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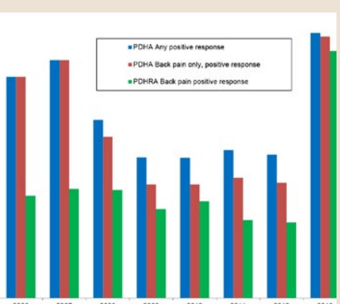

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Update: Malaria, U.S. Armed Forces, 2015

U.S. service members are at risk of acquiring malaria infection when they are located in endemic areas because of long-term duty assignments, participation in shorter-term contingency operations, or personal travel. The number of malaria cases among U.S. military service members in 2015 (n=30) was the lowest annual count in at least 20 years and follows 3 previous years of greatly reduced incidence. The relatively low numbers of cases during 2012–2015 mainly reflect decreases in cases acquired in Afghanistan as the number of troops who served in Afghanistan sharply diminished in those years. About 43% of the 2015 cases were caused by *Plasmodium falciparum* (n=13) and 13% by *Plasmodium vivax* (n=4); about one-third of cases (37%) were reported as "unspecified" malaria. Malaria was diagnosed at or reported from 21 different medical facilities in the U.S., Afghanistan, Germany, and Korea. Providers of health care to military members should be knowledgeable regarding, and vigilant for, clinical presentations of malaria outside of endemic areas.

Malaria is endemic in approximately 100 countries throughout tropical and subtropical regions of the world. The World Health Organization (WHO) estimated that 214 million cases occurred worldwide in 2015, representing a decrease from 262 million cases in 2000. During the same period, WHO estimated that annual deaths from malaria decreased from 839,000 to 438,000.[1] As a result of international efforts to control malaria, many countries have reported reductions in the numbers of malaria cases and deaths during the past decade. Most malaria deaths are still due to *Plasmodium falciparum* infections of children under 5 years old in sub-Saharan Africa.[1]

Since 1999, the *MSMR* has published annual updates on the incidence of malaria among U.S. service members.[2,3] The *MSMR* focus on malaria reflects both historical lessons learned about this mosquito-borne disease and the continuing threat that it poses to military operations and service members' health. Malaria not only afflicted many thousands of service members during World War II (approximately 695,000 cases), the Korean War (approximately 390,000 cases), and the conflict in Vietnam (approximately 50,000 cases),[4,5] but also has necessitated heightened vigilance, preventive measures, and treatment of cases associated with more recent military engagements in Africa, Asia, the Caribbean, and Southwest Asia and the Middle East.[6–13] In the planning for overseas military operations, the geography-based presence or absence of the malaria threat is usually known and can be anticipated. However, when preventive countermeasures are needed, their effective implementation is multifaceted and depends on the provision of protective equipment and supplies, individuals' understanding of the threat and attention to personal protective measures, treatment of malaria cases, and medical surveillance. The U.S. Armed Forces have long had policies and prescribed countermeasures effective against vector-borne diseases such as malaria, including chemoprophylactic drugs, permethrin-impregnated uniforms and bed nets, and topical insect repellents containing N,N-diethyl-meta-toluamide (DEET). When cases and outbreaks of malaria do occur, they are usually due to noncompliance with indicated chemoprophylactic or personal protective measures.[7–9]

The past three *MSMR* updates on malaria documented that the numbers of cases in service members in 2012–2014 were the lowest annual counts in 15 years.[3,14,15] In particular, the numbers of cases associated with service in Afghanistan had fallen sharply in the past 3 years, presumably due to the dramatic reduction in the numbers of service members serving there. This update for 2015 replicates the previously used methods in describing the epidemiologic patterns of malaria incidence in the service members of the U.S. Armed Forces.

METHODS

The surveillance period was 1 January 2006 through 31 December 2015. The surveillance population included active and reserve component members of the U.S. Armed Forces. The Defense Medical Surveillance System (DMSS) was searched to identify reportable medical events and hospitalizations (in military and nonmilitary facilities) that included diagnoses of malaria. A case of malaria was defined as an individual with 1) a reportable medical event record of confirmed malaria; 2) a hospitalization record with a primary (first-listed) diagnosis of malaria; 3) a hospitalization record with a non-primary diagnosis of malaria due to a specific *Plasmodium* species; 4) a hospitalization record with a non-primary diagnosis of malaria plus a diagnosis of anemia, thrombocytopenia and related conditions, or malaria complicating pregnancy in any diagnostic position; or 5) a hospitalization record with a non-primary diagnosis of malaria plus diagnoses of signs or symptoms consistent with malaria (as listed in the Control of Communicable Diseases

Manual, 18th Edition)[16] in each diagnostic position antecedent to malaria. The relevant ICD-9 and ICD-10 codes are shown in **Table 1.** Malaria diagnoses that were recorded only in the records of outpatient encounters (i.e., not hospitalized or reported as a notifiable event) were not considered case-defining for this analysis.

This summary allowed one episode of malaria per service member per 365-day period. When multiple records documented a single episode, the date of the earliest encounter was considered the date of clinical onset, and the most specific diagnosis was used to classify the *Plasmodium* species.

Presumed locations of malaria acquisition were estimated using a hierarchical classification algorithm: 1) cases hospitalized in a malarious country were considered acquired in that country; 2) case reports (submitted as reportable medical events) that listed exposures to malaria endemic locations were considered acquired in those locations; 3) cases diagnosed among service members during or within 30 days of deployment or assignment to a malarious country were considered acquired in that country; 4) cases diagnosed among service members who had been deployed to Afghanistan or Korea within 2 years prior to diagnosis were considered acquired in those countries; and 5) all remaining cases were considered acquired in unknown locations.

RESULTS

In 2015, the number of U.S. service members (n=30) diagnosed and/or reported with malaria was the lowest of the 10-year surveillance period and reflected a continuation of the sharp decline in the annual numbers of cases after 2011 **(Figure 1)**. The number of cases of malaria caused by *Plasmodium vivax* (n=4) was the lowest in the surveillance period. The proportion of all cases due to *P. falciparum* (43%) remained high for the second year in a row even though the number of cases (n=13) in 2015 was much lower than the count in 2014 (n=22) **(Figure 1, Table 2).** There were single cases of malaria due to *Plasmodium ovale* and *Plasmodium malariae* during the year. The responsible agent was "unspecified" for more than one-third (n=11) of 2015 cases.

In 2015, as in prior years, most U.S. military members diagnosed with malaria were male (93%), active component members (83%), in the Army (60%), and in their 20s (60%) **(Table 2)**.

Of the 30 malaria cases in 2015, 30% of the infections were considered to have been acquired in Africa (n=9), 23% in Korea (n=7), and 10% in Afghanistan (n=3) **(Table 3)**. During 2006–2014, malaria attributed to Afghanistan accounted for 54% of all cases **(data not shown)**. There were no cases identified from South/Central America in 2015; for the remaining 11 malaria cases, no specific geographic location could be discerned from the available documentation. Of the nine malaria infections considered acquired in Africa, three infections were linked to Djibouti; two were linked to Nigeria; and one each to Angola, Chad, Ghana, and Sudan **(data not shown)**.

During 2015, malaria cases were diagnosed in or reported from 21 different medical facilities in the U.S., Afghanistan, Germany, and Korea. Almost half of cases (n=14, 47%) were reported from or

TABLE 1. ICD-9 and ICD-10 codes used in defining cases of malaria for inpatient encounters (hospitalizations)

	ICD-9 codes	ICD-10 codes
Malaria (*Plasmodium* species)		
P. falciparum	84.0, 84.8, 84.9	B50
P. vivax	84.1	B51
P. malariae	84.2	B52
P. ovale	84.3	B53.0
Other, mixed	84.4, 84.5	B53.1, B53.8
Unspecified	84.6	B54
Anemia	280–285	D50–D53, D55–D64
Thrombocytopenia	287	D69
Malaria complicating pregnancy	647.4	O98.6
Signs, symptoms, or other abnormalities consistent with malaria	276.2, 518.82, 584.9, 723.1, 724.2, 780.0, 780.01, 780.02, 780.03, 780.09, 780.1, 780.3, 780.31, 780.32, 780.33, 780.39, 780.6, 780.60, 780.61, 780.64, 780.65, 780.7, 780.71, 780.72, 780.79, 780.97, 782.4, 784.0, 786.05, 786.09, 786.2, 786.52, 786.59, 787.0, 787.01, 787.02, 787.03, 787.04, 789.2, 790.4	E87.2, J80, M54.2, M54.5, N17.9, R05, R06.0, R06.89, R07.1, R07.81, R07.82, R07.89, R11, R11.0, R11.1, R11.2, R16.1, R17, R40, R41.0, R41.82, R44, R50, R51, G44.1, R53, R56, R68.0, R68.83, R74.0

This table lists the ICD-9 and ICD-10 codes used in defining cases of malaria from the records for inpatient encounters. Codes are provided for malaria specifically and for associated diagnoses such as anemia, thrombocytopenia, and other signs and symptoms consistent with malaria.

FIGURE 1. Malaria cases among U.S. service members, by *Plasmodium* species and calendar year of diagnosis/report, 2006–2015

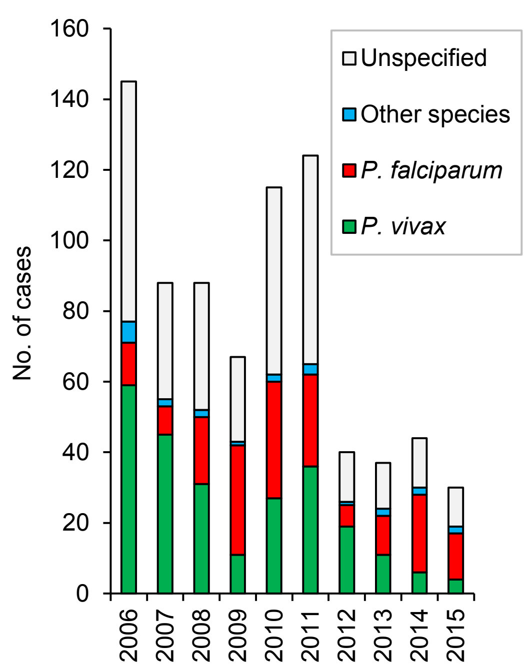


TABLE 2. Malaria cases by *Plasmodium* species and selected demographic characteristics, U.S. Armed Forces, 2015

	P. vivax	*P. falciparum*	Unspecified or other	Total	% of total
Component					
Active	4	11	10	25	83.3
Reserve/Guard	0	2	3	5	16.7
Service					
Army	4	5	9	18	60.0
Air Force	0	7	3	10	33.3
Marine Corps	0	1	1	2	6.7
Sex					
Male	4	13	11	28	93.3
Female	0	0	2	2	6.7
Age group					
20–24	3	4	4	11	36.7
25–29	1	3	3	7	23.3
30–34	0	2	1	3	10.0
35–39	0	1	2	3	10.0
40–44	0	2	0	2	6.7
45–49	0	1	2	3	10.0
50+	0	0	1	1	3.3
Race/ethnicity					
White non-Hispanic	2	5	8	15	50.0
Black non-Hispanic	0	6	3	9	30.0
Other	2	2	2	6	20.0
Total	4	13	13	30	100.0

This table shows the numbers of cases of malaria in 2015 by species (*P. falciparum*, *P. vivax*, and unspecified or other) and how they were distributed by selected demographic characteristics (service component, service, sex, age group, and race/ethnicity).

diagnosed outside the U.S. **(Table 3)**. The largest number of malaria cases associated with a single medical facility during the year was four at Landstuhl Regional Medical Center in Germany. Three cases each were diagnosed at Fort Campbell, KY, and Brian Allgood Army Community Hospital, Korea.

The number of Africa-acquired cases (n=9) in 2015 was slightly lower than the corresponding annual numbers of cases in 2013 (n=11) and 2014 (n=14), but much lower than the numbers in the years 2009–2011 (range: 21–33 cases) **(Figure 2)**. The number of Afghanistan-acquired malaria cases in 2015 (n=3) was the lowest of the 10-year surveillance period. The number of malaria cases acquired in Korea in 2015 (n=7) was slightly lower than the number in 2014 (n=10); the first 2 years of the surveillance period were noteworthy for much higher numbers of cases acquired in Korea (2006: 25 cases; 2007: 30 cases).

