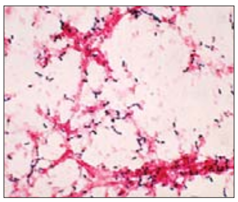
VOL. 16 • NO. 03
MARCH 2009

MSMR

A publication of the Armed Forces Health Surveillance Center



MEDICAL SURVEILLANCE MONTHLY REPORT

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Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
MAR 2009		**00-00-2009 to 00-00-2009**

4. TITLE AND SUBTITLE	
Medical Surveillance Monthly Report (MSMR). Volume 16, Number 3, March 2009	5a. CONTRACT NUMBER
	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **U.S. Army Center for Health Promotion and Preventive Medicine,Armed Forces Health Surveillance Center (AFHSC),2900 Linden Lane, Suite 200,Silver Spring,MD,20910**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**	**Same as Report (SAR)**	**32**	

Standard Form 298 (Rev. 8-98)
Prescribed by ANSI Std Z39-18

Field Investigation: Fatal Pneumococcal Meningitis, Fort Leonard Wood, Missouri, February 2009

Streptococcus pneumoniae (pneumococcus) is a frequent cause of community-acquired pneumonia, otitis media, sinusitis, and meningitis. It is a leading cause of fatal bacterial meningitis in all age groups, but especially in younger children, older adults, and others with immune disorders.[1] Case-fatality ratios of pneumococcal meningitis range between 10-60% and are usually higher in adults than children.[2,3] Although epidemic invasive pneumococcal disease was often reported in crowded human populations before the antibiotic era, reports of epidemics have become increasingly rare, save for occasional occurrences in developing nations, correctional institutions, homeless shelters, and military training facilities.[4-10]

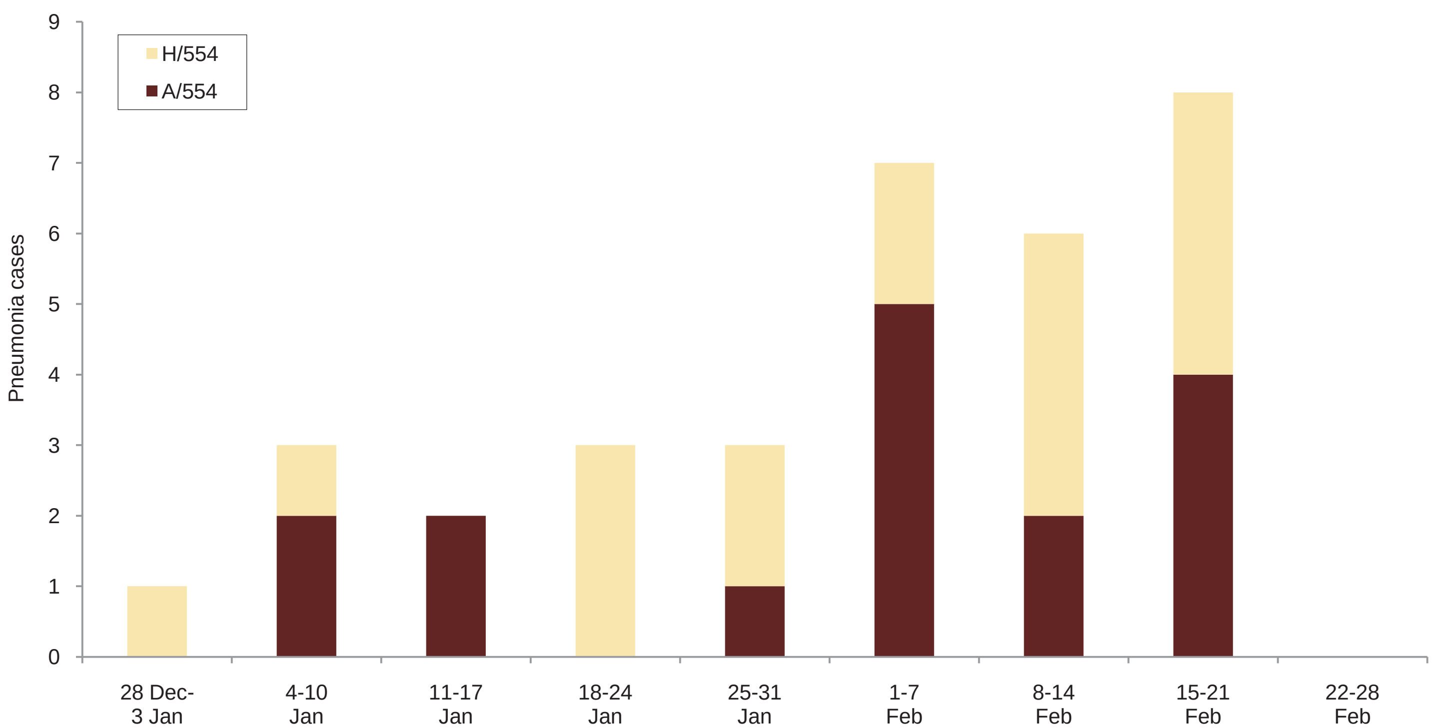
On 18 February 2009, personnel from the U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM) traveled to Fort Leonard Wood, Missouri, to support an epidemiologic investigation led by the Centers for Disease Control and Prevention (CDC). The investigation examined events surrounding the deaths of two soldiers completing Advanced Individual Training (AIT) at Fort Leonard Wood. Both soldiers were assigned to A Company, 554th Engineer Battalion (554th EN BN), and were diagnosed with pneumococcal meningitis (serotype 7F). Because both fatal meningitis cases were caused by *Streptococcus pneumoniae*, an investigation was conducted to assess the nature, distribution, frequencies, and trends of diseases other than meningitis that were caused by *S. pneumoniae* among trainees at Fort Leonard Wood.

Case reports:

The first patient was a 23-year-old male non-smoker with a history of allergic rhinitis. He presented to the troop medical clinic on 3 February 2009 with complaints of right ear pain, nasal passage blockage and discharge, sore throat, and non-productive cough. He was diagnosed with an upper respiratory infection, received supportive care, placed on limited duty, and instructed to return to the clinic if his condition worsened. He returned to the clinic on 4 February with continued complaints of ear pain with purulent drainage, nasal congestion, sore throat, muscle and joint aches, fatigue, fever, chills, headache, and productive cough. He was diagnosed with fever and otitis media, treated with antibiotics, and restricted from duty for 24 hours.

On 5 February, he was brought to the Emergency Department of the Leonard Wood Army Community

Figure 1. Pneumonia cases among the A and H companies of the 554th Engineer Battalion, Fort Leonard Wood, Missouri, 28 December 2008-28 February 2009



Note: No pneumonia cases were documented the week of 22-28 February.

Table 1. Incident cases and incidence rates* of bacterial pneumonia, basic training sites as compared with all Army installations, active component, U.S. Army, 2004-2008

	Pneumococcal meningitis			Pneumococcal pneumonia			Other bacterial pneumonia		
	Total cases 2004-2008	Incidence rate	Relative risk	Total cases 2004-2008	Incidence rate	Relative risk	Total cases 2004-2008	Incidence rate	Relative risk
Ft. Benning, GA	4	4.1	0.83 (0.03 - 1.68)	41	42	1.62 (1.12 - 2.14)	131	135	1.43 (1.18 - 1.69)
Ft. Jackson, SC	0	0.0	0.00 (0.00 - 0.00)	26	54	2.09 (1.28 - 2.92)	108	226	2.44 (1.97 - 2.91)
Ft. Knox, KY	2	5.0	1.02 (0.00 - 2.48)	37	93	3.64 (2.46 - 4.87)	107	269	2.90 (2.35 - 3.47)
Ft. Leonard Wood, MO	3	6.1	1.24 (0.00 - 2.71)	30	61	2.36 (1.51 - 3.24)	75	153	1.62 (1.25 - 2.00)
Ft.Sill, TX	3	4.9	1.00 (0.00 - 2.18)	19	31	1.18 (0.65 - 1.73)	52	86	0.90 (0.65 - 1.14)
All Army	**123**	**5.1**	**Referent**	**663**	**23**	**Referent**	**2,378**	**87**	**Referent**

*Rate per 100,000 p-yrs

Hospital after a fall from his bunk with loss of consciousness. He was disoriented, combative, and had a Glasgow Coma Score (GCS) of 7. Rhonchi were noted on lung examination. As his condition deteriorated, he was intubated and transferred to St. John's Regional Hospital. A cerebrospinal fluid specimen revealed infection with *S. pneumoniae*. The service member was diagnosed with pneumococcal meningitis, sepsis, and multi-system organ failure. He was treated with antibiotics and other supportive measures and remained in critical condition until his death on 9 February.

The second patient was a 28-year-old male smoker with an unremarkable medical history. He had first presented to the troop medical clinic on 5 February 2009 with complaints of chills and night sweats, productive cough with post-tussive vomiting, nasal discharge, dyspnea, and congestion. Wheezing was heard on lung examination, but a chest x-ray (CXR) was unremarkable. He was diagnosed with acute bronchitis, treated with antibiotics and other supportive measures, restricted from duty for 72 hours, and instructed to return to the clinic if his condition worsened. On 10 February, he presented to the hospital's Emergency Department with complaints of fever, chills, nausea and vomiting, cough, nasal discharge and congestion. His throat was red, and CXR was unremarkable. He was diagnosed with acute viral syndrome, treated with anti-emetics and other supportive measures, restricted from duty for 48 hours, and instructed to return for follow-up on 13 February.

On the morning of 13 February, the patient was brought by ambulance to the hospital's Emergency Department with altered mental status, difficulty arousing, and combative behavior that followed dizziness, lightheadedness, and vomiting; his GCS was 9. He was treated with antibiotics and other supportive measures. A CT scan revealed sinusitis and cerebral edema. As his condition worsened, he was intubated and transferred to St. John's Regional Hospital. A cerebrospinal fluid specimen revealed infection with *S. pneumoniae*. The patient was diagnosed with pneumococcal meningitis, treated with antibiotics, and transferred to the Intensive Care Unit. A CXR demonstrated a non-specific, mild, bilateral pulmonary haze. His condition deteriorated until his death on 15 February.

Setting:

The 554th EN BN includes soldiers who have completed basic combat training, either at Fort Leonard Wood or another training installation, and are enrolled in advanced individual training. At the time of the outbreak, the 554th EN BN had two active companies: A/554 and H/554. Each company had four or five platoons, and each platoon was a closed cohort of 40-60 soldiers who remained together throughout the training.

Each company is housed in a separate barracks building; the barracks of A/554 is adjacent to that of H/554. Each barracks consists of rooms (with two to four residents) and "bays" (with 60-100 residents). Soldiers of A/554 and H/554 dine together in a consolidated mess hall. Soldiers assigned to A/554 and H/554 can interact at the gymnasium and other locations on the installation; however, they do not typically participate in organized activities together.

All soldiers in training receive medical care at a single clinic. Ill soldiers who are directed to convalesce "in quarters" return to their barracks and reside in the general population; there is no capability to isolate ill soldiers.

Methods:

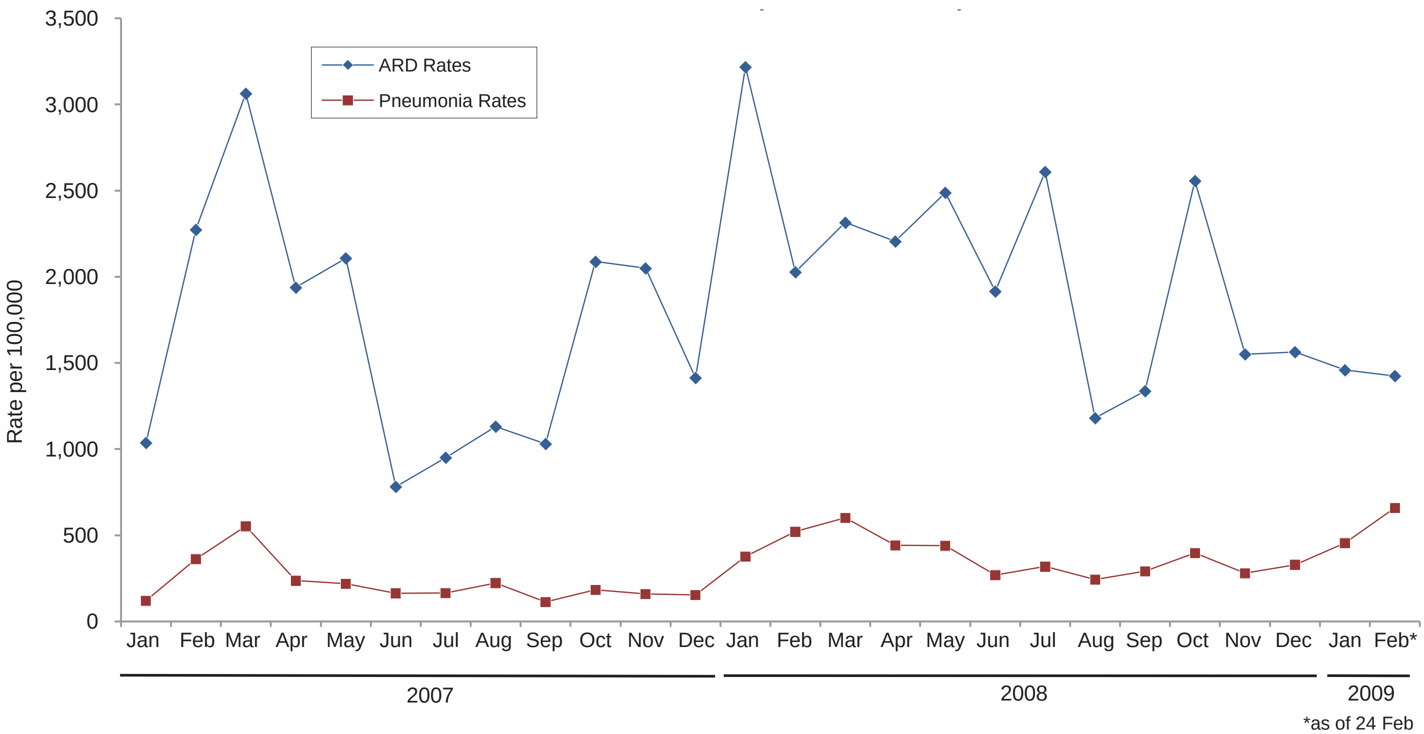
Case definition:

Every active duty patient who presented to the troop medical clinic or the Leonard Wood Army Community Hospital from 1 January 2009 until 23 February 2009 with symptoms or signs of upper respiratory infection or pneumonia, and with subsequent CXR findings indicative of pneumonia, was considered to have a confirmed case of pneumonia.

Data collection:

A pneumonia surveillance database developed and routinely used by the Fort Leonard Wood staff was used to identify cases and enumerate pneumonia patients from January 2007. For cases in 2009, demographic and

Figure 2. Rates of acute respiratory disease and pneumonia among trainees at Fort Leonard Wood, Missouri, 1 January 2007-24 February 2009



medical data were extracted from the Armed Forces Health Longitudinal Technology Application (AHLTA), including date of illness onset, symptoms, prior sick call visits, medical history, and vaccination history. Company rosters were obtained from both A/554 and H/554 to determine living quarters, week of training, and basic combat training sites.

The Military Health System Data Repository was used to determine incidence rates of pneumococcal meningitis, pneumococcal pneumonia (ICD-9-CM: 481.0-481.9), and other bacterial pneumonias (ICD-9-CM: 482.0-482.9) among active duty soldiers at each of the five Army basic combat training installations, and for all non-basic combat training installations as a whole, during 2004-2008. All medical encounters with these diagnoses were counted except those that occurred less than 14 days after a previous visit for the same diagnostic group. The populations at risk were calculated using annualized population estimates obtained from the Defense Medical Epidemiology Database (DMED) application.

Acute respiratory disease (ARD) cases were counted using Fort Leonard Wood-specific data from a surveillance system that is in place at Army basic combat training sites. The Army ARD Surveillance Program tracks patients with recent onset of at least one symptom of acute respiratory infection and a fever greater than or equal to 100.5°F. [11] Monthly denominators were calculated for each training company from weekly surveillance worksheets submitted to the installation's Preventive Medicine (PM) Division since January 2007.

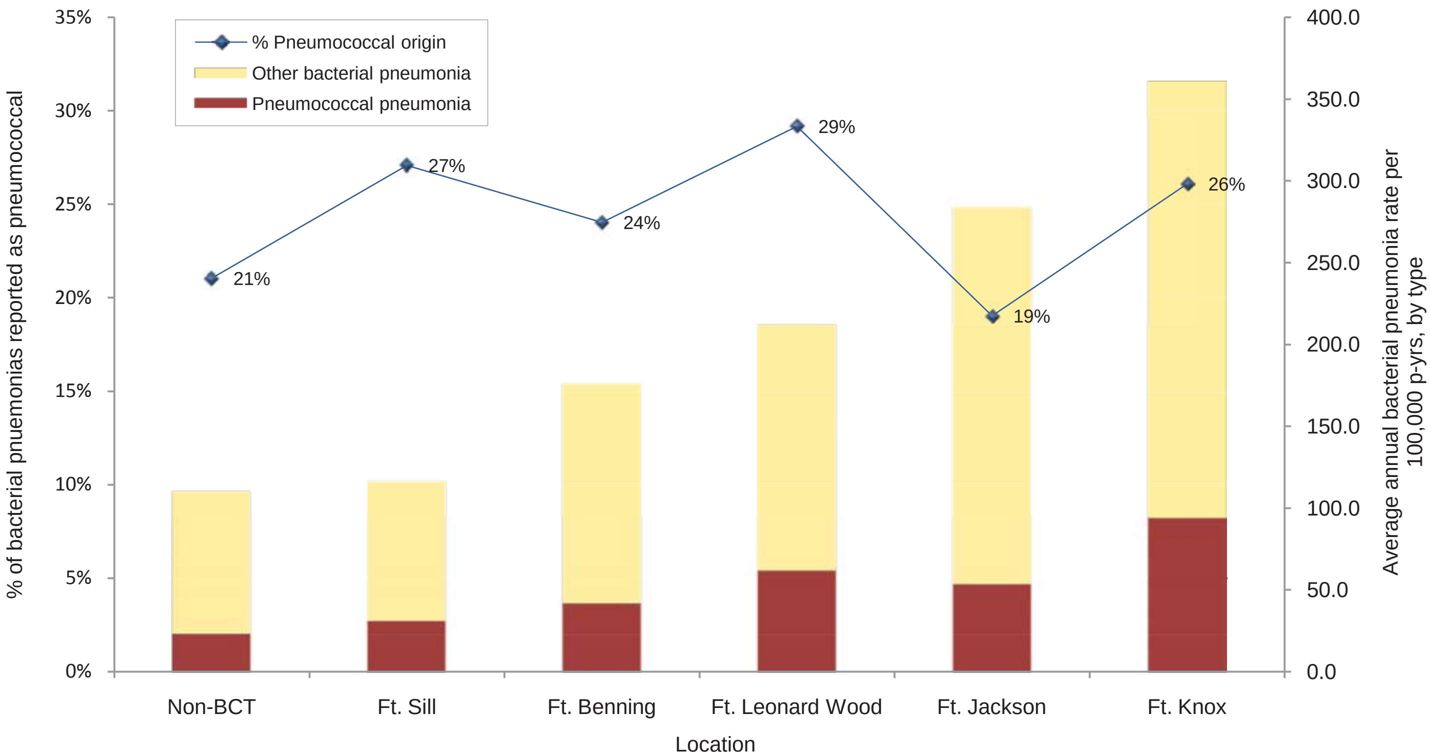
Laboratory:

The Naval Health Research Center (NHRC), San Diego, CA conducts ongoing active surveillance for ARD among basic trainees at Fort Leonard Wood. On 15 and16 February, 37 respiratory swab samples were collected from trainees of A/554 and H/554 who had afebrile upper respiratory symptoms. One nasal and one throat swab were collected from each trainee, placed in universal transport media (Copan Diagnostics Inc., Murietta, CA), frozen, and shipped to NHRC on 17 February. NHRC performed polymerase chain reaction (PCR) testing for *S. pneumoniae, M. pneumoniae, C. pneumoniae, B. pertussis, L. pneumophila, N. meningitidis, S. pyogenes*, influenza A, influenza B, respiratory syncytial virus (RSV), and adenovirus.

