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Update: Routine Screening for Antibodies to Human Immunodeficiency Virus, Civilian Applicants for U.S. Military Service and U.S. Armed Forces, Active and Reserve Components, January 2010–June 2015

This report contains an update through June 2015 of the results of routine screening for antibodies to the human immunodeficiency virus (HIV) among civilian applicants for military service and among members of the active and reserve components of the U.S. Armed Forces. Seroprevalences among civilian applicants in 2014 and the first half of 2015 (0.21 and 0.22 per 1,000 tested, respectively) were markedly lower than in 2012 (0.28 per 1,000 tested). In nearly every component of every military service, seroprevalences in 2014 and 2015 were either lower than, or relatively similar to, prevalences in prior years; however, in the Army National Guard, seroprevalences increased each year and approximately doubled from 2010 (0.18 per 1,000 tested) to 2014–2015 (0.36–0.39 per 1,000 tested). Among active and reserve component service members, seroprevalences continue to be higher among Army and Navy members and males than their respective counterparts.

Since the acquired immune deficiency syndrome (AIDS) was first recognized as a distinct clinical entity in 1981,[1] its spread has had major impacts on the health of populations and on healthcare systems worldwide. The human immunodeficiency virus type 1 (HIV-1) was identified as the cause of AIDS in 1983. Since October 1985, the U.S. military has conducted routine screening for antibodies to HIV-1 to enable adequate and timely medical evaluations, treatment, and counseling; to prevent unwitting transmission; and to protect the battlefield blood supply.[2]

As part of the U.S. military's HIV screening program, civilian applicants for military service are screened for antibodies to HIV during pre-accession medical examinations. Infection with HIV is medically disqualifying for entry into U.S. military service. All members of the active and reserve components of the U.S. Armed Forces have been periodically screened since 1986 to detect newly acquired HIV infections. In 2004, the Department of Defense set a standard testing interval of 2 years for all service members. Service members who are infected with HIV receive clinical assessments, treatments, and counseling; they may remain in service as long as they are capable of performing their military duties.[2]

Before 2009, all of the aforementioned screening programs used techniques that detected only HIV-1-type infection. In 2009, all programs adopted laboratory methods that detect antibodies to both HIV types (i.e., HIV-1 and HIV-2). HIV-2 infection is rare in the U.S. itself, and there has been only one HIV-2 infection case detected among civilian applicants applying for military service since 2009. Although HIV-2 virus is prevalent in areas of the world where service members may be required to serve, to date no service member has been found to be infected with HIV-2. To accommodate the change in laboratory methods and the prospect of detection of HIV-2 infection cases by Service-specific screening programs, this report will hereafter refer to the target of the screening programs as simply "HIV" without specifying either of the types.

This report summarizes numbers, prevalences, and trends of newly identified HIV antibody positivity among civilian applicants for military service and members of the active and reserve components of the U.S. Armed Forces from 1 January 2010 through 30 June 2015. Summaries of results of routine screening for antibodies to HIV among civilian applicants and active and reserve component members of the U.S. military since 1990 are available at http://www.afhsc.mil/reports.

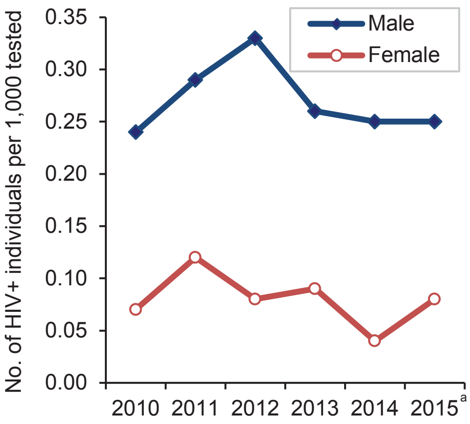
METHODS

The surveillance period was 1 January 2010 through 30 June 2015. The surveillance population included all civilian applicants for U.S. military service and all individuals who were screened for antibodies to HIV while serving in the active or reserve component of the Army, Navy, Air Force, Marine Corps, or Coast Guard during the surveillance period.

All individuals who were tested and all first-time detections of antibodies to HIV through U.S. military medical testing programs were ascertained by matching specimen numbers and serologic test results to the personal identifiers of providers of the specimens. With the exception of U.S. Air Force members, all results were accessed from records routinely maintained in the Defense Medical Surveillance System (DMSS). The U.S. Air Force provided summarized results of serologic screening for antibodies to HIV among its members.

An incident case of HIV antibody seropositivity was defined as two positive results from serologic testing of two

FIGURE 1. Diagnoses of HIV infection by gender, civilian applicants for U.S. military service, January 2010–June 2015

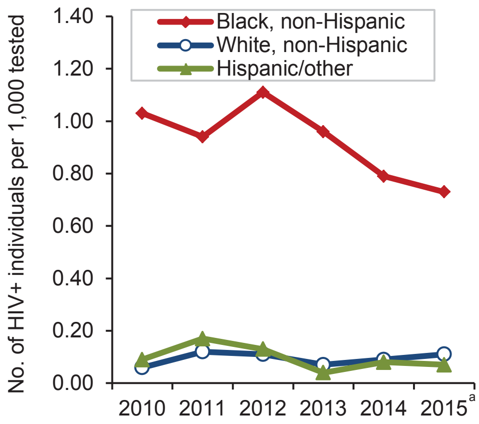


[a]Through 30 June 2015

different specimens from the same individual, or one positive result from serologic testing of the most recent specimen provided by an individual.

Annual prevalences of HIV seropositivity among civilian applicants for service

FIGURE 2. Diagnoses of HIV infections by race/ethnicity, civilian applicants for U.S. military service, January 2010–June 2015



[a]Through 30 June 2015

were calculated by dividing the number of applicants identified as HIV antibody seropositive during each calendar year by the number of applicants tested during the corresponding year. For annual summaries of routine screening among U.S. service members, denominators were the numbers of individuals in each component of each service branch who were tested at least once during the relevant calendar year.

RESULTS

Civilian applicants

From January 2014 through June 2015, a total of 452,956 civilian applicants for U.S. military service were tested for antibodies to HIV, and 97 applicants were identified as HIV antibody positive (seroprevalence: 0.21 per 1,000 applicants tested) **(Table 1)**. During the period, annual seroprevalences among applicants for service peaked in 2012 (0.28 per 1,000 tested), then decreased to 0.21 per 1,000 tested in 2014.

Throughout the period, seroprevalences were much higher among males than females and among black non-Hispanics than other race/ethnicity groups **(Tables 1, 2; Figures 1, 2)**. Of note, during 2012 to

TABLE 1. Diagnoses of HIV infections by gender, civilian applicants for U.S. military service, January 2010–June 2015

Year	Total HIV tests	Total persons tested	Male tested	Female tested	Total HIV(+)	HIV(+) male	HIV(+) female	Overall rate per 1,000 tested	Male rate per 1,000 tested	Female rate per 1,000 tested
2010	**292,312**	**278,908**	224,879	54,029	**59**	55	4	**0.21**	0.24	0.07
2011	**269,504**	**261,963**	212,300	49,663	**68**	62	6	**0.26**	0.29	0.12
2012	**270,990**	**263,552**	212,480	51,072	**75**	71	4	**0.28**	0.33	0.08
2013	**279,607**	**271,263**	218,224	53,039	**62**	57	5	**0.23**	0.26	0.09
2014	**275,889**	**269,895**	216,495	53,400	**57**	55	2	**0.21**	0.25	0.04
2015[a]	**190,041**	**183,061**	146,251	36,810	**40**	37	3	**0.22**	0.25	0.08
Total	**1,578,343**	**1,528,642**	1,230,629	298,013	**361**	337	24	**0.24**	0.27	0.08

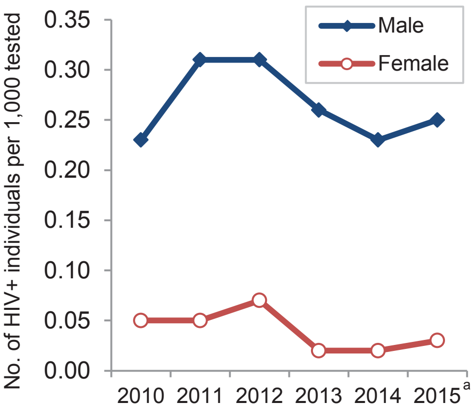
[a]Through 30 June 2015

TABLE 2. Diagnoses of HIV infections by race/ethnicity, civilian applicants for U.S. military service, January 2010–June 2015

Year	Total persons tested	White, non-Hispanic tested	Black, non-Hispanic tested	Hispanic/others tested	Total HIV(+)	White, non-Hispanic HIV(+)	Black, non-Hispanic HIV(+)	Hispanic/others HIV(+)	Overall rate per 1,000 tested	White, non-Hispanic rate per 1,000 tested	Black, non-Hispanic rate per 1,000 tested	Hispanic/others rate per 1,000 tested
2010	278,909	**190,680**	41,688	46,541	**59**	12	43	4	**0.21**	0.06	1.03	0.09
2011	261,968	**180,445**	41,286	40,237	**68**	22	39	7	**0.26**	0.12	0.94	0.17
2012	263,552	**174,176**	43,992	45,384	**75**	20	49	6	**0.28**	0.11	1.11	0.13
2013	271,263	**170,269**	49,996	50,998	**62**	12	48	2	**0.23**	0.07	0.96	0.04
2014	269,895	**170,848**	48,307	50,740	**57**	15	38	4	**0.21**	0.09	0.79	0.08
2015[a]	183,061	**120,886**	34,017	28,158	**40**	13	25	2	**0.22**	0.11	0.73	0.07
Total	1,528,648	**1,007,304**	259,286	262,058	**361**	94	242	25	**0.24**	0.09	0.93	0.10

[a]Through 30 June 2015

FIGURE 3. New diagnoses of HIV infections by gender, active component, U.S. Army, January 2010–June 2015



[a]Through 30 June 2015

2015, seroprevalences decreased by approximately 24% among male applicants and by 34% among black, non-Hispanic applicants. During 2014, on average, one civilian applicant for service was detected with antibodies to HIV per 4,840 screening tests **(Table 1)**.

U.S. Army

Active component: From January 2014 through June 2015, a total of 558,428 soldiers in the active component of the U.S. Army were tested for antibodies to HIV, and 114 soldiers were identified as HIV antibody positive (seroprevalence: 0.20 per 1,000 soldiers tested) **(Table 3)**.

Annual seroprevalences increased 33% from 2010 (0.21 per 1,000 tested) to 2012 (0.28 per 1,000 tested) and then decreased to 0.20 per 1,000 tested in 2014 **(Table 3, Figure 3)**.

During 2014, on average, one new HIV infection was detected among active component Army soldiers per 6,306 screening tests **(Table 3)**. Of the 531 active component soldiers diagnosed with HIV infections since 2010, 318 (60%) were still in military service in 2015.

