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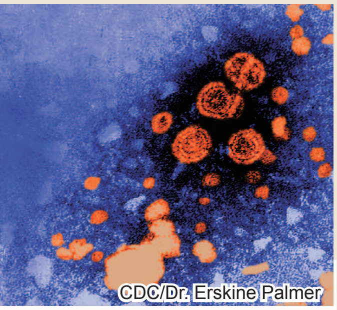
CDC/Amanda Mills



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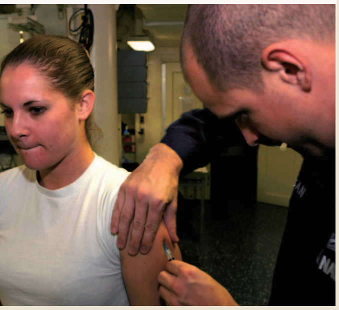

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Viral Meningitis, Active and Reserve Components, U.S. Armed Forces, 2002-2011

Viruses are the most common causes of meningitis, a condition characterized by inflammation of the protective membranes that surround the brain and spinal cord. During the 10-year surveillance period, there were 3,205 confirmed cases, 724 probable cases, and 2,495 suspected cases of viral meningitis among active and reserve component members. In all three categories of cases, the most common diagnoses were meningitis due to enteroviruses; however a majority of these were unspecified enteroviruses. Nearly two-thirds (64.2%) of all cases due to enteroviral infection were hospitalized; on average, cases were hospitalized for 3.2 days. Numbers of cases peaked in late summer/early fall; and higher than average numbers of cases in 2003 reflected several outbreaks that occurred in civilian populations that year. Six states (Texas, California, Virginia, North Carolina, Florida, Georgia) reported the most cases in 2003 and overall during the period. Prevention of viral meningitis relies upon the interruption of viral transmission, e.g., thorough hand washing and disinfection of contaminated surfaces.

Meningitis is a condition characterized by inflammation of the meninges, the protective membranes that surround the brain and spinal cord. Infection is the usual cause of meningitis, and viruses are much more common causes than bacteria, fungi, or parasites. Non-polio enteroviruses (members of the subgenera coxsackieviruses, echoviruses, and enteroviruses) are the most common causes of viral meningitis; however, varicella-zoster virus (VZV), herpes simplex virus (HSV), mumps virus, adenovirus, and lymphocytic choriomeningitis virus can also cause the disease. Several viruses transmitted by mosquitoes and other arthropods ("arboviruses") also can cause viral meningitis.

Common symptoms of viral meningitis include stiff neck, sensitivity to light, altered mental status, and non-specific flu-like symptoms, e.g., fever, body ache, nausea, vomiting, and headache. Because symptoms of viral meningitis are similar to those of the more serious and possibly life-threatening meningitides due to bacteria, viral meningitis is often a diagnosis of exclusion after bacterial meningitis has been ruled out.[1] Despite significant recent improvements in the detection of viral RNA from cerebrospinal fluid by PCR assessment, the etiologies of many viral meningitis cases are unknown.[2]

Enteroviruses are spread through both fecal-oral and respiratory transmission. The transmission of these viruses is seasonal; a majority of cases are diagnosed during the summer months.[3,4] Enteroviruses are common human viruses; infections with enteroviruses can cause a range of clinical syndromes ranging from minor febrile illnesses to more severe conditions such as viral meningitis.[3] Although not associated with significant mortality, meningitis due to enterovirus infection can cause appreciable morbidity in adults often requiring hospitalization for palliative care for relief of symptoms. In most cases, the clinical course is self-limited with full recovery in 7 to 10 days. In 2011, "meningitis due to enterovirus" (ICD-9-CM: 047) was the 2nd or 3rd leading cause of hospitalizations for infectious and parasitic diseases among male and female U.S. active duty service members, respectively.[5]

This report describes trends of viral meningitis by viral etiology (excluding cases caused by arboviruses) among active and reserve component members of the

Outbreak of viral meningitis at Travis Air Force Base, July-August 2012

During the period of 28 July to 16 August 2012, a total of ten cases of viral meningitis were diagnosed in adults aged 22 to 46 years at Travis Air Force Base, California. Nine were admitted to the hospital for closer observation or pain management. Of the ten cases, seven were parents of young children who attended a particular child development center; one was a close family contact of a case; and two were childcare providers at the center. Of the cases, six were active duty service members and six were females. All have recovered.

Echovirus 9 (an enterovirus) was identified in specimens from 4 of the patients and is believed to be the principal cause of the outbreak.

The child development center affected by the outbreak had experienced an increase in absenteeism due to febrile illness since mid-July. Eighty (46.5%) of the 172 children enrolled at the center had been excluded at least once (either by a parent or the center) for fever and/or rash illness. In addition, at least six staff members reported recent illnesses consistent with enterovirus infections.

No cases have been linked to the other two child development centers on base. California health authorities have provided laboratory support to the investigation. There is no evidence of a similar outbreak in the surrounding civilian community.

Information provided by: Lt Col Natalie M. Johns, USAF, DVM, MPH, 60th Aerospace Medicine Squadron Public Health Flight Commander, Travis Air Force Base, California.

U.S. Armed Forces. The report also summarizes the military and demographic characteristics of service members diagnosed with meningitis due to enteroviruses; documents the seasonality of disease occurrence and identifies spatiotemporal case clusters; summarizes the health care burden associated with evaluation and treatment of cases; and enumerates the number of cases medically evacuated from the theater of operations in southwest Asia.

METHODS

The surveillance period was 1 January 2002 to 31 December 2011. 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 or reserve component during the surveillance period. Cases were identified from standardized records of all hospitalizations and outpatient medical encounters during the surveillance period in fixed (e.g., not deployed, at sea) military and nonmilitary (purchased care) medical facilities.

For surveillance purposes, cases of viral meningitis were classified into three categories, i.e., confirmed, probable, and suspected. A confirmed case was defined by a hospitalization record with a case-defining ICD-9 code (per Table 1) in the primary or secondary diagnostic position. A probable case was defined by: 1) a hospitalization record with a case-defining ICD-9 code in any of the diagnostic positions 3 through 8; or 2) an outpatient encounter record with a case-defining ICD-9 code in the primary diagnostic position and a procedure code (CPT code) indicative of a spinal tap (CPT: 62270, 76005, 77003). A suspected case was defined by an outpatient encounter record with a case-defining ICD-9 code in the primary diagnostic position but with no CPT code indicative of spinal tap.

Incidence rates were calculated for active component members only. For reserve component members, complete administrative medical records and precise dates of active service periods were unavailable.

Medical evacuations for viral meningitis were defined as viral meningitis cases diagnosed 5 days prior to 10 days after a reported medical evacuation from the U.S. Central Command (CENTCOM) to a location other than CENTCOM.

RESULTS

During the 10-year surveillance period, there were 3,205 confirmed cases, 724 probable cases, and 2,495 suspected cases of viral meningitis among active and reserve component members **(Table 1)**. A majority of the recorded diagnoses specified enteroviruses (86.4% confirmed, 65.9% probable, 46.9% suspected) – but relatively few (<1% in each) specified the subgenera coxsackie or echoviruses – as the causes **(Table 1)**.

In all three categories of cases, the most common diagnoses were "enteroviral meningitis not otherwise specified" (ICD-9 code: 047.9) and "meningitis due to other specified enteroviruses" (ICD-9-CM: 047.8). Meningitis cases due to other viruses such as HSV and VZV were identified in 6.1 percent (n=196), 1.2 percent (n=9), and 9.5 percent (n=238) of confirmed, probable, and suspected cases, respectively. Diagnoses of unspecified meningitis (i.e., due to viruses not elsewhere classified, or unspecified cause) accounted for 7.5 percent (n=239), 32.9 percent (n=238), and 43.6 percent (n=1,088) of confirmed, probable, and suspected cases, respectively **(Table 1)**.

Meningitis Due to Enteroviruses

During the period, the overall incidence rate of enteroviral meningitis decreased, particularly for cases reported as "enteroviral meningitis not otherwise specified" and confirmed cases **(Figures 1,2)**. Incidence rates for cases reported as due to coxsackieviruses, echoviruses, and "other specified enteroviruses" remained

TABLE 1. Incident cases of viral meningitis by etiologic agent, active and reserve component, U.S. Armed Forces, 2002-2011

		Confirmed (n=3,205)		Probable (n=724)		Suspected (n=2,495)	
ICD-9-CM code	Description	No.	% confirmed	No.	% probable	No.	% suspected
Enteroviruses		2,770	86.4	477	65.9	1,169	46.9
047.0	Meningitis due to coxsackieviruses	10	0.3	1	0.1	20	0.8
047.1	Meningitis due to echoviruses	7	0.2	0	0.0	4	0.2
047.8	Meningitis due to other specified enteroviruses	347	10.8	48	6.6	124	5.0
047.9	Enteroviral meningitis not otherwise specified	2,406	75.1	428	59.1	1,021	40.9
Other viruses		196	6.1	9	1.2	238	9.5
054.72	Meningitis due to herpes simplex virus	106	3.3	4	0.6	17	0.7
053.0	Meningitis due to varicella-zoster virus	58	1.8	0	0.0	192	7.7
049.0	Meningitis due to lymphocytic choriomeningitis virus	21	0.7	3	0.4	22	0.9
049.1	Meningitis due to adenovirus	10	0.3	2	0.3	1	0.0
072.1	Meningitis due to mumps virus	1	0.0	0	0.0	6	0.2
Unspecified		239	7.5	238	32.9	1,088	43.6
321.2	Meningitis due to viruses not elsewhere classified	3	0.1	8	1.1	78	3.1
322.x	Meningitis of unspecified cause	236	7.4	230	31.8	1,010	40.5

FIGURE 1. Incidence rates of "confirmed" viral meningitis due to enterovirus, by enterovirus classification, active component, U.S. Armed Forces, 2002-2011

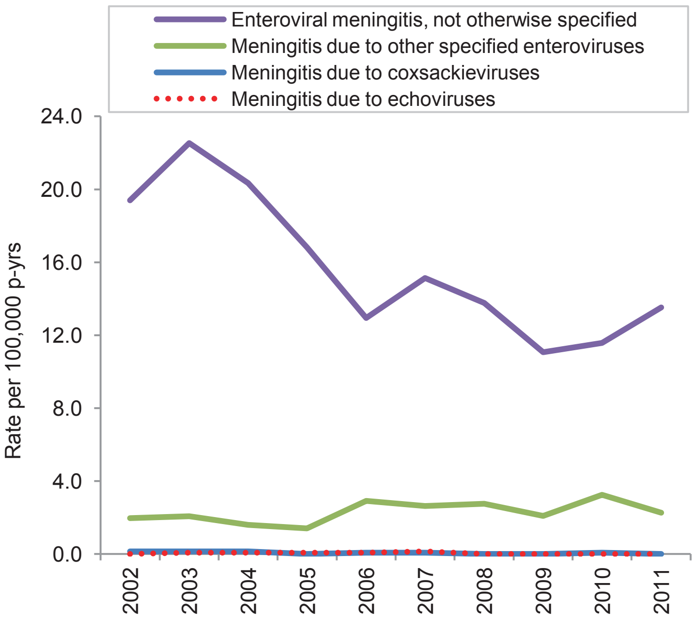


FIGURE 2. Incidence rates of viral meningitis due to enterovirus, by case classification, active component, U.S. Armed Forces, 2002-2011

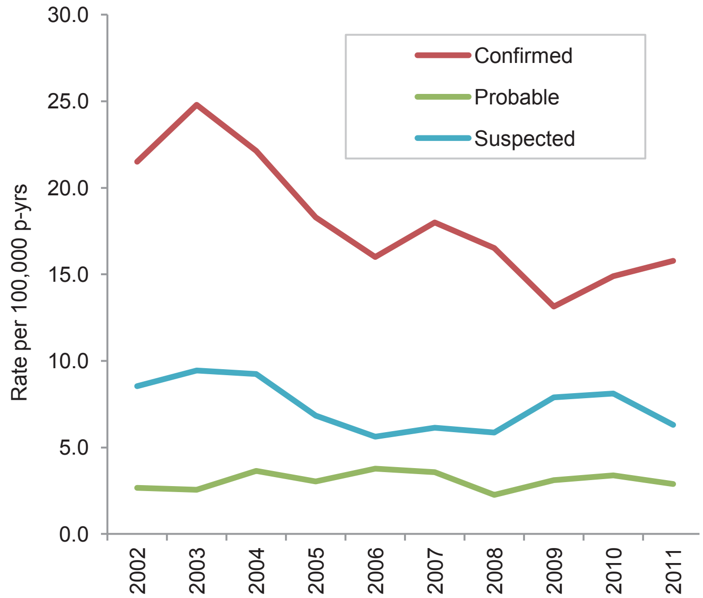


FIGURE 3. Meningitis due to enterovirus, by case type and month, active and reserve components, U.S. Armed Forces, 2002-2011

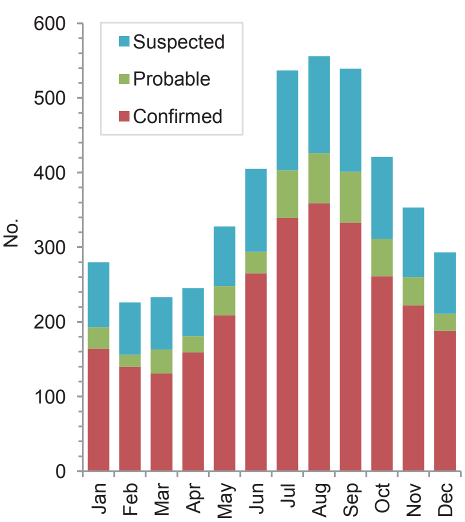
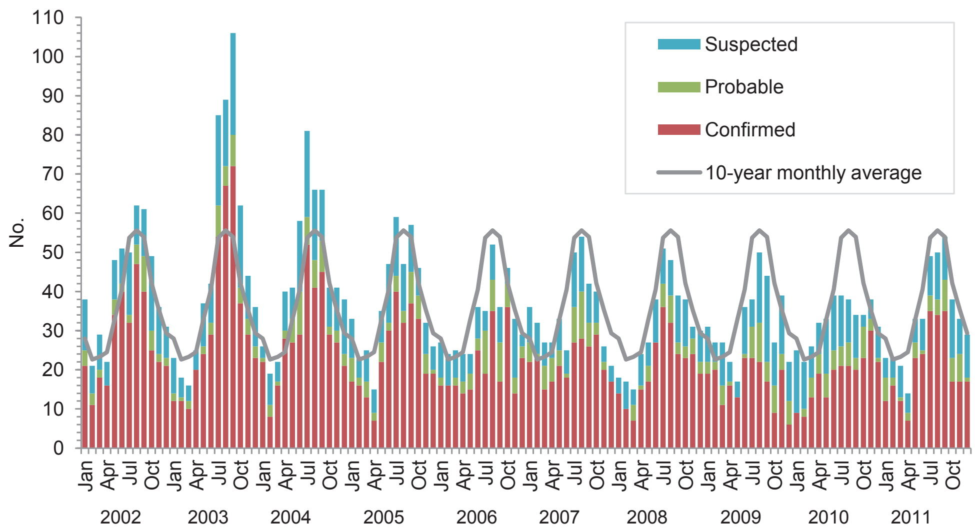


FIGURE 4. Meningitis due to enterovirus, by case classification, month and year, active and reserve components, U.S. Armed Forces, January 2002-December 2011



relatively low and constant throughout the surveillance period **(Figure 1)**.