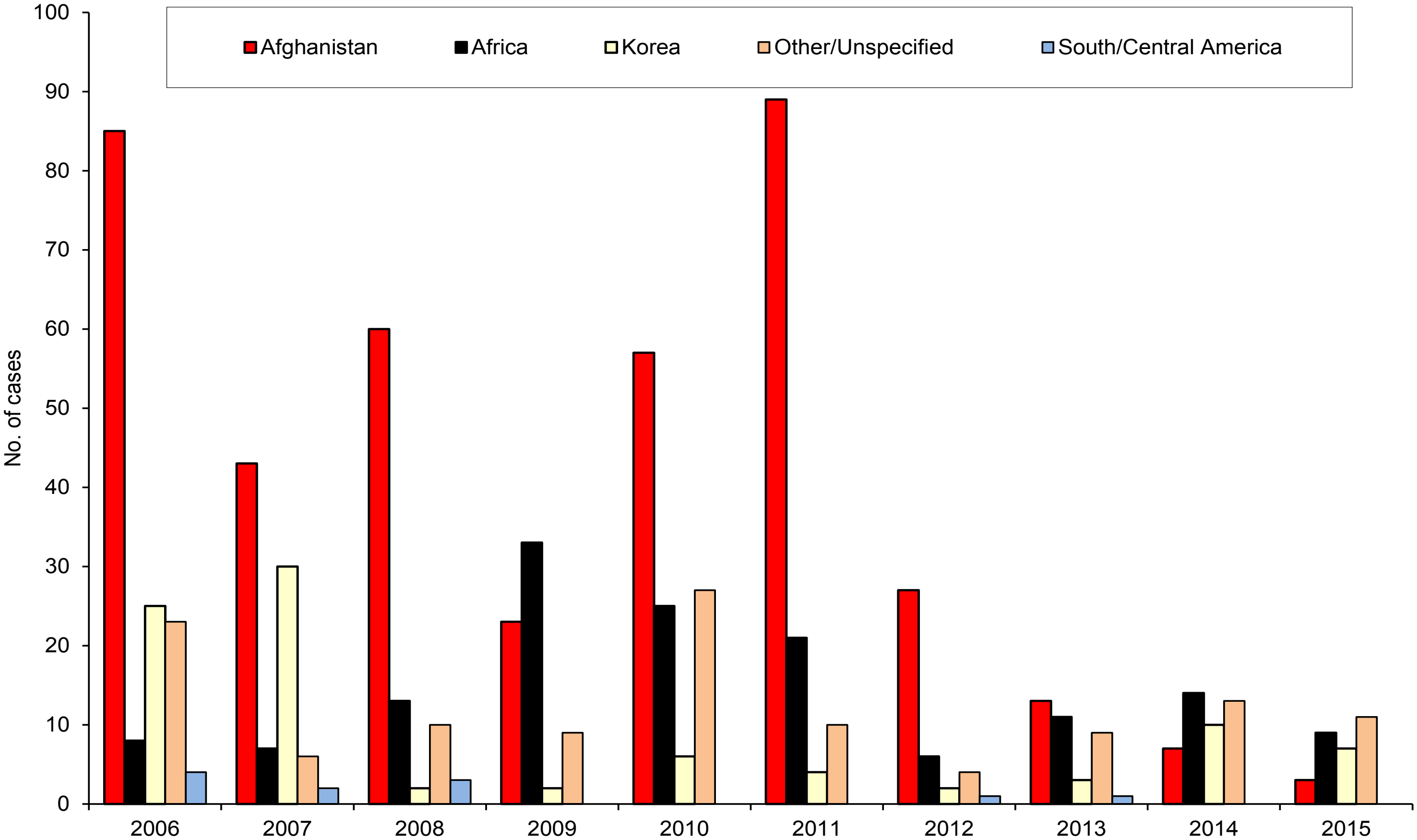
In 2015, 63% of malaria cases among U.S. service members were diagnosed during May–October. This proportion was

TABLE 3. Number of malaria cases by geographical locations of diagnosis or report and presumed location of acquisition, U.S. Armed Forces, 2015

	Presumed location of infection acquisition						
Location where diagnosed or reported from	Korea	Afghanistan	Africa	South/ Central America	Other or unknown location	Total for location of diagnosis or report	% of total 2015 cases
Landstuhl Regional Medical Center, Germany	0	0	2	0	2	4	13.3
Army Health Clinic, Yongsan, Seoul, Korea	3	0	0	0	0	3	10.0
Fort Campbell, KY	1	1	0	0	1	3	10.0
Fort Lewis, WA	0	0	1	0	1	2	6.7
Naval Health Clinic, Quantico, VA	0	0	2	0	0	2	6.7
Brian Allgood Army Community Hospital, Seoul, Korea	1	0	0	0	0	1	3.3
Army Health Clinic, Camp Stanley, Korea	1	0	0	0	0	1	3.3
86th Medical Group, Ramstein AB, Germany	0	0	0	0	1	1	3.3
Army Health Clinic, Grafenwoehr, Germany	0	0	0	0	1	1	3.3
Army Health Clinic, Baumholder, Germany	0	0	1	0	0	1	3.3
Army Health Clinic, Kaiserslautern, Germany	0	0	1	0	0	1	3.3
96th Medical Group, Eglin AFB, FL	0	1	0	0	0	1	3.3
779th Medical Group, Andrews AFB, MD	0	0	0	0	1	1	3.3
87th Medical Group, McGuire AFB, NJ	0	0	0	0	1	1	3.3
Fort Benning, GA	0	0	0	0	1	1	3.3
Fort Stewart, GA	1	0	0	0	0	1	3.3
Fort Knox, KY	0	0	1	0	0	1	3.3
Walter Reed National Military Medical Center, MD	0	0	1	0	0	1	3.3
Fort Sam Houston, TX	0	0	0	0	1	1	3.3
Unspecified clinic, U.S.	0	0	0	0	1	1	3.3
Bagram/Camp Lacy, Afghanistan	0	1	0	0	0	1	3.3
Total	7	3	9	0	11	30	

This table shows the numbers of malaria cases according to the geographical locations of the medical facilities that diagnosed or reported the cases and by the presumed geographic locations of acquisition of the infection.

FIGURE 2. Annual numbers of cases of malaria associated with specific locations of acquisition, U.S. Armed Forces, 2006–2015

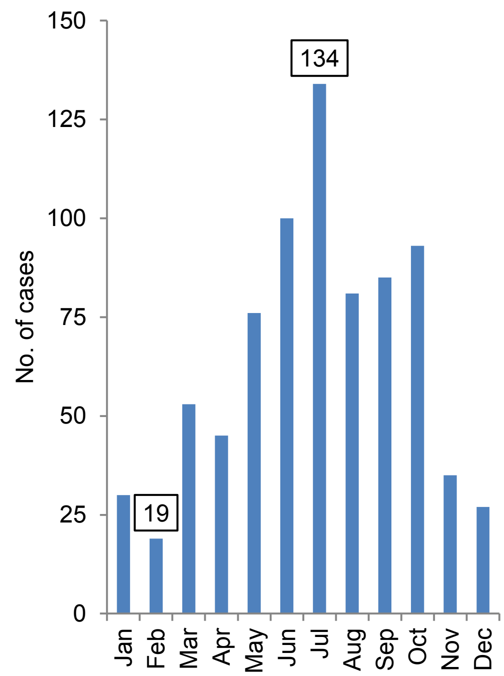


lower than the 73% of cases diagnosed during the same 6-month periods over the entire 10-year period **(Figure 3)**. During the past 10 years, the proportions of malaria cases diagnosed or reported during May–October varied by region of acquisition: Korea (97%); Afghanistan (80%); Africa (55%); and South/Central America (36%) **(data not shown).**

EDITORIAL COMMENT

Not only do the 30 cases of malaria in 2015 represent the lowest annual number of cases among U.S. service members during the 10-year surveillance period, but that count of cases is also the lowest in more than 20 years. *MSMR* annual reports on malaria incidence among all U.S. services began in 2007 and those reports document that the lowest annual numbers of cases during the interval 2001–2015 were in the most recent 4 years, reaching a nadir of 30 in 2015. During the years 1999–2006, *MSMR* reports about malaria described cases in just Army personnel, but the lowest annual case count during 1995–2005 among soldiers only was 31 cases in 1996.[17] Most of the marked decline in the recent years is attributable to the decrease in numbers of malaria cases associated with service in Afghanistan. The dominant factor in that trend has undoubtedly been the progressive withdrawal of U.S. forces from that country. This report also documents the fluctuating incidence of acquisition of malaria in Africa and Korea among U.S. military members during the past decade. Although the predominant species of malaria in Korea and Afghanistan has been *Plasmodium vivax*, the more dangerous *P. falciparum* species is of primary concern in Africa. The planning and execution of military operations on that continent must incorporate actions to counter the threat of infection by that potentially deadly parasite wherever it is endemic. The recent employment of U.S. service members to aid in the response to the Ebola virus outbreak

FIGURE 3. Cumulative numbers of diagnoses and reported cases of malaria, by month of clinical presentation or diagnosis, U.S. Armed Forces, January 2006–December 2015



in West Africa is an example of an operation where the risk of *P. falciparum* malaria was significant. Individual service members must be diligent in protecting themselves from biting mosquitoes and in taking prescribed chemoprophylactic drugs.

The finding that *P. falciparum* malaria was diagnosed in nearly half of the cases in 2015 emphasizes the need for continued emphasis on prevention of this disease, given its potential severity and risk of death. Although the case count for *P. falciparum* may be largely explained by infections acquired in Africa, the absence of data about geographic location of acquisition for 11 cases precludes a firm conclusion about that possibility. The striking decline in cases associated with service in Afghanistan, where *P. vivax* predominates, allowed *P. falciparum* to account for the highest proportion of cases in 2015. The four cases of *P. vivax* in 2015 represented the lowest annual count of that species in the past decade.

The observations about the seasonality of diagnoses of malaria are compatible with the presumption that the risk of acquiring and developing symptoms of malaria in a temperate climatic zone of the northern hemisphere would be greatest during May–October. Given the typical incubation periods of malaria infection (approximately 9–14 days for *P. falciparum*, 12–18 days for *P. vivax* and *P. ovale*, and 18–40 days for *P. malariae*)[16] and the seasonal disappearance of biting mosquitoes during the winter, most malaria acquired in Korea and Afghanistan would be expected to cause symptoms during the warmer months of the year. However, it should be noted that studies of *P. vivax* malaria in Korea have found that the incubation period can be remarkably long, ranging from 1 to 18 months.[18] On the other hand, transmission of malaria in tropical regions such as sub-Saharan Africa is less subject to the limitations of the seasons in temperate climates but depends more on other factors affecting mosquito breeding such as the timing of the rainy season and altitude (below 2000 meters).[19]

There are significant limitations to this report that should be considered when interpreting the findings. For example, the ascertainment of malaria cases is likely incomplete; some cases treated in deployed or non-U.S. military medical facilities may not have been reported or otherwise ascertained at the time of this analysis. A review of the series of *MSMR* updates on malaria reveals that the annual counts of cases for the most recent year have often been revised upward when the data analyses are repeated for subsequent updates. For example, this update reports 37 cases for 2013, but the original count in the update for that year reported 30 cases. Similarly, the original count of 38 cases for 2012 was revised upward to 40 cases the following year. It is possible that future analyses will find more than the 30 cases associated with 2015 in this report. Additionally, only malaria infections that resulted in hospitalizations in fixed facilities or were reported as notifiable medical events were considered cases for this report. Infections that were treated only in outpatient settings and not reported as notifiable events were not included as cases. Also, the locations of infection acquisitions were estimated from reported relevant information. Some cases had reported exposures in multiple malarious areas, and others had no relevant exposure information. Personal travel to, or military activities in, malaria-endemic countries were not accounted for unless specified in notifiable event reports.

As in prior years, in 2015 most malaria cases among U.S. military members were treated at medical facilities remote from malaria endemic areas. Providers of acute medical care to service members (in both garrison and deployed settings) should be knowledgeable of, and vigilant for, the early clinical manifestations of malaria among service members who are or were recently in malaria-endemic areas. Care providers should also be capable of diagnosing malaria (or have access to a clinical laboratory that is proficient in malaria diagnosis) and initiating treatment (particularly when *P. falciparum* malaria is clinically suspected).