Environmental review:

Barracks inspections were conducted by the Environmental Health (EH) and Industrial Hygiene (IH) Sections of the installation's PM Division. The EH inspection was completed in accordance with USACHPPM Technical Guide 314 and included room measurements and determinations of space allocations for soldiers.[12] EH personnel also inspected ranges and training areas to evaluate personal hygiene practices in field environments. IH personnel completed air-flow studies measuring air exchanges and fresh air compositions. Indoor air quality testing was subsequently performed in each individual room or bay of the barracks.

Figure 3. Average annual rates of bacterial pneumonia, by type and basic combat training (BCT) site, as compared with all other Army installations, active component, U.S. Army, 2004-2008



Intervention:

Between 18 and 24 February, prophylactic benzathine penicillin G (Bicillin®, single intramuscular dose of 1.2 million units) and 23-valent pneumococcal polysaccharide vaccine (PPV23, single dose) were administered to 349 trainees of A/554, 232 trainees of H/554, and 178 military and civilian members of the A/554 and H/554 cadre. Those with documented penicillin allergies received oral azithromycin, 250 mg per day for 5 days.

Results:

Pneumonia incidence:

At Fort Leonard Wood since January 2007, monthly incidence rates of pneumonia averaged 298 per 100,000 person-years (p-yrs) (median: 274/100,000). The rate in February 2009 was 658 per 100,000 p-yrs, more than double the two-year baseline rate. In November 2008, pneumonia rates began to increase in the 554th EN BN; and in January and February 2009, 33 pneumonia cases were identified among members of the battalion **(Figure 1)**.

Pneumonia rates during February 2009 were 3,584 per 100,000 p-yrs in A/554 and 3,780 per 100,000 p-yrs in H/554; the rates were approximately 10-times higher than the respective two-year baseline rates. Platoon/squad assignment, barracks room assignment, class assignment, and training week were associated with pneumonia risk. ARD rates were not elevated in January or February 2009. In fact, since December 2008, ARD rates declined as pneumonia rates increased **(Figure 2)**.

From 2004 through 2008, among active component soldiers, annual incidence rates of pneumococcal pneumonia and other bacterial pneumonias were generally higher among those stationed at basic combat training sites than at other Army installations and in the Army overall **(Figure 3 and Table 1)**. The exception was Fort Sill, OK, where the rates were comparable to those in the Army overall.

Laboratory results:

PCR testing of specimens collected from 37 trainees with afebrile respiratory illnesses revealed the following (number and percent positive): *S. pneumonia* (n=31; 84%); *C. pneumonia* (n=12; 32%); *N. meningitidis* (n=4; 11%); influenza A (n=2; 5%); influenza B (n=2; 5%). Parallel testing of specimens collected from 17 Fort Leonard Wood basic trainees with febrile acute respiratory illnesses found 14 (82%) *S. pneumonia* and no *C. pneumoniae* positives.

Environmental results:

Previously, the Commanding General of Fort Leonard Wood had approved per-person space requirements of 60 square feet per soldier (consistent with guidelines in TRADOC Reg. 350-6).[13] The barracks housing the A/554 and H/554 soldiers are three-story brick buildings. Twenty living areas in the building provided less than 60 square feet of space per soldier. Initial air flow studies indicated an adequate supply of fresh air. Air exchanges and HVAC systems were recently serviced. Results of tests in the former living areas of the two deceased soldiers were within normal limits.

Editorial comment:

Crowded living conditions, rigorous training schedules, and other mental, emotional, and physical stressors unique to military service probably place initial entry trainees at higher risk of pneumococcal infection, bacterial pneumonia, and ARD in general compared to the general population. Personal space allocation for soldiers living in barracks and the need to isolate ill and potentially infectious soldiers remain critical areas of consideration for the military training leadership, garrison commanders and local medical commanders when planning and implementing infectious disease prevention programs. In addition, appropriate hygiene practices (such as hand washing and cough etiquette) should continue to be emphasized in the training environment.

For decades, military training facilities have used febrile ARD rates as indicators of current acute respiratory disease activity and to signal potentially emerging epidemics. At Fort Leonard Wood, ARD rates were not elevated during the recent pneumonia outbreak or prior to the occurrence of the two fatal, pneumococcal meningitis cases. Furthermore, Fort Leonard Wood rates of pneumococcal illness were similar to rates at other training installations. Thus, no surveillance alarms warned of ongoing or emerging potential problems.

Because the Fort Leonard Wood PM Division conducts unique surveillance of pneumonia cases by company, it did detect an elevated pneumonia rate in the affected company before the two meningitis deaths occurred. This suggests that ARD surveillance and response procedures might be improved by tracking other presentations of acute respiratory diseases, such as atypical pneumonia, and establishing new unit-level thresholds for action. In particular, antimicrobial prophylaxis is now primarily aimed at mitigating epidemics of group A streptococcal infections during basic combat training, as correlated with general ARD rates; but such prophylaxis may need to be considered in direct relation to correlates of pneumococcal disease incidence — including during the AIT period.

The results of this investigation may inform decisions regarding uses of PPV23 to prevent pneumococcal disease in recruits and those who work closely with them in the initial entry training environment. During a survey conducted as part of this investigation (data not shown), 44% of respondents reported "current" cigarette smoking. During the 2005 DoD survey of health related behaviors, 45.9% of all junior enlisted (E1-E3) service members reported smoking at least once during the past 30 days.[14] The Advisory Committee on Immunization Practices (ACIP) recommends that any adult who smokes cigarettes or has a chronic pulmonary disease, such as asthma, should be administered a single dose of PPV23.[15] Because military trainees are at relatively high risk of pneumonias, enhanced smoking cessation programs and routine pneumococcal vaccination among military trainees may be indicated.

Report and comment provided by John F. Ambrose, MPH, CHES, Michele A. Soltis MAJ, MC, USA, Nakia S. Clemmons, MPH, Bruce P. Russell, MPH Candidate, Anthony Hawksworth, Nikki N. Jordan, MPH, Paul Pietrusiak, MHS, Nicole K. Leamer, MPH, Steven J. Brewster, LTC(P), MC, USA

We would like to express our gratitude to those who helped with this investigation including: Ft. Leonard Wood staff Susan M. Wolf and SGT Richard G. Whisenhunt, GLWACH Command; NHRC staff CDR Dennis Faix, MD and Dr. Patrick Blair, PhD; and CDC team members Dr. Fatimah Dawood, Dr. Jennifer Rosen, Emily Westin, Nina Glass and Dr. Matt Moore

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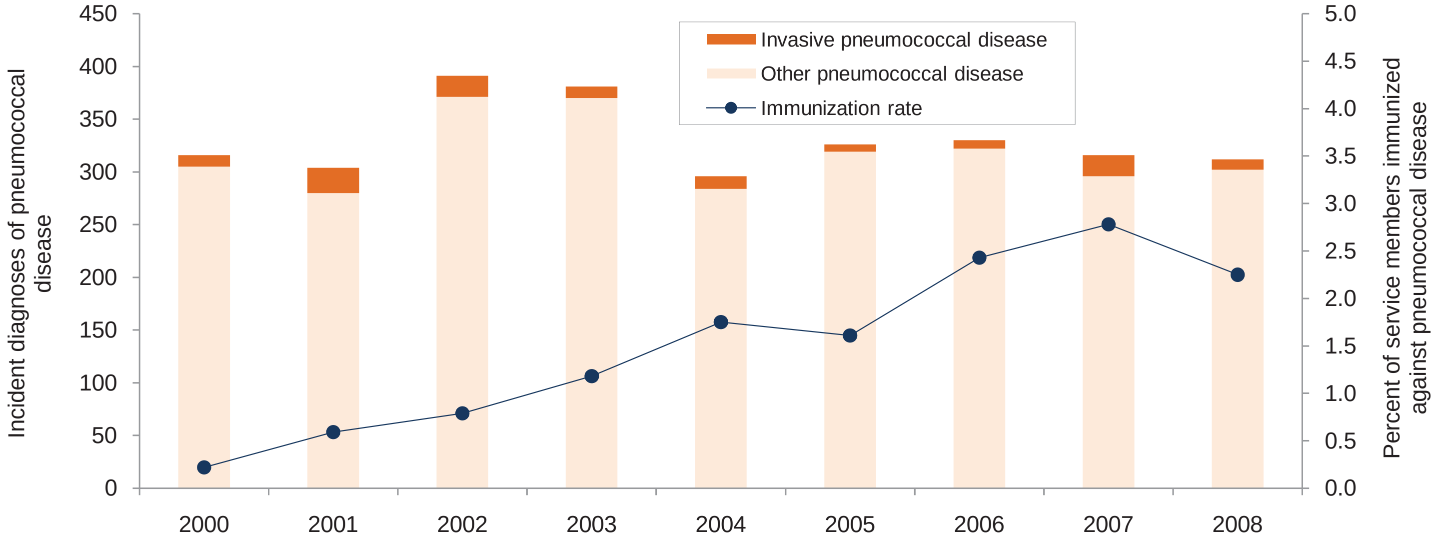
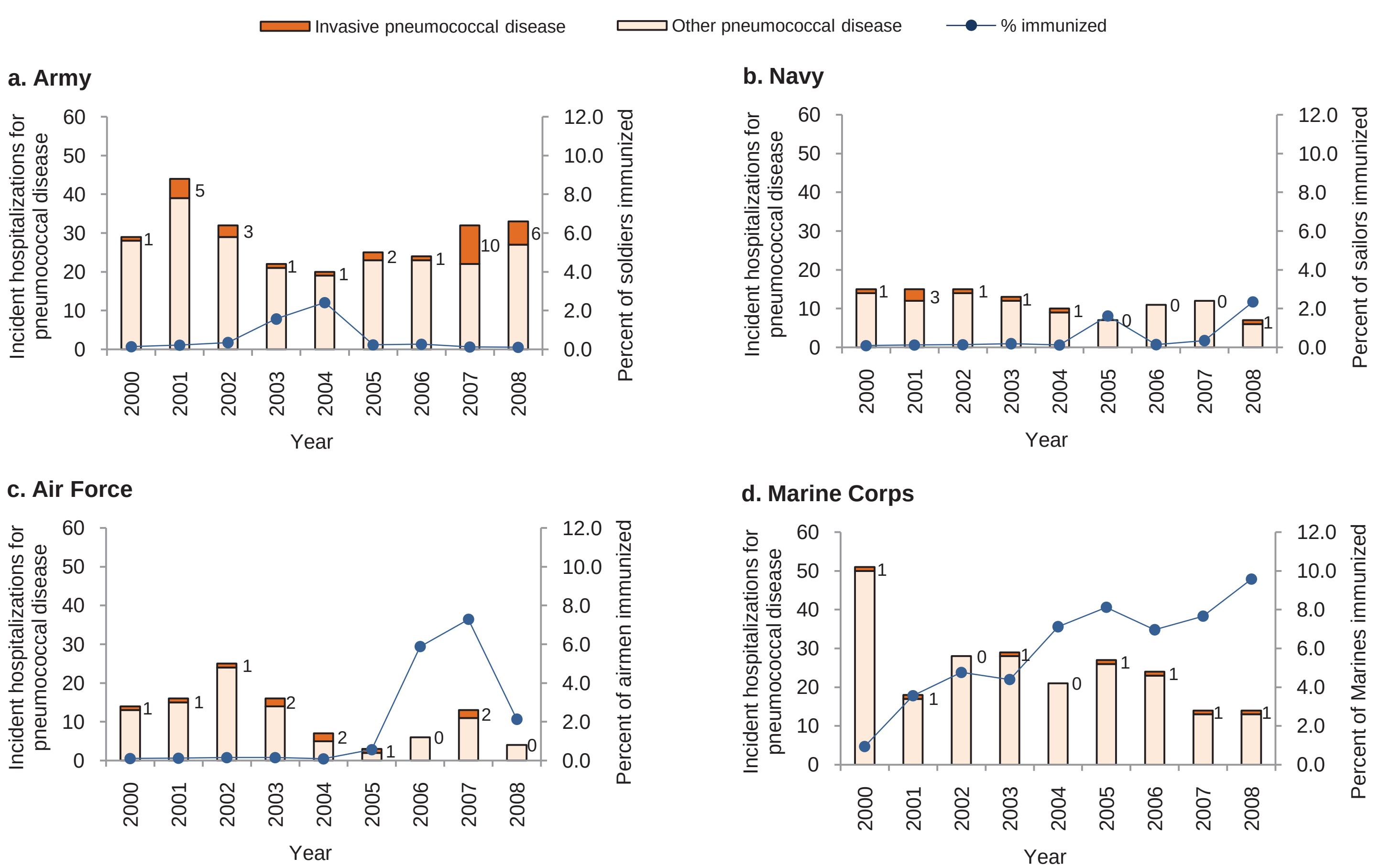
SURVEILLANCE SNAPSHOT:
Immunization Against and Incidence of Pneumococcal Disease

Diagnoses of pneumococcal disease* and percent of service members immunized, active component, U.S. Armed Forces, 2000-2008



*Inpatient or outpatient diagnoses (one per individual per 60 days) of invasive pneumococcccal disease (pneumococcal meningitis, pneumococcal peritonitis and pneumococcal septicemia) or other pneumococcal disease (pneumococcus, pneumococcal pneumonia) in any diagnostic position.

Incident hospitalizations for pneumococcal disease and percent of service members immunized, by Service, active components, U.S. Armed Forces, 2000-2008



Update: Heat Injuries, Active Component, U.S. Armed Forces, 2008

Throughout history, heat-related injuries have posed significant threats to the health and operational effectiveness of military members and their units.[1] Decades of lessons learned during military training and operations and findings of numerous research studies have resulted in doctrine, equipment, and methods that significantly reduce the adverse effects of military activities in heat.[2] Still, physical exertion in hot environments causes hundreds of injuries among U.S. service members[3]. This report summarizes heat injury-related medical events among members of active components during 2008 and compares them to recent years.

Methods:

The surveillance population included all individuals who served in the active component of the U.S. Armed Forces any time from 1 January 2004 through 31 December 2008. The Defense Medical Surveillance System (DMSS) was searched to identify all medical encounters and notifiable medical event reports that included either primary (dx1) or secondary (dx2) diagnoses of "heat stroke" (ICD-9-CM: 992.0) or "heat exhaustion" (993.3-993.5). If more than one data source documented a heat injury episode, information for summary purposes was derived from the hospitalization record (if one was available) or the reportable event record; ambulatory records were the sources of information regarding cases if no hospitalization or reportable event records documented the episodes.

This summary includes only incident cases, defined as one heat injury per service member within a six month period. Finally, as the DMSS is limited to data reported from fixed medical facilities, medical encounters for heat injuries that occurred while deployed, during training exercises, or while at sea are not included unless they resulted in medical evacuations to fixed medical facilities that routinely report medical encounters of U.S. military members.

Results:

In 2008, there were 299 incident cases of heat stroke and 1,467 incident cases of heat exhaustion among active component members. Overall crude incidence rates of heat stroke and heat exhaustion were 0.21 and 1.04 per 1,000 person-years (p-yrs), respectively **(Table 1)**.

The overall rate (unadjusted) of heat stroke in 2008 was lower than the rate in 2004 and similar to the annual rates from 2005-2007 **(Figure 1)**. The overall rate (unadjusted) of heat exhaustion in 2008 was lower than in any of the previous four years **(Figure 2)**. In 2008, there were fewer cases of heat exhaustion than in any of the prior four years. The number of heat stroke cases in 2008 was similar to the numbers in 2005-2007.

Table 1. Incident cases and rates of heat stroke and heat exhaustion, active components, U.S. Armed Forces, 2008

	Heat stroke ICD-9-CM: 992.0		Heat exhaustion ICD-9-CM: 992.3-5	
	No.	Incidence rate*	No.	Incidence rate*
Total	299	0.21	1467	1.04
Sex				
Male	267	0.22	1196	0.98
Female	32	0.16	271	1.35
Age group				
<20	38	0.38	381	3.83
20-24	153	0.33	607	1.30
25-29	59	0.18	260	0.79
30-34	23	0.11	98	0.49
35-39	18	0.10	86	0.50
>=40	8	0.05	35	0.24
Race/Ethnicity				
White	201	0.22	977	1.08
Black	44	0.19	237	1.03
Other	54	0.19	253	0.89
Service				
Army	192	0.36	683	1.29
Navy	20	0.06	136	0.42
Air Force	15	0.05	169	0.52
Marine Corps	65	0.34	462	2.38
Coast Guard	7	0.17	17	0.41
Military status				
Enlisted	263	0.22	1373	1.16
Officer	36	0.16	94	0.41
Military occupation				
Combat	99	0.33	327	1.10
Healthcare	24	0.21	93	0.81
Other	176	0.18	1047	1.04

*per 1,000 person-years

In 2008, as in previous years, incidence rates of heat stroke and heat exhaustion declined with increasing age and were higher in combat-related compared to other occupational groups **(Table 1)**. The heat stroke rate was nearly one-third higher among males than females; however, the heat exhaustion rate was higher among females than males.

Rates of heat stroke were similar in the Army and Marine Corps; however, the rate of heat exhaustion was more than 80% higher among Marines than soldiers. Relative to the Army and Marine Corps, the Air Force, Navy, and Coast Guard had much lower heat injury rates **(Table 1)**.

