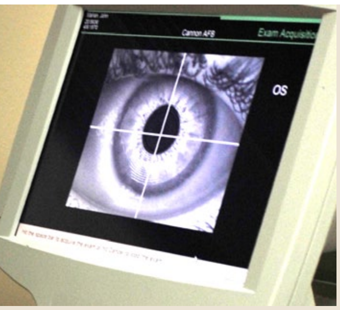
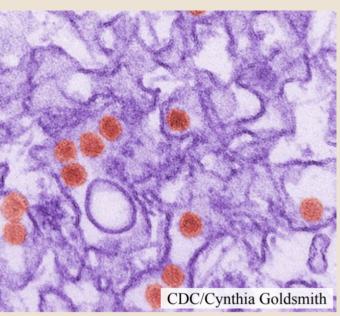
MAY 2016

Volume 23
Number 5

MSMR

MEDICAL SURVEILLANCE MONTHLY REPORT





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A publication of the Armed Forces Health Surveillance Branch

Post-Refractive Surgery Complications and Eye Disease, Active Component, U.S. Armed Forces, 2005–2014

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Refractive surgery (RS) is a common procedure in the U.S. military population. This report provides an estimation of incident RS for vision correction purposes in the active component of the U.S. military from 1 January 2005 through 31 December 2014 and the prevalence of post-RS complications and eye disease in the 1-year period after RS. During the surveillance period, a total of 121,571 subjects without a diagnosis of eye disease other than hyperopia, myopia, or astigmatism in the previous year received a single incident RS procedure. In the 1-year period after RS, 5.3% of subjects with preoperative hyperopia or myopia had treatment-persistent (unresolved) hyperopia or myopia; 2.0% of subjects with preoperative astigmatism had treatment-persistent (unresolved) astigmatism; and 3.8% were diagnosed with tear film insufficiency. In general, most outcomes showed higher prevalences in Army and Air Force personnel versus Navy and Marine Corps personnel, in women versus men, in officer versus enlisted personnel, and in aviation and Special Forces personnel. A wide variation in outcome prevalences was noted by procedural military treatment facility.

In the past 20 years, refractive surgery (RS) has become an increasingly common procedure to correct visual refractive error in otherwise healthy adults who desire an alternative to traditional glasses and contact lenses. An estimated 1 million to 2 million persons in the U.S. annually receive corneal RS for various eye disease and vision correction purposes.[1–3] Although there are many forms and uses of RS, the most common types utilized to correct refractive error from myopia (nearsightedness), hyperopia (farsightedness), and astigmatism in healthy adults are laser-assisted in situ keratomileusis (LASIK), photorefractive keratectomy (PRK), and laser epithelial keratomileusis (LASEK).[1,4–6] Compared to the general population, military personnel have an increased interest in RS because normal or near-normal uncorrected visual acuity (UCVA) is highly advantageous in a deployed or combat environment and for careers in aviation and Special Forces.[2,7,8] A significant percentage of military service academy cadets and reserve officer training corps personnel undergo RS prior to college graduation and entry into active duty military service. In addition, many active duty personnel obtain these procedures to change or maintain their professional qualifications.[2,7,8] When service members achieve normal UCVA after RS, the military medical departments realize reductions in the healthcare burden and associated costs of periodic eye examinations and the provision of eyeglasses, contact lenses, gas-mask inserts, and related eye care supplies for those personnel.

Although a majority of patients (greater than 90%) who receive RS can expect to have postsurgical uncorrected visual acuity (UCVA) of 20/40 or better and report a high degree of procedural satisfaction,[1,5,9,10] patients must be carefully screened, and some may experience complications that can adversely affect their vision, quality of life, and career opportunities. Personnel with postsurgical complications or eye disease may also represent a short- or long-term loss of service and training investment to the military. The most common post-RS adverse outcomes include residual refractive error (UCVA worse than 20/40), dry eye symptoms, and nighttime visual disturbances such as ghosting, glares, and halos.[3,5,6,9,11–15] Less common complications, but potentially more significant with respect to long-term outcomes and overall satisfaction, are corneal and conjunctival disease, infection, and glaucoma. Although many of these adverse outcomes are transient and may be corrected or mitigated within the first year of follow-up, a small percentage of patients (less than 1%) are at risk of experiencing varying degrees of problems with permanent vision or other eye-related health.

With approximately 60% of the U.S. population and 33% of U.S. military personnel living with a refractive error, demand for RS is likely to remain high.[2,10,16] This is especially true in adults who desire a career or are currently working in fields in which normal or near-normal UCVA is advantageous or required, such as aviation, emergency response, and construction. From a U.S. military force capability perspective, especially in the aviation and Special Forces communities, the availability of RS to normalize UCVA allows for an increase in the available recruit population, enables currently trained personnel to maintain qualifications, improves individual warfighting performance, and reduces the extent of manpower and logistical support necessary to provide corrective glasses and contact lenses to personnel with refractive error. Given the high demand for RS, even a relatively low complication rate (less than 1%) represents an important area of study from a public health and military readiness perspective.

RS in military personnel has been studied as early as 1993[17]; however, the epidemiology of this procedure within the military and the prevalences of, and associated risk factors for, postsurgical adverse outcomes have not been fully described. The objective of this study was to estimate the annual incidence of RS within the military and the prevalences of post-RS complications and eye disease within the 1-year period after RS at military treatment facilities (MTFs) in healthy active component personnel with refractive error due to myopia, hyperopia, or astigmatism. The study cohort was selected from active component personnel who received an incident refractive surgical procedure between 1 January 2005 and 31 December 2014. A prevalence comparison was conducted for multiple post-RS outcome diagnoses by demographic characteristics such as service branch, gender, age, rank, deployment within 1 year after RS, and the procedural MTF.

METHODS

The Defense Medical Surveillance System (DMSS), maintained by the Armed Forces Health Surveillance Branch, was used to identify the study population, demographics, deployment status, and outcomes of interest. Incident RS and postsurgical complications and eye disease were derived from medical encounter administrative records (diagnosis and procedural codes) maintained in the DMSS **(Table 1).** The study population consisted of all individuals who served in the active component of the U.S. Navy, Army, Air Force, or Marine Corps at any point between 1 January 2005 and 31 December 2014 whose health records documented an identifiable incident LASIK, PRK, or LASEK RS procedure for the correction of refractive error (myopia, hyperopia, or astigmatism). Incident RS events were identified from current procedural terminology (CPT) codes recorded during a LASIK, PRK, and LASEK surgical procedure. Currently, the same CPT code is used for both PRK and LASEK (S0810).

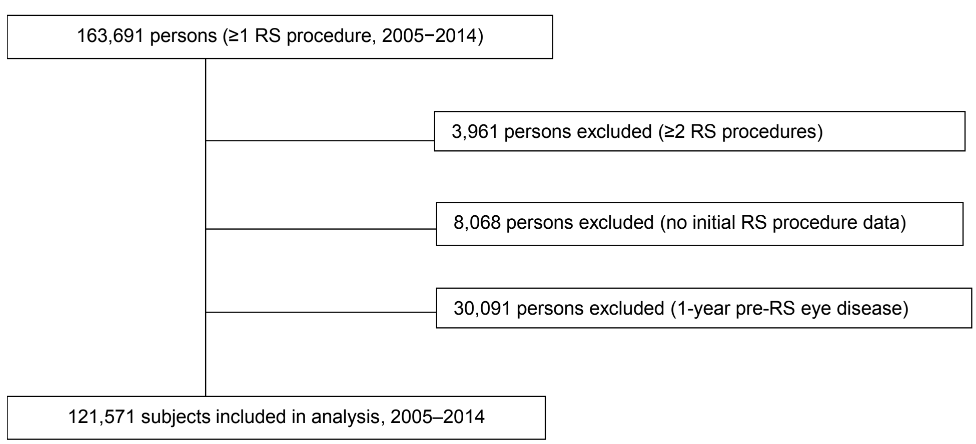
Because the objective of the study was to evaluate postsurgical complications and eye disease in otherwise healthy service members, persons with multiple RS procedures or persons with eye disease (other than refractive error) in the 1-year period prior to RS were excluded from the study population. As detailed in **Figure 1**, a total of 163,691 service members underwent one or more RS procedures during the surveillance period. A total of 3,961 persons had two or more RS procedures and were excluded. Another 8,068 persons were identified from post-RS follow-up medical encounters as having had RS; however, they were excluded because the initial RS procedure medical encounter and its date could not be identified within the DMSS. Finally, 30,091 persons were excluded due to pre-existing eye disease (other than refractive error) in the 1-year period prior to RS. After these exclusions, the records of 121,571 subjects were available for analysis.

From the final subject population, diagnoses of postsurgical complications and eye disease were identified from ICD-9 diagnostic codes recorded in any diagnostic position of an outpatient medical encounter in the 1-year period after an incident RS **(Table 1)**. Subjects with incident RS procedures up to 30 September 2014 were evaluated for the selected outcomes diagnoses for 1 year extending, as applicable, into calendar year 2015. However, due to the change from ICD-9 to ICD-10 coding within the Military Health System on 1 October 2015, subjects with incident RS procedures from 1 October 2014 through 31 December 2014 were followed for outcome diagnoses only up to 30 September 2015. The analysis used counts of incident RS procedures by each calendar year during the surveillance period and counts of postsurgical complications and eye disease in the 1-year period after RS. Prevalences of postsurgical complications and eye disease were stratified by service branch, sex, age, rank, deployment within 1 year after RS, and procedural MTF.

TABLE 1. CPT and ICD-9 diagnostic codes, post-refractive surgery and eye disease complications

Description	CPT and ICD-9 codes
LASIK	S0800
PRK/LASEK	S0810
Postoperative follow-up	99024, 92012, 92105, V58.71, V67.09, V45.69, V67.00
Refractive error	367.0, 367.1, 367.31, 367.8x, 367.9
Astigmatism	367.2x
Tear film insufficiency	375.15
Superficial keratitis	370.2x
Visual disturbance	368.x
Corneal disease	371.x
Conjunctival disease	372.x
Infection/ inflammation	360.0x, 360.1x, 373.x, 375.x, 379.6x
Glaucoma	365.x

FIGURE 1. Selection process for post-refractive surgery (RS) study subjects



RESULTS

A total of 121,571 subjects without eye disease in the preceding year (other than refractive error) underwent an initial RS procedure during the period 1 January 2005 through 31 December 2014. The incidence rates of RS per 10,000 service members by service and calendar year are shown for subjects receiving LASIK, PRK/LASEK, and total RS procedures in **Figures 2–4,** respectively. Annual RS procedure incidence rates during the surveillance period increased moderately from 69.3 per 10,000 persons in 2005 to 84.5 per 10,000 in 2014. Incidence peaked at 94.4 per 10,000 persons in 2013 and was lowest in 2010 at 51.9 per 10,000 persons. A general trend of increasing rates for all services was demonstrated for both LASIK and PRK/LASEK from 2005 to 2014. During the surveillance period, the Army had the highest incidence of RS. PRK/LASEK was performed approximately three to 10 times more frequently than LASIK over the surveillance period. However, this ratio decreased over time, consistent with the gradual acceptance of LASIK as a safe procedure for military personnel likely to serve in combat environments and in the operational environments of aviation and Special Forces personnel.[18–21]

Overall prevalences of postsurgical complications and eye disease in the first year after RS for the entire surveillance period are shown in **Table 2**. Diagnoses in the upper portion of the table (separated by the bolded line) represent outcomes that typically occur more frequently after RS and have a lower potential to impact short- or long-term patient satisfaction or military readiness. Additionally, these outcomes may be associated with subjective patient perceptions such as the level of visual acuity expected after RS, the severity of dry eye symptoms from tear film insufficiency or superficial keratitis, and the severity of nighttime visual disturbances. Furthermore, some of these outcomes, although diagnosed within the first year after RS, often resolve during this same time period with no impact on patient satisfaction or military readiness. Diagnoses in the lower portion of the table are outcomes that

FIGURE 2. Annual incidence rates of laser-assisted in situ keratomileusis (LASIK) surgeries, by service, U.S. Armed Forces, 2005–2014

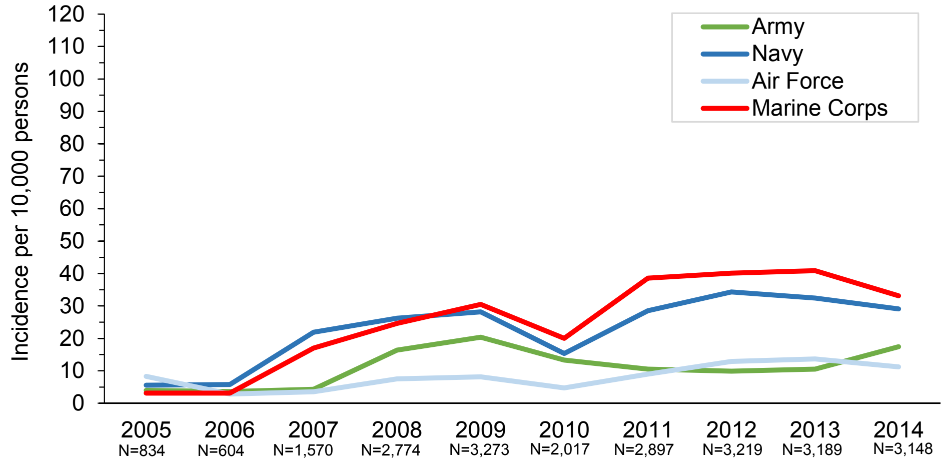


FIGURE 3. Annual incidence rates of photorefractive keratectomy (PRK) or laser epithelial keratomileusis (LASEK) surgeries, by service, U.S. Armed Forces, 2005–2014

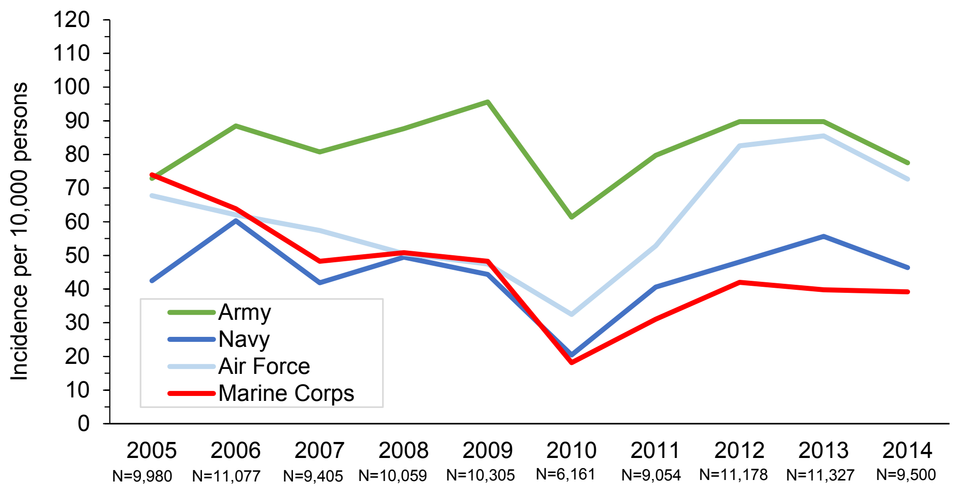


FIGURE 4. Annual incidence rates of all refractive surgeries (LASIK and PRK/LASEK), by service, U.S. Armed Forces, 2005–2014