Continued emphasis on standard malaria prevention protocols is warranted for all military members at risk of malaria. Personal protective measures against malaria include the proper wear of uniforms and the use of bed nets, both of which have been permethrin-impregnated; the topical use of military-issued DEET-containing insect repellent; and compliance with prescribed chemoprophylactic drugs before, during, and after times of exposure in malarious areas. Current Department of Defense guidance about medications for prophylaxis of malaria summarizes the roles of chloroquine, atovaquone-proguanil, doxycycline, mefloquine, and primaquine.[20]

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Durations of Service Until First and Recurrent Episodes of Clinically Significant Back Pain, Active Component Military Members: Changes Among New Accessions to Service Since Calendar Year 2000

John F. Brundage, MD, MPH; Zheng Hu, MS; Leslie L. Clark, PhD, MS

This report summarizes frequencies and timing of first and recurrent episodes of back pain treated in the U.S. Military Health System among more than 2 million military members who began active service between July 2000 and June 2012. In the population overall, at least 5% were affected by clinically significant back pain within 6 months and 10% within 13 months of beginning active service; and 34% had at least one episode of back pain while in active service during the surveillance period. After initial episodes of back pain, more than half (54%) of those affected had at least one recurrent episode; and after first recurrences, 65% had second recurrences while still in active service. In general, back pain episode–free periods preceding initial and between successive episodes markedly decreased during the period. Frequencies and timing of back pain episodes varied in relation to service branch, gender, and occupation. Acute back pain is a common disorder that is unpredictable in onset and often debilitating. Its prevention should be a military medical research objective of high priority.

Back and neck disorders are a common, often extremely painful, and frequently disabling group of injuries. As such, they are consistently leading causes of medical encounters, lost duty time, and medical disability discharges among U.S. military members.[1–3]

In recent years, "back problems" have accounted for more medical encounters by active military members than any other category of illness or injury diagnoses.[2] In addition, during the wars in Afghanistan and Iraq, low back pain was one of the most frequent diagnoses during medical encounters in, and a leading cause of medical evacuations from, the combat theaters.[4,5] A report in the December 2015 issue of the *MSMR* documented that 689,073 service members accounted for more than 6 million outpatient encounters and nearly 26,000 hospitalizations for back pain–related conditions during the 5-year period from 2010 through 2014. The overall incidence rate during the period was 12.0 incident encounters per 100 service members per year. Interestingly, although rates of incident episodes of low back pain decreased during the period, annual numbers of back pain–related ambulatory visits markedly increased.[3]

There have been numerous and varied approaches to preventing new onsets of back pain in otherwise healthy young adults, such as military members.[5–9] Although policies and practices that are effective in preventing initial and recurrent episodes of back pain have been eagerly sought, they remain elusive. Studies designed to assess the effects of physical (e.g., core strengthening) and psychological (e.g., psychosocial education) interventions to prevent new onsets of back pain in military populations have varying results.[5–8] In the absence of effective preventive countermeasures, and in light of new physical and psychological stressors related to active military service (e.g., wartime deployments, heavy loads, and protective equipment),[10–13] it is particularly important to monitor rates and trends, and to identify groups at particularly high risk, of medically and military operationally significant conditions such as back pain.

To this end, the objectives of this analysis were to estimate the distributions of "survival times" until first and recurrent episodes of medically treated back pain among newly accessed members of active components of the military services since calendar year 2000; and to assess differences in "survival times" until first and recurrent episodes of back pain in relation to gender, military service, and military occupation.

METHODS

The surveillance population included all individuals who entered military service in the active component of the U.S. Army, Navy, Air Force, or Marine Corps between 1 July 2000 and 30 June 2012. To assess trends in survival times until initial and recurrent episodes of back pain, the surveillance population overall was divided into four cohorts that were characterized by the dates that they entered military service: cohort 1 members entered service from 1 July 2000 through 30 June 2003; cohort 2 members entered service from 1 July 2003 through 30 June 2006; cohort 3 members entered service from 1 July 2006 through 30 June 2009; and cohort 4 members entered service from 1 July 2009 through 30 June 2012.

Endpoints of analyses were episodes of clinically significant back pain. An episode of clinically significant back pain consisted of one or more medical encounters (hospitalizations or ambulatory visits) with back pain–related diagnoses in any of the first three diagnostic positions of the electronic records of the encounters. Each episode was defined by an incident encounter and all subsequent back pain–related encounters that occurred within 30 days of a preceding back pain–related encounter. The diagnostic codes (ICD-9) considered indicative of back pain were the same as those considered indicator diagnosis codes during analyses of back pain for previous *MSMR* reports.[3]

The start date of each episode of back pain was defined by the first back pain–related encounter of an individual while in active military service or by the first back pain–related encounter that occurred more than 30 days after any prior back pain–related encounter. The end date of each episode was defined by the first back pain–related encounter of an episode that occurred within 30 days of a preceding back pain–related encounter but more than 30 days before a subsequent back pain–related encounter.

For survival analysis purposes, survival times until initial episodes of back pain were the number of days from accession to active military service until the start date of the first episode of back pain. Survival times until first recurrent episodes of back pain were the number of days from the last encounter of the initial episode until the next encounter, if more than 30 days later (i.e., the start date of the first recurrent episode). Survival times until second recurrent episodes were the number of days from the last encounter of the first recurrent episode until the next encounter, if more than 30 days later (i.e., the start date of the second recurrent episode).

The Kaplan-Meier method was used to estimate the cumulative percentages still surviving (i.e., without back pain episodes) at various times from accession to military service until initial episodes, from the end of initial episodes until first recurrent episodes, and from the end of first recurrent episodes until second recurrent episodes of back pain for all members, and for selected demographic and military subgroups, of cohorts 1–4. The follow-up experiences of cohort members were censored when individuals left military service (due to death, retirement, or discharge) or on the last day of the surveillance period.

RESULTS

Initial episodes: During the 12-year surveillance period, 2,104,421 individuals began service in the active component of the U.S Army, Navy, Air Force, or Marine Corps. Of these individuals, approximately one-third (34.5%) had an episode of clinically significant back pain during the surveillance period; approximately one-fourth (24.3%) had no documented episodes of back pain and were still in active service at the end of the surveillance period; and the remainder (41.2%) terminated active service without a documented episode of back pain **(Table 1)**.

During the 12-year period, among all new accessions to service, the estimated durations of service until 5% and 10% of them had first episodes of clinically significant back pain increased from 4.2 months and 11.3 months, respectively, early in the period (cohort 1) to 5.4 months and 13.1 months, respectively, at the end of the period (cohort 4) **(Table 1)**.

In contrast, the estimated durations of service until 25% and 50% of all accessions had first episodes of back pain generally decreased during the period. For example, estimated times until 25% and 50% of new accessions had first episodes of back pain decreased from approximately 41 months and 107 months, respectively, early in the period (cohort 1) to 36 months (cohort 4) and 85 months (cohort 3), respectively, later in the period. (Of note, the time until 50% of cohort 4 members were affected could not be estimated because of the relatively short follow-up of this cohort) **(Table 1, Figure 1)**.

In general, durations of service until 5%, 10%, 25%, and 50% of accessions had first episodes of back pain were much shorter among females, members of the Army, and those in medical occupations than their respective counterparts. However, in nearly all demographic/military subgroups, durations of service until 5% and 10% of accessions were affected increased during the period, while durations of service until 25% and 50% were affected decreased. A notable exception to the general trend was the experience of those in combat-specific occupations. In this group, durations of service until 5%, 10%, 25%, and 50% of accessions had their first episodes of back pain markedly decreased throughout the period **(Table 1, Figure 1)**.

First recurrent episodes: Of all members of the surveillance population who had initial episodes of clinically significant back pain during the surveillance period, more than half (54.3%) had at least one recurrent episode during the surveillance period; approximately one-fifth (20.6%) had no recurrences and were still in active service at the end of the surveillance period; and the remainder (24.1%) terminated active service without a documented recurrence **(Table 2)**.

Among those service members who had an initial episode of back pain during the surveillance period, overall and in every demographic/military subgroup assessed for this report, the lengths of time from the end of initial episodes until 5%, 25%, 50%, and 75% of those affected had first recurrences markedly decreased during the period. In the population overall, the lengths of time until 5% of those affected with initial episodes had first recurrences decreased from 10 days (cohort 1) to 6 days (cohort 4); and estimated times until 25, 50, and 75% of those with initial episodes had first recurrences decreased from approximately 5.8, 30.3, and 91.9 months, respectively, at the beginning of the period (cohort 1) to 3.3 months (44% decrease), 18.6 months (41% decrease), and 60.0 months (35% decrease), respectively, at the end of the period (cohort 4) **(Table 2)**.

In general, the durations of service from initial episodes until first recurrences were much shorter among females, members of the Army, and those in medical occupations than their respective counterparts. Of note, the largest relative decreases in times from initial to first recurrent episodes were among those in combat-specific occupations. In this subgroup, times until first recurrences were approximately half as long at the end (cohort 4) than the beginning (cohort 1) of the period (% decreases

TABLE 1. Number of and estimated times until initial episodes of back pain among active component members of U.S. Armed Forces, by periods of entry to active service, July 2000–June 2012

