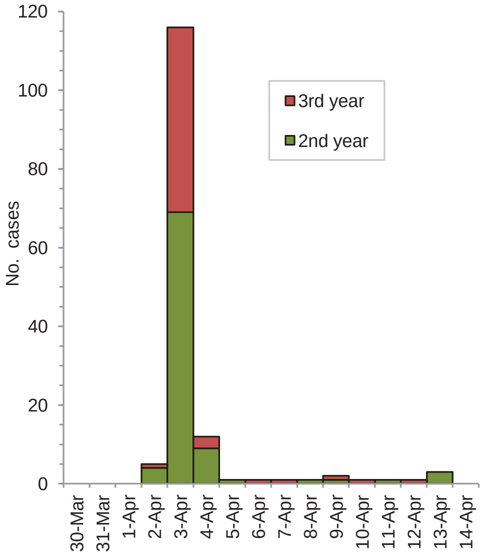
An epidemic curve based on the questionnaire data revealed at least four waves of symptom onset that first started at least a week before the March 30 to April 1 weekend, suggesting person-to-person spread, and that trainees in all three classes were involved **(Figure 3)**. Because data were not collected about the time period before March 26 (with the exception of the one write-in date), the dates of any earlier cases could not be identified.

## COUNTERMEASURES

Once alerted to the outbreak, military personnel immediately started active retrospective tracing of cases and prospective surveillance, and implemented isolation and treatment with the antibiotic amoxicillin of suspected cases **(Figure 3)**. Antibiotic administration started on April 5, but the possibility of self-medication by some trainees cannot be discounted, especially among those who started to experience symptoms in March. Prophylactic antibiotics were not given. A 30 day follow-up was conducted by military clinicians in order to detect sequelae.

**FIGURE 1.** Suppurative tonsillar plaques and pharyngeal erythema in a patient from the outbreak later confirmed to have Group A *Streptococcus* infection

**FIGURE 2.** Epidemiologic curve of 145 cases of GAS[a] pharyngitis detected at initial investigation, among Peruvian military trainees, 30 March 2012-14 April 2012




[a]GAS= Group A *Streptococcus*

**TABLE 1.** Demographic characteristics of cases and controls during an outbreak of GAS[a] pharyngitis among Peruvian military trainees, March 2012-April 2012

| | Cases | Controls | P value (95%) |
|---|---|---|---|
| | n=64 (%) | n=44 (%) | |
| Mean age (yrs) | 20.5 ± 1.70 | 19.8 ±3.00 | 0.12 |
| Male gender | 53 (83) | 31 (70) | 0.13 |
| Class | | | |
| 2nd year | 35 (55) | 32 (74) | 0.003 |
| 3rd year | 29 (45) | 11 (26) | |

[a]GAS= Group A *Streptococcus*

**TABLE 2.** Bivariate analysis of exposure and behavioral data from the case-control study of a GAS[a] pharyngitis outbreak among Peruvian military trainees, March 2012-April 2012 (statistically significant variables are bolded)

| | Odds ratio | 95% confidence interval |
|---|---|---|
| Contact with another case | **6.92** | **3.60-13.30** |
| Hand washing before eating | 1.37 | 0.38-4.96 |
| Cough etiquette (covering mouth) | 0.85 | 0.58-1.25 |
| Hand washing after coughing | 0.70 | 0.32-1.51 |
| Hand washing after defecating | 0.59 | 0.20-1.72 |
| Hand washing after urinating | 0.55 | 0.17-1.78 |
| Hand washing after working out | 0.52 | 0.16-1.67 |

[a]GAS= Group A *Streptococcus*

## EDITORIAL COMMENT

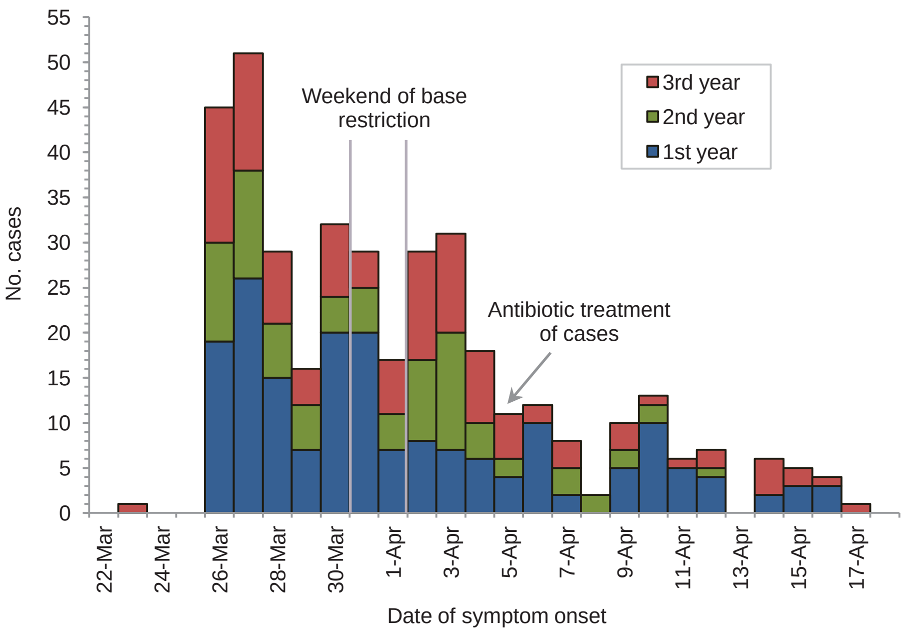
This report presents data on a large outbreak of acute pharyngitis in a military facility in Peru, with an attack rate of 34 percent. Because 75 percent of throat cultures performed in the midst of the outbreak were positive for the same M-type GAS, it was presumed that most, if not all, of the cases of pharyngitis in the outbreak were due to GAS. This is one of the higher attack rates on record for a GAS outbreak.[5] It is also the first published report of a GAS outbreak in any setting in Peru, military or otherwise, although other outbreaks have likely occurred but were not reported. The etiologic agent of this outbreak, GAS *emm* type 80.1, has been isolated from persons in various places in Europe as well as in Brazil.[1,17-19] However, this specific M-type has not been reported among the 25 most prevalent types producing GAS disease in Latin America and has not been detected at Naval Health Research Center in isolates obtained in surveillance of GAS in recruit populations carried out in several military facilities across the United States.

The outbreak had some unique and illustrative features of particular importance to military populations. First, the initial alert came from the electronic syndromic disease surveillance system established in 2002 in the Peru military, with assistance from the U.S. Armed Forces Health Surveillance Center's Global Emerging Infections Surveillance and Response System (AFHSC-GEIS).

Secondly, initial results suggested a common source exposure in late March or early April, leading to hypotheses about possible food-borne transmission or the existence of a super-spreader. However, with time it became apparent that these initial results were misleading, likely in part because of disincentives of personnel to report illness or seek medical attention due to the prospect of being restricted to base. Military training procedure in Peru calls for suspension of ordinary duties and of daily routine for sick persons in order to allow the trainee time to recover under medical supervision.[20] Unfortunately, an unintended consequence of this policy is to suppress disease reporting and increase self-medication to avoid these consequences, especially restriction to base over weekends or holidays. In such situations, anonymous surveys, such as the one subsequently conducted in this study, become an effective strategy to collect information that might otherwise be missed.

Interestingly, the frequencies of hand washing and cough etiquette behaviors were not discernibly different between cases and controls, a finding that might be discouraging for health professionals, who routinely encourage such measures for respiratory disease. These behaviors serve

**FIGURE 3.** Final epidemic curve of 383 cases of GAS[a] pharyngitis detected from a follow-up survey among Peruvian military trainees, 22 March 2012-18 April 2012




[a]GAS= Group A *Streptococcus*

dual purposes; for infected persons, their observance may limit spread of infectious pathogens to other, susceptible individuals. Conversely, hand washing by susceptible persons may provide some protection from hand-to-mouth transfer of pathogens. In the crowded setting of the military trainees described in this report, these practices may have been too infrequent to have an impact on transmission. The relatively small sample size of the case-control study may have also limited the ability to make meaningful inferences about a beneficial effect from these practices.

Lastly, closed populations such as those in military training facilities usually share the same general environment and risk factors for communicable diseases. In such settings, as with our study, it is generally not possible to identify specific risk factors for disease since there is so little variability in the study population; i.e., virtually the entire population shared the same space, ate the same things, and had the same contacts. These impediments are likely to occur with many if not most outbreaks in military settings, especially when institutional-based.

