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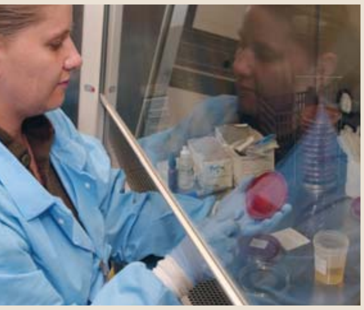

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Human T-lymphotropic Virus Infections in Active Component Service Members, U.S. Armed Forces, 2000–2008

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Emergency whole blood transfusions may increase the risk of transmitting bloodborne pathogens, including human T-lymphotropic viruses (HTLVs). U.S. military personnel with any medical encounter for HTLV infection during 2000–2008 were identified from surveillance data. Using both inclusive and restrictive case definitions, the incidence of diagnoses of HTLV infection was analyzed in relation to demographic factors and prior deployment. There were 247 "possible" cases of HTLV infection identified, or 1.88 cases per 100,000 person-years (p-yrs) (95% CI 1.66, 2.13). Seventy of these met the restrictive definition, translating to a rate of 0.53 per 100,000 p-yrs (95% CI 0.42, 0.67). Under the restrictive definition, a higher rate was noted among females versus males (RR 2.37; 95% CI 1.41, 3.98), service members with a healthcare occupation versus those who are primarily trained to engage in combat (RR 2.54; 95% CI 1.06, 6.10), and service members with any deployment experience (RR 8.98; 95% CI 5.61, 14.37). These findings, and a prior military case report of transfusion-transmitted HTLV-I, suggest a need to better define the epidemiology of HTLV in U.S. military personnel to further ensure emergency transfusion safety.

A recent report documented an instance of human T-lymphotropic virus type I (HTLV-I) infection acquired by a U.S. Army soldier through blood transfusion.[1] The implicated transfusion had been among 13 units of fresh whole blood that the soldier received emergently during treatment in Afghanistan for multiple injuries caused by an improvised explosive device. The donor had no identifiable risk factors and was not part of a pre-screened donor pool, so existing countermeasures did not identify his infection status. The transmission occurred at one of the forward operating bases, which typically lack pre-donation screening resources, a sufficient number of pre-screened donors, and a large capacity of pre-positioned blood components.

In accordance with U.S. Food and Drug Administration (FDA) guidelines, HTLV screening is performed on military blood donors; however, in the case of emergent blood collection to treat war-wounded service members, donor testing is done retrospectively whenever pre-screening of volunteers in donor pools is not possible.[2,3] Recipients are screened at 3, 6, and 12 months post-transfusion when whole blood is transfused during combat operations and the donor blood had not been screened according to FDA standards.

The identification of the case of transfusion-transmitted HTLV-I raised at least two questions of interest: What is the prevalence of HTLV infection among military personnel, and how can it be that more cases of other, more common types of transfusion-transmitted virus infections such as hepatitis B virus (HBV) and hepatitis C virus (HCV) have not emerged among combat veterans despite efforts to find such cases?[4] The latter might be partially explained by the variety of screening and treatment opportunities that many military service members may have, as well as widespread use of the hepatitis B vaccine in both civilian and military populations. Nevertheless, the questions are important because military personnel are potential, emergent blood donors in hostile and remote territories.

A causal association has been demonstrated between HTLV-I and several different diseases, notably adult T-cell leukemia-lymphoma (ATL) and HTLV-I–associated myelopathy (HAM). Most of the known HTLV-I subtypes are endemic in populations of tropical origin (equatorial Africa, the Seychelles, the Caribbean, and South America)—hence the name tropical spastic paraparesis (TSP) originally used to describe the myelopathy. At least one temperate-zone, cosmopolitan subtype is endemic to southern Japan. Possible links have also been drawn between HTLV-II and human diseases, particularly neurological disorders. HTLV-II is endemic in Native American populations and among some groups of intravenous drug users in both the Eastern and Western Hemispheres. In the healthcare arena, transmission of these human retroviruses is possible with the transfer of tissues among patients, including blood product transfusion and organ transplantation. Secondary transmission may occur via sexual contact or breastfeeding.

The objectives of the current analysis were to estimate incidence rates of HTLV infection among U.S. military personnel using diagnostic codes recorded during clinical encounters, and then to explore demographic factors, as well as a history of deployment to a combat or peacekeeping theater, as possible risk factors.

METHODS

The Defense Medical Surveillance System (DMSS) was used to identify all active component military personnel with a diagnosis of either HTLV-I or HTLV-II infection during 2000–2008 and to obtain individual demographic and deployment-related data. Demographic and deployment-related data for active component service members during 2000–2008 were obtained separately for rate calculations.

An initial group of "possible" cases was identified by using a more inclusive case definition: individuals with at least one record of a medical encounter for which a diagnosis of HTLV-I or HTLV-II infection was documented in any diagnostic position (inpatient or outpatient). A final group of more strictly defined cases was then selected by requiring a minimum of two outpatient encounters or one inpatient encounter within the Military Healthcare System for which the International Classification of Diseases version 9 (ICD-9) code for either HTLV-I or HTLV-II infection was recorded (ICD-9: 079.51 or 079.52). Two outpatient encounters would meet the inclusion criteria even if the same virus type (I or II) did not appear in both records.

Using SAS [SAS Institute Inc., Cary, NC, USA], OpenEpi,[5] and WINPEPI[6] for descriptive and bivariate analysis, the diagnoses of HTLV were assessed in relation to various demographic characteristics, to the type of clinic where the diagnoses were recorded, and to prior deployment for a combat or peacekeeping mission.

RESULTS

There were 372 encounters with either HTLV-I or HTLV-II recorded as a diagnostic code among 247 individual patients with possible infection (HTLV-I, n=175; HTLV-II, n=24; HTLV-I and HTLV-II, n=48). The overall incidence rate was 1.88 "possible" cases per 100,000 person-years (p-yrs). Seventy of the 247 patients were identified as meeting the stricter definition of infection by having at least a second outpatient encounter—or still just one hospitalization—documented with a code for HTLV-I or HTLV-II (HTLV-I, n=42; HTLV-II, n=2; HTLV-I and HTLV-II, n=26). The overall crude incidence rate based on more strictly defined cases was 0.53 new diagnoses per 100,000 p-yrs.

On exploration of clinic types, 47 of the 70 patients had at least one encounter at an infectious disease, preventive medicine, or community health clinic, which in the military services perform public health functions that include counseling, contact tracing, and follow-up testing **(Table 1)**. Thus, two thirds of the patients had at least one encounter with a provider who would typically see military patients with HTLV infection in consultation or follow-up.

Five patients (7%) had at least one encounter at a hematology-oncology clinic, whereas none had encounters with a neurology clinic. At least seven (10%) had significant hematologic or neurologic diagnoses, including one case of peripheral T-cell lymphoma **(Table 1)**.

Among cases of HTLV infection identified with the stricter definition, the incidence rate was higher among females than males. Higher rates were also found among persons with an occupational specialty in the healthcare arena, compared to those in combat specialties, and among service members with any deployment experience compared to those who had not previously

TABLE 1. Number of patients with probable human T-lymphotropic virus infection (type I and type II) with medical encounters in the specific types of clinic settings. Clinic types for the initial and subsequent encounters are cross-tabulated.

Initial encounter	No. of patients by specialty	No. of patients with subsequent encounters by specialty[a]					No. of patients with subsequent hospital admission
		Primary care	Infectious diseases	Preventive medicine[b]	Hematology-oncology	Other specialties	
Primary care	27	16	9	.	1	1 general surgery, 1 obstetrics/gynecology	3[c]
Infectious diseases	26	8	23	.	.	1 general surgery, 1 dermatology	.
Preventive medicine	11	2	5	7	.	.	.
Hematology-oncology[d]	4	2	1	.	4	.	.
Obstetrics-gynecology	2	.	.	.	.	1 obstetrics/gynecology	1[e]
Total	70	28	38	7	5	5	4

[a]Patients who had subsequent encounters at more than one type of clinic are counted more than once in the stratified data.

[b]Preventive medicine, the military equivalent of public health, includes encounters coded as community health as well as epidemiology.