		At least one episode of back pain during service			Left active service with no episode of neck/back pain		Estimated time (in years) from entry to service until first episodes of back pain, by %s of those affected							
							5% affected		10% affected		25% affected		50% affected	
	Period of entry into service	No. of service members in cohort	No. with at least one episode of pain	% of cohort	No.	% of cohort	Time in years	Relative to earliest time period	Time in years	Relative to earliest time period	Time in years	Relative to earliest time period	Time in years	Relative to earliest time period
All accessions	1 July 2000–30 June 2003	570,446	206,210	36.2	267,908	47.0	0.35	1.00	0.94	1.00	3.40	1.00	8.90	1.00
	1 July 2003–30 June 2006	511,670	184,490	36.1	228,471	44.7	0.36	1.01	1.01	1.07	3.62	1.07	8.19	0.92
	1 July 2006–30 June 2009	526,427	187,118	35.5	223,796	42.5	0.38	1.08	0.97	1.03	3.18	0.94	7.11	0.80
	1 July 2009–30 June 2012	495,878	147,659	29.8	146,574	29.6	0.45	1.27	1.09	1.16	3.01	0.88	N/A	N/A
Gender														
Male	1 July 2000–30 June 2003	466,347	157,205	33.7	225,404	48.3	0.42	1.00	1.16	1.00	4.04	1.00	9.73	1.00
	1 July 2003–30 June 2006	426,883	144,856	33.9	194,850	45.6	0.44	1.03	1.28	1.10	4.18	1.04	8.79	0.90
	1 July 2006–30 June 2009	439,594	145,622	33.1	192,197	43.7	0.45	1.07	1.18	1.02	3.62	0.89	7.66	0.79
	1 July 2009–30 June 2012	411,287	112,659	27.4	123,096	29.9	0.54	1.26	1.30	1.12	3.36	0.83	N/A	N/A
Female	1 July 2000–30 June 2003	104,099	49,005	47.1	42,504	40.8	0.21	1.00	0.50	1.00	1.69	1.00	4.96	1.00
	1 July 2003–30 June 2006	84,787	39,634	46.8	33,621	39.7	0.18	0.87	0.48	0.97	1.71	1.01	4.99	1.01
	1 July 2006–30 June 2009	86,833	41,496	47.8	31,599	36.4	0.20	0.97	0.52	1.04	1.63	0.96	4.33	0.87
	1 July 2009–30 June 2012	84,591	35,000	41.4	23,478	27.8	0.23	1.11	0.61	1.23	1.75	1.04	4.30	0.87
Military service														
Army	1 July 2000–30 June 2003	216,114	92,091	42.6	87,047	40.3	0.18	1.00	0.45	1.00	2.08	1.00	6.69	1.00
	1 July 2003–30 June 2006	200,144	87,290	43.6	76,329	38.1	0.18	1.03	0.50	1.11	2.48	1.19	6.28	0.94
	1 July 2006–30 June 2009	201,832	90,220	44.7	73,684	36.5	0.19	1.11	0.52	1.15	2.18	1.05	5.18	0.77
	1 July 2009–30 June 2012	201,676	76,794	38.1	59,617	29.6	0.23	1.31	0.65	1.44	2.18	1.05	4.90	0.73
Navy	1 July 2000–30 June 2003	139,939	38,074	27.2	77,547	55.4	0.74	1.00	1.81	1.00	5.63	1.00	11.98	1.00
	1 July 2003–30 June 2006	119,564	31,509	26.4	61,556	51.5	0.68	0.92	1.85	1.02	5.82	1.03	11.27	0.94
	1 July 2006–30 June 2009	117,303	30,328	25.9	54,798	46.7	0.70	0.94	1.74	0.96	5.02	0.89	N/A	N/A
	1 July 2009–30 June 2012	109,628	21,923	20.0	31,793	29.0	0.79	1.06	1.75	0.97	4.78	0.85	N/A	N/A
Air Force	1 July 2000–30 June 2003	119,740	52,194	43.6	45,179	37.7	0.62	1.00	1.23	1.00	3.25	1.00	8.13	1.00
	1 July 2003–30 June 2006	96,541	40,390	41.8	33,765	35.0	0.71	1.14	1.31	1.06	3.47	1.07	7.93	0.98
	1 July 2006–30 June 2009	98,307	39,513	40.2	31,466	32.0	0.64	1.03	1.21	0.98	3.10	0.95	6.89	0.85
	1 July 2009–30 June 2012	96,007	29,640	30.9	19,522	20.3	0.79	1.26	1.34	1.08	3.06	0.94	N/A	N/A
Marine Corps	1 July 2000–30 June 2003	94,653	23,851	25.2	58,135	61.4	0.67	1.00	1.80	1.00	5.47	1.00	11.34	1.00
	1 July 2003–30 June 2006	95,421	25,301	26.5	56,821	59.6	0.72	1.07	2.02	1.12	5.23	0.96	9.79	0.86
	1 July 2006–30 June 2009	108,985	27,057	24.8	63,848	58.6	0.80	1.19	1.96	1.09	4.56	0.83	8.55	0.75
	1 July 2009–30 June 2012	88,567	19,302	21.8	35,642	40.2	0.79	1.17	1.89	1.05	4.21	0.77	N/A	N/A
Military occupation														
Combat	1 July 2000–30 June 2003	182,191	57,053	31.3	96,253	52.8	0.45	1.00	1.21	1.00	4.20	1.00	10.05	1.00
	1 July 2003–30 June 2006	56,883	21,330	37.5	22,856	40.2	0.25	0.56	0.90	0.75	3.54	0.84	7.91	0.79
	1 July 2006–30 June 2009	58,522	21,784	37.2	22,998	39.3	0.23	0.52	0.80	0.66	3.02	0.72	6.85	0.68
	1 July 2009–30 June 2012	62,707	19,050	30.4	19,365	30.9	0.28	0.63	0.98	0.81	2.89	0.69	N/A	N/A
Medical	1 July 2000–30 June 2003	17,682	8,290	46.9	6,680	37.8	0.20	1.00	0.46	1.00	1.91	1.00	6.19	1.00
	1 July 2003–30 June 2006	19,124	8,887	46.5	6,707	35.1	0.20	1.01	0.50	1.09	2.19	1.15	6.02	0.97
	1 July 2006–30 June 2009	20,811	9,744	46.8	6,479	31.1	0.23	1.16	0.54	1.17	2.00	1.04	5.20	0.84
	1 July 2009–30 June 2012	22,751	9,298	40.9	4,974	21.9	0.31	1.53	0.70	1.52	2.05	1.07	4.77	0.77
Other	1 July 2000–30 June 2003	370,573	140,867	38.0	164,975	44.5	0.33	1.00	0.88	1.00	3.16	1.00	8.53	1.00
	1 July 2003–30 June 2006	435,663	154,273	35.4	198,908	45.7	0.39	1.17	1.06	1.20	3.72	1.18	8.32	0.98
	1 July 2006–30 June 2009	447,094	155,590	34.8	194,319	43.5	0.42	1.26	1.03	1.16	3.28	1.04	7.23	0.85
	1 July 2009–30 June 2012	410,420	119,311	29.1	122,235	29.8	0.49	1.48	1.14	1.29	3.10	0.98	N/A	N/A

This table depicts, for each of the four cohorts of service members grouped by the 3-year periods of their entry into service, the numbers and proportions who received care for at least one episode of back pain, and the numbers and proportions who left active service with no episode of back pain. For those who had an episode of back pain, separate columns show, for each cohort, the time in years from accession to the first episode of back pain for 5%, 10%, 25%, and 50% of those affected. Similar data are presented, by cohort of time of entry into service, for each gender, for each military service, and for the military occupational categories of combat, medical, and other.

TABLE 2. Number of and estimated times from initial episodes to first recurrences of back pain among active component members of U.S. Armed Forces, by periods of entry to active service, July 2000–June 2012

	Period of entry into service	No. at risk of a first recurrence of back pain	At least one recurrence of back pain: No. who had a first recurrence	At least one recurrence of back pain: % of those at risk	Left active service with no recurrence of back pain: No.	Left active service with no recurrence of back pain: %	5% affected: Time in years	5% affected: Relative to earliest time period	25% affected: Time in years	25% affected: Relative to earliest time period	50% affected: Time in years	50% affected: Relative to earliest time period	75% affected: Time in years	75% affected: Relative to earliest time period
All	1 July 2000–30 June 2003	199,298	109,795	55.1	55,564	27.9	0.03	1.00	0.49	1.00	2.61	1.00	7.66	1.00
	1 July 2003–30 June 2006	177,508	98,750	55.6	46,463	26.2	0.02	0.80	0.37	0.76	2.23	0.85	6.52	0.85
	1 July 2006–30 June 2009	179,053	98,380	54.9	45,709	25.5	0.02	0.70	0.29	0.60	1.78	0.68	5.31	0.69
	1 July 2009–30 June 2012	139,674	70,573	50.5	27,009	19.3	0.02	0.60	0.27	0.56	1.55	0.59	5.00	0.65
Gender														
Male	1 July 2000–30 June 2003	152,037	81,220	53.4	43,145	28.4	0.03	1.00	0.53	1.00	2.91	1.00	8.29	1.00
	1 July 2003–30 June 2006	139,593	75,428	54.0	37,206	26.7	0.02	0.80	0.39	0.74	2.43	0.84	6.97	0.84
	1 July 2006–30 June 2009	139,324	73,945	53.1	36,728	26.4	0.02	0.70	0.31	0.58	1.94	0.67	5.71	0.69
	1 July 2009–30 June 2012	106,478	51,299	48.2	21,528	20.2	0.02	0.60	0.29	0.55	1.74	0.60	5.42	0.65
Female	1 July 2000–30 June 2003	47,261	28,575	60.5	12,419	26.3	0.02	1.00	0.40	1.00	1.90	1.00	5.80	1.00
	1 July 2003–30 June 2006	37,915	23,322	61.5	9,257	24.4	0.02	0.78	0.31	0.79	1.66	0.87	5.02	0.86
	1 July 2006–30 June 2009	39,729	24,435	61.5	8,981	22.6	0.02	0.67	0.25	0.62	1.37	0.72	4.11	0.71
	1 July 2009–30 June 2012	33,196	19,274	58.1	5,481	16.5	0.01	0.56	0.22	0.55	1.16	0.61	3.58	0.62
Military service														
Army	1 July 2000–30 June 2003	89,807	51,410	57.2	23,942	26.7	0.02	1.00	0.39	1.00	2.19	1.00	6.81	1.00
	1 July 2003–30 June 2006	84,466	49,501	58.6	21,133	25.0	0.02	0.78	0.28	0.71	1.90	0.87	5.55	0.81
	1 July 2006–30 June 2009	87,128	51,073	58.6	21,801	25.0	0.02	0.67	0.22	0.58	1.49	0.68	4.43	0.65
	1 July 2009–30 June 2012	72,933	39,729	54.5	14,659	20.1	0.01	0.56	0.21	0.54	1.29	0.59	3.98	0.58
Navy	1 July 2000–30 June 2003	36,479	17,708	48.5	11,759	32.2	0.03	1.00	0.69	1.00	3.69	1.00	10.03	1.00
	1 July 2003–30 June 2006	30,008	14,467	48.2	8,730	29.1	0.03	0.91	0.59	0.86	3.25	0.88	9.02	0.90
	1 July 2006–30 June 2009	28,640	13,560	47.4	7,680	26.8	0.02	0.73	0.48	0.69	2.68	0.73	7.30	0.73
	1 July 2009–30 June 2012	20,557	8,915	43.4	3,824	18.6	0.02	0.73	0.45	0.66	2.51	0.68	na	na
Air Force	1 July 2000–30 June 2003	50,622	30,237	59.7	11,028	21.8	0.03	1.00	0.54	1.00	2.49	1.00	7.00	1.00
	1 July 2003–30 June 2006	38,960	23,269	59.7	7,266	18.7	0.02	0.90	0.44	0.81	2.16	0.87	6.15	0.88
	1 July 2006–30 June 2009	37,848	21,819	57.7	6,666	17.6	0.02	0.80	0.36	0.68	1.81	0.73	5.21	0.74
	1 July 2009–30 June 2012	28,208	14,250	50.5	3,143	11.1	0.02	0.70	0.32	0.60	1.56	0.62	5.00	0.71
Marine Corps	1 July 2000–30 June 2003	22,390	10,440	46.6	8,835	39.5	0.03	1.00	0.58	1.00	3.64	1.00	9.81	1.00
	1 July 2003–30 June 2006	24,074	11,513	47.8	9,334	38.8	0.02	0.80	0.46	0.79	2.97	0.82	8.31	0.85
	1 July 2006–30 June 2009	25,437	11,928	46.9	9,562	37.6	0.02	0.60	0.32	0.55	2.24	0.61	6.61	0.67
	1 July 2009–30 June 2012	17,976	7,679	42.7	5,383	30.0	0.02	0.60	0.36	0.63	2.24	0.61	na	na
Military occupation														
Combat	1 July 2000–30 June 2003	38,952	19,510	50.1	12,247	31.4	0.02	1.00	0.54	1.00	3.17	1.00	8.56	1.00
	1 July 2003–30 June 2006	36,980	19,815	53.6	10,172	27.5	0.02	0.67	0.31	0.58	2.21	0.70	6.42	0.75
	1 July 2006–30 June 2009	32,612	16,878	51.8	9,367	28.7	0.02	0.67	0.24	0.45	1.87	0.59	5.53	0.65
	1 July 2009–30 June 2012	25,542	12,055	47.2	6,388	25.0	0.01	0.56	0.24	0.45	1.68	0.53	4.94	0.58
Medical	1 July 2000–30 June 2003	16,964	10,465	61.7	3,953	23.3	0.03	1.00	0.39	1.00	1.93	1.00	6.09	1.00
	1 July 2003–30 June 2006	15,355	9,473	61.7	3,197	20.8	0.02	0.70	0.30	0.77	1.68	0.87	5.31	0.87
	1 July 2006–30 June 2009	16,084	9,885	61.5	3,063	19.0	0.02	0.60	0.24	0.61	1.35	0.70	4.31	0.71
	1 July 2009–30 June 2012	14,342	8,037	56.0	1,900	13.3	0.01	0.50	0.22	0.56	1.20	0.62	3.88	0.64
Other	1 July 2000–30 June 2003	143,382	79,820	55.7	39,364	27.5	0.03	1.00	0.49	1.00	2.58	1.00	7.60	1.00
	1 July 2003–30 June 2006	125,173	69,462	55.5	33,094	26.4	0.02	0.80	0.40	0.81	2.32	0.90	6.69	0.88
	1 July 2006–30 June 2009	130,357	71,617	54.9	33,279	25.5	0.02	0.70	0.31	0.63	1.83	0.71	5.40	0.71
	1 July 2009–30 June 2012	99,790	50,481	50.6	18,721	18.8	0.02	0.60	0.29	0.58	1.59	0.61	5.13	0.67

Estimated time (in years) from initial episodes to first recurrences of back pain, by %s of those affected.

