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Assessment of ICD-9-based Case Definitions for Influenza-like Illness Surveillance

Angelia A. Eick-Cost, PhD, ScM; Devin J. Hunt, MS

ABSTRACT

Population-based surveillance of influenza routinely relies on administrative medical encounter databases and ICD-9 codes. However, an assessment of the ICD-9 codes used for the Department of Defense (DoD) influenza-like illness (ILI) case definition has not been conducted since 2007. As coding practices may have changed over time, this analysis was done to determine the sensitivity, specificity, and positive predictive value (PPV) of the current ILI case definition and three alternative case definitions for the 2014–2015 influenza season. Influenza laboratory tests conducted on specimens from DoD beneficiaries during the 2014–2015 season were matched to ambulatory and inpatient medical encounters. The current DoD ILI case definition had high sensitivity (92%) but low specificity (30%) and moderate PPV (63%). A more specific ILI case definition utilizing only codes with greater than 75% influenza positivity for the matched laboratory test had high specificity (96%) and PPV (96%) and moderate sensitivity (62%). The current ILI case definition is sufficient for broad, sensitive population-based surveillance; however, an alternative case definition may be more appropriate when there is a need to maximize specificity.

START OF ARTICLE

BACKGROUND

Illness caused by influenza viruses has historically imposed a significant annual health burden among Department of Defense (DoD) healthcare beneficiaries.[1] Because human immunity to influenza as a result of natural disease or immunization is relatively short-lived in the face of the antigenic drift and shift of circulating influenza viruses, continual surveillance of influenza disease is necessary to identify temporal and geographic changes in incidence, emergence of new strains of virus, and effectiveness of influenza vaccines. For many years now, DoD has conducted weekly influenza surveillance for military members and dependents.[2–5] Although DoD laboratory-based influenza surveillance is conducted at many sentinel sites around the world, population-level surveillance of DoD beneficiaries relies on administrative databases that contain ICD-9 diagnosis codes recorded at the time of healthcare encounters.[2–5] As influenza virus infection is not routinely confirmed by laboratory testing during most medical encounters, various symptom- or syndrome-based ICD-9 codes are typically used to document the illness in medical records. For this reason, population-based influenza surveillance relies on documentation of influenza-like illness (ILI) codes as opposed to just influenza-specific codes for comprehensive surveillance.

In 2001, DoD began using the Electronic Surveillance System for the Early Notification of Community-based Epidemics (ESSENCE), a syndromic surveillance system.[6] ILI was one of the syndromes of interest and ESSENCE originally utilized 29 ICD-9 codes to capture this outcome. However, after an evaluation of how well ESSENCE ILI code groupings correlated with laboratory test results, a smaller, more specific list of codes was selected to monitor ILI incidence.[7] This modified list of 14 codes (plus ICD-9 code 488, which was created after the Marsden-Haug et al. analysis was conducted) has been used by the Armed Forces Health Surveillance Center for ILI surveillance since 2007 (Table 1). However, because many years have passed since the original evaluation was carried out and there may have been changes in coding practices for ILI, this analysis was conducted to reassess the ILI case definition for encounters occurring during the 2014–2015 influenza season.

METHODS

The study population consisted of all DoD beneficiaries who had a laboratory test for influenza performed on a biological specimen collected from 29 September 2014 through 31 May 2015 at a military treatment facility. Laboratory data that classified test results as negative or positive for influenza were provided by the Navy and Marine Corps Public Health Center. Rapid

influenza tests with a negative result were excluded from the analysis as the sensitivity of these assays is known to be poor.[8]

Data from the Defense Medical Surveillance System (DMSS) were used to match each influenza laboratory test result to a single inpatient or outpatient medical encounter occurring within 5 days before or after the specimen collection date. If more than one encounter was temporally associated with a specimen test result, then the closest encounter with an ILI (Table 1) or pneumonia and influenza (P&I) codes (480.xx–488.xx) was preferentially matched to the specimen; if such a match was not possible, then a test result was matched to the closest encounter with a non-specific respiratory illness code (either 460.xx–496.xx or 786.xx); if neither of those types of encounter was documented, then the test result was linked to the closest encounter regardless of diagnosis. Tests without a matching encounter were dropped from the analysis.

Summary statistics on how the tests matched to a medical encounter were generated overall and by beneficiary category (service member/sponsor and dependents). The percentage of medical encounters with each ICD-9 code was calculated using the primary diagnostic position only and then using any diagnostic position for each beneficiary category. As codes did not differ substantially between beneficiary categories, the remainder of the analysis was conducted without stratification by beneficiary category. Based on the frequency results, the 20 most often used codes in the "primary diagnostic position" analysis and the top 20 from the "all diagnostic position" analysis were compiled. In addition, all codes from the original ILI case definition that were not in these two top 20 lists were added. Nine diagnostic codes that were adjudged to be unrelated to influenza (e.g., 401.9, "Essential hypertension, unspecified") were excluded from subsequent analyses. After taking into account duplicate codes from each list, 21 distinct codes were kept for the remaining analysis (079.99, 382.9, 460, 461.9, 462, 465.8, 465.9, 466.0, 466.19, 477.9, 486, 487.0, 487.1, 487.8, 488.82, 490, 491.21, 493.90, 493.92, 780.6x, and 786.2). The codes added to the original case definition for the purpose of the analysis are listed in Table 2.

For the 21 selected ICD-9 codes, the total number of encounters with that code (in any diagnostic position for all matching encounters) and the percentage of these encounters that were positive for influenza A or B were calculated. Alternative ILI case definitions were developed based on 1) codes with greater than 75% positivity for influenza and 2) codes with greater than 50% positivity for influenza. Sensitivity, specificity, and positive predictive values (PPV) were calculated for the following ILI case definitions: 1) original ILI case definition (fever is defined as 780.6x); 2) original ILI case definition but using only 780.6 and 780.60 fever codes; 3) original case definition plus any additional codes with greater than 50% positivity for influenza (462.xx, 477.9x, and 493.90); and 4) only codes with greater than 75% positivity for influenza (487.0, 487.1, 487.8, 488.82).

RESULTS

A total of 33,482 influenza tests were identified for the study period. One-third of the samples tested were from service members/sponsors and the remaining samples were from dependents. Overall, 77.2% were matched to an ILI or P&I encounter; 2.4% were matched to a nonspecific respiratory encounter; 18.4% could only be matched to a nonrespiratory encounter; and 2% could not be matched to any medical encounter (Table 3).

The majority of ICD-9 codes included in the original ILI case definition were among the most common codes recorded during medical encounters linked to influenza laboratory tests. Influenza with other respiratory manifestations (487.1) was the most frequently used code, accounting for 30.8% of encounters when used in the primary diagnostic position and 36.1% of encounters when used in any diagnostic position (Table 4). Acute upper respiratory infections of unspecified sites (465.9) and unspecified viral infection (079.99) were the next two most commonly used codes during encounters that had an influenza test performed. With regard to percentage of encounters that had a positive influenza laboratory test, all encounters with a diagnosis of influenza due to identified novel influenza A virus with other respiratory manifestations (488.82) had a positive influenza laboratory test (Table 4). All of the other influenza diagnosed encounters (487.0, 487.1, 487.8) had high percent positivity for influenza (78.5%–96.3%).

Four case definitions (as defined in the methods section) were assessed for sensitivity, specificity, and PPV (Table 5). The standard ILI case definition (case definition 1) performed very well with regard to sensitivity (92%); however, the specificity was very low (29%). Restricting the fever code (case definition 2) did not result in any significant changes to the sensitivity (92%) or specificity (30%). The positive predictive value for each of these definitions was moderate (63%). Additionally, adding codes with greater than 50% positivity (case definition 3) did not result in much improvement over the standard case definition either (93% sensitivity; 26% specificity; 62% PPV). The use of a very specific case definition (case definition 4: codes with greater than 75% positivity) resulted in very high specificity (96%) and PPV (96%) but moderate sensitivity (62%).

EDITORIAL COMMENT

This report estimates the sensitivity, specificity, and PPV of four different ILI case definitions, including the definition currently used by ESSENCE and the AFHSC for surveillance purposes. As expected, the original ILI case definition was very sensitive but lacked specificity. Although the case definition includes very specific diagnostic codes for influenza, it also includes symptom codes (fever, cough) and nonspecific respiratory illness codes. Because many respiratory viruses and bacteria can cause these symptoms, it was not surprising that the case definition had very low specificity. However, for surveillance purposes many times there is a need to maximize sensitivity, so this case definition continues to be well suited for influenza surveillance with the caveat that there will always be an underlying level of background "noise" from other respiratory infections.

With regard to inclusion of all fever codes or specific fever codes, there was little difference in the performance estimates of the case definitions. This is probably due to the low number of medical encounters matched to influenza testing that had diagnoses for the other fever codes (780.61–780.66: fever presenting with conditions classified elsewhere, post procedural fever, post vaccination fever, chills without fever, hypothermia not associated with low environmental temperature, and febrile non-hemolytic transfusion reaction). It should be noted that these five-digit fever codes did not come into use until 2008 so they were not available for evaluation at the time of the earlier study of ICD-9 codes for ILI surveillance.[7] Because these other fever codes are not related to influenza infections, it makes biologic sense not to include them in the ILI case definition. Therefore, ILI case definition 2 seems to be the most appropriate definition to use for broad, sensitive influenza surveillance. However, if a surveillance effort or an influenza study needs to be very specific, limiting the number of false positives, ILI case definition 4 is the best choice to maximize specificity without losing too much sensitivity.

This analysis was limited to medical encounters for which an influenza test was ordered at a military treatment facility. There may be bias introduced into the data, depending on who is tested for influenza with relation to the severity of the symptoms, timing during the influenza season (more testing early on to identify the start of the season), and the facility where the patient is seen. If these biases exist, then the results of this analysis may not be applicable to all medical encounters for influenza. However, this analysis was able to provide data on a population level, something that would be hard to implement in a prospective, consented study. As with all surveillance efforts, decisions on the most appropriate case definition to use need to incorporate an understanding of the data sources being used, the population being studied, and the purpose of the surveillance.

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TABLES

TABLE 1. ICD-9 codes for original influenza-like illness case definition

ICD-9 code	Description
079.99	Unspecified viral infection
382.9	Unspecified otitis media
460	Acute nasopharyngitis [common cold]
461.9	Acute sinusitis, unspecified
465.8	Acute upper respiratory infections of other multiple sites
465.9	Acute upper respiratory infections of unspecified site
466.0	Acute bronchitis
486	Pneumonia, organism unspecified
487.0	Influenza with pneumonia
487.1	Influenza with other respiratory manifestations
487.8	Influenza with other manifestations
488.xx	Influenza due to certain identified influenza viruses
490	Bronchitis, not specified as acute or chronic
780.6	Fever
786.2	Cough

Table 1 Summary

Table 1 lists the 15 numerical classification codes (ICD-9) and their text descriptions that constitute the case definition of influenza-like illness (ILI) that has been used by the Armed Forces Health Surveillance Center for ILI surveillance since 2007.

TABLE 2. ICD-9 codes added to those in the original case definition for the analysis

ICD-9 code	Description
462	Acute pharyngitis
466.19	Acute bronchiolitis due to other infectious organisms
477.9	Allergic rhinitis, cause unspecified
491.21	Obstructive chronic bronchitis, with acute exacerbation
493.9	Asthma, unspecified
493.92	Asthma, unspecified, with acute exacerbation

Table 2 Summary

Table 2 lists 6 classification codes (ICD-9) and their text descriptions for the diagnoses added to those in the original case definition in order to perform the analyses described in this article.