[c]One patient had a diagnosis of peripheral T-cell lymphoma, received antineoplastic chemotherapy, and was listed as awaiting organ transplant. Another patient was treated for missed abortion, and a third patient was treated for acute appendicitis.

[d]This group included a patient given the diagnoses "primary thrombocytopenia" and "aplastic anemia," and another patient with "leukocytopenia."

[e]This patient received the following diagnostic codes: secondary uterine inertia, infection of amniotic cavity, postpartum hemorrhage, and other viral diseases in the mother.

deployed. There were no significant associations between incidence rates and age or racial/ethnic group **(Table 2)**.

Deployment history was further analyzed in relation to sex and occupation **(data not shown)**. Among patients who met the more restrictive definition, 10 (50%) of 20 females had prior deployments to a combat zone; this proportion did not differ significantly from that of the 50 infected males, 28 (56%) of whom had histories of prior deployment (p=0.65). Likewise, deployment history did not differ significantly between those with and without a healthcare occupation. Six (60%) of the 10 healthcare workers with more strictly defined infection had deployed, compared to 32 (53%) of 60 infected service members

TABLE 2. Human T-lymphotropic virus cases (type I and type II) among active component U.S. military personnel, 2000–2008

	Cases meeting inclusive definition[a]						Cases meeting restrictive definition[b]					
	No.	%	Rate[c]	(95% CI)	Rate ratio (RR)	(RR 95% CI)	No.	%	Rate[c]	(95% CI)	Rate ratio (RR)	(RR 95% CI)
Total	247	100.0	1.88	(1.66, 2.13)	.	.	70	100.0	0.53	(0.42, 0.67)	.	.
Sex												
Female	59	23.9	3.12	(2.40, 3.99)	1.86	(1.39, 2.49)	20	28.6	1.06	(0.66, 1.60)	2.37	(1.41, 3.98)
Male	188	76.1	1.68	(1.45, 1.93)	1.00	.	50	71.4	0.45	(0.33, 0.58)	1.00	.
Age												
17–19	23	9.3	1.77	(1.15, 2.60)	1.00	.	6	8.6	0.46	(0.19, 0.96)	1.00	.
20–24	73	29.6	1.66	(1.31, 2.08)	0.94	(0.59, 1.50)	26	37.1	0.59	(0.40, 0.85)	1.28	(0.53, 3.12)
25–29	58	23.5	2.21	(1.69, 2.83)	1.25	(0.77, 2.02)	11	15.7	0.42	(0.22, 0.73)	0.91	(0.34, 2.46)
30–34	37	15.0	1.97	(1.41, 2.68)	1.11	(0.66, 1.88)	12	17.1	0.64	(0.35, 1.09)	1.39	(0.52, 3.69)
35–39	31	12.6	1.86	(1.29, 2.61)	1.05	(0.61, 1.81)	9	12.9	0.54	(0.26, 0.99)	1.17	(0.42, 3.29)
40+	25	10.1	2.02	(1.34, 2.94)	1.15	(0.65, 2.02)	6	8.6	0.49	(0.20, 1.01)	1.05	(0.34, 3.27)
Race/ethnicity												
White, non-Hispanic	129	52.2	1.55	(1.30, 1.84)	0.75	(0.41, 1.35)	31	44.3	0.37	(0.26, 0.52)	1.07	(0.26, 4.49)
Black, non-Hispanic	60	24.3	2.57	(1.98, 3.28)	1.23	(0.66, 2.29)	17	24.3	0.73	(0.44, 1.14)	2.10	(0.48, 9.07)
Hispanic	37	15.0	2.86	(2.05, 3.90)	1.38	(0.72, 2.64)	16	22.9	1.24	(0.73, 1.97)	3.57	(0.82, 15.52)
Asian/Pacific Islander	12	4.9	2.08	(1.13, 3.54)	1.00	.	2	2.9	0.35	(0.06, 1.15)	1.00	.
American Indian/ Alaskan native	5	2.0	2.40	(0.88, 5.32)	1.15	(0.41, 3.28)	2	2.9	0.96	(0.16, 3.17)	2.77	(0.39, 19.65)
Other	4	1.6	1.05	(0.33, 2.53)	0.50	(0.16, 1.56)	2	2.9	0.52	(0.09, 1.73)	1.51	(0.21, 10.73)
Occupation												
Combat	41	16.6	1.52	(1.10, 2.04)	1.00	.	10	14.3	0.37	(0.19, 0.66)	1.00	.
Health care	36	14.6	3.39	(2.41, 4.63)	2.23	(1.43, 3.49)	10	14.3	0.94	(0.48, 1.68)	2.54	(1.06, 6.10)
Other	170	68.8	1.82	(1.56, 2.11)	1.20	(0.85, 1.69)	50	71.4	0.54	(0.40, 0.70)	1.45	(0.73, 2.85)
Deployment												
Any	129	52.2	8.43	(7.07, 9.98)	8.27	(6.44, 10.61)	38	54.3	2.48	(1.78, 3.37)	8.98	(5.61, 14.37)
None	118	47.8	1.02	(0.85, 1.22)	1.00	.	32	45.7	0.28	(0.19, 0.39)	1.00	.
Service												
Army	100	40.5	2.12	(1.74, 2.57)	2.04	(1.22, 3.40)	32	45.7	0.68	(0.47, 0.95)	2.77	(0.98, 7.83)
Navy	66	26.7	2.04	(1.59, 2.58)	1.95	(1.15, 3.33)	23	32.9	0.71	(0.46, 1.05)	2.89	(1.00, 8.37)
Coast Guard	5	2.0	1.45	(0.53, 3.22)	1.39	(0.51, 3.77)	1	1.4	0.29	(0.01, 1.43)	1.18	(0.13, 10.58)
Air Force	59	23.9	1.85	(1.42, 2.37)	1.77	(1.03, 3.04)	10	14.3	0.31	(0.16, 0.56)	1.28	(0.40, 4.07)
Marine Corps	17	6.9	1.04	(0.63, 1.64)	1.00	.	4	5.7	0.25	(0.08, 0.59)	1.00	.
Grade												
Junior enlisted (E1–E4)	124	50.2	2.15	(1.80, 2.55)	1.97	(1.14, 3.43)	38	54.3	0.66	(0.47, 0.89)	2.82	(0.87, 9.14)
Senior enlisted (E5–E9)	98	39.7	1.88	(1.53, 2.28)	1.72	(0.98, 3.02)	27	38.6	0.52	(0.35, 0.74)	2.22	(0.67, 7.30)
Junior officer (O1–O3)	14	5.7	1.09	(0.62, 1.78)	1.00	.	3	4.3	0.23	(0.06, 0.64)	1.00	.
Senior officer (O4+)	11	4.5	1.32	(0.70, 2.30)	1.21	(0.55, 2.67)	2	2.9	0.24	(0.04, 0.79)	1.03	(0.17, 6.16)

[a]Personnel having had at least one medical encounter coded for HTLV-I or HTLV-II.
[b]Personnel having had at least two outpatient encounters or one hospital admission coded for HTLV-I or HTLV-II.
[c]Rate per 100,000 person-years

with other specialties (p=0.70). Among the 38 infected service members who had a prior deployment, three (50%) of the six healthcare workers were women, compared to only seven (22%) women among the 32 with other specialties (p=0.15).

EDITORIAL COMMENT

This exploratory study used the incidence of recorded diagnoses of HTLV-I or HTLV-II infection as an indirect way to estimate how prevalent such infections might be among military personnel during a fairly recent multi-year period. Also of interest was an analysis to see if the probability of infection varied among population subgroups. The more restrictive case selection criteria for this analysis may be considered as a reasonably valid way to count the number of infected individuals who came to medical attention. An analysis of repeat blood donors to the American Red Cross indicated a seroconversion rate of 0.304 per 100,000 p-yrs (0.045 among males; 0.582 among females).[7] Given this low, estimated incidence rate of new infections, a reliance on testing of asymptomatic persons as a means of identifying prevalent infections, and an assumption of lifelong HTLV antibody detectability among infected persons, the incidence of infections coming to medical attention may reflect the underlying population prevalence. In the present study, the separate incidence rates based on more restrictive and more inclusive criteria, respectively, may serve as lower and upper limits of an estimated prevalence in the active component military population.