Approximately two-thirds (64.2%; n=2,835) of all cases of enteroviral meningitis (n=4,416) ascertained for this report were hospitalized **(data not shown)**; of these, 2,770 were classified as "confirmed" (i.e., a hospitalization with a case-defining ICD-9 code in the primary or secondary diagnostic position) and 65 as "probable" cases. The remaining 412 probable and 1,169 suspected cases were documented with outpatient encounter records only **(data not shown)**.

Throughout the surveillance period, cases of enteroviral meningitis peaked in late summer/early fall – particularly, in July, August, and September **(Figures 3, 4)**. Of note, in 2003, there were 141 more cases (n=583) than the average number of cases per year (mean, per year: 442) during the 10-year period. The highest numbers of cases in 2003 occurred in California (n=62), Texas (n=44), North Carolina (n=31), Florida (n=30), Virginia (n=25), and Georgia (n=21) **(data not shown)**. In contrast to the experience in 2003, in 2010, there were markedly fewer cases overall – particularly during the summer and fall seasons – compared to the respective averages over the entire period **(Figure 4)**.

The six states that recorded the most cases in 2003 also recorded the most cases during the entire period: Texas (n=560), California (n=541), Virginia (n=332), North Carolina (n=276), Florida (n-246), and Georgia (n=215) **(Table 2)**. The three military installations/cities with the most cases were San Diego, CA (n=280), Portsmouth, VA (n=261), and Lackland Air Force Base/San Antonio, TX (n=225).

Among active component members, crude incidence rates of confirmed cases were higher among females (25.5 per 100,000 p-yrs) than males (16.9 per 100,000 p-yrs) (IRR: 1.51) and members of the Marine Corps (19.6 per 100,000 p-yrs) than the other services **(Table 3)**. Rates were lower among the youngest and oldest (<20 years: 13.1 per 100,000 p-yrs; 40+ years: 11.7 per 100,000 p-yrs) and highest among 25-29-year-old (20.9 per 100,000 p-yrs) service members. Rates were higher among service members in healthcare (28.5 per 100,000 p-yrs) than other military occupational categories and similar across racial/ethnic subgroups **(Table 3)**. The military and demographic characteristics of confirmed cases were generally similar to those of probable and suspected cases **(data not shown)**.

TABLE 2. States and cities/installations reporting the most cases of meningitis due to enterovirus, active and reserve components, U.S. Armed Forces, 2002-2011

Location	No.
Texas	560
Lackland Air Force Base/ San Antonio	225
Fort Hood	178
California	541
San Diego	280
Camp Pendleton	106
Virginia	332
Portsmouth	261
North Carolina	276
Camp Lejeune/Cherry Point	144
Fort Bragg	108
Florida	246
Jacksonville	93
Pensacola/Eglin AFB	95
Georgia	215
Fort Benning/Columbus	68
Fort Gordon/Augusta	48

During the surveillance period, 2,835 incident hospitalizations for confirmed (n=2,770) and probable (n=65) cases accounted for 8,981 hospital bed days (bed days per case, mean: 3.2) **(Figure 5)**. Also during the period, 35 service members were medically evacuated from a theater of combat operations (Iraq, Afghanistan) for viral meningitis; medical evacuations occurred during all months but were slightly more frequent in July than any others **(data not shown)**. For a majority (n=21, 60%) of those medically evacuated, meningitis was the primary (first-listed) diagnosis on the medical evacuation record.

TABLE 3. Military and demographic characteristics of "confirmed" cases of meningitis due to enteroviruses, active and reserve components, U.S. Armed Forces, 2002-2011

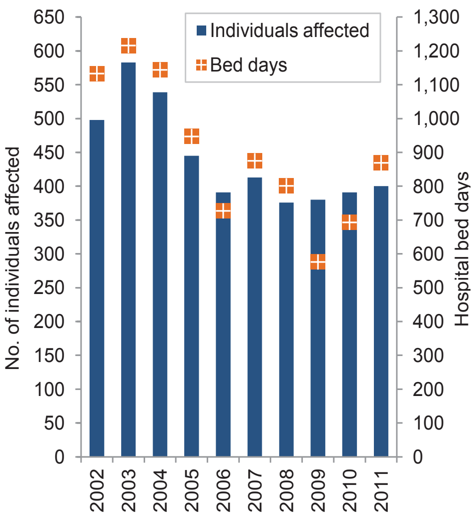
	Reserve	Active		
	No.	No.	Rate[a]	IRR[b]
Total	190	2,580	18.1	.
Sex				
Male	140	2,053	16.9	Ref
Female	50	527	25.5	1.51
Service				
Army	96	918	18.0	1.02
Navy	39	621	18.1	1.03
Air Force	14	608	17.8	1.01
Marine Corps	41	363	19.6	1.12
Coast Guard	0	70	17.6	Ref
Race/ethnicity				
White, non-Hispanic	114	1,610	18.0	1.04
Black, non-Hispanic	37	449	18.7	1.08
Hispanic	25	279	18.8	1.09
Other	14	242	17.3	Ref
Age group				
< 20	10	131	13.1	1.12
20-24	50	901	19.0	1.62
25-29	39	659	20.9	1.78
30-34	25	406	19.7	1.68
35-39	30	305	17.5	1.49
40 +	36	178	11.7	Ref
Military occupation				
Combat-related[c]	13	286	15.9	1.01
Motor transport	7	106	17.6	1.12
Repair/eng	41	741	17.6	1.12
Comm/intel	66	602	18.9	1.20
Healthcare	23	332	28.5	1.81
Other	40	513	15.8	Ref

[a]Per 100,000 p-yrs
[b]Incidence rate ratio
[c]Infantry, artillery, combat engineering, armor transport

EDITORIAL COMMENT

Enteroviruses are the most common cause of viral meningitis. This report documents that the crude incidence rate of enteroviral meningitis (particularly "confirmed" cases) among active component members sharply decreased during the period. Of note in this regard, throughout the period, a majority of enteroviral meningitis diagnoses were non-specific (i.e., "enteroviral meningitis not otherwise specified," "meningitis due to other specified enteroviruses"); as such, the decline in rates of diagnoses overall and confirmed

FIGURE 5. Individuals affected by and hospital bed days attributable to meningitis due to enterovirus, active and reserve component, U.S. Armed Forces, 2002-2011



cases in particular is unlikely related to significant changes in clinical evaluation, diagnosis coding, or reporting practices.

Unlike bacterial meningitis, viral meningitis is rarely life threatening; however, it does cause significant morbidity and short term disability among affected service members. For example, most cases (64.4%) of enteroviral meningitis identified in this report were hospitalized, and the average length of hospitalization was 3.2 days. Enteroviral meningitis is one of the leading causes of hospitalizations for infectious and parasitic diseases among U.S. military members.[5] After enteroviruses, the leading causes of confirmed viral meningitis cases among service members were herpes simplex virus (n=106) and varicella-zoster virus (n=58).

As in the U.S. general population, among U.S. military members, cases of enteroviral meningitis peaked in the summer-early fall. Of note, the relatively large number of cases among U.S. military members in 2003 correlate with large outbreaks of viral meningitis associated with echoviruses 9 and 30 that occurred that year in several states in the United States.[6] Of the seven states reporting outbreaks in civilian populations in 2003, three (California, Georgia, and Texas) were associated with relatively large numbers of cases among military members – in 2003 and overall.

In this report, the largest numbers of cases occurred in geographic locations with large military populations or training installations (e.g., San Diego, CA; Lackland Air Force Base, TX; Fort Hood, TX; Camp Lejeune, NC). Crowded living conditions common to military barracks is a well-known risk factor for spread of viral diseases (e.g., influenza, acute respiratory infections, enteroviruses). In addition, because service members from many locations across the U.S. assemble at training installations, they may be exposed to viral etiologies to which they are immunologically naive.

Unlike studies in the general U.S. population that report similar rates of viral meningitis by gender, crude incidence rates were higher among females than males in this report.[2,4] A study of infectious disease rates in the U.S. Navy also documented a higher rate among female sailors.[7] The relatively high rate among female military members may be partly explained by the greater proportion of females in health care occupations. Among all occupations the highest proportion of female enlisted (30.5%) and female officers (39.2%) serve in health care occupations; as such, a greater proportion of females may be at risk of exposure to enteroviruses in the health care setting, or may have better access to health care when they become ill.[8] Further investigation is necessary to clarify the natures and strengths of associations between gender, health care work, and risk of viral meningitis.

Several limitations should be considered when interpreting the results of the analyses reported here. For example, for this report, cases were identified and classified (as confirmed, probable, suspected) for surveillance purposes using available medical encounter data. However, such classifications are more indicative of clinical severity than confirmation of the viral etiologies of infections of the meninges. For example, for this analysis, all confirmed cases were hospitalized; as such, they were likely to have relatively severe presenting symptoms and/or signs, symptoms, and histories suggestive of bacterial meningitis. In contrast, most probable and all suspected cases were diagnosed in outpatient settings (e.g., emergency rooms, ambulatory clinics) and not hospitalized for further evaluation or treatment. Also, spinal taps done in civilian outpatient settings (contracted/reimbursed care) are not completely documented by procedural (CPT) codes in the Defense Medical Surveillance System (DMSS), the source of data used for analyses. As a result, some probable cases may have been misclassified as suspected cases for this report.

Similar to other viral infections such as influenza and cold viruses, prevention of viral meningitis relies upon the interruption of viral transmission. Because transmission occurs from both exposure to respiratory secretions and through fecal material, adherence to good hygienic practices, e.g., frequent and thorough hand washing, disinfection of contaminated surfaces, and avoidance of shared utensils and drinking containers, are the best measures to prevent transmission and should be rigidly enforced in crowded military settings.[9]

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Updates: Routine Screening for Antibodies to Human Immunodeficiency Virus, Type 1 (HIV-1), Civilian Applicants for U.S. Military Service and U.S. Armed Forces, Active and Reserve Components

During routine testing of civilian applicants for U.S. military service, the overall seroprevalence of antibodies to HIV-1 in 2011 was the second lowest of any year since 1990. Among members of the active components of the U.S. Army, HIV-1 seroprevalences were higher during 2008 to 2011 than in recent prior years. Among members of the active components of the U.S. Air Force, Navy and Marine Corps, the Marine Corps Reserve, and the Army National Guard, HIV-1 seroprevalences have slightly declined or remained relatively stable for at least ten years. In the reserve components of most service branches, it is difficult to discern long-term trends because of instability of seroprevalences in the relatively small numbers of reserve component members tested each year. Monitoring of HIV-1 seroprevalences can help target and focus prevention initiatives. The recent repeal of the Don't Ask Don't Tell policy has created opportunities for prevention messages targeted to men who have sex with men.

Human immunodeficiency virus, type 1 (HIV-1) infection causes a life-threatening illness with a long and variable clinical course; the end stage of HIV-1 disease is acquired immunodeficiency syndrome (AIDS). Novel and effective therapies can arrest the progression of HIV-1 disease and prolong the lives of infected persons; such therapies must be continued throughout the lifetimes of those infected.

HIV-1 is generally transmitted from person-to-person during sexual encounters or via blood (e.g., contaminated needles). The immune deficiency that occurs after HIV-1 infection increases the risk of debilitating opportunistic infections and malignant neoplasms and limits the military operational capabilities of affected service members. In order to provide appropriate medical evaluations, treatment, and counseling, prevent unwitting HIV-1 infection transmissions, and protect the battlefield blood supply, civilian applicants for military service are screened for antibodies to HIV-1 during pre-accession medical examinations. Infection with HIV-1 is medically disqualifying for entry into U.S. military service.

Members of the active and reserve components are routinely and periodically screened to detect newly acquired HIV-1 infections. Service members who are infected with HIV-1 receive clinical assessments, treatments, and counseling; they may remain in service as long as they are capable of performing their military duties. Since October 1985, the U.S. military has conducted routine screening for antibodies to HIV-1 among civilian applicants for U.S. military service. Since 1986, all members of the active and reserve components of the U.S. Armed Forces have been periodically screened for antibodies to HIV-1. In 2004, the Department of Defense set a standard testing interval of two years for all service members.

This report summarizes prevalences and trends of HIV-1 antibody seropositivity among civilian applicants for military service who have been screened since 2007. It also summarizes incident (first time per individual) diagnoses of HIV-1 antibody seropositivity among those members of the active and reserve components of the U.S. military who were tested in each of the specified years in this report. Summaries of HIV-1 antibody seropositivity among civilian applicants and military members screened since 1990 are available at http://www.afhsc.mil/reports.

METHODS

Among civilian applicants for U.S. military service and active and reserve component military members, prevalences of HIV-1 antibody seropositivity were assessed by matching specimen numbers and serologic test results to the personal identifiers of the individuals who provided specimens. All results (except those from U.S. Air Force members) were accessed from records routinely maintained in the Defense Medical Surveillance System. Summary data from U.S. Air Force testing were provided by the Air Force for use in this report.