This table is similar to Table 1, but it focuses on service members who ever had a first recurrence (i.e., a second episode) of care for back pain. In this table, the time intervals captured are the time between the initial episode of back pain and the onset of the first recurrence. Time intervals are shown for 5%, 25%, 50%, and 75% of those affected.

TABLE 3. Number of and estimated times from first to second recurrences of back pain among active component members of U.S. Armed Forces, by times of entry to active service, July 2000–June 2012

			2nd recurrence of back pain while in service		Left active service prior to 2nd recurrence of back pain		Estimated time (in years) from first to second recurrences of back pain, in various %s of those with initial episodes							
							25% affected		50% affected		75% affected		90% affected	
	Period of entry into service	No. at risk of 2nd recurrence of back pain	No. who had a 2nd recurrence	% of those at risk	No.	%	Time in years	Relative to earliest time period	Time in years	Relative to earliest time period	Time in years	Relative to earliest time period	Time in years	Relative to earliest time period
All	1 July 2000–30 June 2003	106,799	70,470	66.0	20,253	19.0	0.15	1.00	1.02	1.00	4.02	1.00	8.97	1.00
	1 July 2003–30 June 2006	95,594	63,441	66.4	17,374	18.2	0.11	0.76	0.80	0.79	3.18	0.79	7.45	0.83
	1 July 2006–30 June 2009	94,466	61,548	65.2	17,569	18.6	0.09	0.61	0.61	0.60	2.54	0.63	5.95	0.66
	1 July 2009–30 June 2012	66,378	40,800	61.5	9,901	14.9	0.08	0.56	0.50	0.49	2.16	0.54	5.39	0.60
Gender														
Male	1 July 2000–30 June 2003	78,977	51,471	65.2	14,852	18.8	0.15	1.00	1.05	1.00	4.22	1.00	9.32	1.00
	1 July 2003–30 June 2006	72,956	47,781	65.5	13,316	18.3	0.11	0.75	0.80	0.77	3.29	0.78	7.73	0.83
	1 July 2006–30 June 2009	70,877	45,389	64.0	13,503	19.1	0.09	0.60	0.61	0.58	2.64	0.62	6.26	0.67
	1 July 2009–30 June 2012	48,103	28,781	59.8	7,486	15.6	0.08	0.57	0.52	0.49	2.33	0.55	N/A	N/A
Female	1 July 2000–30 June 2003	27,822	18,999	68.3	5,401	19.4	0.16	1.00	0.95	1.00	3.49	1.00	8.04	1.00
	1 July 2003–30 June 2006	22,638	15,660	69.2	4,058	17.9	0.13	0.82	0.80	0.85	2.89	0.83	6.66	0.83
	1 July 2006–30 June 2009	23,589	16,159	68.5	4,066	17.2	0.10	0.65	0.62	0.65	2.32	0.67	5.42	0.67
	1 July 2009–30 June 2012	18,275	12,019	65.8	2,415	13.2	0.08	0.51	0.45	0.48	1.88	0.54	4.60	0.57
Military service														
Army	1 July 2000–30 June 2003	50,346	33,947	67.4	9,449	18.8	0.13	1.00	0.88	1.00	3.55	1.00	8.28	1.00
	1 July 2003–30 June 2006	48,036	32,851	68.4	8,642	18.0	0.10	0.76	0.66	0.75	2.76	0.78	6.66	0.80
	1 July 2006–30 June 2009	49,301	33,389	67.7	9,168	18.6	0.08	0.63	0.49	0.56	2.17	0.61	5.16	0.62
	1 July 2009–30 June 2012	37,544	24,129	64.3	5,803	15.5	0.07	0.57	0.41	0.46	1.82	0.51	4.77	0.58
Navy	1 July 2000–30 June 2003	17,123	10,481	61.2	3,678	21.5	0.17	1.00	1.24	1.00	5.30	1.00	12.81	1.00
	1 July 2003–30 June 2006	13,971	8,551	61.2	2,757	19.7	0.14	0.81	0.98	0.79	4.13	0.78	9.91	0.77
	1 July 2006–30 June 2009	12,887	7,704	59.8	2,426	18.8	0.12	0.68	0.85	0.69	3.60	0.68	7.32	0.57
	1 July 2009–30 June 2012	8,362	4,647	55.6	1,244	14.9	0.10	0.60	0.78	0.63	3.44	0.65	N/A	N/A
Air Force	1 July 2000–30 June 2003	29,332	20,106	68.6	4,348	14.8	0.20	1.00	1.14	1.00	3.95	1.00	8.57	1.00
	1 July 2003–30 June 2006	22,522	15,316	68.0	2,933	13.0	0.16	0.83	0.98	0.86	3.35	0.85	7.38	0.86
	1 July 2006–30 June 2009	21,012	13,791	65.6	2,834	13.5	0.13	0.65	0.76	0.66	2.78	0.71	6.46	0.75
	1 July 2009–30 June 2012	13,392	8,130	60.7	1,137	8.5	0.11	0.54	0.60	0.52	2.32	0.59	N/A	N/A
Marine Corps	1 July 2000–30 June 2003	9,998	5,936	59.4	2,778	27.8	0.13	1.00	1.08	1.00	5.03	1.00	10.95	1.00
	1 July 2003–30 June 2006	11,065	6,723	60.8	3,042	27.5	0.10	0.79	0.80	0.73	3.78	0.75	8.98	0.82
	1 July 2006–30 June 2009	11,266	6,664	59.2	3,141	27.9	0.08	0.60	0.60	0.56	3.08	0.61	6.80	0.62
	1 July 2009–30 June 2012	7,080	3,894	55.0	1,717	24.3	0.07	0.57	0.61	0.56	3.00	0.60	N/A	N/A
Military occupation														
Combat	1 July 2000–30 June 2003	17,755	11,228	63.2	3,577	20.2	0.13	1.00	0.95	1.00	4.14	1.00	9.26	1.00
	1 July 2003–30 June 2006	19,105	12,463	65.2	3,706	19.4	0.09	0.68	0.67	0.71	3.03	0.73	7.44	0.80
	1 July 2006–30 June 2009	16,132	10,179	63.1	3,389	21.0	0.07	0.57	0.53	0.56	2.50	0.60	6.01	0.65
	1 July 2009–30 June 2012	11,501	6,734	58.6	2,321	20.2	0.07	0.53	0.45	0.47	2.34	0.57	N/A	N/A
Medical	1 July 2000–30 June 2003	10,815	7,518	69.5	1,923	17.8	0.16	1.00	0.94	1.00	3.55	1.00	7.83	1.00
	1 July 2003–30 June 2006	9,604	6,795	70.8	1,436	15.0	0.13	0.78	0.76	0.80	2.81	0.79	6.82	0.87
	1 July 2006–30 June 2009	9,995	6,917	69.2	1,460	14.6	0.11	0.68	0.65	0.69	2.32	0.65	5.28	0.67
	1 July 2009–30 June 2012	7,892	5,096	64.6	873	11.1	0.08	0.53	0.45	0.48	2.00	0.56	4.49	0.57
Other	1 July 2000–30 June 2003	78,229	51,724	66.1	14,753	18.9	0.15	1.00	1.05	1.00	4.08	1.00	9.17	1.00
	1 July 2003–30 June 2006	66,885	44,183	66.1	12,232	18.3	0.12	0.80	0.85	0.81	3.28	0.80	7.53	0.82
	1 July 2006–30 June 2009	68,339	44,452	65.1	12,720	18.6	0.09	0.62	0.62	0.59	2.59	0.64	6.15	0.67
	1 July 2009–30 June 2012	46,985	28,970	61.7	6,707	14.3	0.08	0.56	0.52	0.49	2.17	0.53	5.39	0.59

This table is similar to Tables 1 and 2, but it focuses on service members who ever had a second recurrence (i.e., a third episode) of care for back pain. In this table, the time intervals captured are the time between the first recurrence of back pain and the onset of the second recurrence. Time intervals are shown for 25%, 50%, 75%, and 90% of those affected.

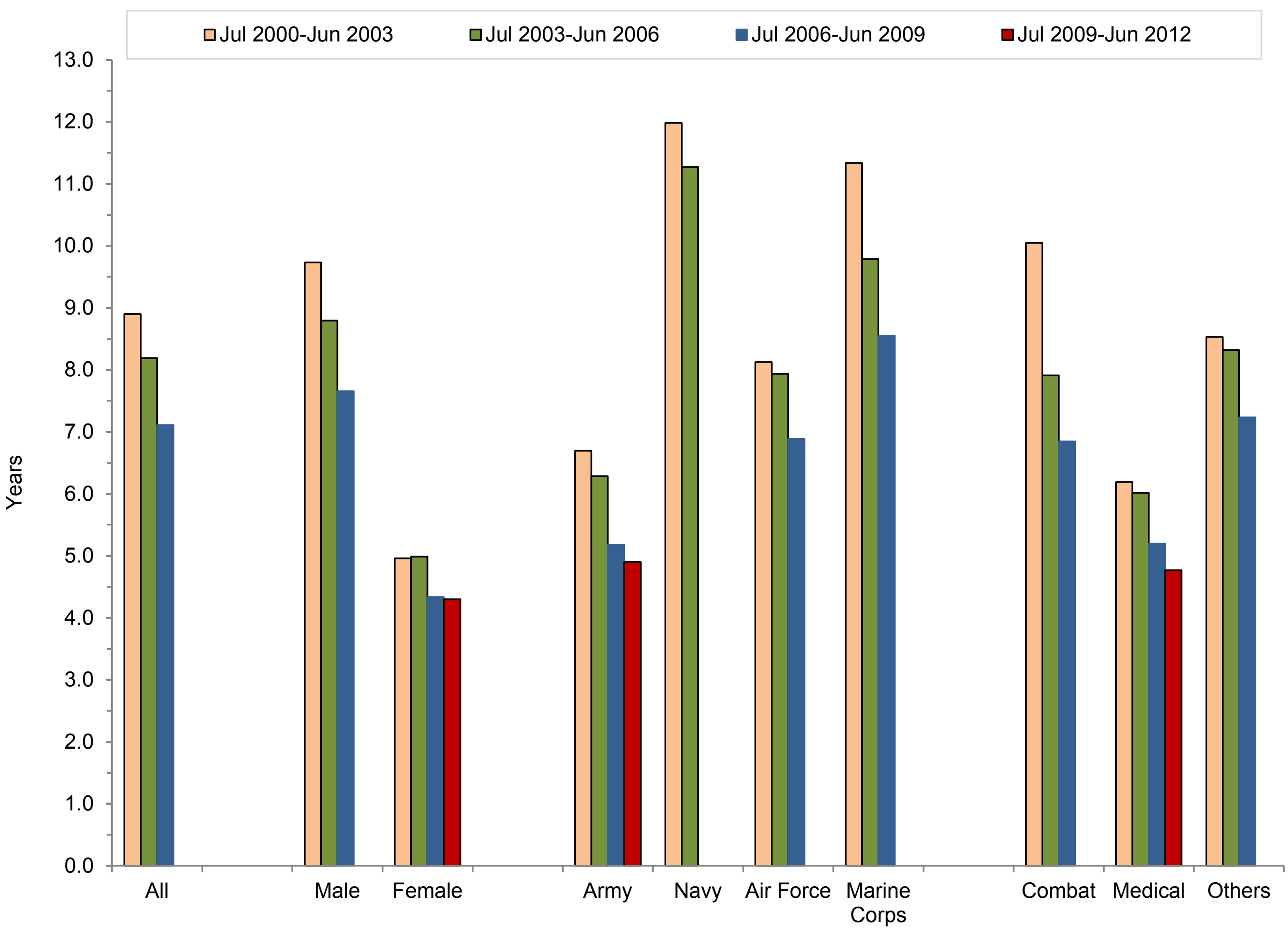
in times from initial to first recurrent episodes, cohort 4 versus cohort 1, range: -55% [time until 25% affected];-42% [time until 75% affected]) **(Table 2, Figure 2)**.

Second recurrent episodes: Of all surveillance population members who had first recurrences of clinically significant back pain during the surveillance period, approximately two-thirds (65.0%) had second recurrent episodes during the surveillance period, approximately one-sixth (17.0%) had no additional recurrences and were still in active service at the end of the surveillance period, and the remainder (17.9%) terminated active service without a documented second recurrence **(Table 3)**.