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## REFERENCES

1. Steer AC, Law I, Matatolu L, Beall BW, Carapetis JR. Global *emm* type distribution of group A streptococci: systematic review and implications for vaccine development. *Lancet Infect Dis*. 2009;9(10):611-616.
2. Cohen D, Ferne M, Rouach T, Bergner-Rabinowitz S. Food-borne outbreak of group G streptococcal sore throat in an Israeli military base. *Epidemiol Infect*. 1987;99(2):249-255.
3. Falkenhorst G, Bagdonaite J, Lisby M, et al. Outbreak of group A streptococcal throat infection: don't forget to ask about food. *Epidemiol Infect*. 2008;136(9):1165-1171.
4. Takayama Y, Hikawa S, Okada J, Sunakawa K, Akahoshi T. A foodborne outbreak of a group A streptococcal infection in a Japanese university hospital. *Eur J Clin Microbiol Infect Dis*. 2009;28(3):305-308.
5. Carapetis JR, Steer AC, Mulholland EK, Weber M. The global burden of group A streptococcal diseases. *Lancet Infect Dis*. 2005;5(11):685-694.
6. Gaydos CA, Gaydos JC. Adenovirus vaccines in the U.S. military. *Mil Med*. 1995;160(6):300-304.
7. Gray GC, Mitchell BS, Tueller JE, Cross ER, Amundson DE. Pneumonia hospitalizations in the US Navy and Marine Corps: rates and risk factors for 6,522 admissions, 1981-1991. *Am J Epidemiol*. 1994;139(8):793-802.
8. Thomas RJ, Conwill DE, Morton DE, Brooks TJ, Holmes CK, Mahaffey WB. Penicillin prophylaxis for streptococcal infections in United States Navy and Marine Corps recruit camps, 1951-1985. *Rev Infect Dis*. 1988;10(1):125-130.
9. Gray GC, Callahan JD, Hawksworth AW, Fisher CA, Gaydos JC. Respiratory diseases among U.S. military personnel: countering emerging threats. *Emerg Infect Dis*. 1999;5(3):379-385.
10. Chretien JP, Blazes DL, Coldren RL, et al. The importance of militaries from developing countries in global infectious disease surveillance. *World Hosp Health Serv*. 2007;43(4):32-37.
11. Lewis SL, Feighner BH, Loschen WA, et al. SAGES: a suite of freely-available software tools for electronic disease surveillance in resource-limited settings. *PloS one*. 2011;6(5):e19750.
12. Bar-Dayan Y, Klainbaum Y, Shemer J. Food-borne outbreak of streptococcal pharyngitis in an Israeli Airforce Base. *Scand J Infect Dis*. 1996;28(6):563-566.
13. Kaluski DN, Barak E, Kaufman Z, et al. A large food-borne outbreak of group A streptococcal pharyngitis in an industrial plant: potential for deliberate contamination. *Isr Med Assoc J*. 2006;8(9):618-621.
14. Levy M, Johnson CG, Kraa E. Tonsillopharyngitis caused by foodborne group A *streptococcus*: a prison-based outbreak. *Clin Infect Dis*. 2003;36(2):175-182.
15. Linhart Y, Amitai Z, Lewis M, Katser S, Sheffer A, Shohat T. A food-borne outbreak of streptococcal pharyngitis. *Isr Med Assoc J*. 2008;10(8-9):617-620.
16. Wang Sh X, Li YM, Sun BC, et al. The SARS outbreak in a general hospital in Tianjin, China - the case of super-spreader. *Epidemiol Infect*. 2006;134(4):786-791.
17. Dicuonzo G, Fiscarelli E, Gherardi G, et al. Erythromycin-resistant pharyngeal isolates of *Streptococcus pyogenes* recovered in Italy. *Antimicrob Agents Chemother.* 2002;46(12):3987-3990.
18. Kittang BR, Langeland N, Mylvaganam H. Distribution of *emm* types and subtypes among noninvasive group A, C and G streptococcal isolates in western Norway. *APMIS*. 2008;116 (6):457-464.
19. Smeesters PR, Vergison A, Junior DC, Van Melderen L. Emerging fluoroquinolone-non-susceptible group A streptococci in two different paediatric populations. *Int J Antimicrob Agents*. 2009;34(1):44-49.
20. Internal Rules of Training Centres of the Armed Forces. Sect. Article 47 (2010).

# Arm and Shoulder Conditions, Active Component, U.S. Armed Forces, 2003-2012

This analysis estimated the incidence and healthcare burden of acute and chronic conditions of the arm and shoulder among active component service members of the Armed Forces from 1 January 2003 through 31 December 2012. There were 196,789 diagnosed incident cases of acute arm and shoulder conditions for a rate of 13.7 cases per 1,000 person-years. The annual incidence rates of sprains, the most common acute condition, nearly doubled during the period. Diagnoses of chronic conditions (overall rate of 28.8 per 1,000 person-years) increased 25 percent during the period, mainly associated with a doubling of the incidence of diagnoses of joint pain. Incidence rates of chronic disorders were progressively higher among successively older age groups of service members. The healthcare burden of all arm and shoulder conditions together steadily increased during the period, as indicated by numbers of healthcare encounters, individuals affected, and lost work time. The most commonly documented causes associated with acute and chronic conditions are described.

Both acute and chronic disorders of the joints, ligaments, and bones of the arm and shoulder are common in the general population. A recent *MSMR* article about the 2012 morbidity burdens attributable to various illness and injuries among U.S. service members documented that acute injuries of the "arm and shoulder" accounted for more medical encounters than any other anatomical location in the injury and poisoning category. Among all illnesses and injuries, "arm and shoulder" injuries ranked 5th in numbers of medical encounters, 7th in the number of individuals affected, and 21st in the number of hospital bed days.[1] The "arm and shoulder" injuries category includes acute traumatic injuries such as sprains, fractures, and wounds of the arm (above the wrist) and shoulder.

Similarly, in the musculoskeletal disease category, "other shoulder diseases" ranked 4th in numbers of medical encounters. The "other shoulder diseases" category is comprised of non-acute disorders of the shoulder joint and its muscular and tendinous attachments, such as joint pain, arthropathies, and enthesopathies, many of which may be due to chronic overuse or past injuries.

Service members are at risk for acute and chronic arm and shoulder conditions due to both occupational factors and activities unrelated to their military duties. Common occupational exposures associated with such conditions include lifting and carrying heavy loads, physical training exercises and patrols, battle injuries, and overuse injuries from repetitive microtrauma.[2-5] Service members are also at risk for arm and shoulder conditions from recreational activities (e.g., sports, exercise) and accidents (e.g., falls, motor vehicle accidents).[4-6] Natural, age-related degeneration is also a risk factor for arm and shoulder conditions.[7]

Much attention has been focused on lower extremity and back conditions in the U.S. military population; however, the epidemiology of arm and shoulder conditions has not been similarly described. The objective of this analysis is to determine the counts, rates, and correlates of risk for acute and chronic arm and shoulder conditions in active component service members.

## METHODS

The surveillance period was 1 January 2003 to 31 December 2012. The surveillance population included all U.S. service members of the Army, Navy, Air Force, Marine Corps, and Coast Guard who served in the active component at any time during the surveillance period. Cases were identified from standardized records of hospitalizations and outpatient medical encounters during the surveillance period in fixed (i.e., not deployed, at sea) military and nonmilitary (purchased care) medical facilities.

For the purpose of this analysis, musculoskeletal conditions of the arm and shoulder were divided into acute conditions (i.e., sudden "acute" injuries) and chronic conditions (i.e., overuse injuries and conditions not associated with an acute traumatic event). These main categories were further stratified into specific subcategories and one special category, rotator cuff disease, which

**TABLE 1.** ICD-9-CM codes for acute and chronic arm and shoulder conditions

| Categories | ICD-9-CM code |
|---|---|
| Acute | |
| Traumatic arthropathy | 716.1 5th digit (1-3) |
| Dislocations | 718.2 5th digit (1-3), 718.3 5th digit(1-3), 831.xx, 832.xx |
| Fracture | 733.1 5th digit (1-2), 810.xx-813.xx, 818.x, 819.x |
| Sprains | 840.xx, 841.xx |
| Other injuries | 880.xx, 881.xx, 923.0x, 923.1x, 927.0x, 927.1x, 959.4th digit(2-3) |
| Chronic | |
| Other arthropathies | 711.x(1-3), 712.x(1-3), 716.x(2-3), 719. 4th digit (2,3,5,6,8,9), 5th digit (1-3) |
| Osteoarthrosis | 715.x(1-3) |
| Joint derangement | 718. 4th digit (0,1,4,5,8), 5th digit (1-3), 719. 4th digit (0,1), 5th digit (1-3) |
| Joint pain | 719.4(1-3) |
| Enthesopathies | 726.0, 726.1x, 726.2, 726.3x |
| Nontraumatic rupture | 727.61-727.62 |
| Infection | 730.x(1-3) |
| Special category | |
| Rotator cuff | 726.1, 726.10, 726.11, 726.13, 726.61, 840.4 |

includes all ICD-9 codes associated with rotator cuff conditions **(Table 1)**.

A case of an acute arm and shoulder condition was defined as 1) a hospitalization with an acute arm and shoulder condition ICD-9 code in the primary or secondary diagnostic position or 2) two outpatient encounters with the same ICD-9 code in the primary diagnostic position within 90 days of each other. For the overall main category count and rate, an individual could be an acute case once every 365 days.

A case of a chronic arm and shoulder condition was defined as 1) a hospitalization with an ICD-9 code indicating a chronic arm and shoulder condition in the primary or secondary diagnostic position or 2) two outpatient encounters with the same ICD-9 code in the primary diagnostic position within 365 days of each other. For the overall main category count and rate, an individual was counted as a case of a chronic arm and shoulder condition just once during the surveillance period. The rotator cuff disease category was considered a chronic shoulder condition, but was analyzed separately from the other chronic diagnoses using a similar case definition.