Between 2004 and 2008, heat-related injuries were diagnosed at more than 300 medical facilities worldwide. However, 14 facilities treated at least 200 cases each and accounted for approximately 60% of all cases. Since 2004, the

Figure 1. Heat stroke cases and incidence rate, by source of report and year of diagnosis, active component, U.S. Armed Forces, 2004-2008

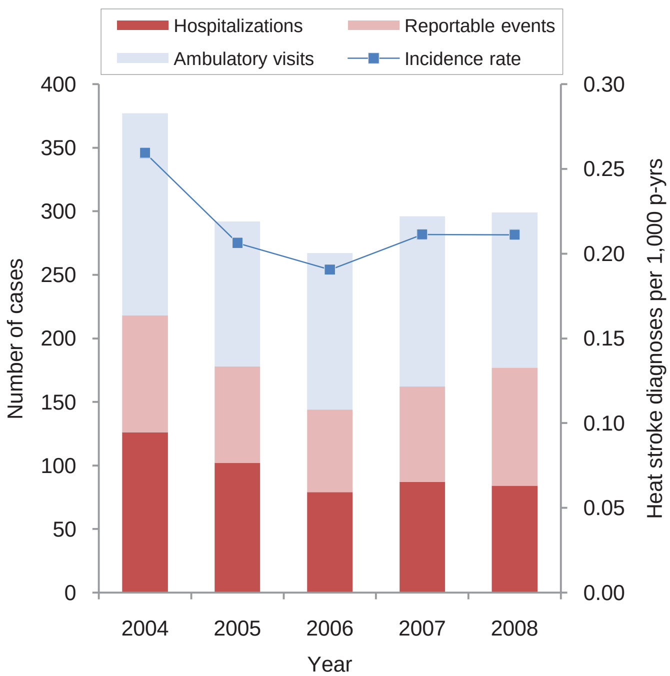
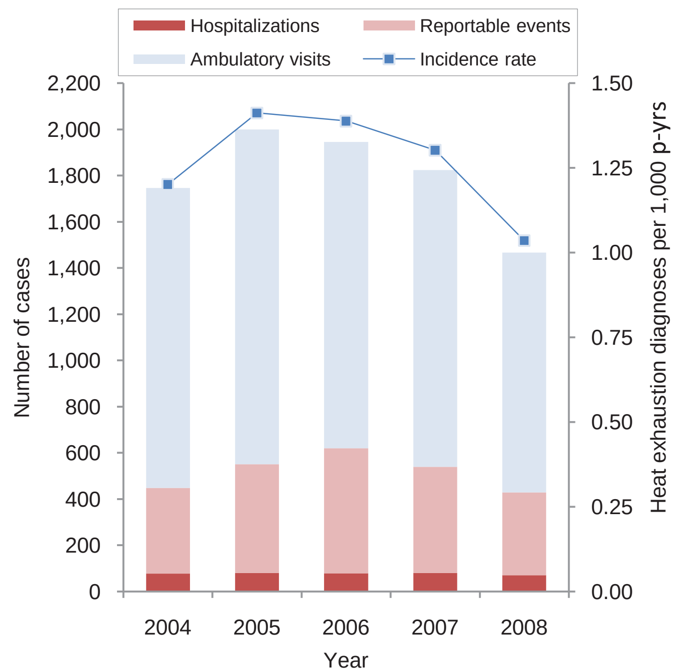


Figure 2. Heat exhaustion cases and incidence rate, by source of report and year of diagnosis, active component, U.S. Armed Forces, 2004-2008



five locations with the most cases overall were MCRD Parris Island/Beaufort, SC (n=1,111), Fort Bragg, NC (n=1,037), Fort Benning, GA (n=889), MCB Camp Lejeune/Cherry Point, NC (n=560), and Fort Campbell, KY (n=390) (data not shown).

Editorial comment:

Since 2005, rates of heat stroke have been fairly stable, and rates of heat exhaustion have slightly declined. In recent years, annual numbers of hospitalized cases (the most clinically severe) of both heat stroke and heat exhaustion have been stable.

Military activities in hot and humid environments are persistent, significant threats to the health and operational effectiveness of service members. Of all service members, the youngest and most inexperienced are at highest risk of heat-related injuries — including life threatening heat-associated conditions such as heat stroke, exertional hyponatremia, and exertional rhabdomyolysis.

Recent heat injury-related reports have documented that heat-related injury risk may be increased among service members with acute respiratory[4] and possibly other infections.[5] Such infections are common among basic/recruit trainees who are also at high risk of heat-related injuries. Small unit leaders, training cadre, and supporting medical personnel, particularly at initial entry/recruit training centers, must ensure that service members whom they supervise and support are informed regarding risks, preventive countermeasures (e.g., water consumption), early signs and symptoms, and first responder actions related to heat injuries.[2] Leaders should be particularly vigilant of trainees with active respiratory and other infections. Finally, leaders should be aware of the upper limits of water intake, designed to prevent rare but life-threatening events of overhydration/hyponatremia.

Information related to heat injury prevention and treatment are available at: http://chppm-www.apgea.army.mil/heat/#PM.

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Update: Exertional Rhabdomyolysis among U.S. Military Members, 2008

Rhabdomyolysis is the breakdown of striated muscle cells with release into the bloodstream of their potentially toxic contents (e.g., myoglobin).[1-3] In high enough concentrations, the contents of skeletal muscle cells can cause organ and systemic dysfunction, including disseminated intravascular coagulation (DIC), disturbances of fluid, electrolyte, and acid-base balances, compartment syndrome, and renal failure.[1-3] In the United States, case fatality with rhabdomyolysis is less than 5% and depends on the nature of the precipitating cause, the severity and clinical effects of comorbid conditions, and the prior state of health of affected individuals. Most otherwise healthy individuals recover with aggressive hydration and management of metabolic, renal, and systemic complications.[1,3]

There are numerous and diverse causes of rhabdomyolysis, including acute traumatic injury – particularly, soft tissue compression ("crush") injuries; electrocution; infections and immune disorders that cause inflammation of skeletal muscle; toxic effects of prescribed, over-the counter, recreational (e.g., alcohol), and illicit drugs; ischemia; invasive and toxigenic infections; sepsis; and seizures.[1,2] In healthy, physically active young adults (such as military members), rhabdomyolysis is a significant threat during physical exertion ("exertional rhabdomyolysis"), particularly under heat stress.[1-3] Militarily-relevant risk factors for exertional rhabdomyolysis – particularly among recruits – include rapid increase in physical activity, high heat and humidity, inadequate hydration, concurrent heat injury, and ongoing/recent acute infectious illness.[1-3]

For the purpose of estimating recent experience with "exertional rhabdomyolysis," we identified all incident medical encounters of U.S. service members for "rhabdomyolysis" and excluded those with concurrent diagnoses of injuries (other than sprains and strains), poisonings, and/or toxic effects. For this report, cases of presumed exertional rhabdomyolysis in calendar year 2008 are summarized and compared with cases from recent years with respect to the geographic locations of their occurrence and the military and demographic characteristics of affected service members.

Methods:

The surveillance period was defined as 1 January 2004 to 31 December 2008. The surveillance population included all individuals who served in an active component of the U.S. Armed Forces any time during the surveillance period.

For surveillance purposes, a case of "exertional rhabdomyolysis" was defined as a hospitalization or ambulatory visit with a discharge diagnosis in any position of ICD-9-CM: 728.88: "rhabdomyolysis" and/or ICD-9-CM: 791.3 "myoglobinuria"; plus a diagnosis in any position of ICD-9-CM: 276.5 "volume depletion (dehydration)" and/or ICD-9-CM: 992.0-992.9 "effects of heat" and/or ICD-9-CM: 994.3-994.5 "effects of thirst (deprivation of water)", "exhaustion due to exposure" and "exhaustion due to excessive exertion (overexertion)."

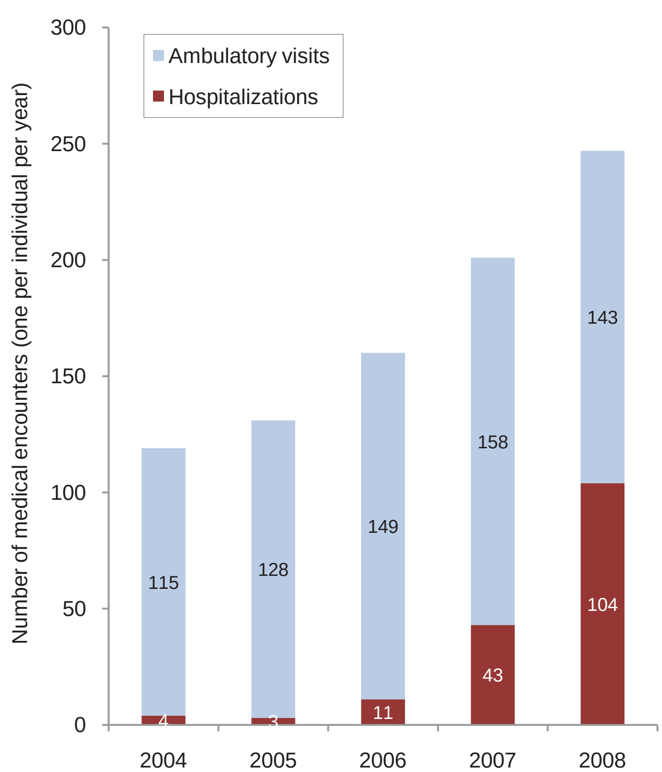
To exclude cases of rhabdomyolysis that were secondary to traumatic injuries, intoxications, or adverse drug reactions, medical encounters with diagnoses in any position of ICD-9-CM: 800-999 "injury, poisoning, toxic effects" (except ICD-9-CM: 992.0-992.9, 994.3-994.5, and 840-848 "sprains and strains of joints and adjacent muscles") were excluded from consideration as "exertional rhabdomyolysis" case defining encounters.

Each individual was included as a case only once per calendar year.

Results:

In 2008, there were 247 diagnoses of rhabdomyolysis likely due to physical exertion and/or heat stress ("presumed exertional rhabdomyolysis") **(Table 1)**. Most service members diagnosed with presumed exertional rhabdomyolysis in 2008 were males (94.7%), in the Army (46.2%) or Marine Corps

Figure 1. Incident diagnoses of presumed exertional rhabdomyolysis, by type of medical encounter and calendar year, active component, U.S. Armed Forces, 2004-2008



(32.4%), enlisted (91.1%), and younger than 25 years old (59.5%). Compared to the racial/ethnic composition of U.S. service members overall, those diagnosed with exertional rhabdomyolysis were more likely to be black (24.3%) or of "other" (19.8%) race/ethnicities **(Table 1)**.

There were more exertional rhabdomyolysis cases diagnosed in 2008 than in any of the previous four years. From 2004 through 2007, approximately 10% of all exertional rhabdomyolysis cases were diagnosed during hospitalizations; however, in 2008, more than 40% of all cases were diagnosed during hospitalizations **(Table 1, Figure 1)**. From 2007 to 2008, the number of cases diagnosed during ambulatory visits decreased, while the number of hospitalized cases more than doubled **(Figure 1)**.

Of service members hospitalized with exertional rhabdomyolysis in 2008 (n=104), approximately 40% were in the Marine Corps (n=42) and one-third in the Army (n=34) **(Table 1)**. Between 2007 and 2008, hospitalized cases increased more than 3-fold in the Marine Corps and approximately doubled in each of the other services **(Figure 2)**.

From 2004 through 2008, exertional rhabdomyoloysis diagnoses increased beginning in March, rose through the spring and summer to a sharp peak in August, and then sharply declined through December. Of all cases, nearly three-fourths were diagnosed from May through September — and nearly one-fifth in August. Since 2004, numbers of hospitalized cases increased through the spring and early summer to a broad peak in July and August and then declined through the fall. **(Figure 3)**.

During the period, 22 medical treatment facilities reported at least 10 cases each of presumed exertional rhabdomyolysis; of these, nine provided medical support to recruit/basic combat training centers **(Table 2)**. Medical facilities at ten installations – six Army and four Navy/Marine Corps – accounted for more than one-half of all incident diagnoses of exertional rhabdomyolysis. The Army medical facilities with the most cases overall were at Fort Bragg, NC (n=99), Fort Benning, GA (n=40), Fort Jackson, SC (n=26), Fort Campbell, KY (n=25) and Fort Knox, KY (n=25); these facilities accounted for one-fourth of all exertional rhabdomyolysis diagnoses among service members. The Navy medical facilities with the most cases overall were at Beaufort, SC (which supports the Marine Corps Recruit Depot, Parris Island) (n=85), Camp Pendleton, CA (n=55), and Camp Lejeune/MCAS Cherry

Table 1. Incident diagnoses of exertional rhabdomyolysis, active component, U.S. Armed Forces, 2008

	Hospitalized		Ambulatory		Total	
	No.	%	No.	%	No.	%
Total	104	100.0	143	100.0	247	100.0
Service						
Army	34	32.7	80	55.9	114	46.2
Navy	10	9.6	9	6.3	19	7.7
Air Force	14	13.5	14	9.8	28	11.3
Marine Corps	42	40.4	38	26.6	80	32.4
Coast Guard	4	3.8	2	1.4	6	2.4
Sex						
Male	102	98.1	132	92.3	234	94.7
Female	2	1.9	11	7.7	13	5.3
Race/ethnicity						
White, non-Hisp	59	56.7	79	55.2	138	55.9
Black, non-Hisp	23	22.1	37	25.9	60	24.3
Other	22	21.2	27	18.9	49	19.8
Age						
<20	21	20.2	24	16.8	45	18.2
20-24	42	40.4	60	42.0	102	41.3
25-29	19	18.3	34	23.8	53	21.5
30-34	7	6.7	10	7.0	17	6.9
35-39	12	11.5	9	6.3	21	8.5
40+	3	2.9	6	4.2	9	3.6
Rank						
Enlisted	89	85.6	136	95.1	225	91.1
Officer	15	14.4	7	4.9	22	8.9
Military occupation						
Combat	19	18.3	40	28.0	59	23.9
Health Care	8	7.7	6	4.2	14	5.7
Other	77	74.0	97	67.8	174	70.4

Figure 2. Hospitalizations for presumed exertional rhabdomyolysis, by Service and calendar year, active component, U.S. Armed Forces, 2004-2008

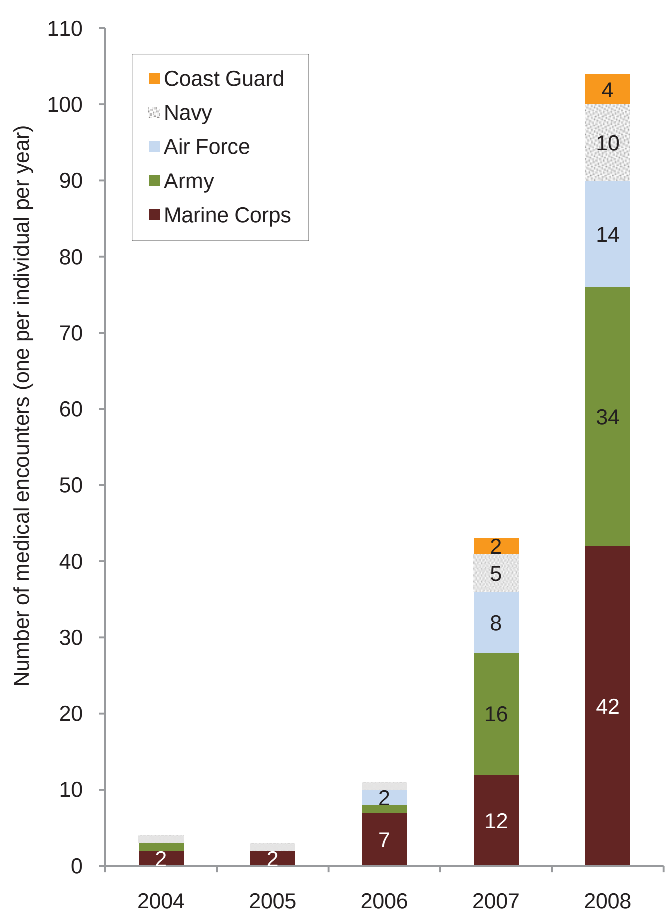


Table 2. Exertional rhabdomyolysis, by installation (among installations with at least 10 cases during the period), active components, U.S. Armed Forces, January 2004-December 2008

Location of diagnosis	Total 2004-2008		2004		2005		2006		2007		2008	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Fort Bragg, NC	99	11.5	6	5.0	10	7.6	11	6.9	21	10.4	51	20.6
Beaufort/Parris Island, SC	85	9.9	7	5.9	14	10.7	21	13.1	23	11.4	20	8.1
Camp Pendleton, CA	55	6.4	7	5.9	11	8.4	11	6.9	6	3.0	20	8.1
Fort Benning, GA	40	4.7	12	10.1	11	8.4	6	3.8	7	3.5	4	1.6
Camp Lejeune/Cherry Point, NC	31	3.6	0	0.0	9	6.9	2	1.3	4	2.0	16	6.5
Fort Jackson, SC	26	3.0	5	4.2	0	0.0	3	1.9	8	4.0	10	4.0
Fort Campbell, KY	25	2.9	8	6.7	3	2.3	2	1.3	8	4.0	4	1.6
Fort Knox, KY	25	2.9	3	2.5	10	7.6	6	3.8	5	2.5	1	0.4
San Diego, CA	25	2.9	7	5.9	5	3.8	2	1.3	7	3.5	4	1.6
Fort Shafter,HI	21	2.4	2	1.7	7	5.3	7	4.4	5	2.5	0	0.0
Lackland AFB, TX	20	2.3	0	0.0	1	0.8	2	1.3	12	6.0	5	2.0
Quantico, VA	17	2.0	4	3.4	1	0.8	5	3.1	2	1.0	5	2.0
Fort Leonard Wood, MO	13	1.5	3	2.5	5	3.8	1	0.6	3	1.5	1	0.4
Fort Lewis, WA	13	1.5	3	2.5	2	1.5	2	1.3	2	1.0	4	1.6
Portsmouth, VA	13	1.5	4	3.4	2	1.5	3	1.9	3	1.5	1	0.4
Fort Belvoir, VA	12	1.4	1	0.8	0	0.0	2	1.3	2	1.0	7	2.8
Okinawa, Japan	12	1.4	3	2.5	1	0.8	2	1.3	5	2.5	1	0.4
Washington, DC	12	1.4	4	3.4	0	0.0	0	0.0	4	2.0	4	1.6
Fort Sill, OK	11	1.3	0	0.0	1	0.8	4	2.5	3	1.5	3	1.2
Great Lakes, IL	11	1.3	1	0.8	3	2.3	5	3.1	2	1.0	0	0.0
Fort Polk, LA	10	1.2	1	0.8	1	0.8	3	1.9	2	1.0	3	1.2
Fort Stewart, GA	10	1.2	3	2.5	0	0.0	1	0.6	1	0.5	5	2.0
Other locations	272	31.7	35	29.4	34	26.0	59	36.9	66	32.8	78	31.6
Total cases	858	100.0	119	100.0	131	100.0	160	100.0	201	100.0	247	100.0

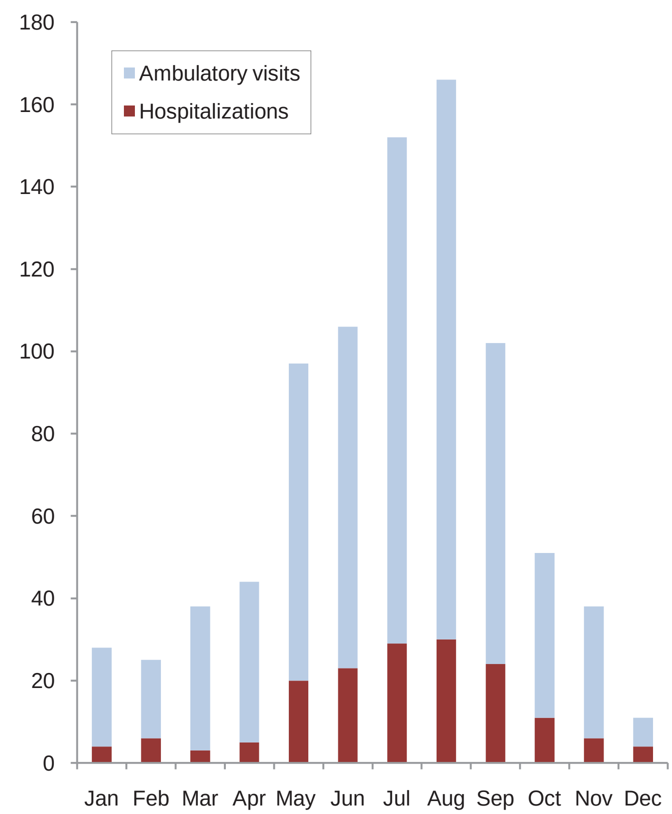
Point, NC (n=31); these facilities accounted for one-fifth of all exertional rhabdomyolysis diagnoses among service members **(Table 2)**.

Finally, during the period, there were 14 spatial-temporal clusters (i.e., 3 or more cases at the same medical facility within 7 days). All of the clusters occurred in July (n=4), August (n=6), or September (n=4). From July-September 2008, there were five clusters of exertional rhabdomyolysis at Fort Bragg, NC; the two largest clusters overall (5 cases each) occurred at Fort Bragg in late July and early September 2008. The three clusters that accurred at Beaufort/Parris Island, SC were they occurred in three different years (August 2005, n=4; September 2006, n=3; August 2007, n=3).