TABLE 3. Summary of matched flu tests to inpatient and outpatient encounters by sponsor and beneficiary classification

	All tests		Service members/ sponsors		Dependents	
	No.	%	No.	%	No.	%
Total	33,482	100.0	11,231	100.0	22,251	100.0
No matching encounters	669	2.0	415	3.7	254	1.1
Match with ILI or P&I encounter	25,850	77.2	8,443	75.2	17,407	78.2
Match with non-specific respiratory encounter	801	2.4	343	3.1	458	2.1
Match with non-respiratory encounter	6,162	18.4	2,030	18.1	4,132	18.6
ILI=influenza-like illness; P&I=pneumonia and influenza						

Table 3 Summary

Table 3 displays, for all 33,482 persons who had an influenza laboratory test performed during the study period, the numbers of persons who had outpatient health care encounters for influenza-like illness or pneumonia (25,850), for another non-specific respiratory illness (801), for a non-respiratory condition (6,162), or who had no matching encounters (669) at all. The table also displays, in the same way, the distribution of encounters for the 11,231 service members or sponsors and the 22,251 dependents, whose patterns of distribution were very similar to one another.

TABLE 4. Selected ICD-9 codes: overall proportion of encounters and percent positive for influenza

ICD-9 code	No. of encounters (any diagnostic position)	% of encounters (any diagnostic position)	% of encounters (primary diagnostic position)	% of encounters positive for influenza
488.82	289	0.9	0.8	100.0
487.0	135	0.4	0.3	96.3
487.1	11,844	36.1	30.8	95.9
487.8	93	0.3	0.2	78.5
477.9	397	1.2	0.2	58.7
493.90	499	1.5	0.4	56.7
490	403	1.2	0.8	52.6
780.6x	3,137	9.6	5.4	52.4
079.99	3,371	10.3	8.1	51.0
466.0	356	1.1	0.8	50.8
462	1,288	3.9	2.0	50.5
382.9	1,046	3.2	1.5	46.0
465.8	11	<0.1	<0.1	45.5
461.9	309	0.9	0.6	45.3
465.9	6,103	18.6	14.8	44.1
786.2	1,991	6.1	2.8	43.7
460	361	1.1	0.9	40.7
493.92	303	0.9	0.6	37.3
491.21	282	0.9	0.5	29.1
486	2,346	7.1	5.0	21.3
466.19	361	1.1	0.8	9.7

Table 4 Summary

Table 4 shows 21 rows of data. Each row corresponds to one of the classification codes used in the analysis. For each code, its row displays, in separate columns, the total number of encounters associated with that code, the percentages of all encounters that contained that code, and the percentages of those encounters that were associated with a positive laboratory test for influenza. The only codes with percentages of positive tests greater than 75% were 4 codes that specified the diagnoses as influenza.

TABLE 5. Sensitivity, specificity, and positive predictive value (PPV) by case definition for influenza-like illness (ILI)

1. Original ILI case definition using all fever codes (780.6x)						
ILI per case definition	Laboratory test result for influenza					
	Positive	Negative	Total		Sensitivity	92%
Positive	17,039	10,065	27,104		Specificity	29%
Negative	1,540	4,169	5,709		PPV	63%
Total	18,579	14,234	32,813			
2. Original ILI case definition using specific fever codes (780.6 and 780.60)						
ILI per case definition	Laboratory test result for influenza					
	Positive	Negative	Total		Sensitivity	92%
Positive	17,038	10,000	27,038		Specificity	30%
Negative	1,541	4,234	5,775		PPV	63%
Total	18,579	14,234	32,813			
3. Original ILI case definition plus codes with >50% positivity for influenza (462.xx, 477.9x, and 493.90)						
ILI per case definition	Laboratory test result for influenza					
	Positive	Negative	Total		Sensitivity	93%
Positive	17,193	10,419	27,612		Specificity	26%
Negative	1,386	3,815	5,201		PPV	62%
Total	18,579	14,234	32,813			
4. New ILI case definition using only codes with >75% positivity for influenza (488.82, 487.0/1/8)						
ILI per case definition	Laboratory test result for influenza					
	Positive	Negative	Total		Sensitivity	62%
Positive	11,562	507	12,069		Specificity	96%
Negative	7,017	13,727	20,744		PPV	96%
Total	18,579	14,234	32,813			

Table 5 Summary

Table 5 shows the data used in comparing the 4 possible case definitions for influenza-like illness. Two-by-two tables show the numbers of persons whose laboratory tests for influenza were positive or negative according to whether or not their associated health care encounters were for a diagnosis in the case definition being analyzed. For each case definition, the calculated sensitivity, specificity, and positive predictive value are shown.

Incidence of Syphilis, Active Component, U.S. Armed Forces, 1 January 2010 Through 31 August 2015

Leslie L. Clark, PhD, MS; Devin J. Hunt, MS

ABSTRACT

In 2014, the Centers for Disease Control and Prevention reported significant increases in cases of primary and secondary syphilis in the U.S.; among beneficiaries of the Military Health System, monthly surveillance reports tracking reportable medical events of syphilis have reflected similar increases. This analysis reports on incident cases and rates of syphilis among active component service members of the U.S. Armed Forces from 1 January 2010 through 31 August 2015. During the surveillance period, 2,976 cases of syphilis were diagnosed. Crude incidence rates increased from 30.9 cases per 100,000 person-years (p-yrs) in 2010 to 47.4 cases per 100,000 p-yrs in 2015. Males accounted for 88.7% of cases. Incidence rates of syphilis were highest among service members who were black, non-Hispanic or who were aged 20–29 years. About one-quarter of syphilis cases (24.4%; 727 cases) were diagnosed as HIV infected. Primary and secondary syphilis cases comprised 42% of all syphilis cases. Increasing rates of primary and secondary syphilis in active component service members reflect similar trends reported in the U.S. civilian population.

START OF ARTICLE

Syphilis is a highly contagious, systemic infectious disease caused by the bacterium *Treponema pallidum*. It is transmitted primarily through sexual or other physically intimate contact; transmission requires direct contact with a syphilitic sore. Syphilis can also be spread from mother to baby via the placenta at any time during pregnancy or delivery (i.e., congenital syphilis).[1]

Syphilis is categorized into four distinct stages: primary, secondary, tertiary (or late) and latent. Primary syphilis is characterized by the appearance of painless sores or chancres; these lesions typically appear between 10 days and 3 months (mean, 21 days) after initial exposure. If untreated, primary syphilis progresses into a secondary stage in which symptoms usually include rash and may also include multiple other symptoms (e.g., fever, sore throat, arthralgias). Latent syphilis is a stage in which clinical signs and symptoms are not present, but serologic evidence of infection is present. Late syphilis affects 15%–30% of syphilis patients who remain untreated. This stage occurs many years after the original infection and can affect multiple organ systems, including the brain and nervous system (neurosyphilis), cardiovascular system, liver, bones, and joints.[1–3]

In the U.S. civilian population, rates of primary and secondary syphilis have increased in males since 2005; the rate of reported cases of primary and secondary syphilis in men in 2013 (9.8 per 100,000 population) was 91% higher than the rate reported in 2005 (5.1 per 100,000 population). Among U.S. civilian women, rates increased during 2005–2008, and then declined from 2009 until the end of the surveillance period.[4]

Similarly, in beneficiaries of the Military Health System (MHS), reported syphilis cases have increased since 2012; in July of this year, the number of reported syphilis cases in the past 12 months was higher than any similar 12-month period in the previous 5 years.[5]

This report summarizes incident cases and rates of syphilis among active component military members from 2010 through August 2015.

METHODS

The surveillance period was from 1 January 2010 through 31 August 2015. The surveillance population consisted of all active component service members who served at any time during the surveillance period. Diagnoses of syphilis were derived from medical administrative data and reports of notifiable medical events routinely provided to the Armed Forces Health Surveillance Center (AFHSC) and maintained in the Defense Medical Surveillance System (DMSS). Data from the Theater Medical Data Store (TMDS) is included in DMSS; this includes medical encounter data for care provided at theater-based medical treatment facilities as well as some shipboard care. For each service member, the amount of time spent in active military

service was calculated and aggregated into a total for all service members in each calendar year. This total was expressed as person years of service and was used as the denominator for the calculation of incidence rates.

The Navy and Marine Corps Public Health Center (NMCPHC) provided data utilizing its case-finding algorithm developed to identify suspect syphilis cases. This algorithm utilizes only confirmatory syphilis tests (e.g., fluorescent treponemal antibody absorption [FTA-ABS] test, *T. pallidum* particle agglutination assay [TP-PA], microhemagglutination assay for *T. pallidum* [MHA-TP]). Records that indicate a reactive, positive, or borderline result are classified as suspect. Determination of the percentage of syphilis cases with corresponding laboratory results were calculated only for cases ascertained through records of care provided at military medical treatment facilities (MTFs) because laboratory test results are unavailable for tests ordered and performed in outsourced care (G. Nowak, NMCPHC; personal communication, 1 September 2015).

An incident case of syphilis was defined by the presence of one of the ICD-9 codes listed in Table 1 in either the first or second diagnostic position of a record of an outpatient encounter, or in one of the first three diagnostic positions of a record of hospitalization, or through a confirmed reportable medical event. An individual could be counted as having a second (or subsequent) case only if there were more than 365 days between the dates of the encounters in which the diagnoses were recorded. Individuals with syphilis diagnoses prior to the surveillance period were censored until 1 year after their most recent syphilis diagnosis after which they were eligible to become a case again. Incidence of syphilis by stage (primary and secondary, latent, and late syphilis) was also analyzed; categorization was determined as shown in Table 1; for a reportable medical event, placement into a stage required that the stage be specified in the diagnosis name (e.g., "SYPHILIS, PRIMARY/SECONDARY" was categorized as primary or secondary syphilis).

Syphilis cases were also classified by HIV status. For this analysis, positive HIV status 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.[6]

RESULTS

Between 1 January 2010 and 31 August 2015, a total of 2,976 cases of syphilis were diagnosed. Crude incidence rates increased from 30.9 cases per 100,000 person-years (p-yrs) in 2010 to 47.4 cases per 100,000 p-yrs through August 2015. Fifty-one percent of cases (n=1,523) were identified through a reportable medical event for syphilis, while another 45.6% (n=1,357) were identified via a diagnosis in an outpatient record. Sixty cases (2.0%) and 36 cases (1.2%) were identified via TMDS or by a discharge diagnosis in an inpatient record, respectively (Table 2).

Forty-two percent (n=1,253) of cases were specifically identified as primary or secondary syphilis; crude incidence rates of primary and secondary syphilis cases increased every year since 2011. Syphilis cases staged as latent accounted for an additional 27.1% (n=809) of cases; cases where the stage was unspecified comprised another 670 (22.5%) cases. Crude rates of latent and unspecified syphilis peaked during years 2013 and 2014, respectively, while late syphilis rates in 2015 were slightly lower than the rates in the first year of the surveillance period (Figure) (Table 2).

Men contributed the greatest proportion of syphilis cases (88.7%) during the period, and incidence rates for males increased every year of the surveillance period. Female rates of syphilis were highest in 2014 at 34.0 cases per 100,000 p-yrs (Table 2).

Overall, syphilis rates were highest in those service members aged 20–29 years; these age groups accounted for 61.6% of the total number of cases ascertained. These age groups have also demonstrated consistent increases in incidence rates year after year during the surveillance period (Table 2).

The overall incidence rate in black, non-Hispanic service members was twice that of Hispanics, who had the second highest overall incidence rate of syphilis (Table 2).

Almost one-quarter of syphilis cases (24.4%; 727 cases) also were diagnosed as HIV seropositive; of these, 601 (20.2%) were diagnosed before they became a syphilis case and the remainder were diagnosed as HIV seropositive after syphilis diagnosis (Table 3).

A significant proportion of cases identified in data from a reportable medical event or medical care provided at an MTF did not have a confirmatory laboratory test for syphilis within a 14-day window (± 14 days) of the case identifying medical encounter or reportable medical event. Approximately 25% of reportable medical events and 15.3% of cases identified in MTF ambulatory care had confirmatory laboratory results within the time window specified (data not shown).

Primary and secondary syphilis

Between 1 January 2010 and 31 August 2015, a total of 1,253 cases of primary and secondary syphilis were ascertained. Crude incidence rates increased from 13.0 cases per 100,000 p-yrs in 2010 to 22.8 cases per 100,000 p-yrs through August

2015. Seventy-six percent of cases (n=952) were identified through a reportable medical event for syphilis, while another 21.8% (n=273) were identified via a diagnosis in an outpatient record. Twenty three cases (1.8%) and five cases (0.4%) were identified via TMDS or by a discharge diagnosis in an inpatient record, respectively (Table 4a).