Army National Guard: From January 2014 through June 2015, a total of 346,321 members of the U.S. Army National Guard were tested for antibodies to HIV, and 132

TABLE 3. New diagnoses of HIV infections by gender, active component, U.S. Army, January 2010–June 2015

Year	Total HIV tests	Total persons tested	Males tested	Females tested	Total new HIV(+)	New HIV(+) male	New HIV(+) female	Overall rate per 1,000 tested	Male rate per 1,000 tested	Female rate per 1,000 tested	HIV(+) still in military service in 2015
2010	589,929	**451,532**	390,215	61,317	**93**	90	3	**0.21**	0.23	0.05	**37**
2011	538,934	**431,337**	371,981	59,356	**118**	115	3	**0.27**	0.31	0.05	**48**
2012	519,040	**416,715**	359,451	57,264	**116**	112	4	**0.28**	0.31	0.07	**68**
2013	506,874	**405,158**	348,862	56,296	**90**	89	1	**0.22**	0.26	0.02	**59**
2014	447,712	**361,929**	309,967	51,962	**71**	70	1	**0.20**	0.23	0.02	**63**
2015[a]	215,860	**196,499**	167,522	28,977	**43**	42	1	**0.22**	0.25	0.03	**43**
Total	2,818,349	**2,263,170**	1,947,998	315,172	**531**	518	13	**0.23**	0.27	0.04	**318**

[a]Through 30 June 2015

TABLE 4. New diagnoses of HIV infections by gender, U.S. Army National Guard, January 2010–June 2015

Year	Total HIV tests	Total persons tested	Males tested	Females tested	Total new HIV(+)	New HIV(+) male	New HIV(+) female	Overall rate per 1,000 tested	Male rate per 1,000 tested	Female rate per 1,000 tested	HIV(+) still in military service in 2015
2010	240,468	**197,662**	170,188	27,474	**36**	35	1	**0.18**	0.21	0.04	**13**
2011	224,408	**187,246**	160,544	26,702	**45**	43	2	**0.24**	0.27	0.07	**14**
2012	192,298	**163,277**	137,897	25,380	**50**	50	0	**0.31**	0.36	0.00	**13**
2013	173,613	**147,714**	122,212	25,502	**50**	49	1	**0.34**	0.40	0.04	**24**
2014	265,914	**239,328**	199,813	39,515	**94**	93	1	**0.39**	0.47	0.03	**75**
2015[a]	113,130	**106,993**	89,925	17,068	**38**	37	1	**0.36**	0.41	0.06	**38**
Total	1,209,831	**1,042,220**	880,579	161,641	**313**	307	6	**0.30**	0.35	0.04	**177**

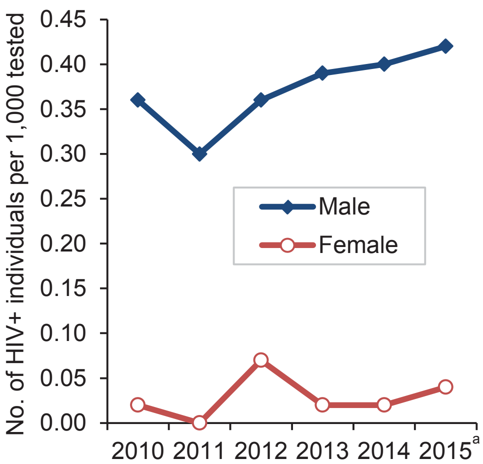
[a]Through 30 June 2015

TABLE 5. New diagnoses of HIV infections by gender, U.S. Army Reserve, January 2010–June 2015

Year	Total HIV tests	Total persons tested	Males tested	Females tested	Total new HIV(+)	New HIV(+) male	New HIV(+) female	Overall rate per 1,000 tested	Male rate per 1,000 tested	Female rate per 1,000 tested	HIV(+) still in military service in 2015
2010	113,101	**93,577**	73,031	20,546	**36**	36	0	**0.38**	0.49	0.00	**16**
2011	106,761	**88,715**	68,935	19,780	**37**	35	2	**0.42**	0.51	0.10	**23**
2012	86,095	**73,643**	57,098	16,545	**43**	42	1	**0.58**	0.74	0.06	**27**
2013	127,338	**113,145**	87,322	25,823	**53**	49	4	**0.47**	0.56	0.15	**39**
2014	120,282	**107,297**	81,903	25,394	**47**	44	3	**0.44**	0.54	0.12	**40**
2015[a]	45,837	**42,637**	32,763	9,874	**15**	15	0	**0.35**	0.46	0.00	**15**
Total	599,414	**519,014**	401,052	117,962	**231**	221	10	**0.45**	0.55	0.08	**160**

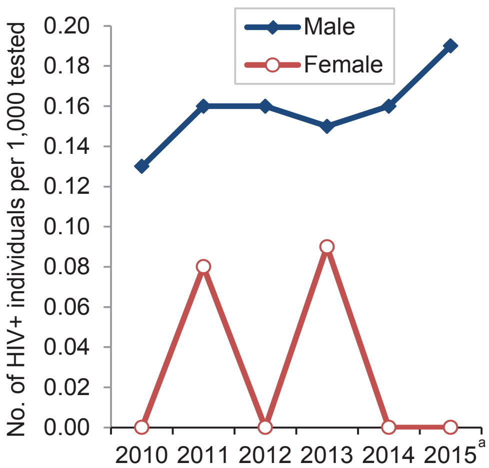
[a]Through 30 June 2015

FIGURE 4. New diagnoses of HIV infections by gender, active component, U.S. Navy, January 2010–June 2015



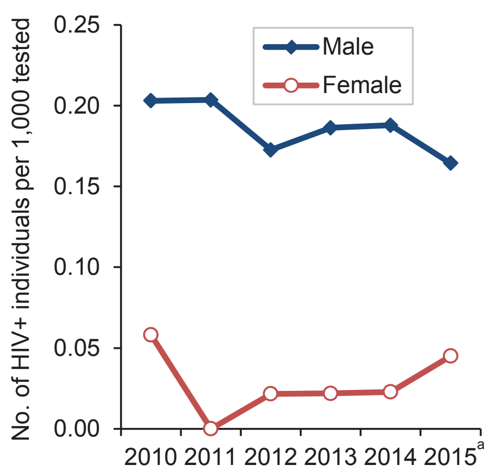
[a]Through 30 June 2015

FIGURE 5. New diagnoses of HIV infections by gender, active component, U.S. Marine Corps, January 2010–June 2015



[a]Through 30 June 2015

FIGURE 6. New diagnoses of HIV infections by gender, active component, U.S. Air Force, January 2010–June 2015



[a]Through 30 June 2015

soldiers were identified as HIV antibody positive (seroprevalence: 0.38 per 1,000 soldiers tested) **(Table 4)**. Among National Guard soldiers, annual seroprevalences increased each year, and more than doubled, from 2010 through 2014 (seroprevalences: 0.18 and 0.39 per 1,000 soldiers tested, respectively) and then decreased slightly in 2015.

During 2014, on average, one new HIV infection was detected among Army National Guard soldiers per 2,829 screening tests **(Table 4)**. Of the 313 National Guard soldiers who tested positive for HIV since 2010, 177 (57%) were still in military service in 2015.

Army Reserve: From January 2014 through June 2015, a total of 149,934 members of the U.S. Army Reserve were tested for antibodies to HIV, and 62 soldiers were identified as HIV antibody positive (seroprevalence: 0.41 per 1,000 soldiers tested) **(Table 5)**.

Among Army reservists, the seroprevalence in 2012 (0.58 per 1,000 tested) was higher than in any other year of routine HIV antibody screening of Army reservists since 1991 **(data not shown)**. However, the seroprevalence among Army reservists tested from January 2014 through June 2015 was 29% lower than in 2012 **(Table 5)**.

During 2014, on average, one new HIV infection was detected among Army reservists per 2,559 screening tests **(Table 5)**. Of the 231 Army reservists diagnosed with HIV infections since 2010, 160 (69%) were still in military service in 2015.

U.S. Navy

Active component: From January 2014 through June 2015, a total of 342,133 active component members of the U.S. Navy were tested for antibodies to HIV, and 115 sailors were identified as HIV antibody positive (seroprevalence: 0.34 per 1,000 sailors tested) **(Table 6)**. Among tested male active component sailors, the annual HIV antibody seroprevalence declined between 2010 and 2011 but increased each year since then **(Figure 4)**.

During 2014, on average, one new HIV-infection was detected among active component sailors per 3,430 screening tests **(Table 6)**. Of the 387 active component sailors who tested positive for HIV since 2010, 257 (66%) were still in military service in 2015.

Navy Reserve: From January 2014 through June 2015, a total of 57,626 members of the U.S. Navy Reserve were tested for antibodies to HIV, and 29 sailors were identified as HIV antibody positive (seroprevalence: 0.50 per 1,000 sailors tested) **(Table 7)**. The HIV antibody seroprevalence among Navy reservists nearly doubled between 2013 and 2015 (seroprevalences: 0.31 and 0.60 per 1,000 sailors tested, respectively). The seroprevalence in 2015 (through June) was higher than in any other year of routine HIV antibody screening of Navy reservists **(data not shown)**. Of note, no female Navy reservists have been detected with antibodies to HIV during routine screening since 2007 **(data not shown)**.

During 2014, on average, one new HIV infection was detected among Navy reservists per 2,518 screening tests **(Table 7)**. Of the 86 reserve component sailors diagnosed with HIV infections since 2010, 58 (67%) were still in military service in 2015.

U.S. Marine Corps

Active component: From January 2014 through June 2015, a total of 222,684 members of the active component of the U.S. Marine Corps were tested for antibodies to HIV, and 35 Marines were identified as HIV antibody positive (seroprevalence: 0.16 per 1,000 Marines tested) **(Table 8)**. From 2012 through June 2015, prevalences of antibodies to HIV remained relatively low and stable among routinely tested Marines **(Figure 5)**.

During 2014, on average, one new HIV infection was detected among active component Marines per 7,879 screening tests **(Table 8)**. Of the 127 active component Marines diagnosed with HIV infections since 2010, 61 (48%) were still in military service in 2015.

TABLE 6. New diagnoses of HIV infections by gender, active component, U.S. Navy, January 2010–June 2015

Year	Total HIV tests	Total persons tested	Males tested	Females tested	Total new HIV(+)	New HIV(+) male	New HIV(+) female	Overall rate per 1,000 tested	Male rate per 1,000 tested	Female rate per 1,000 tested	HIV(+) still in military service in 2015
2010	283,050	**240,011**	199,582	40,429	**72**	71	1	**0.30**	0.36	0.02	**29**
2011	271,444	**232,624**	192,226	40,398	**58**	58	0	**0.25**	0.30	0.00	**31**
2012	273,478	**234,250**	192,638	41,612	**72**	69	3	**0.31**	0.36	0.07	**41**
2013	247,852	**217,517**	177,241	40,276	**70**	69	1	**0.32**	0.39	0.02	**54**
2014	250,384	**222,115**	180,799	41,316	**73**	72	1	**0.33**	0.40	0.02	**61**
2015[a]	126,950	**120,018**	96,949	23,069	**42**	41	1	**0.35**	0.42	0.04	**41**
Total	1,453,158	**1,266,535**	1,039,435	227,100	**387**	380	7	**0.31**	0.37	0.03	**257**

[a]Through 30 June 2015

TABLE 7. New diagnoses of HIV infections by gender, U.S. Navy Reserve, January 2010–June 2015

Year	Total HIV tests	Total persons tested	Males tested	Females tested	Total new HIV(+)	New HIV(+) male	New HIV(+) female	Overall rate per 1,000 tested	Male rate per 1,000 tested	Female rate per 1,000 tested	HIV(+) still in military service in 2015
2010	54,309	**45,452**	36,900	8,552	**18**	18	0	**0.40**	0.49	0.00	**6**
2011	50,448	**42,850**	34,661	8,189	**14**	14	0	**0.33**	0.40	0.00	**9**
2012	48,212	**41,335**	33,312	8,023	**13**	13	0	**0.31**	0.39	0.00	**9**
2013	45,151	**38,539**	30,692	7,847	**12**	12	0	**0.31**	0.39	0.00	**7**
2014	42,806	**37,609**	29,911	7,698	**17**	17	0	**0.45**	0.57	0.00	**15**
2015[a]	21,313	**20,017**	15,761	4,256	**12**	12	0	**0.60**	0.76	0.00	**12**
Total	262,239	**225,802**	181,237	44,565	**86**	86	0	**0.38**	0.47	0.00	**58**

[a]Through 30 June 2015

TABLE 8. New diagnoses of HIV infections by gender, active component, U.S. Marine Corps, January 2010–June 2015