For the analyses by subcategory, an individual could be a case of each of the subcategories once during the surveillance period for chronic conditions and once per 365 days for acute conditions. For example, an individual could be an incident case of both joint pain and osteoarthrosis once each during the surveillance period; likewise, an individual could be an incident case of both a sprain and a fracture once each per year.

The overall burden of arm and shoulder conditions was determined by recording the number of inpatient or outpatient encounters with a primary (first-listed) arm and shoulder diagnostic code and summarizing the numbers of medical encounters, individuals affected, hospital bed days, and lost work time. Lost work time is a measure of time that is the sum of bed days, days of convalescence, and the assignment of one-half day for each ambulatory visit that resulted in limited duty. For the burden analysis an individual could be counted once per day.

External causes of arm and shoulder conditions were ascertained from external cause of injury codes (ICD-9 E-codes) reported on records of inpatient and ambulatory encounters from both military and civilian treatment facilities. Cause of injury codes (STANAG codes) reported on records of military hospitalizations in signatory nations of the North Atlantic Treaty Organization's Standard Agreement on cause of injury coding (STANAG 2050) were also summarized.

**TABLE 2.** Incident counts and incidence rates of acute and chronic arm and shoulder conditions by demographic and military characteristics, active component, U.S. Armed Forces, 2003-2012

| | Acute | | Chronic | | Rotator cuff | |
|---|---|---|---|---|---|---|
| | No. | Rate | No. | Rate | No. | Rate |
| Total | 196,789 | 13.7 | 412,194 | 28.8 | 57,539 | 4.0 |
| Sex | | | | | | |
| Male | 177,111 | 14.4 | 357,649 | 29.2 | 50,513 | 4.1 |
| Female | 19,678 | 9.5 | 54,545 | 26.3 | 7,026 | 3.4 |
| Age total | | | | | | |
| <20 | 12,846 | 13.5 | 15,085 | 15.8 | 1,215 | 1.3 |
| 20-24 | 65,256 | 13.7 | 91,193 | 19.2 | 9,007 | 1.9 |
| 25-29 | 44,961 | 13.8 | 82,415 | 25.2 | 9,802 | 3.0 |
| 30-34 | 27,128 | 12.9 | 61,998 | 29.5 | 8,949 | 4.3 |
| 35-39 | 23,596 | 13.6 | 71,967 | 41.6 | 12,004 | 6.9 |
| 40-44 | 15,048 | 14.7 | 56,046 | 54.7 | 10,150 | 9.9 |
| 45-49 | 5,953 | 15.9 | 24,505 | 65.3 | 4,632 | 12.3 |
| 50+ | 2,001 | 15.8 | 8,985 | 71.0 | 1,780 | 14.1 |
| Race/ethnicity | | | | | | |
| White, non-Hispanic | 135,884 | 15.1 | 272,998 | 30.3 | 37,395 | 4.1 |
| Black, non-Hispanic | 24,916 | 10.5 | 65,514 | 27.5 | 10,006 | 4.2 |
| Hispanic | 19,091 | 12.5 | 38,312 | 25.2 | 5,175 | 3.4 |
| Asian/Pacific Islander | 5,807 | 10.2 | 13,632 | 23.9 | 1,896 | 3.3 |
| American Indian/Alaskan native | 1,269 | 7.3 | 2,110 | 12.1 | 288 | 1.7 |
| Other/Unknown | 9,822 | 14.4 | 19,628 | 28.8 | 2,779 | 4.1 |
| Service | | | | | | |
| Army | 77,076 | 14.8 | 174,031 | 33.3 | 20,918 | 4.0 |
| Navy | 36,855 | 10.8 | 66,799 | 19.6 | 11,242 | 3.3 |
| Air Force | 42,363 | 12.4 | 112,801 | 33.0 | 16,747 | 4.9 |
| Marine Corps | 31,426 | 16.6 | 45,350 | 24.0 | 6,072 | 3.2 |
| Coast Guard | 9,069 | 22.3 | 13,213 | 32.5 | 2,560 | 6.3 |
| Rank | | | | | | |
| Recruit | 5,331 | 18.6 | 7,319 | 25.6 | 407 | 1.4 |
| Enlisted | 165,882 | 14.2 | 335,661 | 28.7 | 45,584 | 3.9 |
| Officer | 25,576 | 10.8 | 69,214 | 29.2 | 11,548 | 4.9 |
| Occupation | | | | | | |
| Combat-related[a] | 29,277 | 15.8 | 50,447 | 27.2 | 5,631 | 3.0 |
| Armor/motor transport | 9,035 | 15.0 | 17,058 | 28.4 | 2,322 | 3.9 |
| Pilot/aircrew | 5,650 | 10.6 | 12,680 | 23.8 | 1,974 | 3.7 |
| Repair/eng | 59,556 | 14.1 | 122,255 | 29.0 | 17,445 | 4.1 |
| Comm/intel | 39,398 | 12.3 | 95,647 | 29.9 | 13,876 | 4.3 |
| Healthcare | 14,748 | 12.5 | 39,176 | 33.2 | 5,728 | 4.9 |
| Other | 39,125 | 14.2 | 74,931 | 27.2 | 10,563 | 3.8 |

[a]Infantry, artillery, combat engineering

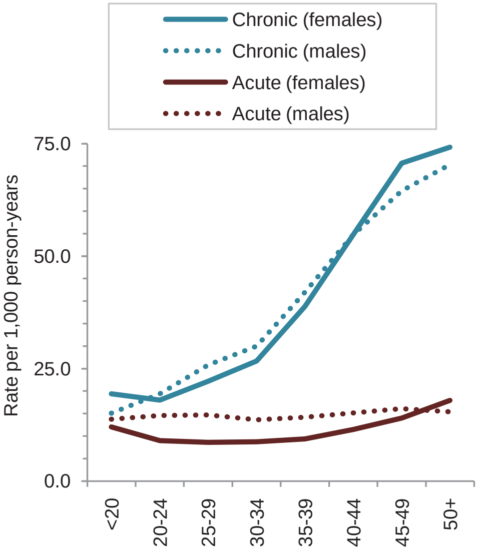
## RESULTS

### Acute arm and shoulder conditions

During the surveillance period there were 196,789 incident cases of acute arm and shoulder conditions with an overall rate of 13.7 per 1,000 person-years (p-yrs) **(Table 2)**. The rate of acute conditions among males was 51.6 percent higher than females; however, after age 29 the rate in females increased with advancing age and surpassed that of males in the oldest age group (50+) **(Figure 1)**. Rates remained relatively stable among males in successive age groups.

Incidence rates of acute conditions were highest among white, non-Hispanics (15.1

**FIGURE 1.** Incidence rates[a] of acute and chronic arm and shoulder conditions by age and gender, active component, U.S. Armed Forces, 2003-2012




[a]One acute condition per person per year; one chronic condition per person per lifetime

per 1,000 p-yrs) and those of other/unknown race/ethnicity (14.4 per 1,000 p-yrs), among service members in the Coast Guard (22.3 per 1,000 p-yrs), among recruits (18.6 per 1,000 p-yrs), and those in combat-related occupations (15.8 per 1,000 p-yrs) **(Table 2)**.

The annual incidence rates of all acute conditions increased 15.7 percent from 2003 to 2010 and then decreased 10.6 percent from 2010 to 2012 **(Figure 2)**. The overall increase from 2003 to 2012 was 3.5 percent. Sprains accounted for the greatest number of arm and shoulder injuries; the incidence rate of sprains more than doubled between 2003 (3.9 per 1,000 p-yrs) and 2010 (8.7 per 1,000 p-yrs) but then decreased 12 percent from 2010 to 2012 (7.7 per 1,000 p-yrs). From 2003 to 2012, the annual incidence rates of sprains in each age group increased by at least 75 percent; these increases did not correlate with an increase in age **(data not shown)**. Fracture and dislocation rates both increased from 2003 to 2008, then declined in 2009 through 2012.

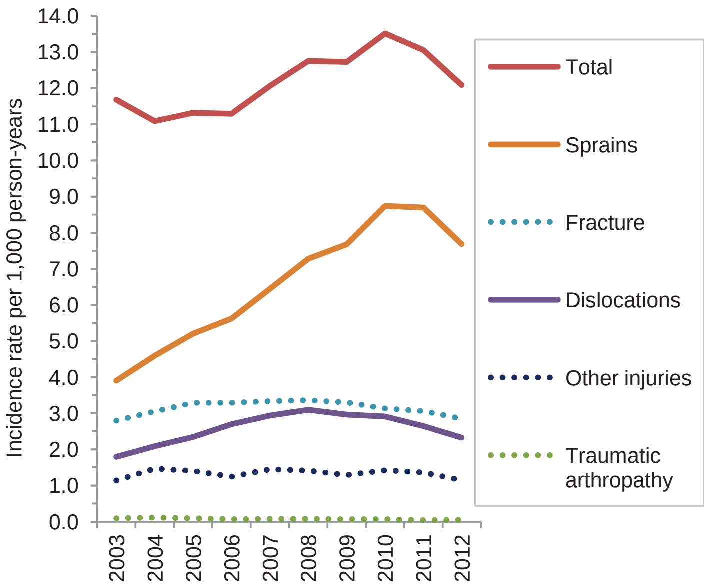
## Chronic arm and shoulder conditions

During the surveillance period there were 412,194 incident cases of chronic arm and shoulder conditions with an overall rate of 28.8 per 1,000 p-yrs **(Table 2)**. The overall rate of chronic conditions in males was 11 percent higher than females; however, women less than 20 years of age and older than 44 years had higher rates than males in those age groups **(Figure 1)**. For both genders incidence rates were higher in successive age groups, especially above the age of 34.