For summary purposes, an incident diagnosis of HIV-1 antibody seropositivity was defined as two "positive" results from serologic testing of two different specimens from the same individual (or one "positive" result from serologic testing of the most recent specimen provided by an individual).

Annual prevalences of HIV-1 seropositivity among civilian applicants for service were calculated by dividing the number of applicants identified as HIV-1 antibody seropositive during each calendar year by the number of applicants tested during the corresponding year. For annual summaries of routine screening among U.S. service members, denominators were the numbers of individuals in each component of each service branch who were tested at least once during the relevant calendar year.

RESULTS

Civilian applicants

During the 18-month period from January 2011 to June 2012, 538,192 tests for antibodies to HIV-1 were conducted among 520,991 civilian applicants for U.S. military service. During the period, 105 applicants were detected with antibodies to HIV-1 (seroprevalence: 0.20 per 1,000 tested) **(Table 1)**.

TABLE 1. Diagnoses of HIV-1 infections by gender, civilian applicants for U.S. military service, January 2007-June 2012

Year	Total HIV tests	Total persons tested	Males tested	Females tested	Total HIV-1(+)	HIV-1(+) Male	HIV-1(+) Female	Overall rate per 1,000 tested	Male rate per 1,000 tested	Female rate per 1,000 tested
2007	266,234	**259,001**	208,809	50,192	**116**	108	8	**0.45**	0.52	0.16
2008	298,742	**291,156**	235,968	55,188	**142**	131	11	**0.49**	0.56	0.20
2009	320,985	**304,211**	245,739	58,472	**112**	103	9	**0.37**	0.42	0.15
2010	307,237	**285,166**	229,992	55,174	**61**	57	4	**0.21**	0.25	0.07
2011	319,583	**311,835**	255,028	56,807	**68**	62	6	**0.22**	0.24	0.11
2012[a]	218,609	**209,154**	170,253	38,901	**37**	33	4	**0.18**	0.19	0.10
Total	1,731,390	**1,660,523**	1,345,789	314,734	**536**	494	42	**0.32**	0.37	0.13

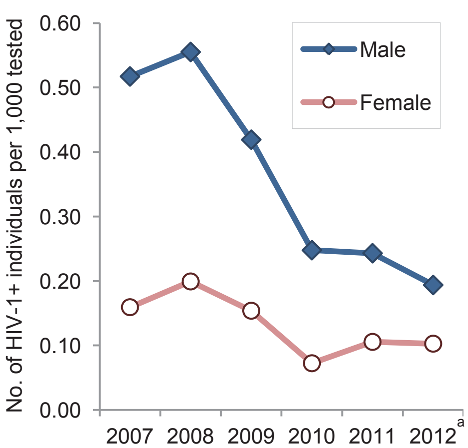
[a]Through 30 June 2012

TABLE 2. Diagnoses of HIV-1 infections by race/ethnicity, civilian applicants for U.S. military service, January 2007-June 2012

Year	Total HIV tests	Total persons tested	White non-Hispanic tested	Black non-Hispanic tested	Hispanic and others tested	Total HIV-1 (+)	White non-Hispanic HIV-1(+)	Black non-Hispanic HIV-1(+)	Hispanic and others HIV-1(+)	Overall rate per 1,000 tested	White non-Hispanic rate per 1,000 tested	Black non-Hispanic rate per 1,000 tested	Hispanic and others rate per 1,000 tested
2007	266,234	**259,006**	186,635	35,222	37,149	**116**	40	66	10	**0.45**	0.21	1.87	0.27
2008	298,742	**291,156**	205,235	44,237	41,684	**142**	40	88	14	**0.49**	0.19	1.99	0.34
2009	320,985	**304,221**	215,635	45,707	42,879	**112**	35	66	11	**0.37**	0.16	1.44	0.26
2010	307,237	**285,167**	204,062	43,651	37,454	**61**	13	44	4	**0.21**	0.06	1.01	0.11
2011	319,583	**311,837**	222,132	48,603	41,102	**68**	22	39	7	**0.22**	0.10	0.80	0.17
2012[a]	218,609	**209,154**	144,421	35,406	29,327	**37**	8	26	3	**0.18**	0.06	0.73	0.10
Total	1,731,390	**1,660,541**	1,178,120	252,826	229,595	**536**	158	329	49	**0.32**	0.13	1.30	0.21

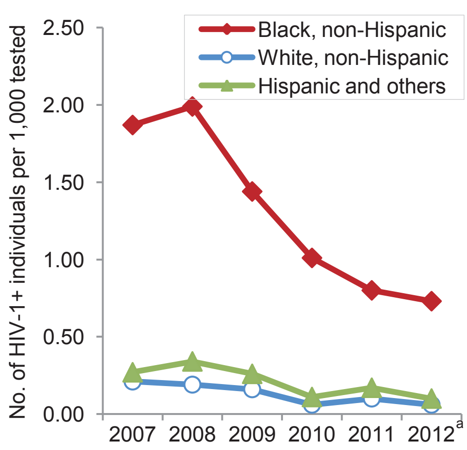
[a]Through 30 June 2012

FIGURE 1. Diagnoses of HIV-1 infections by gender, civilian applicants for U.S. military service, January 2007-June 2012



[a]Through 30 June 2012

FIGURE 2. Diagnoses of HIV-1 infections by race/ethnicity, civilian applicants for U.S. military service, January 2007-June 2012



[a]Through 30 June 2012

Among civilian applicants overall, annual prevalences of HIV-1 antibody seropositivity were relatively low and stable between 1996 and 2006 **(data not shown)**, were higher in 2007 (0.45 per 1,000) and 2008 (0.49 per 1,000), and then declined through 2011 (0.22 per 1,000) **(Table 1)**. The annual prevalences in 2010 and 2011 were the lowest of the past 21 years. Among male applicants, seroprevalences generally increased after 2005 to a relative plateau in 2008 (0.56 per 1,000) and then declined sharply through 2011 (0.24 per 1,000). Among female applicants, annual seroprevalences have been lower than those of males and stable since 2002 **(Table 1, Figure 1)**.

As in the past, in 2011, the seroprevalence was sharply higher among applicants who were black non-Hispanic (0.80 per 1,000) than white non-Hispanic (0.10 per 1,000) or Hispanic/other (0.17 per 1,000) racial/ethnic identities. HIV-1 seroprevalences among black non-Hispanic applicants were lower in 2011 than in any of the prior 21 years **(Table 2, Figure 2)**.

U.S. Army

Active component: During the 18-month period from January 2011 through June 2012, 799,423 tests for antibodies to HIV-1 were conducted among 669,370 soldiers in the active component of the U.S. Army. During the period, 172 soldiers (0.26 per 1,000 persons tested) were detected with antibodies to HIV-1 **(Table 3)**.

During 2011, there were 109 incident diagnoses of HIV-1 infections among active component soldiers. The overall prevalence of seropositivity was 0.25 per 1,000 soldiers tested; on average, one new HIV-1 infected soldier was detected per 4,943 screening tests **(Table 3)**.

From 2000 through 2007, annual seroprevalences were relatively stable **(data not shown)**; in 2008, there were more incident diagnoses of HIV-1 infections and a higher prevalence of HIV-1 antibody seropositivity than in any prior year since 1995. Since 2008, rates have remained high compared to recent prior years. The increases in the numbers and prevalences of incident diagnoses of HIV-1 overall since 2008 were entirely attributable to increases among men; rates of HIV-1 seropositivity among active component female soldiers have been low and stable, with between 1 and 3 new infections detected per year **(Table 3, Figure 3)**. Finally, of the 492 active component soldiers diagnosed with HIV-1 infections since 2007, 333 (68%) were still in service in 2012 **(Table 3)**.

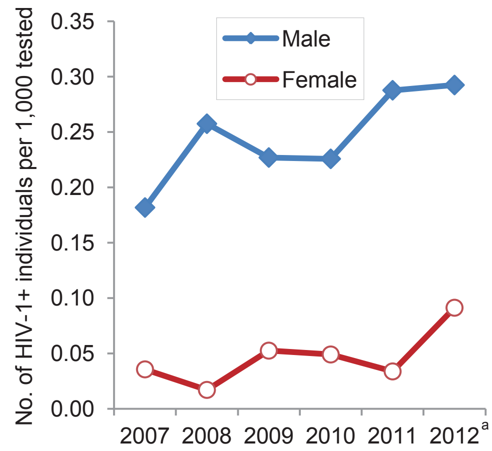
Army National Guard: During the 18-month period from January 2011 through June 2012, 321,585 tests for antibodies to HIV-1 were conducted among 277,171 members of the U.S. Army National Guard. During the period, 72 soldiers (0.26 per 1,000 persons tested) were detected with antibodies to HIV-1 **(Table 4)**.

During 2011, there were 43 incident diagnoses of HIV-1 infection among National Guard soldiers. The overall prevalence of seropositivity was 0.23 per 1,000 soldiers tested. The annual prevalence in 2011 was consistent with the annual prevalences documented in the Army National Guard since 1998. In 2011, on average, one new HIV-1 infected National Guard soldier was detected per 5,218 screening tests. Of the 267 National Guard soldiers diagnosed with HIV-1 infections since 2007, 130 (49%) were still in service in 2012 **(Table 4)**.

Army Reserve: During the 18-month period from January 2011 through June 2012, 148,202 tests for antibodies to HIV-1 were conducted among 127,260 soldiers in the U.S. Army Reserve. During the period, 62 soldiers (0.49 per 1,000 tested) were detected with antibodies to HIV-1 **(Table 5)**.

During calendar year 2011, there were 36 incident diagnoses of HIV-1 infection among U.S. Army Reserve soldiers; the

FIGURE 3. New diagnoses of HIV-1 infections, by gender, active component, U.S. Army, January 2007-June 2012



[a]Through 30 June 2012

TABLE 3. New diagnoses of HIV-1 infections, by gender, active component, U.S. Army, January 2007-June 2012

Year	Total HIV tests	Total persons tested	Males tested	Females tested	Total new HIV-1 (+)	New HIV-1 (+) Male	New HIV-1 (+) Female	Overall rate per 1,000 tested	Male rate per 1,000 tested	Female rate per 1,000 tested	HIV-1(+) still in military service in 2011
2007	454,374	**380,875**	324,614	56,261	**61**	59	2	**0.16**	0.18	0.04	28
2008	511,505	**420,129**	361,251	58,878	**94**	93	1	**0.22**	0.26	0.02	46
2009	559,251	**431,765**	374,562	57,203	**88**	85	3	**0.20**	0.23	0.05	42
2010	589,103	**451,055**	389,819	61,236	**91**	88	3	**0.20**	0.23	0.05	65
2011	538,802	**431,299**	371,942	59,357	**109**	107	2	**0.25**	0.29	0.03	89
2012[a]	260,621	**238,071**	205,183	32,888	**63**	60	3	**0.26**	0.29	0.09	63
Total	2,913,656	**2,353,194**	2,027,371	325,823	**506**	492	14	**0.22**	0.24	0.04	333

[a]Through 30 June 2012

TABLE 4. New diagnoses of HIV-1 infections, by gender, U.S. Army National Guard, January 2007-June 2012

Year	Total HIV tests	Total persons tested	Males tested	Females tested	Total new HIV-1 (+)	New HIV-1 (+) Male	New HIV-1 (+) Female	Overall rate per 1,000 tested	Male rate per 1,000 tested	Female rate per 1,000 tested	HIV-1(+) still in military service in 2011
2007	201,684	**182,256**	157,731	24,525	**53**	50	3	**0.29**	0.32	0.12	14
2008	234,765	**209,579**	180,416	29,163	**51**	49	2	**0.24**	0.27	0.07	14
2009	245,558	**204,826**	177,051	27,775	**55**	53	2	**0.27**	0.30	0.07	24
2010	240,604	**197,729**	170,248	27,481	**36**	35	1	**0.18**	0.21	0.04	21
2011	224,377	**187,230**	160,544	26,686	**43**	42	1	**0.23**	0.26	0.04	28
2012[a]	97,208	**89,941**	76,774	13,167	**29**	29	0	**0.32**	0.38	0.00	29
Total	1,244,196	**1,071,561**	922,764	148,797	**267**	258	9	**0.25**	0.28	0.06	130

[a]Through 30 June 2012

TABLE 5. New diagnoses of HIV-1 infections, by gender, U.S. Army Reserve, January 2007-June 2012

Year	Total HIV tests	Total persons tested	Males tested	Females tested	Total new HIV-1 (+)	New HIV-1 (+) Male	New HIV-1 (+) Female	Overall rate per 1,000 tested	Male rate per 1,000 tested	Female rate per 1,000 tested	HIV-1(+) still in military service in 2011
2007	110,594	**98,691**	76,426	22,265	**42**	40	2	**0.43**	0.52	0.09	16
2008	109,137	**97,433**	74,519	22,914	**43**	38	5	**0.44**	0.51	0.22	24
2009	113,132	**95,618**	74,176	21,442	**36**	34	2	**0.38**	0.46	0.09	19
2010	113,107	**93,592**	73,046	20,546	**35**	35	0	**0.37**	0.48	0.00	30
2011	106,673	**88,667**	68,895	19,772	**36**	34	2	**0.41**	0.49	0.10	34
2012[a]	41,529	**38,593**	30,254	8,339	**26**	26	0	**0.67**	0.86	0.00	26
Total	594,172	**512,594**	397,316	115,278	**218**	207	11	**0.43**	0.52	0.10	149

[a]Through 30 June 2012

TABLE 6. New diagnoses of HIV-1 infections, active component, U.S. Navy, January 2007-June 2012

Year	Total HIV tests	Total persons tested	Males tested	Females tested	Total new HIV-1 (+)	New HIV-1 (+) Male	New HIV-1 (+) Female	Overall rate per 1,000 tested	Male rate per 1,000 tested	Female rate per 1,000 tested	HIV-1(+) still in military service in 2011
2007	282,585	**239,411**	201,468	37,943	**72**	69	3	**0.30**	0.34	0.08	32
2008	287,077	**242,763**	204,074	38,689	**86**	85	1	**0.35**	0.42	0.03	45
2009	266,084	**227,501**	189,776	37,725	**82**	81	1	**0.36**	0.43	0.03	47
2010	282,658	**239,826**	199,448	40,378	**72**	71	1	**0.30**	0.36	0.02	54
2011	271,232	**232,499**	192,119	40,380	**58**	58	0	**0.25**	0.30	0.00	47
2012[a]	137,985	**128,704**	106,211	22,493	**35**	34	1	**0.27**	0.32	0.04	35
Total	1,527,621	**1,310,704**	1,093,096	217,608	**405**	398	7	**0.31**	0.36	0.03	260

[a]Through 30 June 2012

overall seropositivity was 0.41 per 1,000 soldiers tested. In 2011, on average, one new HIV-1 infected soldier was detected per 2,963 screening tests. The prevalence of HIV-1 antibody seropositivity among females remained low; among female reserve soldiers, there were two incident diagnoses of HIV-1 seropositivity in 2011 and none in the first half of 2012. Of the 218 Army Reservists diagnosed with HIV-1 infections since 2007, 149 (68%) were still in service in 2012 **(Table 5)**.

