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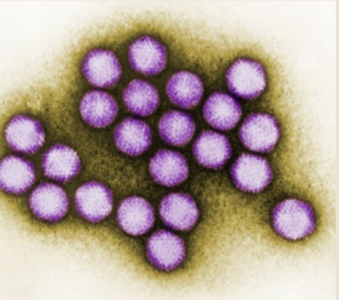

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Follow-up Analysis of the Incidence of Acute Respiratory Infections Among Enlisted Service Members During Their First Year of Military Service Before and After the 2011 Resumption of Adenovirus Vaccination of Basic Trainees

Francis L. O'Donnell, MD, MPH; Stephen B. Taubman, PhD

This analysis estimated the incidence rates of acute respiratory infections (ARIs) during the first year of military service for service members in 16 cohorts (designated 1999 through 2014) based on the years in which they began their service. That first year of service was divided into two separate follow-up periods: the first 3 months of service (corresponding to the period of initial entry training) and the next 9 months of service (months 4–12). The surveillance period covered service members whose first years of service were before and after the 2011 resumption of the administration of adenovirus vaccines, types 4 and 7, to enlisted trainees at the beginning of their initial training periods. In general, the findings were that incidence rates of ARIs were relatively high for the cohorts who did not receive the vaccines and that the rates were dramatically lower in the cohorts (2012–2014) who did receive the vaccines. These observations pertained to both the first 3 months of service and the next 9 months of service. Possible interpretations of these findings and the limitations of the study methods are discussed.

In the 1950s, adenoviruses were first identified as important causes of common acute respiratory infections (ARIs) among U.S. military recruit trainees during initial training. The introduction in 1971 of live, oral adenovirus vaccine for use in trainee populations was followed by a dramatic decline in the incidence of both adenoviral disease and febrile respiratory illnesses in general among trainees.[1,2] As has been described elsewhere, the use of the vaccines against adenovirus types 4 and 7 ended in 1999, after which there was a well-documented resurgence of associated illness at training centers that lasted until the vaccine use at training centers was restored in late 2011.[3] Thereafter, as demonstrated by the ongoing surveillance program of the Naval Health Research Center (NHRC), there was an almost immediate, dramatic reduction in adenovirus-associated respiratory illness among recruit trainees that has persisted to the present day.[3–5]

A *MSMR* study in 2013 examined the incidence of ARIs among enlisted service members who entered the Services both before and after resumption of the adenovirus vaccine program.[6] The estimates of incidence were based on clinical diagnoses recorded in the electronic health records of enlisted service members during their first year of service. This report describes a similar analysis based on 2 more years of additional surveillance of the population of interest.

METHODS

The surveillance period was 1 January 1999 through 30 September 2015. The methodology was the same as that of the 2013 study with the following modifications.[6] The study population consisted of enlisted members of all five Services who entered military service for the first time during the years 1999 through 2014 except that Coast Guard members who entered before 2003 were again excluded due to incomplete records. Other criteria for inclusion or exclusion were as previously used. The population was distributed over 16 cohorts (designated 1999 through 2014) based on the years in which the service members began their military service. Outcomes of interest were inpatient and outpatient encounters for ARIs during the service members' first 12 months of service. The follow-up period was divided into two separate intervals (i.e., the first 3 months of service [corresponding to the period of initial entry training] and the next 9 months of service [months 4–12]). For those who entered service in 2014, the follow-up period extended into 2015 but only through September 2015. For complete descriptions of the methods used in ascertainment of time in service, derivation of person-time for rate calculations, incidence rules, and prioritization of diagnoses and hospitalizations, please refer to the Methods section of the earlier analysis.[6] ARIs were divided into three categories based on the ICD-9 codes shown in **Table 1**. The categories were acute upper respiratory infection (URI), acute bronchitis and bronchiolitis (AB), and pneumonia (PN). In addition to calculating the incidence of ARIs, the total healthcare burden of ARI was estimated by counting all outpatient visits and hospitalizations, subject to a limitation of one such encounter per day. Incidence rates of ARI cases and rates of all healthcare encounters for ARI were analyzed separately for the first 3 months of service and for the remaining 9 months of the first year.

RESULTS

During the 1999–2014 portion of the surveillance period, 2,633,299 individuals began recruit training. Of these, 2,460,551

TABLE 1. ICD-9 codes and specific diagnoses for each of the three categories of acute respiratory infection (ARI)

Acute upper respiratory infections	ICD-9 code
Acute nasopharyngitis (common cold)	460
Acute pharyngitis	462
Acute tonsillitis	463
Acute laryngitis and tracheitis	464
Acute laryngitis	464.0x
Acute tracheitis	464.1x
Acute laryngotracheitis	464.2x
Acute epiglottitis	464.3x
Croup	464.4
Supraglottitis, unspecified	464.5x
Acute upper respiratory infections of multiple or unspecified sites	465
Acute laryngopharyngitis	465.0
Other multiple sites	465.8
Unspecified site	465.9
Acute bronchitis and bronchiolitis	
Acute bronchitis and bronchiolitis	466
Acute bronchitis	466.0
Acute bronchiolitis	466.1
Acute bronchiolitis due to other infectious organisms	466.19
Pneumonia	
Pneumonia due to adenovirus	480.0
Viral pneumonia, unspecified	480.9
Bronchopneumonia, organism unspecified	485
Pneumonia, organism unspecified	486

This table lists the ICD9 codes and corresponding descriptions for the diagnoses that were grouped into the three categories of "acute upper respiratory infections," "acute bronchitis and bronchiolitis," and "pneumonia" that together constituted the acute respiratory infections enumerated in this analysis.

(93.4%) completed at least 3 months of service (and thus were included in the analysis) and contributed 2,382,275 person-years (p-yrs) of follow-up. Because those who entered service after October 2014 did not complete 12 months of service before the end of the study period (September 2015), the 2014 cohort accounted for only about 81.2% of the average follow-up time of the preceding year-of-entry cohorts **(data not shown)**.

For all year-of-entry cohorts during the surveillance period, the incidence rates of each type of ARI were much higher during the first 3 months than the next 9 months of the first year of service **(Table 2)**. The incidence rate ratios (IRRs) comparing outpatient rates during the enlistees' first 3 months to rates in the next 9 months were 4.8 for URI, 3.4 for AB, and 5.9 for PN. For hospitalizations, the same pattern held, especially for the IRRs for PN (5.1) and AB (3.5) **(Table 2)**.

TABLE 2. Total incidence rates (per 1,000 person-years) of cases of respiratory infections among recruit cohorts during their first year of service, by time period, 1999–2015

	Months 1–3, first year	Months 4–12, first year	IRR
Outpatient care			
Upper respiratory infection	1,418.2	294.3	4.8
Bronchitis/bronchiolitis	99.4	29.6	3.4
Pneumonia	108.9	18.4	5.9
Hospitalizations			
Upper respiratory infection	1.3	0.8	1.6
Bronchitis/bronchiolitis	0.2	0.1	3.5
Pneumonia	7.1	1.4	5.1

IRR=incidence rate ratio

This table compares the incidence rates of diagnoses of each of the three types of acute respiratory infections between the two time periods of interest, namely the first 3 months of service and months 4–12 of the first year of service. Diagnoses made during outpatient healthcare encounters are examined separately from diagnoses during hospitalizations. The ratios of the rates in the first 3 months to the rates in months 4–12 are shown and demonstrate that the incidence rates of all three types of acute respiratory infections were much higher in the first 3 months of service.

Burden

In addition to enumerating incident cases of ARIs among new enlisted service members, the analysis also captured total numbers of medical encounters for ARIs. During the surveillance period among all 16 cohorts, enlisted service members in their first year of service accounted for 2,177,525 outpatient encounters and 9,508 hospitalizations for ARIs. Of all ARI-related outpatient encounters and hospitalizations during the first year of service, 67% and 57%, respectively, were associated with care for service members in their first 3 months of service **(Table 3)**. Not surprisingly, there were more outpatient encounters per incident case of PN (2.53) than per case of AB (1.66) or URI (1.34) during the first 3 months of care **(data not shown)**. Of all hospitalization *encounters* that occurred during the first years of service, the proportions that occurred in the first 3 months of service were virtually identical to the proportions of hospitalization *incident cases* that occurred in the first 3 months. On the other hand, of all outpatient encounters, the proportions that occurred in the first 3 months of service were consistently higher than the proportions of *incident cases* that occurred in the first 3 months of service **(Table 3)**.

Upper respiratory infections

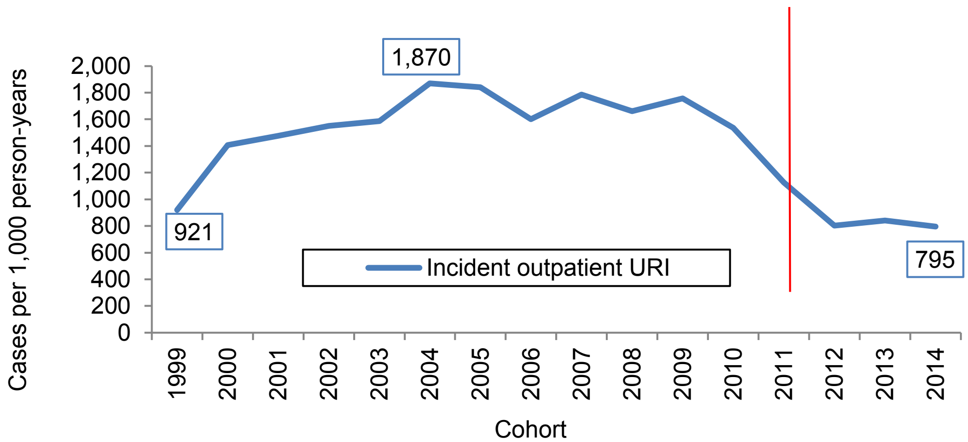
The incidence rate of outpatient diagnoses of acute URIs during the first 3 months of service for the 1999 cohort was 921 cases per 1,000 p-yrs. Thereafter, incidence rates were higher than 1,400 cases per 1,000 p-yrs for all of the cohort years 2000 through 2010. The rate for the 2011 cohort was 1,127 per 1,000 p-yrs and the rates for the 2012–2014 cohorts ranged from 795 to 841 cases per 1,000 p-yrs **(Figure 1)**.

TABLE 3. Outpatient encounters and hospitalizations and incident cases of acute respiratory infections in the first years of military service and the proportions of those cases that occurred in the first 3 months of those first years, active component, U.S. Armed Forces, 1999–2015

	Healthcare encounters		Incident cases	
	12 mos. total of encounters	Proportion (%) of encounters in months 1–3	12 mos. total of incident cases	Proportion (%) of incident cases in months 1–3
Outpatient care	2,177,525	66.8	1,612,479	62.6
Upper respiratory infection	1,782,744	66.3	1,398,672	62.9
Bronchitis/bronchiolitis	164,552	62.2	113,831	54.2
Pneumonia	230,229	74.2	99,976	67.6
Hospitalizations	9,508	57.3	9,344	57.3
Upper respiratory infection	2,282	36.1	2,258	36.1
Bronchitis/bronchiolitis	215	54.9	213	55.4
Pneumonia	7,011	64.3	6,873	64.3

This table shows the total numbers of healthcare encounters and the total numbers of incident cases of acute respiratory infections during the first 12 months of military service for each of the three types of illness. Diagnoses during outpatient care are examined separately from diagnoses during hospitalizations. For each 12-month count of diagnoses, the proportion of diagnoses made during the first 3 months is shown. The proportions collectively show that the majority of encounters and incident cases occurred during the first 3 months of service.