Year	Total HIV tests	Total persons tested	Males tested	Females tested	Total new HIV(+)	New HIV(+) male	New HIV(+) female	Overall rate per 1,000 tested	Male rate per 1,000 tested	Female rate per 1,000 tested	HIV(+) still in military service in 2015
2010	187,690	**153,377**	142,632	10,745	**19**	19	0	**0.12**	0.13	0.00	**4**
2011	206,241	**172,275**	160,237	12,038	**26**	25	1	**0.15**	0.16	0.08	**5**
2012	202,076	**166,046**	154,089	11,957	**25**	25	0	**0.15**	0.16	0.00	**10**
2013	180,214	**151,866**	140,291	11,575	**22**	21	1	**0.14**	0.15	0.09	**12**
2014	173,344	**146,848**	135,128	11,720	**22**	22	0	**0.15**	0.16	0.00	**17**
2015[a]	80,707	**75,836**	69,773	6,063	**13**	13	0	**0.17**	0.19	0.00	**13**
Total	1,030,272	**866,248**	802,150	64,098	**127**	125	2	**0.15**	0.16	0.03	**61**

[a]Through 30 June 2015

TABLE 9. New diagnoses of HIV infections by gender, U.S. Marine Corps Reserve, January 2010–June 2015

Year	Total HIV tests	Total persons tested	Males tested	Females tested	Total new HIV(+)	New HIV(+) male	New HIV(+) female	Overall rate per 1,000 tested	Male rate per 1,000 tested	Female rate per 1,000 tested	HIV(+) still in military service in 2015
2010	28,935	**25,339**	24,237	1,102	**6**	6	0	**0.24**	0.25	0.00	**0**
2011	32,882	**28,027**	26,889	1,138	**4**	4	0	**0.14**	0.15	0.00	**1**
2012	30,271	**25,833**	24,801	1,032	**4**	4	0	**0.15**	0.16	0.00	**1**
2013	27,651	**24,160**	23,174	986	**4**	4	0	**0.17**	0.17	0.00	**3**
2014	27,335	**24,387**	23,452	935	**7**	7	0	**0.29**	0.30	0.00	**5**
2015[a]	14,464	**13,872**	13,377	495	**7**	7	0	**0.50**	0.52	0.00	**7**
Total	161,538	**141,618**	135,930	5,688	**32**	32	0	**0.23**	0.24	0.00	**17**

[a]Through 30 June 2015

TABLE 10. New diagnoses of HIV infections by gender, active component, U.S. Air Force, January 2010–June 2015

Year	Total HIV tests	Total persons tested[b]	Males tested	Females tested	Total new HIV(+)	New HIV(+) male	New HIV(+) female	Overall rate per 1,000 tested	Male rate per 1,000 tested	Female rate per 1,000 tested
2010	282,446	**263,451**	211,830	51,621	**46**	43	3	**0.17**	0.20	0.06
2011	257,586	**219,328**	176,902	42,426	**36**	36	0	**0.16**	0.20	0.00
2012	250,687	**237,451**	191,140	46,311	**34**	33	1	**0.14**	0.17	0.02
2013	245,013	**233,514**	187,889	45,625	**36**	35	1	**0.15**	0.19	0.02
2014	236,011	**224,877**	180,964	43,913	**35**	34	1	**0.16**	0.19	0.02
2015[a]	118,980	**113,463**	91,272	22,191	**16**	15	1	**0.14**	0.16	0.05
Total	1,390,723	**1,292,084**	1,039,997	252,087	**203**	196	7	**0.16**	0.19	0.03

[a]Through 30 June 2015
[b]Total persons tested includes unknown or missing genders.

TABLE 11. New diagnoses of HIV infections by gender, U.S. Air National Guard, January 2010–June 2015

Year	Total HIV tests	Total persons tested[b]	Males tested	Females tested	Total new HIV(+)	New HIV(+) male	New HIV(+) female	Overall rate per 1,000 tested	Male rate per 1,000 tested	Female rate per 1,000 tested
2010	24,294	**22,612**	18,837	3,775	**0**	0	0	**0.00**	0.00	0.00
2011	43,231	**37,972**	31,540	6,432	**3**	3	0	**0.08**	0.10	0.00
2012	47,687	**45,197**	37,668	7,529	**6**	6	0	**0.13**	0.16	0.00
2013	37,090	**35,577**	29,577	6,000	**2**	2	0	**0.06**	0.07	0.00
2014	38,615	**37,444**	30,987	6,457	**1**	1	0	**0.03**	0.03	0.00
2015[a]	18,811	**18,005**	14,852	3,153	**2**	2	0	**0.11**	0.13	0.00
Total	209,728	**196,807**	163,461	33,346	**14**	14	0	**0.07**	0.09	0.00

[a]Through 30 June 2015
[b]Total persons tested includes unknown or missing genders.

TABLE 12. New diagnoses of HIV infections by gender, U.S. Air Force Reserve, January 2010–June 2015

Year	Total HIV tests	Total persons tested[b]	Males tested	Females tested	Total new HIV(+)	New HIV(+) male	New HIV(+) female	Overall rate per 1,000 tested	Male rate per 1,000 tested	Female rate per 1,000 tested
2010	25,101	**23,938**	18,584	5,354	**9**	9	0	**0.38**	0.48	0.00
2011	27,329	**24,998**	19,570	5,428	**5**	5	0	**0.20**	0.26	0.00
2012	29,444	**28,461**	21,957	6,504	**10**	10	0	**0.35**	0.46	0.00
2013	25,584	**24,956**	19,319	5,637	**10**	10	0	**0.40**	0.52	0.00
2014	28,150	**27,427**	20,975	6,452	**6**	5	1	**0.22**	0.24	0.15
2015[a]	13,336	**12,940**	9,810	3,130	**0**	0	0	**0.00**	0.00	0.00
Total	148,944	**142,720**	110,215	32,505	**40**	39	1	**0.28**	0.35	0.03

[a]Through 30 June 2015
[b]Total persons tested includes unknown or missing genders.

Marine Corps Reserve: From January 2014 through June 2015, a total of 38,259 members of the U.S. Marine Corps Reserve were tested for antibodies to HIV, and 14 Marines were identified as HIV antibody positive (seroprevalence: 0.37 per 1,000 Marines tested) **(Table 9)**. Through June 2015, the prevalence of antibodies to HIV among male Marine reservists was 0.52 per 1,000 Marines tested, the highest seroprevalence among male Marine Corps reservists since 1990 **(data not shown)**. Of note, since 1990, no female Marine Corps reservist has been detected with antibodies to HIV during routine screening **(data not shown)**.

During 2014, on average, one new HIV infection was detected among Marine Corps reservists per 3,905 screening tests **(Table 9)**. Of the 32 Marine Corps reservists diagnosed with HIV infection since 2010, 17 (53%) were still in military service in 2015.

U.S. Air Force

Active component: During January 2014 through June 2015, a total of 338,340 active component members of the U.S. Air Force were tested for antibodies to HIV, and 51 airmen were diagnosed with HIV infections (seroprevalence: 0.15 per 1,000 airmen tested) **(Table 10)**. From 2010 through 2014, annual seroprevalences remained relatively low and stable among active component Air Force members **(Figure 6)**. During 2014, on average, one new HIV infection was detected among active Air Force members per 6,743 screening tests **(Table 10)**.

Air National Guard: From January 2014 through June 2015, a total of 55,449 members of the Air National Guard were tested for antibodies to HIV, and three airmen were diagnosed with HIV infections (seroprevalence: 0.05 per 1,000 airmen tested) **(Table 11)**. Since 2007, no female Air National Guard member has been detected with antibodies to HIV during routine testing. During 2014, on average, one new HIV infection was detected among Air National Guard members per 38,615 screening tests **(Table 11)**.

Air Force Reserve: From January 2014 through June 2015, a total of 40,367 members of the Air Force Reserve were tested for antibodies to HIV, and six airmen were diagnosed with HIV infections (seroprevalence: 0.15 per 1,000 airmen tested) **(Table 12)**. During 2014, on average, one new HIV infection was detected among Air Force reservists per 4,692 screening tests **(Table 12)**.

Data summaries for the U.S. Air Force were provided by the U.S. Air Force School of Aerospace Medicine (USAFSAM).

U.S. Coast Guard

Active component: From January 2014 through June 2015, a total of 30,634 active component members of the U.S. Coast Guard were tested for antibodies to HIV, and four Coast Guard members were diagnosed with HIV infections (seroprevalence: 0.13 per 1,000 guardsmen tested) **(data not shown)**. During 2014, on average, one new HIV infection was detected among active Coast Guardsmen per 7,973 screening tests **(data not shown)**.

Coast Guard Reserve: From January 2014 through June 2015, a total of 7,594 reserve component members of the U.S. Coast Guard were tested for antibodies to HIV, and one HIV infection was detected (seroprevalence: 0.13 per 1,000 guardsman tested) **(data not shown)**. During 2014, on average, one new HIV infection was detected among Coast Guard reservists per 5,698 screening tests **(data not shown)**. Of note, no female Coast Guard reservist has been detected with antibodies to HIV during routine screening in more than 25 years.

EDITORIAL COMMENT

For nearly 30 years, the U.S. military has conducted routine screening for antibodies to HIV among all civilian applicants for service and all active and reserve component members of the services.[2] For 20 years, results of U.S. military HIV antibody testing programs have been summarized in the *MSMR*.[3]

This report documents that, since 2010, prevalences of HIV seropositivity among civilian applicants for military service have generally declined. In fact, the prevalence of antibodies to HIV among civilian applicants in 2014 was the lowest annual seroprevalence since routine testing began. Of note, however, because applicants for military service are not randomly selected from the general population of U.S. young adults, seroprevalences among them are not directly indicative of HIV prevalences, infection rates, or trends in the general U.S. population. As such, relatively low prevalences of HIV among civilian applicants for military service do not necessarily indicate low prevalences or incidence rates of HIV among young adults in the U.S. in general.

This report also documents that, in 2014 and 2015, compared to prior years, seroprevalences among most of the active and reserve components of the Services were relatively low, and that recent trends of seroprevalences have been relatively stable. Again, however, such results should be interpreted with consideration of the limitations of the surveillance data summarized herein. For example, because all military members have been screened as civilian applicants for service (since October 1985), routinely every 2 years (since 2004), and before and after overseas deployments (for more than a decade), routine screening now detects relatively recently acquired HIV infections (i.e., infections acquired since the most recent negative test of each affected individual). As such, annual HIV antibody seroprevalences during routine screening of military populations are reflective of, but are not direct unbiased estimates of, incidence rates and trends of acquisitions of HIV infections among military members.

So, for example, the Army National Guard was the only Service and component–defined subgroup in whom annual seroprevalences consistently increased since 2010. However, increasing seroprevalences among Army National Guard members could reflect lengthening time intervals between routine tests (allowing more newly acquired infections to accumulate before they are detected through screening), changes in "selection criteria" for testing (e.g., targeting of individuals at presumed higher risk such as those with multiple/anonymous sexual contacts or diagnosed with sexually transmitted infections), and/or increasing rates of acquisitions of new infections.

In summary, the U.S. military has conducted comprehensive HIV prevention, education, counseling, and treatment programs for nearly 30 years. Since the beginning of the programs, routine screening of all civilian applicants for service and routine periodic testing of all active and reserve component members of the Services have been fundamental components of the military's HIV control and clinical management efforts. Summaries of results of screening programs such as those in this report provide insights into the current status and trends of HIV's impacts in various U.S. military populations.

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Durations of Military Service After Diagnoses of HIV-1 Infections Among Active Component Members of the U.S. Armed Forces, 1990–2013

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This report describes the trends in length of military service for active component members of the U.S. Armed Forces who were diagnosed with human immunodeficiency virus type 1 (HIV-1) infections during 1990–2013. Durations of service after service members' initial diagnoses of HIV-1 infection were compared for five different cohorts that corresponded to when diagnoses were made during the 5-year intervals beginning in 1990, 1995, 2000, and 2005, and the 4-year interval of 2010–2013. By several measures, the durations of service after initial diagnoses of HIV-1 infection increased from the earliest to the later cohorts. The findings are discussed in the context of changes in several factors during the surveillance period: the growing availability and effectiveness of treatments for HIV-1 disease; the stigmas associated with the diagnosis of HIV-1 infection and its link to homosexuality; and the changes in U.S. military policy about the inclusion of homosexuals in its ranks. Also discussed are the limitations of the estimates for the most recent cohorts and the future prospects for continued lengthening of service for those infected with HIV-1.