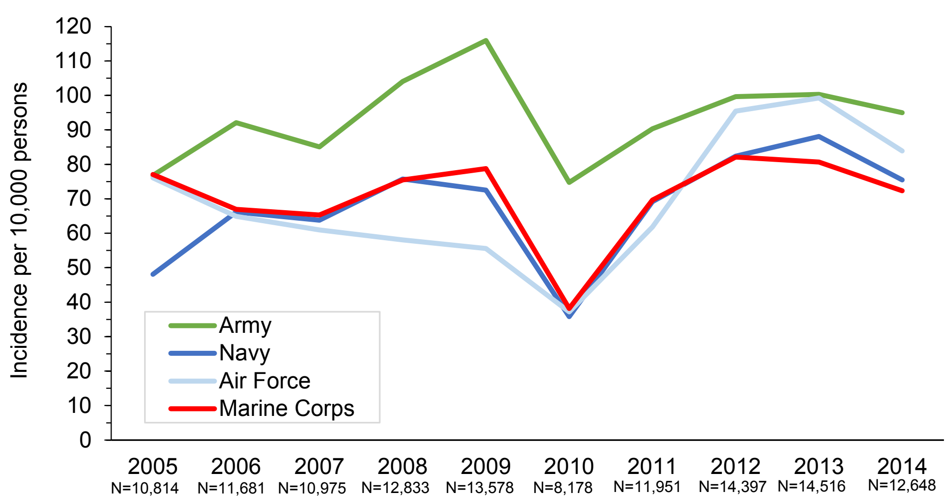


TABLE 2. Prevalence of 1-year post-refractive surgery (RS) complications and eye disease, U.S. Armed Forces, 2005–2014

Description	LASIK (N)	LASIK (%)	PRK[a] (N)	PRK[a] (%)	Total (N)	Total (%)
Myopia/hyperopia (present pre-RS)	1,017	4.3	5,436	5.6	6,453	5.3
Myopia/hyperopia (absent pre-RS)	2	3.2	20	6.1	22	5.6
Astigmatism (present pre-RS)	414	1.9	1,811	2.0	2,225	2.0
Astigmatism (absent pre-RS)	79	5.9	409	4.5	488	4.7
Tear film insufficiency	734	3.1	3,852	3.9	4,586	3.8
Superficial keratitis	82	0.3	292	0.3	374	0.3
Visual disturbance[b]	157	0.7	794	0.8	951	0.8
Corneal disease	460	2.0	1,944	2.0	2,404	2.0
Conjunctival disease	410	1.7	2,119	2.2	2,529	2.1
Infection/inflammation	227	1.0	1,264	1.3	1,491	1.2
Glaucoma	47	0.2	618	0.6	665	0.5

LASIK,laser-assisted in situ keratomileusis; PRK, photorefractive keratectomy.
[a]PRK includes laser epithelial keratomileusis (LASEK) procedures.
[b]Visual disturbance includes subjective complaints such as diplopia, field defects, and nighttime vision issues such as ghosting, glare, halos, and starbursts.

typically occur less frequently after RS, have a higher potential to impact patient satisfaction and military readiness, and are less likely to resolve within the first year after RS. For all outcomes, except treatment-emergent astigmatism (i.e., astigmatism not present before RS), PRK/LASEK had equal or higher prevalences compared to LASIK.

Figure 5 displays the estimated proportion of otherwise healthy service members with incident RS for vision correction, by demographic characteristics, for the entire surveillance period. For example, 0.5% of all personnel in the Army during 2005–2014, without prior eye disease in the previous year, received an incident LASIK RS procedure and another 3.6% received an incident PRK/LASEK RS procedure. Proportions of incident RS were lower in the other services during the same time period. By occupation, Special Forces members had the highest proportion of RS procedures with 1.5% receiving LASIK and another 9.8% receiving PRK/LASEK. During the surveillance period 3.4% of all service members received RS for vision correction; this overall proportion is indicated by the dotted red line in **Figure 5.**

Figure 6 displays the number of RS procedures by procedural MTF during the surveillance period. PRK was performed more often at all MTFs other than Camp Pendleton and Naval Medical Center San Diego. The Marine Corps does not have its own service component medical facilities and these personnel are usually treated at Navy medical facilities. The facility designated as Washington, DC, includes incident RS counts from locations labeled in DMSS as Bethesda, MD; Fort Belvoir, VA; and Washington, DC.

FIGURE 5. Percentage of healthy service members with incident refractive surgery (laser-assisted in situ keratomileusis [LASIK] or photorefractive keratectomy/laser epithelial keratomileusis [PRK/LASEK]) for vision correction, by demographics, U.S. Armed Forces, 2005–2014

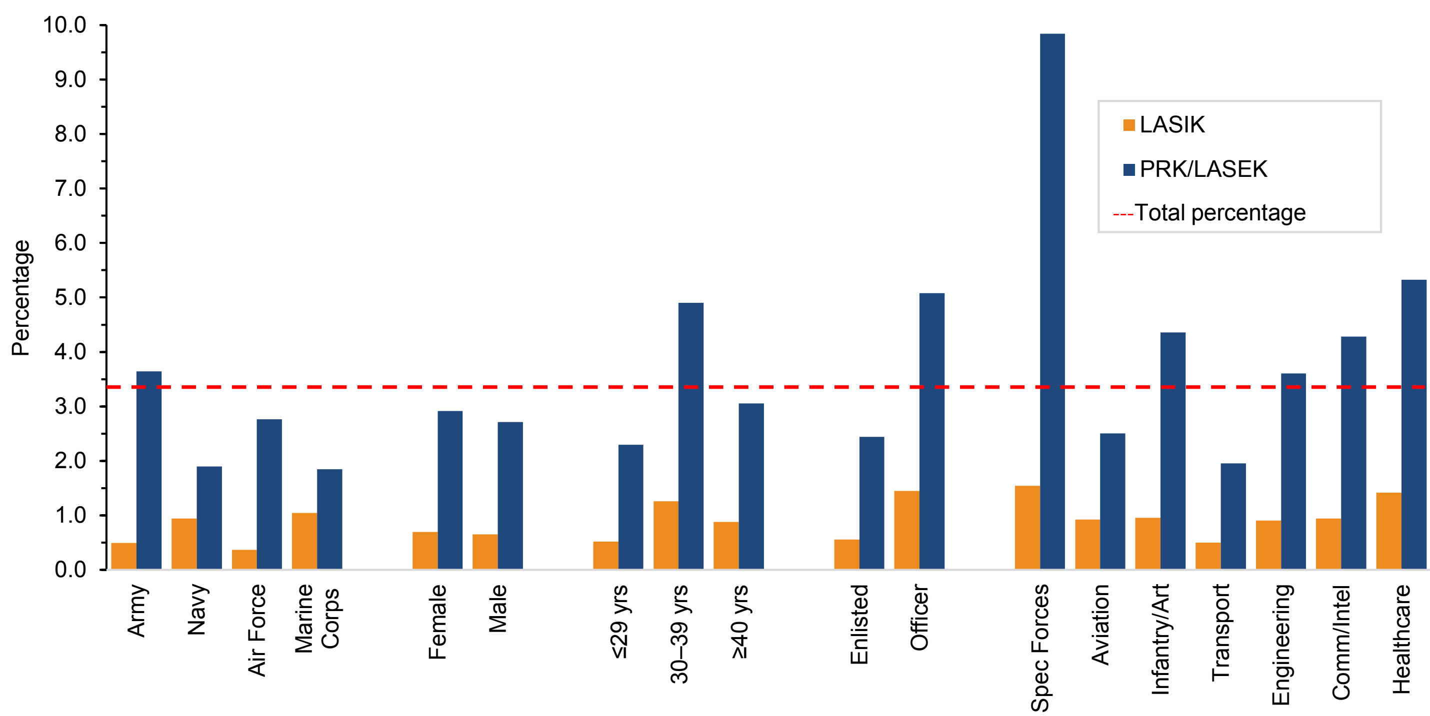
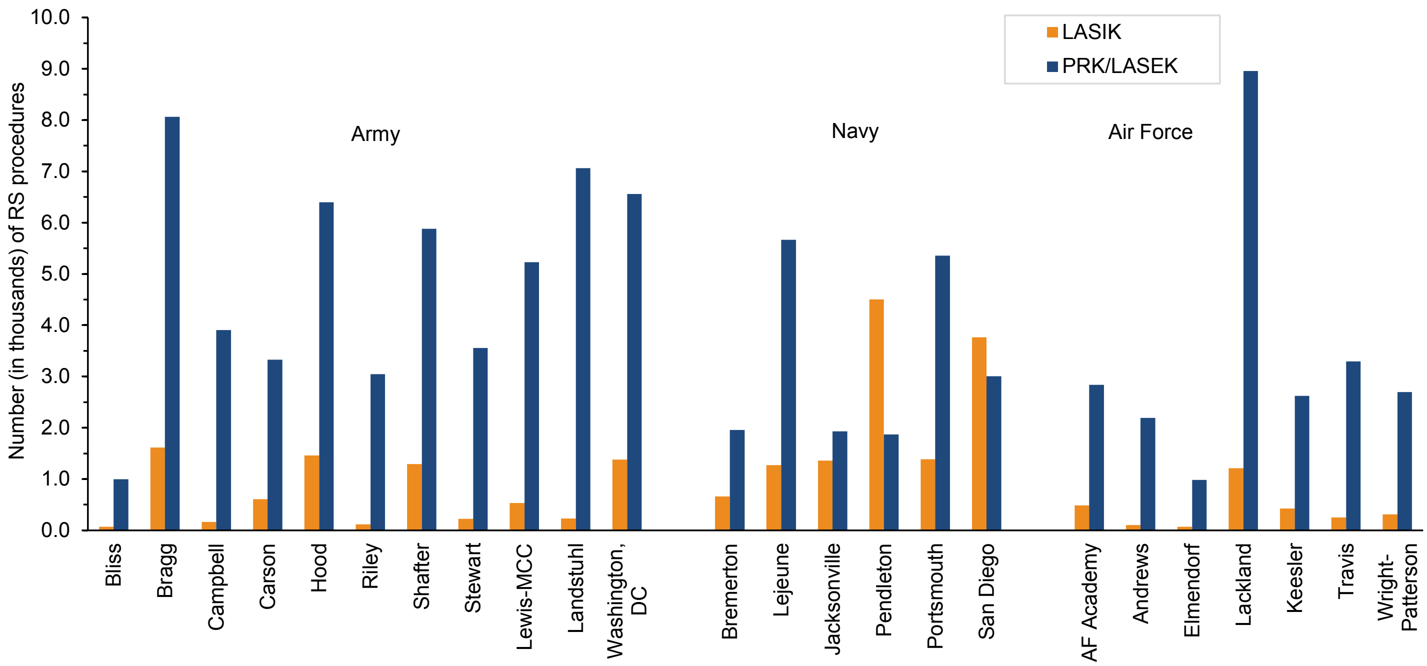


FIGURE 6. Number (in thousands) of refractive surgery procedures by medical treatment facility, by service, U.S. Armed Forces,[a] 2005–2014



LASIK, laser-assisted in situ keratomileusis; PRK, photorefractive keratectomy; LASEK, laser epithelial keratomileusis

[a]The Marine Corps is not represented here because it does not have its own service component medical facilities. Marine Corps personnel are usually treated at Navy medical facilities.

Tables 3–6 list the overall number and prevalences of 1-year postsurgical complications and eye disease by demographics and location of procedural MTF. Similar to **Table 2**, post-RS outcomes for myopia/hyperopia and astigmatism are separated into treatment-persistent and treatment-emergent outcomes. However, the results for treatment-emergent myopia/hyperopia are not presented because only 22 subjects were in this category.

A generally consistent trend for each outcome by the various demographic characteristics was observed. Army and Air Force personnel had higher prevalences for most outcomes than Navy and Marine Corps personnel. Additionally, female versus male subjects, subjects of increased age, officers versus enlisted, subjects in the aviation and Special Forces occupations, and subjects who did not deploy in the first year after RS generally had higher prevalences of most outcomes. With respect to location of procedural MTF, a wide variation in outcome prevalences was observed with no single MTF demonstrating a consistently high or low prevalence of any outcome. Army and Air Force MTFs generally had higher prevalences of each outcome, an observation that is consistent with the trend observed in Army and Air Force personnel. However, service members are not restricted to receiving treatment at MTFs that match their service branch (i.e., Army personnel can receive treatment at Navy MTFs and vice versa).

EDITORIAL COMMENT

This report provides an estimation of the incidence of RS for the correction of refractive error in otherwise healthy active component military personnel from 2005–2014. The prevalence of post-RS complications and eye disease in these personnel by various demographic characteristics and procedural MTF was also estimated. The outcomes with the highest prevalences, post-RS myopia, hyperopia, astigmatism, and dry eye symptoms from tear film insufficiency and superficial keratitis, were consistent with results from published case reports of dissatisfied patients who received RS for vision correction.[11,15] In those studies, visual disturbances were also a common post-RS complaint, but the overall prevalence in this study was only 0.8%. A comparison of the prevalences of post-RS corneal disease, conjunctival disease, infection/inflammation, and glaucoma to other studies could not be conducted due to limited epidemiologic data in the published literature.