U.S. Navy

Active component: During the 18-month period from January 2011 through June 2012, 409,217 tests for antibodies to HIV-1 were conducted among 361,203 sailors of the active component of the U.S. Navy. During the period, 93 sailors (0.26 per 1,000 persons tested) were detected with antibodies to HIV-1 **(Table 6)**.

During 2011, there were 58 incident diagnoses of HIV-1 infections among active component sailors. The overall prevalence of seropositivity was 0.25 per 1,000 sailors tested. Rates in females have remained low; among female active component sailors, there were no incident diagnosis of HIV-1 seropositivity in 2011 and one in the first half of 2012 **(Table 6, Figure 4)**. In 2011, on average, one new HIV-1 infected sailor was detected per 4,676 screening tests. Of the 405 active component sailors diagnosed with HIV-1 infections since 2007, 260 (64%) were still in service in 2012 **(Table 6)**.

Navy Reserve: During the 18-month period from January 2011 through June 2012, 75,965 tests for antibodies to HIV-1 were conducted among 66,554 sailors in the U.S. Navy Reserve. During the period, 22 sailors (0.33 per 1,000 tested) were detected with antibodies to HIV-1 **(Table 7)**.

During calendar year 2011, there were 14 incident diagnoses of HIV-1 infection among U.S. Navy Reserve sailors; the overall seropositivity was 0.33 per 1,000 sailors tested. Among female reserve sailors, there have been no incident diagnoses of HIV-1 seropositivity since 2007 (and only 13 reported in the past 21 years).

In 2011, on average, one new HIV-1 infected sailor was detected per 3,601 screening tests. Of the 77 reserve component sailors diagnosed with HIV-1 infections since 2007, 55 (71%) were still in service in 2012 **(Table 7)**.

U.S. Marine Corps

Active component: During the 18-month period from January 2011 through June 2012, 303,056 tests for antibodies to HIV-1 were conducted among 261,606 members of the active component of the U.S. Marine Corps. During the period, 38 Marines (0.15 per 1,000 persons tested) were detected with antibodies to HIV-1 **(Table 8)**.

During 2011, there were 26 incident diagnoses of HIV-1 infection among active component Marines. The overall prevalence of seropositivity was 0.15 per 1,000 Marines tested **(Table 8, Figure 5)**. During the past 12 years (2000-2011), annual numbers of new HIV-1 infectious detected among Marines were fairly consistent, ranging from 12 to 24 among males and 0 to 1 among females. In 2011, on average, one new HIV-1 infected Marine was detected per 7,938 screening tests. Of the 119 active component Marines diagnosed with HIV-1 infections since 2007, 71 (60%) were still in service in 2012 **(Table 8)**.

U.S. Marine Corps Reserve: During the 18-month period from January 2011 through June 2012, 49,477 tests for antibodies to HIV-1 were conducted among 43,541 Marines in the U.S. Marine Corps Reserve. During the period, seven

FIGURE 4. New diagnoses of HIV-1 infections, active component, U.S. Navy, January 2007-June 2012

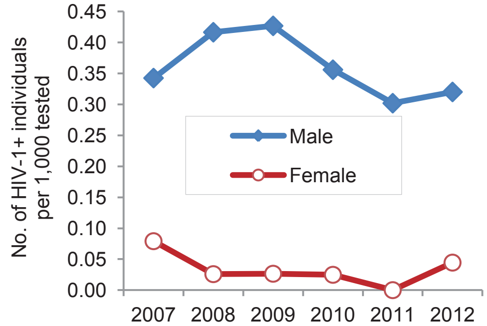


FIGURE 5. New diagnoses of HIV-1 infections, by gender, active component, U.S. Marine Corps, January 2007-June 2012

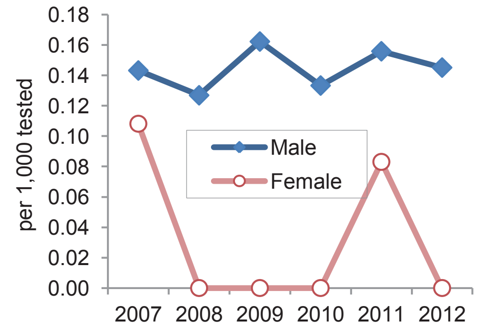


TABLE 7. New diagnoses of HIV-1 infections, by gender, Navy Reserve, U.S. Navy, January 2007-June 2012

Year	Total HIV tests	Total persons tested	Males tested	Females tested	Total new HIV-1 (+)	New HIV-1 (+) Male	New HIV-1 (+) Female	Overall rate per 1,000 tested	Male rate per 1,000 tested	Female rate per 1,000 tested	HIV-1(+) still in military service in 2011
2007	57,597	**48,943**	39,670	9,273	**15**	14	1	**0.31**	0.35	0.11	8
2008	54,712	**46,982**	38,128	8,854	**12**	12	0	**0.26**	0.31	0.00	5
2009	52,065	**43,682**	35,475	8,207	**10**	10	0	**0.23**	0.28	0.00	7
2010	54,321	**45,462**	36,913	8,549	**18**	18	0	**0.40**	0.49	0.00	16
2011	50,411	**42,835**	34,654	8,181	**14**	14	0	**0.33**	0.40	0.00	11
2012[a]	25,554	**23,719**	19,182	4,537	**8**	8	0	**0.34**	0.42	0.00	8
Total	294,660	**251,623**	204,022	47,601	**77**	76	1	**0.31**	0.37	0.02	55

[a]Through 30 June 2012

TABLE 8. New diagnoses of HIV-1 infections, by gender, active component, U.S. Marine Corps, January 2007-June 2012

Year	Total HIV tests	Total persons tested	Males tested	Females tested	Total new HIV-1 (+)	New HIV-1 (+) Male	New HIV-1 (+) Female	Overall rate per 1,000 tested	Male rate per 1,000 tested	Female rate per 1,000 tested	HIV-1(+) still in military service in 2011
2007	183,535	**148,859**	139,616	9,243	**21**	20	1	**0.14**	0.14	0.11	9
2008	188,754	**151,519**	141,814	9,705	**18**	18	0	**0.12**	0.13	0.00	7
2009	188,902	**151,761**	141,696	10,065	**23**	23	0	**0.15**	0.16	0.00	11
2010	187,536	**153,214**	142,497	10,717	**19**	19	0	**0.12**	0.13	0.00	10
2011	206,377	**172,387**	160,350	12,037	**26**	25	1	**0.15**	0.16	0.08	22
2012[a]	96,679	**89,219**	82,656	6,563	**12**	12	0	**0.13**	0.15	0.00	12
Total	1,051,783	**866,959**	808,629	58,330	**119**	117	2	**0.14**	0.14	0.03	71

[a]Through 30 June 2012

TABLE 9. New diagnoses of HIV-1 infections, by gender, U.S. Marine Corps Reserve, January 2007-June 2012

Year	Total HIV tests	Total persons tested	Males tested	Females tested	Total new HIV-1 (+)	New HIV-1 (+) Male	New HIV-1 (+) Female	Overall rate per 1,000 tested	Male rate per 1,000 tested	Female rate per 1,000 tested	HIV-1(+) still in military service in 2011
2007	29,903	**25,564**	24,434	1,130	**6**	6	0	**0.23**	0.25	0.00	2
2008	29,565	**26,015**	24,911	1,104	**7**	7	0	**0.27**	0.28	0.00	2
2009	29,137	**24,966**	23,948	1,018	**5**	5	0	**0.20**	0.21	0.00	4
2010	28,960	**25,358**	24,256	1,102	**6**	6	0	**0.24**	0.25	0.00	4
2011	32,875	**28,023**	26,885	1,138	**4**	4	0	**0.14**	0.15	0.00	4
2012[a]	16,602	**15,518**	14,876	642	**3**	3	0	**0.19**	0.20	0.00	3
Total	167,042	**145,444**	139,310	6,134	**31**	31	0	**0.21**	0.22	0.00	19

[a]Through 30 June 2012

Marine Corps Reservists (0.16 per 1,000 tested) were detected with antibodies to HIV-1 **(Table 9)**.

During 2011, there were four incident diagnoses of HIV-1 infection among Marine Corps Reservists; the overall seropositivity was 0.14 per 1,000 Marines tested. In 2011, on average, one new HIV-1 infected Marine was detected per 8,219 screening tests **(Table 9)**. Of note, in the past 21 years, there have been no incident diagnoses of HIV-1 infection among female Marine Reservists. Of the 31 Marine Reservists diagnosed with HIV-1 infections since 2007, 19 (61%) were still in service in 2012 **(Table 9)**.

U.S. Coast Guard

Active component: During the 18-month period from January 2011 through June 2012, 35,920 tests for antibodies to HIV-1 were conducted among 34,274 members of the active component of the U.S. Coast Guard. During the period, two Coast Guard members (0.06 per 1,000 persons tested) were detected with antibodies to HIV-1 **(data not shown)**.

During 2011, there were two incident diagnoses of HIV-1 infection among active component Coast Guard members. The overall prevalence of seropositivity was 0.09 per 1,000 Coast Guardsmen tested. In 2011, on average, one new HIV-1 Coast Guard member was detected per 12,036 screening tests. Of the 19 active component Coast Guardsman diagnosed with HIV-1 infections since 2007, 13 (68%) were still in service in 2012. Only two female

TABLE 10. New diagnoses of HIV-1 infections, by gender, active component, U.S. Air Force, January 2007-June 2012

Year	Total HIV tests	Total persons tested	Males tested	Females tested	Total new HIV-1 (+)	New HIV-1 (+), males	New HIV-1 (+), females	Overall rate per 1,000 tested	Male rate per 1,000 tested	Female rate per 1,000 tested
2007	229,556	**204,424**	162,738	41,686	**40**	40	0	**0.20**	0.25	0.00
2008	268,263	**237,393**	190,215	47,178	**49**	49	0	**0.21**	0.26	0.00
2009	290,056	**244,077**	195,826	48,251	**45**	44	1	**0.18**	0.22	0.02
2010	282,446	**263,451**	211,830	51,621	**46**	43	3	**0.17**	0.20	0.06
2011	257,586	**219,328**	176,902	42,426	**36**	36	0	**0.16**	0.20	0.00
2012[a]	131,459	**124,521**	100,177	24,344	**13**	12	1	**0.10**	0.12	0.04
Total	1,459,366	**1,293,194**	1,037,688	255,506	**229**	224	5	**0.18**	0.22	0.02

[a]Through 30 June 2012

TABLE 11. New diagnoses of HIV-1 infections, by gender, Air National Guard, U.S. Air Force, January 2007-June 2012

Year	Total HIV tests	Total persons tested	Males tested	Females tested	Total new HIV-1 (+)	New HIV-1 (+), males	New HIV-1 (+), females	Overall rate per 1,000 tested	Male rate per 1,000 tested	Female rate per 1,000 tested
2007	15,296	**14,044**	11,321	2,723	**2**	1	1	**0.14**	0.09	0.37
2008	25,976	**23,004**	19,020	3,984	**2**	2	0	**0.09**	0.11	0.00
2009	31,577	**27,083**	22,684	4,399	**4**	4	0	**0.15**	0.18	0.00
2010	24,294	**22,612**	18,837	3,775	**0**	0	0	**0.00**	0.00	0.00
2011	43,231	**37,972**	31,540	6,432	**3**	3	0	**0.08**	0.10	0.00
2012[a]	27,586	**25,935**	21,592	4,343	**3**	3	0	**0.12**	0.14	0.00
Total	167,960	**150,650**	124,994	25,656	**14**	13	1	**0.09**	0.10	0.04

[a]Through 30 June 2012

TABLE 12. New diagnoses of HIV-1 infections, by gender, Air Force Reserve, U.S. Air Force, January 2007-June 2012

Year	Total HIV tests	Total persons tested*	Males tested	Females tested	Total new HIV-1 (+)	New HIV-1 (+), males	New HIV-1 (+), females	Overall rate per 1,000 tested	Male rate per 1,000 tested	Female rate per 1,000 tested
2007	26,824	**24,953**	19,579	5,374	**6**	5	1	**0.24**	0.26	0.19
2008	26,487	**24,054**	18,581	5,473	**5**	5	0	**0.21**	0.27	0.00
2009	27,720	**24,882**	19,364	5,518	**6**	6	0	**0.24**	0.31	0.00
2010	25,101	**23,938**	18,584	5,354	**9**	9	0	**0.38**	0.48	0.00
2011	27,329	**24,998**	19,570	5,428	**5**	5	0	**0.20**	0.26	0.00
2012[a]	16,905	**16,349**	12,606	3,743	**4**	4	0	**0.24**	0.32	0.00
Total	150,366	**139,174**	108,284	30,890	**35**	34	1	**0.25**	0.31	0.03

[a]Through 30 June 2012

Coast Guard members have been diagnosed with HIV-1 seropositivity since 1996 **(data not shown)**.

Coast Guard Reserve: Since 2007, there were two incident diagnoses of HIV-1 seropositivity among male members of the Coast Guard Reserve; neither of these individuals was still in service in 2012 **(data not shown)**.