For nearly 30 years, the U.S. military has conducted routine screening for antibodies to human immunodeficiency virus type 1 (HIV-1) among all civilian applicants for and individuals serving in the U.S. military. Because all new entrants to military service must be HIV-1 seronegative and because all members of the military services are periodically tested for HIV-1 infections, since the late 1980s, nearly all HIV-1 infections documented among U.S. military members have been relatively recently acquired.[1,2]

When the military's HIV-1 testing program began, there were no specific treatments to counter the inexorable progression to death of HIV-1-associated diseases. However, in 1987, the antiretroviral drug azidothymidine (AZT) (also known as zidovudine or ZDV) was approved by the FDA for use against HIV-1. Since then, there have been extraordinary advances in the treatment of HIV-1-associated disease (e.g., combination antiretroviral therapy guided by CD4+ T lymphocyte concentrations and HIV-1 viral loads). As a result, with state-of-the-art clinical management, the clinical courses of HIV-1 disease have dramatically lengthened, especially for those diagnosed and treated in early (presymptomatic) clinical stages.[3–6]

For example, in 1991, Longini and colleagues estimated the range of times from HIV-1 seroconversion until the first diagnoses of opportunistic infections among U.S. military members as 8.9–11.1 years (more rapid progression among the older aged).[7] In 1998, Gardner and colleagues estimated that, in HIV-1-infected U.S. military members, the relative risk of progression for those treated early versus late with AZT was 0.58; notably, the duration of the beneficial effects was limited to approximately 2 years.[8] The introduction of combination therapies for HIV-1 increased not only the magnitudes but also the persistence of treatment effects. So, for example, in 2012, Weistrich and colleagues estimated that, among HIV-1-infected participants in several follow-up cohorts in the U.S., antiretroviral treatment nearly halved the hazard of acquired immune deficiency syndrome (AIDS) or death (point estimate, hazard ratio = 0.55), and the effects persisted throughout the 6.5 years of follow-up.[6]

Since the U.S. military's HIV-1 screening programs began, all individuals in active service who have been diagnosed with HIV-1 infections have been permitted to remain in active service as long as they are capable of performing their military duties and are not subject to discharge for administrative or disciplinary reasons. When infected individuals become too debilitated from their illnesses to continue to serve, they are referred for medical disability separations or retirements. Of course, military members who are infected with but not significantly debilitated from HIV-1 may elect to terminate their service when their obligations have been fulfilled.[9]

With the clinical management tools and treatment regimens that are currently available, the asymptomatic stages of the disease courses of HIV-1-infected military members can be very long. For this report, we assessed characteristics of and changes over time in the durations of military service of active component members of the U.S. military after initial diagnoses of HIV-1 infections from 1990 through 2013.

METHODS

The surveillance cohort consisted of all individuals who were diagnosed with HIV-1 infections while serving in the active component of the U.S. Armed Forces any time between 1 January 1990 and 31 December 2013. For each surveillance cohort member, "survival time" in active military service after the diagnosis of HIV-1 infection extended from the date of their first documented HIV-1 infection diagnosis (per HIV-1 serologic test records maintained in the Defense Medical Surveillance System [DMSS]) until the date of their death, discharge, or retirement from military service, or 30 June 2015 (the end of the surveillance period).

The Kaplan-Meier survival method was used to estimate the distributions of durations of military service after HIV-1 diagnoses among various cohorts of HIV-1-infected service members. For survival analysis purposes, "failure events" were deaths (while still in service), retirements, or discharges from active service. Survival times of cohort members who remained in active service until the end of the surveillance period (30 June 2015) were censored as of that day.[10]

To assess temporal trends in the durations of active military service after new diagnoses of HIV-1, survival analyses were conducted in five cohorts of military members based on the calendar years of their initial HIV-1 diagnoses: Cohort 1, initial diagnoses in 1990–1994; Cohort 2, initial diagnoses in 1995–1999; Cohort 3, initial diagnoses in 2000–2004; Cohort 4, initial diagnoses in 2005–2009; and Cohort 5, initial diagnoses in 2010–2013.

RESULTS

During the 24-year surveillance period, a total of 5,227 military members were newly diagnosed with HIV-1 infections. The mean number of HIV-1 infection diagnoses per year was 218 (range, new diagnoses per year: 86 [1995] to 817 [1990]) **(data not shown)**.

Because the cohorts were defined by the years when their infections were diagnosed, the lengths of time from diagnoses until the end of the surveillance period markedly varied across the cohorts. In turn, the proportions of cohort members still in military service at the end of the surveillance period varied across the cohorts (% of cohort members in service at end of the follow-up period: Cohort 1 [1990–1994], 0.2%; Cohort 2 [1995–1999], 5.6%; Cohort 3 [2000–2004], 16.4%; Cohort 4 [2005–2009], 32.2%; Cohort 5 [2010–2013], 62.9%) **(data not shown)**.

Estimated median durations of service after initial HIV-1 diagnoses ranged from 2.29 years in Cohort 1 (1990–1994) to 3.65 years in Cohort 4 (2005–2009). Thus, in the 15 years between 1990–1994 and 2005–2009, the median durations of service after HIV-1 diagnoses increased by 1.4 years **(Figures 1, 2)**. (Because more than 60% of Cohort 5 were still in service at the end of the surveillance period, the estimate of the median duration of service after diagnoses of Cohort 5 members was unstable and is not included here.)

The estimated duration of service from HIV-1 diagnoses until 75% of cohort members had left service was much longer among Cohort 2 (8.48 years), and more than twice as long among Cohort 3 (9.13 years), than Cohort 1 (4.39 years) members. Thus, in the 10 years between 1990–1994 and 2000–2004, the durations of service of the 25% who stayed in service the longest after diagnoses increased by 4.7 years **(Figures 1, 2)**. (Because more than one-third of Cohorts 4 and 5 were still in service at the end of the surveillance period, estimates of the 75%iles of durations of service after diagnoses of those cohorts were unstable and are not included here.)

The estimated duration of service from diagnoses until one-fourth of cohort members had left service changed only slightly between 1990–1994 (0.85 years) and 2005–2009 (1.30 years). Thus, in the 15 years between 1990–1994 and 2005–2009, the durations of service of the first 25% to leave service after diagnoses increased by less than 6 months **(Figures 1,2)**.

During the surveillance period overall, median durations of service after HIV-1 diagnoses steadily increased with age from <20 years through 30–39 years at times of diagnoses. Also, compared to their respective counterparts, median durations of service after diagnoses were longer among females, officers and senior enlisted members, and Navy members **(Table 1)**.

EDITORIAL COMMENT

This report documents a marked and continuous increase (60% overall) in the median durations of military service after

FIGURE 1. Estimated percentages of HIV-1-infected service members still in active military service, by time (in years) since diagnoses of HIV-1 infections, by cohorts of active component members diagnosed with HIV-1, U.S. Armed Forces, 1990−2013

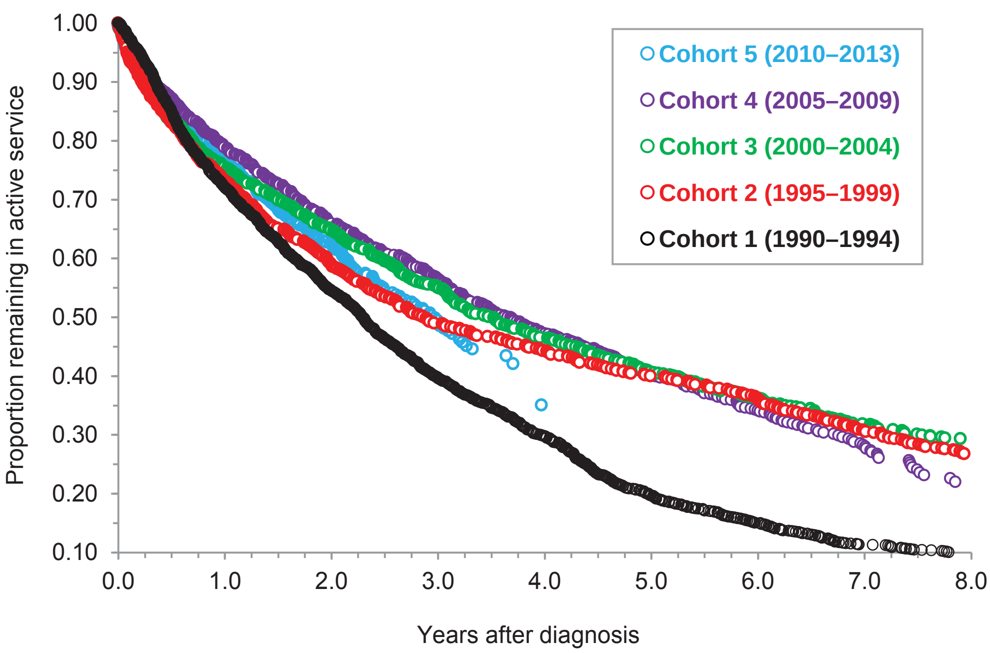
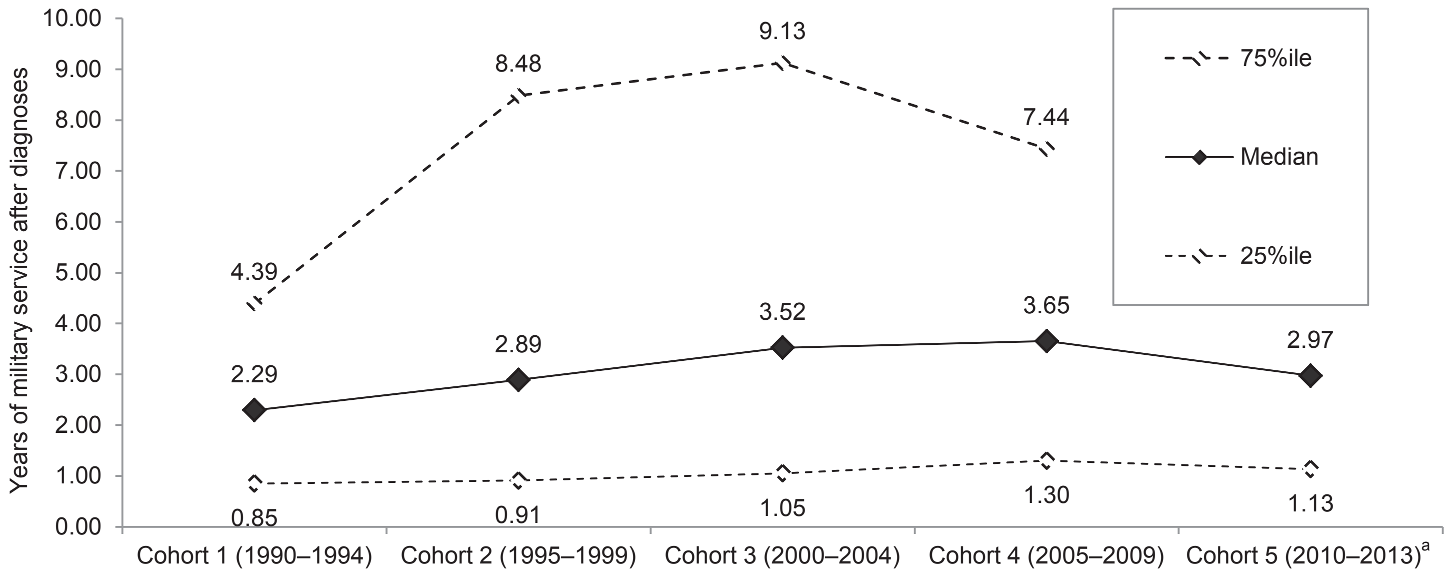