Men contributed the greatest proportion of syphilis cases (91.5%) during the period, and the incidence rate for males in 2015 was 1.8 times the rate in 2010 (data not shown).

In males, rates over the entire period were highest in those service members aged 20–29 years; for those aged 17–29 years, incidence rates have increased every year from 2012 to 2014. In females, those aged 17–24 years had the highest overall incidence rates of primary and secondary syphilis. Because of the small cell counts, it is difficult to assess a trend over time in females by age category (Tables 4a, 4b).

Over the entire surveillance period, the incidence rate in black, non-Hispanic male service members was almost double that of Hispanic male service members, who had the second highest overall incidence rate of primary and secondary syphilis overall (Table 4a).

Female cases of primary and secondary syphilis were much less likely to be HIV seropositive than male cases. Almost one-quarter of male cases of syphilis (24.7%; 284 cases) were diagnosed as HIV seropositive; of these, 221 (19.3% of all males with primary or secondary syphilis) were diagnosed before they became a syphilis case and the remainder were diagnosed as HIV seropositive after their syphilis diagnosis. No female cases of primary or secondary syphilis were diagnosed as HIV seropositive (data not shown).

EDITORIAL COMMENT

The report documents a marked and continuous increase (49.1% overall) in crude syphilis incidence rates during the period between 2010 and 2014 (the last full year of the surveillance period). The crude incidence rate of 47.4 cases per 100,000 p-yrs through 31 August 2015 was the highest during the surveillance period. The number of syphilis cases has increased every year during 2011–2014.

For primary and secondary syphilis, several trends identified in the U.S. civilian population are mirrored in this report. First, rates of primary and secondary syphilis have increased steadily over the past several years overall. Although this trend is evident in both sexes, males comprised a much greater proportion of cases. Rates in black, non-Hispanic males have increased, but rates have also been on the rise in several other groups (notably white, non-Hispanics and Hispanics) since 2012.[4]

The increasing incidence of syphilis in military members is of significant public health concern because this finding suggests that some service members have been engaging in unsafe sexual practices that increase the likelihood of acquisition of other sexually transmitted infections (including HIV).

The findings in this report are subject to several limitations. First, syphilis cases were identified through an algorithm that included ICD-9 diagnoses; a significant proportion of these cases did not have confirmatory laboratory testing records identified by the NMCPHC algorithm and falling within the ±14-day window used in this analysis. There are several reasons why this may be the case. First, the requirement that the confirmatory lab results occur within the ±14-day window may be unnecessarily restrictive. Additionally, in some settings (notably in theater), a service member may have a diagnosis entered based on a positive screening test for syphilis (e.g., due to a positive rapid plasma reagin [RPR], a nontreponemal test) and may be diagnosed and treated presumptively without confirmatory testing because none is readily available. It is also possible that physicians may not be using syphilis specific ICD-9 codes to record syphilis cases. Last, some of these cases identified through ICD-9 codes may not represent true cases of disease.

This analysis was restricted to care provided in an MTF, but it is important to note that laboratory results available for MHS surveillance do not include laboratory results for outsourced care; therefore, cases ascertained in outsourced care will not have confirmatory laboratory data available.

There have been multiple hypotheses posited for the resurgence of syphilis in the civilian population: among these are decreases in safer sex practices; increased use of the Internet as a means of meeting sexual partners; and the increase of harm reduction strategies such as oral sex, which can decrease the risk of HIV transmission but conversely increase the risk of contracting syphilis.[2] Several of these sexual risk behaviors have been documented as being increased in Army service members who are HIV seroconverters.[7] Developing and implementing syphilis prevention measures targeting service members at high risk of acquisition should continue to be promoted as well as continuation of aggressive sexual partner notification programs.

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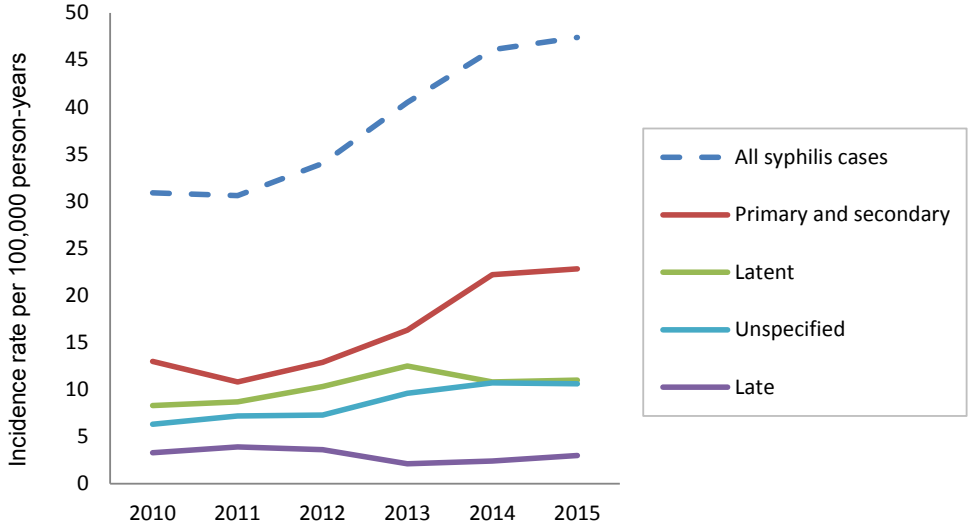
FIGURES

FIGURE. Annual incidence rates of syphilis cases overall and by stage, active component, U.S. Armed Forces, 1 January 2010 through 31 August 2015



TABLES

TABLE 1. ICD-9 codes for syphilis categories

Description	ICD-9 codes
Syphilis, all types	All of those below
Primary and secondary syphilis	091.x
Latent syphilis	092.x, 097.1
Late syphilis	093.x, 094.x, 095.x, 096.x, 097.0
Unspecific syphilis	097.9

Table 1 Summary

This table displays the ICD-9 diagnostic codes for each of the categories (primary and secondary syphilis, latent syphilis, late syphilis, and unspecified syphilis) used in the analysis for this article.

TABLE 2. Incident case counts and incidence rates of syphilis by data source and demographic characteristics, active component, U.S. Armed Forces, 1 January 2010 through 31 August 2015

	2010		2011		2012		2013		2014		2015		Total	
	Count	Rate	Count	Rate	Count	Rate	Count	Rate	Count	Rate	Count	Rate	Count	Rate
Total	447	30.9	442	30.6	484	34.0	565	40.5	630	46.1	408	47.4	2,976	37.5
Source														
Reportable Medical Event	224	15.5	205	14.2	222	15.6	296	21.2	340	24.9	236	27.4	1,523	19.2
Inpatient	8	0.6	6	0.4	8	0.6	5	0.4	7	0.5	2	0.2	36	0.5
Outpatient	202	14.0	210	14.5	246	17.3	255	18.3	277	20.3	167	19.4	1,357	17.1
Theater Medical Data Store	13	0.9	21	1.5	8	0.6	9	0.6	6	0.4	3	0.3	60	0.8
Stage														
Primary and secondary (091.x)	188	13.0	156	10.8	183	12.9	227	16.3	303	22.2	196	22.8	1,253	15.8
Latent (092.X, 097.1)	120	8.3	126	8.7	146	10.3	174	12.5	148	10.8	95	11.0	809	10.2
Late (093.X-097.X, excl 097.1)	48	3.3	56	3.9	51	3.6	30	2.1	33	2.4	26	3.0	244	3.1
Unspecified	91	6.3	104	7.2	104	7.3	134	9.6	146	10.7	91	10.6	670	8.5
Sex														
Male	385	31.1	394	31.9	423	34.8	501	42.1	560	48.2	376	51.5	2,639	39.0
Female	62	29.9	48	23.0	61	29.4	64	30.9	70	34.0	32	24.3	337	28.8
Age														
17–19	18	21.7	15	19.2	22	27.8	23	26.6	29	34.6	22	40.7	129	27.7
20–24	146	31.0	151	32.8	148	33.5	188	43.8	215	50.8	145	52.4	993	39.7
25–29	114	32.4	127	35.2	129	36.2	161	47.1	197	59.9	111	55.6	839	43.3
30–34	75	34.8	54	24.1	74	32.5	91	40.0	94	41.7	62	44.0	450	35.7
35–39	44	26.1	46	27.9	58	35.7	49	31.0	47	30.1	35	33.7	279	30.5
40–44	35	34.8	30	29.2	37	36.1	35	35.1	32	33.4	20	36.1	189	34.0
45–49	12	29.9	12	30.1	10	25.3	15	38.2	12	30.5	8	36.1	69	31.4
50+	3	21.7	7	49.4	6	42.2	3	21.0	4	27.7	5	54.2	28	34.9
Race/ethnicity														
White, non-Hispanic	135	14.9	154	17.1	163	18.4	195	22.7	221	26.6	132	25.6	1,000	20.4
Black, non-Hispanic	201	87.9	181	79.5	214	95.9	220	99.8	250	114.1	176	123.8	1,242	98.5
Hispanic	63	39.6	68	42.0	67	41.5	96	59.4	96	59.0	57	54.4	447	49.1
Asian/Pacific Islander	17	29.7	13	22.7	8	14.1	18	31.7	22	38.5	22	57.7	100	30.9
American Indian/Alaskan Native	2	12.4	2	12.6	5	32.5	6	39.8	7	47.8	4	41.9	26	30.0
Other	18	39.3	14	27.6	15	27.7	19	33.5	25	43.7	11	31.3	102	34.0
Unknown	11	35.8	10	34.7	12	43.7	11	41.4	9	35.1	6	39.6	59	38.2
Rank														
Junior enlisted (E1–E4)	208	32.8	219	34.4	209	33.8	275	45.8	322	55.3	213	57.5	1,446	42.1
Senior enlisted (E5–E9)	194	33.9	188	33.3	233	41.6	234	42.5	260	48.0	172	51.0	1,281	41.0
Officer (including warrant officer)	45	18.8	35	14.4	42	17.1	56	22.9	48	19.7	23	15.0	249	18.2
Marital status														
Single	261	46.2	242	43.3	285	51.7	352	63.7	391	71.7	249	70.9	1,780	58.7
Married	171	21.0	178	21.7	156	19.4	169	21.7	207	27.2	133	28.1	1,014	23.4
Other	14	21.2	22	32.6	42	63.0	43	67.5	32	53.7	25	69.8	178	50.9
Unknown	1	562.3	0	0.0	1	108.7	1	109.8	0	0.0	1	187.5	4	119.4

Table 2 Summary

This large table presents the case counts and incidence rates for syphilis for each year in the surveillance period 2010 to 31 August 2015 and the totals for the entire period. The top row covers all cases of syphilis identified. The rows below that display the distribution of annual case counts and rates according the following characteristics: types of records used to identify cases of syphilis, stage of syphilis (as specified in Table 1), sex, age groups, racial/ethnic groups, military rank, and marital status. In general, much of the data indicate the increasing annual rates of syphilis during the period. In particular, rising rates were most apparent for cases identified through reportable events and outpatient records, for primary and secondary syphilis, for males, for those under age 30, for members of all of the most common racial/ethnic groups, for enlisted service members, and for those with marital status of single or other (i.e., not married).

TABLE 3. Incident syphilis cases by HIV status, active component, U.S. Armed Forces, 1 January 2010 through 31 August 2015

Syphilis categorization	No. of cases	% of cases
Syphilis, all cases	2,976	100
Ever HIV positive	727	24.4
HIV positive before syphilis diagnosis	***601***	***20.2***
HIV positive after syphilis diagnosis	***126***	***4.2***
HIV negative	2,249	75.6

Table 3 Summary

This table displays the total number of syphilis cases reported in this article, the numbers and proportions of all cases who tested positive for HIV infection before and after their first diagnosis of syphilis and who had not tested positive for HIV.