Unadjusted incidence rates of chronic conditions were highest among white, non-Hispanics (30.3 per 1,000 p-yrs) and among service members in the Army (33.3 per 1,000 p-yrs), Air Force (33.0 per 1,000 p-yrs) and Coast Guard (32.5 per 1,000 p-yrs) **(Table 2)**. Rates were similar among enlisted service members and officers (28.7 and 29.2 per 1,000 p-yrs, respectively), and lowest among recruits (25.6 per 1,000 p-yrs). Service members in healthcare occupations had the highest rates (33.2 per 1,000 p-yrs) compared to their respective occupational counterparts.

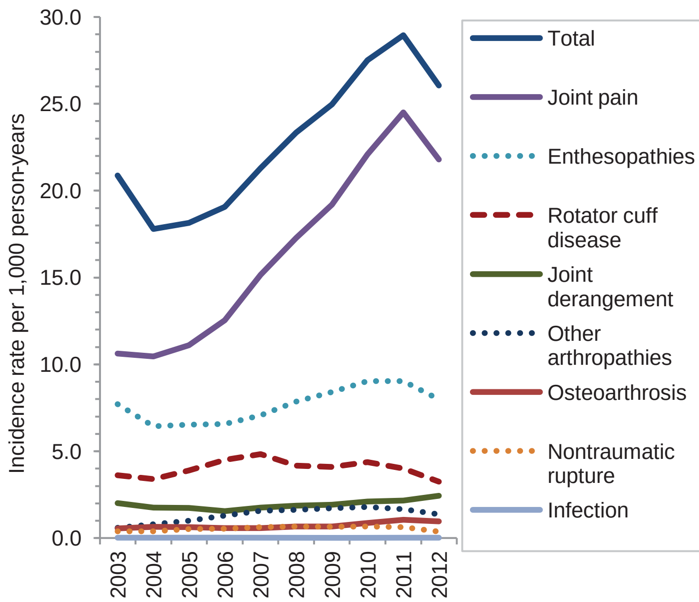
Overall rates of chronic conditions increased 24.8 percent during the surveillance period **(Figure 3)**. Joint pain accounted for the highest rates of chronic arm and shoulder conditions throughout the 10-year surveillance period. Rates of joint pain more than doubled from 2004 (10.5 per 1,000 p-yrs) to 2011 (24.5 per 1,000 p-yrs) then decreased to 21.8 per 1,000 p-yrs in 2012. From 2003 to 2012, the annual incidence rates of joint pain in each age group increased by at least 74 percent; these increases did not correlate with an increase in age **(data not shown)**.

**FIGURE 2.** Incidence rates[a] of acute arm and shoulder conditions, overall and by subcategories, active component, U.S. Armed Forces, 2003-2012




[a]An individual could be in more than one subcategory, but is counted only once in the total category

**FIGURE 3.** Incidence rates[a] of chronic arm and shoulder conditions overall and by subcategory, active component, U.S. Armed Forces, 2003-2012




[a]An individual could be in more than one subcategory, but is counted only once in the total category

Enthesopathies (disorders occurring at the site of attachment of muscle tendons and ligaments to bones or joint capsules) were the second most common chronic conditions ranging from a low in 2004 (6.4 per 1,000 p-yrs) to a high in 2010 and 2011 (9.0 per 1,000 p-yrs) **(Figure 3)**.

## Rotator cuff disease

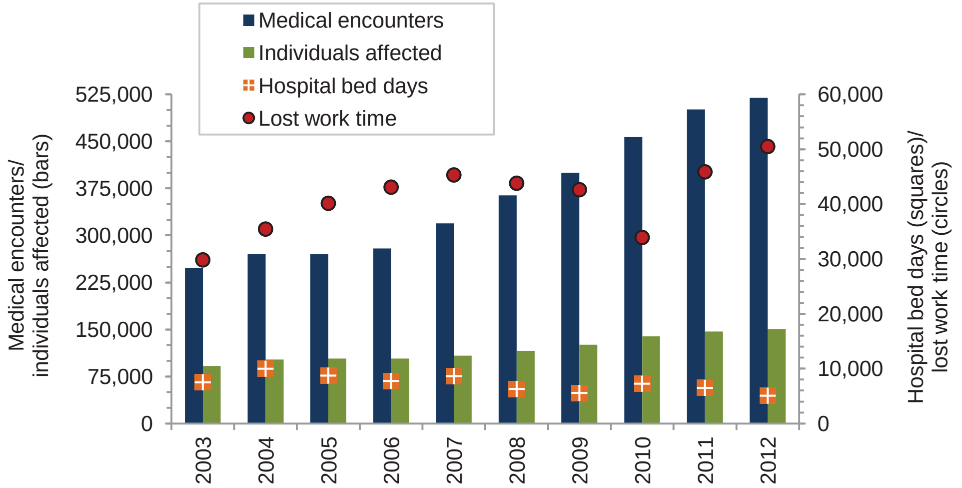
There were 57,539 cases of rotator cuff disease during the surveillance period (overall rate: 4.0 per 1,000 p-yrs) **(Table 2)**. Rates during the period remained relatively stable (range: 3.3 per 1,000 p-yrs in 2012; 4.8 per 1,000 p-yrs in 2007) **(Figure 3)**. Overall rates among males were 21 percent higher than females; however, rates among males and females were similar in the youngest (<20, 20-24) and oldest (45-49, 50+) age groups **(data not shown)**. Overall rates were higher with each increasing age group; the percent increase was most dramatic from the 30-34 to 35-39 age groups (% increase: 62.6).

Rates of rotator cuff injuries were highest in black, non-Hispanic service members (4.2 per 1,000 p-yrs) and lowest among American Indian/Alaskan natives (1.7 per 1,000 p-yrs). Compared to their respective counterparts, rates were also highest among members of the Coast Guard (6.3 per 1,000 p-yrs), among officers (4.9 per 1,000 p-yrs), and those in healthcare-related occupations (4.9 per 1,000 p-yrs) **(Table 2)**.

## Burden of arm and shoulder conditions

During the surveillance period the annual numbers of overall medical encounters and of individuals affected for arm and shoulder conditions increased, particularly from 2006 to 2012 **(Figure 4)**. The annual number of individuals affected grew from 91,699 in 2003 to 150,815 in 2012. The proportion of medical encounters per individual also increased during the period from 2.7 medical encounters/individual in 2003 to 3.4 medical encounters/individual in 2012. Hospital bed days varied by year, but overall decreased 32 percent from 2003 (n=7,499 bed days) to 2012 (n=5,066 bed days). Lost work time increased from 2003 to 2007, decreased from 2008 to 2010, and then increased again in 2011 and 2012.

**FIGURE 4.** Medical encounters,[a] individuals affected,[b] hospital bed days, and lost work time,[c] for arm and shoulder conditions, active component, U.S. Armed Forces, 2003-2012




[a]Medical encounters: total hospitalizations and ambulatory visits for arm and shoulder conditions (with no more than one encounter per individual per day).
[b]Individuals with at least one hospitalization or ambulatory visit for an arm and shoulder conditions per year.
[c]A measure of lost work time due to bed days, convalescence, and one-half day for each ambulatory visit that resulted in limited duty.

## Causes of arm and shoulder conditions

Of the records of hospitalizations for acute arm and shoulder conditions, 68.0 percent (n=7,073) had a STANAG code; 14.5 percent (n=700) of the chronic arm and shoulder conditions hospitalizations had a STANAG code. Of the total 7,773 hospitalizations with a STANAG code, 25.2 percent (n=1,959) had a STANAG code in the category of "guns, explosive, and related agents, not in wartime." The next most common STANAG category, accounting for 14.9 percent (n=1,160) was "accidents in land transport"; 42.6 percent of these (n=494) were associated with motorcycles. The next three most common STANAG categories which made up an additional 35.1 percent, were other, unspecified (12.6%; n=983), "machinery, tools, and selected agents" (11.4%; n=884 [89.9%; n=795 from cutting/piercing instruments]), and "falls" (11.1%; n=865) **(Table 3)**.