FIGURE 2. Estimated distributions of durations (in years) of active military service after diagnoses of HIV-1 among cohorts of active component members diagnosed with HIV-1, U.S. Armed Forces, 1990−2013



[a]Estimate of 75%ile duration of service of Cohort 5 not included because of relatively short follow-up until end of surveillance period

TABLE 1. Estimated distributions of durations of active military service after diagnoses of HIV-1 infections, by military/demographic characteristics, active component, U.S. Armed Forces, 1990–2013

			Distribution of duration (in years) of military service after diagnosis of HIV-1		
	No.	%	25%ile	50%ile	75%ile
Overall	5,227	100.0	0.85	2.34	4.99
Sex[a]					
Male	5,047	96.6	0.85	2.34	4.93
Female	179	3.4	0.84	3.05	9.02
Age[a]					
<20	223	4.3	0.11	1.33	2.80
20–24	1,821	34.8	0.73	1.95	4.21
25–29	1,422	27.2	0.96	2.61	5.38
30–39	1,417	27.1	1.29	3.40	6.24
≥40	343	6.6	0.74	1.78	3.38
Service					
Army	1,976	37.8	0.91	2.15	4.93
Navy	2,325	44.5	0.90	2.70	5.29
Air Force	383	7.3	0.71	2.22	4.58
Marine Corps	487	9.3	0.54	1.75	4.25
Coast Guard	56	1.1	0.83	2.21	5.54
Rank					
Junior enlisted (E1–E4)	2,618	50.1	0.61	1.73	3.79
Senior enlisted (E5–E9)	2,249	43.0	1.30	3.17	6.07
Officer (including warrant)	360	6.9	1.02	3.07	5.69
Reason for end of follow-up					
Terminated service "T"	4,131	79.0	0.71	2.11	4.45
End of follow-up period "C"	1,096	21.0	1.59	3.67	6.69

[a]One service member not included because characteristic was unknown

HIV-1 diagnoses among cohorts diagnosed from 1990–1994 (2.29 years) through 2005–2009 (3.65 years). During the 15-year period between 1990–1994 and 2005–2009, median durations of service after diagnoses increased by approximately 1 month per year (16 months overall).

Of note, the increases in service after diagnoses did not uniformly affect all military members diagnosed with HIV-1. For example, among the first 25% of each infected cohort to leave service, there were relatively small increases in post-diagnosis durations of service. Of the first 25% of cohort members to leave service, durations of service only increased by 5.4 months overall between 1990–1994 and 2005–2009.

The findings suggest that regardless of the availability and effectiveness of treatments for HIV-1 disease, at least 25% of infected service members left service within the first 16 months after diagnoses. However, it is relevant that during most of the surveillance period considered here, there were significant stigmas associated with both HIV-1 infection status and homosexuality; such stigmas likely discouraged many HIV-1-infected service members from remaining in service.

Through the early 1990s, many U.S. military members considered HIV-1 infection a "death warrant" because it inevitably progressed to AIDS, an incurable and ultimately fatal disease. Also, military members who were infected with HIV-1 were precluded from some career-enhancing assignments and activities (e.g., military schools, overseas deployments). Thus, throughout much of the period of routine HIV-1 testing in the military, there were significant stigmas associated with HIV-1 infection status.

Also, for most of the period of interest of this report, individuals who were openly homosexual/bisexual were precluded from serving in the U.S. military. However, in September 2011, all proscriptions against U.S. military service based on sexual orientation were removed. Thus, until fairly recently, there were significant institutionalized stigmas associated with homosexuality in the military.

Because men who have sex with men are at relatively high risk of HIV-1 infection, homosexual men constitute a relatively large proportion of military members diagnosed with HIV-1.[11,12] Because of the stigmas associated with both HIV-1 infection status and homosexuality, it is likely that some service members who were diagnosed with HIV-1 infections, particularly if homosexual, were unwilling—even if eligible—to remain in service. Perhaps, many such individuals were among the 25% of HIV-1-infected service members who left service soon after HIV-1 diagnoses.

However, as the management of HIV-associated disease continues to improve and as the U.S. military adapts to the inclusion of homosexuals within its ranks, stigmas associated with HIV-1 infection and homosexuality will decrease. Thus, in the future, relatively more service members who are diagnosed with HIV-1 infections, regardless of their sexual orientations, may elect to continue their military service careers.

In regard to the one-fourth of each cohort who remained in service the longest after diagnoses (i.e., 75%ile of durations of service), estimates of the durations of service after diagnoses more than doubled (4.7 years difference overall) during the 10 years between the times of diagnoses of the 1990–1994 and 2000–2004 cohorts. As follow-up of the most recently infected cohort (2010–2013) considered here becomes more complete over time, the durations of service after diagnoses of those who remain the longest will likely exceed the durations of the earlier infected cohorts.

The findings of this report should be interpreted with consideration of its limitations. Most notably, approximately one-fifth (21%) of all HIV-1-infected cohort members were in active military service at the end of the follow-up period. And in each cohort of HIV-1-infected service members, median durations of service were much longer among those who were still in service than those who had departed. The Kaplan-Meier survival methods used for this analysis enabled the use of all active service time that each HIV-1-infected cohort member provided from the day of diagnosis until death, retirement, discharge, or the end of the follow-up period.[10] However, because the proportions of cohort members still in service at the end of the surveillance period so markedly varied across the cohorts (range, % of cohorts still in active service at end of the surveillance period: 0.2% [Cohort 1: 1990–1994] to 62.9% [Cohort 5: 2010–2013]), estimates of the distributions of durations of service after diagnoses—particularly of median and 75%ile durations—are more stable and reliable for the earlier than the later-diagnosed cohorts.

In summary, the findings of this report document large increases in the durations of service after HIV-1 diagnoses among service members who are motivated to continue their military careers. In the past 30 years, HIV-1 infection has gone from an untreatable disease marked by inexorable clinical progression through extreme debility to death to a treatable disease that is compatible with active service throughout a full career in the U.S. military. As stigmas associated with HIV-1 infection status and homosexuality decrease within the military, it is likely that durations of service after HIV-1 diagnoses will continue to lengthen.

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Case Report: Probable Murine Typhus at Joint Base San Antonio, TX

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Murine typhus, also called flea-borne or endemic typhus, is a bacterial disease caused by the organism *Rickettsia typhi*. The bacteria are transmitted to humans by infected fleas that have acquired the organism from reservoirs such as rats, opossums, and other small animals, including domestic dogs and cats. Murine typhus can cause a mild fever, with rash on the body, headaches, and muscle aches. The disease is treatable with a tetracycline antibiotic, usually doxycycline, and rarely results in death. This report contains a description of a probable case of murine typhus diagnosed in a resident of Texas who was treated at the San Antonio Military Medical Center (SAMMC). The case provides an opportunity to examine significant clinical and epidemiologic characteristics of murine typhus, and to remind the reader about other rickettsial diseases that might affect beneficiaries of the Military Health System (MHS).

CASE REPORT

The 14-year-old daughter of a retired Air Force non-commissioned officer was initially evaluated in January 2015 at the Wilford Hall Ambulatory Surgical Center Urgent Care Center, Joint Base San Antonio, TX, for fever and abdominal pain. She was managed conservatively (supportive care) but returned 3 days later with ongoing fever up to 104°F, continued abdominal pain, and new onset emesis and diarrhea. A rapid influenza screen and a Respiratory Virus Panel were negative at that time. Saline was administered intravenously and the patient was transferred by ambulance to the SAMMC pediatric ward.

No family members or other contacts were ill. The patient denied any recent travel. She has two pet hermit crabs and three dogs and lived with her parents and one sibling in a rural area of Texas where there are feral cats, as well as opossums, raccoons, boars, and coyotes. The patient indicated that she does bring feral cats into her bedroom.

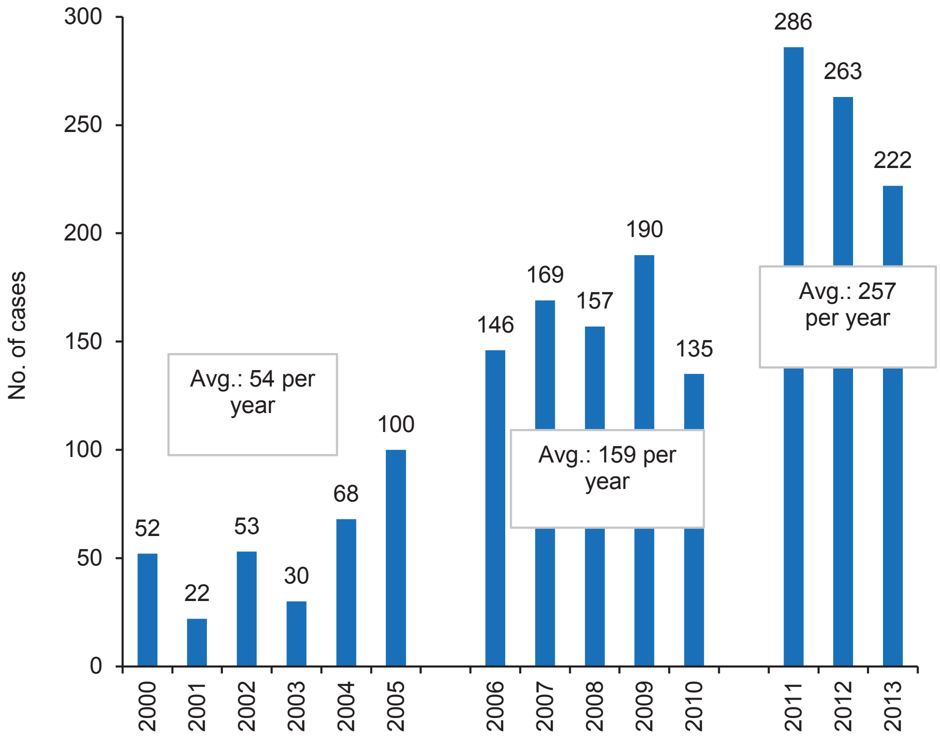
Shortly after arrival at SAMMC, the patient was admitted to the Pediatric Intensive Care Unit in hypotensive shock. Physical exam revealed a temperature of 102.8°F and a respiratory rate of 48 accompanied by mild right upper quadrant abdominal tenderness and an erythematous blanching macular rash on the face, neck, arms, and legs. An admission blood pressure was 113/69 mmHg, but subsequent measurements showed systolic blood pressure of less than 90 mmHg. A complete blood count revealed 5.13×10^3 white cells per microliter with 42% segmented neutrophils and 46% band forms. A hematocrit was 33.4% and a platelet count was 55,000 per microliter. Aspartate and alanine aminotransferases were 47 units per liter (U/L) (reference range: 5–32 U/L) and 29 U/L (reference range: 4–33 U/L), respectively. Blood cultures obtained upon admission showed no growth after 5 days. A rickettsial disease was suspected and the patient was treated with intravenous (IV) doxycycline, 100 mg every 12 hours; ceftriaxone and vancomycin were also administered. The patient recovered promptly and her treatment was converted to an oral regimen of doxycycline (within 48 hours of starting IV doxycycline) to complete a 7-day course with the same oral dosage. The patient was hospitalized for a total of 7 days. During her hospitalization, serologic testing revealed negative immunoglobulin M (IgM) and immunoglobulin G (IgG) antibody titers for *Rickettsia rickettsii* (cause of Rocky Mountain spotted fever) and *Coxiella burnetii* (cause of Q fever). An initial *R. typhi* IgG antibody titer was positive at a 1:128 dilution by indirect fluorescent antibody (IFA) in serum obtained during her hospitalization. A convalescent-phase *R. typhi* IgG antibody titer obtained 3 weeks later was positive at a 1:256 dilution. No serum specimen was ever tested for *R. typhi* IgM antibody titer.