FIGURE 1. Incidence rates of outpatient diagnoses of acute upper respiratory infection (URI), first 3 months of enlisted service, by cohort year

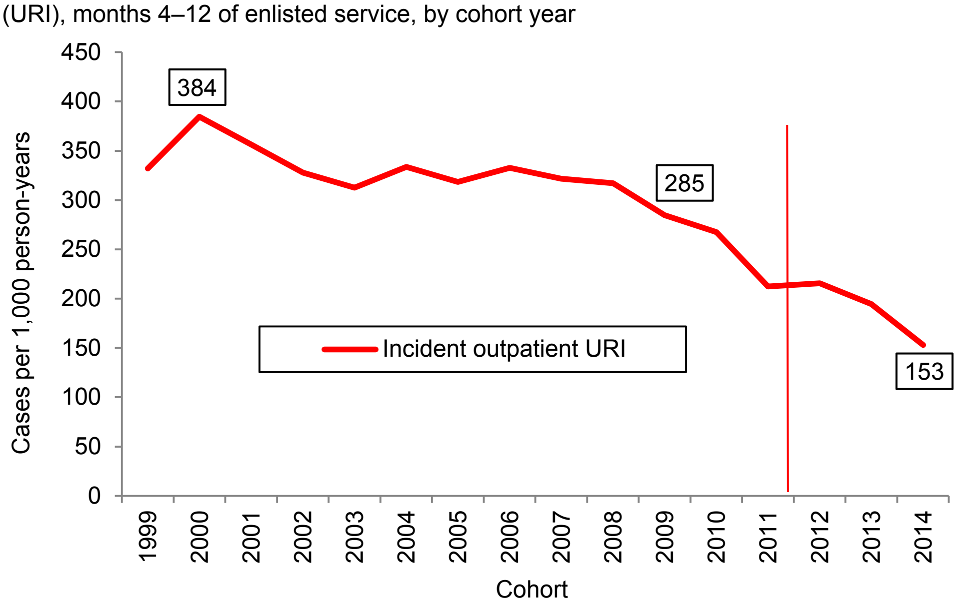


Note: The vertical red line indicates the time of resumption of adenovirus vaccination of basic enlisted trainees (November 2011).

For months 4–12 of the first years of service, incidence rates of outpatient diagnoses of acute URIs peaked at 384 cases per 1,000 p-yrs in cohort 2000, but were otherwise fairly stable in the range of 317 to 356 cases per 1,000 p-yrs among the other cohorts who began service from 1999 through 2008. Thereafter, incidence rates began a steady decline in the successive cohorts from 2009 through 2014 (range of rates: 285 cases per 1,000 p-yrs in 2009 to 153 cases per 1,000 p-yrs in 2014) **(Figure 2)**.

With one exception (first 3 months of service for the 2000 cohort), all cohorts' rates of hospitalization for URIs were less than 2 per 1,000 p-yrs for both the first 3 months (overall rate: 1.31 cases per 1,000 p-yrs) and the next 9 months of service (overall rate: 0.82 cases per 1,000 p-yrs) throughout the surveillance period. In general, rates were noticeably lower and trending downward in both periods of service for the cohorts after 2007 **(data not shown)**.

FIGURE 2. Incidence rates of outpatient diagnoses of acute upper respiratory infection (URI), months 4–12 of enlisted service, by cohort year



Note: The vertical red line indicates the time of resumption of adenovirus vaccination of basic enlisted trainees (November 2011).

Bronchitis and bronchiolitis

Incidence rates of outpatient diagnoses of AB in the first 3 months of service were higher in the cohorts after 1999 until 2003, were relatively high and stable from 2003 through 2009, and then generally declined after 2009 through 2014. Rates for the last three cohorts were the lowest of the entire surveillance period **(Figure 3)**.

Rates of outpatient AB diagnoses during months 4–12 generally increased in successive cohorts from 1999 through 2002, were relatively high and stable in cohorts from 2002 through 2008, and then sharply declined in successive cohorts from 2009 through 2014. Rates for the last five cohorts (2010–2014) were the lowest of the entire surveillance period **(Figure 4)**.

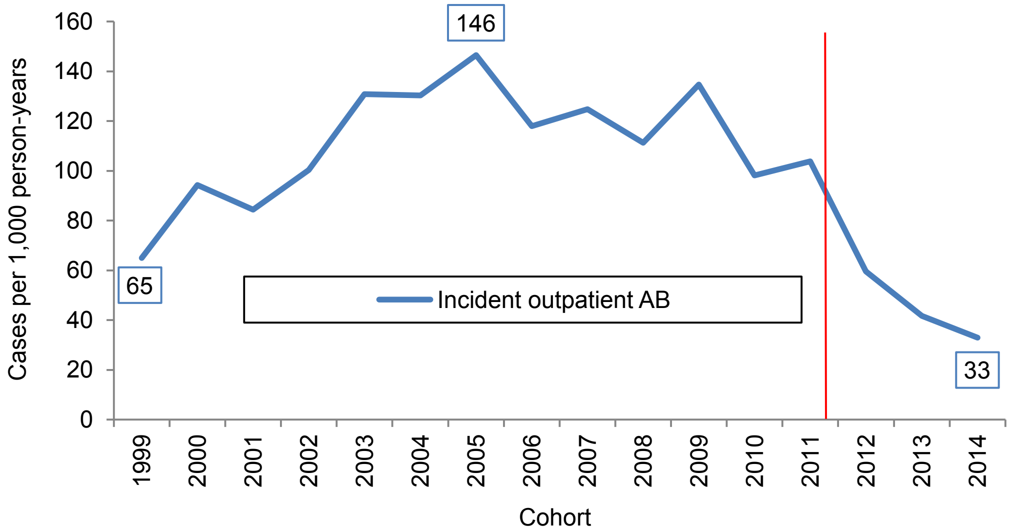
Because hospitalizations for AB were uncommon and rates were very low (less than 0.5 per 1,000 p-yrs), the rates fluctuated greatly from cohort to cohort, and no patterns in incidence were discernible **(data not shown)**.

Pneumonia

Rates of outpatient diagnoses of PN during the first 3 months of service were higher for cohorts 2003 through 2011 (range: 103 to 186 cases per 1,000 p-yrs) but were notably lower for the last three cohorts **(Figure 5)**. During months 4–12 of the first year of service, rates of outpatient diagnoses of PN slowly rose from a low of 12.4 cases per 1,000 p-yrs in the 2001 cohort to peaks in cohorts 2008 and 2009 (rates: 23.8 and 24.1 cases per 1,000 p-yrs, respectively). Thereafter, rates among successive cohorts trended downward, and the rate in the 2014 cohort was the lowest of all cohorts in the surveillance period (12.1 cases per 1,000 p-yrs) **(Figure 6)**.

Incidence rates of hospitalizations for PN during the first 3 months of service increased in successive cohorts from 1999 through 2003, were relatively high in cohorts 2003 through 2009, but then generally declined in successive cohorts from 2010 through 2014. The rate in the 2014 cohort was the lowest of any of the cohorts in the surveillance population **(Figure 7)**.

FIGURE 3. Incidence rates of outpatient diagnoses of acute bronchitis and bronchiolitis (AB), first 3 months of enlisted service, by cohort year



Note: The vertical red line indicates the time of resumption of adenovirus vaccination of basic enlisted trainees (November 2011).

PN hospitalization rates during months 4–12 gradually increased in cohorts after 1999, peaked in cohort 2009, and then sharply declined in cohorts 2010 through 2012. After a slight increase in the hospitalization rate in the 2013 cohort, the rate in the 2014 cohort fell to the lowest level of any of the 16 cohorts **(Figure 8)**.

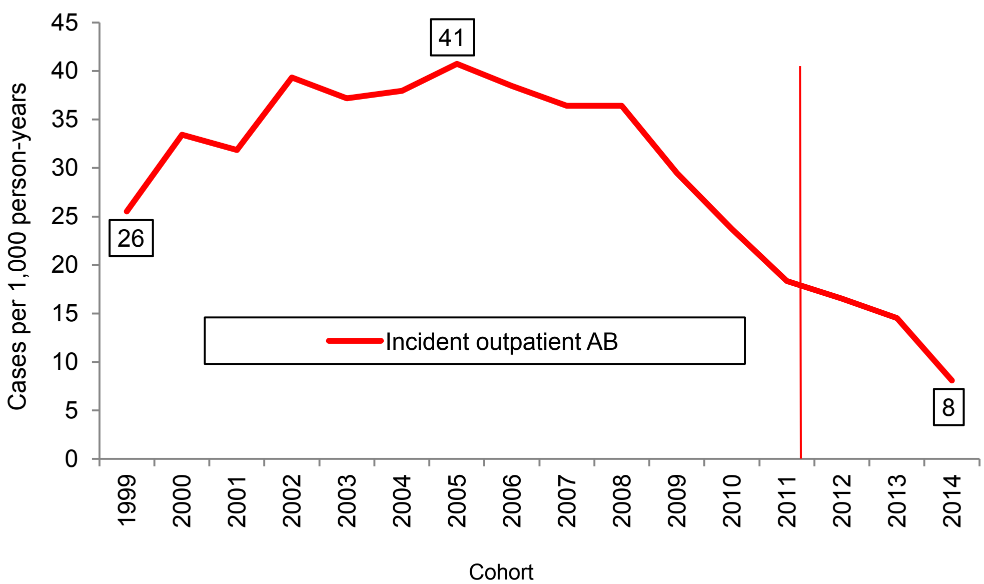
EDITORIAL COMMENT

The principal objective of administering adenovirus vaccine to military basic trainees has been to reduce the impact of adenovirus infections on new service members during their initial few months of training. The careful, laboratory-based surveillance carried out by the NHRC has convincingly demonstrated the achievement of that objective. Since the resumption of the adenovirus vaccination program near the end of 2011, NHRC has documented that the rates of febrile respiratory illness (FRI) among basic trainees have plummeted, and that the identification of adenovirus in respiratory tract samples from sick trainees has become rare.[3–5] NHRC laboratory testing includes samples from a limited number of febrile trainees at each training center each week, so it is reasonable to presume that the overall decline in FRI rates observed by NHRC reflects the prevention of adenovirus disease on a scale beyond just the sampled trainees. Since the decline in adenovirus disease at basic training centers, NHRC surveillance has continued to document the role of other viral and bacterial pathogens in the now-reduced incidence of FRI in trainees.

One objective of the analyses in this report was to assess, in cohorts that had or had not received adenovirus vaccine, the incidence of overall ARI in new accessions to military service. The expectation was that overall incidence rates of ARI would have fallen among trainee cohorts during the period of basic training (i.e., the first 3 months of service) after adenovirus vaccination had resumed. Such a finding would be consistent with NHRC's findings to date. A secondary objective was to explore ARI incidence after basic training (i.e., during the rest of service members' first year of military service). The routine, systematic NHRC surveillance of service members does not extend beyond the basic training period, so it has been unclear whether the adenovirus vaccine might confer any protection against ARI beyond the first 3 months of service.