Among those service members who had a first recurrent episode during the surveillance period, overall and in every subgroup, estimated times from the end of first recurrences until 25%, 50%, 75%, and 90% of those affected had second recurrences markedly decreased over the period. In the population overall, estimated times from the end of first recurrences until 25% had second recurrences decreased by 44% during the period (from 1.8 months in cohort 1 to 1.0 month in cohort 4); and estimated times until 50%, 75%, and 90% of those with first recurrences had second recurrences decreased from approximately 12.3, 48.3, and 107.7 months, respectively, at the beginning of the period (cohort 1) to 5.9 months (51% decrease), 26.0 months (46% decrease), and 64.7 months (40% decrease), respectively, at the end of the period (cohort 4) **(Table 2)**.

Estimated times between first and second recurrences were generally shorter among members of the Army and those in combat-specific occupations than their respective counterparts. The largest relative decreases in times from first to second recurrent episodes were among Army members. In this subgroup, times from first to second recurrences were approximately half as long at the end than the beginning of the period (% decreases in times from first to second recurrences, cohort 4 versus cohort 1, range: -54% [time until 50% affected];-42% [time until 90% affected]) **(Table 3, Figure 3)**.

FIGURE 1. Estimated durations of service until 50% of new accessions had first episodes of medically treated back pain, in accession cohorts from 2000−2012, overall and in military/demographic subgroups, active component, U.S. Armed Forces



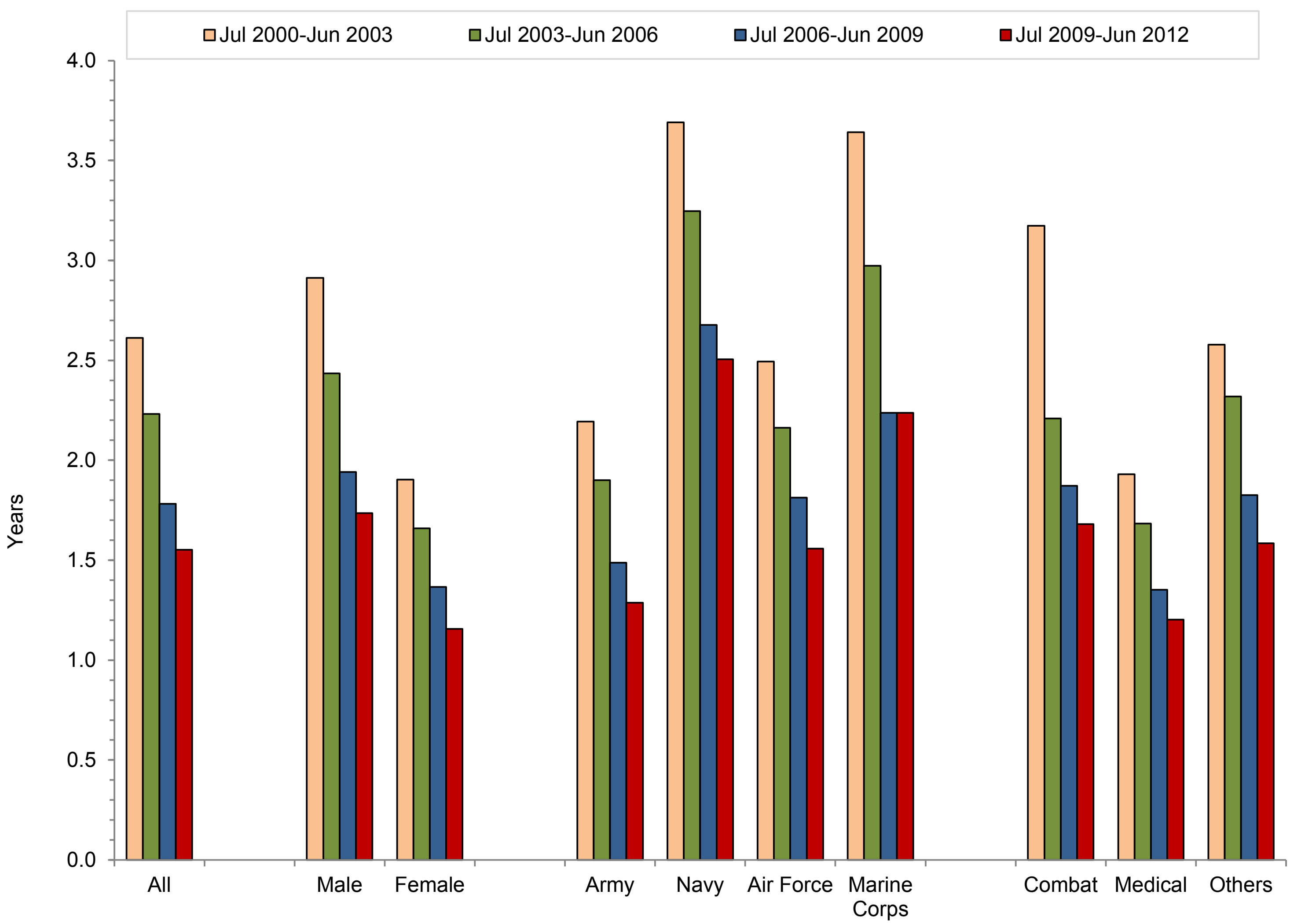
EDITORIAL COMMENT

The main finding of this report is that, in general, times from beginning military service until first episodes of clinically significant back pain and "back pain episode–free" times preceding first and second recurrent episodes have markedly decreased since calendar year 2000. The report also documents that, regardless of when individuals were inducted into military service since calendar year 2000, at least 5% were affected by clinically significant back pain within 6 months and 10% within approximately 13 months of beginning active service.

Of interest, among new accessions to service other than those in combat-specific occupations, lengths of time until 5% and 10% were affected by back pain generally increased during the surveillance period. The finding suggests that changes in physical fitness regimens, military training programs, and/or psychosocial supports that are provided during the first year of service may have reduced risk of acute back pain in trainees during their first year of service, excepting those training for combat-specific occupations. Among trainees for combat-specific occupations, estimated times until 5%, 10%, 25%, and 50% had first episodes of clinically significant back pain markedly decreased—by approximately 20%–40%—during the surveillance period. Changes in the natures, rigor, and/or intensity of training in combat-specific occupations, possibly related to the near certainty of future assignments in active war zones, may have increased the risk of back pain in this group. If risky activities unique to combat-specific training can be identified, training regimens may be modifiable to reduce injury risk while maintaining or enhancing the benefits of training in regard to military readiness and operational proficiency.

This report also documents that, in general, females, service members in medical occupations, and Army soldiers developed initial and recurrent episodes of

FIGURE 2. Estimated times until 50% of those with initial episodes of medically treated back pain had first recurrences, in accession cohorts from 2000−2012, overall and in military/demographic subgroups, active component, U.S. Armed Forces

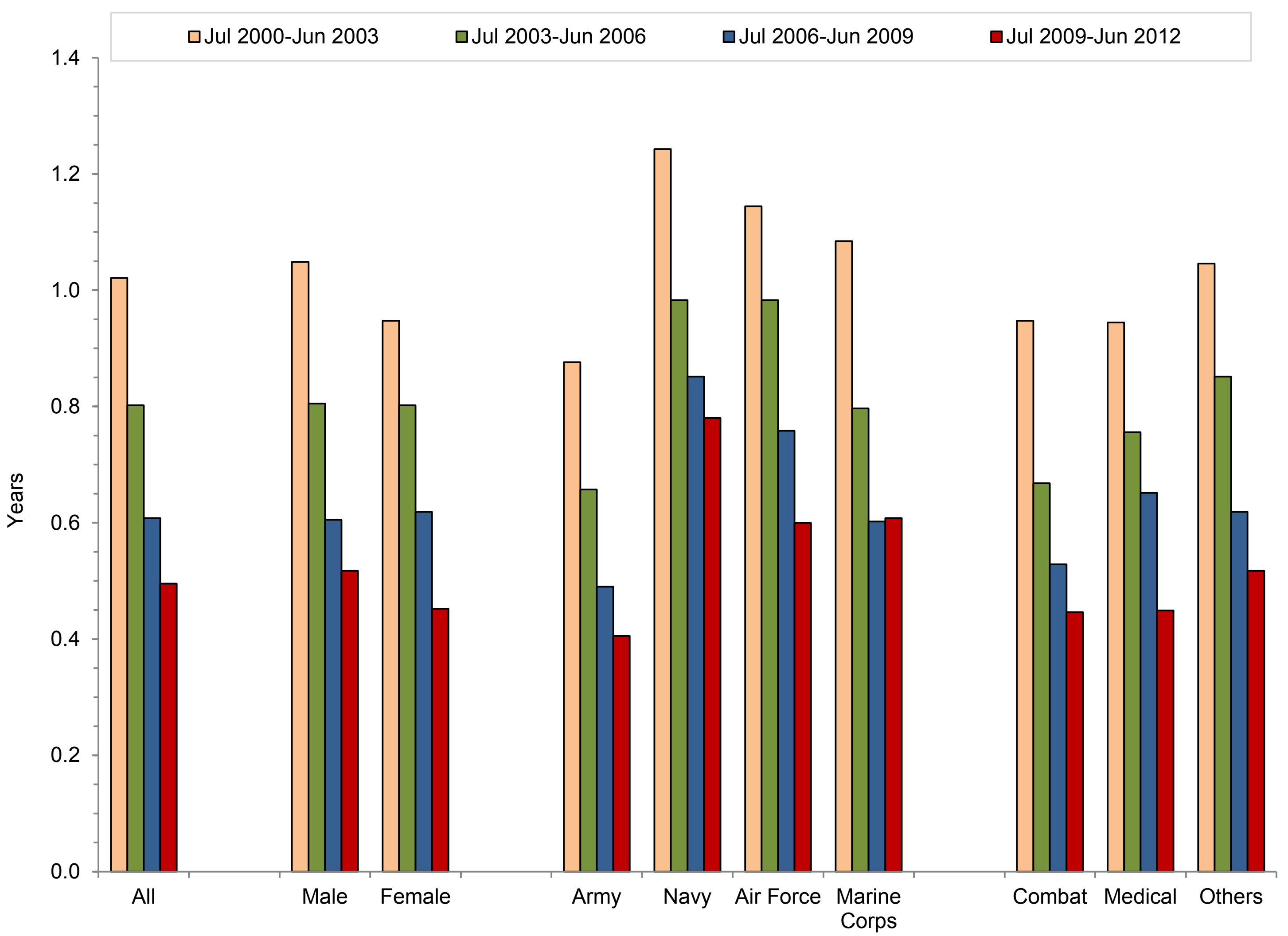


clinically significant back pain much more rapidly than their respective counterparts. The finding is consistent with numerous reports that have documented high risks of back pain among females and nursing personnel.[14–17] Also, back pain risk has been associated with long periods of walking while wearing body armor and bearing heavy loads.[10–12] To some extent, such activities are conducted by members of all the Services; however, these activities are integral to core activities of the Army (e.g., dismounted road marching, cross-country land navigation, combat patrolling), especially in combat theaters, such as Afghanistan and Iraq, during wartime.[10–12]

This report also documents that pain-free times preceding episodes of back pain decrease as the number of prior episodes of back pain increase. Thus, for example, in the population overall and in each subgroup of interest, times from entry to service until first episodes of back pain were much longer than times from first to second episodes; and times from first to second episodes were much longer than times from second to third episodes. The findings are consistent with those of many reports that document that history of back pain is a strong risk factor for future episodes of back pain.[10,11,18,19]

The findings of this report should be interpreted with consideration of its limitations. For example, the endpoints of survival analyses were clinical encounters (i.e., hospitalizations or ambulatory visits) that were documented in administrative records with diagnostic codes indicative of back pain. However, for this analysis, case-defining diagnoses were not characterized in relation to the natures or severity of the associated pain or disabilities; precipitating activities; affected anatomic sites (e.g., muscle, ligament, tendon, nerve, disc, spine); military operational impacts; or pathophysiologic bases (e.g., sprain, strain, fracture, disc herniation, degenerative joint, nerve irritation/compression). Thus, the "clinical endpoint" of the analysis is not a single clinical entity. Rather, the endpoint encompasses a diverse group of injuries, all clinically expressed as "back pain," that have varying causes, clinical severities, and military operational impacts.