Editorial comment:

The findings of this report should be interpreted with consideration of several limitations. For example, because the diagnostic code specific for "rhabdomyolysis" was not added to the International Classification of Diseases, 9th revision, clinical modifications [ICD-9-CM] until 2004, a complete and consistent record of recent experience is not available. The recency of implementation of a specific diagnostic code makes it difficult to determine if the increase in reported cases of rhabdomyolysis from 2004 through 2008 reflects increasing awareness and use of the code in standardized

Figure 3. Incident diagnoses of presumed exertional rhabdomyolysis, by type of medical encounter and calendar month, 2004-2008



reporting, the continuation of a trend of increasing incidence, or a recent increase in case incidence. Also, the diagnosis of "rhabdomyolysis" does not indicate the cause; in turn, it is difficult to discern cases that are "exertional" and/or heat-related from those with other precipitating causes.

Still, the findings of this analysis are informative and potentially useful for prevention. For example, among U.S. service members, most cases of exertional rhabdomyolysis occur in mid-to-late summer at basic combat/recruit training installations and at the home bases of major Army and Marine Corps combat units. Individuals who suddenly increase overall levels of physical activity and/or increase stress on weight bearing muscles – particularly in high heat and humidity – are at increased risk of exertional rhabdomyolysis. Recruits who are not physically fit when they begin training have relatively high risks of training-related (including exertional heat) injuries, in general. Also, recruits from relatively cool and dry climates may not be acclimated to the high heat and humidity at training camps in mid-late summer. Finally, soldiers and Marines in combat units often conduct rigorous unit physical training, personal fitness training, and field training exercises regardless of weather conditions. It is not surprising, therefore, that recruit camps and installations with large combat units account for most exertional rhabdomyolysis cases.

Also, relative to their counterparts, service members who represent black and other non-white race/ethnic groups have higher rates of exertional rhabdomyolysis during military service. The finding may reflect, at least in part, increased risk of exertional rhabdomyolysis among individuals with sickle cell trait.[4,5] Supervisors at all levels should assure that guidelines to prevent heat injuries are enforced for all service members. They should be vigilant for early signs of exertional heat injuries including rhabdomyolysis among all (particularly, non-white) service members.

The measures that are effective at preventing exertional heat injuries in general are indicated for preventing exertional rhabdomyolysis. Work-rest cycles should be adapted not only to ambient weather conditions but also the fitness levels of participants in strenuous activities. Of particular note, the strenuous physical activities of overweight and/or previously sedentary new recruits – particularly in hot, humid weather – should increase gradually and be closely monitored. Water intake should comply with current guidelines and be closely supervised. Strenuous activities during relatively cool mornings following days of high heat stress should be particularly closely monitored; in the past, such situations have been associated with increased risk of exertional heat injuries (including rhabdomyolysis).[6] Commanders and supervisors at all levels should be aware of and alert for early signs of exertional heat injuries – including rhabdomyolysis – and should aggressively intervene when dangerous conditions, activities, or suspicious illnesses are detected.

Finally, medical care providers should consider exertional rhabdomyolysis in the differential diagnosis when service members – particularly recruits – present with muscular pain, swelling, and limited range of motion after strenuous physical activity, particularly in hot, humid weather. Brown colored urine from increased concentrations of myoglobin in urine is a distinctive clinical sign of rhabdomyolysis.

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Update: Exertional Hyponatremia, U.S. Military Members, 1999-2008

Hyponatremia is defined as abnormally low concentrations of sodium in the blood (serum sodium concentration <135 mEq/L).[1,2] In otherwise healthy young adults, hyponatremia can result from excessive sodium losses in sweat and/or excessive water consumption during prolonged exercise.[1] Although symptomatic hyponatremia occurs infrequently, when it does occur, it is potentially life threatening.[1-3]

Acute hyponatremia creates an osmotic imbalance between fluid outside and inside of cells. In response to the osmotic gradient, water flows from outside to inside the cells of various organs, including the lungs ("pulmonary edema") and brain ("cerebral edema"). Swelling of the brain increases intracranial pressure which can decrease cerebral blood flow and disrupt brain function (e.g., hypotonic encephalopathy, seizures, coma). Without rapid and definitive treatment to relieve increasing intracranial pressure, the brain stem can herniate through the base of the skull which can compromise life sustaining functions controlled by the cardio-respiratory centers of the brain stem.[1-3]

There are many potential causes of hyponatremia, including endocrine, kidney, and neuropsychiatric conditions; prescribed, over the counter, and recreational drugs; and medical errors.[3] However, in otherwise healthy, physically active young adults (e.g., long distance runners, military service members), hyponatremia is often associated with excessive water consumption during prolonged physical exertion ("exertional hyponatremia"), particularly during heat stress.[1-3]

In the summer of 1997, multiple hospitalizations of soldiers for hyponatremia secondary to excessive water consumption during rigorous physical training in hot, humid weather were reported from Army training centers — one case was fatal and several others required intensive medical care.[4] In April 1998, the U.S. Army Research Institute of Environmental Medicine (USARIEM), Natick, Massachusetts, published new guidelines for fluid replacement during military training in heat **(Figure 1)**. The new guidelines were designed to protect service members not only from heat injury but also from hyponatremia due to excessive water consumption. Of note, the guidelines limited fluid intake regardless of heat category or work level to no more than 1½ quarts hourly and 12 quarts daily.[5] There were fewer hospitalizations of soldiers for hyponatremia due to excessive water consumption during the year after compared to before implementation of the new guidelines.[5]

This report defines a new surveillance case definition for exertional hyponatremia that may be useful for routinely and systematically tracking the condition in otherwise healthy U.S. military populations. The definition is used here to summarize the experience in calendar year 2008 and compare it to that in recent years.

Methods:

The surveillance period was 1 January 1999 to 31 December 2008. The surveillance population included all individuals who served in an active component of the U.S. Armed Forces any time during the surveillance period.

For surveillance purposes, a possible case of exertional hyponatremia was defined as a hospitalization or ambulatory visit with a primary (first-listed) diagnosis of "hyposmolality and/or hyponatremia" (ICD-9-CM: 276.1) and no other

Figure 1. Fluid replacement guidelines for warm weather training (applies to average acclimated soldier wearing BDU, hot weather)

Heat Category	WBGT Index, °F	Easy Work: Work / Rest	Easy Work: Water Intake, Qt/hr	Moderate Work: Work / Rest	Moderate Work: Water Intake, Qt/hr	Hard Work: Work / Rest	Hard Work: Water Intake, Qt/hr
1	78-81.9	NL	½	NL	¾	40/20 min	¾
2 (Green)	82-84.9	NL	½	50/10 min	¾	30/30 min	1
3 (Yellow)	85-87.9	NL	¾	40/20 min	¾	30/30 min	1
4 (Red)	88-89.9	NL	¾	30/30 min	¾	20/40 min	1
5 (Black)	> 90	50/10 min	1	20/40 min	1	10/50 min	1

- The work:rest times and fluid replacement volumes will sustain performance and hydration for at least 4 hours of work in the specified heat category. Individual water needs will vary ± ¼ qt/hour.
- NL= no limit to work time per hour.
- Rest means minimal physical activity (sitting or standing), accomplished in shade if possible.
- **CAUTION: Hourly fluid intake should not exceed 1½ quarts.**
- **Daily fluid intake should not exceed 12 quarts.**
- Wearing body armor add 5°F to WBGT Index
- Wearing MOPP overgarment add 10°F to WBGT Index.

Easy Work	Moderate Work	Hard Work
• Walking Hard Surface at 2.5 mph, ≤ 30 lb Load • Weapon Maintenance • Manual of Arms • Marksmanship Training • Drill and Ceremony	• Walking Hard Surface at 3.5 mph < 40 lb Load • Walking Loose Sand at 2.5 mph no Load • Calisthenics • Patrolling • Individual Movement Techniques. i.e. low crawl, high crawl • Defensive Position Construction • Field Assaults	• Walking Hard Surface at 3.5 mph, 2: 40 lb Load • Walking Loose Sand at 2.5 mph with Load

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illness or injury-specific diagnoses (ICD-9-CM: 001-999) in any position; or both "hyposmolality and/or hyponatremia" (ICD-9-CM: 276.1) and at least one of the following within the first three diagnostic positions (dx1-dx3): "fluid overload" (ICD-9-CM: 276.6), "alteration of consciousness" (ICD-9-CM: 780.0), "convulsions" (ICD-9-CM: 780.39), "effects of heat/light" (ICD-9-CM: 992.0-992.9) or "rhabdomyolysis" (ICD-9-CM: 728.88).

Medical encounters were not considered case defining events if they included complicating diagnoses such as alcohol/illicit drug abuse; psychosis, depression, other major mental disorders; endocrine (e.g., pituitary, adrenal) disorders; kidney diseases; cancers; major traumatic injuries; and complications of medical care.

Each individual was included as a case only once per calendar year.

Results:

From 1999 through 2008, there were 730 incident diagnoses of exertional hyponatremia among active service members. During the 10-year surveillance period, the average number of incident cases per year was 73 and the range was 54 (1999) to 96 (2006) **(Table 1).**

In 2008, there were 92 incident diagnoses (incidence rate: 6.5 per 100,000 person-years [p-yrs]) of exertional hyponatremia among active service members. The rate in 2008 was similar to the rates in 2006-2007 but higher than the rates from 1999-2005 **(Table 1, Figure 2).**

In 2008, the incidence rate was highest in the Marine Corps (18.5 per 100,000 p-yrs), lowest in the Navy (3.7 per 100,000 p-yrs), and intermediate in the Army (4.1 per 100,000 p-yrs) and Air Force (6.2 per 100,000 p-yrs) **(Table 1, Figure 3).** The numbers of cases and the rates in both the Marine Corps and Air Force were higher in 2008 than in any of the previous nine years. Rates of exertional hyponatremia in the Marine Corps increased more than 3-fold during the 10-year period, while rates in the Army were relatively stable **(Figure 3).**

Nearly 90% of exertional hyponatremia cases in 2008 were diagnosed among males. Annual incidence rates were higher among males than females in 2008 and 2006; however, rates were higher among females than males in all other years of the period and overall (female-to-male incidence rate ratio: 1.37) **(Table 1).** In 2008, as in most other years of the period, incidence rates were higher among white non-Hispanic than black non-Hispanic or other racial/ethnic subgroup members **(Table 1).**

Table 1. Incident cases and rates* of hyponatremia/overhydration, active component, U.S. Armed Forces, January 1999-December 2008

	Total 1999-2008		1999		2000		2001		2002		2003		2004		2005		2006		2007		2008	
	No.	Rate*	No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate
Total	730	5.2	54	3.9	60	4.3	77	5.5	57	4.0	67	4.6	78	5.4	62	4.4	96	6.9	87	6.2	92	6.5
Service																						
Army	267	5.4	23	4.9	25	5.3	37	7.8	19	4.0	22	4.5	30	6.1	24	4.9	36	7.3	29	5.7	22	4.1
Navy	101	2.8	4	1.1	7	1.9	5	1.4	12	3.2	13	3.5	13	3.5	7	2.0	18	5.2	10	3.0	12	3.7
Air Force	151	4.3	18	5.1	14	4.0	9	2.6	14	3.9	18	4.9	16	4.3	12	3.4	16	4.6	14	4.2	20	6.2
Marine Corps	201	11.3	9	5.3	11	6.4	26	15.2	12	7.0	14	7.9	18	10.2	19	10.7	24	13.5	32	17.5	36	18.5
Coast Guard	10	2.6	0	0.0	3	8.6	0	0.0	0	0.0	0	0.0	1	2.6	0	0.0	2	5.0	2	4.9	2	4.8
Sex																						
Male	593	4.9	41	3.4	48	4.0	58	4.9	45	3.7	53	4.3	64	5.2	51	4.2	84	7.0	67	5.6	82	6.7
Female	137	6.7	13	6.6	12	6.0	19	9.3	12	5.7	14	6.5	14	6.5	11	5.3	12	5.9	20	10.0	10	5.0
Race/ethnicity																						
White, non-Hispanic	505	5.7	33	3.8	38	4.3	52	5.9	38	4.2	46	5.0	59	6.4	41	4.6	69	7.8	64	7.2	65	7.2
Black, non-Hispanic	97	3.8	5	1.8	8	2.9	12	4.4	10	3.7	12	4.5	5	1.9	12	4.9	11	4.7	12	5.2	10	4.3
Other	128	4.8	16	6.2	14	5.8	13	5.4	9	3.5	9	3.4	14	5.1	9	3.3	16	5.7	11	3.9	17	6.0
Age																						
<20	126	11.3	12	10.3	11	8.8	20	15.8	9	7.3	16	13.9	15	13.4	9	9.2	9	9.4	11	11.3	14	13.6
20-24	233	5.0	11	2.6	17	3.9	19	4.2	18	3.8	16	3.2	26	5.2	22	4.6	31	6.5	41	8.7	32	6.7
25-29	120	4.1	13	4.5	14	5.0	15	5.6	10	3.6	6	2.1	10	3.3	7	2.3	20	6.5	9	2.9	16	4.9
30-34	75	3.6	6	2.7	5	2.3	9	4.3	6	2.9	7	3.4	10	4.8	6	2.9	12	6.0	7	3.5	7	3.5
35-39	76	4.1	8	3.8	4	1.9	6	3.0	7	3.6	9	4.8	8	4.4	8	4.6	10	5.8	7	4.1	9	5.3
40+	100	6.8	4	2.9	9	6.6	8	5.6	7	4.7	13	8.5	9	5.8	10	6.5	14	9.3	12	8.2	14	9.8
Military occupation																						
Combat	173	6.0	13	4.6	21	7.5	20	7.1	14	5.0	10	3.5	19	6.5	15	5.0	28	9.6	18	6.1	15	5.0
Health care	64	5.5	7	6.0	3	2.6	7	6.0	11	9.4	9	7.6	4	3.4	7	6.0	4	3.5	3	2.6	9	7.8
Other	493	4.9	34	3.4	36	3.6	50	5.0	32	3.1	48	4.6	55	5.3	40	4.0	64	6.4	66	6.7	68	6.8

*Rate per 100,000 person-years

In 2008, as in previous years, the highest rates were among the youngest (incidence rate, <20 years old: 13.6 per 100,000 p-yrs) and oldest (incidence rate, >39 years old: 9.8 per 100,000 p-yrs) service members **(Table 1)**. Of note, the overall rate of hyponatremia was approximately seven times higher among recruits than non-recruits (data not shown).

During the 10-year period, exertional hyponatremia cases were diagnosed at more than 150 medical facilities. However, the medical facilities of just 15 locations reported at least 12 cases each and accounted for approximately one-half of the total. The five locations with the most cases overall were MCRD Parris Island/Beaufort, SC (n=84), Fort Benning, GA (n=56), MCB Camp Lejeune/Cherry Point, NC (n=31), Fort Bragg, NC (n=23) and Lackland AFB, TX (n=20) **(Table 2)**.

Finally, during the period, there were 11 spatial-temporal clusters (i.e., three or more cases at the same medical facility with 7 days). All clusters occurred in June (n=3), July (n=5), or August (n=3). In 2008, there were four clusters of exertional hyponatremia — at MCRD Parris Island, SC, in June (n=2) and at MCB Quantico, VA, in June and July. Six cases on 12-13 June 2008 at MCRD Parris Island, SC, was the largest cluster of exertional hyponatremia cases during the 10-year period.

Editorial comment:

This report suggests that the incidence of exertional hyponatremia among U.S. service members was higher in 2008 than in any but one (2006) of the previous 10 years. The results, however, must be interpreted with consideration of several limitations. For example, there is not a diagnostic code specific for "exertional hyponatremia." Thus, for surveillance purposes, we ascertain cases by identifying all medical encounters that include the diagnosis of "hyposmolality and/or hyponatremia" but not concurrent diagnoses indicative of conditions that may have caused or significantly increased risk of hyponatremia (e.g., metabolic, renal, psychiatric conditions; medical treatment). The results should be considered estimates of the true incidence of symptomatic exertional hyponatremia from excessive water consumption among U.S. service members. However, the use of a standard case definition for surveillance purposes enables routine and systematic tracking of incidence trends, correlates of risk, and high risk locations and settings over time. Such tracking should be useful for assessing the effectiveness of current policies and practices regarding heat injury and exercise-associated hyponatremia prevention.

In years prior to 2008, incidence rates of hyponatremia were often higher among females than males (the increased risk among females may account, at least in part, for the higher rates among service members in health care professions). In a recent review of clinical aspects of hyponatremia, Lien and Shapiro reported that, at similar levels of hyponatremia, women may be more likely than men to develop clinically significant hyponatremic injury (e.g., cerebral/pulmonary edema, encephalopathy, permanent brain injury).[3] The authors suggest that female sex hormones may be determinants of the increased risk.[3]

Figure 2. Incident diagnoses of hyponatremia (presumably caused by excessive water consumption during physical exertion/heat stress), active component, U.S. service members, 1999-2008

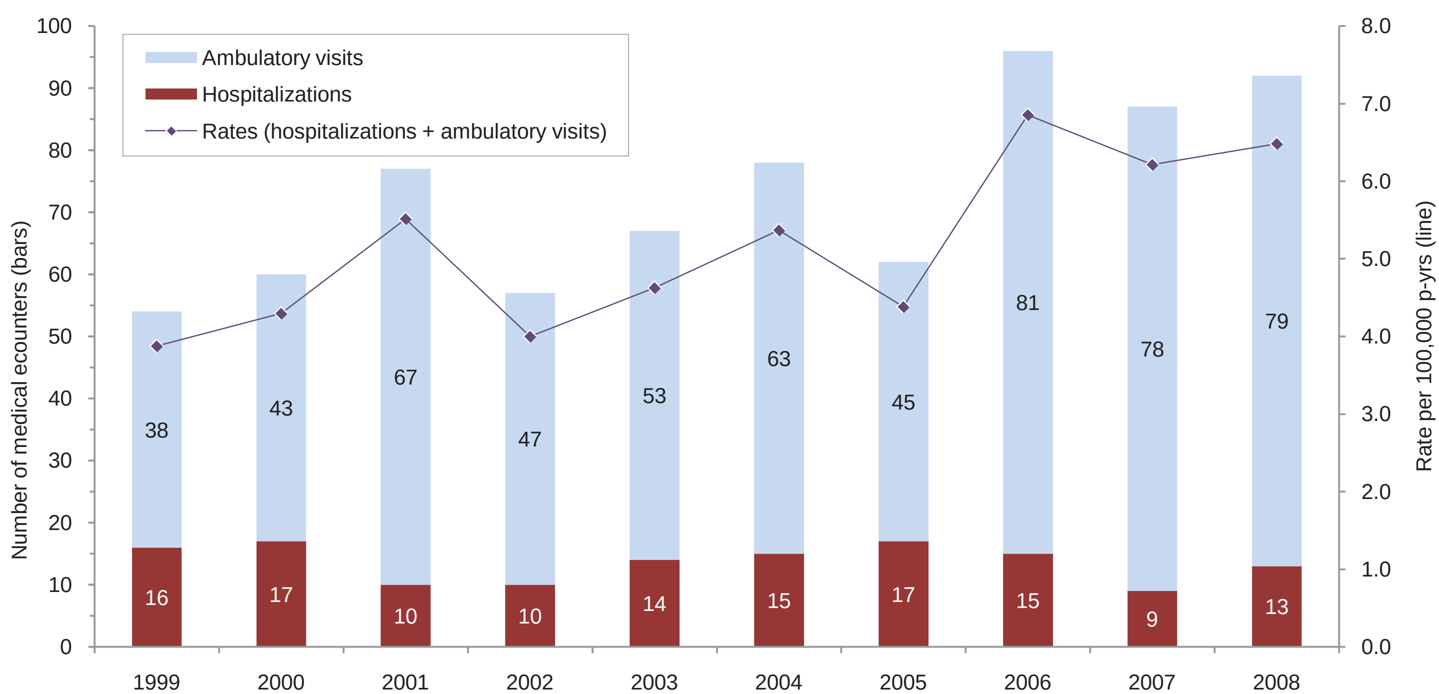
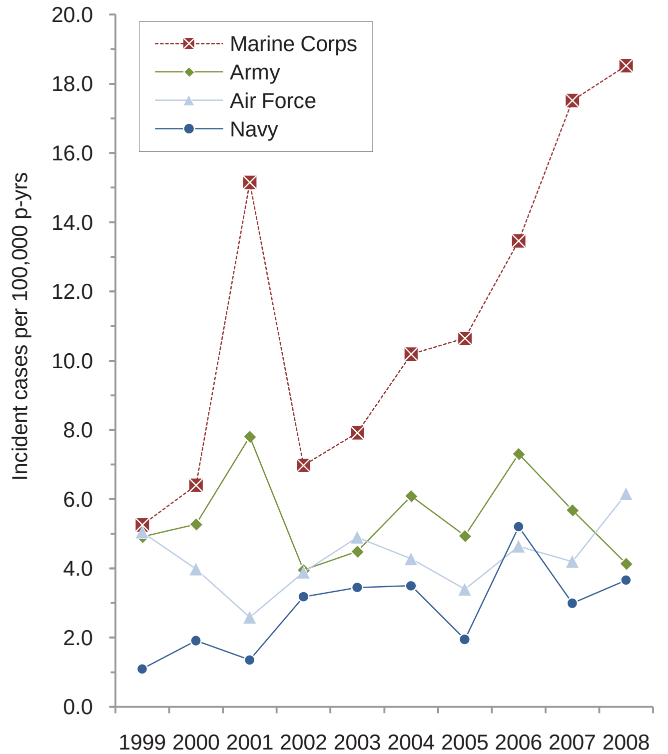