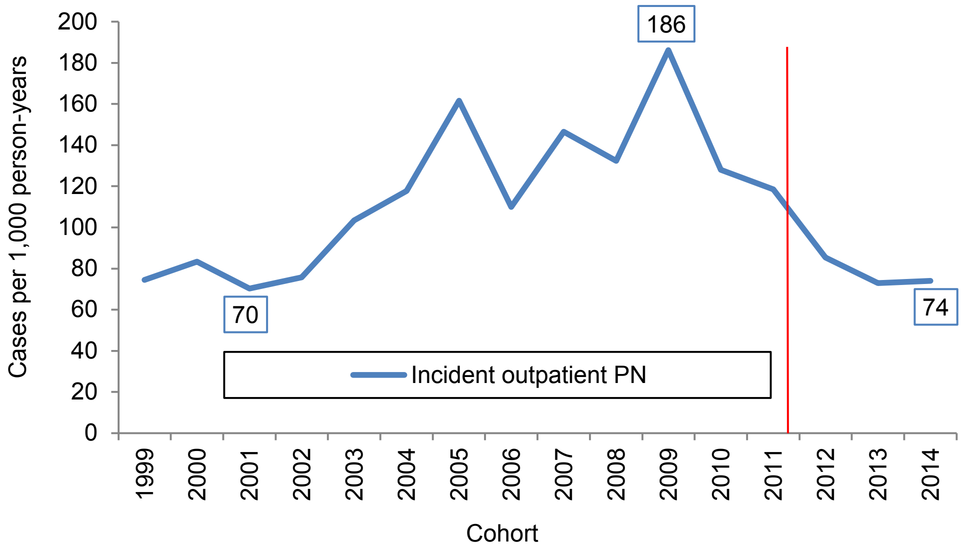
In summary, the analyses in this report found that incident rates of cases of URI, AB, and PN rose in the cohorts after the 1999 cohort and remained at relatively high levels for most of the surveillance period. It should be noted that the 1999 cohort included some trainees who had received the adenovirus vaccines before the supplies were depleted during that year, but precise numbers of vaccine recipients were not available. Members of the cohorts 2000

FIGURE 4. Incidence rates of outpatient diagnoses of acute bronchitis and bronchiolitis (AB), months 4–12 of enlisted service, by cohort year



Note: The vertical red line indicates the time of resumption of adenovirus vaccination of basic enlisted trainees (November 2011).

FIGURE 5. Incidence rates of outpatient diagnoses of pneumonia (PN), first 3 months of enlisted service, by cohort year



Note: The vertical red line indicates the time of resumption of adenovirus vaccination of basic enlisted trainees (November 2011).

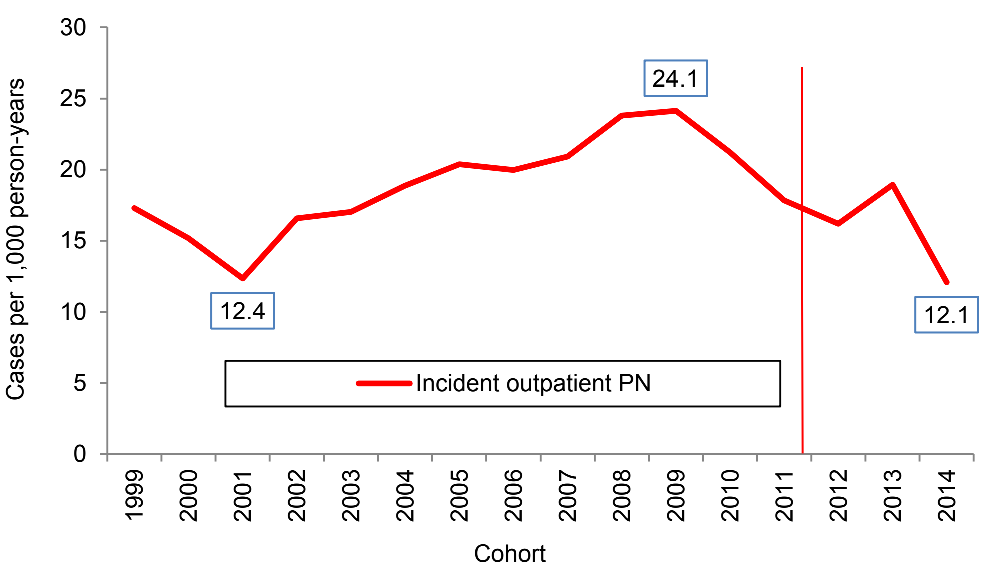
through 2010 received no adenovirus vaccine. In cohort 2011, vaccine was administered to trainees whose service began in November and December of that year. For the outpatient health care and hospitalizations for ARI shown in the figures of this report, most incidence rates were clearly lower for the three cohorts (2012, 2013, and 2014) whose members had all received adenovirus vaccine, when compared to unvaccinated cohorts. This pattern was true for incident ARIs during the first 3 months of military service as well as during the final 9 months of the first year of service for the last three cohorts. These observations are compatible with the hypothesis that the immunizing effects of adenovirus vaccine had reduced not only the incidence of laboratory-documented adenovirus disease and FRI in basic trainees, as found in the continuing surveillance by the NHRC, but also the incidence of ARIs in the 9 months following basic training.

Although it is plausible that the administration of adenovirus vaccine prevented adenovirus infections after the period of basic training, that interpretation of the data in this report should be regarded as tentative. The findings of this analysis, which estimated the incidence of diagnoses of ARIs of any etiology, present no direct evidence of a reduction in adenovirus infections in either the basic training period or in the subsequent 9-month periods. The incidence of ARI may have declined a great deal since the resumption of adenovirus vaccination of trainees, but the link to vaccination is best substantiated by the compelling data from the NHRC, and just for the first 3 months of military service.

This report contains no virologic or serologic evidence for the impact of the vaccine on adenovirus disease incidence after basic training. There are at least two published reports of outbreaks of adenovirus disease in service members who had transitioned to other bases from basic training centers during periods when vaccine was not available.[7-8] Both reports documented the occurrence of laboratory-confirmed adenovirus disease due to the same specific serotype that was predominant at the basic training centers from which the service members had come. These reports raise the possibility that vaccine-induced immunity against adenovirus infection could reduce the incidence of ARI caused by adenovirus among service members after basic training. Although such an inference is compatible with the reduction in ARI incidence in months 4–12 observed in this analysis, serologic and virologic confirmation is lacking at this time.

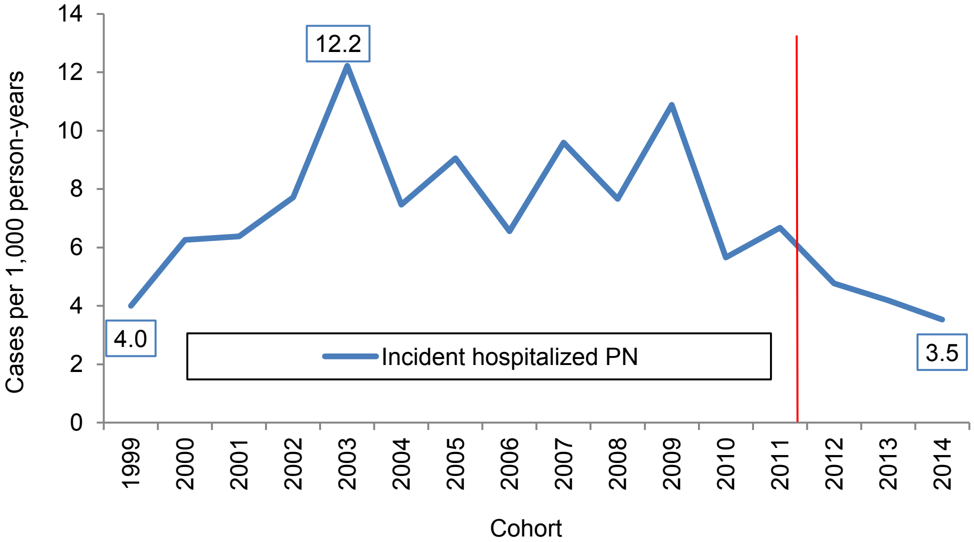
It should also be noted that some of the incidence rates of ARI found in this analysis, mostly rates for months 4–12 of the first year of service, had shown downward trends before the resumption of adenovirus vaccination in late 2011. It seems unlikely that

FIGURE 6. Incidence rates of outpatient diagnoses of pneumonia (PN), months 4–12 of enlisted service, by cohort year



Note: The vertical red line indicates the time of resumption of adenovirus vaccination of basic enlisted trainees (November 2011).

FIGURE 7. Incidence rates of hospitalized cases of pneumonia (PN), first 3 months of enlisted service, by cohort year

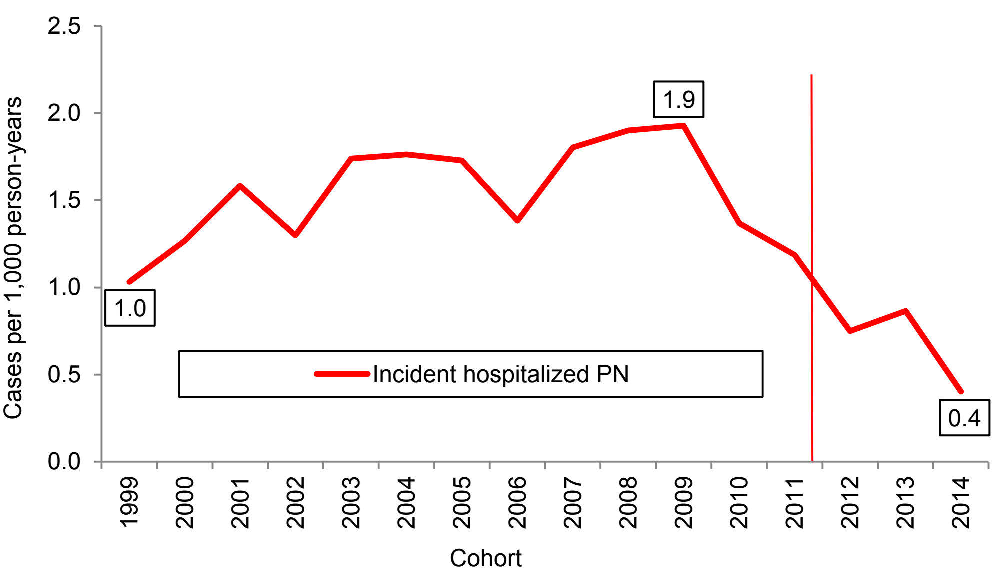


Note: The vertical red line indicates the time of resumption of adenovirus vaccination of basic enlisted trainees (November 2011).

the adenovirus vaccine safety and efficacy trial, the basis for FDA approval of the vaccine, was responsible for the decline in rates because the trial was conducted in 2006–2007. It is conceivable that the incidences of ARIs due to other respiratory pathogens were declining for reasons unrelated to adenovirus vaccination. The relative importance of this possibility is difficult to quantify at this time.

Another reminder of the need for a cautious approach to interpreting data from administrative healthcare records pertains to influences on measures of healthcare delivery that are not directly attributable to incidence of disease. For example, the observations about proportions of *encounters* versus proportions of *incident cases* during the first 3 months of service were likely influenced by the unique healthcare practices for basic trainees. In general, sick trainees are often required to return daily to clinic for follow-up evaluations until they are cleared to return to training. This practice would elevate the numbers of encounters per incident case during the basic training period. In contrast, during service after basic training, when administrative requirements to obtain health care are less prevalent, other factors (such as proximity to healthcare facilities, disincentives for individuals to assume the sick role, adverse weather, lack of transportation, and so on) may affect counts of healthcare encounters as measures of disease or injury incidence. In the context of these various influences on data completeness and accuracy, the interpretation of findings must be done judiciously.