FIGURE 3. Estimated times until 50% of those with first recurrences had second recurrences of medically treated back pain, accession cohorts from 2000−2012, overall and in military/demographic subgroups, active component, U.S. Armed Forces



Also, this report documented the experiences of individuals who began their military service since calendar year 2000. As such, the rates and trends of back pain documented here are focused on the experiences of relatively young service members during their first years of military service. As such, the findings of this report should not be generalized to the experiences of U.S. military members of all ages and lengths of service.

It also should be noted that the period of interest of this report spanned the period of direct combat operations in Afghanistan and Iraq. It is possible that the trends of generally decreasing times until initial episodes and between recurrent episodes of back pain were related to training and/or military operational exigencies associated with preparing for and participating in combat operations. If so, the trends documented here may reverse with the termination of continuous and widespread combat operations in Afghanistan and Iraq.

In conclusion, acute back pain episodes are common, recurring, unpredictable in their onsets, and often severely disabling. Thus, even though most episodes of back pain are short lived and self-limited, acute back pain is a category of medical conditions that should be considered of high military operational importance. The prevention of sudden attacks of disabling back pain among military members, especially during operations overseas, should be a military medical research objective of high priority.

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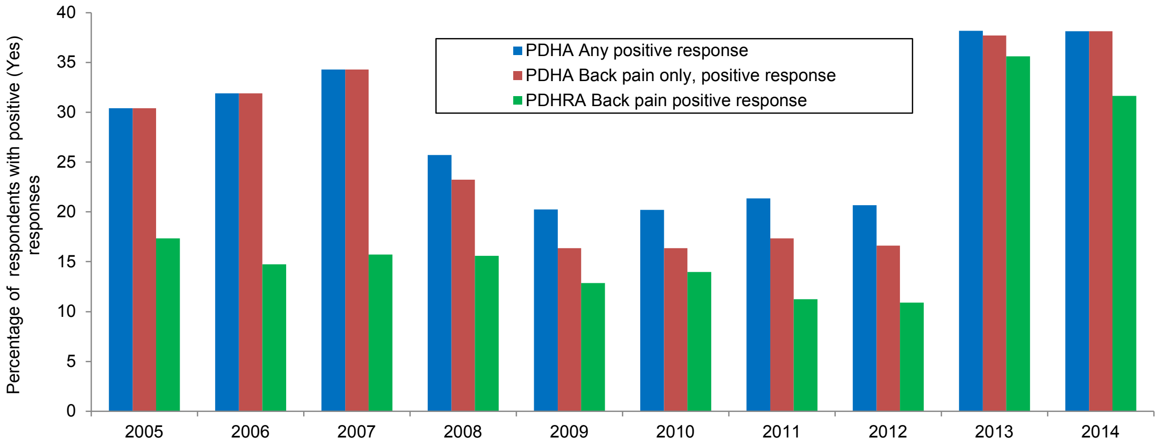
Surveillance Snapshot: Responses to Questions About Back Pain in Post-deployment Health Assessment Questionnaires, U.S. Armed Forces, 2005–2014

FIGURE. Annual proportions of respondents to Post-deployment Health Assessment (PDHA) and Reassessment (PDHRA) forms who endorsed previous health care for back pain or past or current symptoms of back pain, active component service members, U.S. Armed Forces, 2005–2014



2005–2007

PDHA: Do you have back pain now or did you develop back pain anytime during this deployment?

NO
YES DURING
YES NOW

PDHRA: Do you currently have a health concern or condition [back pain] that you feel is related to your deployment?

YES
NO
UNSURE

2008–2012

PDHA: For back pain, indicate whether you saw a healthcare provider, were placed on quarters or given light/limited duty, and whether you are still bothered by back pain now.

SICK CALL YES / NO
QTRS/PROFILE YES / NO
STILL BOTHERED YES / NO

PDHRA: Do you currently have a health concern or condition [back pain] that you feel is related to your deployment?

YES
NO
UNSURE

2013–2014

PDHA: During the PAST MONTH, how much have you been bothered by back pain?

NOT BOTHERED AT ALL
BOTHERED A LITTLE
BOTHERED A LOT

PDHRA: During the PAST MONTH, how much have you been bothered by back pain?

NOT BOTHERED AT ALL
BOTHERED A LITTLE
BOTHERED A LOT

Since 2005, service members who returned from operational deployments of longer than 30 days duration have been required to complete two different standardized questionnaires designed to assess their state of health and to identify concerns they may have about the impact of the deployment experience on their health. The Post-deployment Health Assessment (PDHA) questionnaire should be completed within 30 days of the service member's return from deployment. The Post-deployment Health Reassessment (PDHRA) questionnaire should be completed 90–180 days after return from deployment. Both questionnaires ask about a wide range of symptoms or health concerns. Each form contains just one question about the symptom of back pain.

The Figure depicts, by year of questionnaire completion, the percentage of respondents who responded affirmatively to the questions about back pain. Below the bar graph are text boxes that paraphrase the questions to which service members were responding during the three different periods shown (2005–2007, 2008–2012, and 2013–2014). For each question, any response that contained the word "Yes" or affirmed being "Bothered" was counted as a positive screen for back pain. The bar graph reflects the proportions (percentages) of such positive screens among all respondents. Because of the variability, and in some cases, the complex nature of the questions, the possible epidemiologic interpretation of these data is limited. It is reasonable to conclude that back pain is a common affliction among service members during and after deployments, but these data cannot clarify any possible etiologic association between deployments and the causes of back pain. This limitation was recognized at the time the PDHA was first developed. The purpose of the screening process was and is to use a highly sensitive tool to identify and refer individual service members who could benefit from subsequent clinical evaluations of their symptoms and health concerns. The data shown here are consistent with the goal of having screening questionnaires that are sensitive enough to identify what other studies have shown to be a common symptom among service members.[1–3]

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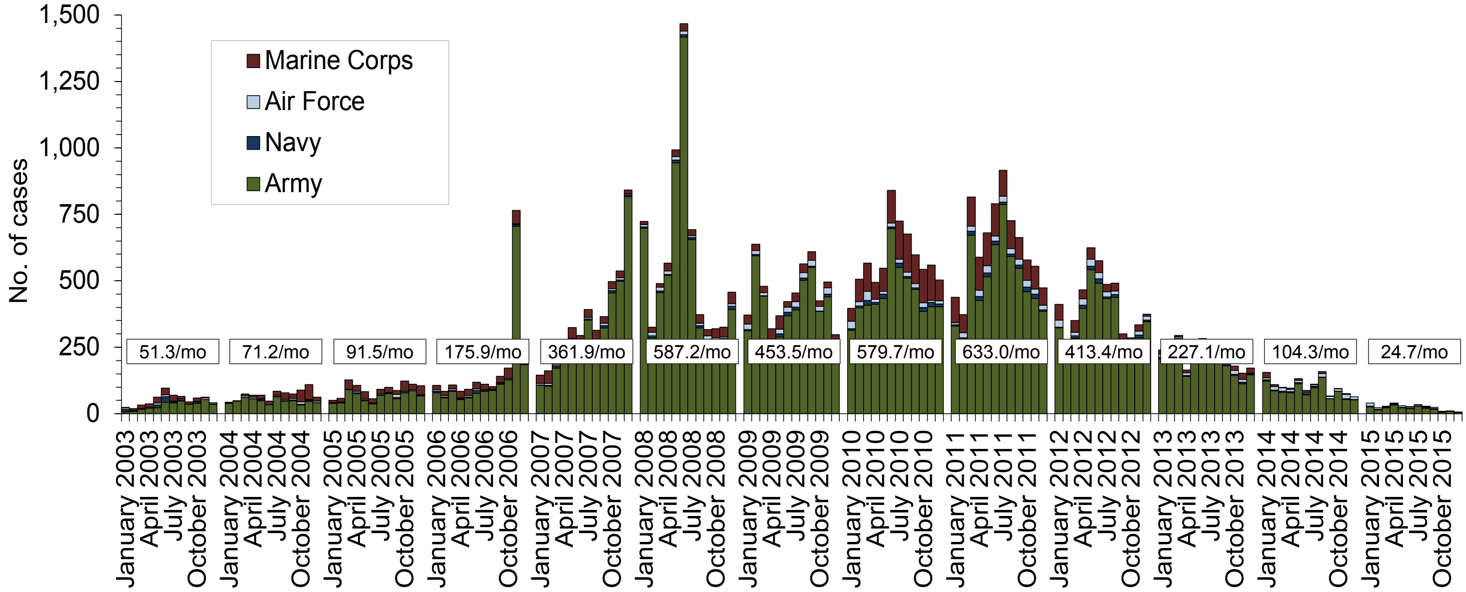
Deployment-related Conditions of Special Surveillance Interest, U.S. Armed Forces, by Month and Service, January 2003–December 2015 (data as of 20 January 2016)

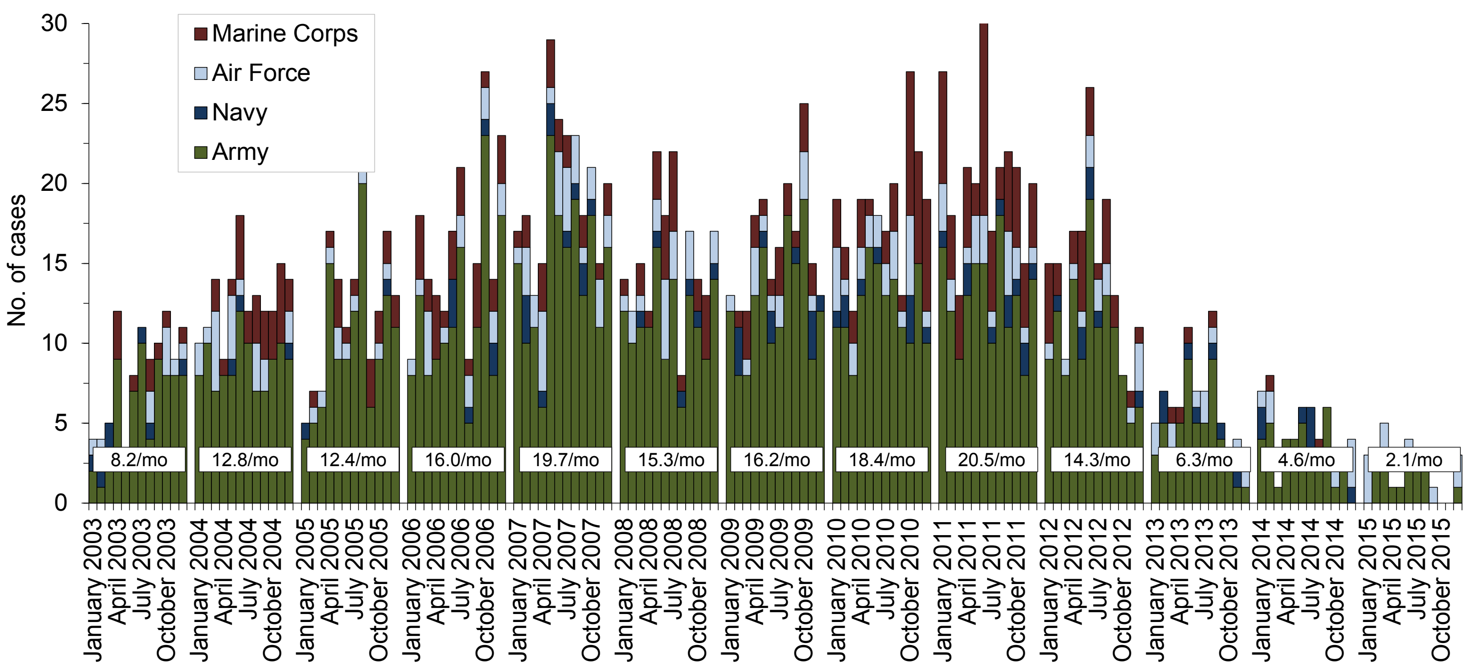
Traumatic brain injury (TBI) (ICD-9: 310.2, 800–801, 803–804, 850–854, 907.0, 950.1–950.3, 959.01, V15.5_1–9, V15.5_A–F, V15.52_0–9, V15.52_A–F, V15.59_1–9, V15.59_A–F)[a]



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 4,645 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]