EDITORIAL COMMENT

Murine typhus, caused by an obligate intracellular, gram-negative bacterial organism, *R. typhi* (formerly *Rickettsia mooseri* and *Rickettsia felis*),[1] is an uncommon flea-borne infectious disease that is reported relatively rarely in the U.S. The illness is diagnosed less frequently in the U.S. than in developing nations because of improvements in hygiene and rat control efforts. The actual prevalence of murine typhus is difficult to ascertain because infection can be mild, self-limiting, and problematic to differentiate from other causes of rash and fever. Human cases of flea-borne typhus are reported worldwide, but they predominate in tropical and coastal areas.

In the U.S., murine typhus is found most commonly in Southern California,[2] Texas,[3] and Hawaii, with an average of about 200 cases reported each year.[4] Texas averaged 54 murine typhus cases annually during 2000–2005; this average increased to 159 cases annually during 2006–2010, an increase that is attributed to active surveillance by public health authorities and enhanced physician reporting. During 2011–2013, Texas averaged 257 cases per year (K. Owens, Texas Department of State Health Services; personal communication, 15 March 2015) **(Figure)**. Murine typhus is primarily transmitted by the rat flea, *Xenopsylla cheopis*.[5] In contrast, epidemic typhus

FIGURE. Annual numbers[a] of reported cases of murine typhus, Texas, 2000–2013[3]



[a]Data source: K. Owens, Texas Department of State Health Services; personal communication, 15 March 2015

is transmitted primarily by lice. Additional murine typhus vectors include the cat flea, *Ctenocephalides felis*, and the mouse flea, *Leptopsyllia segnis*.[5] Fleas remain permanently infected with *R. typhi*, but their lifespan is not reduced by the presence of rickettsiae. Humans are infected by inoculation of infective flea feces into bite wounds.[6] The majority of cases of murine typhus are associated with environments where rats accumulate in large numbers. In the U.S., domestic cats, cat fleas, and opossums may maintain a cycle of both *R. typhi* and *R. felis* (a spotted fever group rickettsia that is flea-borne and produces an illness that is clinically similar to murine typhus).[6] Fleas may become infected when they feed on these animals and then can transmit the bacteria to humans, dogs, and cats. Murine typhus is likely underdiagnosed because it is easily mistaken for a viral illness, and most cases resolve spontaneously. Moreover, patients are seldom aware of having had flea bites so the association of a febrile illness with the vector is usually not deduced. A serologic study of 513 children from South Texas found that approximately 13% of children aged 1–17 years had IgG antibodies reactive to *R. typhi*.[7] Outbreaks of murine typhus are uncommon. A report of a cluster of 53 cases of murine typhus in Austin, TX, in 2008 indicated that a high density of infection in domestic animals or opossums may have been responsible for the hyperendemic focus of infection secondarily involving humans.[8]

Although *R. typhi* infections can be mild and may go undetected, people diagnosed with flea-borne typhus experience the onset of nonspecific symptoms (headache, chills, prostration, fever, and myalgia) approximately 6–14 days after being bitten by fleas.[5] Some patients may also develop a rash that may begin on the chest and spread to the sides and back. Nonspecific gastrointestinal symptoms such as nausea, vomiting, abdominal pain, and diarrhea may also occur at this time. Gastrointestinal symptoms seem to be particularly common in children with murine typhus, occurring in 77% of 97 infected children in one study.[9] The majority of reported cases in California and Texas have required hospitalization, likely reflecting a reporting bias toward more severe cases. Diagnosis of murine typhus is usually based on clinical recognition and serology; the latter involves comparison of specific antibody levels in acute- and convalescent-phase serum specimens and is thus beneficial only in retrospect. Etiologic agents can usually be identified only to the genus level by serologic testing. Thrombocytopenia is a common finding, occurring in 48% of patients in one study.[10] Leukocytosis or mild leukopenia occurred frequently and hyponatremia and abnormal liver function tests occur in 60% and 90% of patients, respectively, although these abnormalities are typically insignificant.[10] Murine typhus is treated with antibiotics, typically doxycycline for adults. Most people recover within a few days. Death from murine typhus is rare (2%–4% without treatment, worldwide).[10] Although murine typhus is customarily deemed to be a mild illness, the infection may be fatal or severe if misdiagnosed or insufficiently treated. At this time, there is no vaccine of demonstrated efficacy for murine typhus. Patients surviving infection with *R. typhi* do develop subsequent and long-term protective immunity to reinfection.[11]

Within the past 10 years, 13 cases of murine typhus have been reported in U.S. service members **(Table 1)**. Of these cases, 85% (n=11) occurred in males and 77% (n=10) occurred in white non-Hispanics. Only two of these cases were diagnosed outside of the U.S. (Korea and Guam). The remaining cases occurred in the continental U.S.: Texas (seven), California (two), Kentucky (one), and Maryland (one). Although the majority of murine typhus cases occurred in Army service members (n=7), three cases each occurred in Navy and Air Force service members within the past 10 years.

When murine typhus is diagnosed in a beneficiary of the MHS, the case should be reported promptly to local civilian and military public health authorities. In turn, military public health authorities are

TABLE 1. Incident murine typhus cases, U.S. Armed Forces, 2005–2014

	Total
Service	13
Army	7
Navy	3
Air Force	3
Marine Corps	0
Coast Guard	0
Sex	
Male	11
Female	2
Race/ethnicity	
White, non-Hispanic	10
Black, non-Hispanic	2
Other	1
Rank	
Junior enlisted (E01–E04)	5
Senior enlisted (E05–E09)	4
Junior officer (O01–O03) Warrant officer (W01–W03)	1
Senior officer (O04–O10) Warrant officer (W04–W05)	3
Age	
<20–29	6
30–39	2
40–49	5
50+	0
Country/state of diagnosis	
California	2
Kentucky	1
Maryland	1
Texas	7
Guam	1
South Korea	1

Data Source: Defense Medical Surveillance System (DMSS), as of 12 March 2015
Prepared by the Armed Forces Health Surveillance Center on 12 Mar 2015

TABLE 2. Vectorborne rickettsial diseases most common in U.S. and where U.S. Armed Forces may be assigned[14]

Disease	Agent	Vector	Distribution	Reportable
Murine (endemic) typhus	*Rickettsia typhi*	Flea	Global	Yes
Epidemic typhus	*Rickettsia prowazekii*	Louse, squirrel flea (U.S.)	Global	Yes
Rocky Mountain and other spotted fevers	*Rickettsia rickettsii et al.*	Tick	U.S., global	Yes
Scrub typhus	*Orientia (Rickettsia) tsutsugamushi*	Mite	Asia	Yes
Rickettsialpox	*Rickettsia akari*	Mite	Global	No

required to report all cases to the Disease Reporting System internet (DRSi). Timely, accurate reporting of probable, suspected, or confirmed cases ensures proper identification, treatment, control, and follow-up of cases. The case described above meets the definition of a probable case according to the Texas Department of State Health Services Epi Case Criteria Guide, 2012,[11] as evidenced by acute and convalescent phase specimens taken 3 weeks apart. For this case, *R. typhi* IgG antibody tests were positive, with IFA serologic titers of 1:128 and 1:256, respectively. In South Texas and Travis County, TX, where murine typhus is endemic, clinically compatible cases with either *R. typhi* or *R. felis* IgG titers greater than 1:1024 are considered confirmed cases.[11] According to the Armed Forces Reportable Medical Events Guidelines and Case Definitions,[12] the patient in this report would not be considered a case because the guidelines require a 4-fold or greater rise in antibody titer to *R. typhi* by IgG test in the acute and convalescent phase specimens taken 3 weeks apart.[12] To cast a wider net and capture more cases in U.S. service members and other beneficiaries of the MHS, the inclusion of a "probable case" classification is recommended. The probable case classification would be defined as "a clinically compatible illness with supportive laboratory results: a single IFA serologic titer greater than 1:64; or a single complement fixation titer greater than 16; or other supportive serology (single titer greater than 64 by tests employing latex agglutination, indirect hemagglutination, or microagglutination)."[12] Local military public health authorities should continue to identify cases of murine typhus and other rickettsial diseases and to report them as soon as laboratory and clinical information is available.

After the patient described in this report had recovered, she and her family were given instructions for prevention of murine typhus and other diseases by excluding feral cats from their home, eliminating food sources that may attract wild animals, and controlling fleas in their domestic animals.

It should be noted that other rickettsial diseases—though not all—that occur in the U.S. are also reportable, in addition to scrub typhus, which affected many U.S. service members in Asia in the past. **Table 2** summarizes the rickettsial diseases that could most plausibly affect members of the U.S. Armed Forces on the basis of their geographic distribution.[14]

Disclaimer: The view(s) expressed herein are those of the author(s) and do not reflect the official policy or position of the U.S. Army Public Health Command Region–South, Brooke Army Medical Center, U.S. Army Medical Department, U.S. Army Office of the Surgeon General, Department of the Army, Department of Defense, or U.S. Government.

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MSMR's Invitation to Readers

The *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 the Armed Forces Health Surveillance Center (AFHSC) staff, studies that would take advantage of the healthcare and personnel data contained in the Defense Medical Surveillance System would be the most plausible types. For each promising topic, AFHSC 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.

In addition, the *MSMR* encourages the submission for publication of reports on evidence-based estimates of the incidence, distribution, impact, or trends of illness and injuries among members of the U.S. Armed Forces and other beneficiaries of the Military Health System. Instructions for authors can be found on the *MSMR* page of the Armed Forces Health Surveillance Center website at: http://www.afhsc.mil/msmr/Instructions.

Please email your article ideas and suggestions to the *MSMR* editorial staff at: usarmy.ncr.medcom-afhsc.mbx.msmr@mail.mil.

Morbidity Burdens Attributable to Various Illnesses and Injuries in Deployed (per Theater Medical Data Store [TMDS]) Active and Reserve Component Service Members, U.S. Armed Forces, 2008–2014

Denise O. Daniele, MS; Leslie L. Clark, PhD, MS

This report estimates illness and injury-related morbidity and the healthcare "burden" for service members during deployments to the CENTCOM and AFRICOM theaters of operation during 2008–2014. During the 7-year surveillance period, a total of 2,863,834 medical encounters occurred among 1,596,935 service members who were deployed. Four burden categories comprised 50% or more of the total healthcare burden among both male and female deployers: injury and poisoning, mental disorders, musculoskeletal diseases, and signs and symptoms. In both genders, injuries and poisonings, and signs and symptoms, were the top two categories that affected the most individuals. Both genders had the same top four hospitalization categories: injuries and poisonings, signs and symptoms, genitourinary diseases, and digestive diseases. The limitations of the data used in the analysis are discussed.

Every April, the *MSMR* estimates illness and injury-related morbidity and healthcare "burdens" on the U.S. Armed Forces and the U.S. Military Health System (MHS) using electronic records of medical encounters from the Defense Medical Surveillance System (DMSS). These records document health care delivered in the fixed medical facilities of the MHS and in civilian medical facilities when care is paid for by the MHS. Healthcare encounters of deployed service members are documented in records that are maintained in the Theater Medical Data Store (TMDS), which is incorporated into DMSS. An article in the November 2011 *MSMR* compared the burdens of health care documented in both DMSS and TMDS for 2010.[1]

This report examines the distributions of illnesses and injuries that accounted for medical encounters ("morbidity burdens") of active component members in deployed settings in the Central Command and the U.S. Africa Command areas of operations during 2008–2014.