FIGURE 8. Incidence rates of hospitalized cases of pneumonia (PN), months 4–12 of enlisted service, by cohort year



Note: The vertical red line indicates the time of resumption of adenovirus vaccination of basic enlisted trainees (November 2011).

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Diagnoses of Low Back Pain, Active Component, U.S. Armed Forces, 2010–2014

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Low back pain (LBP) is a common cause of disability, lost worker productivity, and healthcare costs in both military and civilian populations. During the 5-year surveillance period of this analysis, the LBP diagnoses of interest were associated with more than 6 million outpatient healthcare encounters and more than 25,000 hospitalizations among active component service members. Annual numbers of outpatient encounters for LBP diagnoses increased 34% during 2010–2014. Annual numbers of inpatient encounters decreased during the period. Incidence rates were lowest among the youngest service members and increased with advancing age. Of all service members ever given a LBP diagnosis during the surveillance period, 91% were diagnosed at least once with a condition in the broad category "nonspecific back pain." The most common specific diagnosis during the surveillance period was lumbago. The discussion covered the importance of LBP in the military, initiatives to lower the incidence of, and enhance the care of, LBP, and methodologic limitations to the analysis.

Low back pain (LBP) is a highly prevalent condition worldwide and a leading cause of disability that imposes a significant economic burden in terms of both lost worker productivity and healthcare costs. In the U.S., LBP is one of the most common reasons for which adults seek medical care. In 2012, low back symptoms were the 10th most frequent reason for physician office visits in the U.S. population, resulting in more than 13 million physician office visits.[1–3]

Among active component military members, LBP is also one of the most frequent reasons for seeking medical care. In the annual *MSMR* burden of disease issue published each April, "other back problems," has been the category responsible for the most medical encounters every year since 2011. In 2015, this category (which includes diagnoses such as lumbago and unspecified backache) was the primary diagnosis in more than a million medical encounters, affecting 223,094 service members.[4]

LBP can also have a significant negative impact on military operations. It is one of the leading causes of evacuations from combat theaters of operations and one of the most frequent reasons for seeking medical care in combat theaters.[5–7]

In 2010, the *MSMR* estimated the incidence of LBP diagnosed during medical encounters using an algorithm developed by Cherkin et al. that utilizes ICD-9 diagnostic and procedure codes to identify patients with "mechanical low back pain." Mechanical LBP was defined as local or radicular pain associated with conditions of the sacrum or lumbar spine unrelated to major trauma, neoplasms, pregnancy, or infectious or inflammatory causes (and subsequently referred to as low back pain).[8,9] This report updates these estimates through 2014 by using the same algorithm.

METHODS

The surveillance period was 1 January 2010 through 31 December 2014. The surveillance population included all active component service members who served at any time during the surveillance period.

Diagnoses of LBP were defined by inpatient or outpatient medical encounters that were documented with a diagnosis (in any diagnostic position) of any of 66 ICD-9 codes indicative of low back problems. The 66 specific diagnoses were grouped into seven clinical categories for summary purposes (nonspecific back pain, miscellaneous back problems, degenerative changes, herniated disc, possible instability, spinal stenosis, and sequelae of back surgery). Encounters that were associated with major trauma (e.g., traffic accidents, vertebral fractures or dislocations), pregnancy, neoplasms, infections, or other inflammatory causes of back pain were excluded.

Incident diagnoses of LBP were defined by the individual's first occurring qualifying LBP-related medical encounter during the surveillance period. Incidence rates of LBP overall were calculated by dividing the total of first (incident) episodes of LBP during the period by the total years (person-time) of active military service during the same period. Also, incidence rates of each of seven clinical categories of LBP were calculated separately. For these analyses, individuals could be counted as incident cases once in each category during the 5-year surveillance period. Medical encounters with multiple LBP indicator diagnoses were classified by using the LBP diagnosis that was reported in the highest diagnostic position of the health record. In this analysis, incidence is defined as the first encounter during the surveillance period. Prevalent cases of back pain (i.e., individuals who had been diagnosed prior to 2010) were not excluded from this analysis.

RESULTS

During the 5-year surveillance period, active component members had 6,268,752 outpatient medical encounters and 25,930 inpatient encounters that included an ICD-9 code for one of the LBP diagnoses of interest **(Table 1).** Among incident outpatient encounters, about 72% (n=492,609) of the LBP diagnoses were in the primary diagnostic position, while approximately 13% of the LBP diagnoses were in the primary diagnostic position in incident inpatient encounters **(data not shown).**

TABLE 1. Numbers of medical encounters for low back pain, by clinical category, active component, U.S. Armed Forces, 2010–2014

Clinical category	No. of inpatient encounters	No. of outpatient encounters
Nonspecific back pain	10,663	3,930,536
Miscellaneous back problems	2,071	1,288,934
Degenerative changes	5,461	563,293
Herniated disc	5,488	359,810
Possible instability	1,300	67,652
Spinal stenosis	770	36,222
Sequelae of back surgery	177	22,305

This table lists the names of the seven clinical categories of diagnoses for back pain. Separate columns list the total numbers of inpatient encounters and outpatient encounters for which the associated diagnoses fell into the respective seven categories during the entire surveillance period (2010–2014).

Slightly less than two-thirds of ambulatory visits (n=3,930,536; 62.7%) were classified as "nonspecific back pain," and approximately one-fifth of all LBP-related ambulatory visits were categorized as "miscellaneous back problems" (n=1,288,934; 20.6%). "Degenerative changes" represented about 9% of outpatient diagnoses (n=563,293), while the category of "herniated disc" comprised approximately 6% of all outpatient diagnoses (n=359,810); the remaining clinical categories combined accounted for only 2% of all visits. About 40% of hospitalizations with a LBP diagnosis were documented with "nonspecific back pain" (n=10,663, 41.1%) related diagnoses **(Table 1)**.

"Lumbago" was by far the most frequent diagnosis (at the three-digit level of the ICD-9) during ambulatory visits for LBP. During the 5-year period, 519,740 service members had 3,216,360 ambulatory visits for lumbago (average per person: 6.2) **(Figure 1)**. The diagnoses of "backache, unspecified" (468,012 visits; 193,193 individuals; average per person: 2.4) and "nonallopathic lesions, lumbar region" (413,025 visits; 83,421 individuals; average per person: 5.0) were the second and third most frequent diagnoses reported during LBP-related visits. **(Figure 1).**

During the 5-year period, 689,073 service members had at least one incident LBP-related medical encounter. The overall incidence rate was 120.0 visits per 1,000 person-years (p-yrs) **(Table 2)**. The number of service members with at least one incident LBP-related visit during each calendar year sharply declined from 2010 (n=214,337) to 2014 (n=99,202). **(Table 3)** Although LBP-related incident encounters decreased over the time period, the overall number of LBP-related ambulatory encounters increased 34% over the time period (2010: 1,004,820; 2014: 1,349,941), while inpatient encounters with a LBP diagnosis decreased during the period (2010: 5,106; 2014: 4,521) **(Table 4).**

Among the categories of LBP, the highest incidence rates during the surveillance period were for "nonspecific back pain" **(Table 2)**. Of service members with any LBP diagnoses during the period, 91% were diagnosed at least once with "nonspecific back pain" (rate: 106.0 per 1,000 p-yrs), while more than one-third (37%) were diagnosed with "miscellaneous back problems" (rate: 37.7 per 1,000 p-yrs). About 17% were diagnosed with "degenerative changes" (rate: 17.0 per 1,000 p-yrs), and 12% with "herniated disc" (rate: 11.6 per 1,000 p-yrs) **(Table 2)**.

For all categories of LBP, incidence rates were lowest among the youngest service members and increased with age **(Table 2)**. Females had higher overall crude incidence rates of LBP overall, as well as higher rates for the specific categories of "nonspecific back pain," "miscellaneous back problems," and "possible instability." Incidence rates for the category of "degenerative changes" were roughly equivalent for males and females, while the categories of "herniated disc," "spinal stenosis," and "sequelae of back surgery" were marginally higher in males **(Table 2)**.

FIGURE. Five most frequent low back pain diagnoses during ambulatory visits, active component, U.S. Armed Forces, 2010–2014

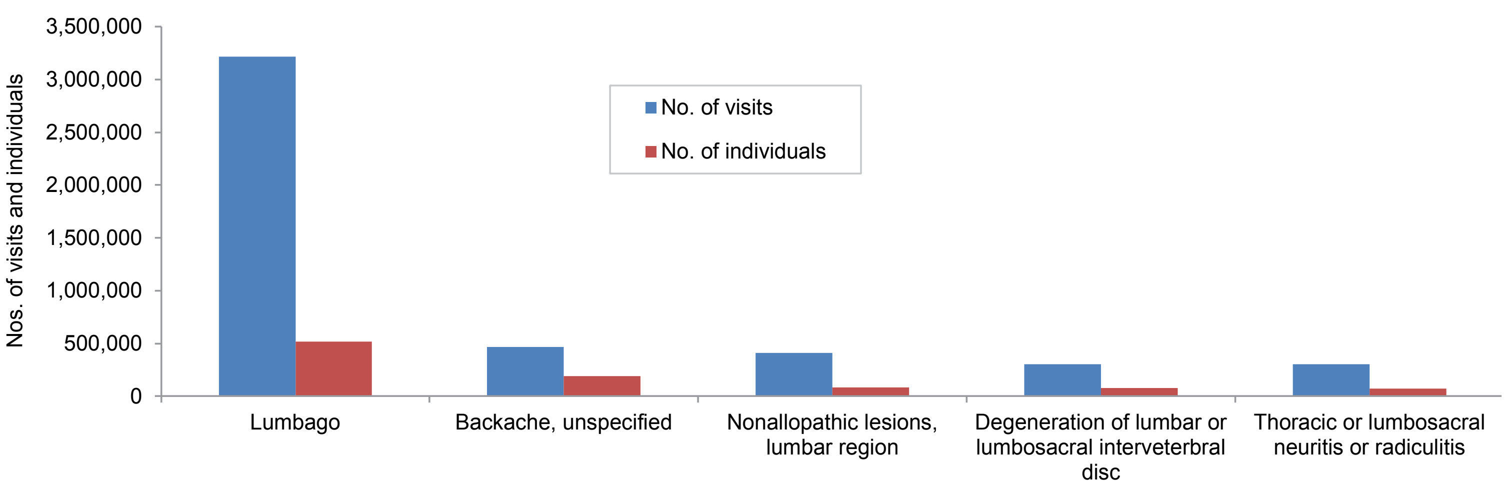

TABLE 2. Incidence rates of low back pain, active component, U.S. Armed Forces, 2010–2014