Table 2. Hypernatremia/overhydration by location of diagnosis/report, active components, U.S. Armed Forces, 1999-2008

Medical facility location	1999-2008	
	No.	% of total
MCRD Parris Island/Beaufort, SC	84	11.51
Fort Benning, GA	56	7.67
MCB Camp Lejeune/Cherry Point, NC	31	4.25
Fort Bragg, NC	23	3.15
Lackland AFB, TX	20	2.74
San Diego, CA	19	2.60
MCB Quantico, VA	18	2.47
NMC Portsmouth, VA	17	2.33
MCB Camp Pendleton, CA	15	2.05
Fort Leonard Wood, MO	14	1.92
Fort Shafter, HI	13	1.78
NNMC Bethesda, MD	12	1.64
Fort Jackson, SC	12	1.64
Fort Sam Houston, TX	12	1.64
NAS/NH Pensacola, FL	12	1.64
Fort Sill, OK	11	1.51
Keesler AFB, MS	11	1.51
Andrews AFB, MD	10	1.37
Fort Gordon, GA	10	1.37
Fort Knox, KY	10	1.37
NH Okinawa et al, Japan	10	1.37
Walter Reed AMC et al/Washington, DC	10	1.37
All others	300	41.10
Total	**730**	**100.00**

Figure 3. Incidence rates of hyponatremia (presumably caused by excessive water consumption during physical exertion/heat stress), by Service, active component, U.S. service members, 1999-2008



In the past, concerns regarding hyponatremia from excessive water consumption were focused at training – particularly basic combat training – installations. Not surprisingly, in this analysis, the highest rates were among the youngest – hence, the most junior – service members; and the most cases were diagnosed at medical facilities in the south-east and south-central United States that support Army (Fort Benning, GA), Marine Corps (Parris Island, SC), and Air Force (Lackland AFB, TX) recruit training; Army airborne and Ranger training (Fort Benning, GA), and Army special operations training (Fort Bragg, NC). In many circumstances (e.g., recruit training, Ranger School), military trainees conduct the activities prescribed by their training schedules – regardless of the weather conditions. In hot, humid weather, commanders, supervisors, instructors, and medical support staffs must be aware of and enforce guidelines for work-rest cycles and water consumption.

In regard to hyponatremia, service members and their supervisors must be knowledgeable of the dangers of excessive water consumption and the prescribed limits for water intake **(Figure 1)** during prolonged physical activity in hot, humid weather – during military activities, personal fitness training, and recreational activities. Service members (particularly trainees) and their supervisors must be vigilant for early signs of heat-related illnesses – and immediately and appropriately– not excessively – intervene in such cases.

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Update: Deployment Health Assessments, U.S. Armed Forces, February 2009

The force health protection strategy of the U.S. Armed Forces is designed to deploy healthy, fit, and medically ready forces, to minimize illnesses and injuries during deployments, and to evaluate and treat physical and psychological problems (and deployment-related health concerns) following deployment.

In 1998, the Department of Defense initiated health assessments of all deployers prior to and after serving in major operations outside of the United States.[1] In March 2005, the Post-Deployment Health Reassessment (PDHRA) program was begun to identify and respond to health concerns that persisted until or emerged within three to six months after returning from deployment.[2]

This report summarizes responses to selected questions on deployment health assessments completed since 2003. In addition, it documents the natures and frequencies of changes in responses from pre-deployment to post-deployment.

Methods:

Completed deployment health assessment forms are transmitted to the Armed Forces Health Surveillance Center (AFHSC) where they are incorporated into the Defense Medical Surveillance System (DMSS).[3] In the DMSS, data recorded on health assessment forms are integrated with data that document demographic and military characteristics and medical encounters (e.g. hospitalizations, ambulatory visits) at fixed military and other (contracted care) medical facilities of the Military Health System. For this analysis, DMSS was searched to identify all pre (DD2795) and post (DD2796) deployment health assessment forms completed since 1 January 2003 and all post-deployment health reassessment (DD2900) forms completed since 1 August 2005.

Results:

During the 12-month period from March 2008 to February 2009, there were 391,939 pre-deployment health assessments, 363,960 post-deployment health assessments, and 300,939 post-deployment health reassessments completed at field sites, forwarded to the Armed Forces Health Surveillance Center, and archived in the Defense Medical Surveillance System **(Table 1)**.

Between January 2003 and February 2009, there were peaks and troughs in the numbers of pre-deployment and post-deployment health assessments that generally corresponded to times of departure and return of large numbers of deployers **(Figure 1)**. Since April 2006, the numbers of post-deployment health reassessments (PDHRA) completed per month have fluctuated in a range between approximately 16,000 and 36,000 **(Figure 1, Table 1)**.

From March 2008 to February 2009, nearly three-fourths (73.2%) of deployers rated their "health in general" as "excellent" or "very good" during pre-deployment health assessments. Smaller proportions of returned deployers rated their health as "excellent" or "very good" during post-deployment assessments (58.3%) and post-deployment reassessments (54.2%). There were increases in the proportions of deployers who rated their health as "fair" or "poor" from pre-deployment to post-deployment and from

Figure 1. Total deployment health assessment and reassessment forms, by month, U.S. Armed Forces, January 2003-February 2009

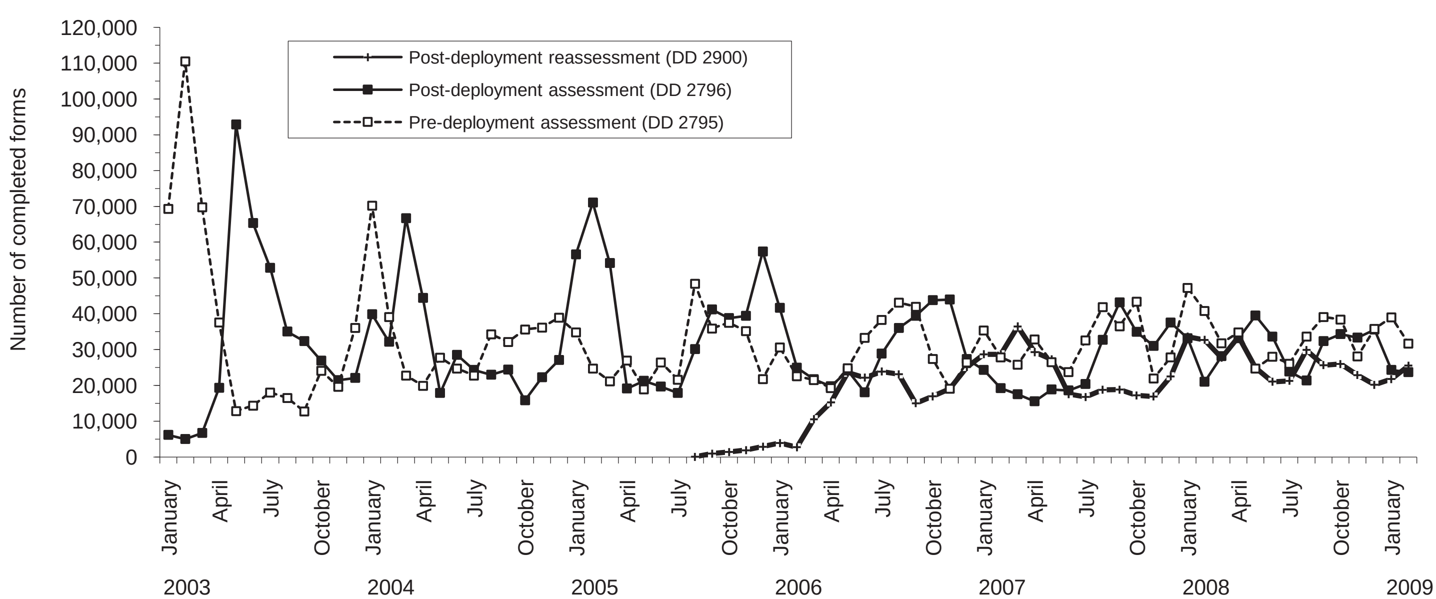


Table 1. Deployment-related health assessment forms, by month, U.S. Armed Forces, March 2008-February 2009

	Pre-deployment assessment DD2795		Post-deployment assessment DD2796		Post-deployment reassessment DD2900	
	No.	%	No.	%	No.	%
Total	**391,939**	**100**	**363,960**	**100**	**300,939**	**100**
2008						
March	31,799	8.1	28,256	7.8	27,771	9.2
April	34,880	8.9	33,209	9.1	33,661	11.2
May	24,796	6.3	39,534	10.9	25,008	8.3
June	28,101	7.2	33,700	9.3	21,069	7.0
July	26,097	6.7	23,893	6.6	21,326	7.1
August	33,756	8.6	21,402	5.9	29,929	9.9
September	39,183	10.0	32,405	8.9	25,687	8.5
October	38,490	9.8	34,361	9.4	26,006	8.6
November	28,149	7.2	33,376	9.2	22,926	7.6
December	35,846	9.1	35,651	9.8	20,200	6.7
2009						
January	39,108	10.0	24,387	6.7	21,810	7.2
February	31,734	8.1	23,786	6.5	25,546	8.5

immediate post-deployment to 3-6 months after returning. For example, prior to deploying, less than one of 40 (2.6%) deployers rated their health as "fair" or "poor"; upon returning from deployment, one of 14 (8.7%) deployers rated their health as "fair" or "poor"; and 3-6 months after returning, one of 7 (13.1%) deployers rated their health as "fair" or "poor" **(Figure 2)**.

In the past 12 months, the proportion of deployers who assessed their general health as "fair" or "poor" was consistently low before deployment (mean, by month: 2.6%), higher at return from deployment (mean, by month: 8.7%), and highest 3-6 months after return from deployment (mean, by month: 12.9%) **(Figure 3)**. There was relatively little variability in the proportions of deployers who rated their health as "fair" or "poor" on pre-deployment and post-deployment reassessment questionnaires **(Figure 3)**. However, the proportions of deployers who rated their health as "fair" or "poor" on the post-deployment questionnaire generally increased during the year from less then 7% in March 2008 to nearly 11% in November 2008 **(Figure 3)**. Of deployers who completed health assessments both prior to and 3-6 months after returning from deployment, nearly one of 6 (15.3%) indicated significant declines (i.e., change of 2 or more categories on a 5-category scale) in their perceived general health states between the assessments **(Figure 4)**.

In general, on post-deployment assessments and reassessments, deployers in the Army and in Reserve components were more likely than their respective counterparts to report health and exposure-related concerns. Among Reserve component members of the Army and Marine Corps, health and exposure-related concerns and indications for referrals were much greater 3-6 months after return from deployment (DD2900) than at the time of return deployment (DD2796). Of note, at the time of return, active component soldiers were the most likely of all deployers to receive mental health referrals; however, 3-6 months after returning, Reserve component members of the Army and

Figure 2. Percent distributions of self-assessed health status as reported on deployment health assesment forms, U.S. Armed Forces, March 2008-February 2009

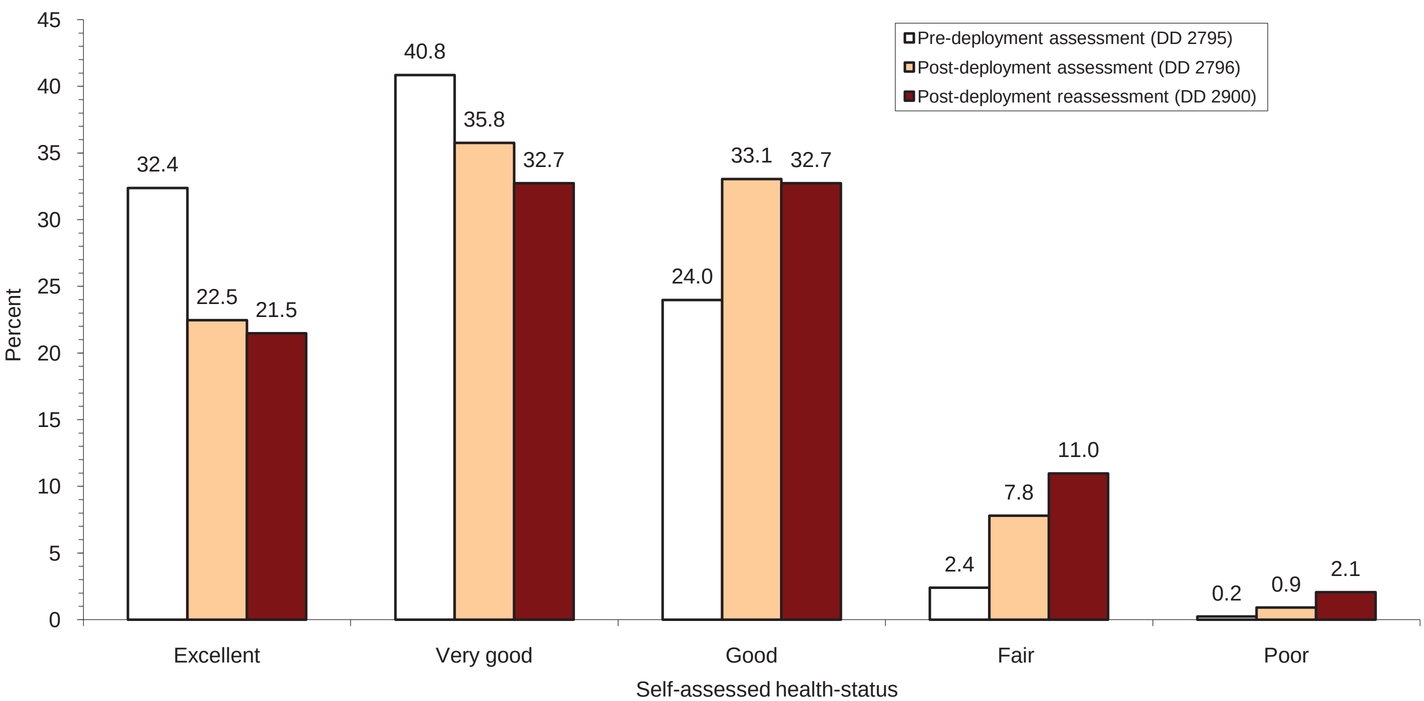
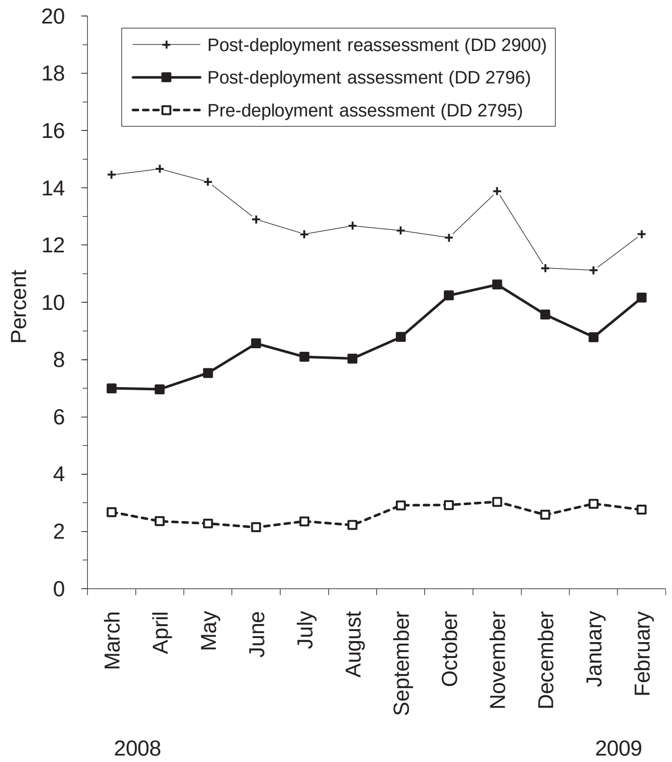


Figure 3. Proportion of deployment health assessment forms with self-assessed health status as “fair” or “poor”, U.S. Armed Forces, March 2008-February 2009



Marine Corps were the most likely of all deployers to receive mental health referrals **(Table 2, Figures 5,6)**.

Finally, in general, soldiers and Reserve component members were more likely than their respective counterparts to report “exposure concerns”; and both active and Reserve component members were more likely to report “exposure concerns” 3-6 months after compared to the time of return from deployment **(Table 2, Figures 6,7)**.

Editorial comment:

A consistent finding of deployment-related health assessments is that deployers rate their general health worse when they return from deployment compared to before deploying, regardless of the Service or component. Deployments are inherently physically and psychologically demanding; and there are more – and more significant – threats to the physical and mental health of service members when they are conducting combat operations away from their families in hostile environments compared to when serving at their permanent duty stations (active component) or when living in their civilian communities (Reserve component).