A rate thus estimated to be between 0.53 and 1.88 HTLV infections per 100,000 p-yrs is comparable to population prevalence rates that have been reported. The prevalence of HTLV-I or HTLV-II infection among donors at U.S. military blood donation centers (continental U.S., Hawaii, Japan, and Germany) is 1.1 per 100,000 units of blood.[1] This finding is consistent with the national prevalence found among male donors in 2009,[7] and is considerably lower than the prevalence reported among civilian applicants for U.S. military service two decades ago (41 per 100,000 applicants on confirmatory testing).[8]

Studies of the seroprevalence of HTLV-I or HTLV-II among blood donors from selected U.S. cities and regions suggest that rates may have declined between the periods 1991–1995 (35.8 per 100,000 donors)[9] and 2000–2009 (21.9 per 100,000 donors).[10] Seroprevalence during both periods was higher in older donors and in specific, demographic strata, including female (29.8 per 100,000 donors) and black donors (116 per 100,000 donors).[10] It should be noted that prevalence rates based on blood donors may not represent rates in the general population.

Conversely, using the 0.53–1.88 per 100,000 p-yrs range from the present study to approximate a prevalence rate likely underestimates the military population prevalence because—despite a relatively high, cumulative rate of participation of service members in military blood donation programs—many personnel may have either not had the opportunity for HTLV screening or had such screening done only near the beginning of their military careers. Accordingly, greater participation in blood donation by younger military personnel may account for the relatively flat distribution of rates by age group in the present study.

Diagnoses of chronic HBV or HCV infection are expected to be identified substantially more frequently than HTLV infections. A previous analysis that used inclusion criteria similar to those for a more strictly defined case in the current study reported incidence rates of diagnoses of chronic HBV and HCV infection during 2000 through 2010 of 9.5 and 17.5 per 100,000 p-yrs, respectively, among active component military personnel.[11,12] Of course, clinical presentations and laboratory abnormalities often prompt providers to test for HBV and HCV, whereas suspicion of HTLV-I or HTLV-II infection as a cause of disease is justifiably rare. As a result, there is a measure of bias in prevalence comparisons, which is reduced when data are derived from screening blood donor populations or from transfusion transmission studies.

In an investigation to estimate the risk of infection during emergency transfusions, a serologic survey recently found the probable transmission rates for HBV and HCV, respectively, to be 0 and 2 per 1,000 blood product recipients in a deployed setting.[4] Even considering possible cases for which testing criteria were not met, the rate did not exceed 8 per 1,000 recipients for HBV and 4 per 1,000 for HCV. Thus the transmission risk introduced by emergent blood donations is relatively low with respect to these viruses, for which widespread vaccination has had an impact (in the case of HBV), and for which excluding donors by risk factor screening can often prevent transmission in the absence of a specific laboratory assay.

This analysis found that the rate of HTLV diagnoses among service members with any deployment experience exceeded that among personnel who had not deployed regardless of which case selection criteria were used. The higher observed incidence may be the result of either of two processes that are more likely to occur among service members who have deployed—or due to a combination of both: 1) veterans of deployments may be more likely to donate blood and, thus, be screened for HTLV, and 2) they may become infected as a result of receiving a blood product from an inadequately screened donor under emergent conditions. The latter would not likely account for the association with deployment, based on the available evidence (retrospective testing has identified only a single case to date). Still, incident cases of HTLV infection may be more likely to occur among combat-wounded transfusion recipients than among recipients at fixed medical facilities outside the theater of war. Transfusion-transmitted infection continues to be a risk associated with life-saving, wartime, medical interventions; recognition of the possible risk emphasizes the importance of pre-donation screening whenever possible in the combat environment.

The observed, higher rate of HTLV-related encounters among women and healthcare workers may well be consistent with what is known about sex-specific transmission efficiency and the possibility of occupational risk, respectively;[13,14] however, this analysis lacks the additional data that would be needed to draw any firm conclusions in this regard. The previously mentioned study of chronic HBV and HCV infections among military personnel also found higher rates of these viral infection diagnoses among women and healthcare workers.[11,12] In the military setting, females and those with a healthcare occupation may be more likely than males and those in non-healthcare occupations to serve as an emergency donor pool; such a tendency would make them more likely to be tested for HTLV infection.

The limitations of this exploratory study should be emphasized. In addition to the likely inclusion of unscreened personnel in denominators for rate estimates, and a possible bias toward case-finding among those who deployed, diagnoses may have been miscoded at individual clinics. Linkage to the results of laboratory studies might have reduced misclassification bias. Yet even if every diagnosis is assumed to be backed by at least a positive HTLV screening test, rates may have been either overestimated (e.g., due to lack of a Food and Drug Administration-approved confirmatory assay for HTLV), or underestimated (e.g., when serology fails to detect actual infection).[15,16] Furthermore, incident cases could not be distinguished from prevalent cases without pre-exposure test results. Despite these limitations, this analysis—together with the prior case report of transfusion-transmitted HTLV infection—suggests a need to define the threat of transmission more precisely among those least likely to be protected by the existing, albeit limited, countermeasures.

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Urinary Tract Infections, Active Component, U.S. Armed Forces, 2000–2013

Urinary tract infections (UTIs) are common among young adults, especially women. During the 14-year surveillance period, 30.4 percent of females and 3.5 percent of males who served in the active component had a least one UTI diagnosed during a medical encounter. The incidence rate of first-time UTIs was 70.4 per 1,000 person-years (p-yrs) among females and 7.2 per 1,000 p-yrs among males. Among those who received a diagnosis of UTI, 41.3 percent of females and 13.0 percent of males had recurrences. Rates of UTIs were highest among the youngest age group among females and the youngest and oldest age groups among males. Service members in armor/motor transport occupations in both genders had the greatest incidence rates of UTI compared to other occupations while pilots and air crew had the lowest incidence rates. The rates of UTIs overall were 130.9 per 1,000 p-yrs among females and 8.5 per 1,000 p-yrs among males. The occurrence of a first-ever urinary tract infection may be an opportunity for a healthcare provider to educate the patient about the risk factors for UTI, strategies to prevent recurrent infection, and the appropriate response to the new onset of typical symptoms of UTI.

Each year in the United States, approximately 4 million ambulatory healthcare visits are attributed to urinary tract infections (UTIs).[1] Infections of the lower urinary tract—i.e., the urethra (urethritis) or the bladder (cystitis)—cause symptoms such as painful, frequent urination; cloudy, foul-smelling urine; and mild abdominal pain. Severe or untreated infections can ascend up the urinary tract to involve the kidneys (acute pyelonephritis), provoke signs and symptoms such as abdominal/back pain and fever, and cause serious complications such as sepsis and impaired kidney function. Most UTIs are caused by contamination by fecal bacteria such as *Escherichia coli*; however, many other organisms can cause UTIs.

UTIs are most common in young adults, especially among women. Most infections are easily treated with antibiotics; however, some patients develop repeat infections, either because treatment failed (relapse) or because of reinfection (after cure). In addition to female gender, other risk factors for UTIs include sexual activity, use of diaphragms or spermicidal agents, changes in vaginal flora in postmenopausal women, and structural abnormalities or obstruction of the urinary tract.[2]

Service members, particularly women, are at risk for UTIs. During 1998–2001, the rates of UTI among active component service members were estimated to be 84.6 per 1,000 person-years (p-yrs) among women and 7.3 per 1,000 p-yrs among men.[3] For this report, the counts, rates, trends, and demographic and military characteristics of UTIs among active component service members were estimated for 2000–2013.

METHODS

The surveillance period was 1 January 2000 through 31 December 2013. The surveillance population included active component service members of the Army, Navy, Air Force, Marine Corps, and Coast Guard. The data used in this analysis were derived from the Defense Medical Surveillance System (DMSS), which maintains electronic records of all actively serving U.S. military members' hospitalizations and ambulatory healthcare visits in U.S. military and civilian (contracted/purchased care through the Military Health System) medical facilities worldwide. Diagnoses associated with deployment—that are derived from records of medical encounters of service members deployed to southwest Asia/Middle East that were documented in the Theater Medical Data Store (TMDS)—were not included in this analysis. Furthermore, person-time during deployment was not included in the overall person-time denominator calculations.