	Total (all categories)		Nonspecific back pain		Miscellaneous back problems		Degenerative changes		Herniated disc		Possible instability		Spinal stenosis		Sequelae of back surgery	
	No.	Rate[a]	No.	Rate[a]	No.	Rate[a]	No.	Rate[a]	No.	Rate[a]	No.	Rate[a]	No.	Rate[a]	No.	Rate[a]
Total individuals	689,073	120.0	625,633	106.0	251,706	37.7	117,623	17.0	81,330	11.6	18,604	2.6	14,826	2.1	4,885	0.7
Age (years)																
<20	33,699	84.6	30,816	77.1	6,104	14.8	762	1.8	546	1.3	339	0.8	62	0.2	1	0.0
20–24	186,963	94.3	171,145	85.3	53,856	24.7	14,806	6.6	11,266	5.0	3,210	1.4	1,547	0.7	373	0.2
25–29	162,218	114.0	147,692	101.4	58,667	35.5	22,359	13.0	17,094	9.9	4,103	2.4	2,550	1.5	884	0.5
30–34	110,642	129.6	100,480	113.5	44,951	43.6	21,255	19.5	15,872	14.5	3,349	3.0	2,647	2.4	990	0.9
35–39	94,922	164.9	85,654	141.4	41,774	57.7	24,589	32.0	16,911	21.7	3,360	4.2	3,262	4.0	1,216	1.5
>=40	100,629	198.3	89,846	164.6	46,354	69.4	33,852	48.0	19,641	26.8	4,243	5.5	4,758	6.2	1,421	1.8
Gender																
Male	561,389	113.2	510,153	100.3	200,600	35.1	100,424	17.0	70,257	11.8	15,114	2.5	13,024	2.1	4,309	0.7
Female	127,684	163.4	115,480	142.1	51,106	53.9	17,199	16.9	11,073	10.8	3,490	3.4	1,802	1.7	576	0.6
Service																
Army	325,809	157.7	302,085	142.0	113,507	45.2	65,691	25.3	44,785	17.0	9,426	3.5	7,437	2.8	2,487	0.9
Navy	109,839	79.7	96,977	68.8	37,454	24.5	14,043	8.9	9,464	6.0	2,429	1.5	1,662	1.0	614	0.4
Air Force	161,653	126.5	144,800	109.4	66,698	44.5	24,951	15.7	18,082	11.3	4,344	2.7	4,172	2.6	1,228	0.8
Marine Corps	74,366	87.1	66,198	76.0	28,354	30.2	9,983	10.3	6,218	6.4	1,871	1.9	1,016	1.0	397	0.4
Coast Guard	17,406	105.4	15,573	91.6	5,693	29.4	2,955	14.8	2,781	13.9	534	2.6	539	2.6	159	0.8
Race/ethnicity																
Black, non-Hispanic	121,479	138.5	112,621	125.0	40,428	38.4	18,728	17.1	12,317	11.1	2,292	2.0	2,379	2.1	528	0.5
White, non-Hispanic	424,479	118.8	381,871	103.8	161,173	39.1	76,855	17.9	53,801	12.4	12,797	2.9	9,832	2.2	3,526	0.8
Other	143,115	110.8	131,141	99.2	50,105	33.6	22,040	14.2	15,212	9.8	3,515	2.2	2,615	1.7	831	0.5
Military occupation																
Combat	127,775	108.3	115,392	95.3	45,234	33.7	23,471	17.0	16,464	11.8	3,636	2.6	2,935	2.1	933	0.7
Health care	67,916	147.9	60,237	125.4	28,113	51.0	11,603	19.8	7,577	12.8	1,951	3.2	1,339	2.2	443	0.7
Admin/supply	187,360	147.2	172,594	131.4	69,006	44.9	33,128	20.6	22,395	13.8	5,036	3.0	4,150	2.5	1,365	0.8
Other	306,022	108.2	277,410	95.7	109,353	33.8	49421	14.7	34,894	10.3	7,981	2.3	6,402	1.9	2,144	0.6

[a] Rate per 1,000 person-years

This table shows the overall numbers and incidence rates of diagnoses of low back pain according to the seven clinical categories during the entire surveillance period (2010–2014) as well as the number and incidence rate for any diagnosis of low back pain. In addition, the table displays the numbers and incidence rates according to the demographic categories of age group, gender, military service, race/ethnicity, and occupational category.

EDITORIAL COMMENT

During the past 5 years, nearly 700,000 active component members had at least one LBP-related medical encounter; the majority of medical encounters with LBP diagnoses were documented with nonspecific back pain diagnoses, particularly "lumbago." This summary included medical encounters reported from fixed medical facilities outside of combat theaters; however, it has been previously documented that LBP is a significant cause of morbidity during deployment.[5–7] It has also been demonstrated that diagnoses for back conditions, along with other musculoskeletal disorders, increase in prevalence with increasing number of deployments.[10]

U.S. military members in combat settings carry heavier loads than those who served in such settings in the past.[11] A survey of U.S. soldiers in Iraq revealed a substantial increase in self-reported back and neck pain during deployment; many respondents attributed the symptoms to lengthy periods of wearing body armor; a study evaluating predictors of LBP during deployment found that length of time wearing body armor was a consistent predictor of LBP.[12]

Because of the high cost to the military (both in terms of direct health care costs and military operational costs) of LBP, research initiatives to develop effective strategies to prevent LBP have been the focus of several recently completed studies. One study, the Prevention of Low Back Pain in the Military cluster randomized trial, reported that brief psychosocial education, rather than traditional or specialized core stabilization exercise programs, reduced the incidence of healthcare utilization for LBP.[13]

Another recent study performed in new LBP patients in the Military Health System indicated that patients who received

TABLE 3. Incidence rates of low back pain, by year, active component, U.S. Armed Forces, 2010–2014

Year	Total (all categories) No.	Rate[a]	Nonspecific back pain No.	Rate[a]	Miscellaneous back problems No.	Rate[a]	Degenerative changes No.	Rate[a]	Herniated disc No.	Rate[a]	Possible instability No.	Rate[a]	Spinal stenosis No.	Rate[a]	Sequelae of back surgery No.	Rate[a]
2010	214,337	159.6	181,906	133.3	63,407	44.5	31,897	22.1	23,607	16.3	3,930	2.7	2,950	2.0	1,290	0.9
2011	141,771	116.1	130,757	104.5	51,215	37.0	23,510	16.5	16,544	11.6	3,524	2.4	2,992	2.1	1,023	0.7
2012	124,295	110.9	115,848	100.2	49,949	37.6	22,446	16.2	15,400	11.0	3,556	2.5	3,163	2.2	944	0.7
2013	109,468	103.5	103,608	94.7	44,019	34.2	20,171	14.8	13,084	9.5	3,526	2.5	2,825	2.0	826	0.6
2014	99,202	99.3	93,514	90.3	43,116	34.7	19,599	14.8	12,695	9.5	4,068	3.0	2,896	2.1	802	0.6

[a] Rate per 1,000 person-years

This table shows the annual numbers and incidence rates of diagnoses of low back pain according to the seven clinical categories for each of the 5 years of the entire surveillance period (2010–2014) as well as the annual incidence rates for any diagnosis of low back pain.

TABLE 4. Number of medical encounters including a low back pain diagnosis, by year, active component, U.S. Armed Forces, 2010–2014

Year	Inpatient	Outpatient
2010	5,106	1,004,820
2011	5,731	1,201,853
2012	5,634	1,351,387
2013	4,938	1,360,751
2014	4,521	1,349,941

This table shows, for each of the 5 years of the surveillance period, separate listings of the numbers of inpatient medical encounters and of outpatient encounters for which the health records contained a diagnosis of low back pain. From 2010 to 2014, the annual numbers of inpatient encounters decreased from 5,106 to 4,521, but the annual numbers of outpatient encounters increased from 1,004,820 to 1,349,941.

physical therapy within 2 weeks of the initial visit for back pain and who adhered to clinical practice guidelines had 60% lower total LBP-related medical costs compared to comparison groups receiving delayed or nonadherent physical therapy.[14]

There are several limitations of this analysis that should be considered. To allow for comparison with the previous *MSMR* analysis, the methods remained unchanged from the prior analysis. However, the algorithm used to identify and categorize LBP was developed in 1992; recently, Sinnott et al. published a comprehensive review of methods for identifying back and neck pain in administrative data partly to evaluate if an update of the methodology used by Cherkin et al. was warranted.[15] Although this analysis reported that the Cherkin algorithm had considerable overlap with more recently developed algorithms to identify back pain, the authors recommended several updates to the methodology that would likely result in the capture of more cases of LBP when applied to administrative data such as that used in this analysis. On the other hand, the methodology used in the current analysis does not require that the ICD-9 code of interest be in the primary diagnostic position. Therefore, the primary reason for seeking medical care may not have been related to LBP.

In addition, this analysis reported that incident diagnoses declined during the surveillance period; it is likely that, to some extent, this is an artifact of not excluding prevalent cases of LBP prior to the beginning of the surveillance period.

The majority of individuals who present for care for LBP pain experience a recurrent LBP episode. This analysis did not examine the rate of recurrent LBP episodes in active component service members. An extensive analysis of recurrent LBP episodes will be presented in a future issue of the *MSMR*.

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Incidence of Diagnoses Using ICD-9 Codes Specifying Chronic Pain (not Neoplasm Related) in the Primary Diagnostic Position, Active Component, U.S. Armed Forces, 2007–2014

Leslie L. Clark, PhD, MS; Stephen B. Taubman, PhD

In fiscal year 2007, multiple new ICD-9 codes related to pain were approved for use. These codes, which fall under the three-digit code 338, were added for several reasons; one reason was to allow for the differentiation between acute and chronic pain in the ICD-9 coding schema. The coding guidelines allow for the codes within the category 338 to be used in the primary diagnostic position when pain control or management is the primary reason for the encounter or when a definitive diagnosis has not been established.[1–2]

This analysis evaluated changes over time in the use of some of the ICD-9 codes in this series that referred specifically to chronic pain. Those codes are: "chronic pain due to trauma" (338.21), "other chronic postoperative pain" (338.28), and "other chronic pain" (338.29). The analysis also included the code for "chronic pain syndrome" (338.4). Not included were diagnoses of "chronic post thoracotomy pain" (338.22) as there were fewer than 30 diagnoses per year for this category during the surveillance period. In a 2013 report of an analysis utilizing multiple data sources from electronic health records (e.g., ICD-9-coded diagnoses, patient-reported pain scores, prescriptions for opioid medication) to develop an algorithm to identify chronic pain patients, these ICD-9 codes were determined to be "highly likely" to identify chronic pain patients. This assessment was based on a chart review conducted to improve the accuracy of the ICD-9 codes used in the algorithm.[3] The analysis for this brief report does not attempt to identify all chronic pain patients; rather, the goal is to evaluate trends in the use of the four codes specified above in the first (i.e., primary) diagnostic position over the surveillance period.

METHODS

For surveillance purposes, an incident diagnosis was defined by the first use of any of the specified chronic pain codes listed above in the primary diagnostic position of the record of an inpatient or outpatient health care encounter. An individual could be counted as an incident case only once during the surveillance period in each specific category of chronic pain diagnosis and only once in the categories "any chronic pain diagnosis" and "more than one chronic pain type." The surveillance population included all individuals serving at any time in the active component of the U.S. Army, Navy, Air Force, or Marine Corps between 1 January 2007 and 31 December 2014.

Co-occurring secondary diagnoses (i.e., diagnoses listed in the second diagnostic position of the record of the incident chronic pain encounter) were summarized for the top 10 most frequent ICD-9 diagnoses when a secondary diagnosis was present in the record of the medical encounter.

RESULTS

Table 1 summarizes the demographic characteristics of active component service members who received incident chronic pain specific diagnoses. For all specific chronic pain diagnoses except "chronic pain due to trauma," females had higher incidence rates during the surveillance period. Except for the category of "other chronic postoperative pain," incidence rates increased linearly with increasing age, although stratification by gender and age group demonstrated some departures from this general trend.

Incidence rates for "any chronic pain diagnosis" increased from a rate of 30.4 incident diagnoses per 10,000 person-years (p-yrs) in 2007 to 107.8 per 10,000 p-yrs in 2014. This trend was largely driven by increases in incident diagnoses of "other chronic pain," which increased from 16.2 incident diagnoses per 10,000 p-yrs in 2007 to 90.3 incident diagnoses per 10,000 p-yrs in 2014 **(Figure)**.