A key finding of this study is that RS is a common procedure in the military with approximately 1% of otherwise healthy active component personnel receiving RS annually. This is approximately twice the annual rate in the general U.S. population.[1–3] Post-RS complications and eye disease are common, occurring in approximately 0.5%–5% of study subjects in the 1-year period after RS. PRK/LASEK is the preferred procedure in the military for correction of refractive error; however, utilization of LASIK became more common during the surveillance period. For all outcomes, except treatment-emergent astigmatism, PRK/LASEK had equal or higher prevalences compared to LASIK. In general, most outcomes showed higher prevalences

TABLE 3. Number and prevalence of 1-year post-refractive surgery (RS) complications and eye disease, U.S. Armed Forces, 2005–2014

	Refractive error (present pre-op)						Astigmatism (present pre-op)						Astigmatism (absent pre-op)					
	LASIK (N)	LASIK (%)	PRK[a] (N)	PRK[a] (%)	Total (N)	Total (%)	LASIK (N)	LASIK (%)	PRK[a] (N)	PRK[a] (%)	Total (N)	Total (%)	LASIK (N)	LASIK (%)	PRK[a] (N)	PRK[a] (%)	Total (N)	Total (%)
Service																		
Army	438	6.6	2,227	4.5	2,665	4.8	131	2.1	740	1.7	871	1.8	41	8.2	226	3.9	267	4.2
Navy	224	2.7	826	5.0	1,050	4.3	153	2.0	371	2.4	524	2.3	27	5.5	58	4.5	85	4.7
Air Force	214	7.2	1,949	8.8	2,163	8.6	65	2.3	537	2.6	602	2.5	7	5.7	102	7.7	109	7.5
Marine Corps	141	2.5	434	4.3	575	3.7	65	1.2	163	1.7	228	1.5	4	1.8	23	3.4	27	3.0
Gender																		
Female	210	5.3	1,057	6.4	1,267	6.2	108	3.0	409	2.8	517	2.8	27	9.6	98	6.3	125	6.8
Male	807	4.1	4,379	5.4	5,186	5.1	306	1.7	1,402	1.9	1,708	1.8	52	4.9	311	4.1	363	4.2
Age (years)																		
≤29	626	4.3	3,244	5.1	3,870	4.9	215	1.6	999	1.8	1,214	1.7	61	6.3	295	4.1	356	4.4
30–39	302	4.4	1,697	6.4	1,999	6.0	141	2.1	596	2.4	737	2.3	11	3.9	85	5.3	96	5.1
≥40	89	4.3	495	6.9	584	6.4	58	2.9	216	3.2	274	3.1	7	8.4	29	8.4	36	8.4
Rank																		
Enlisted	739	4.2	3,957	5.1	4,696	5.0	277	1.7	1,328	1.9	1,605	1.9	60	6.4	298	4.3	358	4.5
Officer	278	4.6	1,479	7.1	1,757	6.6	137	2.4	483	2.6	620	2.5	19	4.8	111	5.1	130	5.1
Occupation																		
Special Forces	7	8.2	33	6.1	40	6.3	3	3.9	4	0.9	7	1.3	1	11.1	4	4.7	5	5.3
Aviation	28	3.9	174	8.8	202	7.5	12	1.7	66	3.5	78	3.0	3	9.1	6	7.7	9	8.1
Infantry	143	4.0	681	4.2	824	4.2	44	1.3	220	1.5	264	1.5	12	5.8	65	3.4	77	3.7
Transport	24	3.8	111	4.5	135	4.4	7	1.2	39	1.7	46	1.6	2	5.0	5	2.2	7	2.6
Engineer	237	3.6	1,432	5.4	1,669	5.0	124	2.0	493	2.0	617	2.0	20	5.8	91	3.9	111	4.2
Comm/intel	240	4.5	1,345	5.6	1,585	5.4	95	1.9	437	2.0	532	2.0	13	4.7	106	4.9	119	4.9
Health care	177	5.3	751	6.0	928	5.8	79	2.5	278	2.4	357	2.5	18	7.8	62	5.1	80	5.5
1 year post RS																		
Not deployed	996	5.0	5,339	6.8	6,335	6.4	405	2.1	1,783	2.5	2,188	2.4	78	6.9	396	5.8	474	6.0
Deployed	21	0.6	97	0.5	118	0.5	9	0.3	28	0.2	37	0.2	1	0.5	13	0.6	14	0.6
Army facilities																		
Fort Bliss	3	4.5	32	3.2	35	3.3	4	6.2	35	3.6	39	3.8	0	0.0	0	0.0	0	0.0
Fort Bragg	296	18.3	891	11.0	1,187	12.3	44	2.9	148	2.0	192	2.2	20	25.3	89	11.0	109	12.3
Fort Campbell	3	1.9	50	1.3	53	1.3	1	0.7	11	0.3	12	0.3	1	6.7	3	1.1	4	1.4
Fort Carson	9	1.5	42	1.3	51	1.3	5	1.1	34	1.3	39	1.3	5	3.7	9	1.1	14	1.5
Fort Hood	28	1.9	179	2.8	207	2.6	23	1.7	84	1.7	107	1.7	3	3.0	41	2.8	44	2.9
Fort Riley	4	3.5	48	1.6	52	1.7	3	2.9	11	0.4	14	0.5	1	10.0	4	1.2	5	1.4
Fort Shafter	27	2.1	189	3.2	216	3.0	27	2.2	124	2.3	151	2.2	2	3.5	20	5.3	22	5.1
Fort Stewart	5	2.3	66	1.9	71	1.9	3	1.5	34	1.1	37	1.2	2	8.0	11	2.0	13	2.3
Joint Base Lewis-McCord	13	2.4	187	3.6	200	3.5	4	0.8	105	2.0	109	1.9	2	25.0	5	6.9	7	8.8
Landstuhl RMC	24	10.5	470	6.7	494	6.8	12	5.6	199	3.0	211	3.1	1	7.1	29	6.9	30	6.9
Washington, DC[b]	83	6.0	451	6.9	534	6.7	59	4.6	178	3.0	237	3.3	11	10.8	41	7.2	52	7.7
Navy facilities																		
NH Bremerton	22	3.3	67	3.4	89	3.4	14	2.3	37	2.1	51	2.1	1	2.5	4	2.5	5	2.5
Camp Lejeune	24	1.9	236	4.2	260	3.8	23	2.0	53	1.0	76	1.2	2	1.5	2	0.5	4	0.8
NH Jacksonville	61	4.5	96	5.0	157	4.8	27	2.1	50	2.8	77	2.5	3	5.6	10	7.9	13	7.2
Camp Pendleton	130	2.9	88	4.7	218	3.4	35	0.8	33	1.9	68	1.1	2	4.9	8	4.6	10	4.7
NMC Portsmouth	28	2.0	308	5.8	336	5.0	23	1.8	117	2.4	140	2.2	1	1.3	21	5.3	22	4.6
NMC San Diego	60	1.6	96	3.2	156	2.3	52	1.5	46	1.7	98	1.6	13	4.8	7	2.8	20	3.9
Air Force facilities																		
AF Academy	56	11.6	405	14.3	461	13.9	10	2.1	42	1.5	52	1.6	0	0.0	4	3.6	4	3.3
Andrews AFB	9	8.8	249	11.5	258	11.4	6	6.3	106	5.6	112	5.7	1	12.5	22	7.2	23	7.4
Elmendorf AFB	2	2.9	73	7.4	75	7.1	1	1.6	28	3.2	29	3.1	0	0.0	5	5.3	5	4.9
Lackland AFB	66	5.4	504	5.6	570	5.6	13	1.1	80	0.9	93	1.0	1	2.4	15	4.0	16	3.9
Keesler AFB	30	7.1	151	5.8	181	6.0	14	4.0	117	5.2	131	5.0	4	5.3	16	4.2	20	4.4
Travis AFB	15	6.0	262	8.0	277	7.8	5	2.1	81	2.7	86	2.7	1	12.5	19	6.1	20	6.3
Wright-Patterson AFB	18	5.7	273	10.1	291	9.7	5	1.6	43	1.7	48	1.7	2	28.6	14	13.6	16	14.5

LASIK, laser-assisted in situ keratomileusis; PRK, photorefractive keratectomy

[a]PRK includes laser epithelial keratomileusis (LASEK) procedures.

[b]Includes incident RS counts from locations labeled in DMSS as Bethesda, MD; Fort Belvoir, VA; and Washington, DC.

TABLE 4. Number and prevalence of 1-year post-refractive surgery (RS) complications and eye disease, U.S. Armed Forces, 2005–2014

	Tear film insufficiency						Superficial keratitis						Visual disturbance[b]					
	LASIK (N)	LASIK (%)	PRK[a] (N)	PRK[a] (%)	Total (N)	Total (%)	LASIK (N)	LASIK (%)	PRK[a] (N)	PRK[a] (%)	Total (N)	Total (%)	LASIK (N)	LASIK (%)	PRK[a] (N)	PRK[a] (%)	Total (N)	Total (%)
Service																		
Army	223	3.3	1,905	3.9	2,128	3.8	23	0.3	127	0.3	150	0.3	66	1.0	432	0.9	498	0.9
Navy	238	2.9	561	3.4	799	3.2	30	0.4	54	0.3	84	0.3	42	0.5	109	0.7	151	0.6
Air Force	131	4.4	1,110	5.0	1,241	4.9	12	0.4	81	0.4	93	0.4	27	0.9	207	0.9	234	0.9
Marine Corps	142	2.5	276	2.7	418	2.7	17	0.3	30	0.3	47	0.3	22	0.4	46	0.5	68	0.4
Gender																		
Female	194	4.9	1,021	6.2	1,215	6.0	31	0.8	50	0.3	81	0.4	40	1.0	192	1.2	232	1.1
Male	540	2.8	2,831	3.5	3,371	3.3	51	0.3	242	0.3	293	0.3	117	0.6	602	0.7	719	0.7
Age																		
≤29	403	2.8	2,121	3.3	2,524	3.2	44	0.3	188	0.3	232	0.3	91	0.6	495	0.8	586	0.7
30–39	240	3.5	1,249	4.7	1,489	4.4	33	0.5	79	0.3	112	0.3	47	0.7	226	0.8	273	0.8
≥40	91	4.4	482	6.8	573	6.2	5	0.2	25	0.4	30	0.3	19	0.9	73	1.0	92	1.0
Rank																		
Enlisted	421	2.4	2,290	3.0	2,711	2.9	55	0.3	179	0.2	234	0.2	118	0.7	633	0.8	751	0.8
Officer	313	5.2	1,562	7.4	1,875	6.9	27	0.5	113	0.5	140	0.5	39	0.7	161	0.8	200	0.7
Occupation																		
Special Forces	1	1.2	10	1.8	11	1.7	0	0.0	1	0.2	1	0.2	2	2.3	2	0.4	4	0.6
Aviation	20	2.7	82	4.2	102	3.8	3	0.4	4	0.2	7	0.3	5	0.7	10	0.5	15	0.6
Infantry	78	2.2	458	2.8	536	2.7	3	0.1	34	0.2	37	0.2	25	0.7	116	0.7	141	0.7
Transport	20	3.2	88	3.6	108	3.5	1	0.2	10	0.4	11	0.4	0	0.0	22	0.9	22	0.7
Engineer	181	2.7	921	3.5	1,102	3.3	23	0.3	76	0.3	99	0.3	38	0.6	181	0.7	219	0.7
Comm/intel	185	3.5	1,047	4.3	1,232	4.2	25	0.5	77	0.3	102	0.3	47	0.9	191	0.8	238	0.8
Health care	139	4.1	659	5.2	798	5.0	17	0.5	42	0.3	59	0.4	17	0.5	132	1.0	149	0.9
1 year post-RS																		
Not deployed	718	3.6	3,789	4.8	4,507	4.6	80	0.4	291	0.4	371	0.4	156	0.8	778	1.0	934	0.9
Deployed	16	0.5	63	0.3	79	0.3	2	0.1	1	0.0	3	0.0	1	0.0	16	0.1	17	0.1
Army facilities																		
Fort Bliss	2	3.0	44	4.4	46	4.3	0	0.0	2	0.2	2	0.2	0	0.0	9	0.9	9	0.8
Fort Bragg	29	1.8	275	3.4	304	3.1	2	0.1	10	0.1	12	0.1	7	0.4	53	0.7	60	0.6
Fort Campbell	9	5.6	106	2.7	115	2.8	0	0.0	2	0.1	2	0.0	2	1.2	37	0.9	39	1.0
Fort Carson	14	2.3	90	2.7	104	2.6	2	0.3	3	0.1	5	0.1	3	0.5	25	0.8	28	0.7
Fort Hood	42	2.9	144	2.3	186	2.4	7	0.5	32	0.5	39	0.5	19	1.3	87	1.4	106	1.3
Fort Riley	8	7.0	101	3.3	109	3.4	0	0.0	16	0.5	16	0.5	1	0.9	23	0.8	24	0.8
Fort Shafter	33	2.6	135	2.3	168	2.3	5	0.4	13	0.2	18	0.3	3	0.2	21	0.4	24	0.3
Fort Stewart	5	2.3	101	2.8	106	2.8	1	0.5	4	0.1	5	0.1	0	0.0	17	0.5	17	0.4
Joint Base Lewis-McCord	28	5.2	258	4.9	286	5.0	5	0.9	17	0.3	22	0.4	8	1.5	46	0.9	54	0.9
Landstuhl RMC	17	7.4	508	7.2	525	7.2	2	0.9	30	0.4	32	0.4	3	1.3	74	1.0	77	1.1
Washington, DC[b]	56	4.1	330	5.0	386	4.9	5	0.4	18	0.3	23	0.3	14	1.0	40	0.6	54	0.7
Navy facilities																		
NH Bremerton	16	2.4	48	2.5	64	2.4	3	0.5	9	0.5	12	0.5	1	0.2	6	0.3	7	0.3
Camp Lejeune	16	1.3	106	1.9	122	1.8	4	0.3	14	0.2	18	0.3	4	0.3	29	0.5	33	0.5
NH Jacksonville	43	3.2	87	4.5	130	3.9	9	0.7	9	0.5	18	0.5	4	0.3	12	0.6	16	0.5
Camp Pendleton	157	3.5	107	5.7	264	4.1	17	0.4	9	0.5	26	0.4	21	0.5	6	0.3	27	0.4
NMC Portsmouth	36	2.6	170	3.2	206	3.1	1	0.1	18	0.3	19	0.3	7	0.5	36	0.7	43	0.6
NMC San Diego	92	2.4	85	2.8	177	2.6	5	0.1	1	0.0	6	0.1	16	0.4	16	0.5	32	0.5
Air Force facilities																		
AF Academy	14	2.9	140	4.9	154	4.6	1	0.2	9	0.3	10	0.3	4	0.8	21	0.7	25	0.8
Andrews AFB	9	8.7	151	6.9	160	7.0	3	2.9	9	0.4	12	0.5	0	0.0	18	0.8	18	0.8
Elmendorf AFB	1	1.5	32	3.3	33	3.1	0	0.0	2	0.2	2	0.2	0	0.0	8	0.8	8	0.8
Lackland AFB	52	4.3	367	4.1	419	4.1	6	0.5	28	0.3	34	0.3	10	0.8	86	1.0	96	0.9
Keesler AFB	24	5.6	139	5.3	163	5.3	2	0.5	8	0.3	10	0.3	26	6.1	71	2.7	97	3.2
Travis AFB	11	4.4	157	4.8	168	4.7	1	0.4	9	0.3	10	0.3	2	0.8	22	0.7	24	0.7
Wright-Patterson AFB	18	5.7	155	5.8	173	5.8	1	0.3	20	0.7	21	0.7	2	0.6	25	0.9	27	0.9

LASIK, laser-assisted in situ keratomileusis; PRK, photorefractive keratectomy

[a]PRK includes laser epithelial keratomileusis (LASEK) procedures.

[b]Visual disturbance includes subjective complaints such as diplopia, field defects, and nighttime vision issues such as ghosting, glare, halos, and starbursts.

[c]Includes incident RS counts from locations labeled in DMSS as Bethesda,MD; Fort Belvoir,VA; and Washington, DC.