TABLE 4A. Male and female specific incident case counts and incidence rates of primary and secondary syphilis by data source and demographic characteristics, active component, U.S. Armed Forces, 1 January 2010 through 31 August 2015

	2010		2011		2012		2013		2014		2015		Total	
	Count	Rate	Count	Rate	Count	Rate	Count	Rate	Count	Rate	Count	Rate	Count	Rate
Total	188	13.0	156	10.8	183	12.9	227	16.3	303	22.2	196	22.8	1,253	15.8
Source														
Reportable Medical Event	132	9.1	113	7.8	128	9.0	172	12.3	242	17.7	165	19.2	952	12.0
Inpatient	3	0.2	1	0.1	1	0.1	0	0.0	0	0.0	0	0.0	5	0.1
Outpatient	47	3.3	35	2.4	50	3.5	54	3.9	58	4.2	29	3.4	273	3.4
TMDS	6	0.4	7	0.5	4	0.3	1	0.1	3	0.2	2	0.2	23	0.3
Males only														
Age														
17–19	7	8.4	3	3.8	2	2.5	5	5.8	14	16.7	8	15.5	39	8.4
20–24	62	13.2	53	11.5	54	12.2	73	17.0	100	23.6	69	24.9	411	16.4
25–29	38	10.8	48	13.3	50	14.0	72	21.1	84	25.5	49	24.4	341	17.6
30–34	32	14.8	14	6.3	25	11.0	23	10.1	36	16.0	30	21.3	160	12.7
35–39	20	11.9	14	8.5	15	9.2	21	13.3	15	9.6	12	12.3	97	10.7
40–44	16	15.9	10	9.7	14	13.7	10	10.0	13	13.6	7	12.0	70	12.5
45–49	3	7.5	3	7.5	5	12.7	3	7.6	5	12.7	5	20.0	24	10.8
50+	0	0.0	0	0.0	2	14.1	1	7.0	0	0.0	2	21.7	5	6.2
Race/ethnicity														
White, non-Hispanic	64	7.0	41	4.5	60	6.8	86	10.0	100	12.0	69	13.4	420	8.6
Black, non-Hispanic	78	34.1	64	28.1	64	28.7	72	32.7	105	47.9	68	47.8	451	35.8
Hispanic	22	13.8	25	15.5	21	13.0	32	19.8	37	22.8	28	26.7	165	18.2
Asian/Pacific Islander	6	10.5	7	12.2	5	8.8	6	10.6	10	17.5	7	18.4	41	12.7
American Indian/Alaskan Native	0	0.0	0	0.0	3	19.5	3	19.9	2	13.6	3	31.5	11	12.7
Other	4	8.7	6	11.8	8	14.8	7	12.3	10	17.5	4	11.4	39	13
Unknown	4	13.0	2	6.9	6	21.9	2	7.5	3	11.7	3	19.8	20	13
Rank														
Junior enlisted (E1–E4)	77	12.1	74	11.6	62	10.0	104	17.3	143	24.5	98	26.4	558	16.2
Senior enlisted (E5–E9)	88	15.4	64	11.3	85	15.2	81	14.7	99	18.3	75	22.2	492	15.7
Officer (including warrant officer)	13	5.4	7	2.9	20	8.1	23	9.4	25	10.3	9	5.9	97	7.1
Education level														
No high school	1	12.5	1	14.8	0	0.0	1	25.8	1	31.8	2	113.9	6	20.9
High school	144	14.2	118	11.8	117	12.2	151	16.5	196	22.2	140	25.4	866	16.3
Some college	16	12.1	11	8.0	20	12.5	21	12.3	36	21.3	21	19.5	125	14.2
College	16	6.3	13	5.0	25	9.3	30	11.0	33	11.8	16	8.8	133	8.8
Unknown	1	2.7	2	5.4	5	14.2	5	14.9	1	3.0	3	14.8	17	8.6
Marital status														
Single	113	20.0	93	16.7	99	18.0	141	25.5	185	33.9	120	34.1	751	24.1
Married	57	7.0	44	5.4	51	6.3	55	7.1	69	9.1	50	10.6	326	7.3
Other	8	12.1	8	11.9	17	25.5	12	18.8	13	21.8	12	33.5	70	19.5
Unknown	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0

Table 4a Summary

This large table presents, in a way very similar to that of TABLE 2, case counts and incidence rates among male service members for primary and secondary syphilis for each year in the surveillance period and the totals for the entire period. Annual rates rose during the period for all males. Rates were highest and tended to increase during the period among those under age 30, in black, non-Hispanic and Hispanic service members, enlisted service members, those with lower levels of educational completion, and those who were not married.

TABLE 4B. Male and female specific incident case counts and incidence rates of primary and secondary syphilis by data source and demographic characteristics, active component, U.S. Armed Forces, 1 January 2010 through 31 August 2015

	2010		2011		2012		2013		2014		2015		Total	
	Count	Rate	Count	Rate	Count	Rate	Count	Rate	Count	Rate	Count	Rate	Count	Rate
Females only														
Age														
17–19	0	0.0	1	1.3	2	2.5	1	1.2	7	8.3	2	5.0	13	2.9
20–24	4	0.8	4	0.9	8	1.8	11	2.6	19	4.5	10	4.9	56	2.3
25–29	3	0.9	6	1.7	1	0.3	3	0.9	1	0.3	1	0.7	15	0.8
30–34	2	0.9	0	0.0	3	1.3	2	0.9	5	2.2	1	1.0	13	1.1
35–39	0	0.0	0	0.0	2	1.2	1	0.6	3	1.9	0	0.0	6	0.7
40–44	0	0.0	0	0.0	0	0.0	1	1.0	1	1.0	0	0.0	2	0.4
45–49	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0
50+	1	7.2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	1.3
Race/ethnicity														
White, non-Hispanic	4	0.4	4	0.4	4	0.5	6	0.7	16	1.9	4	1.0	38	0.8
Black, non-Hispanic	3	1.3	5	2.2	10	4.5	8	3.6	8	3.7	7	6.6	41	3.3
Hispanic	0	0.0	2	1.2	1	0.6	3	1.9	6	3.7	0	0.0	12	1.4
Asian/Pacific Islander	2	3.5	0	0.0	1	1.8	2	3.5	2	3.5	2	7.1	9	2.9
American Indian/Alaskan Native	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0
Other	1	2.2	0	0.0	0	0.0	0	0.0	2	3.5	1	3.8	4	1.4
Unknown	0	0.0	0	0.0	0	0.0	0	0.0	2	7.8	0	0.0	2	1.3
Rank														
Junior enlisted (E1–E4)	4	0.6	10	1.6	12	1.9	12	2.0	26	4.5	10	3.6	74	2.2
Senior enlisted (E5–E9)	5	0.9	1	0.2	3	0.5	4	0.7	9	1.7	3	1.2	25	0.8
Officer (including warrant officer)	1	0.4	0	0.0	1	0.4	3	1.2	1	0.4	1	0.9	7	0.5
Education level														
No high school	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0
High school	8	0.8	10	1.0	10	1.0	14	1.5	23	2.6	10	2.4	75	1.4
Some college	0	0.0	1	0.7	4	2.5	1	0.6	6	3.5	3	3.8	15	1.8
College	2	0.8	0	0.0	2	0.7	3	1.1	6	2.2	1	0.7	14	1
Unknown	0	0.0	0	0.0	0	0.0	1	3.0	1	3.0	0	0.0	2	1
Marital status														
Single	3	0.5	7	1.3	9	1.6	12	2.2	23	4.2	13	5.0	67	2.2
Married	5	0.6	3	0.4	5	0.6	4	0.5	11	1.4	1	0.3	29	0.7
Other	2	3.0	1	1.5	2	3.0	3	4.7	2	3.4	0	0.0	10	2.9
Unknown	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0

Table 4b Summary

This large table presents the same kind of data as shown in TABLE 4a. but the data is for only female service members diagnosed with primary and secondary syphilis. Because the numbers of cases among females are much smaller than for males and the annual incidence rates for syphilis in females showed no clear-cut increase in rates during the surveillance period, the table clearly depicts only the following. Overall rates were higher in females under age 25 than in the older age groups, and among black, non-Hispanic service members. Overall rates also tended to be higher among junior enlisted females and those who were not married.

Brief Report
Rate of Prescriptions by Therapeutic Classification, Active Component, U.S. Armed Forces, 2014

Lee Hurt, DrPH, MS; Xiaosong Zhong, MD, MS

BACKGROUND

This report presents information on drug prescriptions written for active component service members in 2014. It uses the American Hospital Formulary Service (AHFS) Pharmacologic-Therapeutic Drug Classification, maintained by the American Society of Health-System Pharmacists, to categorize the prescriptions by their therapeutic mode of action.[1]

METHODS

The Defense Medical Surveillance System (DMSS) was used to identify all drug prescriptions written for active component service personnel (Army, Navy, Air Force, Marine Corps, Coast Guard) from 1 January 2014 through 31 December 2014. The DMSS contains administrative records for all prescriptions written for service members at military treatment facilities, in theater, or through civilian purchased care. These prescription data were grouped according to the AHFS Pharmacologic-Therapeutic Classification using the first-tier classes.[1] The prescription rates represent the number of prescriptions issued from 1 January 2014 through 31 December 2014, limited to one drug name per day per service member, divided by the number of service members eligible to receive a prescription for at least one day during 2014. Incidence rates were computed by identifying the first prescription of a given drug name for each individual during the year.

Data for prescriptions for central nervous system agents (CNS), the category with the most frequent prescriptions, were further disaggregated through the third-tier classes.[1] Drug classes with rates less than 9.7, or less than 5 for CNS agents, per 1,000 persons are not shown. All data were analyzed using SAS v9.4 (SAS Institute, Cary, NC).

RESULTS

In 2014, there were 9,395,892 prescriptions written for active component service members. The overall rate was 6,099.9 prescriptions per 1,000 service members, or approximately six prescriptions per service member in 2014. Prescription rates varied substantially by type of drug and by service, age, and occupation for active component service members.

Drugs categorized as CNS agents accounted for 38% (n=3,606,665) of all prescriptions and had the highest rate of prescriptions (2,341.5 per 1,000 persons) among all of the drug categories (Figure 1). Army service members had the highest rate of prescriptions for this drug class compared with other services. The Army rate of 3,194.0 per 1,000 persons was more than 1.5 times the next highest rate, 1997.8 per 1,000 persons, among Air Force service members.

Of the 17 drug categories with overall prescription rates of 9.7 per 1,000 persons or greater, the Army had the highest service-specific rates for 12 of those categories, and the Air Force had the highest rates for the other five categories. For all services together, anti-infective agents were the category with the second highest overall rate, at 548.4 prescriptions per 1,000 persons, followed by eye, ear, nose, and throat medicines, at 539.0 per 1,000. For both of these categories, the Air Force had the highest service-specific rates (Figure 1).

In 2014, there were 6,557,258 incident prescriptions, each representing the first occurrence of a prescription for a particular drug name during the year per individual. The incidence rate was 4,257.1 prescriptions per 1,000 persons, or approximately four per active component service member. The distribution of incident prescriptions by drug category and service was very similar to the pattern described above for all prescriptions (Figure 2).

When the data were analyzed by occupational category, service members in healthcare occupations had the highest prescription rates in every drug class. Those working in communications or intelligence fields consistently had the second highest rates but those rates were substantially lower than the rates among service members in the healthcare occupations (Figure 3).

Prescription rates increased steadily with each successive older age group. Service members older than 49 years of age had

the highest rates of prescriptions in every drug class (Figure 4). Rates of prescriptions for cardiovascular drugs among service members in their 40s were triple the rates of those in their 30s. In turn, rates for service members in their 50s were double the rates of those in their 40s.

The data were further analyzed to focus on the therapeutic class with the highest rates of prescriptions, CNS agents (Figure 5). Nonsteroidal anti-inflammatory drugs (NSAIDs) were the most frequently prescribed subcategory, and Army service members received NSAID prescriptions at a rate 44% higher than the next highest service, Air Force. Among all service members, the three subcategories for NSAIDs, opiate agonists, and analgesics and antipyretics accounted for 64% of all prescriptions for CNS agents. Prescriptions for antidepressants represented nearly another 15% of this category. Prescription rates were highest among Army service members in all subcategories of CNS agents except for wakefulness-promoting agents, for which the rate was slightly higher among Air Force members.