The majority of ICD-9 codes listed in the secondary diagnostic position for all chronic pain categories except "other chronic postoperative pain" were related to back pain. For the category "chronic pain due to trauma," 69% of secondary diagnoses were related to back pain, while 66% and 78% of secondary diagnoses were back pain related for the categories of "other chronic pain" and "chronic pain syndrome," respectively **(Table 2)**.

EDITORIAL COMMENT

This report documents a striking increase in the numbers and rates of incident medical encounters with a primary diagnosis related to chronic pain during the 8-year surveillance period. This finding is not entirely unexpected given that new codes allowing for greater specificity of pain diagnoses were introduced just prior to the start of the surveillance period; examinations of the utilization of other newly introduced ICD-9 codes have demonstrated a similar upward trend in use.[4,5]

It is also likely that the results of this analysis represent an overarching increase in the numbers of service members

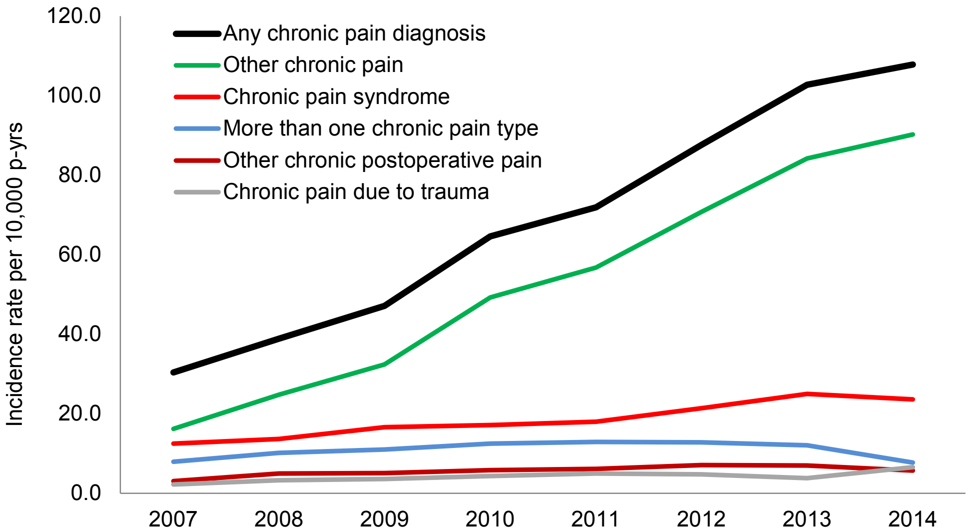
TABLE 1. Incidence rates of, and demographic characteristics of individuals with, chronic pain diagnoses in the primary diagnostic position, active component, U.S. Armed Forces, 2007–2014

	Any chronic pain diagnosis		Chronic pain due to trauma (ICD-9: 338.21)		Other chronic postoperative pain (ICD-9: 338.28)		Other chronic pain (ICD-9: 338.29)		Chronic pain syndrome (ICD-9: 338.4)		More than one chronic pain type diagnosed	
	No.	Rate[a]	No.	Rate[a]	No.	Rate[a]	No.	Rate[a]	No.	Rate[a]	No.	Rate[a]
Total	76,094	68.7	4,617	4.2	6,165	5.6	58,613	52.9	20,419	18.4	12,040	10.9
Sex												
Male	60,762	64.2	4,043	4.3	4,921	5.2	46,813	49.5	16,096	17.0	9,660	10.2
Female	15,332	95.3	574	3.6	1,244	7.7	11,800	73.4	4,323	26.9	2,380	14.8
Race/ethnicity												
White, non-Hispanic	49,880	72.5	3,306	4.8	4,105	6.0	38,246	55.6	13,898	20.2	8,407	12.2
Black, non-Hispanic	12,408	69.0	504	2.8	1,067	5.9	9,708	54.0	2,856	15.9	1,553	8.6
Hispanic	8,007	64.8	454	3.7	609	4.9	6,188	50.1	2,090	16.9	1,197	9.7
Other	5,799	50.2	353	3.1	384	3.3	4,471	38.7	1,575	13.6	883	7.6
Age												
<20	1,145	16.6	69	1.0	102	1.5	837	12.1	202	2.9	104	1.5
20–24	16,618	46.3	1,345	3.7	1,523	4.2	12,471	34.8	3,735	10.4	2,475	6.9
25–29	18,643	70.2	1,227	4.6	1,678	6.3	14,255	53.7	5,008	18.9	3,119	11.8
30–34	13,668	81.6	797	4.8	1,112	6.6	10,638	63.5	3,795	22.6	2,262	13.5
35–39	12,149	94.1	619	4.8	920	7.1	9,403	72.8	3,559	27.6	2,100	16.3
40–49	12,580	117.8	506	4.7	767	7.2	9,977	93.4	3,726	34.9	1,816	17.0
50+	1,291	124.6	54	5.2	63	6.1	1,032	99.6	394	38.0	164	15.8
Sex (by Age)												
Males												
<20	743	12.9	57	1.0	77	1.3	522	9.0	132	2.3	69	1.2
20–24	12,879	42.2	1,222	4.0	1,203	3.9	9,592	31.4	2,874	9.4	1,995	6.5
25–29	15,069	67.0	1,073	4.8	1,366	6.1	11,541	51.3	3,988	17.7	2,538	11.3
30–34	11,077	77.2	689	4.8	913	6.4	8,626	60.1	3,041	21.2	1,852	12.9
35–39	9,802	87.0	534	4.7	717	6.4	7,632	67.8	2,828	25.1	1,672	14.8
40–49	10,210	109.0	423	4.5	602	6.4	8,109	86.6	2,947	31.5	1,416	15.1
50+	982	113.1	45	5.2	43	5.0	791	91.1	286	32.9	118	13.6
Females												
<20	402	35.6	12	1.1	25	2.2	315	27.9	70	6.2	35	3.1
20–24	3,739	69.6	123	2.3	320	6.0	2,879	53.6	861	16.0	480	8.9
25–29	3,574	88.3	154	3.8	312	7.7	2,714	67.0	1,020	25.2	581	14.4
30–34	2,591	107.6	108	4.5	199	8.3	2,012	83.6	754	31.3	410	17.0
35–39	2,347	142.6	85	5.2	203	12.3	1,771	107.6	731	44.4	428	26.0
40–49	2,370	180.8	83	6.3	165	12.6	1,868	142.5	779	59.4	400	30.5
50+	309	183.9	9	5.4	20	11.9	241	143.4	108	64.3	46	27.4
Military grade												
Enlisted	68,130	74.0	4,162	4.5	5,703	6.2	52,371	56.8	18,290	19.9	10,880	11.8
Officer/other	7,964	42.9	455	2.4	462	2.5	6,242	33.6	2,129	11.5	1,160	6.2
Military occupation												
Combat	16,265	72.1	1,608	7.1	1,237	5.5	12,363	54.8	4,330	19.2	2,801	12.4
Health care	8,172	86.2	392	4.1	573	6.0	6,538	68.9	2,315	24.4	1,472	15.5
Admin/Supply	22,116	84.2	1,062	4.0	1,757	6.7	17,218	65.6	5,846	22.3	3,300	12.6
Other	29,541	56.4	1,555	3.0	2,598	5.0	22,494	42.9	7,928	15.1	4,467	8.5

[a]Rate per 10,000 person-years

This table shows the overall numbers and incidence rates of diagnoses of chronic pain diagnoses according to the four specific diagnoses of interest during the entire surveillance period (2007–2014). Also shown are the numbers and incidence rates for any diagnosis of chronic pain as well as for more than one type of chronic pain diagnosis. In addition, the table displays the numbers and incidence rates according to the demographic categories of sex, race/ethnicity, age group, age group for each sex, military grade, and military occupational category.

FIGURE. Incidence rates of chronic pain specific diagnoses among active component service members, U.S. Armed Forces, 2007–2014



presenting for health care for chronic pain conditions. A recent Institute of Medicine report estimated that chronic pain affects approximately 100 million Americans, and that the prevalence of chronic pain is increasing in the civilian U.S. population. Similarly, the prevalence of chronic pain is high in military populations and has been especially well documented in Operation Enduring Freedom/Operation Iraqi Freedom veterans in whom chronic pain may be comorbid with, and exacerbated by, post-traumatic stress disorder (PTSD), depression, or traumatic brain injury. In fact, PTSD, chronic pain, and persistent post-concussive symptoms have been termed the "polytrauma clinical triad."[7–10] However, whether, and to what extent, an increasing proportion of service members

TABLE 2. Frequency of ICD-9 codes in the secondary diagnostic position for specific types of incident chronic pain diagnoses, active component, U.S. Armed Forces, 2007–2014

Chronic pain due to trauma			Other chronic postoperative pain		
No.	ICD-9 code	Description	No.	ICD-9 code	Description
302	724.2	Lumbago	134	719.46	Pain in joint involving lower leg
172	724.8	Other symptoms referable to back	126	724.2	Lumbago
116	721.3	Lumbosacral spondylosis without myelopathy	118	719.41	Pain in joint involving shoulder region
105	723.1	Cervicalgia	109	729.5	Pain in limb
93	729.5	Pain in limb	103	789.09	Abdominal pain other specified site
83	719.46	Pain in joint involving lower leg	90	719.47	Pain in joint involving ankle and foot
76	724.1	Pain in thoracic spine	63	608.9	Unspecified disorder of male genital organs
57	719.47	Pain in joint involving ankle and foot	54	722.83	Postlaminectomy syndrome of lumbar region
56	719.41	Pain in joint involving shoulder region	53	729.2	Neuralgia neuritis and radiculitis unspecified
51	780.52	Insomnia, unspecified	46	723.1	Cervicalgia
Other chronic pain			Chronic pain syndrome		
No.	ICD-9 code	Description	No.	ICD-9 code	Description
10,631	724.2	Lumbago	1,131	724.2	Lumbago
3,450	719.46	Pain in joint involving lower leg	707	722.52	Degeneration of lumbar or lumbosacral intervertebral disc
1,703	723.1	Cervicalgia	518	724.4	Thoracic or lumbosacral neuritis or radiculitis unspecified
1,676	719.41	Pain in joint involving shoulder region	356	729.1	Myalgia and myositis unspecified
1,526	724.5	Backache unspecified	326	723.1	Cervicalgia
1,016	719.47	Pain in joint involving ankle and foot	314	721.3	Lumbosacral spondylosis without myelopathy
1,005	729.5	Pain in limb	312	722.10	Displacement of lumbar intervertebral disc without myelopathy
982	719.45	Pain in joint involving pelvic region and thigh	205	309.81	Post-traumatic stress disorder
961	722.52	Degeneration of lumbar or lumbosacral intervertebral disc	200	719.46	Pain in joint involving lower leg
833	724.1	Pain in thoracic spine	166	311	Depressive disorder not elsewhere classified

This table shows, for each of the four specific diagnoses of chronic pain, the ten most frequent other diagnoses (and corresponding ICD-9 codes) that were recorded in the second diagnostic position of the health care records where the chronic pain diagnoses were in the primary diagnostic position. As described in the main text, except when the diagnosis for "other chronic postoperative pain" was in the first position, the majority of diagnoses in the second diagnostic position were related to back pain.

are suffering from chronic pain cannot be answered by this very limited analysis.