A case of UTI was defined as an individual with a case defining ICD-9-CM code **(Table 1)** documented in the primary or secondary diagnostic position of a record of a hospitalization or ambulatory care encounter. For first-occurrence incidence rate calculations, an individual was counted as a case once during the surveillance period. To calculate the rate of UTIs overall (first-time and recurrent infections), an individual was counted as having a new UTI if at least 30 days had passed since any previous UTI encounter. A recurrent case was defined as an individual who met the case definition more than once during the

TABLE 1. ICD-9-CM codes for urinary tract infection

Description	ICD-9 code
Urinary tract infection, unspecified	599.0
Acute cystitis	595.0
Urethritis, unspecified	597.80
Cystitis, unspecified	595.9

surveillance period. In this report, "UTI" refers to any one of the four diagnoses (assumed to be infections of the lower urinary tract) listed in Table 1. Cases of acute pyelonephritis (ICD-9: 590.1x) were analyzed separately using the same case definition and incidence rules as UTIs.

The annual "morbidity burdens" attributable to UTIs were estimated based on the annual total number of medical encounters attributable to the diagnosis (i.e., total hospitalizations and ambulatory visits for UTIs in the primary diagnostic position alone with a limit of one encounter per individual per day); numbers of service members affected (i.e., individuals with at least one medical encounter for UTI during the year), total bed days during hospitalizations, and total number of lost duty days due to the condition. This fourth measure represents the days of work time lost due to hospitalizations plus one day for each "sick in quarters" disposition and one-half day for each "limited duty" disposition that resulted from ambulatory visits for a UTI.

RESULTS

Among service members who served in the active component during the surveillance period, 30.4 percent of females (n=198,603) and 3.5 percent of males (n=117,922) had at least one medical encounter for UTI **(Table 2)**. Recurrent UTIs (more than one UTI during the period) occurred in 12.5 percent of all active component females and in 0.5 percent of males. One percent of all female service members (n=6,604) had more than five medical encounters for UTI.

The incidence rate of first-time UTIs was 70.4 per 1,000 person-years (p-yrs) among females and 7.2 per 1,000 p-yrs among males **(Table 3)**. Among service members who received a diagnosis of UTI at any point during the period, 41.3 percent of females and 13.0 percent of males had recurrences (i.e., had another UTI encounter 30 days or more after their incident encounter). In females, first-time incidence rates decreased monotonically with older age **(Table 3, Figure 1)**. In males, incidence rates were highest in the youngest (<20 and 20–24 years) and oldest (50+ years) age groups.

Among females, white, non-Hispanics and Hispanics had slightly higher rates of UTI and Asian/Pacific Islanders had the lowest rates **(Table 3)**. Black, non-Hispanic males had more than double the rate of UTI compared to other racial/ethnic counterparts and the highest percentage (18.1%) of recurrent UTI.

Females in the Army and Marine Corps had the highest incidence rates; however, service women in the Coast Guard had the highest percentage of recurrent infections (45.7%) **(Table 3)**. Males in the Army and Coast Guard had the highest incidence rates whereas Coast Guard males had the highest percentage of recurrent cases (15.8%).

In both genders, junior enlisted service members had the highest incidence rates of

TABLE 2. Number and percentages of service members with diagnosis of urinary tract infections (UTIs) by gender, active component, U.S. Armed Forces, 2000–2013

	Females		Males	
	No.	%[a]	No.	%[a]
No recorded diagnosis of a UTI	454,821	69.6	3,282,015	96.5
At least one recorded diagnosis of UTI	198,603	30.4	117,922	3.5
Of those who had at least one recorded UTI	No.	%[b]	No.	%[b]
1 UTI	116,655	58.7	102,603	87.0
2–5 UTIs	75,344	37.9	15,058	12.8
6–10 UTIs	5,886	3.0	247	0.2
>10 UTIs	718	0.4	14	0.0

[a]Percentage of all service members who served in the active component during 2000–2013.
[b]Percentage of service members with at least one recorded diagnosis of UTI.

FIGURE 1. Incidence rate of first-ever urinary tract infections by gender and age group, active component, U.S. Armed Forces, 2000–2013

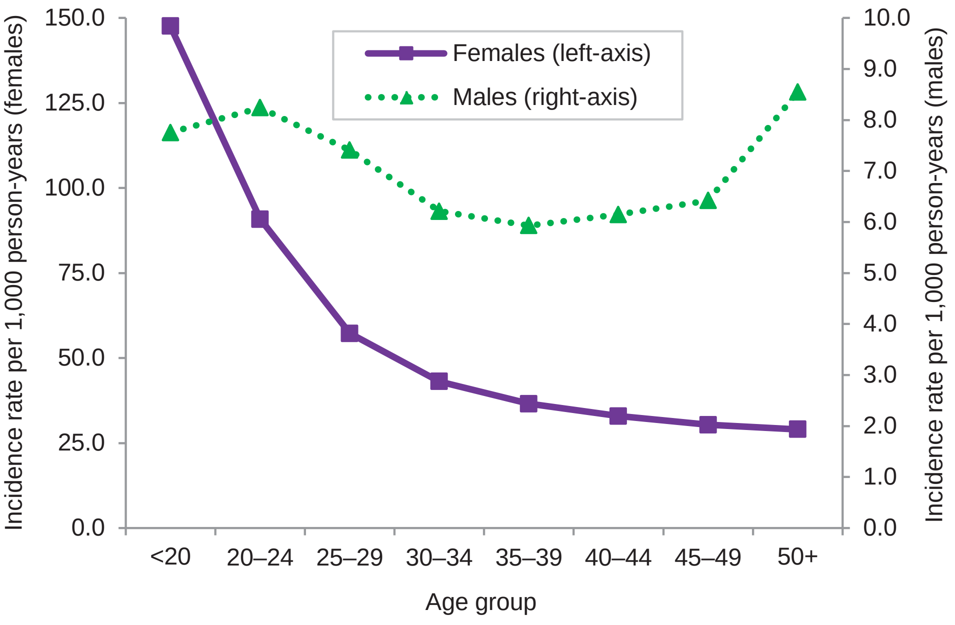


TABLE 3. Incidence counts and incidence rates of urinary tract infections (UTIs) by demographic/military characteristics, active component, U.S. Armed Forces, 2000–2013

	Females				Males			
	UTI (incident)		Recurrent cases[a]		UTI (incident)		Recurrent cases[a]	
	No.	Rate[b]	No.	% total	No.	Rate[b]	No.	% total
Total	198,603	70.4	81,948	41.3	117,922	7.2	15,319	13.0
No. ever hospitalized (%)	3,273 (1.6%)	1.2	1,914 (2.3%)	58.5	1,588 (1.3%)	0.1	386 (2.5%)	24.3
Age								
<20	35,486	147.6	16,805	47.4	8,996	7.8	1,095	12.2
20–24	90,162	90.8	37,205	41.3	43,357	8.2	5,441	12.5
25–29	37,543	57.2	14,644	39.0	26,413	7.4	3,534	13.4
30–34	16,821	43.1	6,858	40.8	15,177	6.2	2,137	14.1
35–39	10,566	36.6	3,986	37.7	12,529	5.9	1,679	13.4
40–44	5,378	32.9	1,714	31.9	7,439	6.1	900	12.1
45–49	1,913	30.3	540	28.2	2,794	6.4	375	13.4
50+	734	29.0	196	26.7	1,217	8.5	158	13.0
Race/ethnicity								
White, non-Hispanic	100,818	72.4	40,817	40.5	63,586	6.0	6,721	10.6
Black, non-Hispanic	53,591	68.4	22,958	42.8	34,366	13.8	6,236	18.1
Hispanic	22,410	72.1	9,307	41.5	11,335	6.8	1,391	12.3
Asian/Pacific Islander	7,373	59.8	3,092	41.9	2,612	4.2	261	10.0
Other/Unknown	14,411	68.9	5,774	40.1	6,023	6.3	710	11.8
Service								
Army	81,843	84.8	33,437	40.9	49,836	8.8	6,633	13.3
Navy	43,619	60.9	17,036	39.1	24,316	6.0	2,960	12.2
Air Force	55,915	61.4	24,512	43.8	26,601	7.0	3,767	14.2
Marine Corps	12,793	79.6	4,938	38.6	13,516	5.8	1,381	10.2
Coast Guard	4,433	66.1	2,025	45.7	3,653	7.5	578	15.8
Status								
Recruit	2,581	71.1	1,043	40.4	1,451	7.3	212	14.6
Active duty (non-recruit)	196,022	40.4	80,905	41.3	116,471	4.3	15,107	13.0
Rank								
Junior enlisted	137,599	103.1	58,216	42.3	58,976	8.4	7,220	12.2
Senior enlisted	40,721	40.8	15,882	39.0	45,317	6.8	6,295	13.9
Junior officer	16,148	48.6	6,458	40.0	8,117	5.1	1,085	13.4
Senior officer	4,135	26.5	1,392	33.7	5,512	5.1	719	13.0
Occupation								
Combat-specific[a]	2,784	66.5	1,011	36.3	14,912	6.6	1,652	11.1
Armor/motor transport	7,770	83.5	3,162	40.7	5,889	8.2	792	13.4
Pilot/air crew	2,337	56.3	981	42.0	3,262	4.8	357	10.9
Repair/engineering	32,421	70.3	12,454	38.4	35,777	6.9	4,667	13.0
Communications/intelligence	71,284	68.2	30,095	42.2	26,369	8.1	3,741	14.2
Health care	33,674	62.0	14,114	41.9	7,037	6.7	850	12.1
Other	48,333	81.5	20,131	41.7	24,676	7.8	3,260	13.2
Marital status								
Married	74,603	58.9	29,733	39.9	59,568	6.5	7,716	13.0
Single	110,174	84.0	46,632	42.3	52,713	8.0	6,764	12.8
Other	13,826	56.9	5,583	40.4	5,641	10.4	839	14.9