METHODS

The surveillance period was 1 January 2008 through 31 December 2014. The surveillance population included all individuals who served in the active or reserve components of the U.S. Army, Navy, Air Force, Marine Corps, or Coast Guard and who had records of healthcare encounters captured in the TMDS during the surveillance period. The analysis was restricted to encounters where the theater of care specified was CENTCOM, AFRICOM, or where the theater of operation was missing or null; by default, this excluded encounters in the NORTHCOM, EUCOM, PACOM, or SOUTHCOM theater of operations. In addition, TMDS records of health care were excluded from this analysis through exclusion of medical encounters where the data source was identified as Shipboard Automated Medical System (e.g., SAMS, SAMS8, SAMS9) or the military treatment facility descriptor indicated care was provided aboard a ship (e.g., USS George H.W. Bush, USS Dwight D. Eisenhower or similar). Summarized are inpatient and outpatient medical encounters during the 7-year surveillance period according to the primary (first-listed) diagnosis (if reported with an ICD-9 code between 001 and 999). Primary diagnoses that did not correspond to an ICD-9 code (e.g., 1XXXX, 4XXXX) were not reported in this burden analysis.

For summary purposes, all illness and injury-specific diagnoses (as defined by the ICD-9 at the three-digit level) were grouped into 135 burden of disease-related conditions and 25 categories based on a modified version of the classification system developed for the Global Burden of Disease (GBD) Study.[2] In general, the GBD system groups diagnoses with common pathophysiologic or etiologic bases and/or significant international health policymaking importance. For this analysis, some diagnoses that are grouped into single categories in the GBD system (e.g., mental disorders) were disaggregated. Also, injuries were categorized by the affected anatomic sites rather than by causes because external causes of injuries are not completely reported in TMDS records.

The "morbidity burdens" attributable to various "conditions" were estimated on the basis of the total number of medical encounters attributable to each condition (i.e., total hospitalizations and ambulatory visits for the condition with a limit of one encounter per individual per condition per day) and the numbers of service members affected by the conditions.

RESULTS

During the 7-year surveillance period, a total of 2,863,834 medical encounters occurred among 1,596,935 individuals while deployed to Southwest Asia/Middle East and Africa. Of the total medical encounters, 4,427 (0.15%) were hospitalizations. A majority of the medical encounters (80.3%), individuals affected (80.9%), and hospitalizations (89.0%) occurred among males **(Figure 1a)**.

Medical encounters/individuals affected

During 2008–2014, the percentages of total medical encounters by burden of disease categories in both deployed men and women were generally similar; in both genders, more encounters were attributable to injuries and poisonings, mental disorders, musculoskeletal diseases, and signs and symptoms than any other categories **(Figures 1a, 1b, 2a, 2b)**. Of note, females had a greater proportion of medical encounters for genitourinary diseases (6.3%) compared to males (1.6%).

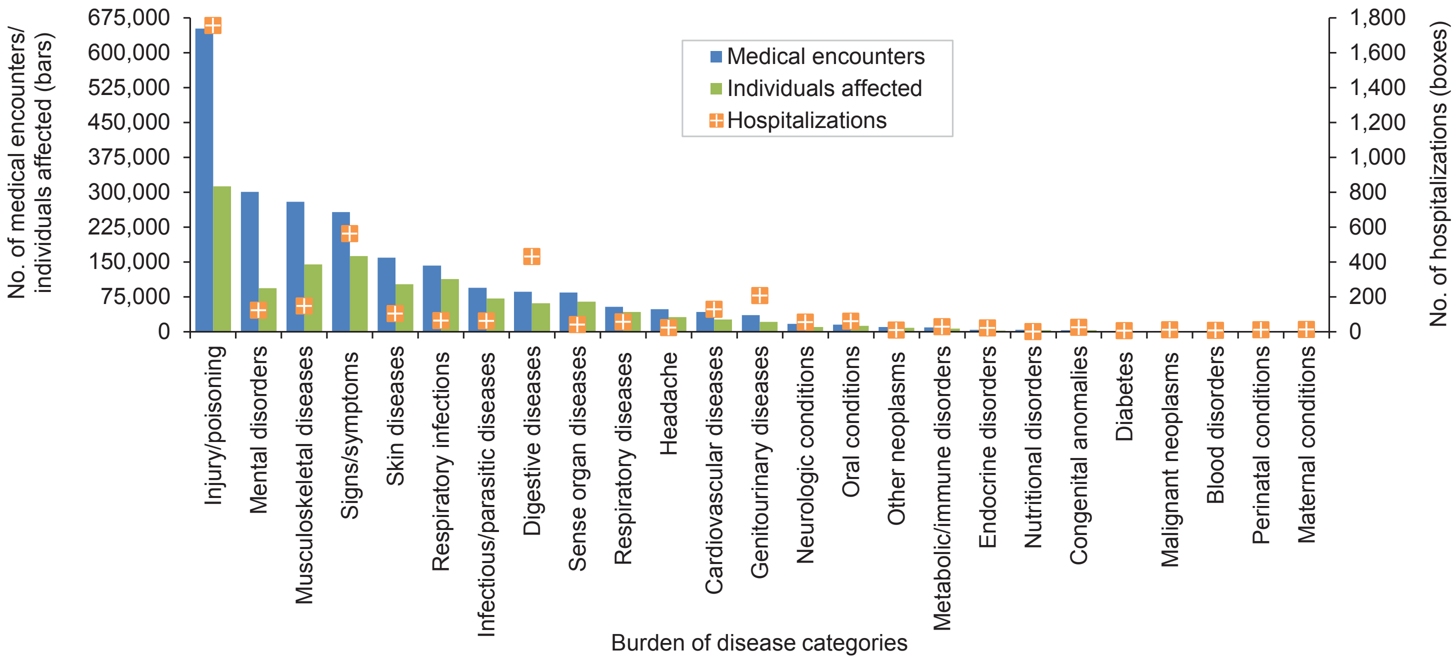
Among males and females, three burden conditions, "other back problems," "other signs and symptoms," and "upper respiratory infections" were among the top five burden conditions that accounted for the most medical encounters **(Figures 3a, 3b)**. Among males, "arm and shoulder injury," and "other skin diseases," and among females, "other musculoskeletal diseases," and "abdomen and pelvis" (i.e., referring to signs and symptoms of the abdomen and pelvis) were the remaining burden conditions among the top five conditions.

The four-digit ICD-9 code with the most medical encounters in the "other signs and symptoms" category was sleep disturbances among both males and females **(data not shown)**. Non-specific rashes, dizziness/giddiness, and syncope/collapse were among the other top "other signs and symptoms" in both genders. Among males, the four-digit ICD-9 codes that accounted for the most medical encounters in "other skin diseases" included folliculitis, cellulitis, and carbuncles/furuncles. The four-digit ICD-9 codes with the most medical encounters in the "other musculoskeletal diseases" category among women were pain in limb and cervicalgia. In the "abdomen and pelvis" category among women, abdominal pain and nausea/vomiting were the top two four-digit ICD-9 codes with the most medical encounters **(data not shown)**.

Of note, among males, fewer than 0.3% of all medical encounters during deployment were associated with any of the following morbidity categories: congenital anomalies, diabetes, malignant neoplasms, blood disorders, and maternal/perinatal conditions **(Figure 1a)**. Among females, fewer than 0.3% of all medical encounters during deployment were associated with: congenital anomalies, metabolic/immune disorders, malignant neoplasms, diabetes, and perinatal conditions **(Figure 1b)**.

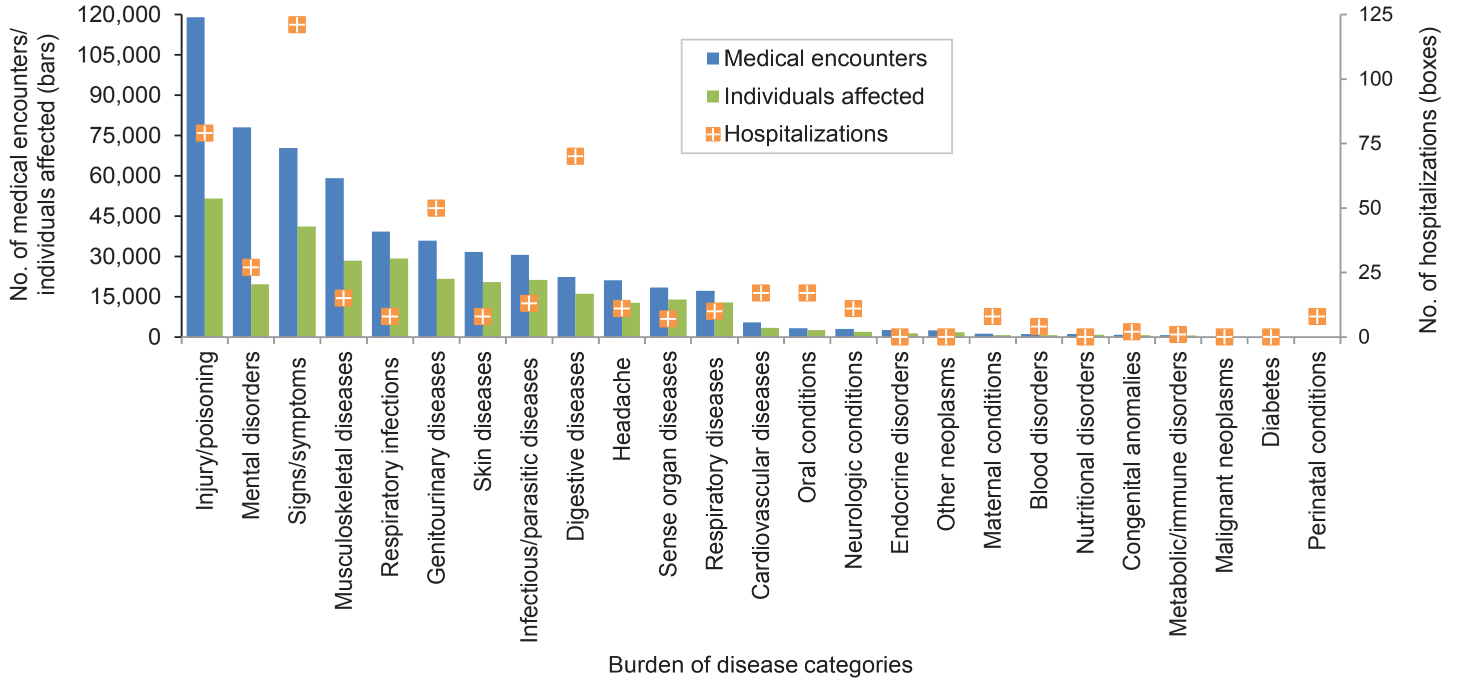
Among both genders, injuries and poisonings, and signs and symptoms, were the top two categories that affected the most individuals **(Figures 1a, 1b)**. Musculoskeletal diseases ranked third among males, and respiratory infections ranked third among females.