U.S. Air Force

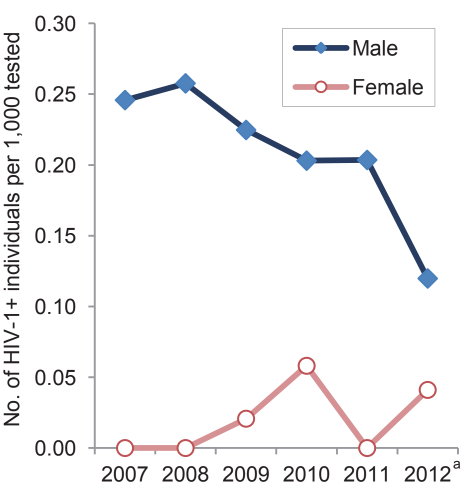
Active component: From January 2011 through July 2012, 389,045 tests for antibodies to HIV-1 were conducted among 343,849 members of the active component of the U.S. Air Force. During the period, 49 airmen (0.14 per 1,000 tested) were detected with antibodies to HIV-1. On average, one new HIV-1 infection was detected per 7,155 screening tests **(Table 10)**. From 2007 to 2011, there were between 36 and 49 male active component airmen detected with antibodies to HIV-1 each year. Since 1996, there have been three or fewer female airmen detected with HIV-1 infections each year **(Table 10, Figure 6)**.

Air National Guard: From January 2011 through July 2012, 70,817 tests for antibodies to HIV-1 were conducted among 63,907 members of the Air National Guard. During the period, six airmen (0.09 per 1,000 tested) were detected with antibodies to HIV-1. Among Air National Guard members, only 14 males and one female have been diagnosed with HIV-1 infections since 2007 **(Table 11)**.

Air Force Reserve: From January 2011 through July 2012, 44,234 tests for antibodies to HIV-1 were conducted among 41,347 members of the U.S. Air Force Reserve. During the period, nine airmen (0.22 per 1,000 tested) were detected with antibodies to HIV-1. In 2011, on average, one new HIV-1 infection was detected per 5,466 screening tests. The seroprevalence among those tested in 2011 was consistent with recent prior years **(Table 12)**.

Data summaries for the U.S. Air Force provided by the U.S. Air Force School of Aerospace Medicine (USAFSAM).

FIGURE 6. New diagnoses of HIV-1 infections, by gender, active component, U.S. Air Force, January 2007-June 2012



[a]Through 30 June 2012

EDITORIAL COMMENT

When the U.S. military began routine screening for HIV-1 in 1986, new detections of HIV-1 infections were relatively frequent because most service members had not previously been tested; thus, both long-standing (prevalent) and recently acquired (incident) infections were subject to detection during the first round of routine screening. By 1990, nearly all service members had been tested for antibodies to HIV-1 at least once — as civilian applicants prior to entering military service and/or while serving in the military. As a result, since then, routine periodic screening has detected infections among active and reserve component members that were acquired since the last negative tests of the respective service members (incident infections).

In 2011, prevalences of HIV-1 infection among male and female civilian applicants were fairly similar to those in 2010, which had the lowest prevalences of any year since testing began. Also, among both active and reserve component members of the U.S. military, HIV-1 seroprevalences remain relatively low, particularly among females.

Results of routine, periodic screening for HIV-1 in dynamic (i.e., continuously changing) military populations must be interpreted cautiously; in particular, comparisons of annual rates and trends of seropositivity across services and components can be misleading. For example, prevalences of seropositivity in repeatedly screened populations depend not only on rates at which new infections are acquired but also on testing frequencies. As such, even if rates of acquisition of HIV-1 infections were identical in two serially tested populations, prevalences of seropositivity would be different if the intervals between testing rounds were not the same (because the longer the interval, the more undetected infections accumulate between testing rounds). Of note in this regard, despite a standard two-year interval (applicable to all services) between mandatory period HIV-1 antibody tests, some service members are tested more frequently given other indications for testing. In particular, those who deploy to military operations overseas are tested before deployment (if they have not been tested during the preceding 120 days)[1] and again upon their return.

New HIV-1 infections among deployed service members do occur.[2,3] Scott and colleagues describe 48 deployed service members whose estimated dates of HIV-1 infection were prior to deploying, while in theater, or during rest and relaxation leave.[3]

The monitoring of results and trends of HIV-1 seroprevalences in various military populations can help target and focus prevention initiatives. The repeal of the Don't Ask Don't Tell policy in September 2011 has created new opportunities for prevention messages targeted to men who have sex with men.[4]

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Pertussis Diagnoses among Service Members and Other Beneficiaries of the U.S. Military Health System, January 2005-June 2012

Pertussis ("whooping cough") is a highly infectious respiratory disease caused by the bacterium *Bordetella pertussis*. Individuals at highest risk are infants and unvaccinated children; however, there have been recent increases in incidence among adolescent and young adult populations in the United States. During the surveillance period, there were 476 confirmed and 3,073 probable cases of pertussis among U.S. military members and other beneficiaries of the U.S. Military Health System. Among service members there were 77 and 13 confirmed cases in active and reserve component members, respectively. In comparison, infants and children aged 15 years and younger accounted for over half of all confirmed cases (n=244). Several spatiotemporal clusters of pertussis among military healthcare beneficiaries were associated with outbreaks in adjacent non-military communities, particularly in five states (California, Texas, Florida, Washington, and New York); one cluster occurred in a military community in Okinawa, Japan.

Pertussis ("whooping cough") is a highly infectious respiratory disease that is commonly known as a disease of childhood. It is caused by the bacterium *Bordetella pertussis*. The clinical course of pertussis begins with upper respiratory tract symptoms (cough, runny nose, mild fever) lasting one to two weeks; this stage is followed by the development of severe coughing episodes (paroxysms) that typically involve a characteristic "whoop" upon inspiration. Recovery from pertussis is prolonged; affected individuals usually experience a persistent cough that takes weeks to months to resolve.[1]

Pertussis is vaccine preventable; yet, thousands of cases and many outbreaks are reported each year in the United States. Individuals at highest risk are infants and unvaccinated children. However, since the 1980s an increasing incidence of pertussis in children aged 7 to 10, adolescents, and young adults has suggested an epidemiologic shift in pertussis disease burden to include individuals with waning immunity. Immunity associated with receipt of pertussis vaccine diminishes over time and this decline may be more rapid in persons vaccinated with acellular vaccines in childhood.[1-3] Other factors contributing to this shift include enhanced surveillance during outbreaks, increased awareness among the general population about the disease (e.g., through media reports), higher index of suspicion among clinicians, and improved laboratory testing.[1]

This report summarizes the numbers, trends, and demographic characterstics of pertussis diagnoses among service members and other beneficiaries of the U.S. Military Health System. Several spatiotemporal clusters of pertussis are identified.

METHODS

The surveillance period was 1 January 2007 through 30 June 2012. The surveillance population consisted of all individuals who are beneficiaries of the U.S. Military Health System, i.e., active and reserve component service members, retired service members, family members and other dependents of service members and retirees, and other authorized government employees and family members. For this report, a confirmed case was defined as an individual identified through a reportable medical event of pertussis. A probable case was defined by a hospitalization or ambulatory encounter with a diagnosis of pertussis (ICD-9-CM: 033) in the primary diagnostic position. Such encounters were excluded if there was either: 1) a record of pertussis vaccine administration or a positive test for serologic immunity to pertussis within seven days before or after the encounter date; or 2) a diagnostic or procedural code indicating pertussis vaccination during the encounter **(Table 1)**.

RESULTS

During the surveillance period, there were 476 confirmed and 3,073 probable cases of pertussis among U.S. military members and other beneficiaries of the U.S. Military Health System **(Figures 1,2)**. Approximately 81.1 percent (n=386) of confirmed cases and 89.9 percent (n=2,762) of probable cases affected non-military members ("other beneficiaries") **(Figures 1,2)**.

Among those individuals whose ages were reported (93% and 99% of confirmed and probable cases, respectively), 38.5 percent of confirmed cases (n=171) were infants and children aged 10 years and younger (44.3% [n=1,348] in probable cases) **(Figure 3)**. An additional 23.9 percent of confirmed cases (n=106) occurred in individuals aged 11 through 20 years (12.2% [n=371] in probable cases). The remaining 37.6 percent of confirmed cases (n=167) were distributed across the adult age groups (43.5% [n=1,324] in probable cases) **(Figure 3)**. There were 253 males and 221 females

TABLE 1. Diagnostic and procedural codes used to exclude medical encounters related to pertussis vaccination

ICD-9-CM	V03.6, V06.1, V06.2, V06.3, 99.37, 99.39
Outpatient procedure codes (CPT)	90698, 90700, 90701, 90715, 90720, 90721, 90723

FIGURE 1. Confirmed and probable cases of pertussis, active and reserve service members U.S. Armed Forces, January 2007-June 2012

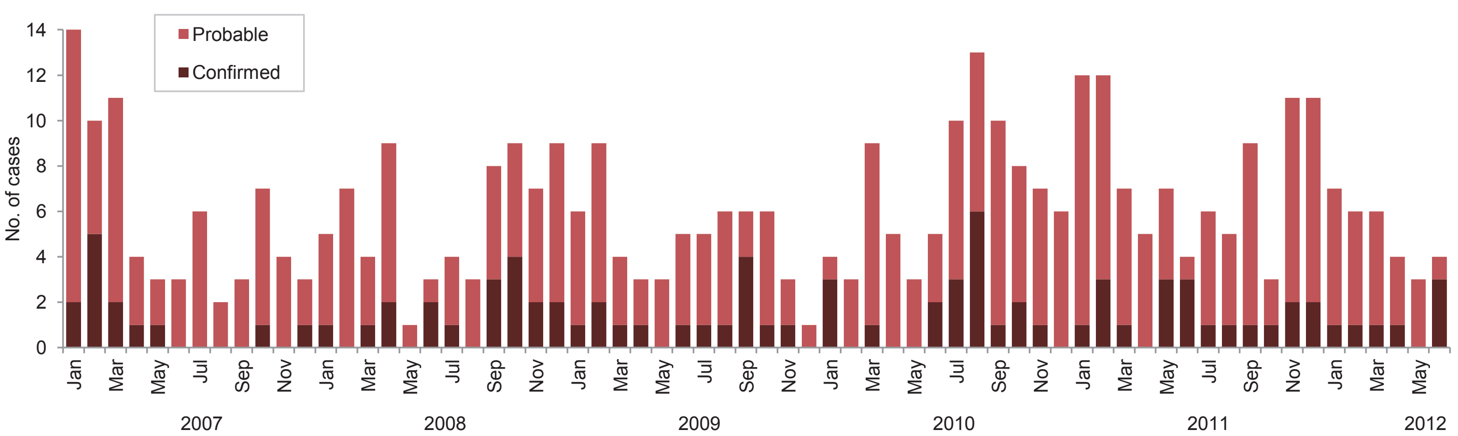


FIGURE 2. Confirmed and probable cases of pertussis among non-service member beneficiaries of the U.S. Military Health System, January 2007-June 2012

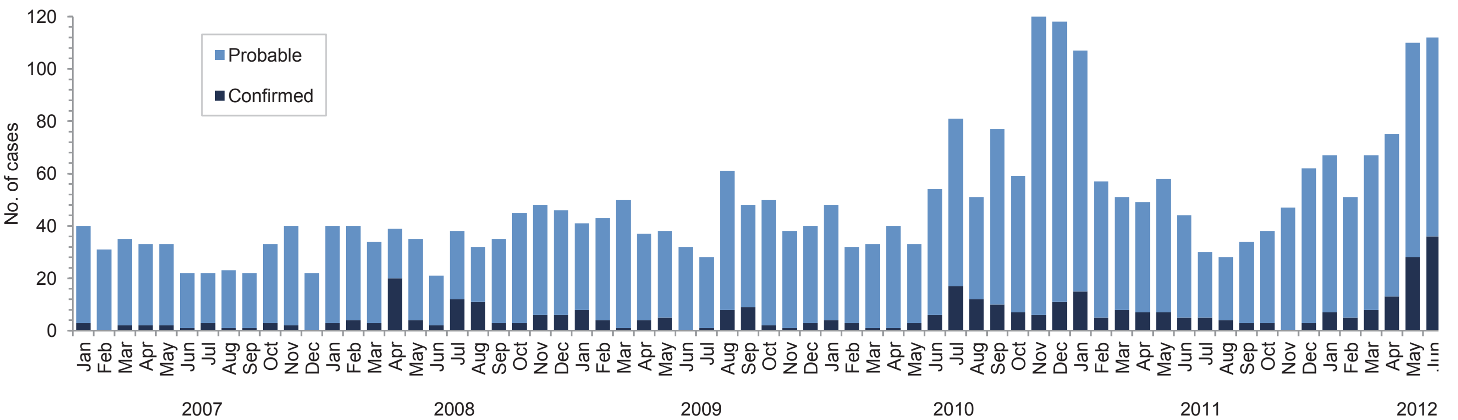
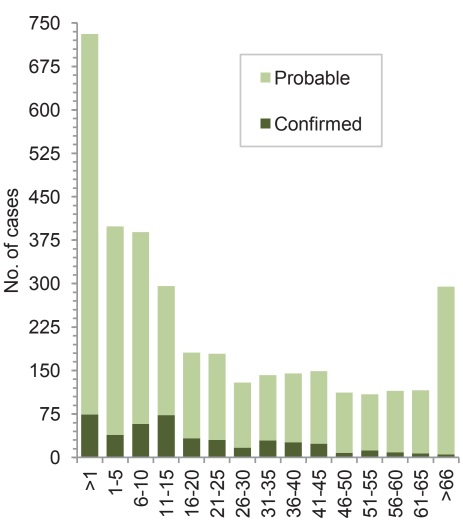


FIGURE 3. Age distribution of confirmed and probable pertussis cases,[a] January 2007-June 2012



[a]Age not available for 32 confirmed and 30 probable cases

among the confirmed cases whose gender was recorded **(data not shown)**.

During the surveillance period, five states, California (CA), Texas (TX), Florida (FL), Washington (WA), and New York (NY) and one country, Japan, had 18 or more cases (confirmed and probable combined) within one month periods ("spatiotemporal clusters") **(Figure 4)**. Within these states (and country), 7 installations or medical facilities reported 12 or more pertussis cases within one month periods. Naval Hospital (NH) Jacksonville, FL and NH Oak Harbor, WA had spatiotemporal clusters in April 2008 and July 2008, respectively. Naval Medical Center (NMC) San Diego, CA and Camp Pendleton, CA had clusters from July 2010 to February 2011. Since March 2012, NH Oak Harbor, WA, Joint Base Lewis-McChord, WA, and Fort Hood, TX have experienced spatiotemporal clusters **(Figures 5,6)**.