TABLE 5. Number and prevalence of 1-year post-refractive surgery (RS) complications and eye disease, U.S. Armed Forces, 2005–2014

	Corneal disease						Conjunctival disease					
	LASIK (N)	LASIK (%)	PRK[a] (N)	PRK[a] (%)	Total (N)	Total (%)	LASIK (N)	LASIK (%)	PRK[a] (N)	PRK[a] (%)	Total (N)	Total (%)
Service												
Army	199	3.0	980	2.0	1,179	2.1	102	1.5	952	1.9	1,054	1.9
Navy	133	1.6	312	1.9	445	1.8	140	1.7	342	2.1	482	1.9
Air Force	50	1.7	513	2.3	563	2.2	88	3.0	680	3.1	768	3.0
Marine Corps	78	1.4	139	1.4	217	1.4	80	1.4	145	1.4	225	1.4
Gender												
Female	96	2.4	350	2.1	446	2.2	94	2.4	467	2.8	561	2.8
Male	364	1.9	1,594	2.0	1,958	1.9	316	1.6	1,652	2.0	1,968	1.9
Age												
≤29	305	2.1	1,200	1.9	1,505	1.9	244	1.7	1,331	2.1	1,575	2.0
30–39	127	1.9	558	2.1	685	2.0	132	1.9	608	2.3	740	2.2
≥40	28	1.4	186	2.6	214	2.3	34	1.7	180	2.5	214	2.3
Rank												
Enlisted	340	1.9	1,506	2.0	1,846	2.0	309	1.8	1,651	2.1	1,960	2.1
Officer	120	2.0	438	2.1	558	2.1	101	1.7	468	2.2	569	2.1
Occupation												
Special Forces	6	7.0	8	1.5	14	2.2	0	0.0	7	1.3	7	1.1
Aviation	4	0.5	40	2.0	44	1.6	11	1.5	52	2.6	63	2.3
Infantry	65	1.8	302	1.9	367	1.9	41	1.2	259	1.6	300	1.5
Transport	11	1.8	50	2.0	61	2.0	9	1.4	51	2.1	60	1.9
Engineer	117	1.8	519	2.0	636	1.9	106	1.6	561	2.1	667	2.0
Comm/intel	96	1.8	467	1.9	563	1.9	107	2.0	561	2.3	668	2.3
Health care	88	2.6	280	2.2	368	2.3	66	2.0	313	2.5	379	2.4
1 year post-RS												
Not deployed	454	2.3	1,918	2.4	2,372	2.4	404	2.0	2,099	2.7	2,503	2.5
Deployed	6	0.2	26	0.1	32	0.1	6	0.2	20	0.1	26	0.1
Army facilities												
Fort Bliss	1	1.5	14	1.4	15	1.4	1	1.5	22	2.2	23	2.2
Fort Bragg	132	8.2	242	3.0	374	3.9	24	1.5	129	1.6	153	1.6
Fort Campbell	1	0.6	41	1.0	42	1.0	1	0.6	50	1.3	51	1.3
Fort Carson	7	1.2	63	1.9	70	1.8	9	1.5	64	1.9	73	1.9
Fort Hood	16	1.1	144	2.3	160	2.0	14	1.0	119	1.9	133	1.7
Fort Riley	4	3.5	94	3.1	98	3.1	4	3.5	70	2.3	74	2.3
Fort Shafter	17	1.3	85	1.4	102	1.4	37	2.9	134	2.3	171	2.4
Fort Stewart	1	0.5	24	0.7	25	0.7	2	0.9	72	2.0	74	2.0
Joint Base Lewis-McCord	9	1.7	107	2.0	116	2.0	6	1.1	97	1.9	103	1.8
Landstuhl RMC	7	3.1	142	2.0	149	2.0	3	1.3	179	2.5	182	2.5
Washington, DC[b]	25	1.8	132	2.0	157	2.0	24	1.7	137	2.1	161	2.0
Navy facilities												
NH Bremerton	5	0.8	40	2.0	45	1.7	14	2.1	46	2.3	60	2.3
Camp Lejeune	3	0.2	72	1.3	75	1.1	16	1.3	96	1.7	112	1.6
NH Jacksonville	11	0.8	37	1.9	48	1.5	30	2.2	38	2.0	68	2.1
Camp Pendleton	110	2.4	38	2.0	148	2.3	77	1.7	21	1.1	98	1.5
NMC Portsmouth	12	0.9	101	1.9	113	1.7	25	1.8	100	1.9	125	1.9
NMC San Diego	51	1.4	39	1.3	90	1.3	49	1.3	43	1.4	92	1.4
Air Force facilities												
AF Academy	5	1.0	72	2.5	77	2.3	9	1.9	79	2.8	88	2.6
Andrews AFB	3	2.9	44	2.0	47	2.0	3	2.9	52	2.4	55	2.4
Elmendorf AFB	0	0.0	10	1.0	10	1.0	1	1.5	23	2.3	24	2.3
Lackland AFB	20	1.6	183	2.0	203	2.0	35	2.9	270	3.0	305	3.0
Keesler AFB	6	1.4	42	1.6	48	1.6	10	2.3	71	2.7	81	2.7
Travis AFB	10	4.0	92	2.8	102	2.9	5	2.0	95	2.9	100	2.8
Wright-Patterson AFB	4	1.3	82	3.0	86	2.9	8	2.5	97	3.6	105	3.5

LASIK, laser-assisted in situ keratomileusis; PRK, photorefractive keratectomy

[a]PRK includes laser epithelial keratomileusis (LASEK) procedures.

[b]Includes incident RS counts from locations labeled in DMSS as Bethesda, MD; Fort Belvoir, VA; and Washington, DC.

TABLE 6. Number and prevalence of 1-year post-refractive surgery (RS) complications and eye disease, U.S. Armed Forces, 2005–2014

	Infection/inflammation						Glaucoma					
	LASIK (N)	LASIK (%)	PRK[a] (N)	PRK[a] (%)	Total (N)	Total (%)	LASIK (N)	LASIK (%)	PRK[a] (N)	PRK[a] (%)	Total (N)	Total (%)
Service												
Army	59	0.9	509	1.0	568	1.0	19	0.3	300	0.6	319	0.6
Navy	88	1.1	251	1.5	339	1.4	12	0.1	71	0.4	83	0.3
Air Force	41	1.4	414	1.9	455	1.8	12	0.4	227	1.0	239	0.9
Marine Corps	39	0.7	90	0.9	129	0.8	4	0.1	20	0.2	24	0.2
Gender												
Female	42	1.1	258	1.6	300	1.5	9	0.2	93	0.6	102	0.5
Male	185	0.9	1,006	1.2	1,191	1.2	38	0.2	525	0.6	563	0.6
Age												
≤29	126	0.9	747	1.2	873	1.1	23	0.2	321	0.5	344	0.4
30–39	74	1.1	367	1.4	441	1.3	18	0.3	220	0.8	238	0.7
≥40	27	1.3	150	2.1	177	1.9	6	0.3	77	1.1	83	0.9
Rank												
Enlisted	162	0.9	941	1.2	1,103	1.2	30	0.2	445	0.6	475	0.5
Officer	65	1.1	323	1.5	388	1.4	17	0.3	173	0.8	190	0.7
Occupation												
Special Forces	0	0.0	3	0.5	3	0.5	1	1.2	0	0.0	1	0.2
Aviation	5	0.7	34	1.7	39	1.4	1	0.1	16	0.8	17	0.6
Infantry	20	0.6	119	0.7	139	0.7	6	0.2	86	0.5	92	0.5
Transport	3	0.5	19	0.8	22	0.7	0	0.0	13	0.5	13	0.4
Engineer	69	1.0	340	1.3	409	1.2	10	0.2	161	0.6	171	0.5
Comm/intel	49	0.9	360	1.5	409	1.4	16	0.3	159	0.7	175	0.6
Health care	49	1.5	172	1.4	221	1.4	10	0.3	92	0.7	102	0.6
1 year post-RS												
Not deployed	224	1.1	1,249	1.6	1,473	1.5	46	0.2	614	0.8	660	0.7
Deployed	3	0.1	15	0.1	18	0.1	1	0.0	4	0.0	5	0.0
Army facilities												
Fort Bliss	1	1.5	4	0.4	5	0.5	0	0.0	6	0.6	6	0.6
Fort Bragg	19	1.2	126	1.6	145	1.5	11	0.7	46	0.6	57	0.6
Fort Campbell	1	0.6	21	0.5	22	0.5	0	0.0	12	0.3	12	0.3
Fort Carson	5	0.8	29	0.9	34	0.9	1	0.2	10	0.3	11	0.3
Fort Hood	7	0.5	42	0.7	49	0.6	0	0.0	83	1.3	83	1.1
Fort Riley	1	0.9	22	0.7	23	0.7	0	0.0	30	1.0	30	0.9
Fort Shafter	12	0.9	60	1.0	72	1.0	4	0.3	14	0.2	18	0.3
Fort Stewart	0	0.0	26	0.7	26	0.7	0	0.0	5	0.1	5	0.1
Joint Base Lewis-McCord	5	0.9	55	1.1	60	1.0	0	0.0	21	0.4	21	0.4
Landstuhl RMC	1	0.4	133	1.9	134	1.8	0	0.0	61	0.9	61	0.8
Washington, DC[b]	29	2.1	114	1.7	143	1.8	4	0.3	38	0.6	42	0.5
Navy facilities												
NH Bremerton	7	1.1	32	1.6	39	1.5	0	0.0	5	0.3	5	0.2
Camp Lejeune	4	0.3	43	0.8	47	0.7	0	0.0	11	0.2	11	0.2
NH Jacksonville	22	1.6	28	1.5	50	1.5	4	0.3	4	0.2	8	0.2
Camp Pendleton	34	0.8	25	1.3	59	0.9	4	0.1	3	0.2	7	0.1
NMC Portsmouth	8	0.6	63	1.2	71	1.1	4	0.3	15	0.3	19	0.3
NMC San Diego	35	0.9	38	1.3	73	1.1	3	0.1	9	0.3	12	0.2
Air Force facilities												
AF Academy	5	1.0	32	1.1	37	1.1	2	0.4	29	1.0	31	0.9
Andrews AFB	4	3.9	47	2.1	51	2.2	0	0.0	17	0.8	17	0.7
Elmendorf AFB	1	1.5	15	1.5	16	1.5	0	0.0	3	0.3	3	0.3
Lackland AFB	12	1.0	132	1.5	144	1.4	3	0.2	137	1.5	140	1.4
Keesler AFB	9	2.1	43	1.6	52	1.7	4	0.9	9	0.3	13	0.4
Travis AFB	1	0.4	50	1.5	51	1.4	3	1.2	29	0.9	32	0.9
Wright-Patterson AFB	4	1.3	76	2.8	80	2.7	0	0.0	21	0.8	21	0.7

LASIK, laser-assisted in situ keratomileusis; PRK, photorefractive keratectomy

[a]PRK includes laser epithelial keratomileusis (LASEK) procedures.

[b]Includes incident RS counts from locations labeled in DMSS as Bethesda, MD; Fort Belvoir, VA; and Washington, DC.

in Army and Air Force personnel versus Navy and Marine Corps personnel, women versus men, older versus younger personnel, officer versus enlisted personnel, and personnel in aviation and Special Forces occupations. A wide variation in outcomes was noted by procedural MTF.

Although this study analyzed RS incidence and post-RS outcomes in a large cohort of military personnel over a 10-year surveillance period, the lack of information on the severity of outcome diagnoses did not allow for an assessment of impact on overall surgical outcome, patient satisfaction, or military readiness. The study potentially underestimated the actual incidence of RS in otherwise healthy military personnel due to the exclusion of 3,961 subjects with more than one RS procedure and 8,068 subjects for whom an initial RS procedure could not be identified within the DMSS. Additionally, data on active component personnel who received RS at civilian facilities were not captured. Another significant limitation is that the severity of myopia, hyperopia, or astigmatism prior to RS and the subsequent impact on post-RS prevalence of these same diagnoses and other outcomes could not be assessed.

Because RS is likely to remain a common procedure within the military, the authors recommend that documentation of diagnoses such as myopia, hyperopia, astigmatism, visual disturbances, and dry eye symptoms be better characterized to allow for an assessment of overall success or failure of treatment within the 1-year period after RS. As noted in the Results section, a wide variation existed in post-RS outcome prevalence by procedural MTF. This may be due to variations in the type of surgical equipment, screening processes, provider expertise, and coding practices. Further standardization and collaboration of RS practices across all MTFs are therefore recommended to allow for a detailed comparison of outcome prevalence.

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Update: Urinary Stones, Active Component, U.S. Armed Forces, 2011–2015

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Urinary stones can cause debilitating morbidity that impairs the operational effectiveness of affected members of the U.S. Armed Forces. This report documents that, during the past 5 years, rates of incident diagnoses of urinary stones decreased by about 17% in the active component of the U.S. military. During the period, annual rates of inpatient diagnosed cases were low and relatively stable, while rates of outpatient diagnosed cases slightly decreased. Incidence rates were slightly higher among females than males in 2011; however, rates were very similar among males and females from 2012 through 2015. Rates of incident diagnoses among white, non-Hispanic and Native American/Alaska Native service members were consistently 80%–100% higher than among black, non-Hispanic and Asian/Pacific Islander service members and 35%–45% higher than among Hispanic and "other race/ethnicity" service members. During the 5-year period, a total of 3,350 service members received more than one incident diagnosis of urinary stones ("recurrent cases"); one-tenth (10.2%) of all incident cases during the period were recurrent cases. Service members with histories of urinary stones should be counseled and closely supervised to avoid dehydration and to adhere to diets that reduce the risk of stone formation.

Urinary stones, or renal calculi, are crystalline deposits of dietary minerals and acid salts that accumulate in the kidneys. The stones vary in size, shape, and composition; however, the majority contain calcium, particularly calcium oxalate.[1] Most stones pass out of the urinary tract without surgical intervention; however, depending on their size and location, urinary stones can trigger severe, undulating pain ("renal colic"). Evaluation, treatment, and lost work days are costly in terms of medical resource expenditures and military operational decrements.[2]

Risk of stone formation is related to advancing age, male gender, family history of urolithiasis, dehydration, diet (e.g., calcium, magnesium, potassium, animal protein), chronic urinary tract infections, metabolic syndrome, and history of previous stones.[3–7] During the past 15 years, the prevalence of urinary stones in the U.S. general population has nearly doubled and has been increasing even more rapidly among historically lower-risk groups, such as women and African Americans.[8–9] These increases in prevalence have been correlated with increasing prevalences of obesity and type 2 diabetes.[10,11] Historically, urinary stones have affected men more than women; however, results of recent studies indicate that the gender gap in urinary stone cases has narrowed.[9,12,13] This analysis estimates incidence rates and trends of urinary stones among active component members of the U.S. military and examines variations in rates and trends in relation to gender, age, and race/ethnicity. The report also enumerates and characterizes urinary stone-related medical evacuations from the combat theaters in Iraq and Afghanistan. This report represents an update to the December 2011 *MSMR* article on the incidence of urinary stones from 2001 through 2010.[14]

METHODS

The surveillance period was 1 January 2011 through 31 December 2015. The surveillance population included all individuals who served in the active component of the U.S. Army, Navy, Air Force, or Marine Corps anytime during the surveillance period. Healthcare encounters (hospitalizations, ambulatory visits and encounters in the Theater Medical Data Store [TMDS]) that were documented with records maintained in the Defense Medical Surveillance System (DMSS) were reviewed to identify those associated with diagnoses of urinary stones.