Among the 196,789 records for acute arm and shoulder conditions, 19.7 percent (n=38,811) had an E-code recorded during their case-defining encounter; 1.5 percent (n=6,264) of records for chronic arm and shoulder conditions had an E-code. Five categories of E-codes accounted for 72.7 percent of the case-defining encounters that reported an E-code. Nearly one-third (30.4%) had an E-code associated

**TABLE 3.** Top five STANAG categories associated with arm and shoulder hospitalizations and top five external cause of injury ICD-9-CM codes (E-codes) associated with arm and shoulder hospitalizations and ambulatory visits

| No. | % hospitalization w/ STANAG | Description |
|---|---|---|
| 1,959 | 25.2 | 500-599 Guns, explosives, and related agents, not in wartime |
| 1,160 | 14.9 | 100-149 Accidents in land transport |
| 983 | 12.6 | 980-999 Other, unspecified |
| 884 | 11.4 | 600-699 Machinery, tools, and selected agents |
| 865 | 11.1 | 900-929 Falls |
| **No.** | **% encounter w/ E-code** | **Description** |
| 13,691 | 30.4 | Falls |
| 8,134 | 18.0 | Overexertion/strenuous/repetitive movements or loads |
| 5,973 | 13.3 | Accidents involving motor vehicles, motorcycles |
| 3,065 | 6.8 | Sports activities |
| 1,994 | 4.4 | Injuries from operations of war/terrorism |

with “falls”; nearly one-fifth (18.0%) had an E-code associated with “overexertion/strenuous/repetitive movements or loads”; 13.3 percent had an E-code associated with “accidents involving motor vehicles or motorcycles”; 6.8 percent had an E-code associated with “sports activities”; and 4.4 percent had an E-code associated with “injuries from operations of war/terrorism” **(Table 3)**.

## EDITORIAL COMMENT

Arm and shoulder conditions are common in the active component of the U.S. Armed Forces. Each year during the surveillance period, an average of 120,000 service members sought care for and were diagnosed with, an acute or chronic condition of the arm or shoulder and these patients had 3,628,833 encounters associated with their care. During the entire period there were 196,789 incident cases of acute arm and shoulder conditions – i.e., on average, nearly 20,000 newly incident acute conditions per year. Furthermore, there were 412,194 incident cases of chronic arm and shoulder conditions – i.e., on average, over 40,000 incident (new) service members were diagnosed with a chronic condition every year.

Acute arm and shoulder conditions were more common among males, recruits, and those in combat-related occupations. The higher rates in these categories may be a result of more risk-taking behavior, greater participation in sports and training exercises, and occupational exposures. It is unclear why service members in the Coast Guard have the highest rates of acute arm and shoulder conditions.

Among chronic arm and shoulder conditions, age was the most consistent correlate of incidence rates. The impact of age may also have an effect on other demographic categories that have greater proportions of older service members, specifically, rank (officers), and occupation (healthcare) The higher rate in service members with healthcare occupations may also be a result of more complete ascertainment of arm and shoulder conditions among healthcare workers. Healthcare workers may be more likely to seek care and may more easily obtain access to care.

While the overall increase in rates of chronic arm and shoulder conditions during 2003 to 2012 coincided with the period of combat operations in Iraq and Afghanistan, the rates of chronic arm and shoulder conditions were not reflected among those more likely to have directly engaged in warfighting, i.e., the younger age groups, those in the Marine Corps, and those in combat-related occupations.

Joint pain was the most common chronic condition and incidence rates increased dramatically during the period. Likewise, sprains demonstrated a similar increase among acute conditions. The associated lost duty time due to these conditions may adversely affect overall combat readiness in the force. The appreciable burden of arm and shoulder conditions is evident from the increasing numbers of medical encounters, individuals affected, and lost work time.

The increases in joint pain and sprains were demonstrated in all age groups during the surveillance period. It is unclear why these two subcategories have increased so dramatically during the period.

The STANAG codes reported in this analysis represent the causes associated with the more serious cases (i.e., those requiring hospitalization) and those hospitalized in military treatment facilities. It is not surprising that the more frequently recorded STANAG codes are related to causes that may be associated with more serious injuries, i.e., “guns, explosive, and related agents, not in wartime” and “accidents involving land transport” (e.g., motor vehicle accidents). The E-codes were recorded from both inpatient and outpatient encounters from all healthcare sources (both MTFs and outsourced care). The E-codes most frequently recorded specified causes such as falls, overuse injuries, and sports-related injuries, a pattern consistent with causes of arm and shoulder conditions previously reported.[2-6, 10]

One limitation of this analysis is the fact that the ICD-9 codes used to identify cases do not specify laterality, i.e., left versus right arms and shoulders. As a consequence, because of the case definitions used for acute and chronic conditions, service members who were counted because of a condition on one side of their body might not have been counted a second time if they developed a condition with the same ICD-9 code on the other arm or shoulder. The result of this coding limitation would be underestimates of incident cases and rates. The ICD-10 coding system provides for specifying laterality and will, when introduced into the Military Health System, potentially alleviate this limitation.

## REFERENCES

1. Armed Forces Health Surveillance Center. Absolute and relative morbidity burdens attributable to various illnesses and injuries, U.S. Armed Forces, 2012. *MSMR*. April 2013. 20(4):5-10.
2. Roy TC, Knapik JJ, Ritland BM, Murphy N, Sharp MA. Risk factors for musculoskeletal injuries for soldiers deployed to Afghanistan. *Aviat Space Environ Med*. 2012;83:1060-1066.
3. Hauret KG, Jones BH, Bullock SH, Canham-Chervak M, Canada S. Musculoskeletal injuries-description of an under-recognized injury problem among military personnel. *Am J Prev Med*. 2010;38(1S)S61-S70.
4. Owens BD, Duffey ML, Nelson BJ, DeBerardino TM, Taylor DC, Mountcastle SB. The incidence and characteristics of shoulder instability at the United States Military Academy. *Am J Sports Med*. 2007;35(7): 1168-1173.
5. Walsworth MK, Doukas WC, Murphy KP, Bimson W, Mielcarek BJ, Michener LA. Descriptive analysis of patients undergoing shoulder surgery at a tertiary care military medical center. *Mil Med.* 2009;174(6):642-644.
6. Lauder TD, Baker SP, Smith GS, Lincoln AE. Sports and physical training injury hospitalizations in the Army. *Am J Prev Med*. 2000;18(3 Suppl):118-128.
7. National Institute of Arthritis and Musculoskeletal and Skin Diseases. Questions and answers about shoulder problems. http://www.niams.nih.gov/health_info/shoulder_problems/#origins. Accessed on 13 June 2013.
8. Tashjian RZ. Epidemiology, natural history, and indications for treatment of rotator cuff tears. *Clin Sports Med*. 2012;31:589-604
9. Cassou B, Derriennic F, Monfort C, Norton J, Touranchet A. Chronic neck and shoulder pain, age, and working conditions: longitudinal results from a large random sample in France. *Occup Environ Med*. 2002;59;537-544.
10. Kroner K, Lind T, Jensen J. The epidemiology of shoulder dislocations. *Arch Orthop Trauma Surg*. 1989;108:288-290.

# The Reportable Events Monthly Report (REMR)

Armed Forces Health Surveillance Center (AFHSC) has established a new report for analysis of reportable events. The purpose of the Reportable Events Monthly Report (REMR) is to inform public health stakeholders and leaders about the recent occurrence of, and trends in, Reportable Medical Events (RME), hereafter referred to as RME or reportable events. Department of Defense (DoD) reportable events are defined by the Armed Forces Reportable Medical Events Guidelines which details a clinical description, case classification, and, if available, laboratory criteria for diagnosis. An event is deemed reportable if it is a diagnosed medical condition (suspected, probable, or confirmed) whose occurrence may represent a significant threat to public health and military operations. Such events have the potential to affect large numbers of people, to be widely transmitted within a population, to have severe/life threatening clinical manifestations, and/or to disrupt military training and deployment.[1] Timely, accurate reporting of probable, suspected, or confirmed cases ensures proper identification, treatment, control, and follow-up of cases and is required by DoD policy.[2] Based on the Centers for Disease Control and Prevention (CDC), the Council of State and Territorial Epidemiologists, and by a consensus of public health experts in all of the Services, the DoD has chosen, and has periodically revised, the list of conditions deemed reportable.[1] Public health and preventive medicine personnel report such events through electronic surveillance systems to their respective Service public health surveillance centers, each of which forwards the information to the AFHSC for consolidation and analysis of trends in DoD as a whole. The AFHSC will post the REMR on its web site to summarize its analyses of the aggregate data. This report in the *MSMR* introduces these data summaries and analyses, using a condensed version of the latest analysis.