Most recently, NH Okinawa, Japan reported 11 cases in May 2012 and 25 cases in June 2012; 17 of these cases (47.2%) were confirmed. Of all cases, 21 (58.3%) were in beneficiaries in the age group of 11 to 15 years **(data not shown)**.

EDITORIAL COMMENT

Pertussis vaccination is required for entry into military service; however, pertussis can still occur in vaccinated individuals due to waning immunity or primary vaccine failure. During the 5-year surveillance period, 77 confirmed cases (16.2%) occurred in the active component and 13 confirmed cases (2.7%) in the reserve component. In

FIGURE 4. States/countries with 18 or more pertussis cases (confirmed and probable combined) during any calendar month, January 2007-June 2012

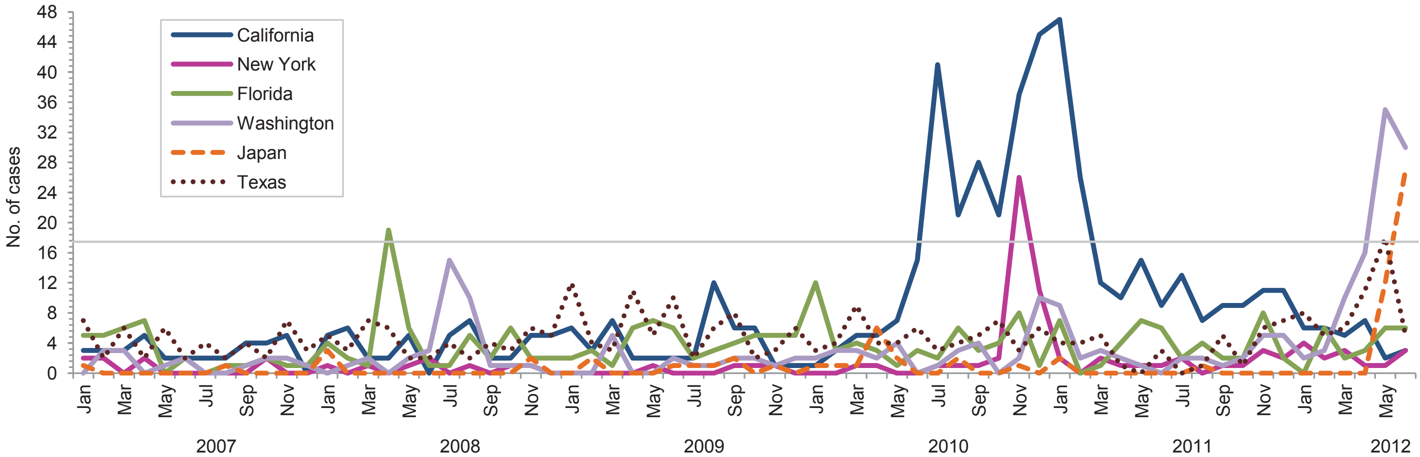
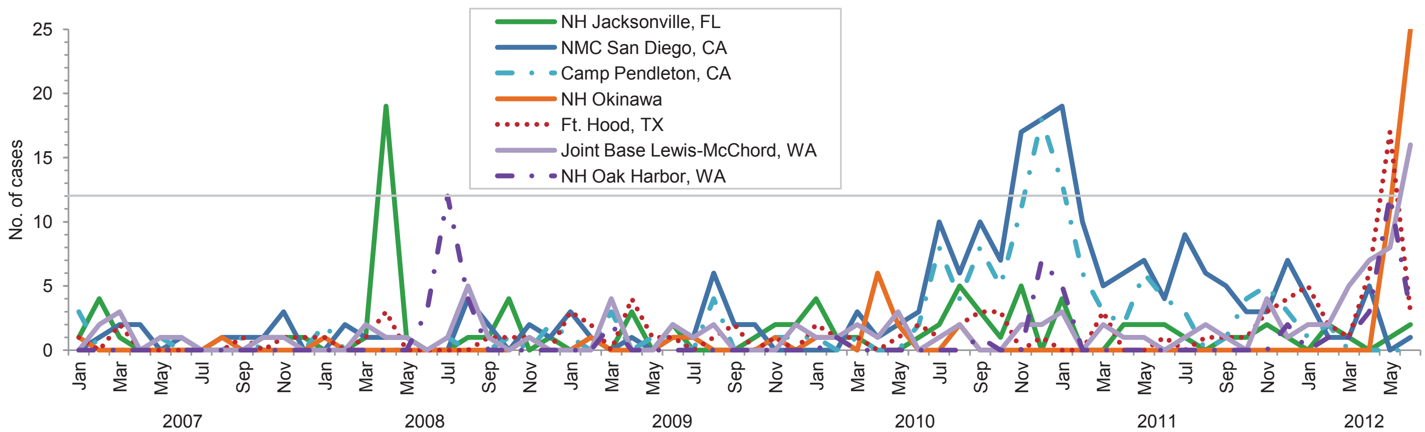


FIGURE 5. Installations/medical treatment facilities with 12 or more pertussis cases (confirmed and probable combined) during any calendar month, January 2007-June 2012

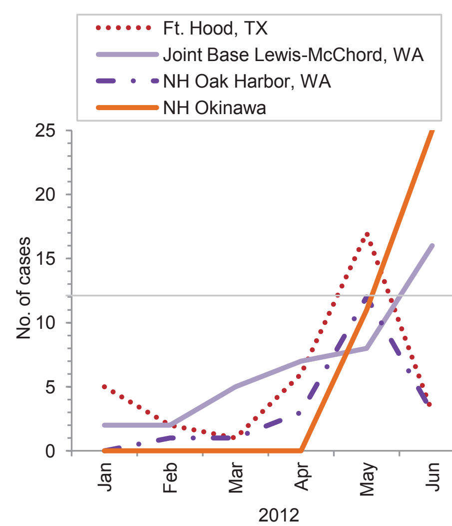


comparison, infants and children aged 15 years or younger accounted for over half of all confirmed cases (n=244, 55.0%). Furthermore, infants younger than 1 year and adolescents aged 11 to 15 years reported the highest numbers of confirmed cases (n=74 [16.7%] and n=73 [16.4%], respectively). These data, along with several reports of recent pertussis outbreaks, demonstrate that the epidemiologic profile of pertussis has shifted to include more members of the adolescent and young adult populations.[2,3]

Several of the military spatiotemporal clusters were associated with outbreaks in adjacent nonmilitary communities. In 2008, the Florida State Public Health Department reported higher numbers of cases in 10 out of 12 months compared to the 5 year average.[4] NH Jacksonville recorded a spatiotemporal peak in April of 2008; the county encompassing Jacksonville reported some of the highest rates of pertussis during 2008.[4]

In 2010, the California Department of Public Health reported a 12-fold increase in pertussis cases compared to 2009; at that time, California did not require a pertussis booster shot for middle school students.[1,5] However, since the fall of 2011, California has required, by law, recent pertussis booster vaccinations in middle school and high school students.[1] In this report, NMC San Diego and Camp Pendleton experienced spatiotemporal clusters of cases from July 2010 through February 2011. New York State also reported increases in pertussis during this period and urged vaccination

FIGURE 6. Installations/military treatment facilities with 12 or more pertussis cases (confirmed and probable combined) during any calendar month, January-June 2012



in infants and children and booster doses for adolescents and adults.[6]

More recently, in May and June of 2012, several states have reported outbreaks of pertussis. Washington State declared a pertussis epidemic in April 2012; by mid-June the state had recorded 2,520 cases, a 1,300 percent increase compared to the same period in 2011.[3,7] NH Oak Harbor and Joint Base Lewis-McChord both demonstrated increases in cases during March through June 2012; these locations are in counties (Island and Pierce, respectively) that reported some of the highest rates of pertussis in the state in 2012.[7]

On 31 May 2012, the U.S. Naval Hospital in Okinawa, Japan released a public announcement reporting several confirmed cases of pertussis in the U.S. military community on Okinawa.[8] Cases have been identified in both adolescents and adults. From January 2007 to March 2012 (i.e., 63 months), NH Okinawa reported a total of nine cases with no more than two cases reported in a single month. In May and June 2012, Okinawa reported 11 and 25 cases, respectively.

During any outbreak situation, there is an increased awareness of the disease in the community and among clinicians; therefore, individuals may be more likely to seek care and clinicians more likely to suspect, test, diagnose, and report the disease. Therefore, "spatiotemporal clusters" reported here may not only reflect an increase in actual disease, but also enhanced surveillance.

A majority of the cases in this report were categorized as probable cases. In the U.S. Military Health System, pertussis is a reportable medical event; therefore, "true" cases (i.e., cases that meet the case definition) of pertussis should be reported through this system. However, many cases may not be properly reported, or reported elsewhere (e.g. state health department) particularly if associated with care given outside the Military Health System ("outsourced" care) or if laboratory or pertinent patient history is unavailable or pending.

Recent trends in pertussis in both military and civilian populations in the U.S. highlight the importance of primary and booster vaccinations against pertussis. The modern acellular vaccine for pertussis is less frequently associated with local and systemic reactions than the predecessor whole-cell vaccine. Current recommendations for pertussis vaccine include 5 doses between ages 2 months and 6 years, one dose for those 11 to 18 years (preferably at age 11 or 12), and one dose for any adult who has never received the acellular vaccine. The recommendation for adults is especially pertinent to health care personnel who have direct patient contact during which they may be exposed to pertussis from their patients or may transmit the bacterium to patients.

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Hospitalizations for Hepatitis A, B, and C, Active Component, U.S. Armed Forces, 1991-2011

Although genetically quite distinct from one another, hepatitis viruses A, B, and C all cause inflammatory liver disease (hepatitis) in humans. Hepatitis A virus (HAV) is spread through fecal-oral transmission and has a long history as an important cause of disease in military populations. Hepatitis B and hepatitis C viruses (HBV and HCV, respectively) are both spread by percutaneous or mucous membrane exposure to infected blood or body fluids and therefore have similar risk factors (e.g., unprotected sex with an infected partner, intravenous drug use, transfusion of contaminated blood).

Screening and immunization programs implemented in the United States and in the U.S. Armed Forces have had major beneficial effects on the incidence of new infections caused by these hepatitis viruses, especially types A and B. Hospitalization data is available from the Defense Medical Surveillance System (DMSS) starting in 1990. This report describes hospitalization trends of hepatitis types A, B, and C during a 21-year period (1991-2011) against the backdrop of important strides in the prevention of hepatitis disease.

HAV

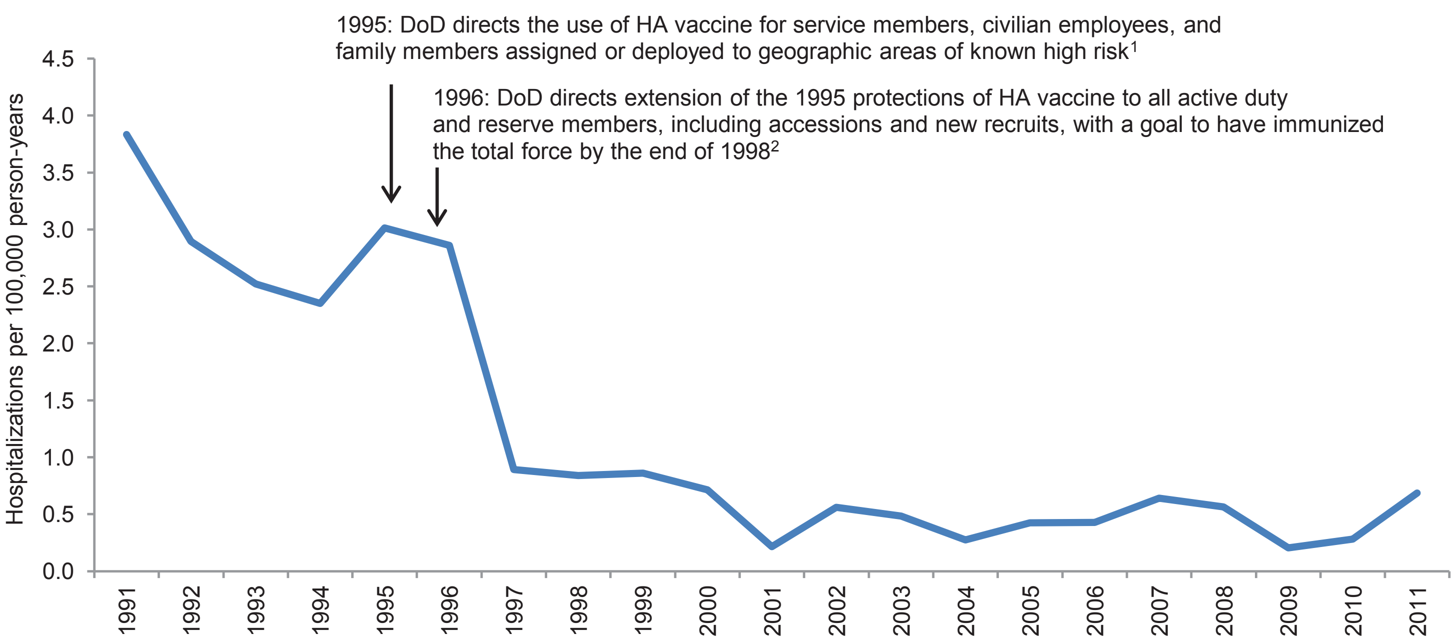
Hospitalizations for acute hepatitis A were identified by International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM) diagnoses codes 070.0 or 070.1 in any diagnostic position. From 1991 to 2011, there were 415 hospitalizations for acute hepatitis A among active component members of the U.S. Armed Forces; the crude overall hospitalization rate during the period was 1.3 per 100,000 person-years (p-yrs) **(Figure 1)**. Annual hospitalization rates of acute hepatitis A fell dramatically following the implementation of the Department of Defense's 1995 and 1996 policies for use of hepatitis A vaccine in the Armed Forces.[1,2] The recent low hospitalization rates of acute hepatitis A among U.S. military members (range for 2000-2011: 0.2 to 0.7 hospitalizations per 100,000 p-yrs) likely reflect not only recruit screening and immunization but also the widespread use of hepatitis A virus vaccine among children and adolescents in the United States.