For this analysis, a case was defined by a diagnosis of "calculus of kidney and ureter" (ICD-9: 592.x, 274.11; ICD-10: N20.x), "calculus of lower urinary tract" (ICD-9: 594.x; ICD-10: N21.x), or "renal colic" (ICD-9: 788.0; ICD-10: N23) in the primary (first-listed) diagnostic position on a record of a hospitalization, ambulatory visit, or TMDS encounter. Uric acid nephrolithiasis was included in the first category, calculus of kidney and ureter, because there was no direct ICD-10 mapping to ICD-9: 274.11. Each affected service member could be counted as an "incident case" only once per 365 days. Service members were considered "recurrent" cases if they were incident cases more than once during the surveillance period. If service members had more than one case-defining encounter during a calendar year, a diagnosis of "calculus of kidney and ureter" was prioritized over a diagnosis of "calculus of lower urinary tract," which was, in turn, prioritized over "renal colic."

Medical evacuations (MEDEVACs) for urinary stones were ascertained from records of service members who were medically evacuated from the U.S. Central Command (CENTCOM) area of responsibility (AOR) to a medical treatment facility outside of the CENTCOM AOR. Evacuations were included in analyses if affected service members had at least one inpatient or outpatient urinary stone-related medical encounter in a fixed U.S. military medical facility within 5 days prior and up to 10 days after their reported evacuation dates.

RESULTS

Incident diagnoses

During the 5-year surveillance period, 32,991 active component members received 36,624 incident diagnoses of urinary stones; most of the cases (n=33,603, 91.8% total) were treated during outpatient encounters **(Table 1)**. The crude overall incidence rate during the period was 54.0 per 10,000 person-years (p-yrs); the annual incidence rate was 16.7% lower in 2015 than in 2011 (49.0 and 58.9 per 10,000 p-yrs, respectively) **(Table 1)**.

Most cases overall (93.1%) were reported as stones in the kidney or ureter ("upper calculus"). From the first to the last year of the surveillance period, the urinary stone-related diagnosis with the largest decline in incidence rate (26.7%) was renal colic **(data not shown)**.

Among racial/ethnic subgroups, annual rates of incident diagnoses among white, non-Hispanic and Native American/Alaska Native service members were consistently 80%–100% higher than among

TABLE 1. Numbers and rates of incident diagnoses of urinary stones by demographics, active component, U.S. Armed Forces, 2011–2015

	Total		2011		2012		2013		2014		2015		2010–2015
	No.	Rate[a]	No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate	% change
Total	36,624	54.0	8,311	58.9	8,002	57.9	7,209	52.9	6,748	50.6	6,354	49.0	-16.7
Inpatient	679	1.0	171	1.2	170	1.2	138	1.0	105	0.8	95	0.7	-39.5
Outpatient	33,603	49.5	7,345	52.0	7,314	52.9	6,615	48.5	6,328	47.5	6,001	46.3	-11.0
TMDS	2,342	3.5	795	5.6	518	3.7	456	3.3	315	2.4	258	2.0	-64.6
Sex													
Female	5,571	55.2	1,303	63.8	1,157	57.3	1,081	53.5	1,026	51.1	1,004	50.4	-21.0
Male	31,053	53.7	7,008	58.0	6,845	57.9	6,128	52.8	5,722	50.6	5,350	48.8	-15.9
Age group													
17–19	742	17.9	177	22.5	149	18.7	161	18.4	126	14.8	129	15.2	-32.6
20–29	15,085	39.7	3,714	46.1	3,417	43.9	2,918	38.5	2,651	35.9	2,385	33.3	-27.8
30–39	13,744	74.4	2,994	79.5	2,969	79.1	2,657	71.5	2,601	70.9	2,523	70.6	-11.2
40+	7,053	97.1	1,426	94.6	1,467	98.3	1,473	100.3	1,370	95.6	1,317	96.6	2.1
Female age group													
17–19	223	32.4	50	38.6	49	38.3	45	31.7	30	21.3	49	33.3	-13.8
20–29	2,986	51.3	750	62.2	629	53.6	591	51.1	532	46.3	484	42.5	-31.7
30–39	1,744	66.1	378	73.2	353	67.2	322	60.3	342	63.8	349	66.0	-9.8
40+	618	66.4	125	65.4	126	66.3	123	65.5	122	66.2	122	68.8	5.2
Male age group													
17–19	519	15.0	127	19.3	100	15.0	116	15.8	96	13.6	80	11.4	-41.1
20–29	12,099	37.6	2,964	43.3	2,788	42.1	2,327	36.3	2,119	34.0	1,901	31.5	-27.1
30–39	12,000	75.8	2,616	80.5	2,616	81.1	2,335	73.3	2,259	72.1	2,174	71.4	-11.4
40+	6,435	101.6	1,301	98.8	1,341	103.0	1,350	105.4	1,248	99.9	1,195	100.7	1.9
Race/ethnicity													
White, non-Hispanic	26,263	63.3	6,059	69.0	5,813	67.9	5,131	61.5	4,837	60.1	4,423	57.1	-17.2
Black, non-Hispanic	3,643	33.1	788	34.8	781	35.3	727	33.1	674	30.9	673	31.4	-9.6
Hispanic	3,592	45.5	788	49.8	774	49.4	716	45.4	657	41.4	657	41.4	-17.0
Asian/Pacific Islander	974	33.8	210	36.3	202	35.3	204	35.5	164	28.4	194	33.4	-8.1
Native American/Alaska Native	492	64.5	124	77.0	98	63.1	99	64.6	82	55.2	89	61.7	-19.9
Other	1,660	43.2	342	45.8	334	43.7	332	42.2	334	42.7	318	41.8	-8.8
Service													
Army	16,287	62.0	3,878	69.0	3,595	65.9	3,167	60.1	2,946	58.2	2,701	55.7	-19.3
Navy	7,787	49.0	1,699	53.0	1,624	51.7	1,548	49.1	1,485	46.6	1,431	44.5	-15.9
Air Force	8,943	55.7	1,880	57.3	1,982	60.6	1,800	55.1	1,660	52.1	1,621	53.0	-7.5
Marine Corps	3,607	37.4	854	42.6	801	40.7	694	35.8	657	34.8	601	32.7	-23.1

[a]Rate per 10,000 person-years

black, non-Hispanic and Asian/Pacific Islander and 35%–45% higher than among Hispanic and "other race/ethnicity" service members **(Table 1)**. Between 2011 and 2015, relative declines in annual incidence rates were largest among Native American/Alaska Native, white non-Hispanic, and Hispanic service members (19.9%, 17.2%, and 17.0%, respectively) **(Table 1)**.

Among the service branches, the highest and lowest overall incidence rates were among the Army (62.0 per 10,000 p-yrs) and Marine Corps (37.4 per 10,000 p-yrs), respectively. Compared to their respective counterparts, members of these two service branches showed the largest relative decreases in annual rates (19.3% and 23.1%, respectively) during the surveillance period **(Table 1)**.

For the entire period, crude overall incidence rates were similar among females (55.2 per 10,000 p-yrs) and males (53.7 per 10,000 p-yrs). However, of note among service members younger than 30 years of age, overall incidence rates were much higher among females than males, while among those older than 30 years of age, rates were higher among males than females **(Table 1)**.

In December 2011, the *MSMR* reported incidence rates of urinary stones among active component members from 2001 and 2010. The report noted that, among males compared to females, annual incidence rates were higher from 2001 to 2004, nearly identical in 2005, and lower from 2006 to 2010.[14] During the surveillance period of interest for this report, the rate was higher among females than males in 2011; however, the annual rates among males and females converged in 2012 and then slowly declined through 2015 **(Figure 1)**.

Among both males and females, rates of urinary stone diagnoses increased with increasing age. While annual rates declined among both males and females overall, absolute and relative declines in rates were largest among those younger than 30 years of age. Of note, during the period, rates slightly increased among both males and females older than 40 years of age **(Table 1)**.

Among both males and females, annual rates of hospitalized cases slightly declined during the surveillance period. Throughout the period, rates of hospitalized cases were slightly higher among females than males **(Figure 2)**. For both genders, trends of incidence rates of hospitalized and outpatient diagnosed cases were similar **(Figures 1, 2)**. Because more than 90% of all cases were diagnosed in outpatients, the downward trend in annual rates of all cases was primarily a reflection of the outpatient trend.

In **Figures 3** and **4**, overall incidence rates of urinary stone diagnoses are summarized by the locations of duty assignments and by season. In general, rates were

FIGURE 1. Incidence rates of urinary stones by gender, active component, U.S. Armed Forces, 2011–2015

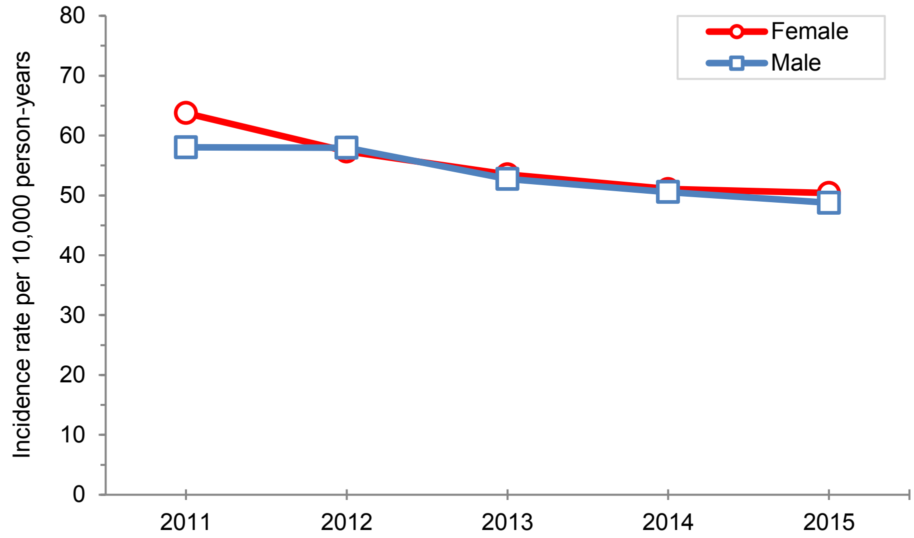


FIGURE 2. Incidence rates of outpatient and inpatient encounters for urinary stones, by gender, active component, U.S. Armed Forces, 2011–2015

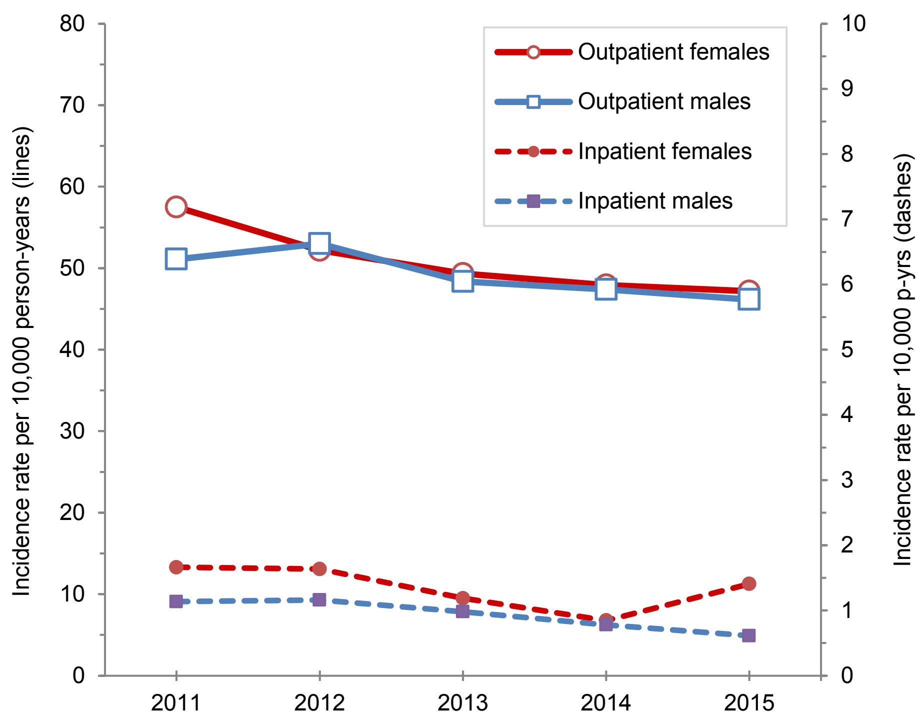
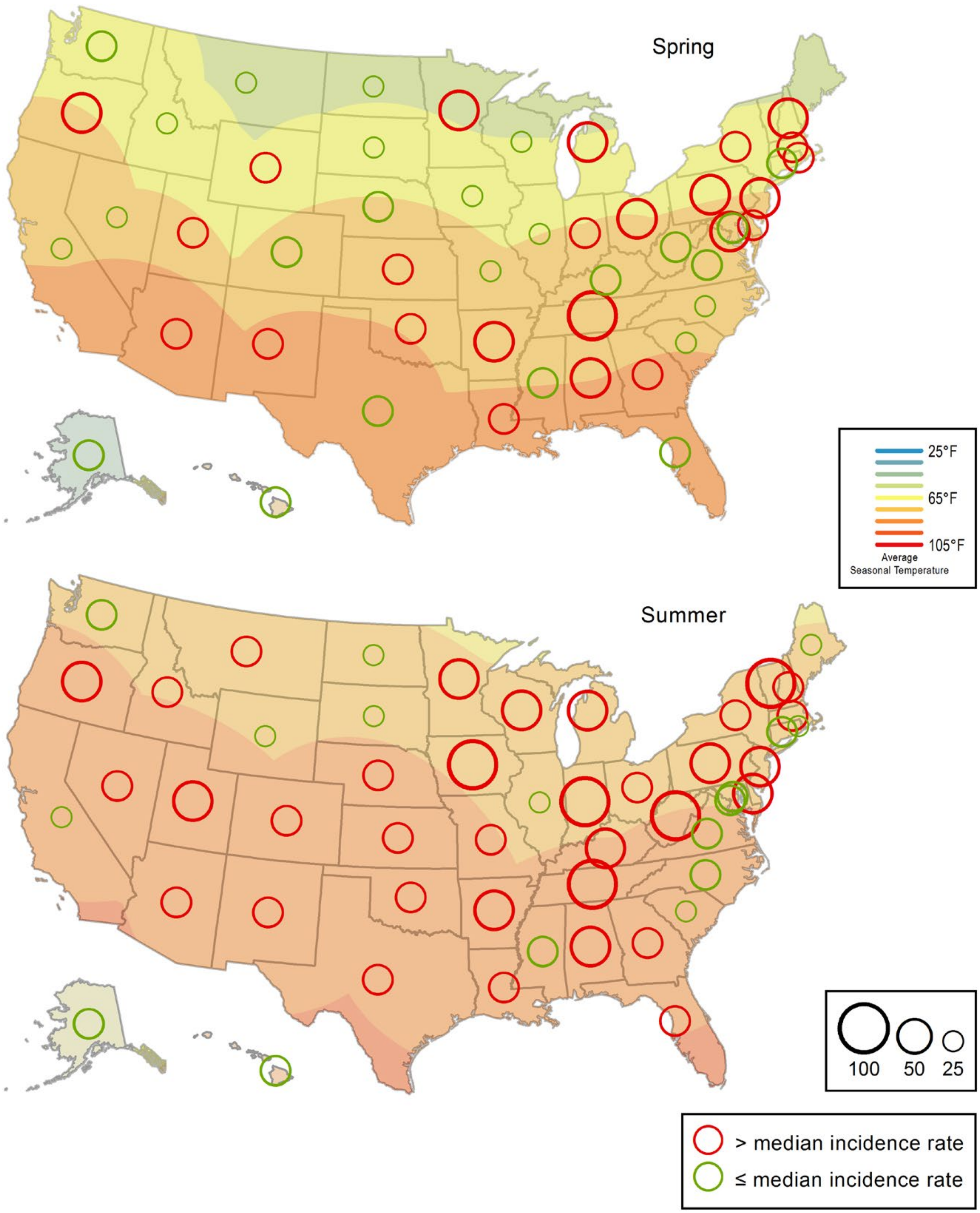