The REMR shows counts of cases of reportable diseases and injuries which the Services have communicated to the AFHSC. For each condition, the number of cases reported in the most recent calendar month (e.g., May 2013) is compared to the median and to the range of the number of cases reported for the same month in the previous five years **(Table).** In addition, the number of cases reported during the 12 month period ending in the most recent calendar month (e.g., June 2012-May 2013) is compared to the median and to the range of the number of cases reported during the five previous 12 month periods. For both comparisons, if the most recent count exceeds the upper bound of the 5-year range, then the corresponding box in the table is colored red. For counts below the lower bound of the 5-year range, the box is colored green **(Table).**

The conditions are displayed in disease groups either with similar clinical presentations (e.g., gastrointestinal and sexually transmitted infections) or with similar public health prevention strategies (e.g., vaccine preventable, vector-borne, zoonotic, or tropical infections, or weather-related injuries). Infections that did not fit easily into these categories are listed together at the end in an "other" category. Because the 66 conditions differ from one another in their etiologies and epidemiology, care must

**TABLE.** Reported cases of vaccine-preventable conditions. Comparison of numbers of cases in May 2013 to the previous five months of May (2008-2012) and comparison of numbers of cases in the 12 month period June 2012-May 2013 to the previous five 12 Month periods (June 2007-May 2012)

| Current month | | | | Previous 12 months | | | |
|---|---|---|---|---|---|---|---|
| Disease | May 2013 counts | 2008-2012 current months median | 2008-2012 current months range | Disease | Jun 2012-May 2013 counts | Jun 2007-May 2012 median | Jun 2007-May 2012 range |
| Diphtheria | 0 | 0 | 0 - 1 | Diphtheria | 0 | 0 | 0 - 2 |
| *H. influenzae* invasive | 0 | 1 | 0 - 4 | *H. influenzae* invasive | 12 | 9 | 3 - 52 |
| Hepatitis A | 1 | 3 | 0 - 5 | Hepatitis A | 50 | 28 | 20 - 31 |
| Measles | 0 | 1 | 0 - 3 | Measles | 0 | 3 | 0 - 6 |
| Meningococcal disease | 0 | 0 | 0 - 1 | Meningococcal disease | 3 | 17 | 8 - 25 |
| Mumps | 0 | 2 | 1 - 3 | Mumps | 6 | 21 | 12 - 24 |
| Pertussis | 3 | 6 | 1 - 38 | Pertussis | 133 | 78 | 44 - 121 |
| Poliomyelitis | 0 | 0 | 0 - 0 | Poliomyelitis | 0 | 0 | 0 - 0 |
| Rubella | 0 | 0 | 0 - 1 | Rubella | 1 | 2 | 0 - 4 |
| Smallpox | 0 | 0 | 0 - 0 | Smallpox | 0 | 0 | 0 - 1 |
| Tetanus | 0 | 0 | 0 - 0 | Tetanus | 0 | 0 | 0 - 0 |
| Varicella, AD only | 0 | 5 | 1 - 9 | Varicella, AD only | 30 | 35 | 25 - 78 |
| Yellow Fever | 0 | 0 | 0 - 0 | Yellow Fever | 0 | 0 | 0 - 0 |

be taken in making comparisons between conditions and groups of conditions.

The report methodology includes a search of the Defense Medical Surveillance System (DMSS) for counts of all 66 reportable conditions that have been reported through the Army, Navy, Marine Corps, and Air Force disease reporting systems for the time periods described above. Included are reportable events for diagnoses that are either suspect, probable, confirmed, or pending confirmation.[1]

Analysis of case counts for a specific month is helpful in understanding expected values for diseases with seasonal variation. The rationale for displaying the previous 12 months (as opposed to calendar years) is to show sufficient amounts of data for comparison throughout the year. Often a full year of data is required for analysis, particularly of diseases with rare events. The time series graphs are displayed for a visual trend analysis of the previous five years of data. Epidemiological characteristics such as seasonality, outbreaks, and normal variability can be more easily seen with these graphics. Conditions with rare events were not usually graphed as the visualization is not as meaningful in those cases.

The brief summaries below and figures highlight noteworthy observations in the most recent month's report (May 2013).

## ILLUSTRATIVE COMMENTS

### Gastrointestinal infections

Campylobacteriosis and norovirus cases have risen sharply in the past 12 months as compared to the 12 month medians over the past five years. Note that prior to 2009 norovirus was not reportable **(Figure 1a)**.

In the time series graph, note that the highest numbers of cases of salmonellosis were reported during the summer months **(Figure 1b)**.

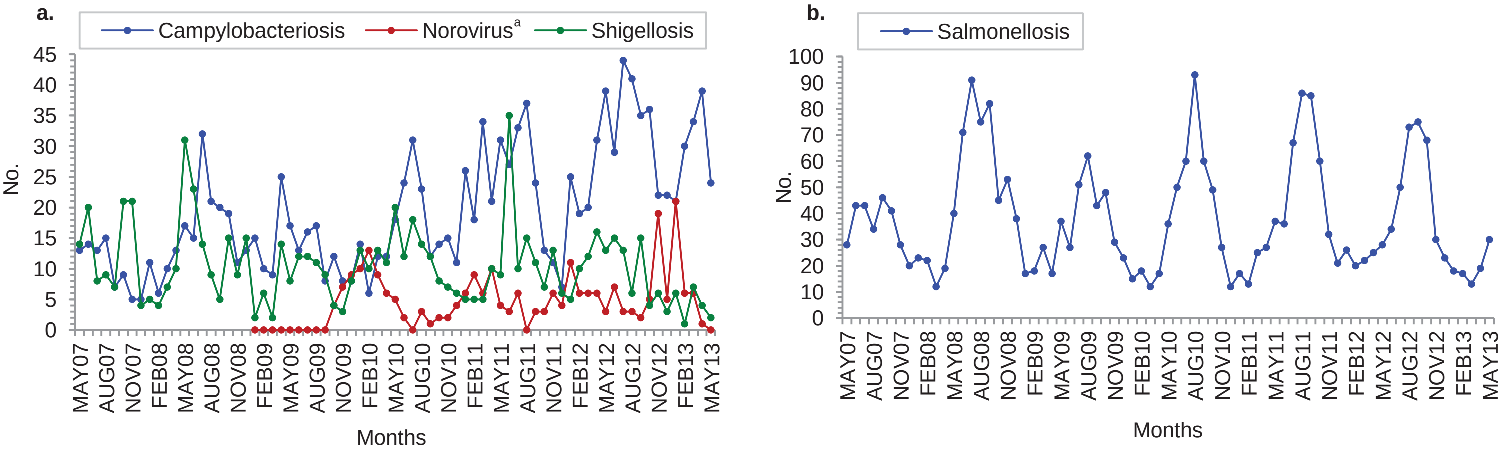
### Vector-borne infections

Cases of Lyme disease were below the 5-year range for the month of May and were within the 5-year range for the previous 12 months **(Figure 2)**.

### Tropical infections

Malaria cases for the past 12 months were below the expected range based on the previous five years of observation. This decline may be related to the troop draw down in Afghanistan and possibly to the proper use of personal protective equipment and prophylaxis **(Figure 3)**.

**FIGURE 1.** Number of reportable medical events by selected gastrointestinal infections, by month, May 2007-May 2013




[a]Prior to 2009 norovirus was not reportable

**FIGURE 2.** Number of reportable medical events for selected vector-borne infections, by month, May 2007-May 2013

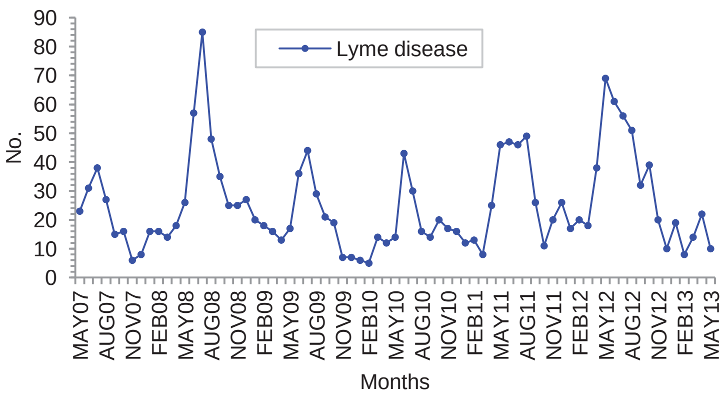



**FIGURE 3.** Number of reportable medical events for selected tropical infections, by month, May 2007-May 2013

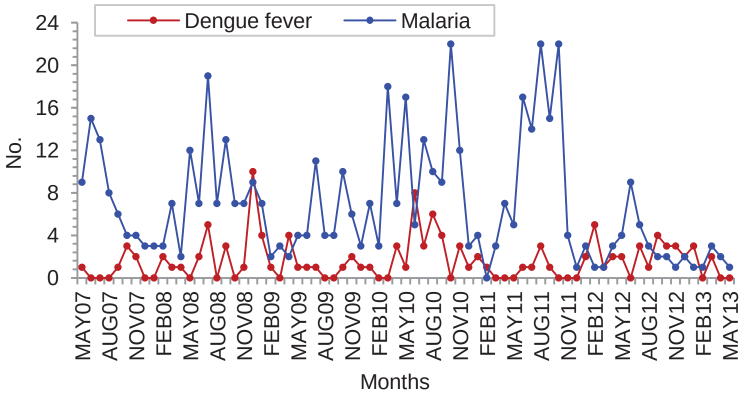


**FIGURE 4.** Number of reportable medical events by selected vaccine-preventable infections, by month, May 2007-May 2013