The results of this analysis are also intriguing with regard to the high frequency with which co-occurring diagnoses are related to back pain. Low back pain conditions, as reported in this issue of the *MSMR*, continue to represent important causes of significant morbidity in the active component force.

Investigating effective interventions to manage chronic pain in U.S. military personnel is a high priority for both the Department of Defense and the Veterans Health Administration.[11,12] Similarly, more comprehensive and complete analyses to estimate the incidence and prevalence of chronic pain in the active component military population are warranted.

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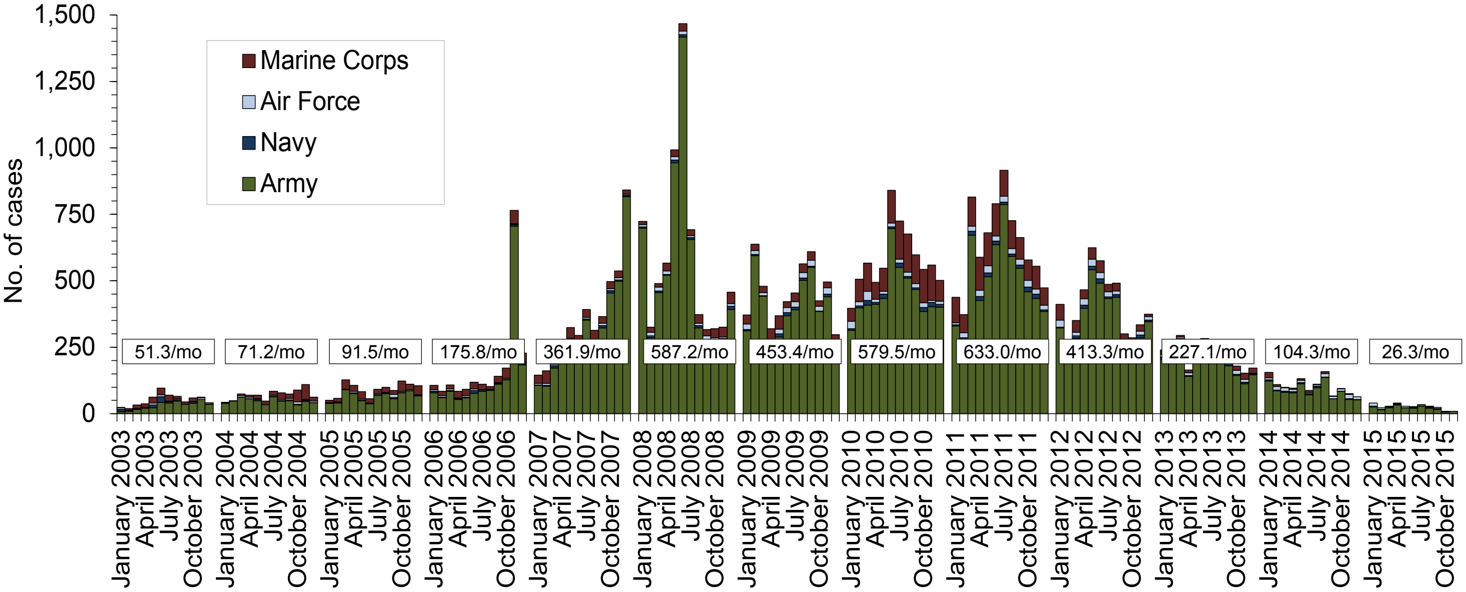
Deployment-related Conditions of Special Surveillance Interest, U.S. Armed Forces, by Month and Service, January 2003–November 2015 (data as of 18 December 2015)

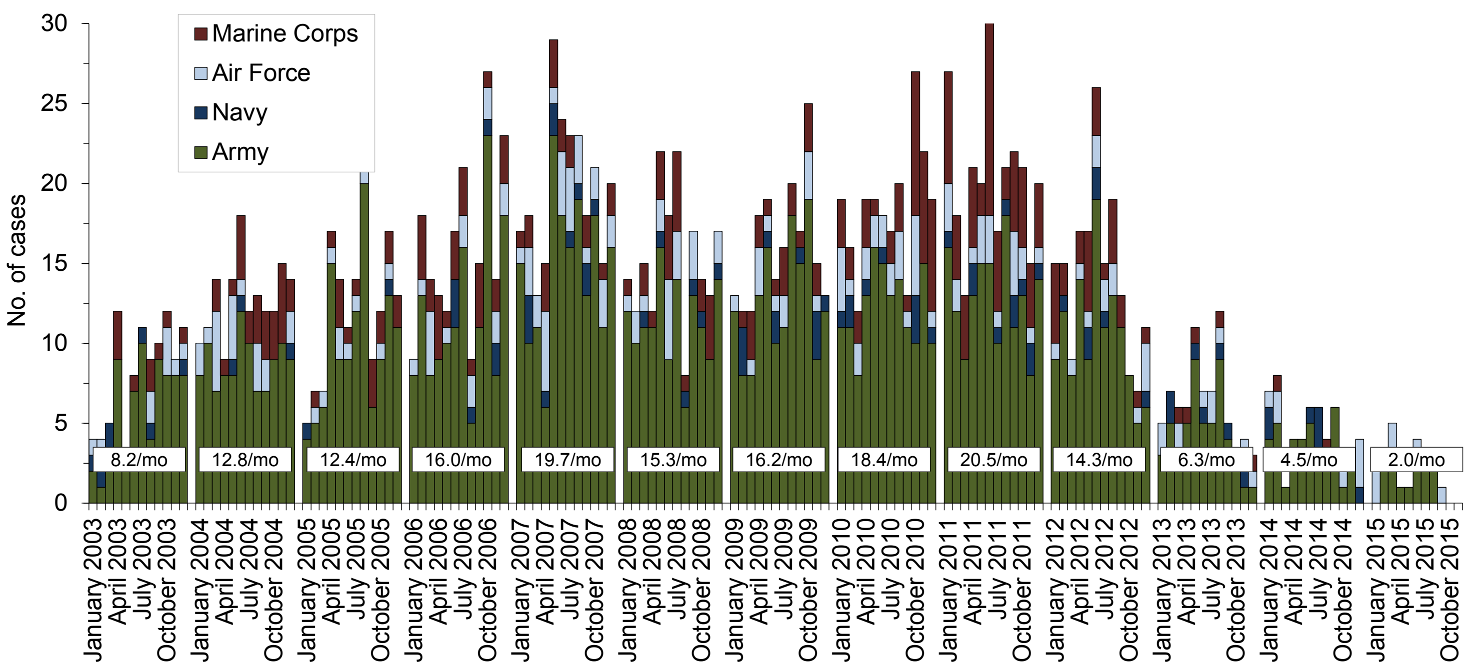
Traumatic brain injury (TBI) (ICD-9: 310.2, 800–801, 803–804, 850–854, 907.0, 950.1–950.3, 959.01, V15.5_1–9, V15.5_A–F, V15.52_0–9, V15.52_A–F, V15.59_1–9, V15.59_A–F)[a]



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 4,636 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]

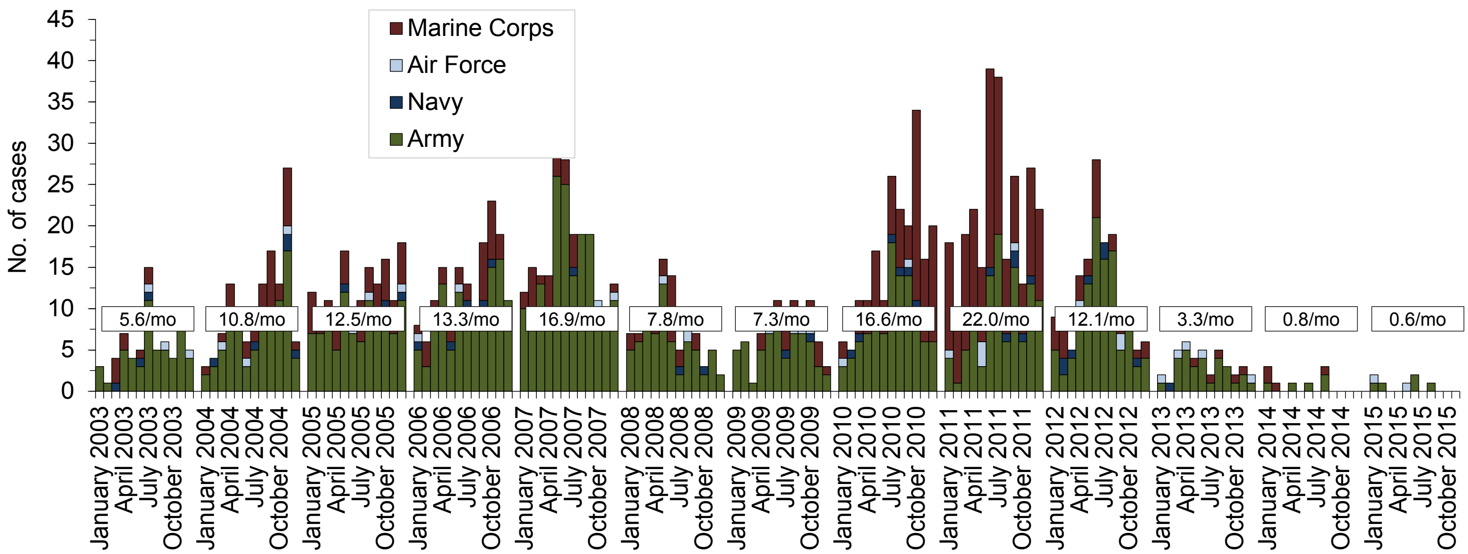


Reference: Isenbarger DW, Atwood JE, Scott PT, et al. Venous thromboembolism among United States soldiers deployed to Southwest Asia. *Thromb Res*. 2006;117(4):379–383.

[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.

Deployment-related Conditions of Special Surveillance Interest, U.S. Armed Forces, by Month and Service, January 2003–November 2015 (data as of 18 December 2015)

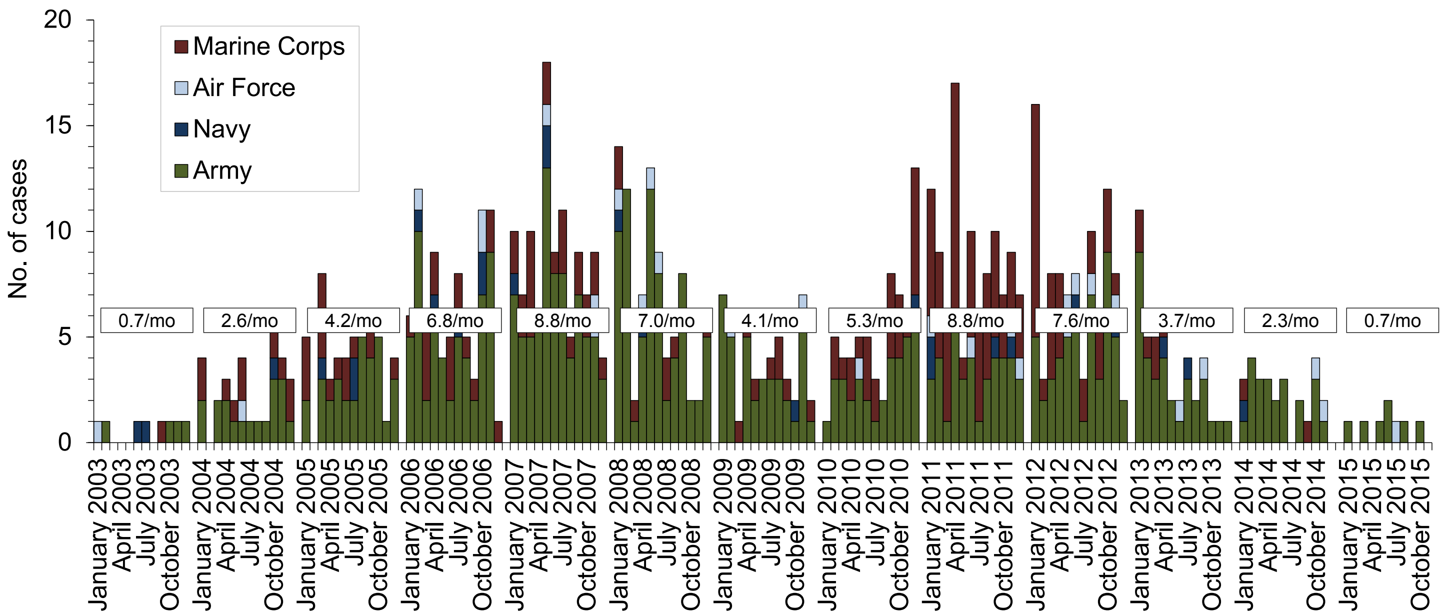
Amputations (ICD-9-CM: 887, 896, 897, V49.6 except V49.61–V49.62, V49.7 except V49.71–V49.72, PR 84.0–PR 84.1, except PR 84.01–PR 84.02 and PR 84.11)[a]