EDITORIAL COMMENT

This analysis identified substantial differences in prescription rates by service, occupation, and age among active component service members. Those in the Army, healthcare fields, and older service members received prescriptions at higher rates than their corresponding peers. Most striking was the finding that CNS agents accounted for 38% of all prescriptions. Further analysis of this category revealed that most of the prescriptions (64%) were for three subcategories that could be described as drugs used for the treatment of pain, inflammation, and fever. Drugs in the subcategory of antidepressants represented the most common prescriptions for what are termed psychotropic agents, but this group accounted for only 15% of all prescriptions for CNS agents. Given that drugs for pain and inflammation and for psychological disorders are often prescribed for long-term treatment of chronic maladies, it is not surprising that the category of CNS agents contains a sizable portion of all the medications prescribed in this analysis.

REFERENCES

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FIGURES

FIGURE 1. Rates of prescriptions (per 1,000 persons) by therapeutic classification and service among active component service members, 1 January 2014 through 31 December 2014

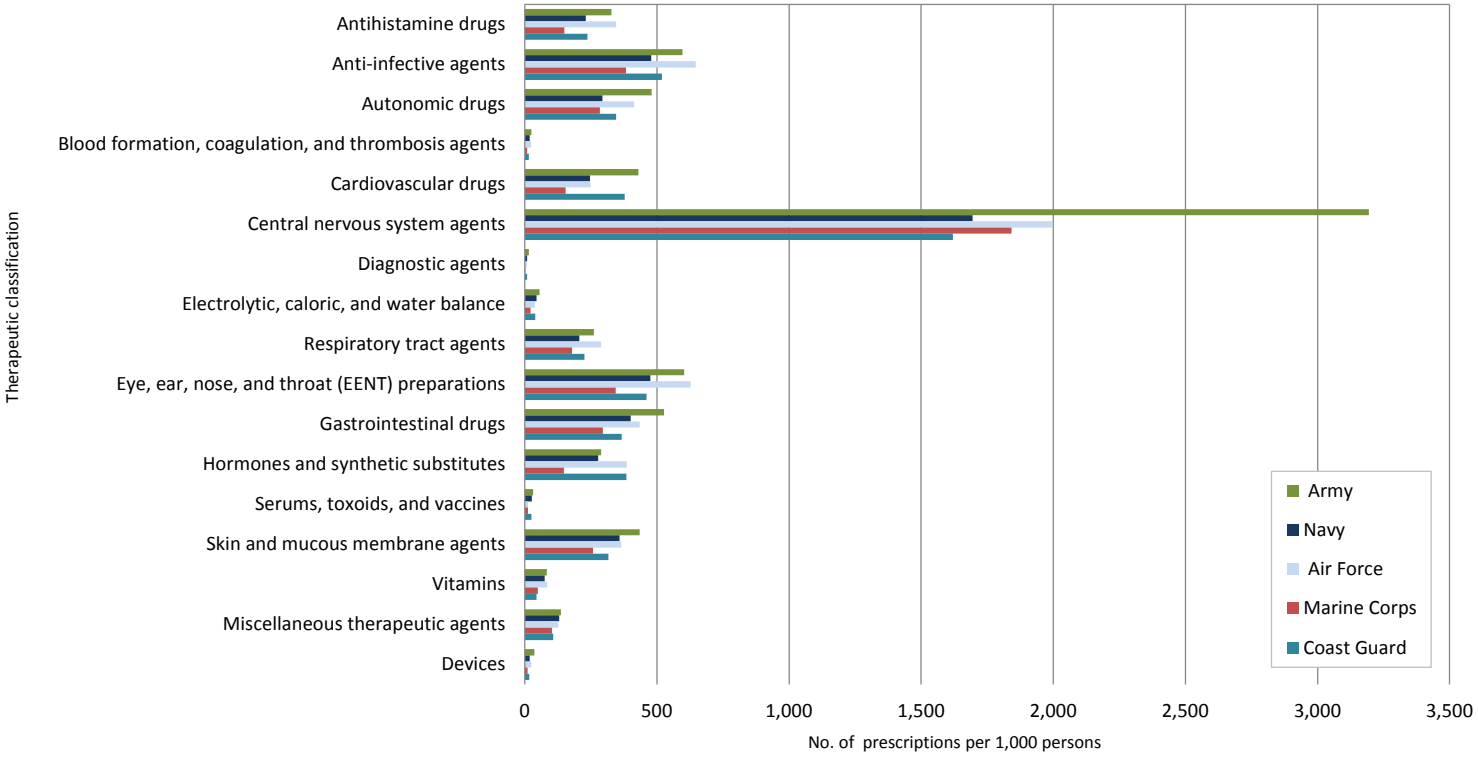


FIGURE 2. Rates of incident prescriptions (per 1,000 persons) by therapeutic classification and service among active component service members, 1 January 2014 through 31 December 2014

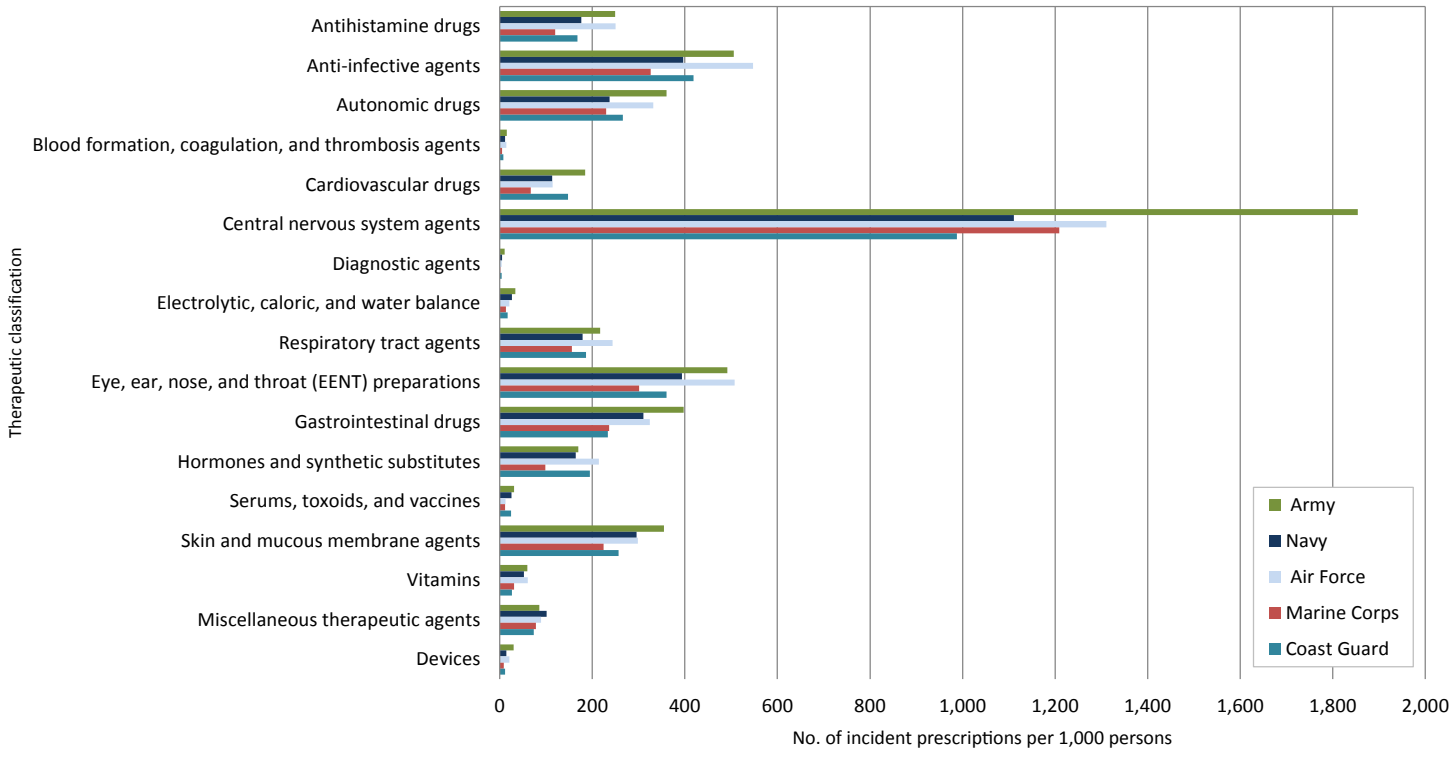


FIGURE 3. Rates of prescriptions (per 1,000 persons) by therapeutic classification and occupation among active component service members, 1 January 2014 through 31 December 2014

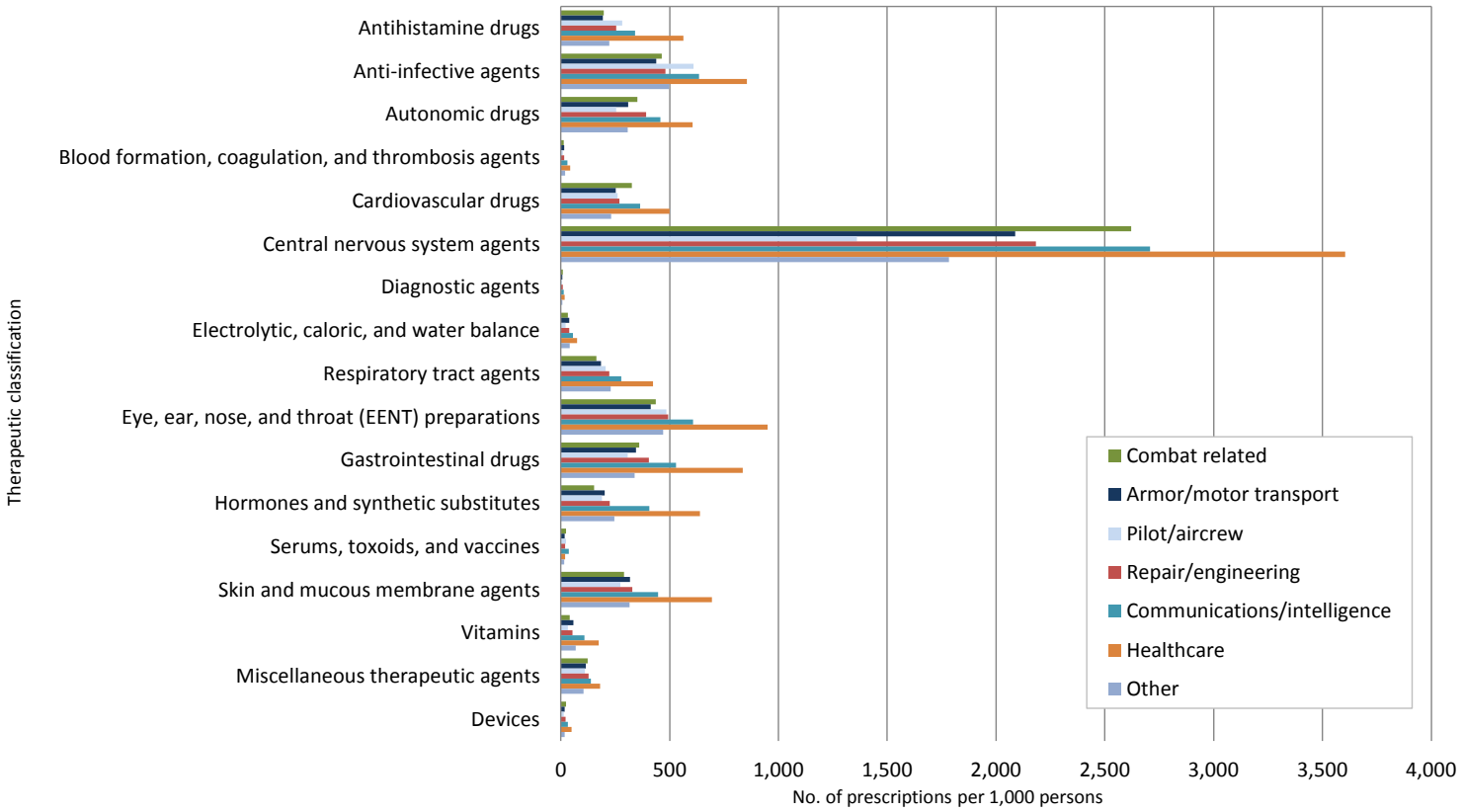


FIGURE 4. Rates of prescriptions (per 1,000 persons) by therapeutic classification and age among active component service members, 1 January 2014 through 31 December 2014