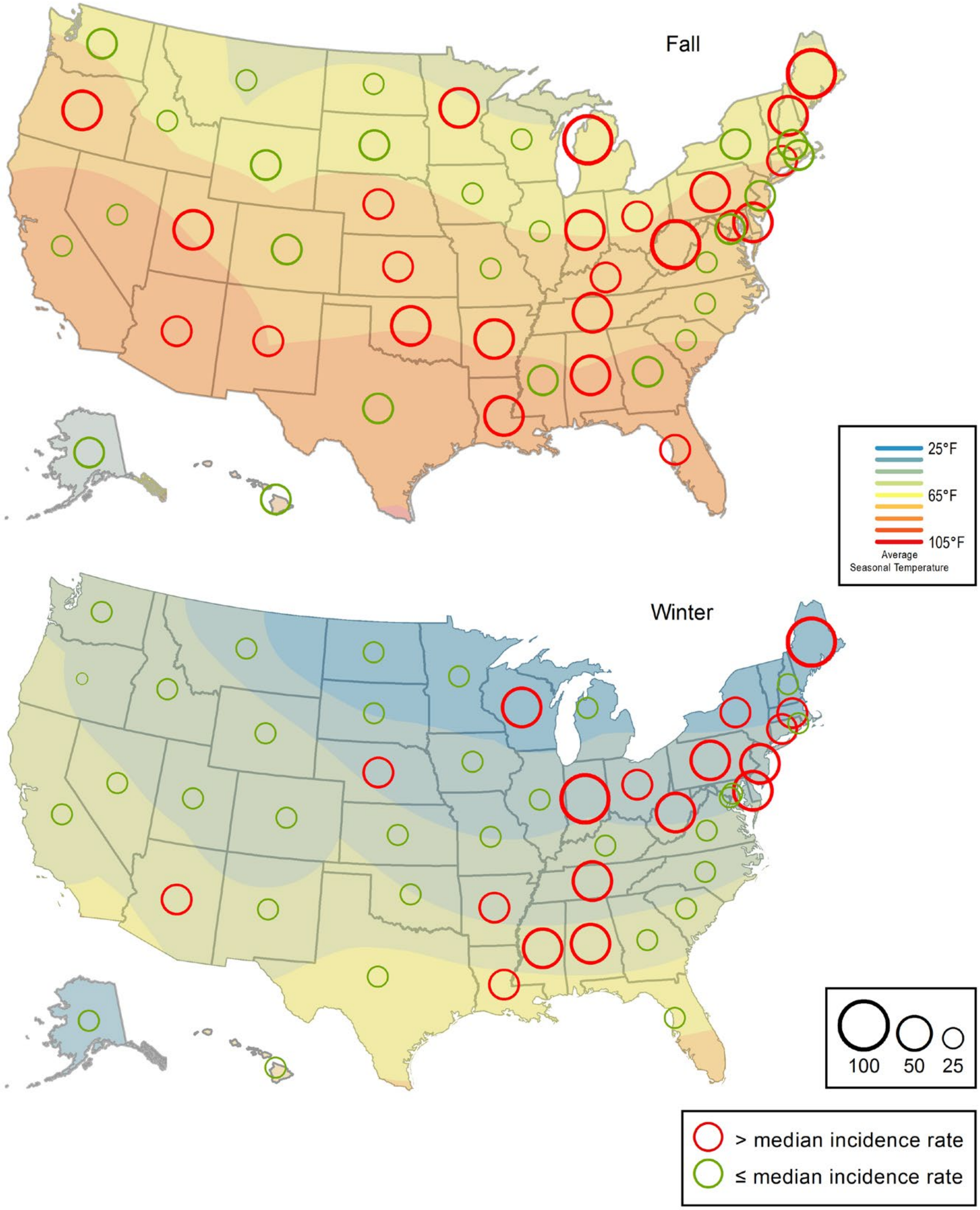
FIGURE 3. Incidence rates[a] of urinary stones by location of duty assignment[b] and season (spring, summer), active component, U.S. Armed Forces, 2011–2015



[a]Rate per 10,000 person-years

[b]Location of duty assignment based on three-digit unit ZIP code

FIGURE 4. Incidence rates[a] of urinary stones by location of duty assignment[b] and season (fall, winter), active component, U.S. Armed Forces, 2011–2015



[a]Rate per 10,000 person-years

[b]Location of duty assignment based on three-digit unit ZIP code

highest in the summer and lowest in the winter. There were no clear and consistent relationships between locations of duty assignments and renal stone risk.

Recurrent diagnoses

During the 5-year period, a total of 3,350 service members received more than one incident diagnosis of urinary stones ("recurrent cases"); one-tenth (10.2%) of all incident cases during the period were recurrent cases (i.e., incident diagnoses in 2 or more years). Among recurrent cases, the majority (n=3,075; 91.8%%) received two, and the remainder received three or four (n=275; 8.2%) incident diagnoses during the period. Of all service members with incident diagnoses of urinary stones during the period, a slightly higher proportion of males (10.4%) than females (8.7%) were recurrent cases **(data not shown).**

Medical evacuations

During the surveillance period, 83 medical evacuations (i.e., from Iraq, Afghanistan) were temporally associated with urinary stone-related medical encounters in fixed medical facilities outside of combat operational theaters **(data not shown)**. No service member was medically evacuated more than once for urinary stones. Of all medical evacuees with urinary stones, 6% (n=5) had been diagnosed with a case-defining medical encounter for urinary stones earlier during the surveillance period; all of these individuals had urinary stone-related encounters less than two years prior to their medical evacuation dates **(data not shown)**.

EDITORIAL COMMENT

This report documents that, during the past 5 years, rates of incident diagnoses of urinary stones have decreased by about 17% in the active component of the U.S. military as a whole. Overall rates of inpatient diagnosed cases were low and relatively stable during the period; however, rates of outpatient diagnosed cases slowly but steadily decreased during this time.

As was noted in a previous *MSMR* report (December 2011) regarding urinary stones, the changing relationship in prevalences of renal calculi among males and females ("gender shift") in the general U.S. population between 2001 and 2010 was reflected in the experience of U.S. military members.[14] By 2009 and 2010, consistently higher incidence rates were observed among females than males. This incidence rate difference is evident at the start of the current study's surveillance period and is followed by a convergence of rates for males and females in 2012. From this point through 2015, rates and the slope of decline among males and females were very similar. Prevalence and incidence data for the U.S. general population during this period were unavailable at the time of this report. However, analyses of hospital encounter data for this period from the U.K. show that incidence of urinary stones for patients aged 15–59 years have remained largely unchanged between 2012 and 2015.[15]

Of interest, this report documents large and consistent differences in incidence rates of urinary stone diagnoses in relation to the race/ethnicities of service members. Most notably, during each year of the period, rates were 80%–100% higher among white, non-Hispanic and Native American/Alaska Native service members compared to their black, non-Hispanic and Asian/Pacific Islander counterparts. The natures and magnitudes of race/ethnicity-related differences among service members from 2011–2015 (as reported here) are very similar to those documented from 2001–2010 (as reported in the December 2011 *MSMR*). The findings in this and the previous *MSMR* report regarding race/ethnicity-related differences in renal stone diagnoses are based on crude (unadjusted) medical encounter rates. As such, there may be characteristics of service members that vary across racial/ethnic groups (e.g., age, off-duty diet) and are associated with urinary stone risk[16,17]; such differences in risk profiles across racial/ethnic groups, if not accounted for in analyses, would bias direct (unadjusted) comparisons of race/ethnicity-specific rates. However, the consistency of the relationships and the degree of the differences in rates across racial/ethnic groups suggest that detailed investigation of race/ethnicity-associated risk of urinary stone formation is warranted.

Several limitations should be considered when interpreting the findings of this report. For example, urinary stones may be incidentally detected during medical evaluations that are unrelated to renal disease (e.g., ultrasound, computed tomography [CT]); incidental findings of asymptomatic urinary stones may be documented on records of related healthcare encounters. To reduce the effect of incidental detections of asymptomatic stones for this analysis, incident cases were restricted to urinary stone diagnoses that were reported as primary (first-listed) diagnoses on hospitalization and ambulatory visit records. Still, some diagnoses that were considered case-defining for this analysis may reflect the documentation of asymptomatic and incidentally diagnosed urinary stones. Another limitation relates to the definition of recurrent cases employed in the analysis. Because the period of case review started in 2011, the summary of recurrent cases for the 5-year period excludes recurrent cases in 2011 and thus likely underestimates the total numbers of recurrent cases. Consider the example of a service member who was diagnosed with a urinary stone in June 2010 (before the surveillance period) and then had another such diagnosis in July of 2011. That 2011 diagnosis would have been recorded as an incident case but would not have been categorized as a recurrent case. In addition, as reflected in the cases identified in TMDS records, other urinary stone-related cases have been treated in theater hospitals and other field medical facilities but not evacuated for that diagnosis **(Table 1)**. Moreover, there were likely other cases treated in Iraq and Afghanistan whose care was not documented in TMDS records. Also, because this report is based on primary (first-listed) diagnoses, renal calculi documented in secondary diagnostic positions of the healthcare records were not included. As a result, this report most likely underestimates the true incidence of urinary stones among active component service members.

Urinary stones are a significant military medical concern because they are associated with decreased military operational effectiveness (e.g., lost duty days, medical evacuation) and may be precipitated by environmental stressors common to military training and operational settings. Particularly during physically rigorous operations in hot, dry environments (such as Iraq and Afghanistan), U.S. military members may be at higher risk of dehydration, decreased urine output, concentration of the urine, and urinary stone formation.[18] Because of the high recurrence rate and the debilitating morbidity that can result from urinary stones, service members with histories of urinary stones should be counseled and closely supervised to avoid dehydration and to adhere to diets that reduce the risk of stone formation.

The reasons for the slight decline over the past 5 years in incidence rates of urinary stones (overall and by gender, race/ethnicity and service) are not clear. At least some of the decline in incidence may be related to the withdrawal of U.S. forces from the hot and dry operational environments of Iraq and Afghanistan and the changes in the natures and intensities of combat engagements in these regions. Continued monitoring of medical encounters over time may allow for the elucidation of the potential reasons for the recent slight decline in incidence of urinary stones.

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Acknowledgment: The authors thank Michael P. Schoelen (GIS Administrator, Armed Forces Health Surveillance Branch, Defense Health Agency), who produced the proportional circle maps for this report.

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Medical Surveillance Monthly Report (MSMR) invites readers to submit topics for consideration as the basis for future *MSMR* reports. The *MSMR* editorial staff will review suggested topics for feasibility and compatibility with the journal's health surveillance goals. As is the case with most of the analyses and reports produced by Armed Forces Health Surveillance Branch staff, studies that would take advantage of the healthcare and personnel data contained in the Defense Medical Surveillance System (DMSS) would be the most plausible types. For each promising topic, Armed Forces Health Surveillance Branch staff members will design and carry out the data analysis, interpret the results, and write a manuscript to report on the study. This invitation represents a willingness to consider good ideas from anyone who shares the *MSMR*'s objective to publish evidence-based reports on subjects relevant to the health, safety, and well-being of military service members and other beneficiaries of the Military Health System (MHS).

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Surveillance Snapshot: Zika Virus Infection Among Military Health System Beneficiaries Following Introduction of the Virus into the Western Hemisphere, 20 May 2016

James V. Writer, MPH; Daniela E. Poss, MPH; Stic Harris, DVM, MPH

As of 20 May 2016, the Armed Forces Health Surveillance Branch (AFHSB) has recorded 17 confirmed Zika virus infections in Military Health System (MHS) beneficiaries; two probable cases were also reported. The first confirmed Department of Defense (DoD) case had an illness onset in late January 2016. Of the 17 confirmed cases, 10 (59%) were reported in Disease Reporting System internet (DRSi); the remaining seven cases (41%) came from other sources, including direct reporting to AFHSB and reviews of laboratory test results.

On 17 May, AFHSB issued updated guidance for Detecting and Reporting DoD Cases of Acute Zika Virus Disease that includes changes to clinical criteria, case definitions, and laboratory testing, as well as a list of DoD laboratory points of contact.[1] Confirmed and probable cases should be reported in DRSi as "Any Other Unusual Condition Not Listed," with "Zika" entered in the comment field along with pertinent travel history and pregnancy status. The guidance defines confirmed cases as meeting clinical and epidemiologic criteria and being reverse transcription polymerase chain reaction (RT-PCR) positive for Zika virus or immunoglobulin M (IgM) antibody positive with a confirmatory plaque reduction neutralization test (PRNT). Probable cases meet the clinical and epidemiologic criteria and are positive on IgM without a confirmatory PRNT.

As of 18 May, two diagnostic tests are available in the DoD under an Emergency Use Authorization (EUA) from the U.S. Food and Drug Administration. The Centers for Disease Control and Prevention (CDC) Zika IgM MAC-ELISA is currently being or has been distributed to six DoD laboratories, with three laboratories (NIDDL, BAMC, and USAFSAM) having received approval to commence patient testing. The CDC Zika Trioplex rRT-PCR assay is currently being or has been distributed to 16 DoD laboratories; to date, 15 laboratories have received approval to start diagnostic testing (BAMC, CRDAMC, EAMC, LRMC, USAMRIID, WBAMC, MAMC, Brian Allgood ACH, NHRC, USAFSAM, WAMC, NAMRU-3, TAMC, WRNMMC, and NIDDL).

Zika virus circulation was first confirmed in the Western Hemisphere in Brazil in May 2015, though it was likely present as early as February 2015.[2] Between 1 May 2015 and 19 May 2016, confirmed autochthonous vector-borne transmission of Zika virus has been reported in 39 countries and territories in the Western Hemisphere and nine countries elsewhere in the world.[3,4] The CDC reports 544 travel-related cases in U.S. states and the District of Columbia, of which 10 were sexually transmitted after travel to an outbreak area. There have been no reported locally acquired vector-borne cases in U.S. states or the District of Columbia as of 18 May 2016.[5]

With contributions from disease surveillance programs at Army Public Health Center, Navy and Marine Corps Public Health Center, U.S. Air Force School of Aerospace Medicine, and U.S. Coast Guard Preventive Medicine.