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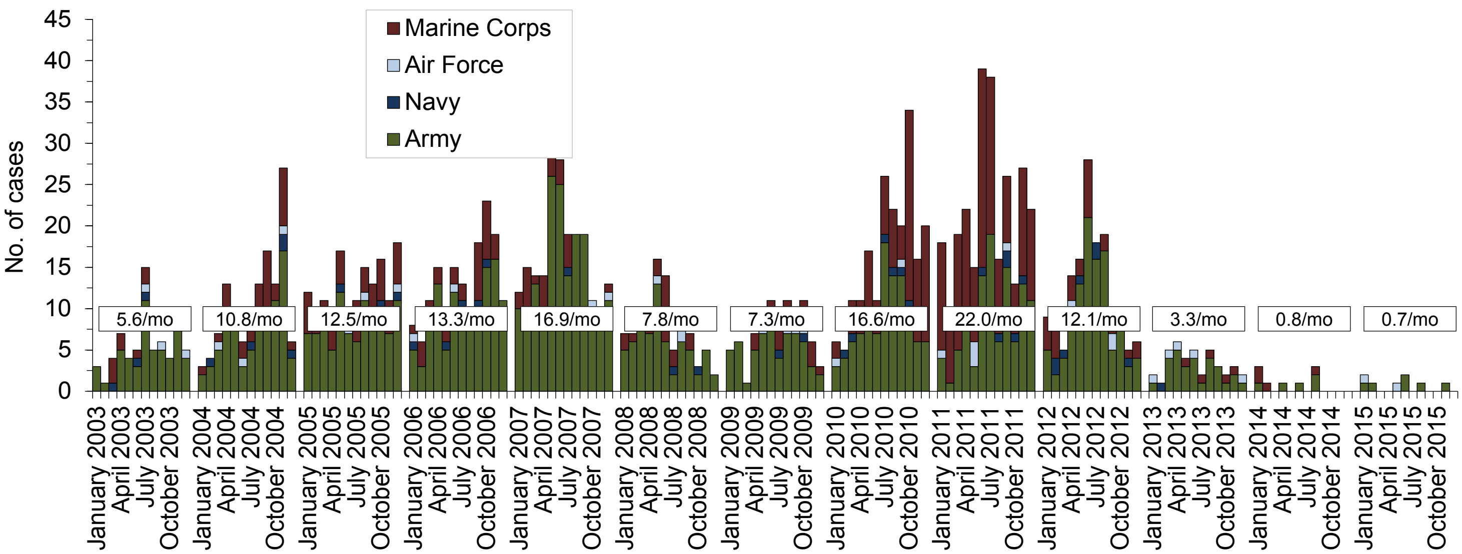
[b]One diagnosis during a hospitalization or two or more ambulatory visits at least 7 days apart (one case per individual) while deployed to/within 90 days of returning from deployment.

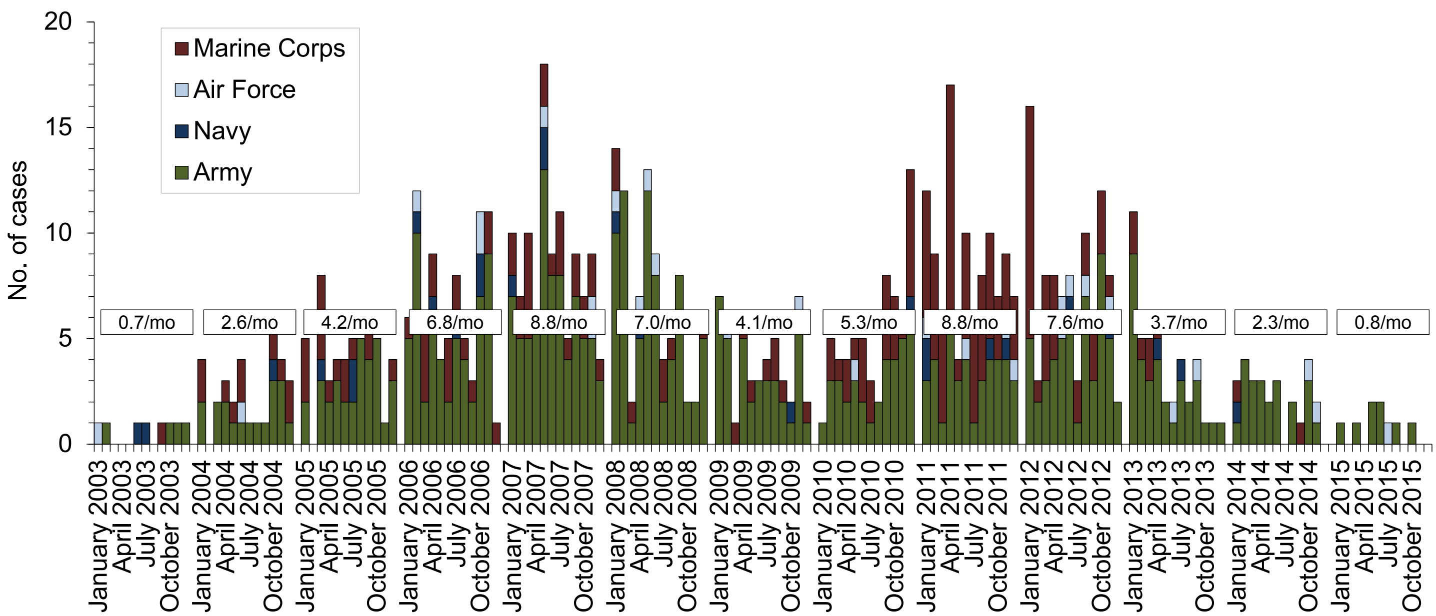
Deployment-related Conditions of Special Surveillance Interest, U.S. Armed Forces, by Month and Service, January 2003–December 2015 (data as of 20 January 2016)

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

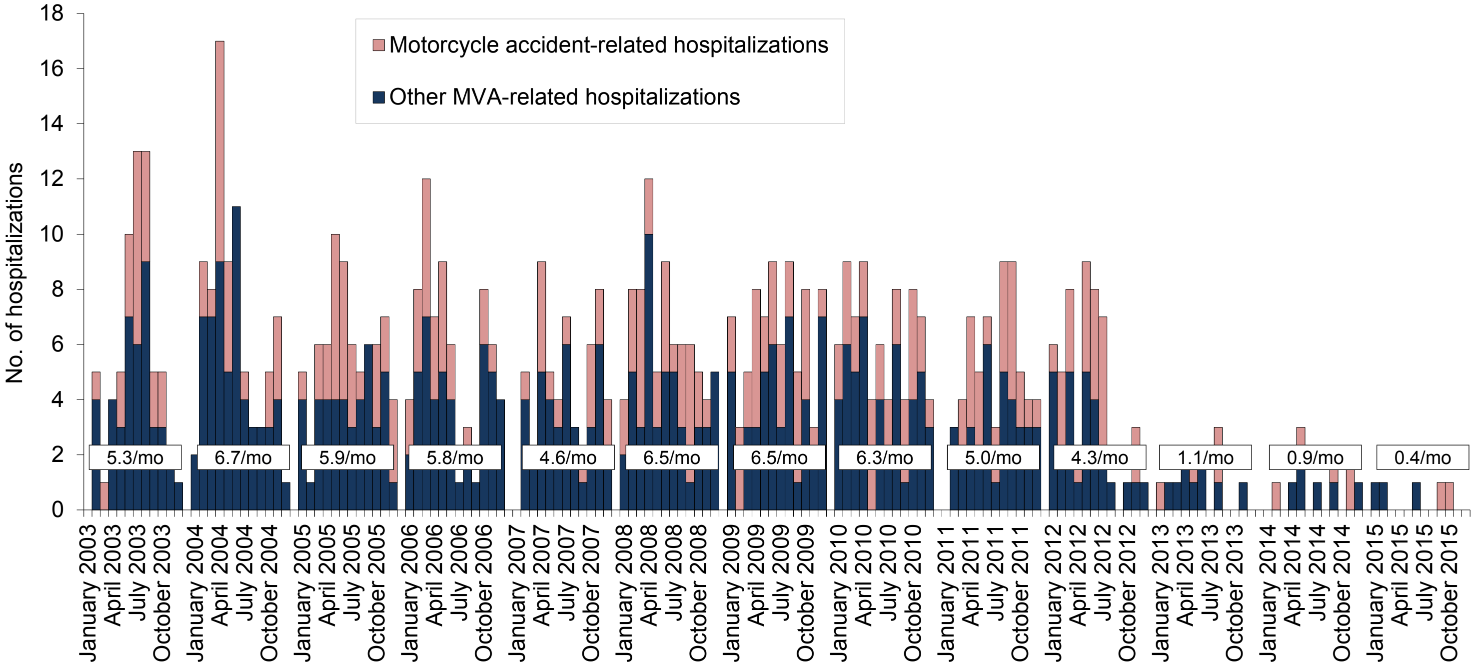
Heterotopic ossification (ICD-9: 728.12, 728.13, 728.19)[b]



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

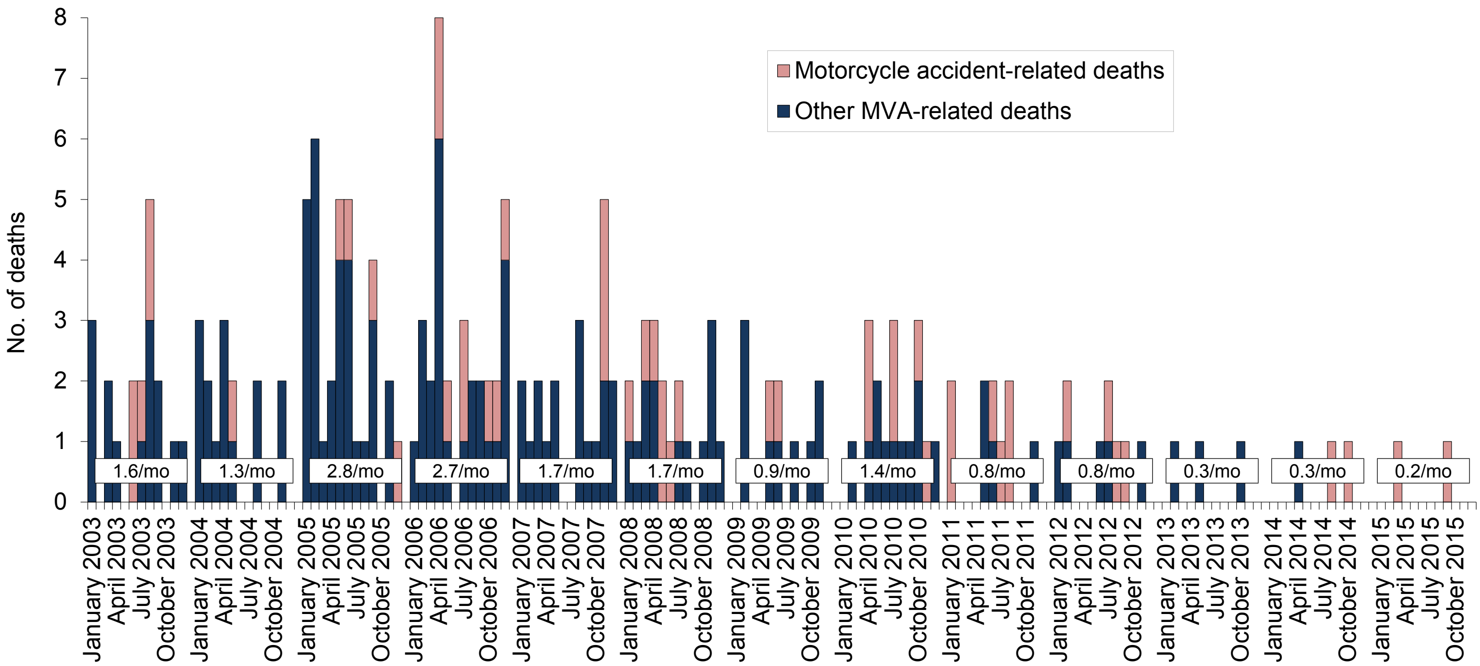
Deployment-related Conditions of Special Surveillance Interest, U.S. Armed Forces, by Month and Service, January 2003–December 2015 (data as of 19 January 2016)

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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