Another consistent finding of deployment-related health surveillance is that, as a group, returned service members rate their general health worse and are more likely to report exposure concerns 3-6 months after returning from deployment compared to the time of return. Symptoms of post deployment stress disorder (PTSD) may emerge or worsen within several months after a life threatening experience (such as military service in a war zone). PTSD among U.S. veterans of combat duty in Iraq has been associated with higher rates of physical health problems after return from deployment.[4] Among British veterans of the Iraq war, Reservists reported more “ill health” than their active counterparts. Roles, traumatic experiences, and unit cohesion while deployed were associated with medical outcomes after

Figure 4. Proportion of service members whose self-assessed health status improved (“better”) or declined (“worse”) (by 2 or more categories on 5-category scale) from pre-deployment to reassessment, by month, U.S. Armed Forces, March 2008-February 2009

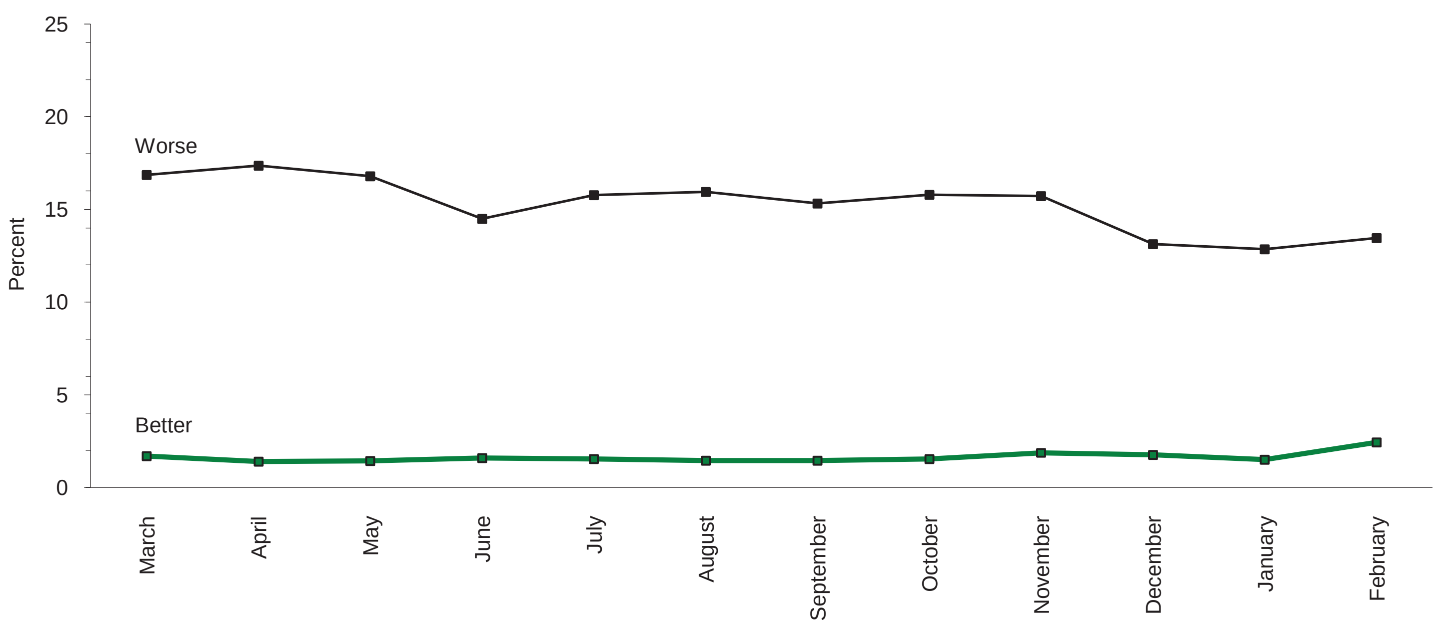


Table 2. Percentage of service members who endorsed selected questions/received referrals on health assessment forms, U.S. Armed Forces, March 2008-February 2009

	Army			Navy			Air Force			Marine Corps			All service members		
	Pre-deploy DD2795	Post-deploy DD2796	Reassess DD2900	Pre-deploy DD2795	Post-deploy DD2796	Reassess DD2900	Pre-deploy DD2795	Post-deploy DD2796	Reassess DD2900	Pre-deploy DD2795	Post-deploy DD2796	Reassess DD2900	Pre-deploy DD2795	Post-deploy DD2796	Reassess DD2900
Active component	n= 141,569	n= 127,161	n= 111,749	n= 12,234	n= 16,558	n= 12,799	n= 58,455	n= 52,273	n= 50,716	n= 18,188	n= 36,635	n= 33,406	n= 230,446	n= 232,627	n= 208,670
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
General health "fair" or "poor"	4.2	10.9	16.2	1.5	4.8	6.3	0.5	3.6	4.4	1.8	6.1	9.3	2.9	8.0	11.6
Health concerns, not wound or injury	13.1	24.9	31.5	4.5	14.2	15.1	1.6	6.9	12.4	3.3	12.9	20.5	9.0	18.2	24.1
Health worse now than before deployed	na	5.4	28.2	na	0.2	13.9	na	1.4	9.4	na	0.3	18.8	na	3.3	21.2
Exposure concerns	na	18.8	23.6	na	14.9	14.9	na	10.4	15.8	na	10.6	18.6	na	15.4	20.4
PTSD symptoms (2 or more)	na	12.0	16.9	na	4.7	7.7	na	2.6	3.0	na	4.3	9.5	na	8.1	11.8
Depression symptoms (any)	na	7.5	37.2	na	0.3	25.8	na	1.4	15.4	na	0.8	32.3	na	4.6	30.4
Referral indicated by provider (any)	5.4	33.7	23.2	5.5	22.4	15.6	1.6	11.5	7.9	4.2	20.2	22.2	4.4	25.8	18.9
Mental health referral indicated*	1.4	8.7	7.0	0.8	3.9	6.0	0.5	1.2	2.2	0.3	2.4	5.0	1.1	5.7	5.5
Medical visit following referral†	98.4	98.3	97.2	91.0	76.9	91.5	77.8	94.7	96.5	75.7	69.9	73.0	92.5	92.9	91.4
	Army			Navy			Air Force			Marine Corps			All service members		
	Pre-deploy DD2795	Post-deploy DD2796	Reassess DD2900	Pre-deploy DD2795	Post-deploy DD2796	Reassess DD2900	Pre-deploy DD2795	Post-deploy DD2796	Reassess DD2900	Pre-deploy DD2795	Post-deploy DD2796	Reassess DD2900	Pre-deploy DD2795	Post-deploy DD2796	Reassess DD2900
Reserve component	n= 75,109	n= 63,859	n= 61,309	n= 2,485	n= 4,212	n= 6,409	n= 15,805	n= 14,955	n= 16,473	n= 1,706	n= 4,551	n= 4,803	n= 95,105	n= 87,577	n= 88,994
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
General health "fair" or "poor"	2.1	10.8	19.2	0.4	8.4	9.5	0.3	4.8	4.8	0.8	9.0	9.8	1.7	9.6	15.3
Health concerns, not wound or injury	13.1	36.9	50.2	2.7	27.3	30.6	0.7	10.7	13.6	2.9	25.8	35.2	10.6	31.4	41.2
Health worse now than before deployed	na	11.5	37.4	na	0.6	23.1	na	1.8	10.3	na	0.3	25.0	na	8.7	30.7
Exposure concerns	na	25.5	35.8	na	34.5	27.4	na	16.4	20.7	na	20.2	28.5	na	24.1	32.0
PTSD symptoms (2 or more)	na	11.2	25.0	na	5.2	10.8	na	2.0	2.6	na	4.8	13.8	na	9.0	19.2
Depression symptoms (any)	na	11.2	39.8	na	0.5	26.0	na	1.2	13.9	na	0.3	32.6	na	8.4	33.6
Referral indicated by provider (any)	4.4	33.6	33.4	3.3	29.1	18.1	0.7	14.3	5.6	5.4	35.6	30.6	3.8	30.2	27.0
Mental health referral indicated*	0.5	5.0	12.2	0.4	3.1	4.7	0.0	0.7	0.9	0.2	2.8	9.7	0.4	4.1	9.4
Medical visit following referral†	96.6	97.9	28.9	86.8	89.5	39.9	53.3	63.4	38.5	74.6	58.7	24.4	94.2	90.3	29.3

*Includes behavioral health, combat stress and substance abuse referrals.
†Record of inpatient or outpatient visit within 6 months after referral

Figure 5. Percent of deployers with mental or behavioral health referrals, by Service and component, by timing of health assessment, U.S. Armed Forces, March 2008-February 2009

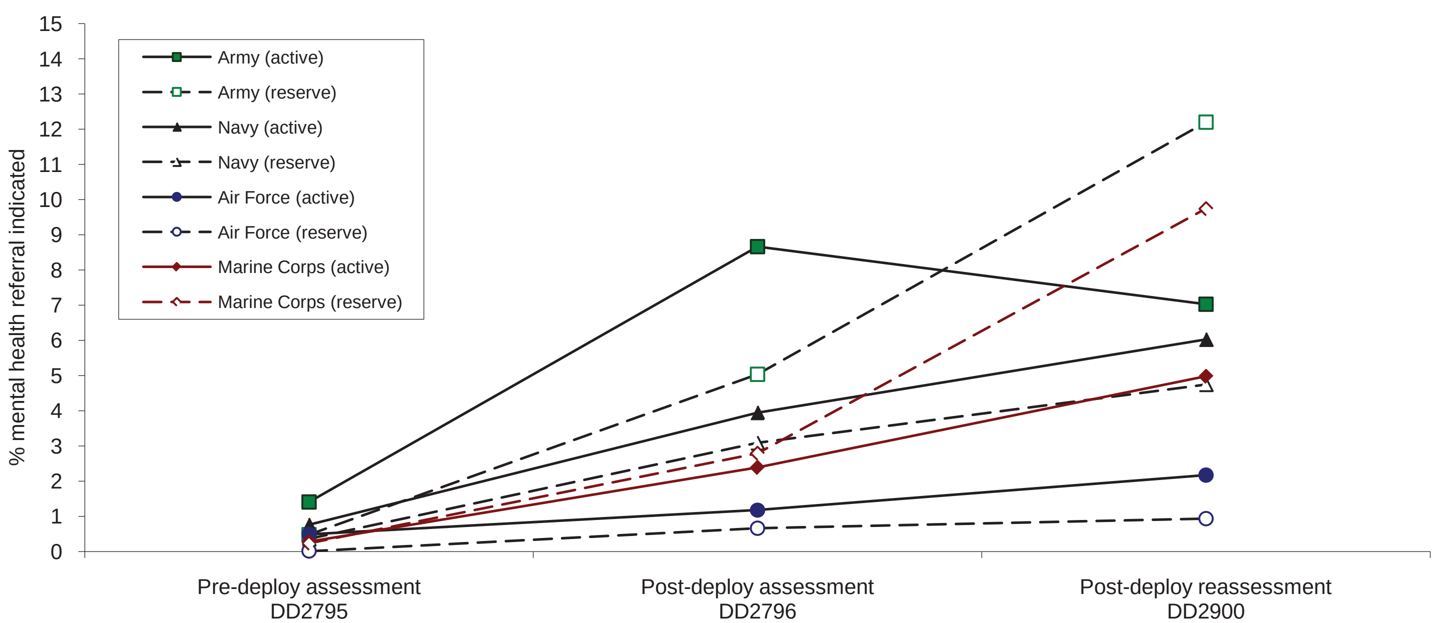


Figure 6. Ratio of percents of deployers who endorse selected questions, Reserve versus active component, on pre-deployment health assessments (DD2795) and post-deployment health reassessments (DD2900), U.S. Armed Forces, March 2008-February 2009

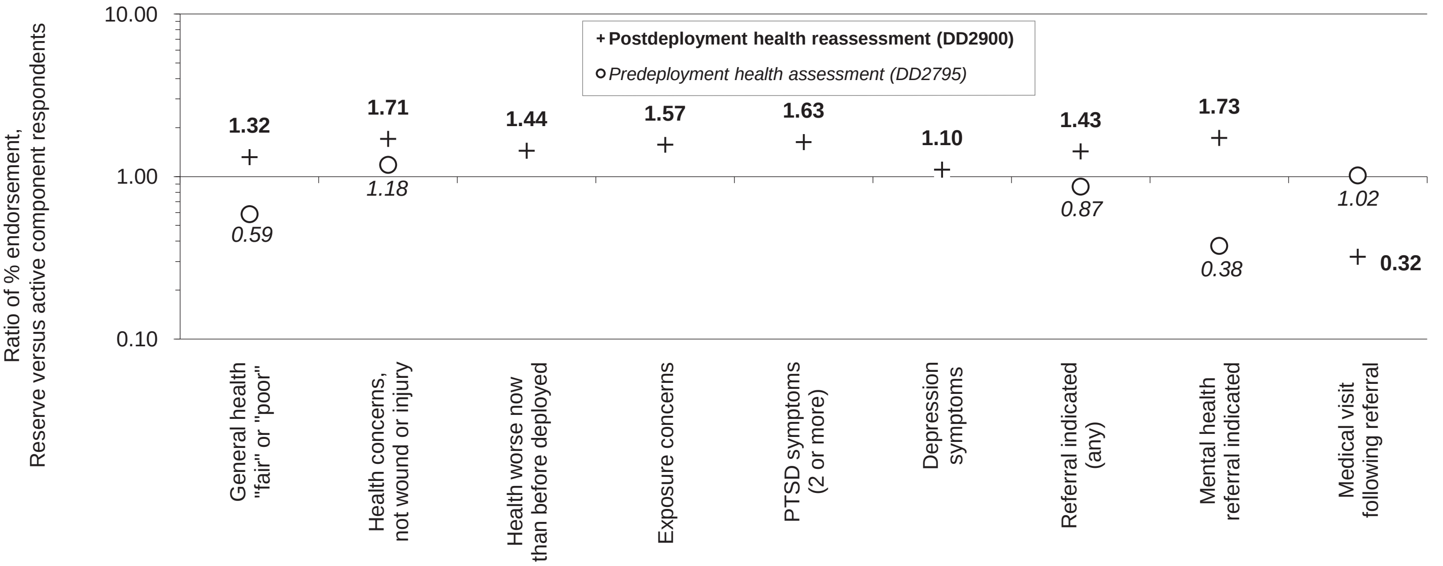
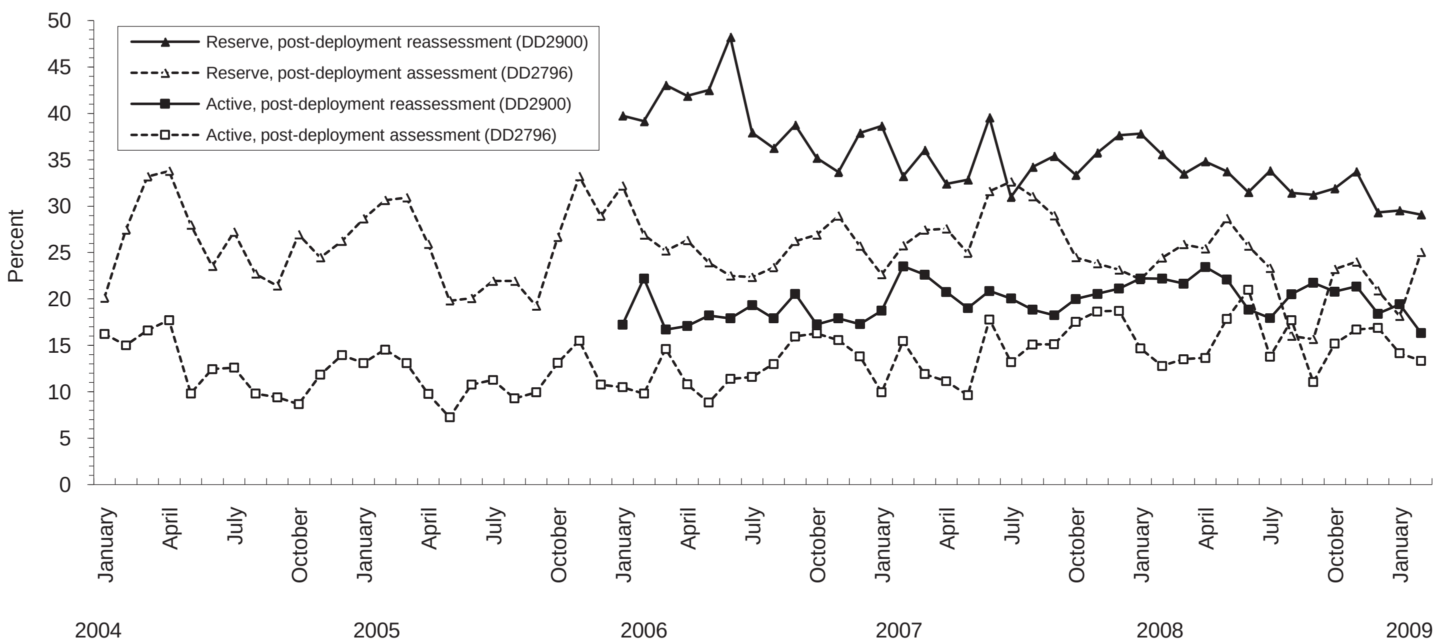


Figure 7. Proportion of service members who endorse exposure concerns on post-deployment health assessments, U.S. Armed Forces, January 2004-February 2009



returning; however, PTSD symptoms were more associated with problems at home (e.g., reintegration into family, work, and other aspects of civilian life) than with events in Iraq.[5]

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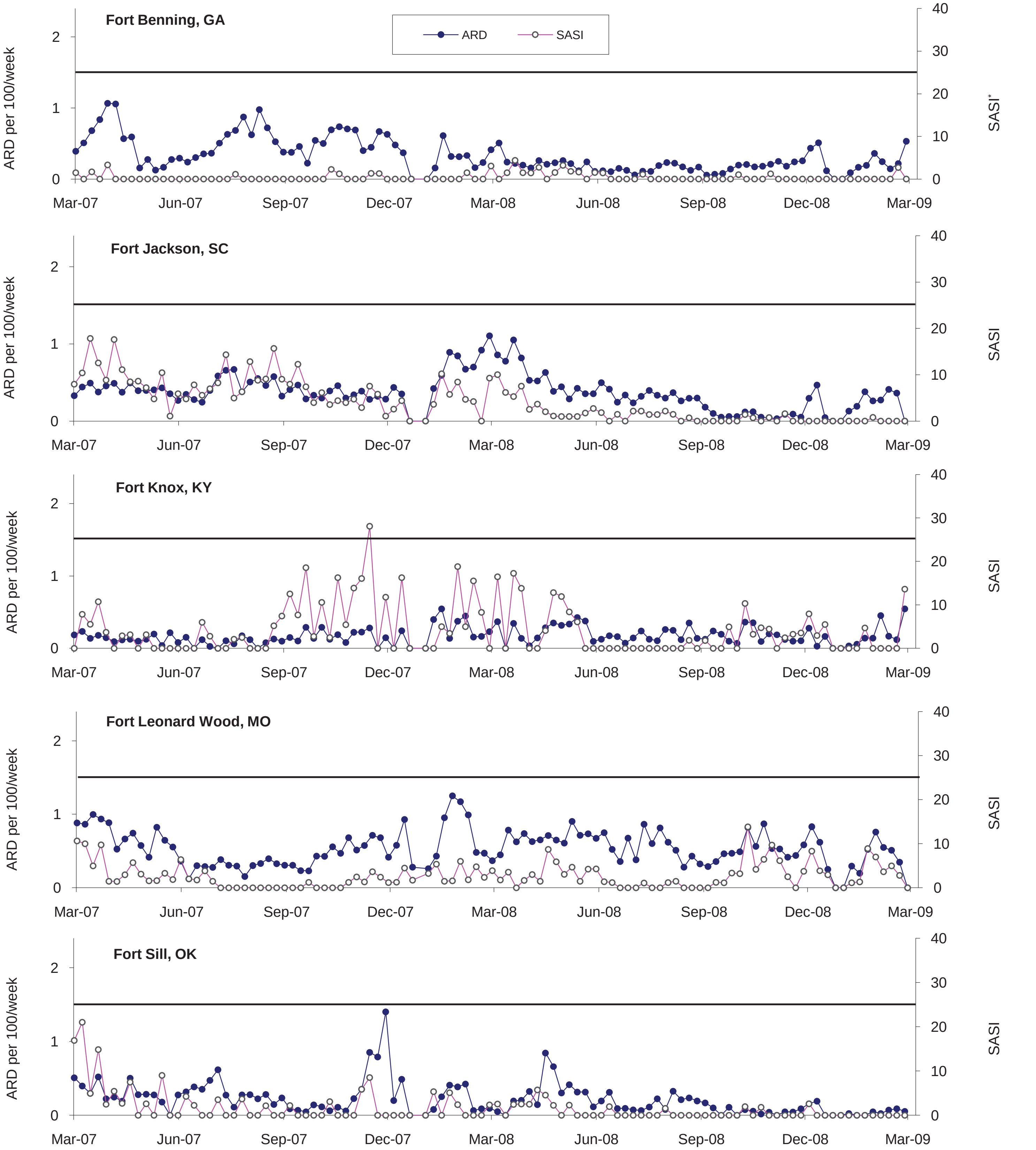
Acute respiratory disease (ARD) and streptococcal pharyngitis rates (SASI*), basic combat training centers, U.S. Army, by week, March 2007-March 2009