HBV

Hospitalizations for hepatitis B were identified by ICD-9-CM codes 070.20, 070.21, 070.30, or 070.31 (acute) or 070.22, 070.23, 070.32, 070.33, or V02.61 (chronic) in any diagnostic position. From 1991 to 2011, there were 820 and 241 hospitalizations of active component members for acute and chronic hepatitis B virus infections, respectively; crude overall hospitalization rates during the period were 2.4 (acute hepatitis B) and 0.7 (chronic hepatitis B) per 100,000 p-yrs **(Figure 2)**.

Annual hospitalization rates for acute hepatitis B declined by 88 percent from 1992 to 1997 (8.7 and 1.0 per 100,000 p-yrs, respectively) and were relatively stable over the next 14 years; the rate in 2011 was lower (0.7 per 100,000 p-yrs) than in any other year of the period. Following the creation of a new ICD-9 code for chronic hepatitis B in late 1994, rates of hospitalizations for chronic hepatitis B increased to 2.2 per 100,000 p-yrs in 2001 and slowly

FIGURE 1. Trend of incident hospitalizations for hepatitis A , active component, U.S. Armed Forces, 1991-2011



declined to their lowest levels ever in 2010 and 2011 (0.3 and 0.7 per 100,000 p-yrs, respectively).

The decline in hospitalizations for acute hepatitis B in the U.S. military during the 1990s likely reflects an increased prevalence of hepatitis B immunity among service members resulting from HBV childhood vaccination campaigns in the United States. Declines after 2002 likely reflect the combined effects of immunization prior to entry into service as well as the 2002 implementation of the DoD policy for screening and vaccination of immunologically naive recruits.[3] The gradual decrease in hospitalization rates for chronic hepatitis B probably represents, at least in part, delayed effects of the factors that have decreased acute hepatitis B incidence.

HCV

Hospitalizations for hepatitis C were identified by ICD-9-CM codes 070.41 or 070.51 (acute) or 070.44, 070.54, 070.70, 070.71, or V02.62 (chronic) in any diagnostic position. From 1991 to 2011, there were 737 and 899 hospitalized cases of acute and chronic hepatitis C, respectively, among active component members of the U.S. Armed Forces; crude overall rates during the period were 2.3 (acute) and 2.7 (chronic) per 100,000 p-yrs **(Figure 3)**. Hospitalization rates of acute hepatitis C diagnoses steadily declined (by 80%) from 1994 to 2000 and then again from 2004 to 2011 (by 97%). Rates of chronic hepatitis C hospitalizations declined from 1995 to 2000 (by 67%). From 2001 to 2011, hospitalization rates for chronic hepatitis C remained relatively stable, ranging from 2.5 per 100,000 p-yrs (2002) to 4.4 per 100,000 p-yrs (2008).

There is no vaccine for hepatitis C; thus, other factors must account for the declines in rates of hospitalization for acute and chronic hepatitis C documented here. First, there were no ICD-9-CM diagnostic codes specific for hepatitis C prior to October 1991 or for chronic hepatitis C until October 1994. As such, during the early years of the surveillance period, hospitalizations for hepatitis C-related illnesses could not be ascertained from the hospitalization records used for this report. Second, a reliable test for HCV infection (a test for antibody to the virus) was not widely available until approximately 1992. As a result, laboratory confirmation of HCV infection was not generally possible until after that time. Third, many individuals who are infected with HCV, especially those who are chronically infected, are asymptomatic; thus, in the early 1990s, absent other indications, asymptomatic individuals were unlikely to be tested. The asymptomatic HCV infections of service members may have been identified eventually, e.g., when attempting to donate blood, which was routinely screened for hepatitis C after 1991, or during other medical evaluations. Thus, the initial identification of persons already infected in 1991 may have been distributed over subsequent years. Fourth, the confirmation of a diagnosis of chronic hepatitis C in the 1990s depended in part on documentation that the patient's "acute" infection had not resolved over a period of six months or more following initial detection of the infection. As a result, it is not surprising that the peaking of cases of chronic

FIGURE 2. Trend of incident hospitalizations for acute and chronic hepatitis B, active component, U.S. Armed Forces, 1991-2011

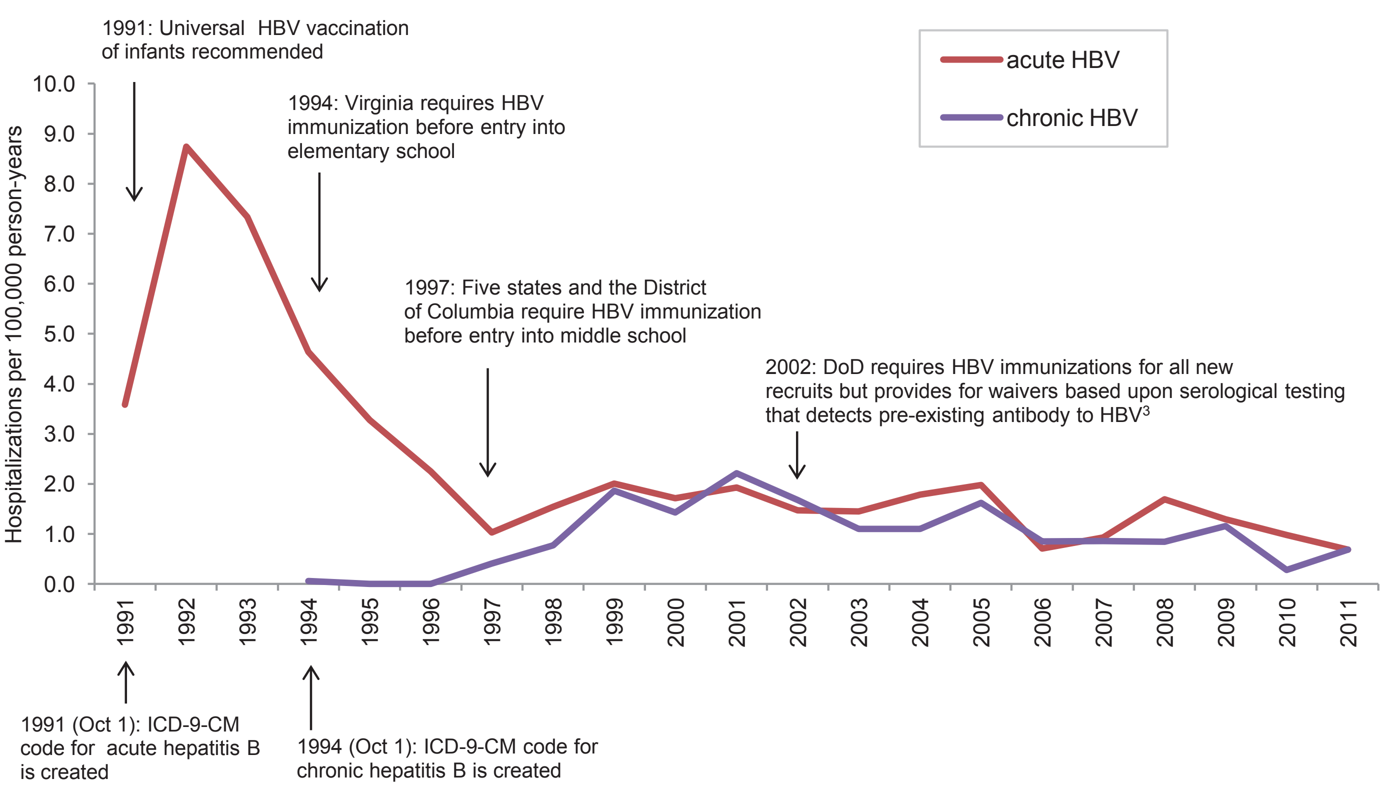
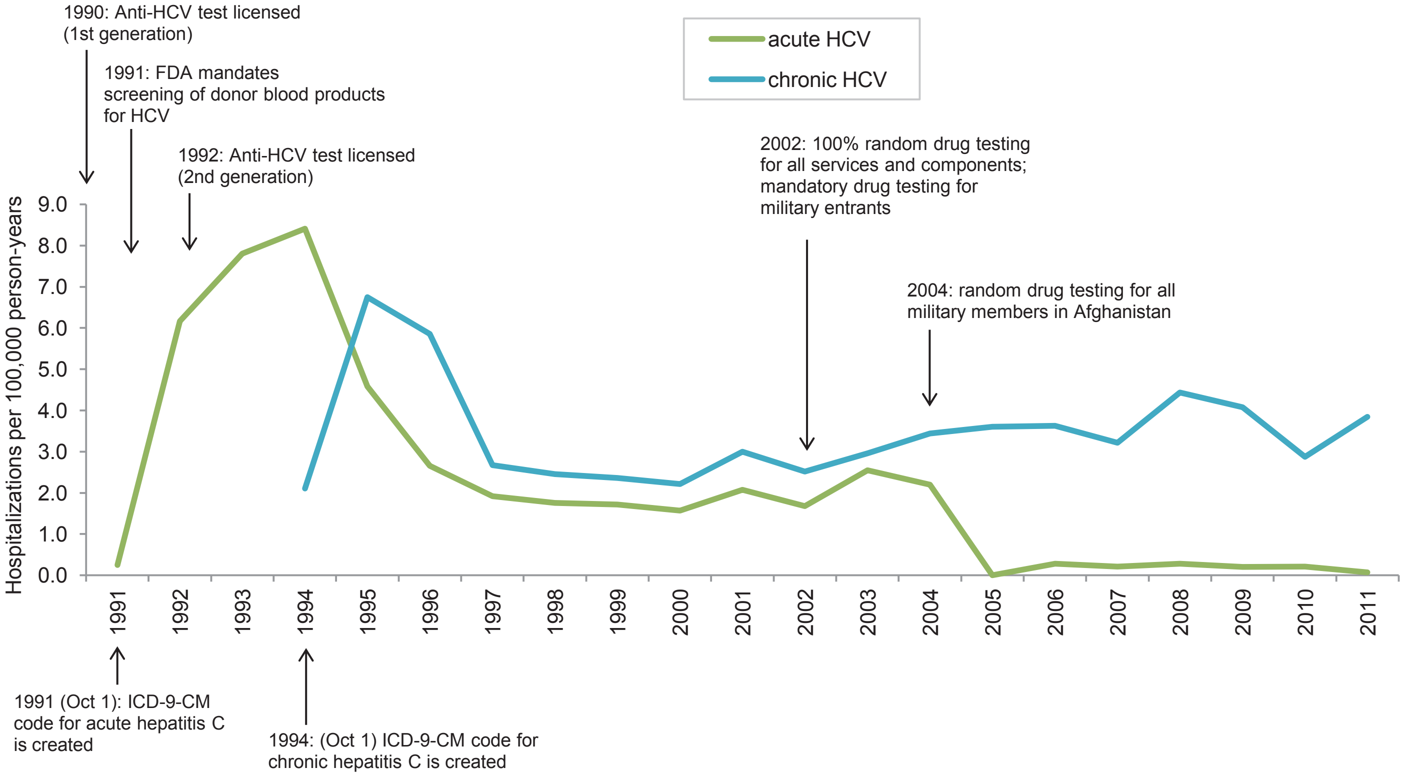


FIGURE 3. Trend of incident hospitalizations for acute and chronic hepatitis C, active component, U.S. Armed Forces, 1991-2011



hepatitis C lagged behind initial diagnoses of acute hepatitis C. Lastly, as many as 80 percent of cases of acute hepatitis C go on to develop persistent infection that leads to chronic hepatitis C. Accordingly, any changes in the incidence of acute hepatitis C will likely be followed by corresponding changes in the incidence of chronic hepatitis C. In summary, as a result of the factors described above, the peak in hospitalizations for acute hepatitis C in the early 1990s was occasioned by the introduction of laboratory tests that enabled detection of HCV infections and ICD-9-CM codes that permitted the documentation of HCV-specific diagnoses in standardized medical records.

Since the late 1990s, the hospitalization rates for both acute and chronic hepatitis C have been relatively stable except for the precipitous and lasting drop in the rates for acute hepatitis C beginning in 2005. A previous *MSMR* report described a downward trend in combined inpatient and outpatient diagnoses of acute hepatitis C since 2000, particularly beginning in 2005.[3] The paucity of hospitalizations since then suggests that recent health care practices have deemphasized the need for inpatient evaluations and management of acute hepatitis C.

The last decade's declines in the incidence of both acute and chronic hepatitis C are most dramatic for service members aged 40 and older. For example, in 2000, the rate of diagnosis of acute hepatitis C was more than fourfold higher among members 40 years and older compared to any younger age group; in 2010, the rates in all age groups were approximately the same. In 2000, the rate of diagnosis of chronic hepatitis C was approximately fivefold higher among service members 40 years and older compared to any younger age group; in 2010, the rate among 40 years and older service members was only about two and a half times that among younger service members.[4]

HBV and HCV in the era of HIV

Because HBV and HCV share risk factors with human immunodeficiency virus (HIV), measures aimed at preventing acquisition and transmission of any one of these viruses can have beneficial impacts on transmission of the others. Since the early 1990s, all donated blood has been screened for the presence of all of these viruses. Not only does the identification of infective blood preclude its transfusion into others, but the recognition of presumably "silent infections" in donors can enable such individuals to avoid unwitting transmissions of life threatening infections to others (e.g., sex partners).