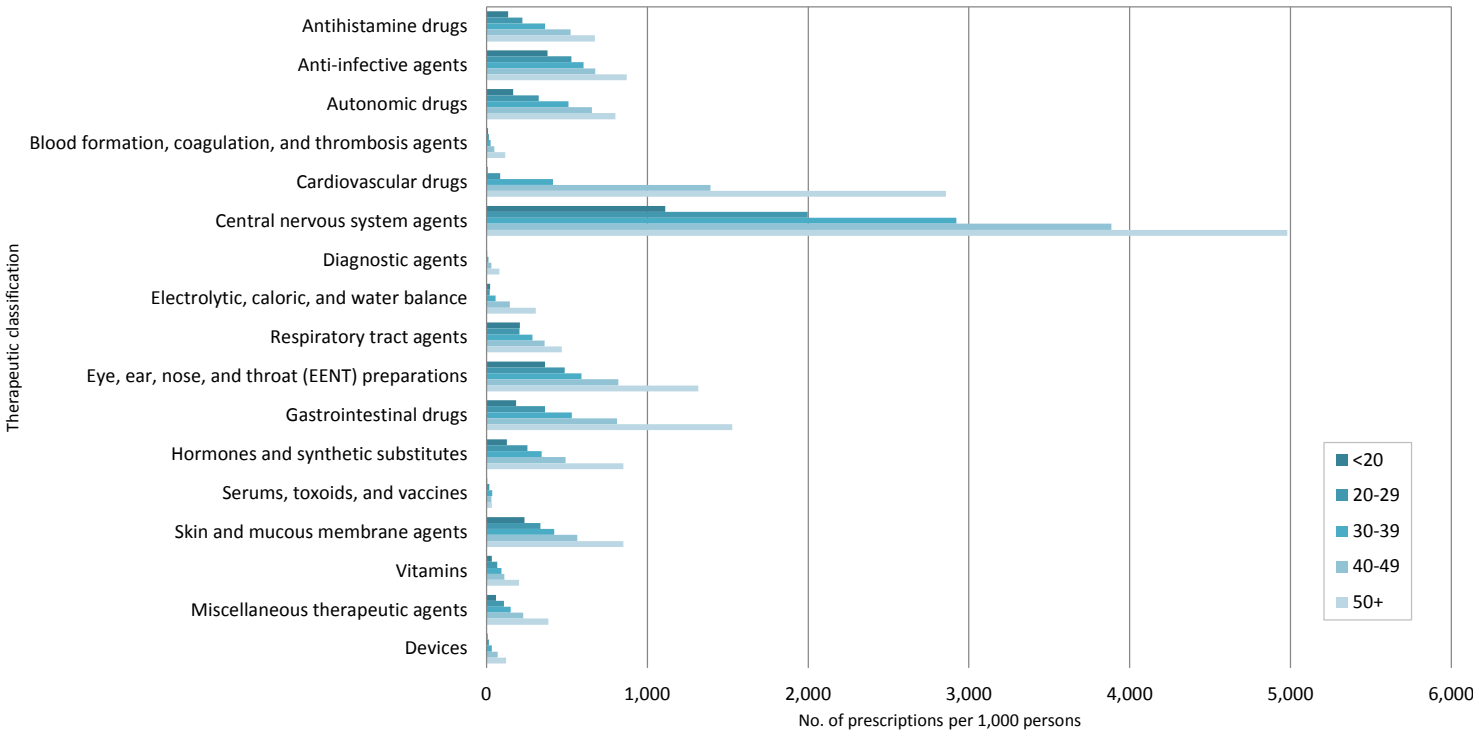
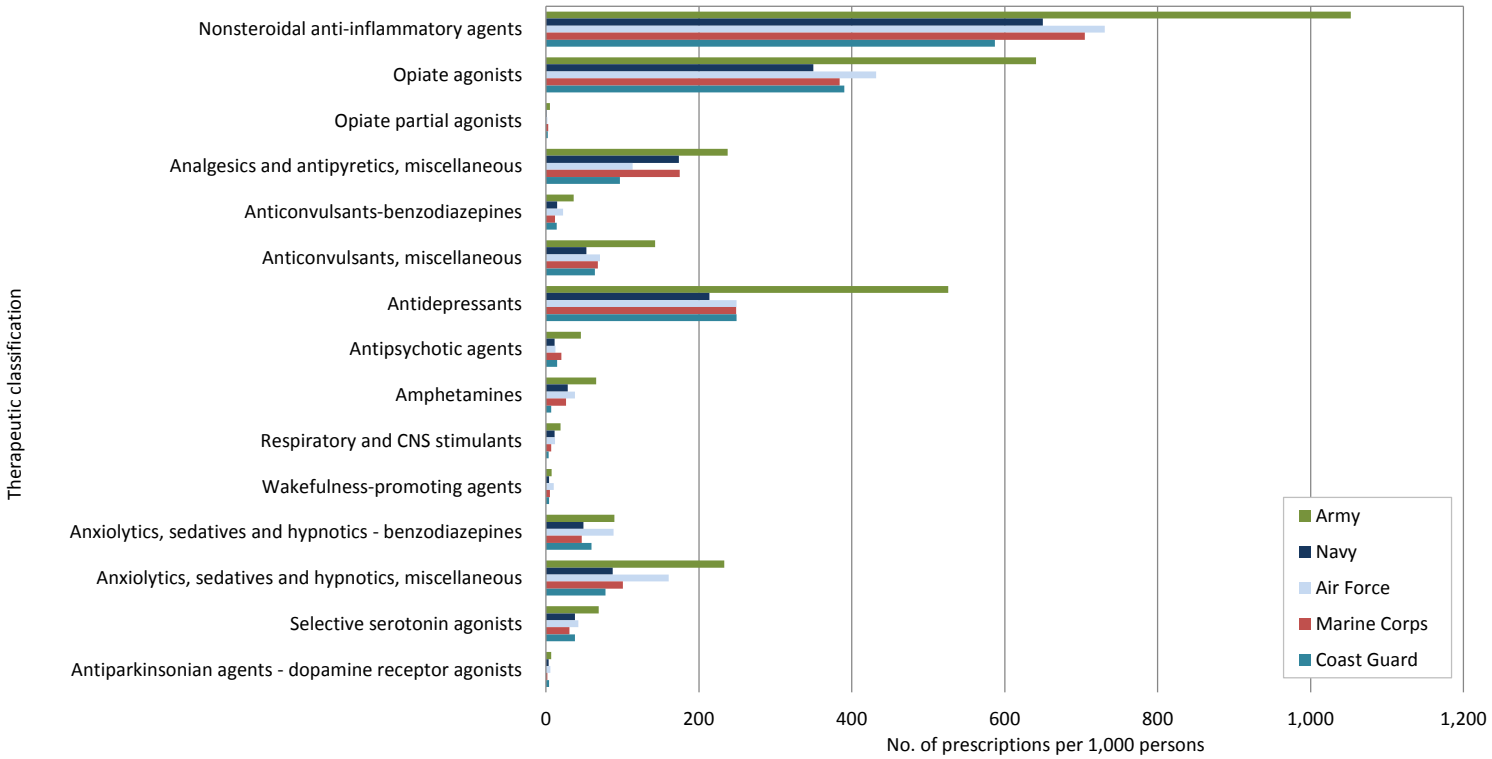


FIGURE 5. Rates of central nervous system agent prescriptions (per 1,000 persons) by therapeutic classification and service among active component service members, 1 January 2014 through 31 December 2014

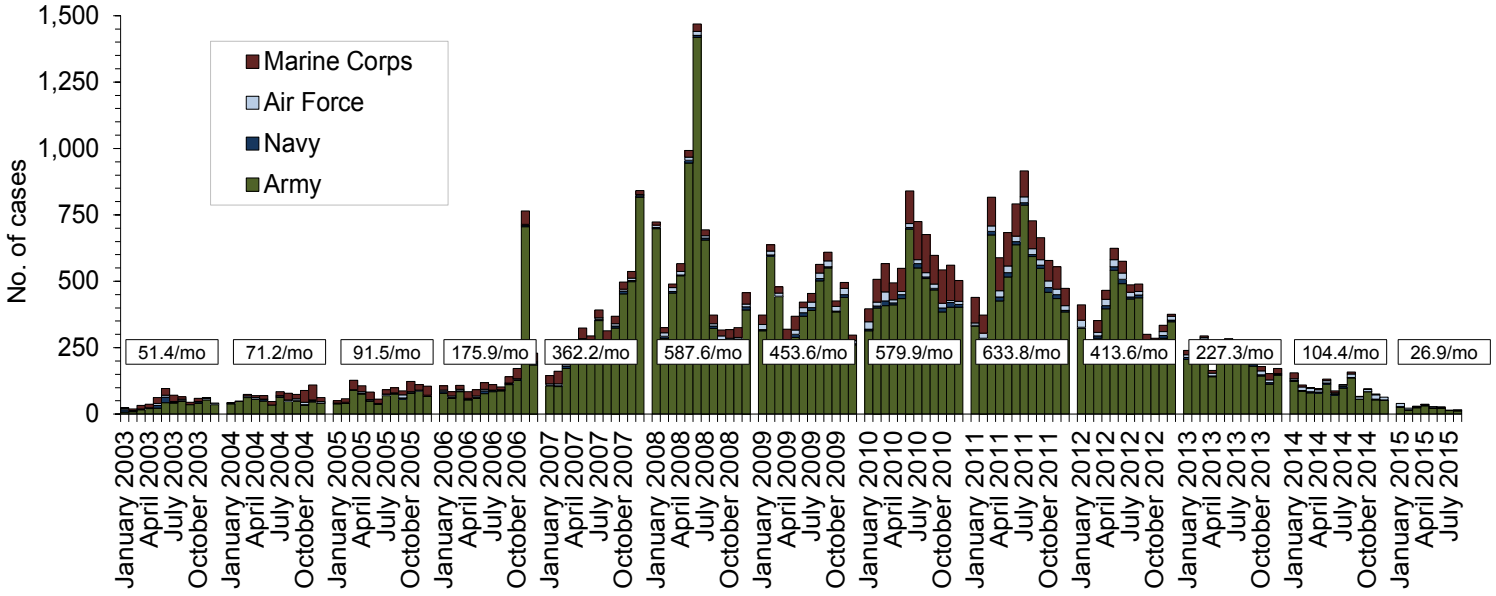


Deployment-related Conditions of Special Surveillance Interest, U.S. Armed Forces, by Month and Service, January 2003–August 2015 (data as of 21 September 2015)

INTRODUCTION TO ALL OF THE BAR GRAPHS FOR DEPLOYMENT-RELATED CONDITIONS

Bar graphs show monthly case counts of health conditions temporally related to deployments during January 2003–August 2015. On the graphs, each month during the nearly 13-year surveillance period is represented by a stacked bar, the total height of which represents the total number of cases in that month. On the first six graphs, within each bar, the numbers of cases in each military Service are represented by different colored sections of the stacked bar.