[a]Recurrent cases=individuals who had more than one UTI encounter during the surveillance period. For recruits, the follow-up UTI could have occurred during or after the recruit period.
[b]Rate per 1,000 person-years

UTIs **(Table 3)**. However, recruit trainees of both genders had rates much lower than those of other junior enlisted members. Service members in armor/motor transport occupations in both genders had the highest incidence rates of UTI compared to other occupations. Pilots and air crew had the lowest incidence rates. Male service members in communications/intelligence occupations also had high incidence rates of UTI and the highest percentage of recurrent cases (14.2%). Among female occupations, pilots and air crew and communications/intelligence occupations had the highest percentage of recurrent cases (42.0% and 42.2%, respectively). In the analysis of marital status, single females and males with a marital status of "other" had the highest incidence rates of UTI and the highest percentages of recurrence.

Diagnoses by gender

The distribution of UTI diagnoses differed by gender **(Table 4)**. "Urethritis, unspecified" was the recorded diagnosis for 42.8 percent of UTIs among males, but for only 0.4 percent of female cases. Most of the remaining UTIs among both genders were coded as "urinary tract infection, unspecified."

TABLE 4. Number and percentages of urinary tract infections by diagnosis and gender, active component, U.S. Armed Forces, 2000–2013

	Females		Males	
	No.	% total	No.	% total
Urinary tract infection, unspecified (599.0)	160,952	81.0	59,108	50.1
Acute cystitis (595.0)	24,235	12.2	4,817	4.1
Urethritis, unspecified (597.80)	886	0.4	50,443	42.8
Cystitis, unspecified (595.9)	12,530	6.3	3,554	3.0

Hospitalizations

During the surveillance period, there were 5,009 hospitalizations for UTI among the 316,525 service members ever diagnosed with a UTI **(data not shown)**. Among incident cases, 1.6 percent (n=3,273) of females and 1.3 percent (n=1,588) of males were ever hospitalized for UTI **(Table 3)**. Among recurrent cases, 2.3 percent (n=1,914) of females and 2.5 percent (n=386) of males were ever hospitalized for a UTI.

The overall rate of hospitalizations for UTI among females was 1.2 per 1,000 p-yrs (the rate ever hospitalized: 1.1 per 1,000 p-yrs) **(Table 3, Figure 2)**. The annual incidence rates of UTI hospitalization were lower during the first half (2000–2006) of the surveillance period (range: 0.8–1.1 per 1,000 p-yrs), then increased during the last half of the period (2007–2013) (range: 1.2–1.6 per 1,000 p-yrs) **(Figure 2)**. The overall rate of hospitalizations among males was 0.1 per 1,000 p-yrs (the rate ever hospitalized: 0.1 per 1,000 p-yrs). The hospitalization rate among males increased 43 percent during the period.

FIGURE 2. Hospitalization rates for urinary tract infections by gender, active component, U.S. Armed Forces, 2000–2013

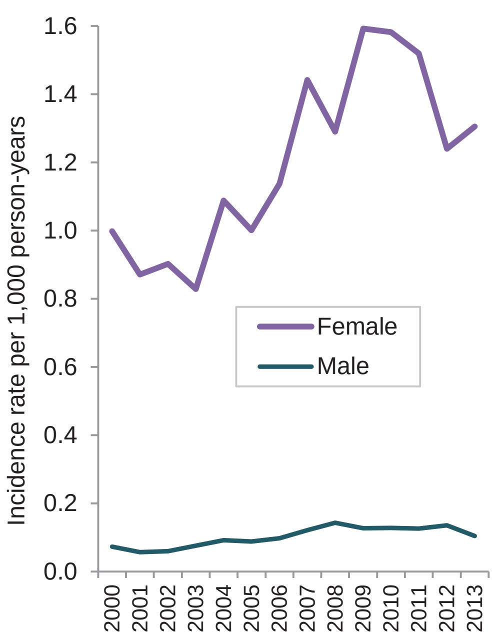
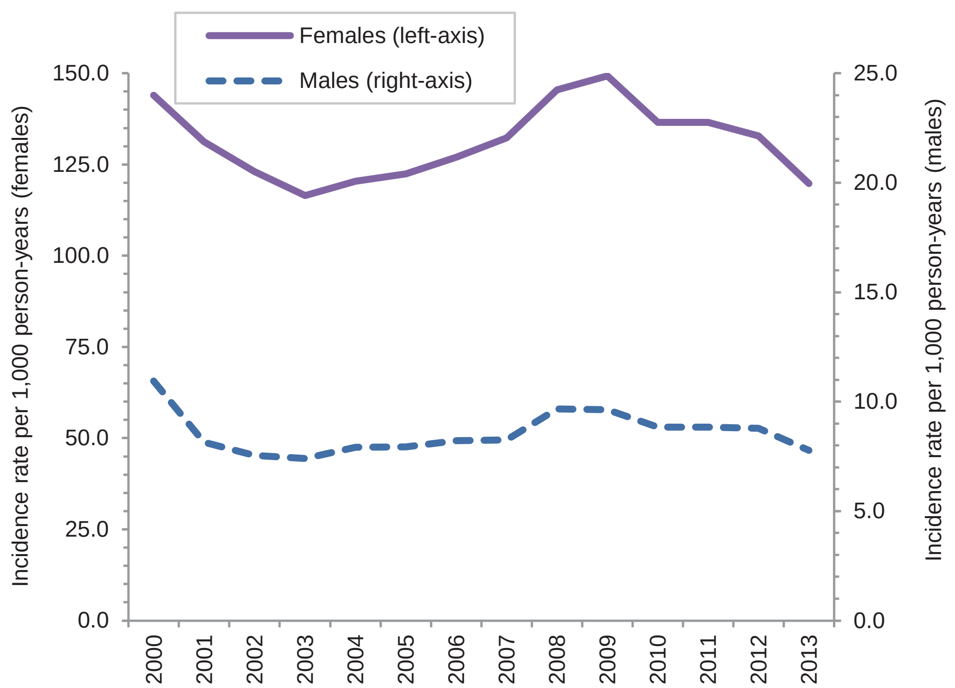


FIGURE 3. Incidence rate of urinary tract infections by gender, active component, U.S. Armed Forces, 2000–2013



Counts and rates of UTIs

During the surveillance period, there were 369,082 UTIs (first infections and recurrent cases) among females and 139,454 among males **(data not shown).** The rates of UTIs overall were 130.9 per 1,000 p-yrs among females and 8.5 per 1,000 p-yrs among males. The annual rates of UTIs among females decreased 19 percent from 2000–2003, increased 24 percent from 2004–2009, then decreased 12 percent from 2010–2013 **(Figure 3)**. Incidence rates among males decreased 32 percent from 2000 to 2003, then remained relatively stable through 2013.