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]

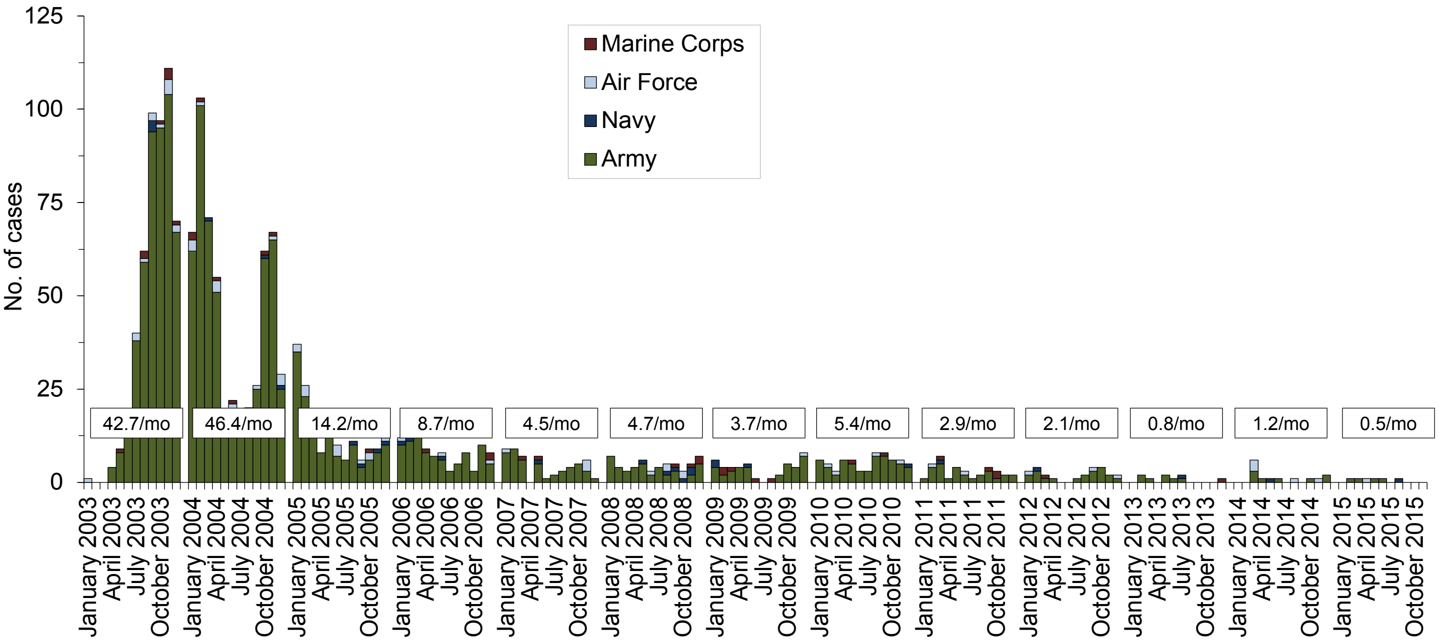


Reference: Army Medical Surveillance Activity. Heterotopic ossification, active components, U.S. Armed Forces, 2002–2007. *MSMR*. 2007;14(5):7–9.

[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–November 2015 (data as of 18 December 2015)

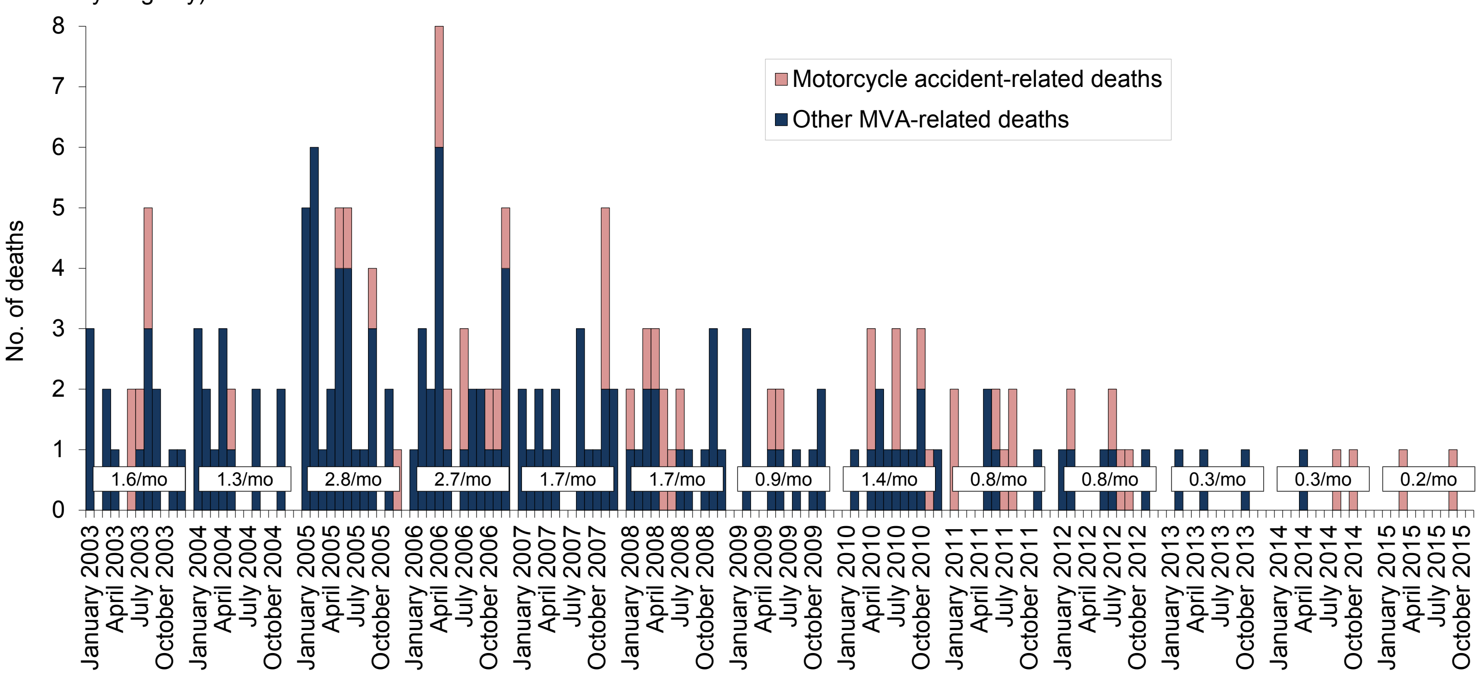
Leishmaniasis (ICD-9: 085.0–085.9)[b]



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.

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

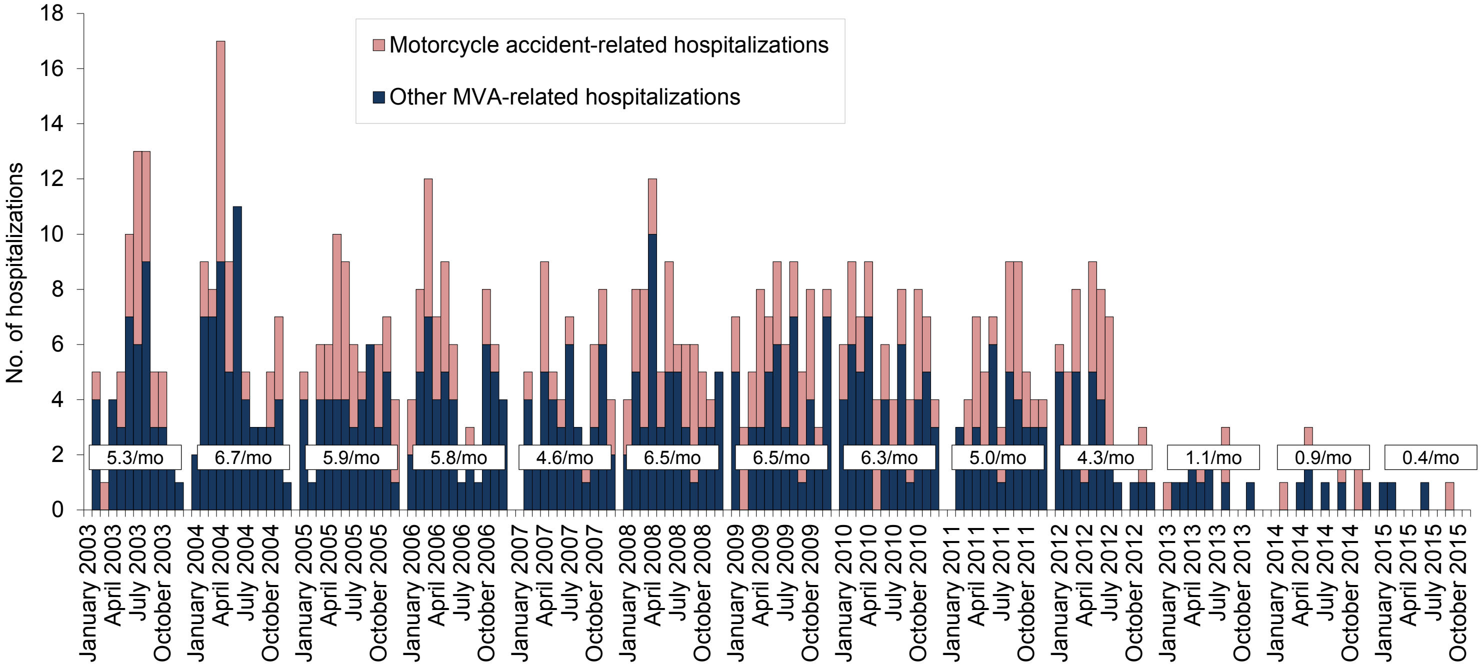


Reference: Armed Forces Health Surveillance Center. Motor vehicle-related deaths, U.S. Armed Forces, 2010. *MSMR*. 2011;17(3):2–6.

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.

Deployment-related Conditions of Special Surveillance Interest, U.S. Armed Forces, by Month and Service, January 2003–November 2015 (data as of 18 December 2015)

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.

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