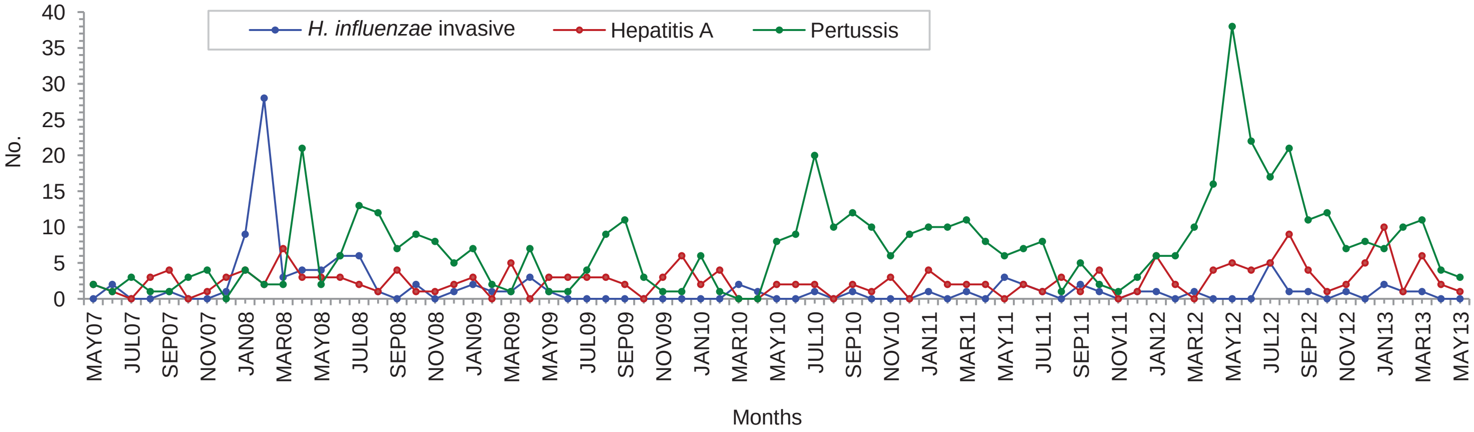



**FIGURE 5.** Number of reportable medical events for selected weather-related injuries, by month, May 2007-May 2013

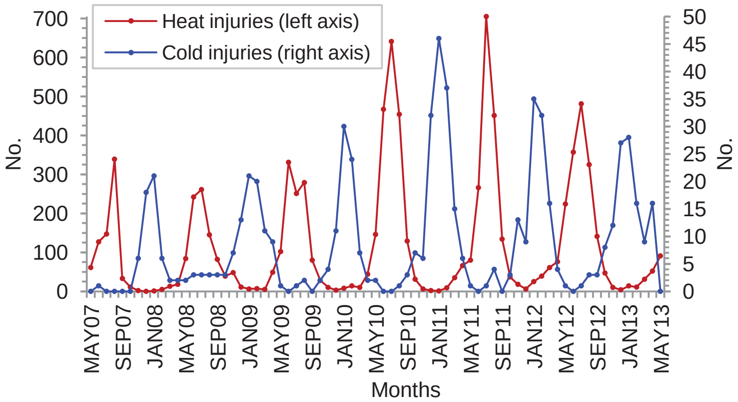
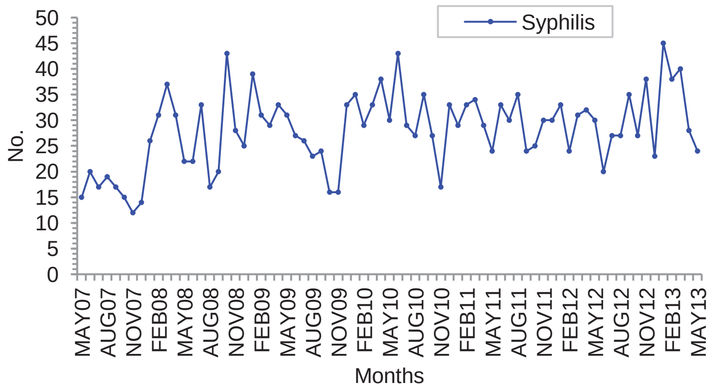



**FIGURE 6.** Number of reportable medical events for selected sexually transmitted infections, by month, May 2007-May 2013




## Vaccine-preventable infections

In the last 12 months, pertussis case counts exceeded the upper bound of the 5-year range. Pertussis cases peaked in May 2012 and then declined. The May 2013 case counts are within the 5-year range and below the median for this month. Hepatitis A cases were elevated for the past 12 months but not this month **(Table, Figure 4)**.

## Weather-related injuries

Heat and cold injuries demonstrated distinct seasonal patterns during the period, but the total number of heat injuries reported was about 12 times that of cold injuries. Both heat and cold injuries were relatively few during May, a seasonal transition month **(Figure 5)**.

## Sexually transmitted illnesses

The May 2013 case count of syphilis was within the range of the previous five months of May; however, the count for the 12 months ending in May 2013 was slightly higher than both the median and the upper bound of the range for the previous five 12-month periods **(Figure 6)**.


*Acknowledgement: Rhonda A. Lizewski, MD, MPH (LCDR, USN) of the Armed Forces Health Surveillance Center (AFHSC) prepared the May 2013 Reportable Events Monthly Report (REMR) upon which this summary is based. LCDR Lizewski is the AFHSC point of contact for questions or comments about the REMR.*

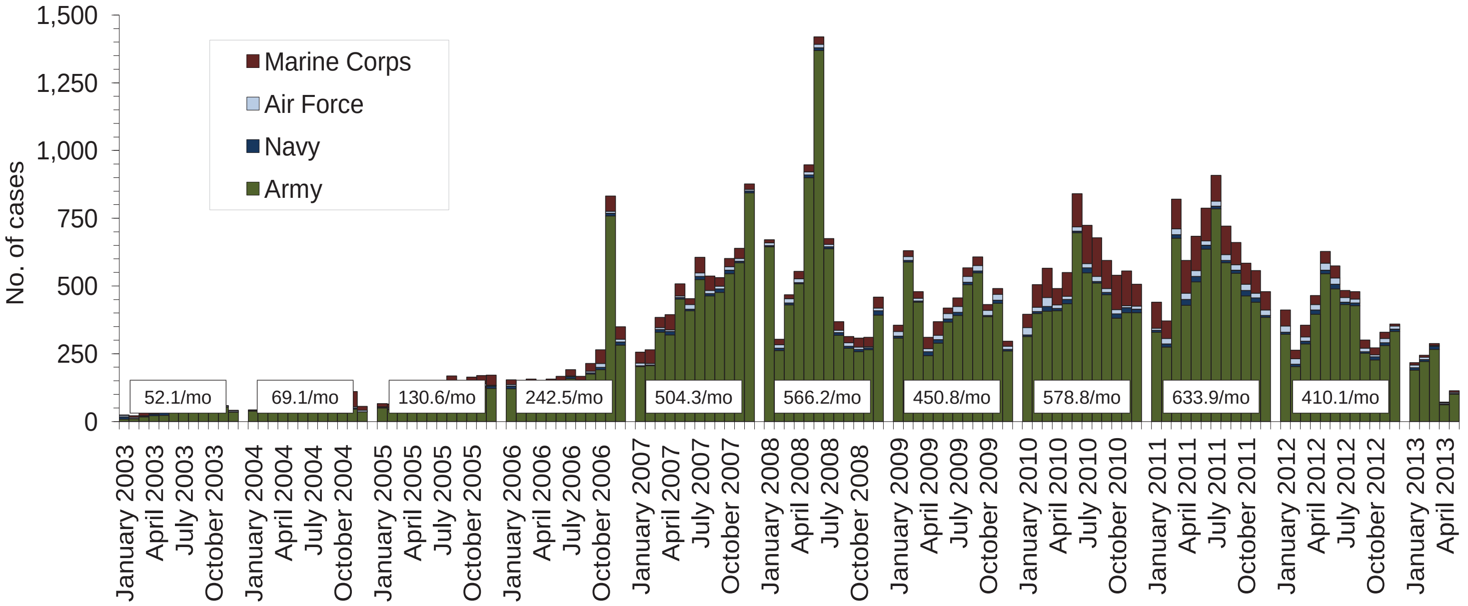

## REFERENCES


1. Armed Forces Health Surveillance Center. Armed Forces Reportable Medical Events Guidelines and Case Definitions. Silver Spring, MD. March 2012. Armed Forces Health Surveillance Center website: http://www.afhsc.mil/viewDocument?file=TriService_CaseDefDocs/ArmedForcesGuidlinesFinal14Mar12.pdf. Accessed on 20 June 2013.

2. Deputy Assistant Secretary of Defense (Clinical and Program Policy). Memorandum to the Surgeons General of the Army, Navy, and Air Force. Subject: Tri-Service Reportable Events Document. 16 November 1998.