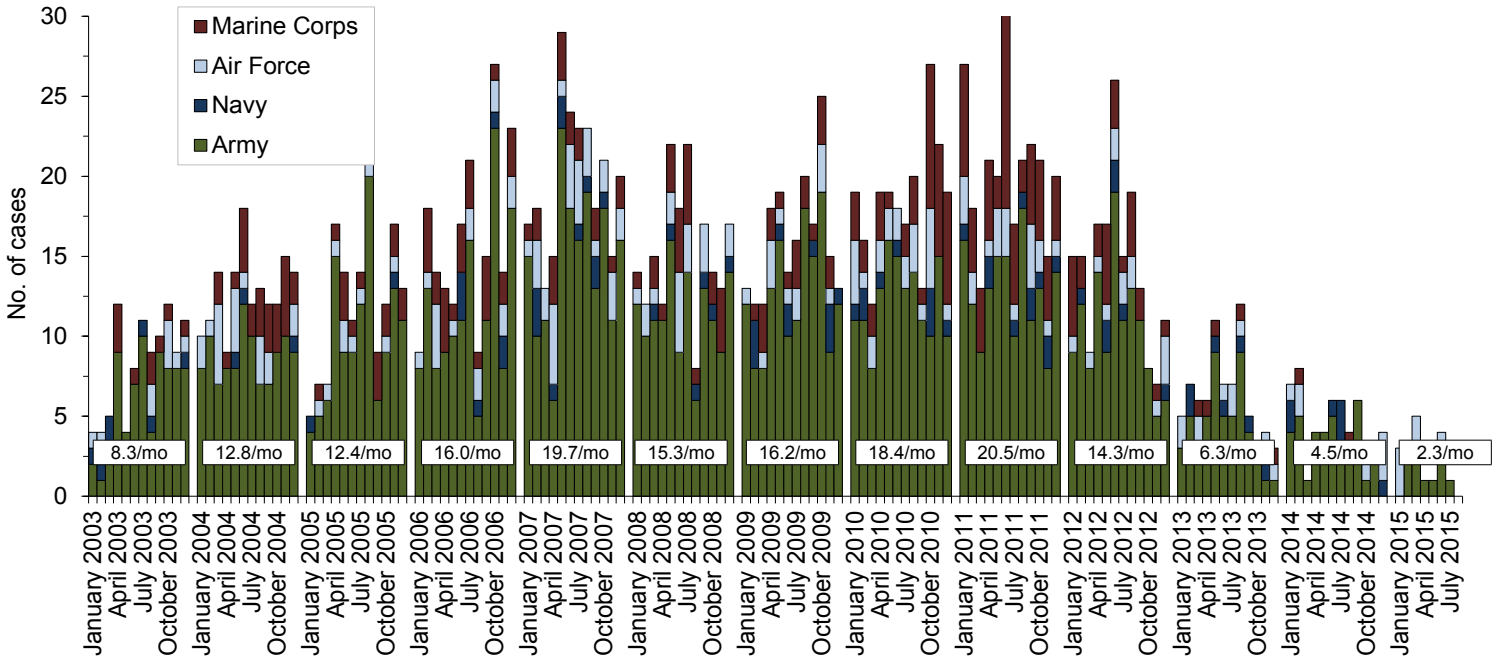
Traumatic brain injury (TBI) (ICD-9: 310.2, 800–801, 803-804, 850–854, 907.0, 950.1–950.3, 959.01, V15.5_1–9, V15.5_A–F, V15.52_0–9, V15.52_A–F, V15.59_1–9, V15.59_A–F)[a]



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

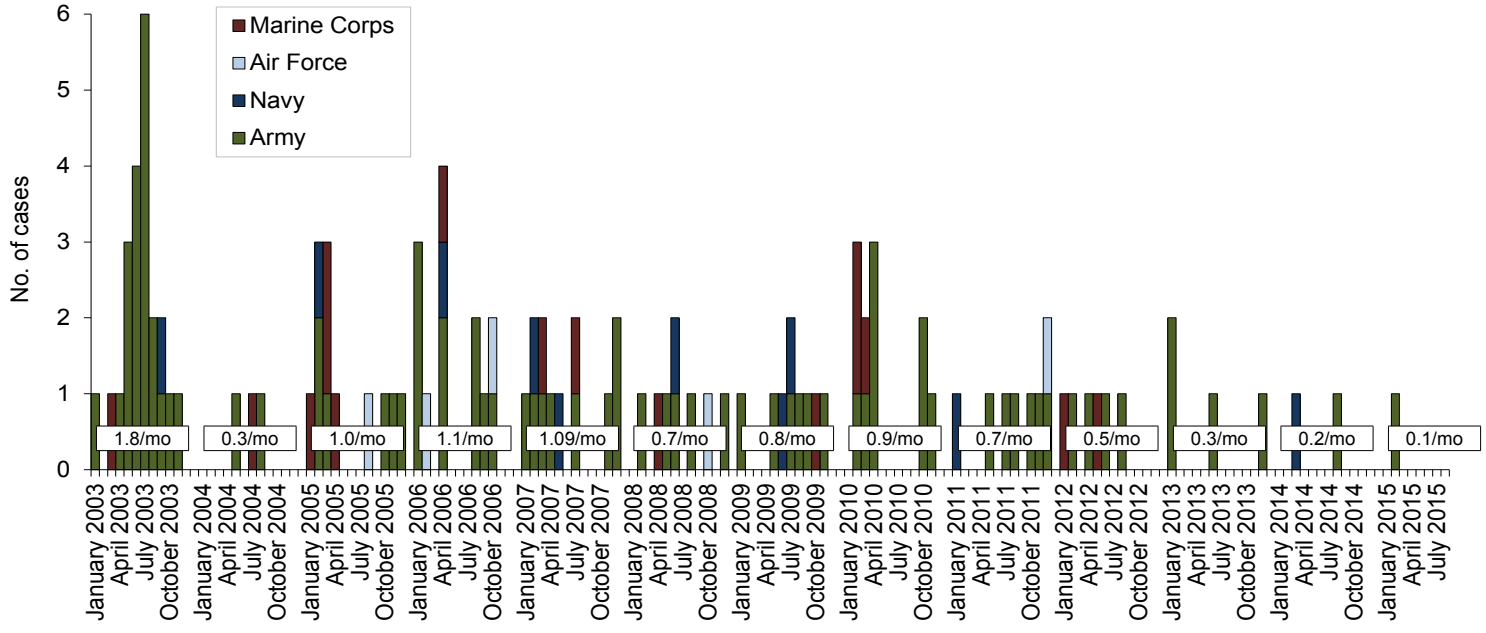
[a]Indicator diagnosis (one per individual) during a hospitalization or ambulatory visit while deployed to/within 30 days of returning from deployment (includes in-theater medical encounters from the Theater Medical Data Store [TMDS] and excludes 4,623 deployers who had at least one TBI-related medical encounter any time prior to deployment).

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]



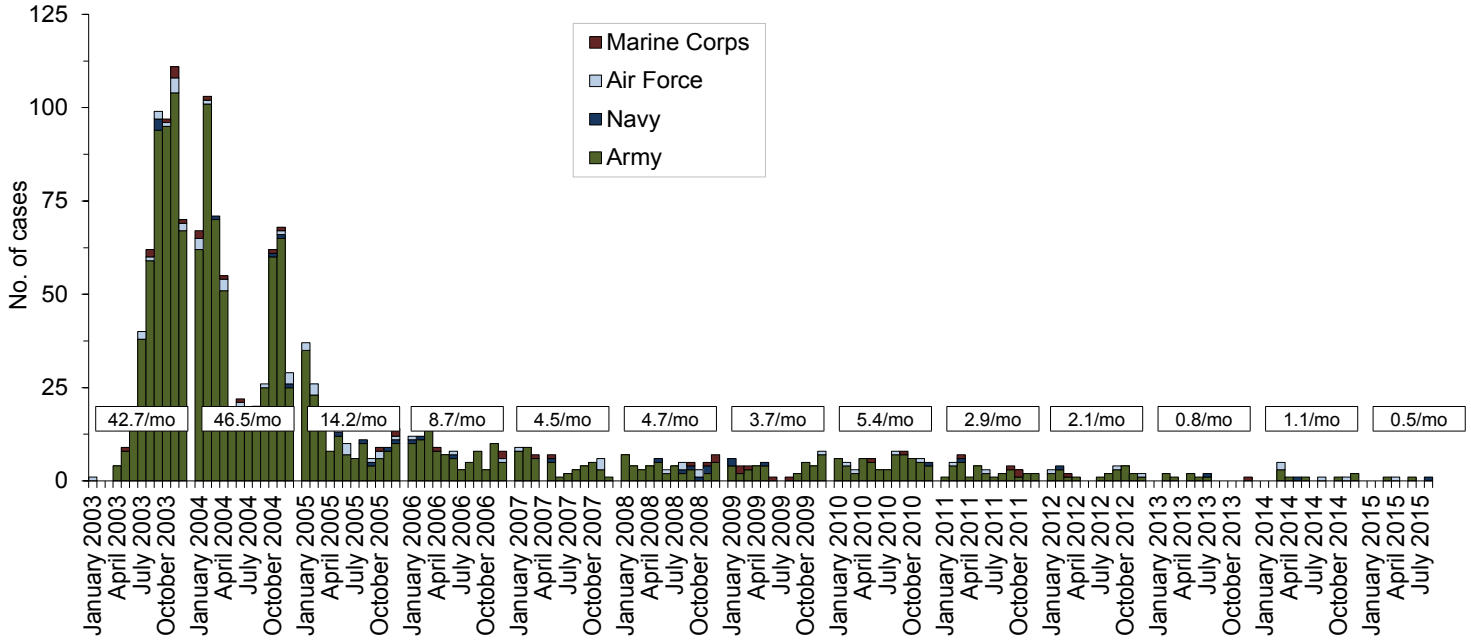
Reference: Isenbarger DW, Atwood JE, Scott PT, et al. Venous thromboembolism among United States soldiers deployed to Southwest Asia. *Thromb Res*. 2006;117(4):379–383.
[b]One diagnosis during a hospitalization or two or more ambulatory visits at least 7 days apart (one case per individual) while deployed to/within 90 days of returning from deployment.

Severe acute pneumonia (ICD-9: 518.81, 518.82, 480–487, 786.09)[a]



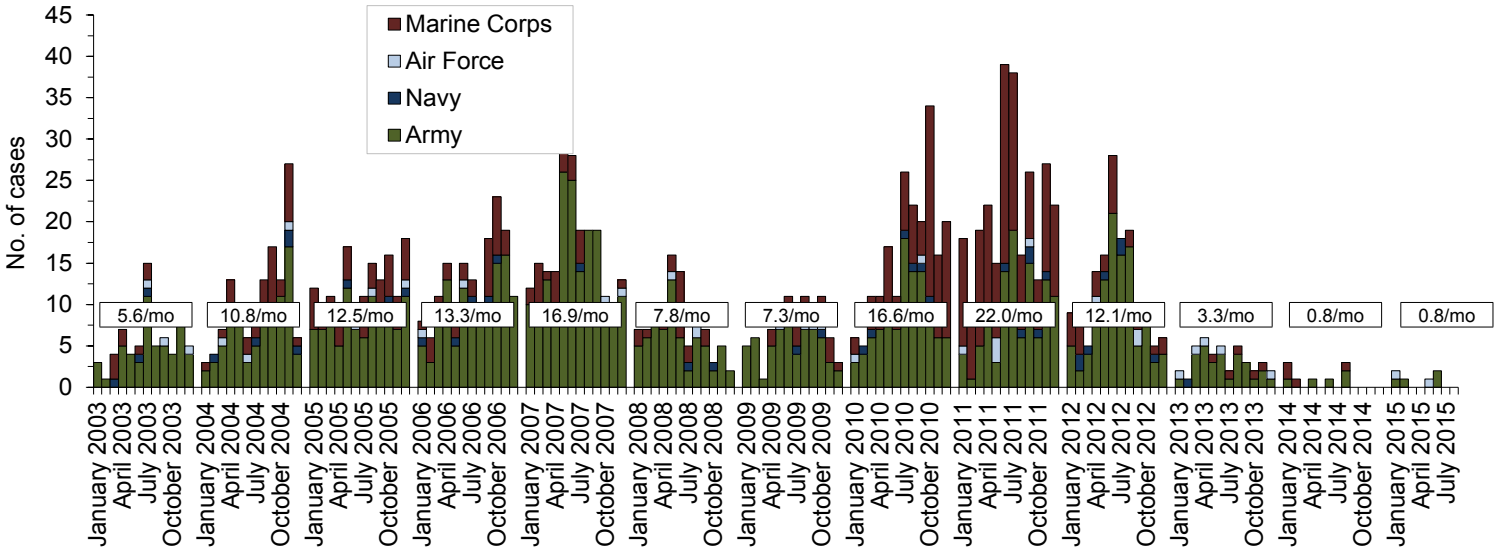
Reference: Army Medical Surveillance Activity. Deployment-related condition of special surveillance interest: severe acute pneumonia. Hospitalizations for acute respiratory failure (ARF)/acute respiratory distress syndrome (ARDS) among participants in Operation Enduring Freedom/Operation Iraqi Freedom,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