* Streptococcal-ARD surveillance index (SASI) = ARD rate x % positive culture for group A streptococcus
ARD rate = cases per 100 trainees per week
ARD rate ≥ 1.5 or SASI ≥ 25.0 for 2 consecutive weeks are surveillance indicators of epidemics

Sentinel reportable events for service members and beneficiaries at U.S. Army medical facilities, cumulative numbers* for calendar years through 29 February 2008 and 28 February 2009

Army

Reporting locations	Number of reports all events†		Food-borne								Vaccine preventable					
			Campylobacter		Giardia		Salmonella		Shigella		Hepatitis A		Hepatitis B		Varicella	
	2008	2009	2008	2009	2008	2009	2008	2009	2008	2009	2008	2009	2008	2009	2008	2009
NORTH ATLANTIC																
Washington, DC Area	89	89	.	.	1	.	.	.	.	.	.	.	.	.	4	.
Aberdeen, MD	0	10	.	.	.	.	.	.	.	.	.	.	.	.	.	.
FT Belvoir, VA	44	51	.	2	.	.	.	.	.	.	.	.	.	.	.	.
FT Bragg, NC	303	292	.	.	.	.	2	3	.	.	.	.	.	2	.	.
FT Drum, NY	73	9	.	.	.	.	.	.	.	.	.	.	.	.	.	.
FT Eustis, VA	270	34	.	.	.	.	.	.	.	.	.	.	.	.	.	.
FT Knox, KY	241	28	1	.	.	.	.	.	.	.	.	.	.	.	.	.
FT Lee, VA	72	130	.	.	.	.	.	.	.	.	.	.	.	.	.	.
FT Meade, MD	123	25	.	.	.	.	.	.	.	.	.	.	.	.	.	.
West Point, NY	9	17	.	.	.	.	.	.	.	.	.	.	.	.	.	.
GREAT PLAINS																
FT Sam Houston, TX	240	163	.	.	.	.	1	.	1	.	.	.	.	.	.	.
FT Bliss, TX	104	161	.	.	.	.	1	.	.	1	.	.	.	5	.	.
FT Carson, CO	194	126	.	1	.	.	1	.	.	.	.	.	.	.	.	.
FT Hood, TX	218	369	.	1	.	.	3	2	1	1	.	.	.	.	.	.
FT Huachuca, AZ	10	13	.	.	.	.	.	.	.	.	.	.	.	.	.	.
FT Leavenworth, KS	7	12	.	.	.	.	.	.	.	.	.	.	.	.	.	.
FT Leonard Wood, MO	232	102	.	.	1	.	1	.	.	.	.	.	1	.	.	.
FT Polk, LA	28	59	.	.	.	1	.	.	.	.	.	.	.	.	1	.
FT Riley, KS	165	109	.	.	.	.	.	1	.	.	.	.	.	.	.	.
FT Sill, OK	77	71	.	.	.	.	.	.	.	1	.	.	.	.	.	.
SOUTHEAST																
FT Gordon, GA	251	164	.	.	.	.	1	.	.	.	.	.	.	.	.	.
FT Benning, GA	71	32	.	.	.	.	.	.	.	.	.	.	.	.	.	.
FT Campbell, KY	74	24	.	.	.	.	.	1	.	.	.	.	.	.	.	.
FT Jackson, SC	30	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.
FT Rucker, AL	12	14	.	.	.	.	.	.	.	.	.	.	.	.	.	.
FT Stewart, GA	144	171	.	.	1	.	2	.	.	.	.	.	2	.	.	.
WESTERN																
FT Lewis, WA	191	252	.	1	.	.	.	.	.	.	.	.	.	.	.	.
FT Irwin, CA	0	14	.	.	.	.	.	.	.	1	.	.	.	.	.	.
FT Wainwright, AK	0	43	.	.	.	.	.	.	.	.	.	.	.	.	.	.
PACIFIC																
Hawaii	141	134	3	3	1	.	3	1	.	.	.	.	.	.	.	.
Japan	14	3	1	.	.	.	.	.	.	.	.	.	.	.	.	.
Korea	98	97	.	.	.	.	.	.	.	.	.	.	.	.	1	.
OTHER LOCATIONS																
Germany	334	385	3	3	1	.	1	1	.	.	.	.	4	.	.	1
Unknown	0	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Total	**3,859**	**3,203**	**8**	**11**	**5**	**1**	**16**	**9**	**2**	**4**	**0**	**0**	**7**	**7**	**6**	**1**

*Events reported by February 7, 2008 and 2009

†Seventy medical events/conditions specified by Tri-Service Reportable Events Guidelines and Case Definitions, May 2004.

Note: Completeness and timeliness of reporting vary by facility.

Sentinel reportable events for service members and beneficiaries at U.S. Army medical facilities, cumulative numbers* for calendar years through 29 February 2008 and 28 February 2009

Army

Reporting location	Arthropod-borne				Sexually transmitted								Environmental			
	Lyme disease		Malaria		Chlamydia		Gonorrhea		Syphilis‡		Urethritis§		Cold		Heat	
	2008	2009	2008	2009	2008	2009	2008	2009	2008	2009	2008	2009	2008	2009	2008	2009
NORTH ATLANTIC																
Washington, DC Area	1	2	.	.	22	30	7	3	2	4	.	.	.	.	.	.
Aberdeen, MD	.	.	.	.	.	2	.	1	.	.	.	.	.	.	.	.
FT Belvoir, VA	.	.	.	.	16	39	.	6	.	.	.	.	.	.	.	.
FT Bragg, NC	.	.	.	.	172	231	42	39	1	.	15	6	.	1	.	.
FT Drum, NY	3	.	.	.	40	3	8	2	.	.	.	.	.	.	.	.
FT Eustis, VA	.	.	.	.	57	29	2	5	.	.	.	.	.	.	.	.
FT Knox, KY	.	.	.	.	30	24	9	4	.	.	.	.	.	.	.	.
FT Lee, VA	.	1	.	.	40	113	24	16	1	.	.	.	.	.	.	.
FT Meade, MD	.	.	.	.	7	11	.	.	.	.	.	.	.	.	.	.
West Point, NY	3	2	.	.	5	5	.	.	.	.	.	.	.	.	.	.
GREAT PLAINS																
FT Sam Houston, TX	.	.	.	.	38	84	9	16	2	1	.	.	1	.	.	.
FT Bliss, TX	.	.	.	.	47	71	12	10	.	1	.	.	.	.	.	.
FT Carson, CO	.	.	.	.	77	94	10	7	.	.	7	.	.	1	.	.
FT Hood, TX	.	.	.	.	111	201	24	53	.	1	5	25	.	.	.	.
FT Huachuca, AZ	.	.	.	.	8	9	2	.	.	.	.	.	.	.	.	.
FT Leavenworth, KS	.	.	.	.	7	8	.	3	.	1	.	.	.	.	.	.
FT Leonard Wood, MO	.	.	.	.	45	54	4	9	.	.	.	.	2	1	.	.
FT Polk, LA	.	.	.	.	17	56	10	2	.	.	.	.	.	.	.	.
FT Riley, KS	.	.	1	.	64	54	4	13	.	.	.	.	1	1	.	.
FT Sill, OK	.	.	.	.	10	37	3	11	.	.	.	.	.	.	.	.
SOUTHEAST																
FT Gordon, GA	.	.	.	.	88	95	41	19	.	.	.	.	.	.	.	.
FT Benning, GA	.	.	.	2	48	22	14	3	.	.	.	.	.	.	.	.
FT Campbell, KY	.	.	.	.	6	14	.	3	.	.	.	.	.	.	.	.
FT Jackson, SC	.	.	.	.	24	.	6	.	.	.	.	.	.	.	.	.
FT Rucker, AL	1	.	.	.	8	12	3	2	.	.	.	.	.	.	.	.
FT Stewart, GA	.	.	.	.	117	135	17	25	.	2	.	.	.	.	.	.
WESTERN																
FT Lewis, WA	.	.	.	.	153	174	14	22	.	.	4	2	.	.	.	.
FT Irwin, CA	.	.	.	.	.	12	.	1	.	.	.	.	.	.	.	.
FT Wainwright, AK	.	.	.	.	.	36	.	5	.	.	.	.	.	.	.	.
PACIFIC																
Hawaii	.	.	.	.	102	111	6	7	.	.	.	.	.	.	.	.
Japan	.	.	.	.	6	3	.	.	.	.	.	.	.	.	.	.
Korea	.	.	.	.	82	92	9	2	.	1	.	.	.	1	.	.
OTHER LOCATIONS																
Germany	4	8	2	.	173	177	33	21	2	1	.	.	8	1	.	.
Unknown	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Total	**12**	**13**	**3**	**2**	**1,620**	**2,038**	**313**	**310**	**8**	**12**	**31**	**33**	**12**	**6**	**0**	**0**

‡Primary and secondary.

§Urethritis, non-gonococcal (NGU).

Sentinel reportable events for service members and beneficiaries at U.S. Navy medical facilities, cumulative numbers* for calendar years through 29 February 2008 and 28 February 2009

Navy

Reporting locations	Number of reports all events†		Food-borne								Vaccine preventable					
			Campylo-bacter		Giardia		Salmonella		Shigella		Hepatitis A		Hepatitis B		Varicella	
	2008	2009	2008	2009	2008	2009	2008	2009	2008	2009	2008	2009	2008	2009	2008	2009
NATIONAL CAPITOL AREA																
NNMC Bethesda, MD	7	1	.	.	.	.	1	.	.	.	.	.	1	.	.	.
NHC Annapolis, MD	3	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.
NHC Patuxent River, MD	4	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.
NHC Quantico, VA	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
NAVY MEDICINE EAST																
NH Beaufort, SC	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
NH Camp Lejeune, NC	14	7	.	.	.	.	1	.	.	.	.	.	.	.	.	.
NH Charleston, SC	6	4	.	.	.	.	1	.	.	.	.	.	.	.	.	.
NH Cherry Point, NC	23	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.
NH Corpus Christi, TX	1	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.
NHC Great Lakes, IL	51	6	.	.	.	.	.	.	.	.	.	.	1	.	.	.
NH Guantanamo Bay, Cuba	0	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.
NH Jacksonville, FL	29	3	.	.	.	.	5	.	.	.	.	.	3	.	.	.
NH Naples, Italy	1	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.
NHC New England, RI	7	3	.	.	.	.	1	.	.	.	.	.	.	.	.	.
NH Pensacola, FL	10	1	.	.	.	.	.	.	1	.	.	.	.	.	.	.
NMC Portsmouth, VA	84	38	.	.	.	.	.	.	.	.	.	.	.	.	.	.
NH Rota, Spain	0	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.
NH Sigonella, Italy	3	1	.	.	.	.	.	.	.	.	.	.	.	.	.	1
NAVY MEDICINE WEST																
NH Bremerton, WA	0	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.
NH Camp Pendleton, CA	4	6	.	.	1	.	.	.	.	.	.	.	.	.	.	.
NH Guam-Agana, Guam	4	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.
NHC Hawaii, HI	3	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.
NH Lemoore, CA	8	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.
NH Oak Harbor, WA	5	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
NH Okinawa, Japan	2	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.
NMC San Diego, CA	21	24	.	.	.	.	.	1	.	.	.	.	1	3	.	.
NH Twentynine Palms, CA	4	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.
NH Yokosuka, Japan	0	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
NAVAL SHIPS																
COMNAVAIRLANT/CINCLANTFLEET	5	6	.	.	.	.	.	.	.	.	.	.	.	.	.	.
COMNAVSURFPAC/CINCPACFLEET	1	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.
OTHER LOCATIONS																
Unknown	6	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Total	**308**	**113**	**0**	**0**	**1**	**0**	**9**	**1**	**1**	**0**	**0**	**0**	**6**	**3**	**0**	**1**

*Events reported by February 7, 2009

†Seventy medical events/conditions specified by Tri-Service Reportable Events Guidelines and Case Definitions, May 2004.

Note: Completeness and timeliness of reporting vary by facility.

Sentinel reportable events for service members and beneficiaries at U.S. Navy medical facilities, cumulative numbers* for calendar years through 29 February 2008 and 28 February 2009

Navy

Reporting location	Arthropod-borne				Sexually transmitted								Environmental			
	Lyme disease		Malaria		Chlamydia		Gonorrhea		Syphilis‡		Urethritis§		Cold		Heat	
	2008	2009	2008	2009	2008	2009	2008	2009	2008	2009	2008	2009	2008	2009	2008	2009
NATIONAL CAPITOL AREA																
NNMC Bethesda, MD	.	.	1	.	2	1	.	.	.	.	.	.	.	.	.	.
NHC Annapolis, MD	.	.	.	.	1	2	.	.	.	.	.	.	.	.	.	.
NHC Patuxent River, MD	.	.	.	.	3	.	1	.	.	.	.	.	.	.	.	.
NHC Quantico, VA	.	.	.	.	1	1	.	.	.	.	.	.	.	.	.	.
NAVY MEDICINE EAST																
NH Beaufort, SC	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.
NH Camp Lejeune, NC	.	.	.	.	7	5	2	2	.	.	3	.	.	.	.	.
NH Charleston, SC	.	.	.	.	2	2	.	1	1	.	.	1	.	.	.	.
NH Cherry Point, NC	.	.	.	.	12	3	3	.	.	.	.	.	.	.	.	.
NH Corpus Christi, TX	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.
NHC Great Lakes, IL	.	.	.	.	45	6	3	.	.	.	.	.	.	.	.	.
NH Guantanamo Bay, Cuba	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
NH Jacksonville, FL	.	.	.	.	11	2	2	.	1	.	.	.	.	.	.	.
NH Naples, Italy	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.
NHC New England, RI	.	.	.	.	5	.	.	.	.	.	.	.	1	.	.	.
NH Pensacola, FL	.	.	.	.	5	.	1	.	.	.	.	.	.	.	.	.
NMC Portsmouth, VA	.	.	.	.	72	28	8	9	.	.	.	.	.	.	.	.
NH Rota, Spain	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
NH Sigonella, Italy	.	.	.	.	1	.	1	.	1	.	.	.	.	.	.	.
NAVY MEDICINE WEST																
NH Bremerton, WA	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.
NH Camp Pendleton, CA	.	.	.	.	2	6	.	.	.	.	.	.	.	.	.	.
NH Guam-Agana, Guam	.	.	.	.	3	.	1	.	.	.	.	.	.	.	.	.
NHC Hawaii, HI	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.
NH Lemoore, CA	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.
NH Oak Harbor, WA	.	.	.	.	4	.	.	.	.	.	.	.	.	.	.	.
NH Okinawa, Japan	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
NMC San Diego, CA	.	.	.	1	17	13	2	2	.	.	.	.	.	.	.	1
NH Twentynine Palms, CA	.	.	.	.	4	.	.	.	.	.	.	.	.	.	.	.
NH Yokosuka, Japan	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.
NAVAL SHIPS																
COMNAVAIRLANT/CINCLANTFLEET	.	.	.	.	4	6	1	.	.	.	.	.	.	.	.	.
COMNAVSURFPAC/CINCPACFLEET	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.
OTHER LOCATIONS																
Unknown	1	.	.	.	4	2	.	.	.	.	.	.	.	.	.	.
Total	**1**	**0**	**1**	**1**	**210**	**81**	**27**	**14**	**3**	**0**	**3**	**1**	**1**	**0**	**0**	**1**

‡Primary and secondary.

§Urethritis, non-gonococcal (NGU).

Sentinel reportable events for service members and beneficiaries at U.S. Air Force medical facilities, cumulative numbers* for calendar years through 29 February 2008 and 28 February 2009

Air Force

Reporting locations	Number of reports all events†		Food-borne								Vaccine preventable					
			Campylo-bacter		Giardia		Salmonella		Shigella		Hepatitis A		Hepatitis B		Varicella	
	2008	2009	2008	2009	2008	2009	2008	2009	2008	2009	2008	2009	2008	2009	2008	2009
Air Combat Cmd	529	166	1	.	1	1	1	2	3	1	.	.	5	.	.	.
Air Education & Training Cmd	210	299	.	.	.	.	1	3	.	.	.	.	1	2	.	1
Air Force Dist. of Washington	80	34	.	.	.	.	.	.	.	.	.	.	1	1	.	.
Air Force Materiel Cmd	199	78	1	.	.	.	.	.	1	.	.	.	.	.	.	.
Air Force Special Ops Cmd	36	28	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Air Force Space Cmd	92	57	.	1	.	.	1	1	.	.	.	.	1	.	.	.
Air Mobility Cmd	300	135	.	.	1	1	.	2	.	.	.	.	1	1	.	1
Pacific Air Forces	187	114	3	.	3	1	1	.	.	.	.	.	2	2	1	1
U.S. Air Forces in Europe	115	98	1	1	.	.	.	.	.	.	.	.	.	1	1	2
U.S. Air Force Academy	6	10	.	.	.	.	.	1	.	.	.	.	.	.	.	.
Other	120	30	1	.	.	1	1	.	.	.	.	.	.	.	.	.
Total	**1,874**	**1,049**	**7**	**2**	**5**	**4**	**5**	**9**	**4**	**1**	**0**	**0**	**11**	**7**	**2**	**5**

*Events reported by February 7, 2009

†Seventy medical events/conditions specified by Tri-Service Reportable Events Guidelines and Case Definitions, May 2004.

Note: Completeness and timeliness of reporting vary by facility

Reporting location	Arthropod-borne				Sexually transmitted								Environmental			
	Lyme disease		Malaria		Chlamydia		Gonorrhea		Syphilis‡		Urethritis§		Cold		Heat	
	2008	2009	2008	2009	2008	2009	2008	2009	2008	2009	2008	2009	2008	2009	2008	2009
Air Combat Cmd	2	.	.	.	219	117	27	17	.	.	1	.	2	2	.	.
Air Education & Training Cmd	1	.	.	.	85	168	5	23	.	1	.	.	.	.	.	.
Air Force Dist. of Washington	1	.	.	.	35	27	6	3	1	.	.	.	.	.	.	.
Air Force Materiel Cmd	2	.	.	.	87	61	8	7	2	1	.	.	.	.	.	.
Air Force Special Ops Cmd	.	.	.	.	33	25	.	1	.	1	.	.	.	.	.	.
Air Force Space Cmd	.	.	.	.	52	46	4	1	.	.	.	.	.	.	.	.
Air Mobility Cmd	1	2	.	.	154	76	14	10	.	.	.	.	2	6	2	.
Pacific Air Forces	.	.	.	.	135	40	6	5	.	.	.	.	.	6	.	.
U.S. Air Forces in Europe	.	.	.	.	79	70	8	8	.	1	.	.	.	2	.	.
U.S. Air Force Academy	.	.	.	.	6	4	.	.	.	.	.	.	.	.	.	.
Other	.	.	.	.	84	.	4	1	1	.	.	.	.	.	.	.
Total	**7**	**2**	**0**	**0**	**969**	**634**	**82**	**76**	**4**	**4**	**1**	**0**	**4**	**16**	**2**	**0**

‡Primary and secondary.