Burden of disease

On average during the 14-year surveillance period, there were 42,308 annual medical encounters with a UTI ICD-9 code in the primary diagnostic position among 31,860 individuals. The yearly average of hospital bed days was 2,240 days and lost work time was 4,981 days. The counts of all four burden estimates varied during the period **(Figure 4)**.

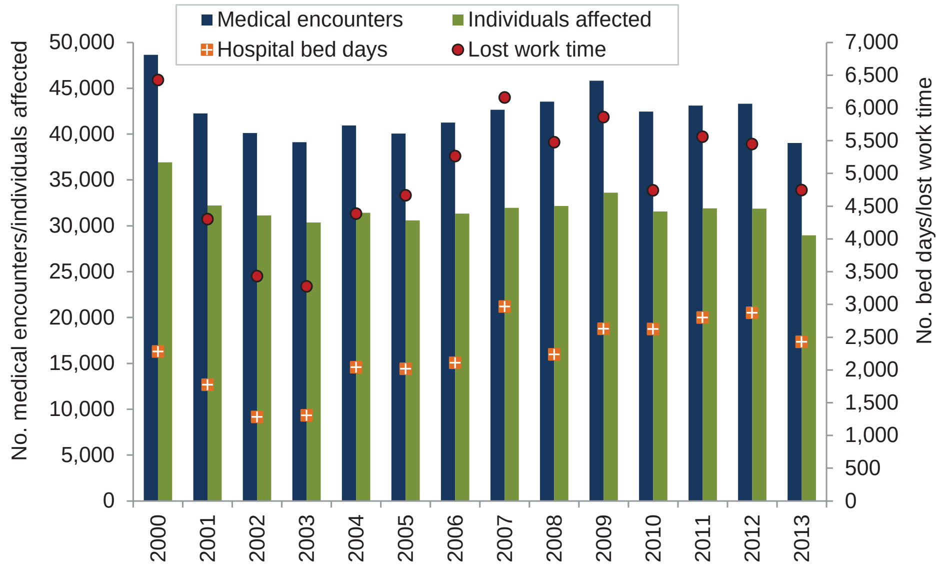
Acute pyelonephritis

During the surveillance period, there were 11,725 cases of acute pyelonephritis among 10,841 female service members and 2,306 cases of acute pyelonephritis among 2,222 male service members **(data not shown)**. Of the entire population of service members, 1.7 percent of females and 0.07 percent of males were given a diagnosis of acute pyelonephritis at least once during the period.

The overall rates of first and recurrent cases of acute pyelonephritis were 4.2 per 1,000 p-yrs in females and 0.1 per 1,000 p-yrs in males **(Figure 5)**. Rates of acute pyelonephritis in females decreased 21 percent from 2001–2003, remained relatively stable from 2004–2011, and then decreased 26 percent from 2012–2013. The rate of acute pyelonephritis decreased in males by 25 percent.

Among the 13,063 service members ever diagnosed with acute pyelonephritis, 9.3 percent had an additional ICD-9 code for a UTI during their incident (first-ever) encounter; 12.9 percent had a UTI code 1–30 days prior to their incident pyelonephritis encounter; and 23.5 percent had a UTI code more than 30 days prior **(data not shown)**. More than half (54.3%) of the incident cases of acute pyelonephritis had no UTI ICD-9 code during the same encounter or prior to their first pyelonephritis encounter.

FIGURE 4. Medical encounters,[a] individuals affected,[b] hospital bed days, and lost work time[c] for urinary tract infections (UTIs), active component, U.S. Armed Forces, 2000–2013



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

FIGURE 5. Incidence rates of acute pyelonephritis by gender, active component, U.S. Armed Forces, 2000–2013

EDITORIAL COMMENT

Among all the active component service members of the Armed Forces during the years 2000–2013, 30.4 percent of females and 3.5 percent of males were diagnosed at least once with a UTI. The incidence rate of first-time UTI among females was nearly 10 times that of males. Following first-ever diagnoses of UTI, recurrent UTIs were common among both females (41%) and males (13%). The methods used in this analysis did not permit distinguishing relapses from reinfections among service members who had recurrences of UTI.

In general, rates of UTI were highest in the younger age groups. However, among males, those aged 50 years and older had the highest rates. The separate analysis of acute pyelonephritis demonstrated that this diagnosis was assigned to 1.7 percent of female service members and just 0.07 percent of males during the surveillance period. Although pyelonephritis is presumed to be the result of infection ascending from the lower urinary tract, more than half of all service members diagnosed with acute pyelonephritis had no documented antecedent healthcare encounters for UTI.

This report's demonstration of the frequency of UTIs among women and the predilection for recurrences are not novel. The finding that more than 3 percent of males in the active component were diagnosed with UTIs should be interpreted in light of the case definition, which included cases of "urethritis, unspecified." Diagnoses of urethritis accounted for 42.8 percent of all UTIs among male service members, but less than 1 percent among females. It is plausible that many of the diagnoses of urethritis represent sexually transmitted infections (STIs), even though the ICD-9 code (579.80) for "urethritis, unspecified" is explicitly reserved for cases of urethritis that are deemed to not be sexually transmitted. Although both men and women are susceptible to urethral infections caused by certain organisms that are best known for being sexually transmitted, the clinical manifestations of urethritis (urethral discharge, dysuria) are typical among men with infections caused by *Neisseria gonorrhoeae* and *Chlamydia trachomatis*, but are not as often the presenting complaint among women. A future *MSMR* analysis will explore potential temporal relationships between diagnoses of urethritis and diagnoses of STIs.

Interpretation of the analysis described in this report is subject to some limitations. The diagnoses of UTI and acute pyelonephritis were ascertained from the DMSS administrative data reflecting diagnoses recorded in patients' health records. Omissions or miscoding of diagnoses would affect the accuracy of the data summary. This analysis did not include data from health care rendered from sources outside of the Department of Defense; therefore, care rendered for UTIs in such settings could not be included. The inability to capture such diagnoses would result in underestimates of the true incidence and healthcare burden of UTIs. Furthermore, some individuals with a history of UTIs may choose to self-treat in the event of a new UTI. The incidence of self-treated UTIs that did not result in a healthcare encounter could not be included in this report.

In this report, it was not possible to capture information about several potential risk factors for UTI, including sexual activity, use of diaphragms or spermicides, and onset of menopause. Furthermore, no attempt was made to ascertain diagnoses of anatomical abnormalities of the urinary tract in this population of service members whose health is screened before entrance to military service.

The large numbers of UTIs recognized in this report and the strikingly disproportionate impact on women service members are noteworthy. Clinicians should have a high index of suspicion for UTI in women whose presenting complaints are characteristic of urinary tract inflammation. Such awareness of the high incidence of UTIs is especially important in austere field settings where the risks of developing a UTI may be higher than in cleaner, more hygienic living circumstances, and where access to health care may not be readily available. In addition, the occurrence of a first-ever UTI may be an opportunity for a healthcare provider to educate the patient about the risk factors for UTI, strategies to prevent recurrent infection, and the appropriate response to the new onset of typical symptoms of UTI.