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TABLE. Demographics for confirmed[a] Zika cases in Military Health System beneficiaries as of 20 May 2016 (N=17 confirmed cases)

	No. of cases	%
Service affiliation		
Army	6	35.3
Air Force	4	23.5
Navy	1	5.9
Marine Corps	2	11.8
Coast Guard	4	23.5
Status		
Service member	11	64.7
Dependent	4	23.5
Retiree	2	11.8
Age		
0–20	1	5.9
21–35	3	17.6
36–50	4	23.5
50+	3	17.6
Not reported	6	35.3
Gender		
Female	4	23.5
Male	11	64.7
Not reported	2	11.8
Travel history		
Barbados	1	5.9
Brazil	1	5.9
Colombia	4	23.5
Dominican Republic	3	17.6
Haiti	1	5.9
Martinique	2	11.8
Philippines	1	5.9
Puerto Rico	3	17.6
Not reported	1	5.9

[a]Confirmed: Meets clinical and epidemiologic criteria and reverse transcription polymerase chain reaction (RT-PCR) positive for Zika virus or immunoglobulin M positive with a confirmatory plaque reduction and neutralization test (PRNT).

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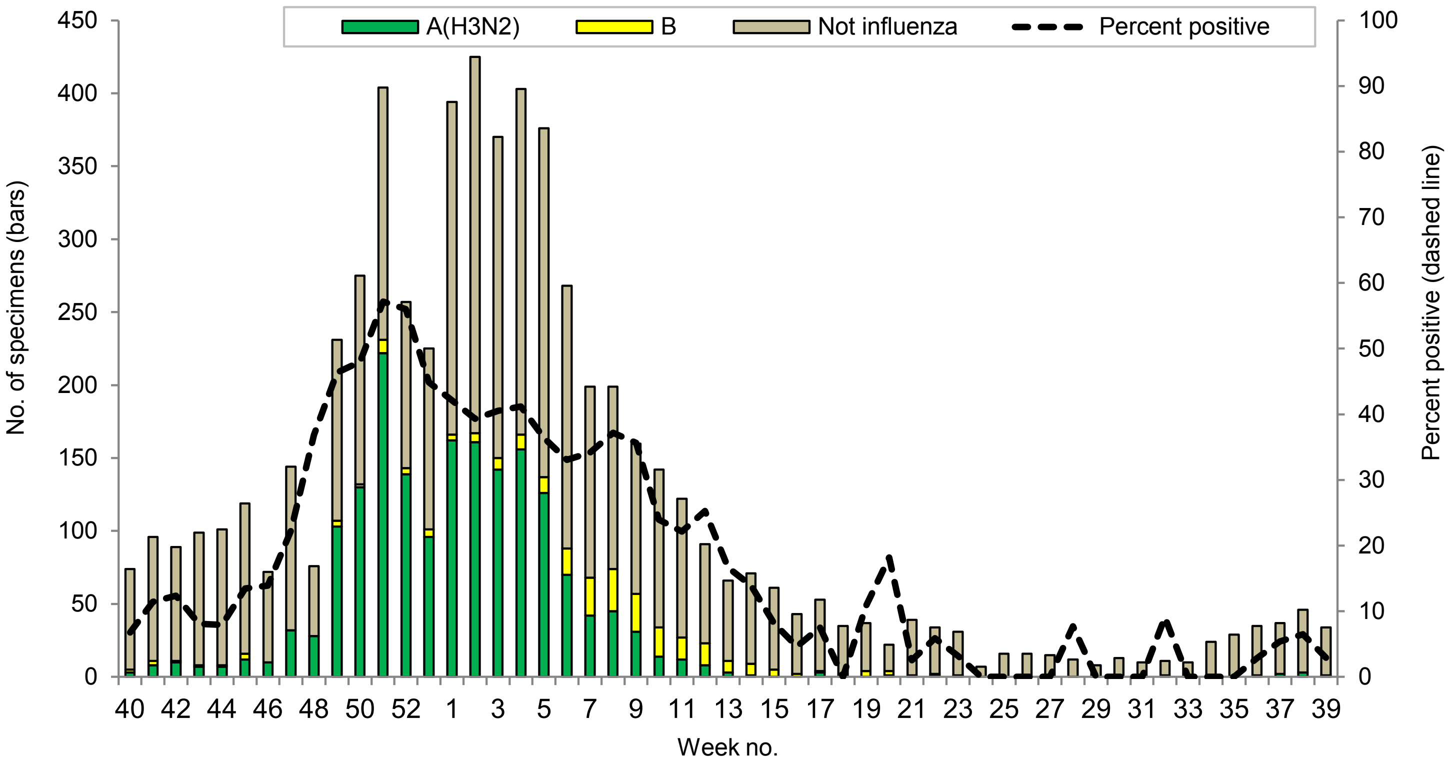
1. Armed Forces Health Surveillance Branch/Defense Health Agency. Detecting and Reporting DoD Cases of Acute Zika Virus Disease Guidance as of 17 May 2016. Accessed on 20 May 2016. https://www.afhsc.mil/documents/pubs/documents/AFHSB_Detecting_Reporting_DoD_Cases_of_Zika.pdf
2. World Health Organization. One year into the Zika outbreak: how an obscure disease became a global health emergency, 5 May 2016. Accessed on 20 May 2016. http://www.who.int/emergencies/zika-virus/articles/one-year-outbreak/en/
3. Pan-American Health Organization. Geographic distribution of confirmed autochthonous cases of Zika virus (vector-borne transmission) in countries and territories of the Americas, 2015–2016. Accessed on 20 May 2016. http://ais.paho.org/phip/viz/ed_zika_countrymap.asp
4. Centers for Disease Control and Prevention. All Countries & Territories with Active Zika Virus Transmission. Accessed on 20 May 2016. http://www.cdc.gov/zika/geo/active-countries.html
5. Centers for Disease Control and Prevention. Zika virus disease in the United States, 2015–2016. Accessed on 20 May 2016. http://www.cdc.gov/zika/geo/united-states.html

Surveillance Snapshot: Department of Defense Global, Laboratory-Based Influenza Surveillance Program, 2014–2015 Season

Tiffany A. Parms, MPH

FIGURE. Numbers[a] and percentage of influenza-positive specimens, by surveillance week, 2014–2015 season



[a]Four influenza A(H1N1)pdm09 and two dual influenza coinfections were excluded from the stacked bars due to small numbers. However, these specimens contribute to the percent positive.

The Department of Defense (DoD) Global, Laboratory-Based, Influenza Surveillance Program is a DoD-wide, year-round, sentinel-based program that tests respiratory specimens collected from DoD beneficiaries presenting to military treatment facilities with influenza-like illness (ILI). ILI is defined as an illness characterized by fever (100.5 degrees F or greater) and cough or sore throat within 72 hours of seeking treatment. Sentinel sites are to submit 6–10 specimens per week from beneficiaries presenting with ILI. Each specimen is tested via reverse transcription–polymerase chain reaction (RT-PCR) and viral culture. Specimens from patients with ILI that are negative for influenza by RT-PCR undergo additional testing on the BioFire FilmArray®, which can detect 20 respiratory pathogens. Influenza-positive specimens may be molecularly sequenced to determine antigenic drift.

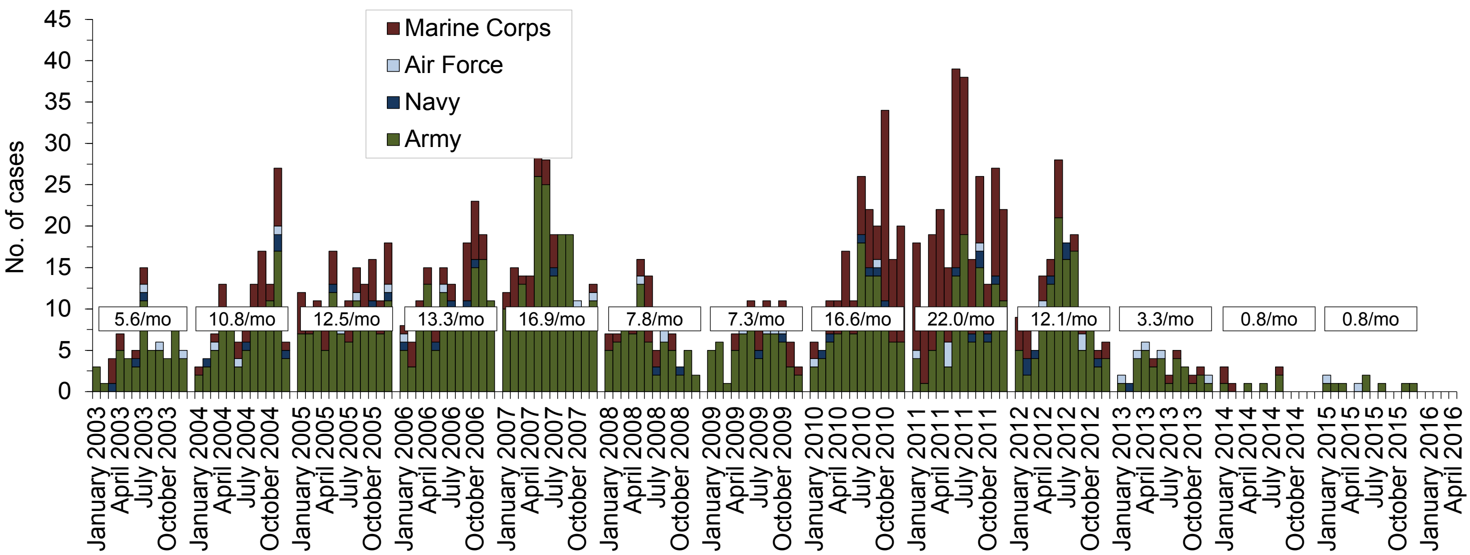
The 2014–2015 influenza season was dominated by influenza A(H3N2) viruses at the beginning of the season; however, beginning in Week 10, identifications of influenza B viruses were more numerous than for influenza A. Influenza activity peaked in Week 51, and influenza transmission was sustained for 42 out of 53 weeks of the season. A total of 6,432 specimens (6,291 submitted for routine surveillance, 141 submitted for sequencing only) were collected from 103 locations. Of those submitted for routine surveillance, 2,058 were positive for influenza (32.7%); 1,231 were positive for other respiratory pathogens (19.6%); and 3,002 (47.7%) were negative. Molecular characterization of specimens showed that the majority of influenza A(H3N2) viruses circulating had drifted from the vaccine strain by December 2014. This finding was in agreement with Centers for Disease Control and Prevention and World Health Organization observations during the 2014–2015 influenza season.

Author affiliations: The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc.; Air Force Satellite Cell of the Armed Forces Health Surveillance Branch, Defense Health Agency.

Acknowledgment: The author thanks the U.S. Air Force School of Aerospace Medicine Epidemiology Laboratory at Wright-Patterson Air Force Base, OH, for their valuable contributions to this work.

Deployment-Related Conditions of Special Surveillance Interest, U.S. Armed Forces, by Month and Service, January 2003–April 2016 (data as of 24 May 2016)

Amputations[a,b]

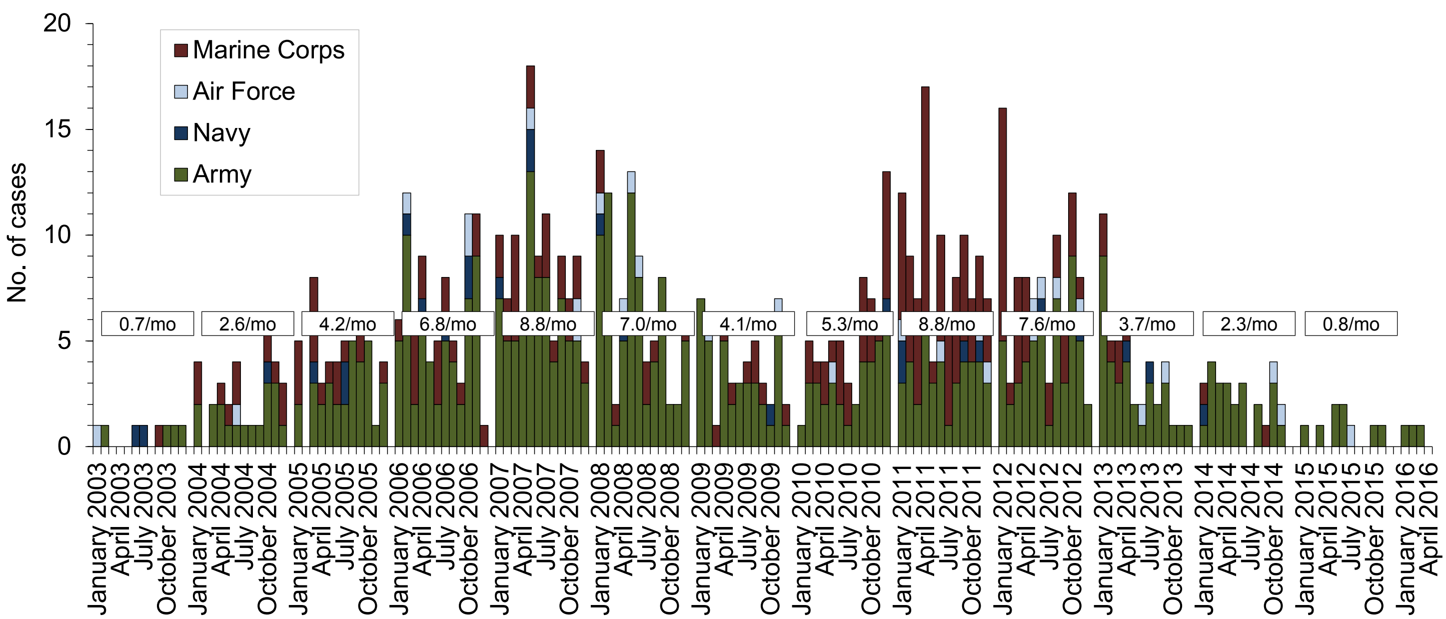


Reference: Army Medical Surveillance Activity. Deployment-related condition of special surveillance interest: amputations. Amputations of lower and upper extremities, U.S. Armed Forces, 1990–2004. *MSMR*. 2005;11(1):2–6.

[a]Amputations (ICD-10: S48, S58, S684, S687, S78, S88, S980, S983, S989, Z440, Z441, Z4781, Z891, Z892, Z8943, Z8944, Z895, Z896, Z899)

[b]Indicator diagnosis (one per individual) during a hospitalization while deployed to/within 365 days of returning from deployment.