Leishmaniasis (ICD-9: 085.0–085.9)[b]



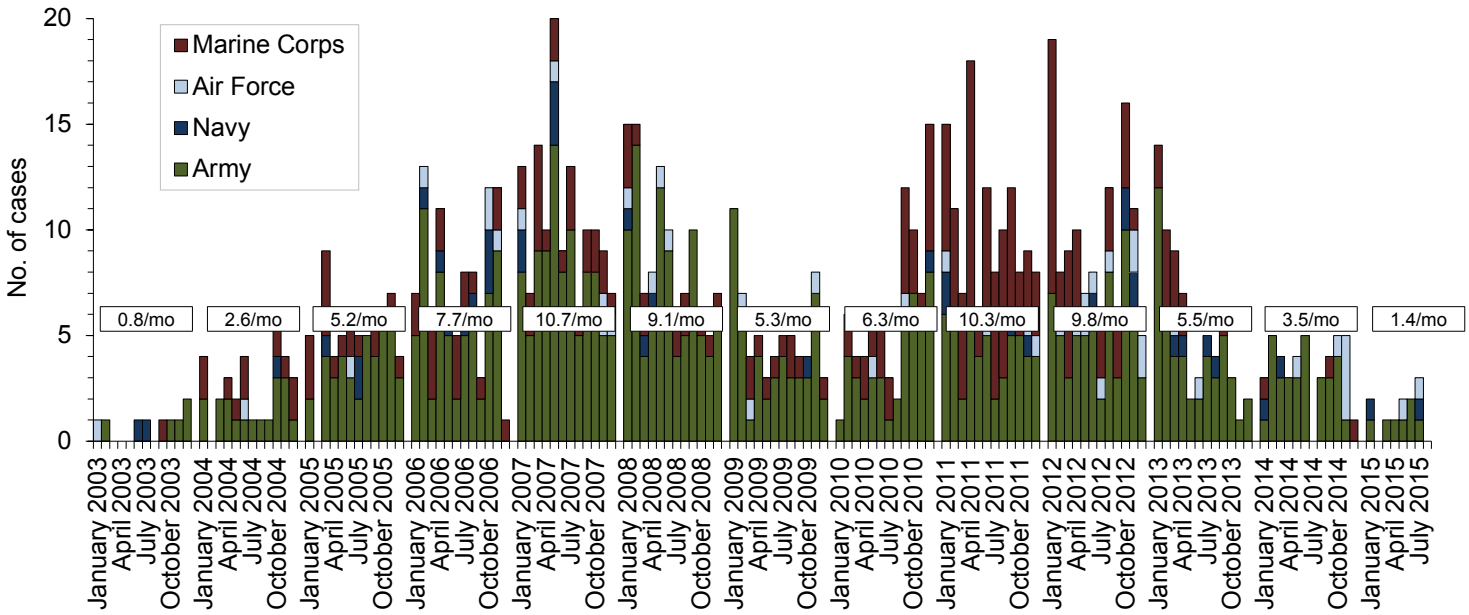
Reference: Army Medical Surveillance Activity. Deployment-related condition of special surveillance interest: leishmaniasis. Leishmaniasis among U.S. Armed Forces, January 2003–November 2004. *MSMR*. 2004;10(6):2–4.
[b]Indicator diagnosis (one per individual) during a hospitalization, ambulatory visit, and/or from a notifiable medical event during/after service in OEF/OIF/OND.

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]



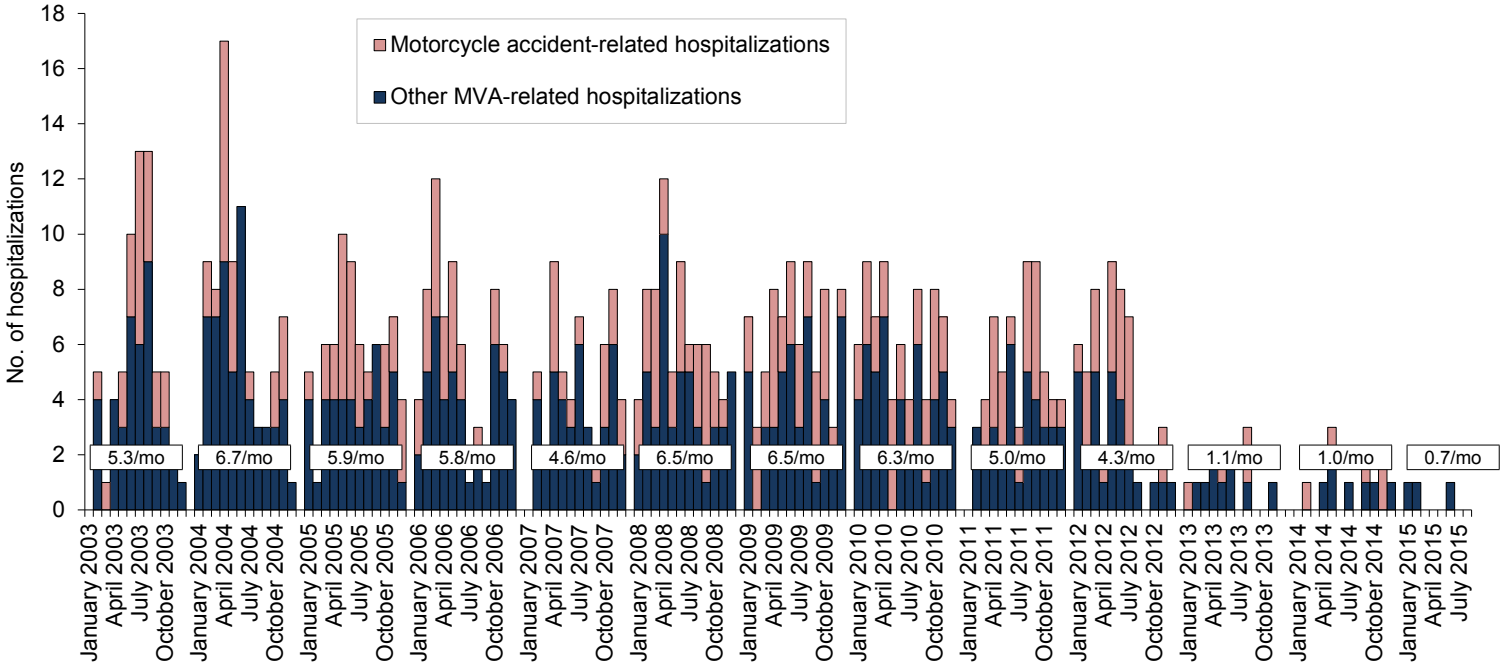
Reference: Army Medical Surveillance Activity. Deployment-related condition of special surveillance interest: amputations. Amputations of lower and upper extremities, U.S. Armed Forces, 1990–2004. *MSMR*. 2005;11(1):2–6.
[a]Indicator diagnosis (one per individual) during a hospitalization while deployed to/within 365 days of returning from deployment

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



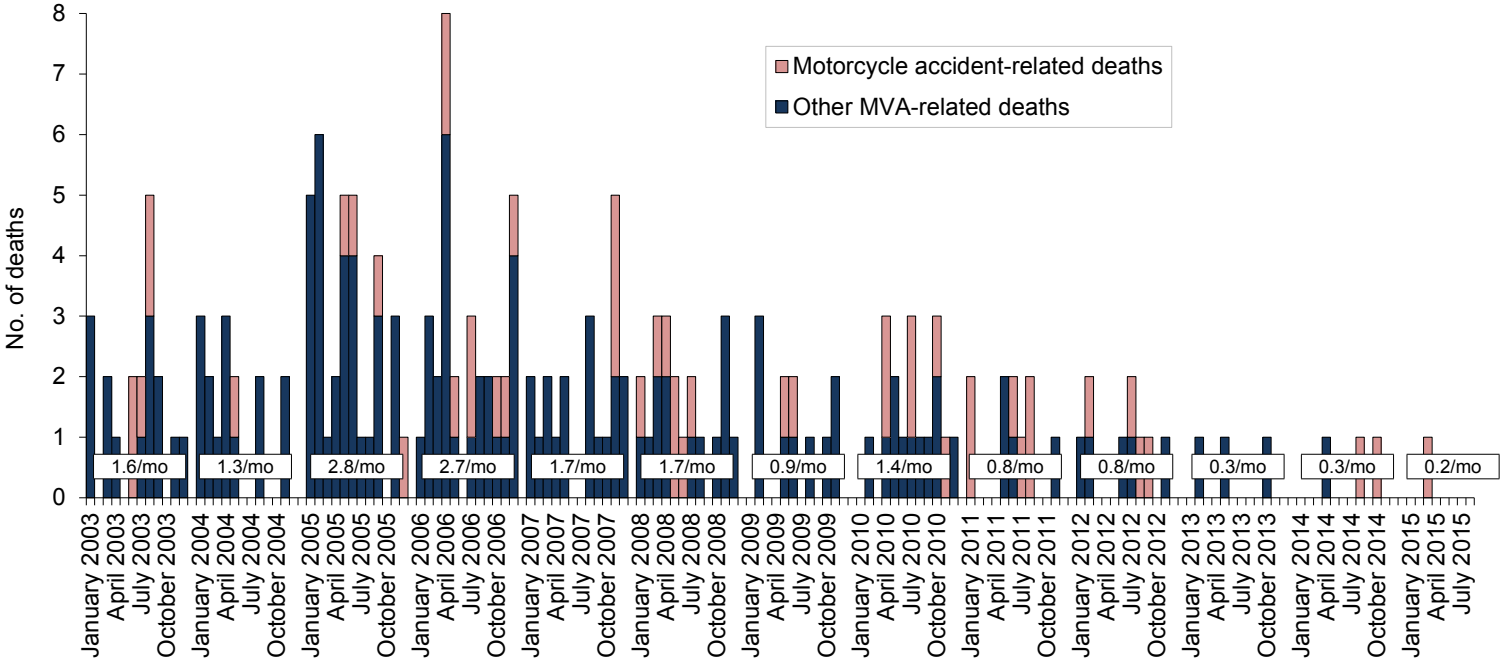
Reference: Army Medical Surveillance Activity. Heterotopic ossification, active components, U.S. Armed Forces, 2002–2007. *MSMR*. 2007;14(5):7–9.
[b]One diagnosis during a hospitalization or two or more ambulatory visits at least 7 days apart (one case per individual) while deployed to/within 365 days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

Hospitalizations outside of the operational theater for motor vehicle accidents occurring in non-military vehicles (ICD-9-CM: E810–E825; NATO Standard Agreement 2050 (STANAG): 100–106, 107–109, 120–126, 127–129)



Note: Hospitalization (one per individual) while deployed to/within 90 days of returning from OEF/OIF/OND. Excludes accidents involving military-owned/special use motor vehicles. Excludes individuals medically evacuated from CENTCOM and/or hospitalized in Landstuhl, Germany, within 10 days of another motor vehicle accident-related hospitalization.

Deaths following motor vehicle accidents occurring in non-military vehicles and outside of the operational theater (per the DoD Medical Mortality Registry)



Reference: Armed Forces Health Surveillance Center. Motor vehicle-related deaths, U.S. Armed Forces, 2010. *MSMR*. 2011;17(3):2–6.
Note: Death while deployed to/within 90 days of returning from OEF/OIF/OND. Excludes accidents involving military-owned/special use motor vehicles. Excludes individuals medically evacuated from CENTCOM and/or hospitalized in Landstuhl, Germany, within 10 days prior to death.

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