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Surveillance Snapshot: Male Infertility, Active Component, U.S. Armed Forces, 2000–2012

FIGURE 1. Incidence rates of male infertility by type, active component, U.S. Armed Forces, 2000–2012

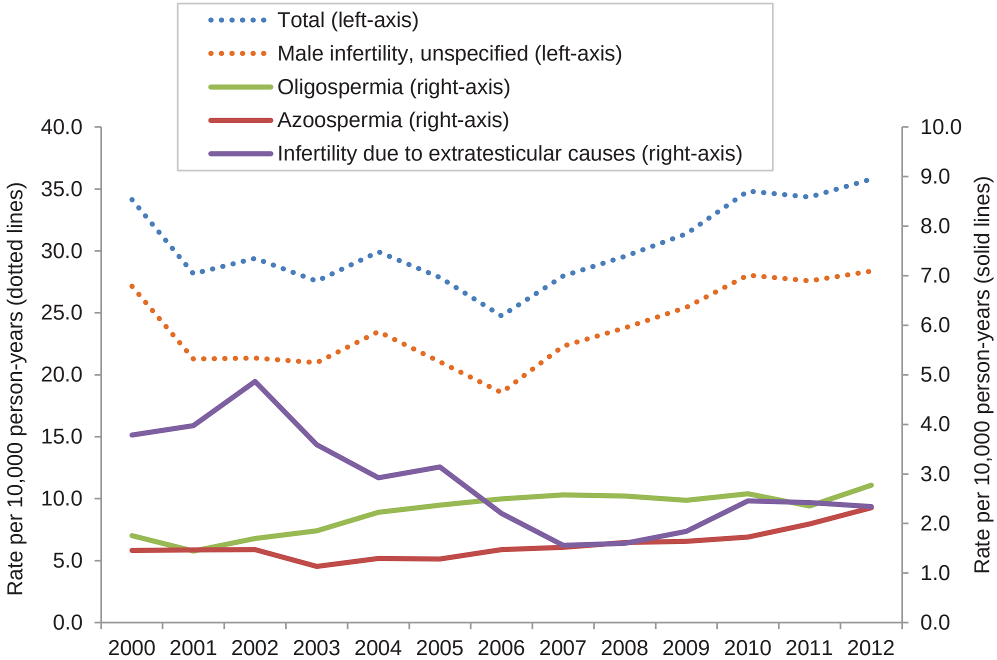
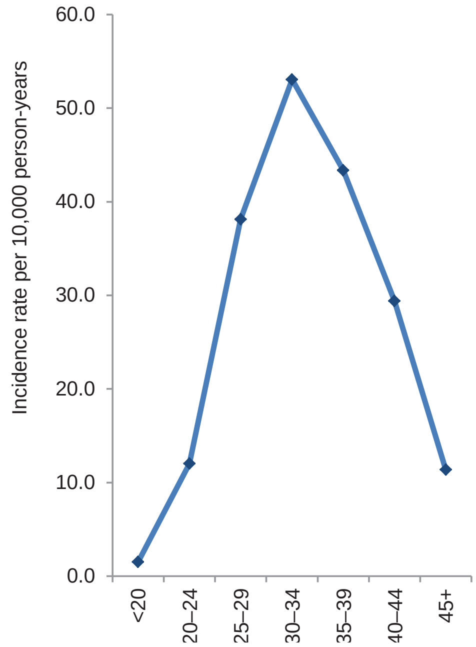


FIGURE 2. Incidence rates of male infertility by age groups, active component, U.S. Armed Forces, 2000–2012



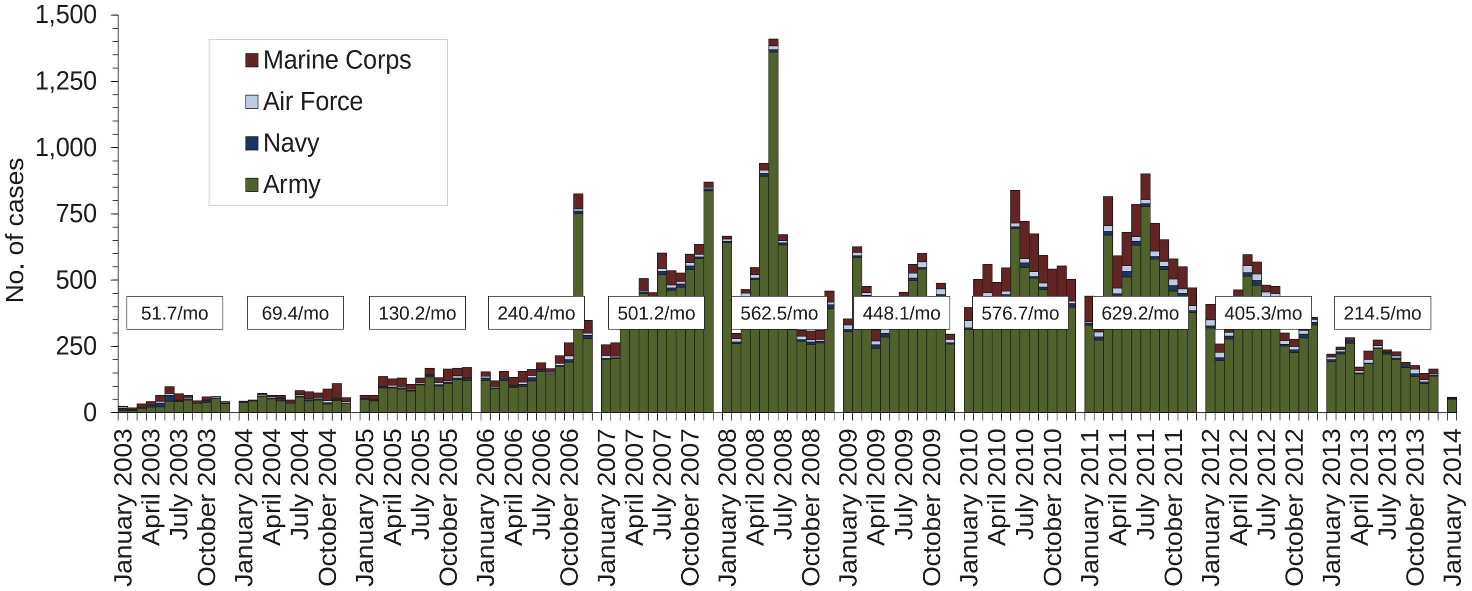
During the 13-year surveillance period, 48,337 active component service men received an incident diagnosis of male infertility (ICD-9-CM: 606.x). The overall incidence rate was 30.5 per 10,000 person-years (p-yrs). From 2000 to 2012, the annual incidence rates increased 4.8 percent from 34.1 to 35.8 per 10,000 p-yrs, but rates had dipped during the intervening years, reaching a low of 24.7 per 10,000 p-yrs in 2006 **(Figure 1)**. A majority of cases were unspecified male infertility (78.2%; overall rate: 28.4 per 10,000 p-yrs); the annual rates of "male infertility, unspecified" cases increased 4.5 percent from 2000 to 2012 but were lowest in 2006 (rate: 18.6 per 10,000 p-yrs).

Compared to unspecified infertility, the three specified types of infertility were diagnosed at much lower rates (azoospermia [1.6 per 10,000 p-yrs], oligospermia [2.2 per 10,000 p-yrs], and infertility due to extratesticular causes [2.8 per 10,000 p-yrs]). During the surveillance period, annual rates of azoospermia and oligospermia increased by 59.3 and 58.1 percent, respectively. Annual rates of infertility due to extratesticular causes decreased by 38.1 percent **(Figure 1)**.

For the entire period, overall incidence rates were highest among men aged 30–34 years **(Figure 2)**. In addition, the rates were highest among married servicemen and among those in healthcare occupational specialties.

Deployment-related Conditions of Special Surveillance Interest, U.S. Armed Forces, by Month and Service, January 2003–January 2014 (data as of 20 February 2014)