Heterotopic ossification[a,b]



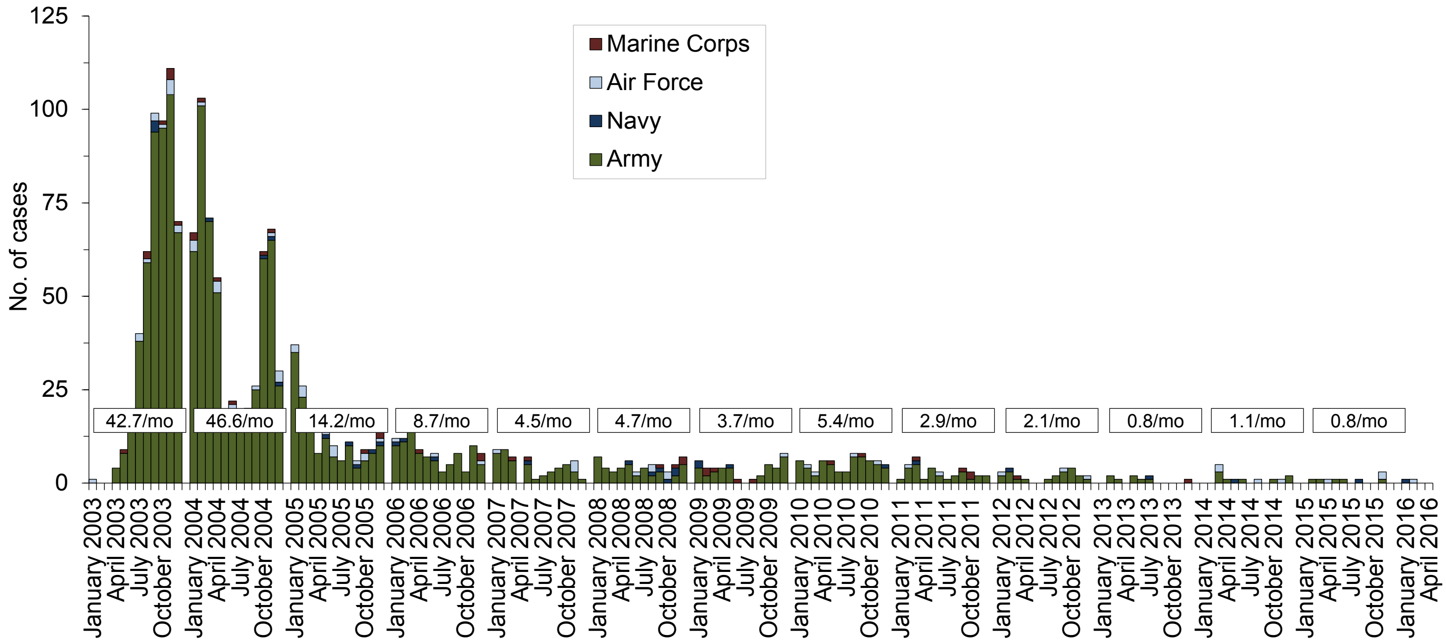
Reference: Army Medical Surveillance Activity. Heterotopic ossification, active components, U.S. Armed Forces, 2002–2007. *MSMR*. 2007;14(5):7–9.

[a]Heterotopic ossification (ICD-10: M610, M614, M615)

[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–April 2016 (data as of 24 May 2016)

Leishmaniasis[a,b]

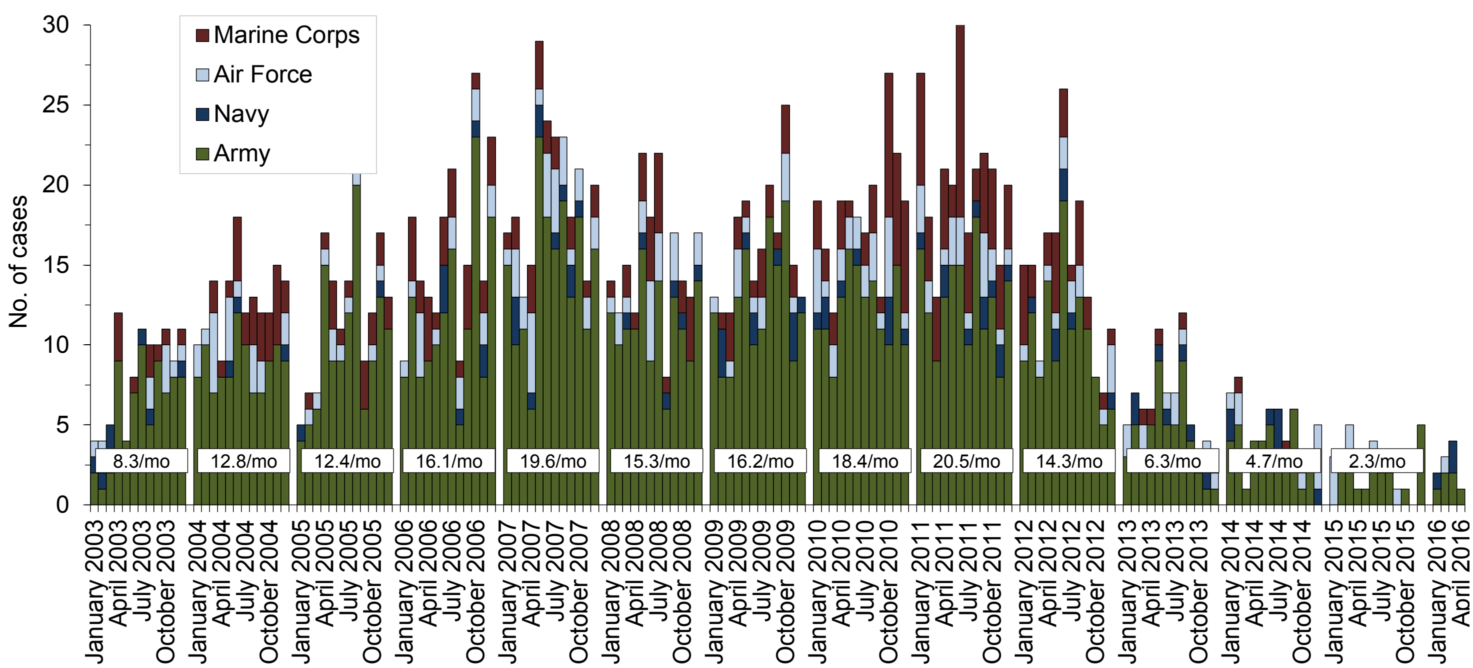


Reference: Army Medical Surveillance Activity. Deployment-related condition of special surveillance interest: leishmaniasis. Leishmaniasis among U.S. Armed Forces, January 2003–November 2004. *MSMR*. 2004;10(6):2–4.

[a]Leishmaniasis (ICD-10: B55, B550, B551, B552, B559

[b]Indicator diagnosis (one per individual) during a hospitalization, ambulatory visit, and/or from a notifiable medical event during or after service in OEF/OIF/OND.

Deep vein thrombophlebitis/pulmonary embolus[a,b]



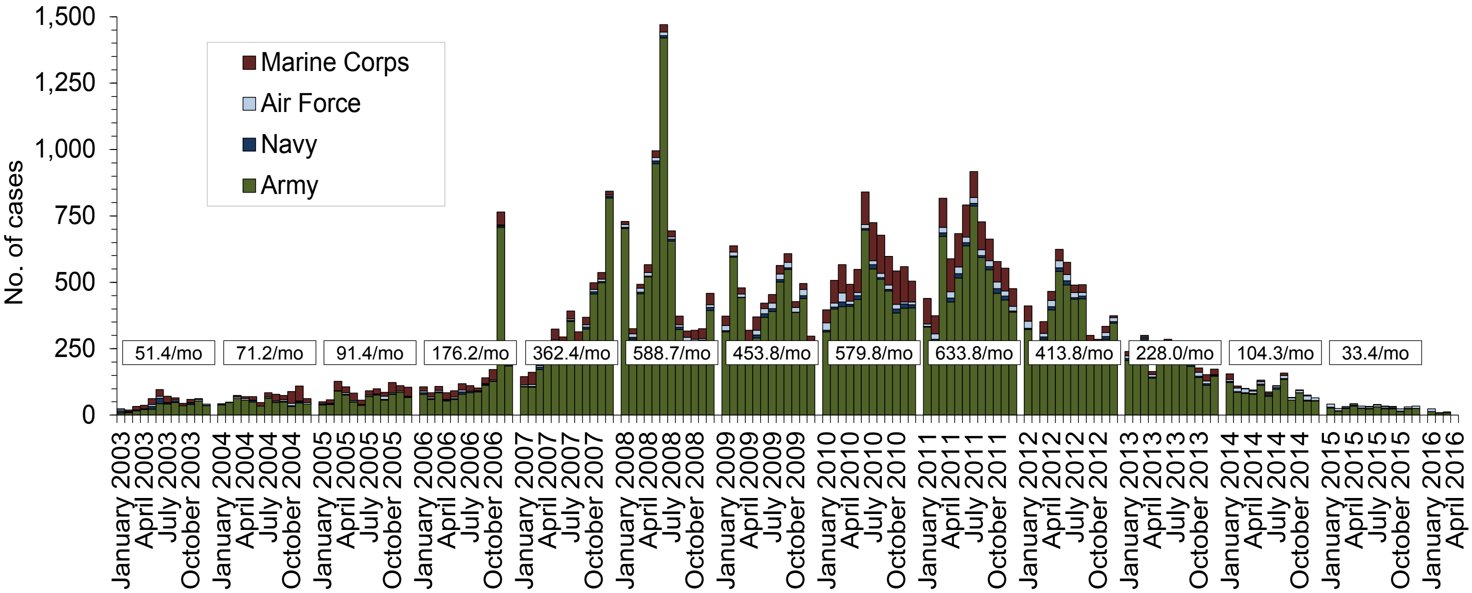
Reference: Isenbarger DW, Atwood JE, Scott PT, et al. Venous thromboembolism among United States soldiers deployed to Southwest Asia. *Thromb Res*. 2006;117(4):379–383.

[a]Deep vein thrombophlebitis/pulmonary embolus (ICD-10: I2601, I2609, I2690, I2699, I801–I803, I808, I809, I822–I824, I826, I82A1, I82B1, I82C1, I8281, I82890, I8290)

[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–April 2016 (data as of 24 May 2016)

Traumatic brain injury (TBI)[a,b]



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]Traumatic brain injury (TBI) (ICD-10: S060, S060X6, S060X6A, S060X5, S060X5A, S060X3, S060X3A, S060X1, S060X1A, S060X2, S060X2A, S060X4, S060X4A, S060X7, S060X7A, S060X8, S060X8A, S060X9, S060X9A, S060X0, S060X0A, S0633, S06334, S06334A, S06335, S06335A, S06336, S06336A, S06333, S06333A, S06331, S06331A, S06332, S06332A, S06337, S06337A, S06338, S06338A, S06339, S06339A, S06330, S06330A, S0632, S06326, S06326A, S06325, S06325A, S06323, S06323A, S06321, S06321A, S06322, S06322A, S06324, S06324A, S06327, S06327A, S06328, S06328A, S06329, S06329A, S06320, S06320A, S0631, S06316, S06316A, S06315, S06315A, S06313, S06313A, S06311, S06311A, S06312, S06312A, S06314, S06314A, S06317, S06317A, S06318, S06318A, S06319, S06319A, S06310, S06310A, S0638, S06386, S06386A, S06385, S06385A, S06383, S06383A, S06381, S06381A, S06382, S06382A, S06384, S06384A, S06387, S06387A, S06389, S06389A, S06380, S06380A, S06388, S06388A, S0637, S06376, S06376A, S06375, S06375A, S06373, S06373A, S06371, S06371A, S06372, S06372A, S06374, S06374A, S06378, S06378A, S06377, S06377A, S06379, S06379A, S06370, S06370A, S071, S071XXA, S062X, S062X5, S062X5A, S062X6, S062X6A, S062X3, S062X3A, S062X1, S062X1A, S062X2, S062X2A, S062X4, S062X4A, S062X7, S062X7A, S062X8, S062X8A, S062X9, S062X9A, S062X0, S062X0A, S064X, S064X6, S064X6A, S064X5, S064X5A, S064X3, S064X3A, S064X1, S064X1A, S064X2, S064X2A, S064X4, S064X4A, S064X7, S064X7A, S064X8, S064X8A, S064X9, S064X9A, S064X0, S064X0A, S021, S0211, S029, S020, S020XXA, S020XXB, S028, S028XXA, S028XXB, S0402, S0402X, S0402XA, S0403, S04032, S04032A, S04031, S04031A, S04039, S04039A, S0404, S04042, S04042A, S04041, S04041A, S04049, S04049A, S0219XB, S0219, S0219XA, S02118, S02118A, S02118B, S0689, S06895, S06895A, S06896, S06896A, S06893, S06893A, S06891, S06891A, S06892, S06892A, S06894, S06894A, S06897, S06897A, S06898, S06898A, S06899, S06899A, S06890, S06890A, Z87820, DOD0101, DOD0102, DOD0103, DOD0104, DOD0105, F0781, S061X, S061X6, S061X6A, S061X5, S061X5A, S061X3, S061X3A, S061X1, S061X1A, S061X2, S061X2A, S061X4, S061X4A, S061X7, S061X7A, S061X8, S061X8A, S061X9, S061X9A, S061X0, S061X0A, S0636, S06366, S06366A, S06363, S06363A, S06361, S06361A, S06362, S06362A, S06369, S06369A, S06365, S06365A, S06364, S06364A, S06367, S06367A, S06368, S06368A, S06360, S06360A, S0635, S06356, S06356A, S06355, S06355A, S06351, S06351A, S06352, S06352A, S06354, S06354A, S06357, S06357A, S06358, S06358A, S06350, S06350A, S06353, S06353A, S06359, S06359A, S0634, S06345, S06345A, S06346, S06346A, S06343, S06343A, S06341, S06341A, S06342, S06342A, S06347, S06347A, S06348, S06348A, S06349, S06349A, S06340, S06340A, S06344, S06344A, S066X, S066X3, S066X3A, S066X6, S066X6A, S066X5, S066X5A, S066X1, S066X1A, S066X2, S066X2A, S066X4, S066X4A, S066X7, S066X7A, S066X8, S066X8A, S066X9, S066X9A, S066X0, S066X0A, S065X, S065X6, S065X6A, S065X5, S065X5A, S065X3, S065X3A, S065X1, S065X1A, S065X7, S065X7A, S065X8, S065X8A, S065X9, S065X9A, S065X0, S065X0A, S065X2, S065X2A, S065X4, S065X4A, S02110, S02110A, S02110B, S02111, S02111A, S02111B, S02112, S02112A, S02112B, S0630, S06306, S06306A, S06305, S06305A, S06303, S06303A, S06301, S06301A, S06302, S06302A, S06304, S06304A, S06307, S06307A, S06308, S06308A, S06309, S06309A, S06300, S06300A, S0210, S0210XA, S0210XB, S02119, S02119A, S02119B, S0291, S0291XA, S0291XB, S069X, S069X4, S069X4A, S069X5, S069X5A, S069X6, S069X6A, S069X3, S069X3A, S069X1, S069X1A, S069X2, S069X2A, S069X7, S069X7A, S069X8, S069X8A, S069X9, S069X9A, S069X9S, S069X0, S069X0A, S02113, S02113A, S02113B

[b]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 4,689 deployers who had at least one TBI-related medical encounter any time prior to deployment).

Medical Surveillance Monthly Report (MSMR)
Armed Forces Health Surveillance Branch
11800 Tech Road, Suite 220 (MCAF-CS)
Silver Spring, MD 20904

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ISSN 2158-0111 (print)
ISSN 2152-8217 (online)