The periodic screening of military service members for HIV antibody identifies persons infected with HIV, who may be at high risk of infection with HBV or HCV. As such, counseling of HIV infected individuals may reduce their risk of acquiring HBV or HCV or transmitting HIV, HBV, or HCV. Increased awareness among service members in general about behaviors that increase risk of acquiring HIV infection (e.g., unprotected sex with infected partners, illicit drug use) should contribute to the prevention of HBV and HCV acquisitions by them. When applicants for military service are screened for drug abuse, HIV infection, and recent history of hepatitis, the exclusion of those who screen positive reduces the prevalence of service members with risk factors for these viral infections. For service members, the performance of randomized and ad hoc drug screening, periodic HIV testing, and periodic health and medical examinations all serve not only to detect individuals at risk but also to sensitize and educate service members about the risks for these diseases. Lastly, in the health care setting, the widespread application of universal blood and body fluid precautions reduces the risks of transmitting these three viruses to patients and to health care workers.[4,5]

There are several limitations to this report that should be considered when interpreting the results. First, trends in rates of hospitalization over time may reflect differences in case management for acute and chronic hepatitides and changes in hospitalization guidelines within the military health system. Second, the summary of hospitalization rates reported here is not as comprehensive as the previously cited report that utilized both inpatient and outpatient health encounters.[4] However, because this report focused on hepatitis-specific hospitalizations, it was able to assess hepatitis incidence among U.S. military members since 1991 (electronic records of outpatient encounters of U.S. military members have been centrally collected and archived since 1997). Third, while the vaccines against HAV and HBV played major roles in the declining incidence rates of these diseases among active component members, the decline in HCV incidence reflects the effects of several factors. The relative impacts on HCV incidence of the factors described above are difficult to discern from available data; it is clear, however, that HCV disease among active component military members has sharply declined over the past two decades.

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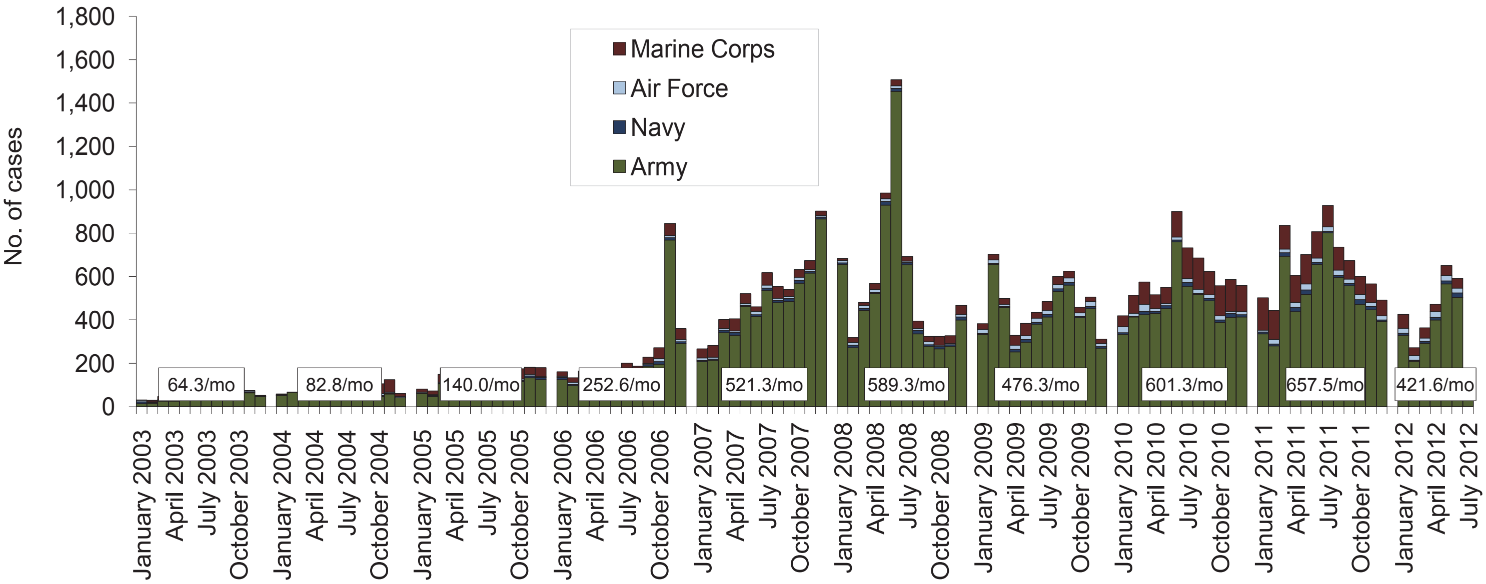
Deployment-related conditions of special surveillance interest, U.S. Armed Forces, by month and service, January 2003-July 2012 (data as of 26 August 2011)

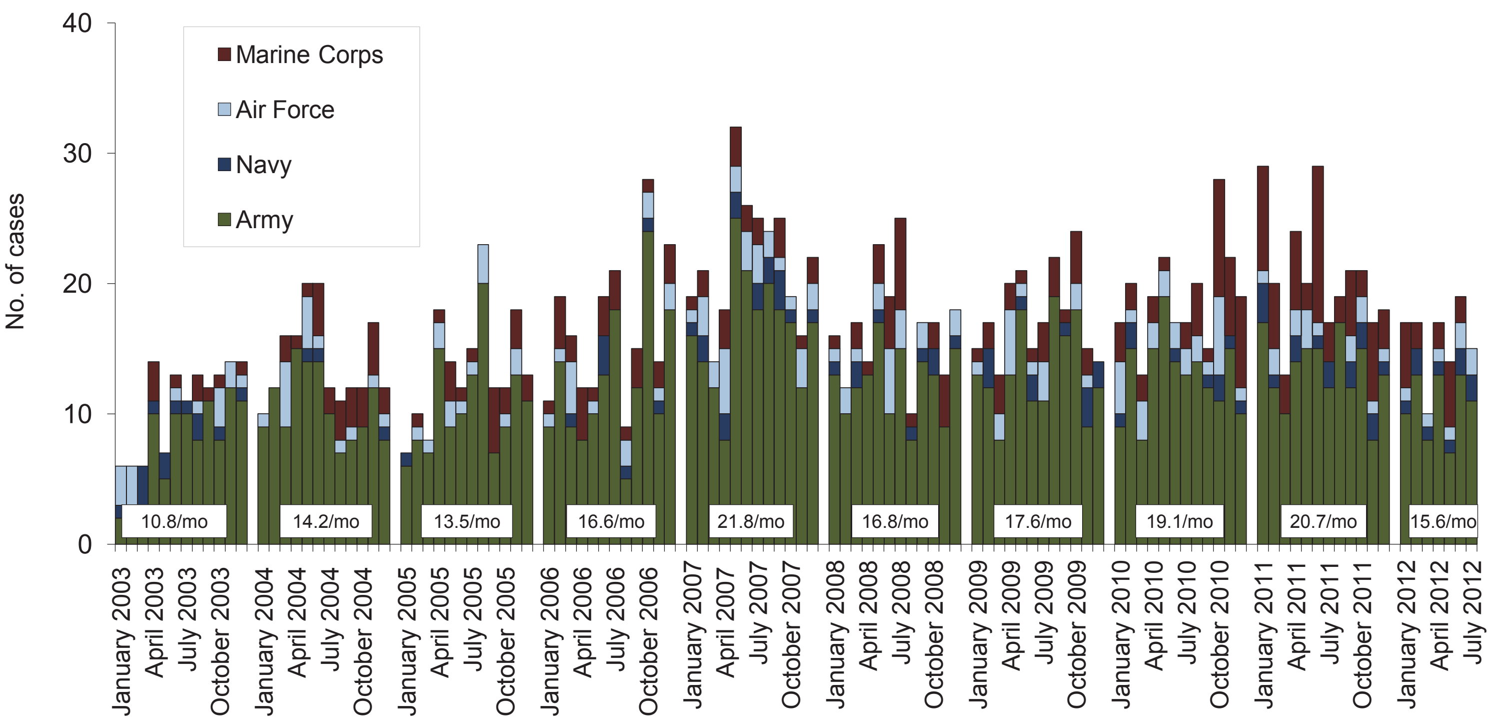
Traumatic brain injury (ICD-9: 310.2, 800-801, 803-804, 850-854, 907.0, 950.1-950.3, 959.01, V15.5_1-9, V15.5_A-F, V15.52_0-9, V15.52_A-F, V15.59_1-9, V15.59_A-F)[a]



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 3,084 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]

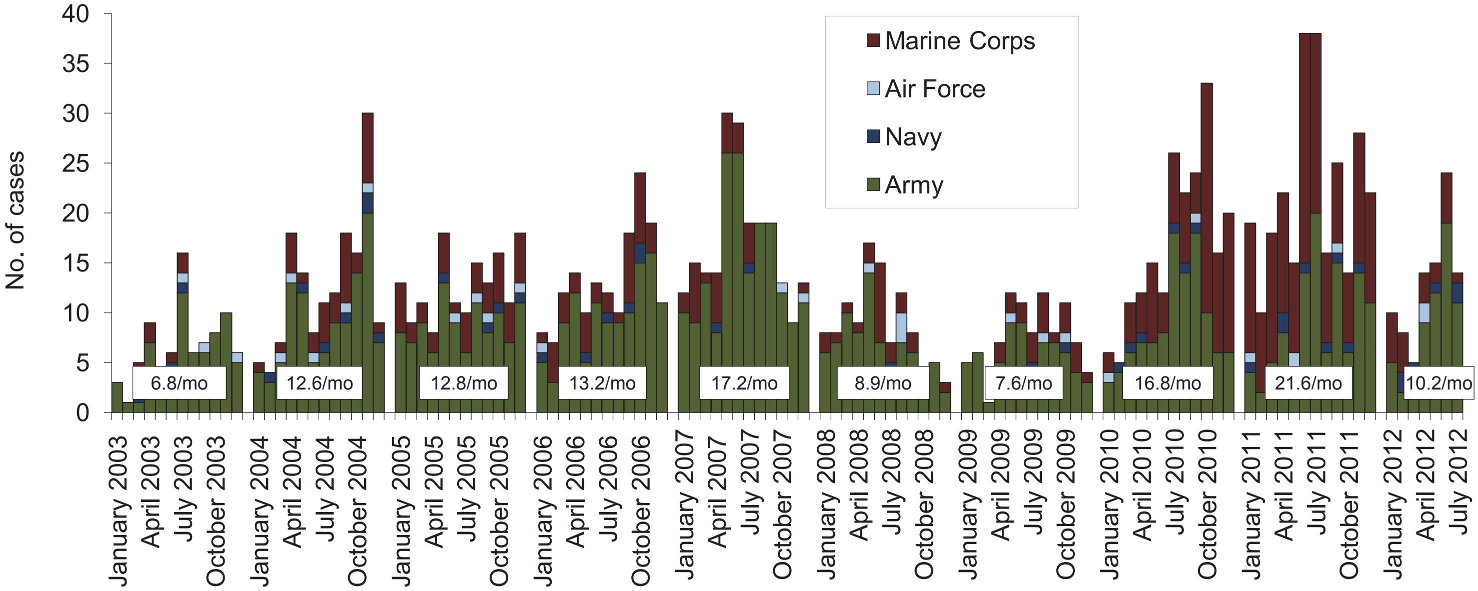


Reference: Isenbarger DW, Atwood JE, Scott PT, et al. Venous thromboembolism among United States soldiers deployed to Southwest Asia. *Thromb Res*. 2006;117(4):379-83.

[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-July 2012 (data as of 26 August 2011)

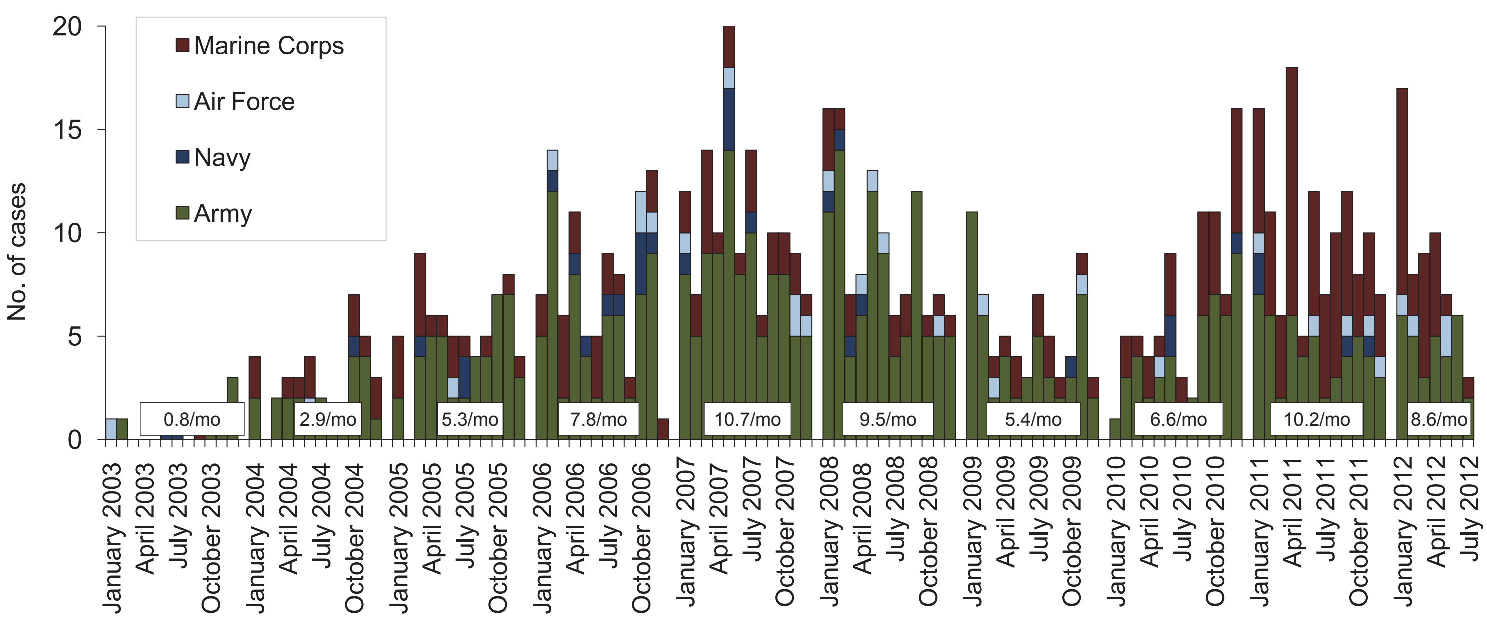
Amputations (ICD-9-CM: 887, 896, 897, V49.6 except V49.61-V49.62, V49.7 except V49.71-V49.72, PR 84.0-PR 84.1, except PR 84.01-PR 84.02 and PR 84.11)[a]



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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