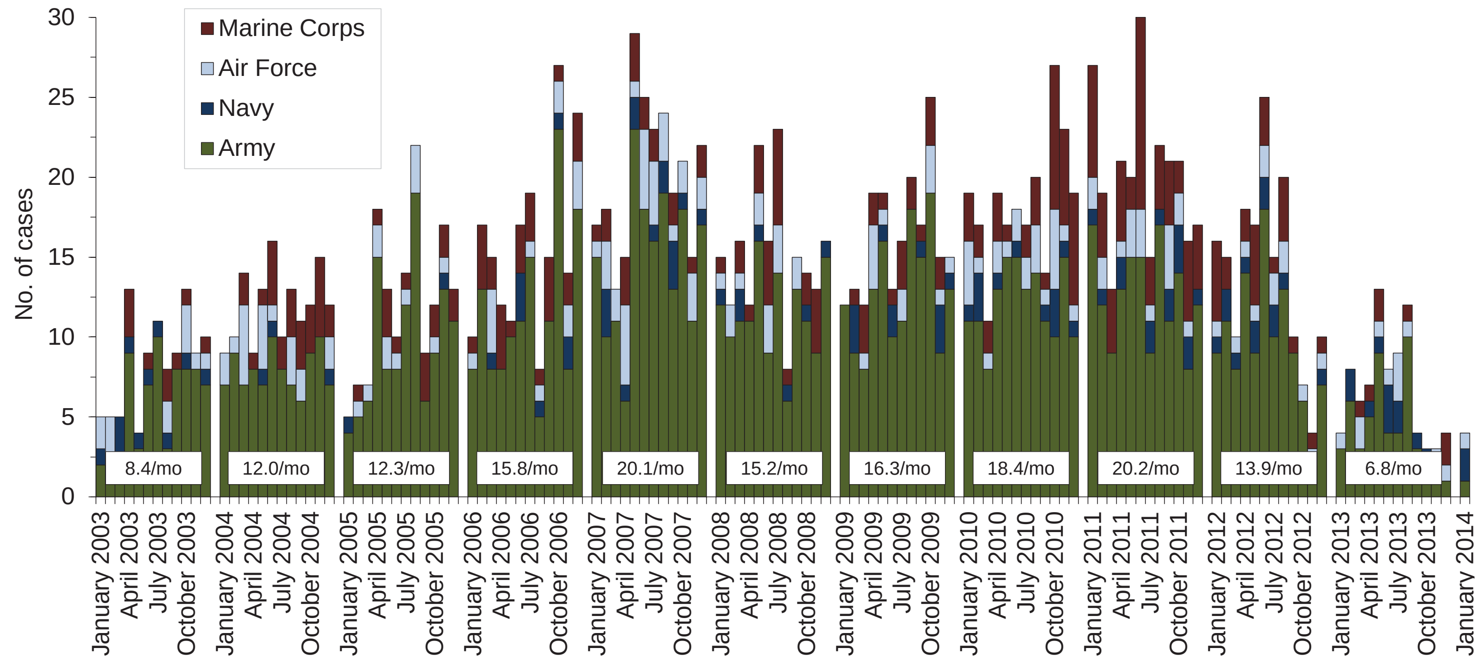
Traumatic brain injury (TBI) (ICD-9: 310.2, 800-801, 803-804, 850-854, 907.0, 950.1-950.3, 959.01, V15.5_1-9, V15.5_A-F, V15.52_0-9, V15.52_A-F, V15.59_1-9, V15.59_A-F)[a]



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

[a]Indicator diagnosis (one per individual) during a hospitalization or ambulatory visit while deployed to/within 30 days of returning from OEF/OIF. (Includes in-theater medical encounters from the Theater Medical Data Store [TMDS] and excludes 4,397 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]

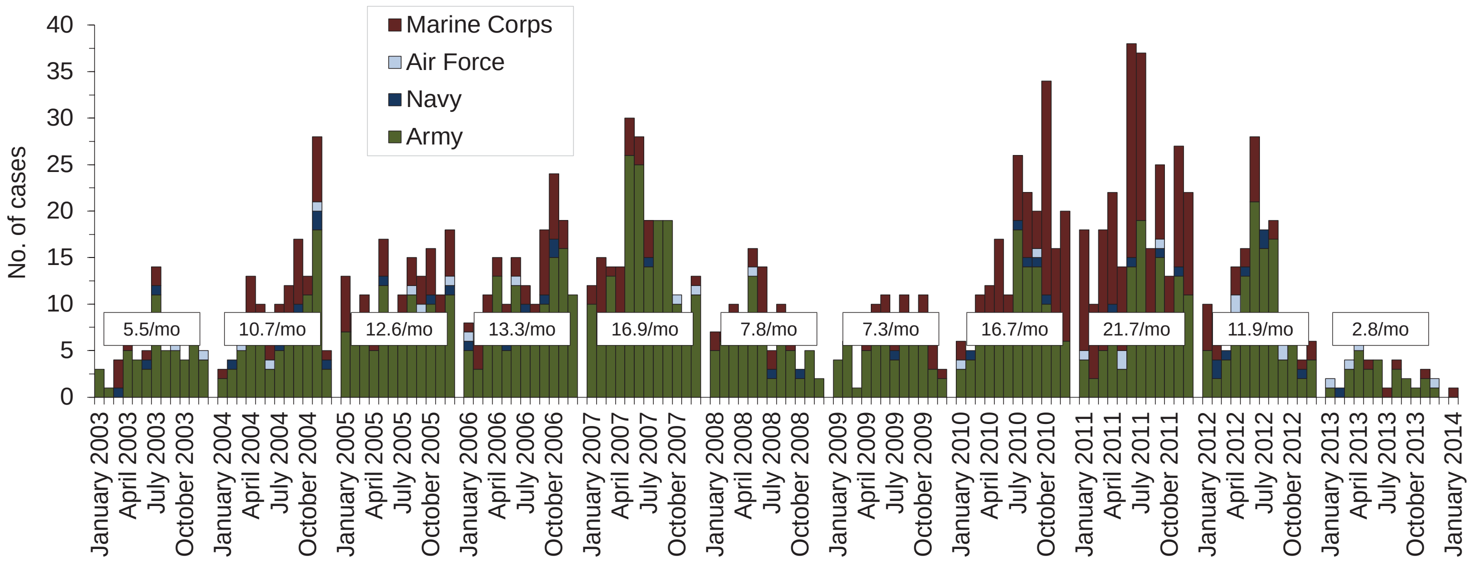


Reference: Isenbarger DW, Atwood JE, Scott PT, et al. Venous thromboembolism among United States soldiers deployed to Southwest Asia. *Thromb Res*. 2006;117(4):379–383.

[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.

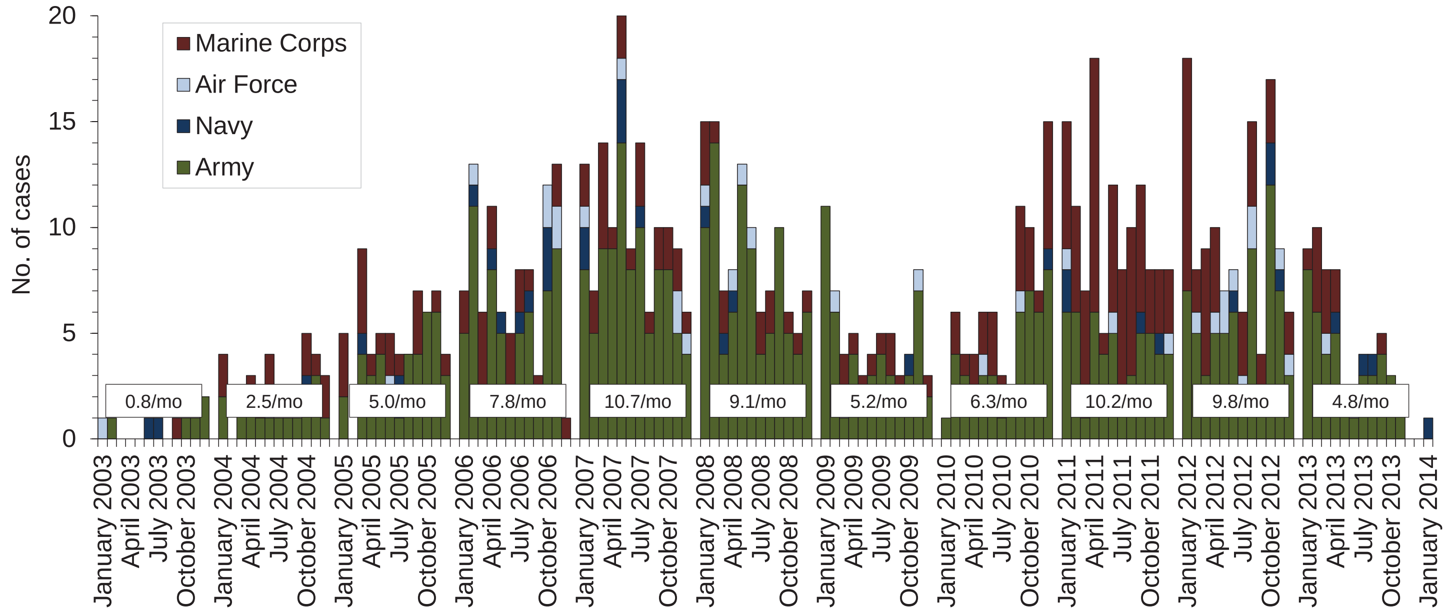
Deployment-related Conditions of Special Surveillance Interest, U.S. Armed Forces, by Month and Service, January 2003–January 2014 (data as of 20 February 2014)

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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