§Urethritis, non-gonococcal (NGU).

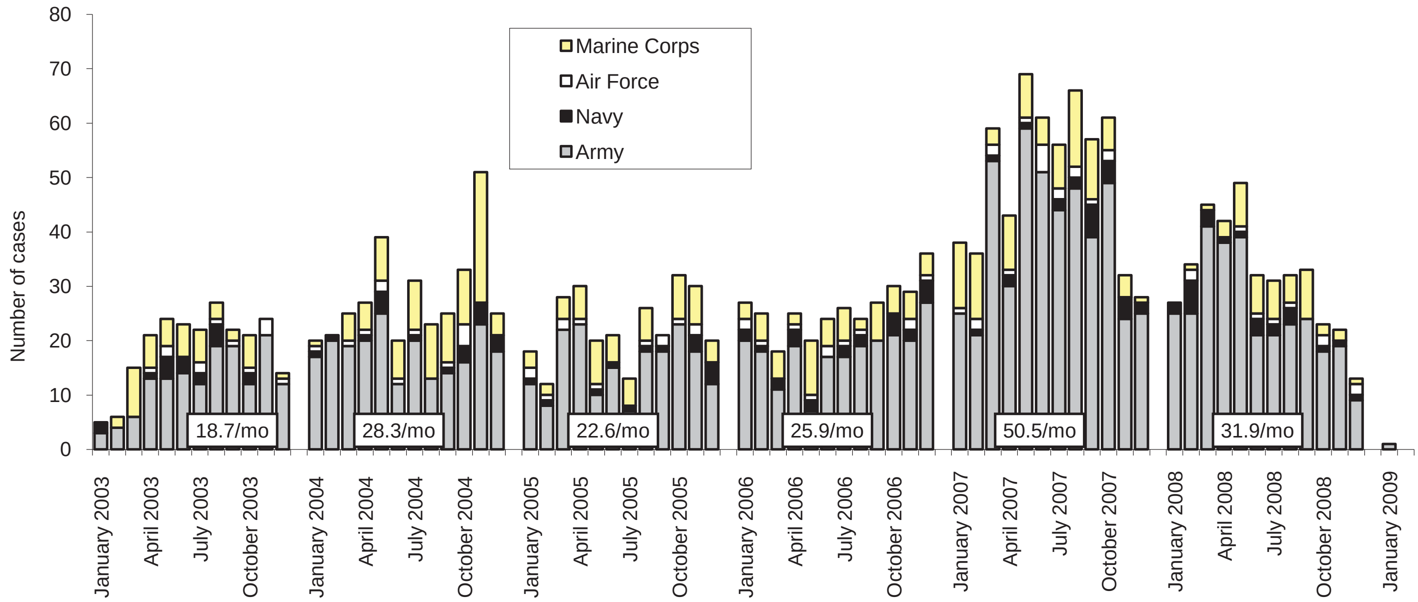
Deployment-related conditions of special surveillance interest, U.S. Armed Forces, by month and service, January 2003 - February 2009 (data as of 31 March 2009)

Correction:

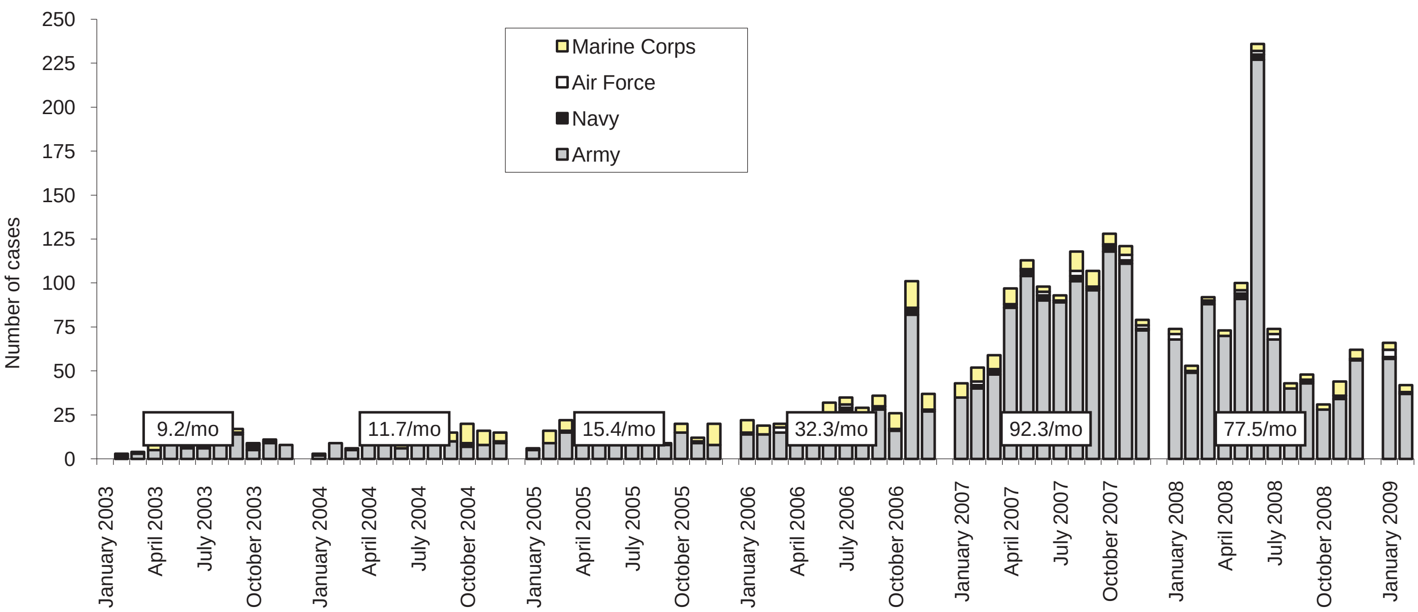
In previous issues of the MSMR, the figure entitled “Traumatic brain injury, multiple ambulatory visits (without hospitalization)” erroneously included service members with TBI-related hospitalizations. The current figure includes only service members with two or more TBI-related ambulatory visits at least 7 days apart — and no TBI-related hospitalizations — while deployed to or within 30 days of returning from OIF/OEF.

In the past, the summary figures for “amputations,” “heterotopic ossification,” “deep vein thrombophlebitis/ pulmonary embolus,” and “severe acute pneumonia” did not match the surveillance case definition. The current figures are correct.

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



Traumatic brain injury, multiple ambulatory visits (without hospitalization),
(ICD-9: 310.2, 800-801, 803-804, 850-854, 950.1-950.3, 959.01, V15.5_1-9, V15.5_A-F)†



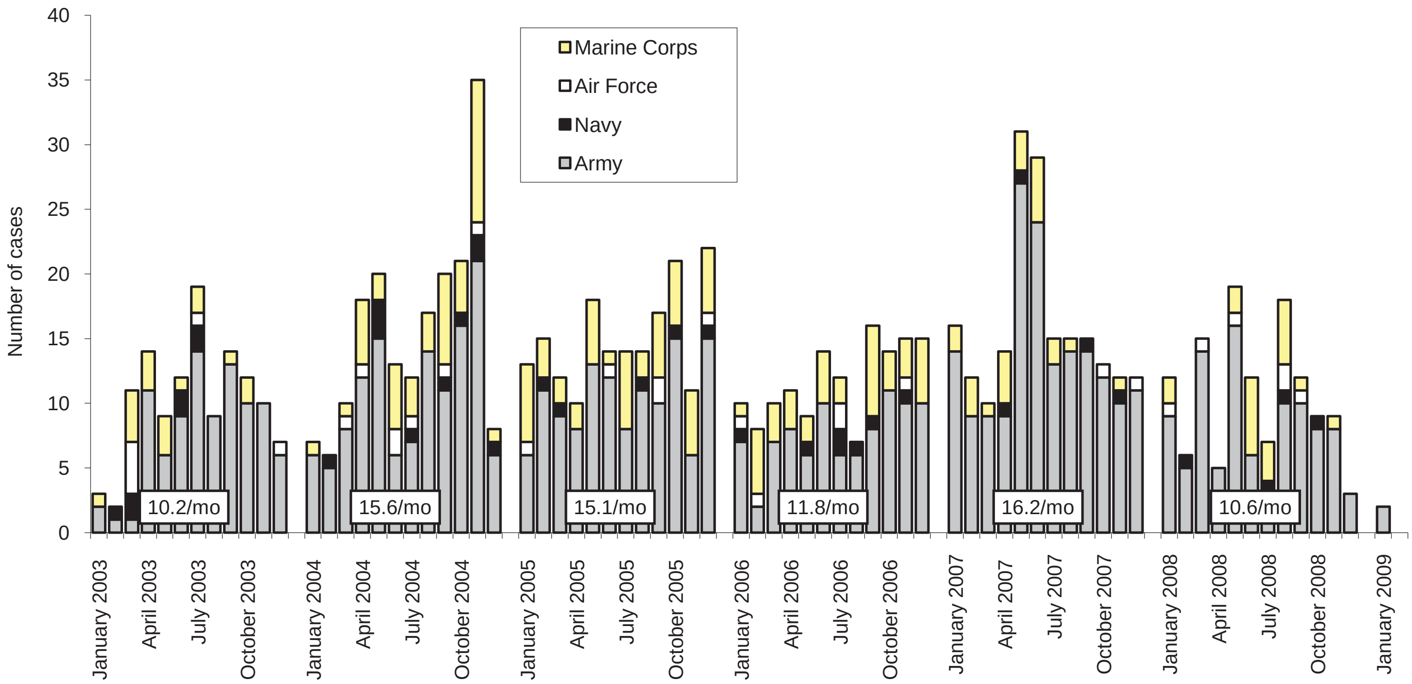
Reference: Armed Forces Health Surveillance Center. Frequencies, rates and trends of use of diagnostic codes indicative of traumatic brain injury (TBI), July 1999-June 2008. *MSMR*. Dec 2008; 15(10):2-9.

*Indicator diagnosis (one per individual) during a hospitalization while deployed to/within 30 days of returning from OEF/OIF.

†Two or more ambulatory visits at least 7 days apart (one case per individual) while deployed to/within 30 days of returning from OEF/OIF.

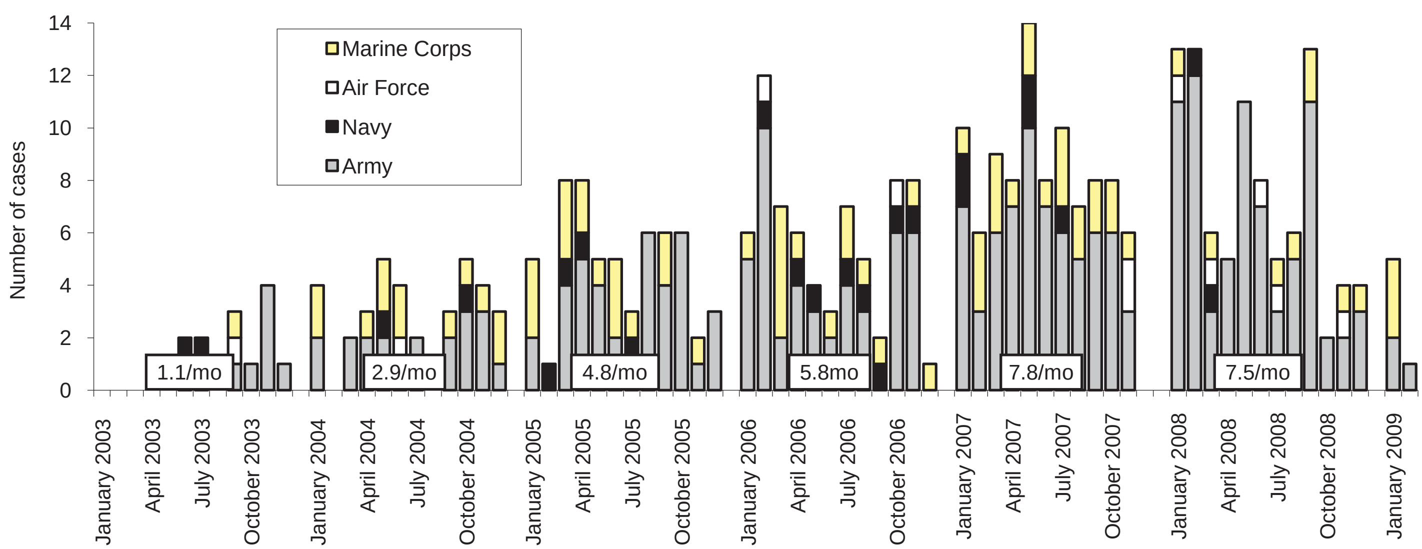
Deployment-related conditions of special surveillance interest, U.S. Armed Forces, by month and service, January 2003 - February 2009 (data as of 31 March 2009)

Amputations (ICD-9: 887, 896, 897, V49.6 to V49.7, PR 84.0 to PR 84.1)*



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

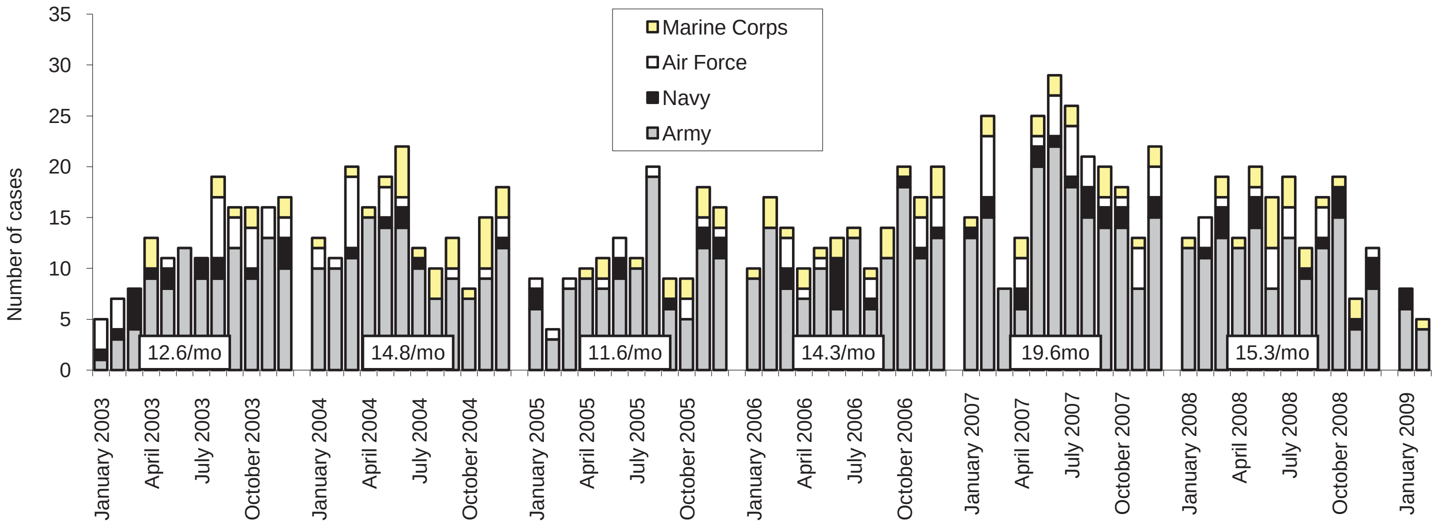
Heterotopic ossification (ICD-9: 728.12, 728.13, 728.19)†



Reference: Army Medical Surveillance Activity. Heterotopic ossification, active components, U.S. Armed Forces, 2002-2007. *MSMR*. Aug 2007; 14(5):7-9.
†One diagnosis during a hospitalization or two or more ambulatory visits at least 7 days apart (one case per individual) while deployed to/within 365 days of returning from OEF/OIF.

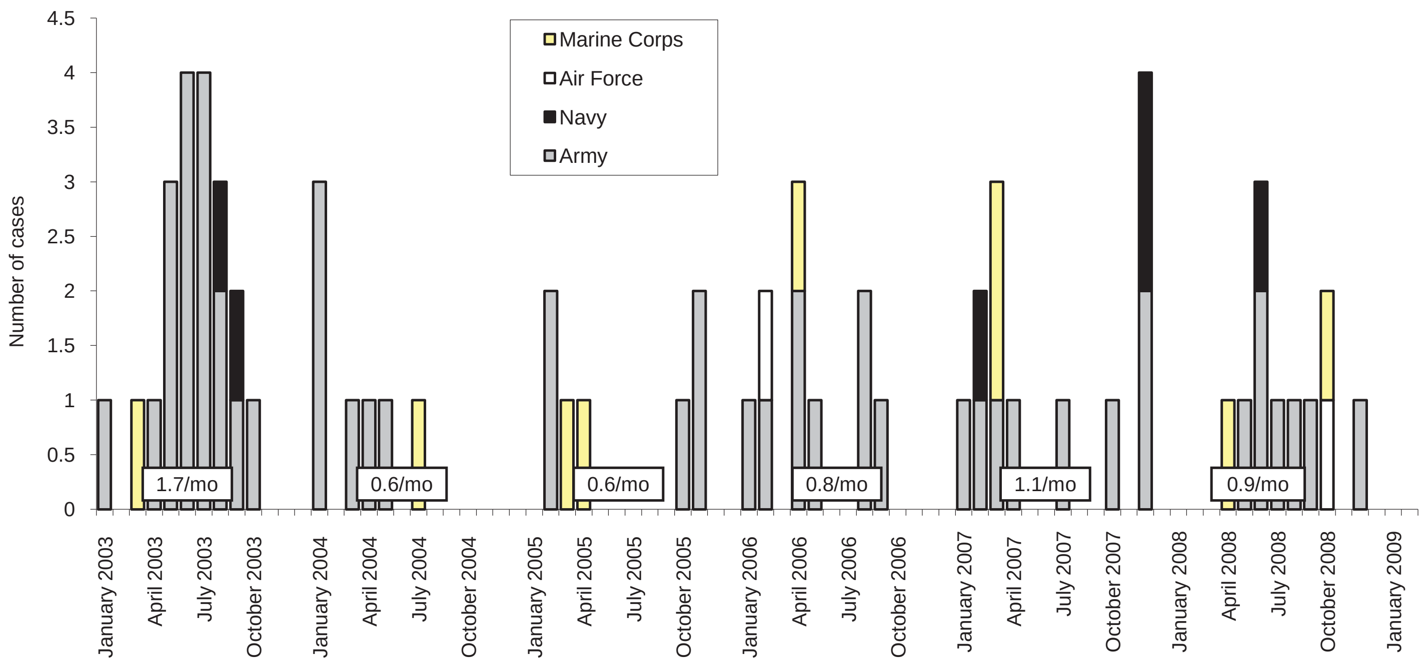
Deployment-related conditions of special surveillance interest, U.S. Armed Forces, by month and service, January 2003 - February 2009 (data as of 31 March 2009)

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)*



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.
*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.

Severe acute pneumonia (ICD-9: 518.81, 518.82, 518.3, 480-487, 786.09)†



Reference: Army Medical Surveillance Activity. Deployment-related condition of special surveillance interest: severe acute pneumonia. Hospitalizations for acute respiratory failure (ARF)/acute respiratory distress syndrome (ARDS) among participants in Operation Enduring Freedom/Operation Iraqi Freedom, active components, U.S. Armed Forces, January 2003-November 2004. *MSMR*. Nov/Dec 2004;10(6):6-7.
†Indicator diagnosis (one per individual) during a hospitalization while deployed to/within 30 days of returning from OEF/OIF.

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The *Medical Surveillance Monthly Report* (MSMR) is prepared by the Armed Forces Health Surveillance Center (AFHSC), US Army Center for Health Promotion and Preventive Medicine (USACHPPM).

Data in the MSMR are provisional, based on reports and other sources of data available to AFHSC.

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