# Deployment-Related Conditions of Special Surveillance Interest, U.S. Armed Forces, by Month and Service, January 2003-May 2013 (data as of 19 June 2013)

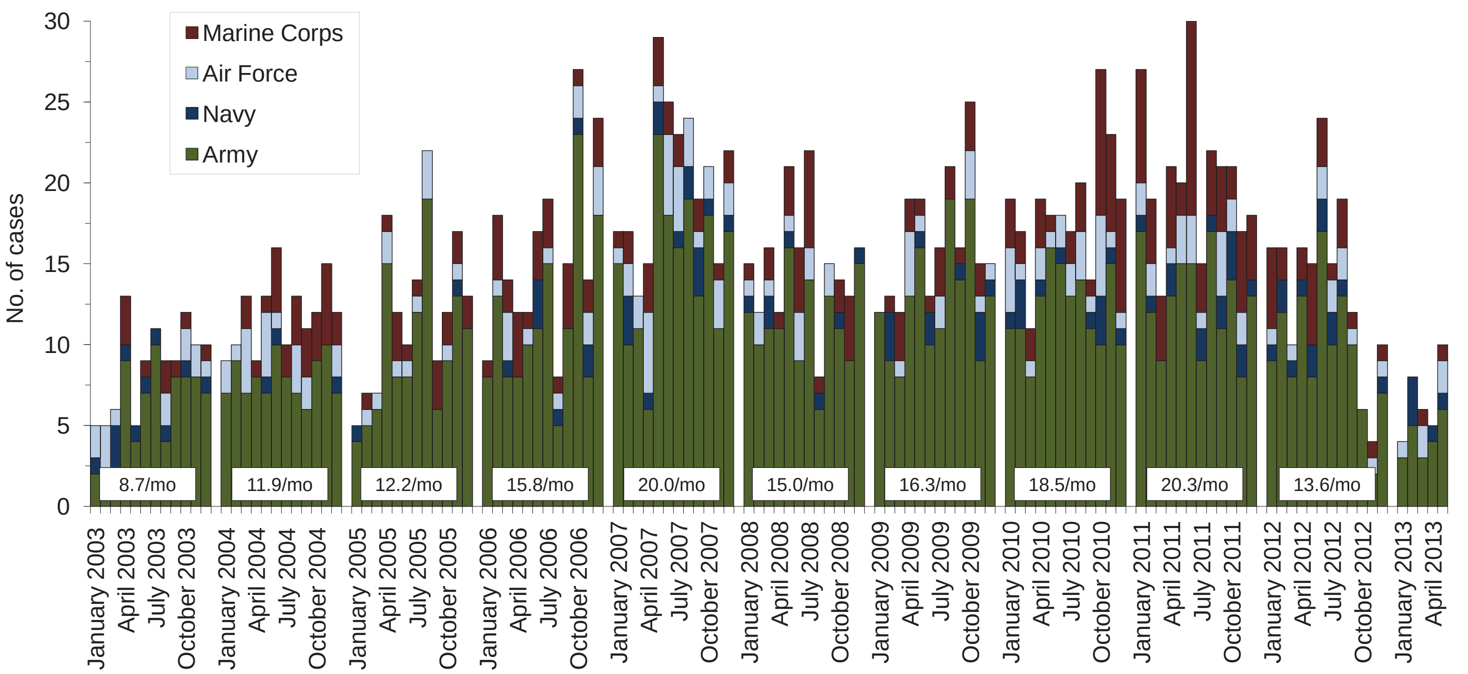
Traumatic brain injury (ICD-9: 310.2, 800-801, 803-804, 850-854, 907.0, 950.1-950.3, 959.01, V15.5_1-9, V15.5_A-F, V15.52_0-9, V15.52_A-F, V15.59_1-9, V15.59_A-F)[a]




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.

[a]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 4,137 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)[b]

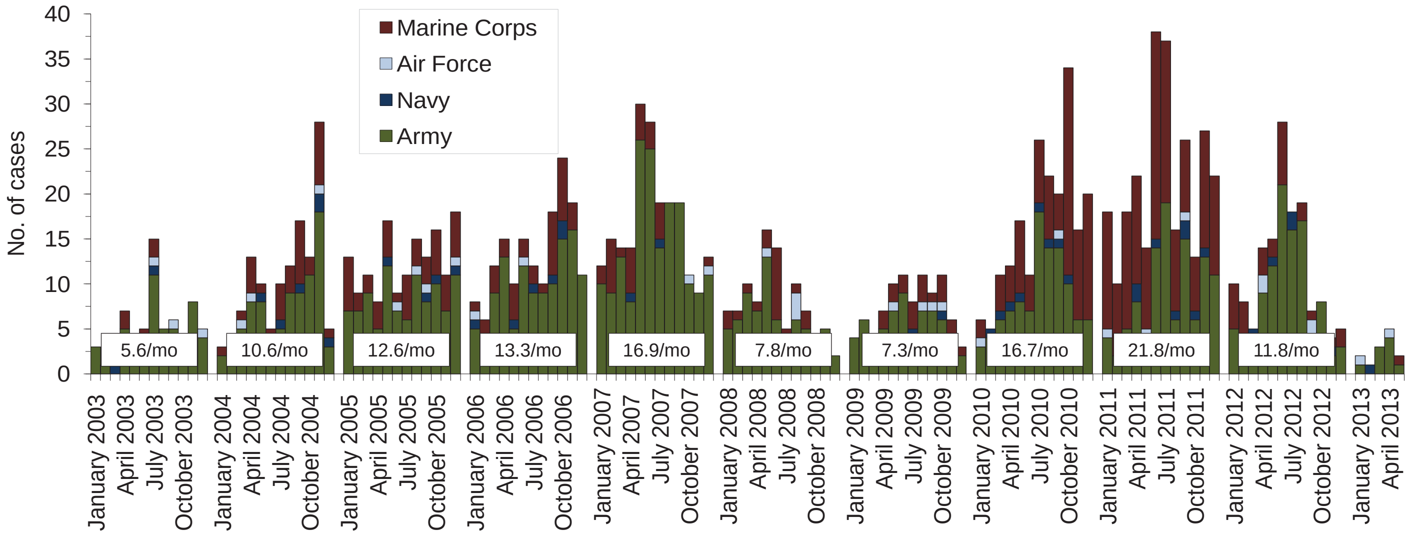



Reference: Isenbarger DW, Atwood JE, Scott PT, et al. Venous thromboembolism among United States soldiers deployed to Southwest Asia. *Thromb Res*. 2006;117(4):379-83.

[b]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-May 2013 (data as of 19 June 2013)

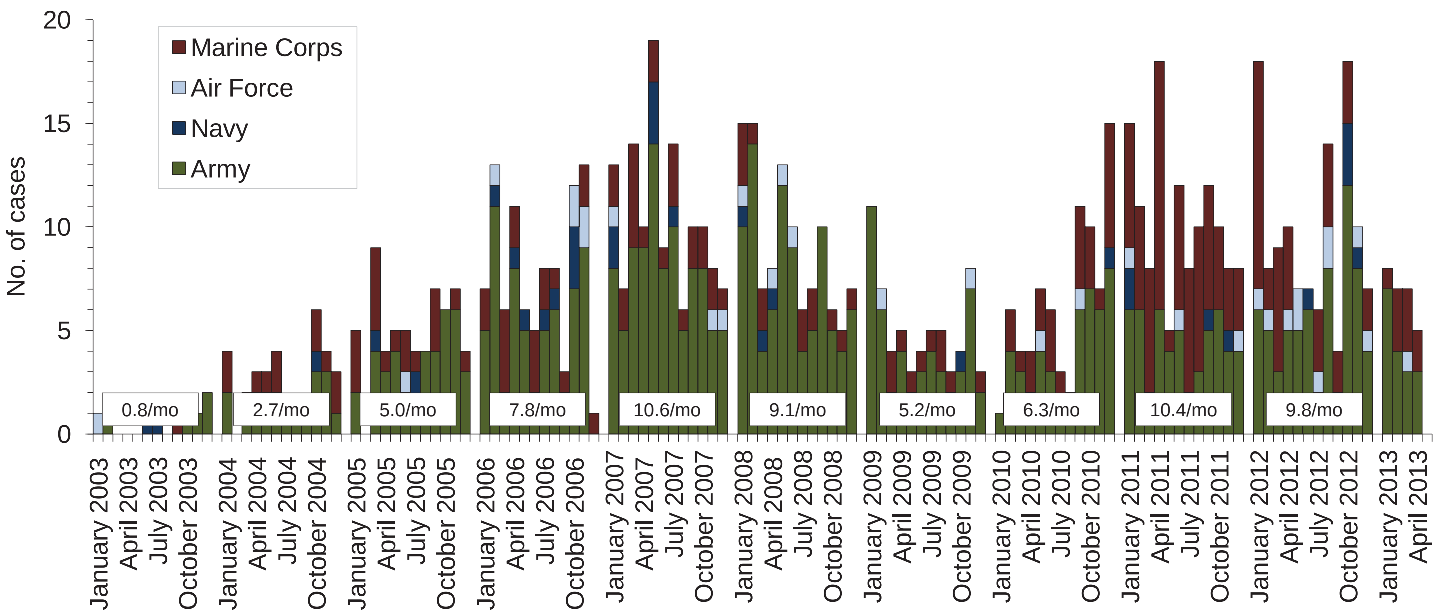
Amputations (ICD-9-CM: 887, 896, 897, V49.6 except V49.61-V49.62, V49.7 except V49.71-V49.72, PR 84.0-PR 84.1, except PR 84.01-PR 84.02 and PR 84.11)[a]




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.

[a]Indicator diagnosis (one per individual) during a hospitalization while deployed to/within 365 days of returning from OEF/OIF/OND.

Heterotopic ossification (ICD-9: 728.12, 728.13, 728.19)[b]




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

[b]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/OND.

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