FIGURE 1a. Medical encounters,[a] individuals affected,[b] and hospitalizations by burden of disease category,[c] among deployed male service members, U.S. Armed Forces, 2008–2014



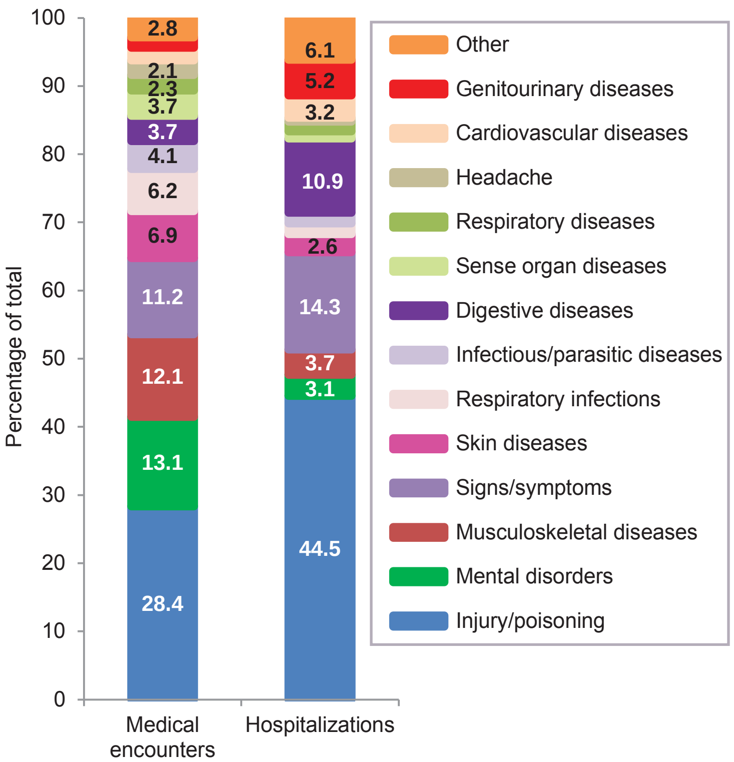
[a]Medical encounters: total hospitalizations and ambulatory visits for the condition (with no more than one encounter per individual per day per condition)
[b]Individuals affected: individuals with at least one hospitalization or ambulatory visit for the condition
[c]Major categories and conditions defined in the Global Burden of Disease Study

FIGURE 1b. Medical encounters,[a] individuals affected,[b] and hospitalizations by burden of disease category,[c] among deployed female service members, U.S. Armed Forces, 2008–2014



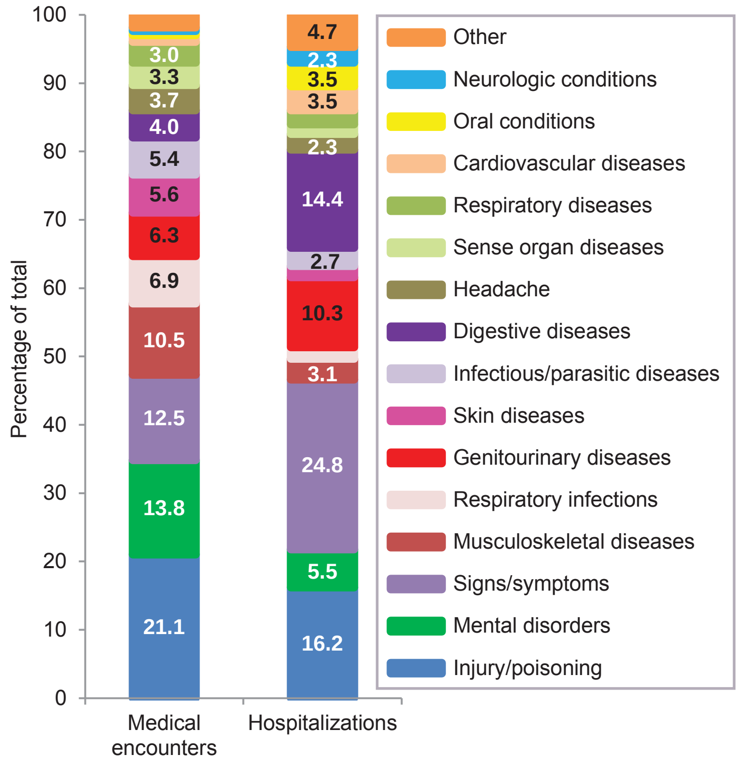
[a]Medical encounters: total hospitalizations and ambulatory visits for the condition (with no more than one encounter per individual per day per condition)
[b]Individuals affected: individuals with at least one hospitalization or ambulatory visit for the condition
[c]Major categories and conditions defined in the Global Burden of Disease Study

FIGURE 2a. Percentage of medical encounters,[a] and hospitalizations by burden of disease category,[b] among deployed male service members, U.S. Armed Forces, 2008–2014



[a]Medical encounters: total hospitalizations and ambulatory visits for the condition (with no more than one encounter per individual per day per condition)
[b]Major categories and conditions defined in the Global Burden of Disease Study

FIGURE 2b. Percentage of medical encounters,[a] and hospitalizations by burden of disease category,[b] among deployed female service members, U.S. Armed Forces, 2008–2014



[a]Medical encounters: total hospitalizations and ambulatory visits for the condition (with no more than one encounter per individual per day per condition)
[b]Major categories and conditions defined in the Global Burden of Disease Study

FIGURE 3a. Percentage and cumulative percentage distribution of burden "conditions" that accounted for the most medical encounters among deployed male service members, U.S. Armed Forces, 2008–2014

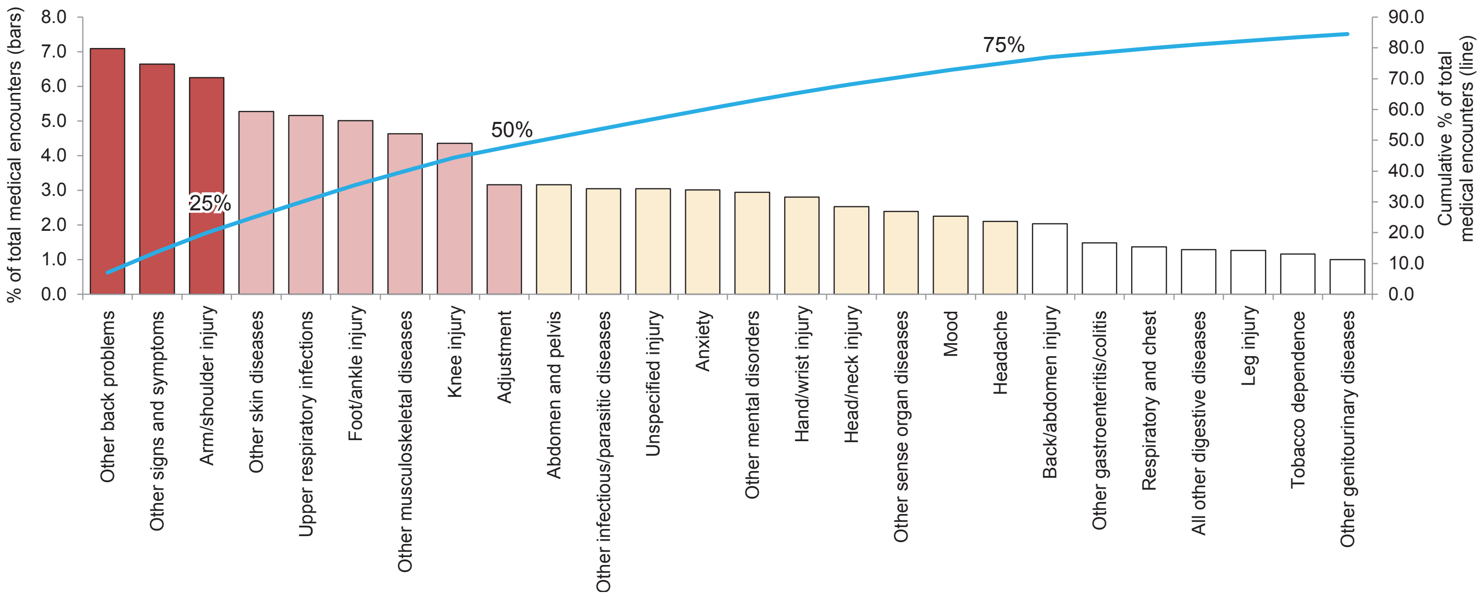
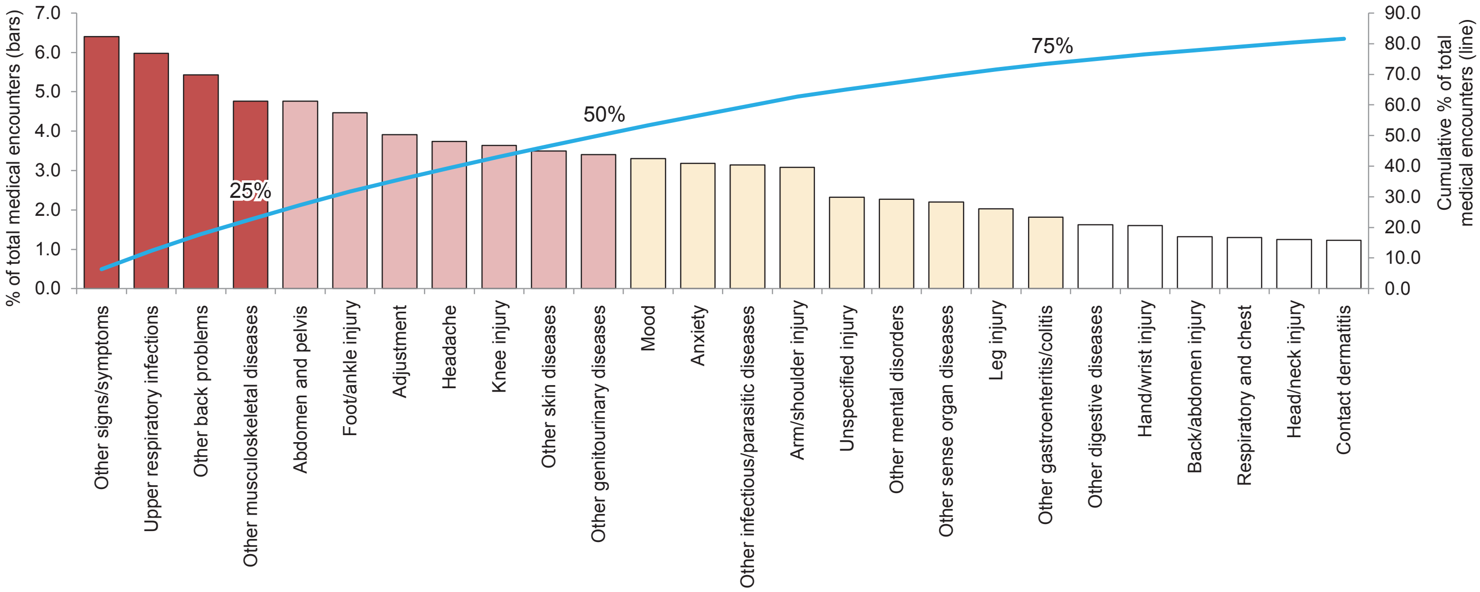


FIGURE 3b. Percentage and cumulative percentage distribution of burden "conditions" that accounted for the most medical encounters among deployed female service members, U.S. Armed Forces, 2008–2014



Hospitalizations

During 2008–2014, both genders had the same top four hospitalization categories: injuries and poisonings, signs and symptoms, genitourinary diseases, and digestive diseases **(Figures 1a, 1b, 2a, 2b)**. However, the proportions of each category by gender varied. Among males, 44.5% of all hospitalizations were for injuries and poisonings, compared to 16.2% for females. Signs and symptoms accounted for the greatest proportion of hospitalizations among females (24.8%) (males: 14.3%). Also of note among females, genitourinary disorder hospitalizations accounted for 10.3% of hospitalizations (males: 5.2%).

Among males, "unspecified injury," "leg injury," and "head/neck injury" were the top three burden conditions that accounted for the most hospitalizations **(Figure 4a)**. Among both genders, "other digestive diseases" and "other signs and symptoms" were among the top five burden conditions that accounted for the most hospitalizations **(Figures 4a, 4b)**. Among females, "abdomen and pelvis," "other genitourinary diseases," and "appendicitis" were the other conditions among the top five burden conditions **(Figure 4a)**.

In the "other signs and symptoms" category, syncope/collapse and convulsions contributed the most hospitalizations among both genders **(data not shown)**. The "abdomen and pelvis" category in females comprised mostly hospitalizations for abdominal pain.

EDITORIAL COMMENT

This report documents the morbidity and healthcare burden that affects U.S. military members while deployed to Southwest Asia/Middle East and Africa during a 7-year surveillance period. Similar to results from 2010,[1] there were four burden categories that comprised 50% or more of the total healthcare burden among both male and female deployers: injury and poisoning, mental disorders, musculoskeletal diseases, and signs and symptoms.

Austere environmental conditions in deployment settings may have compromised hygienic practices and contributed to the relatively greater proportions of

FIGURE 4a. Percentage and cumulative percentage distribution of burden "conditions" that accounted for the most hospitalizations among deployed male service members, U.S. Armed Forces, 2008–2014

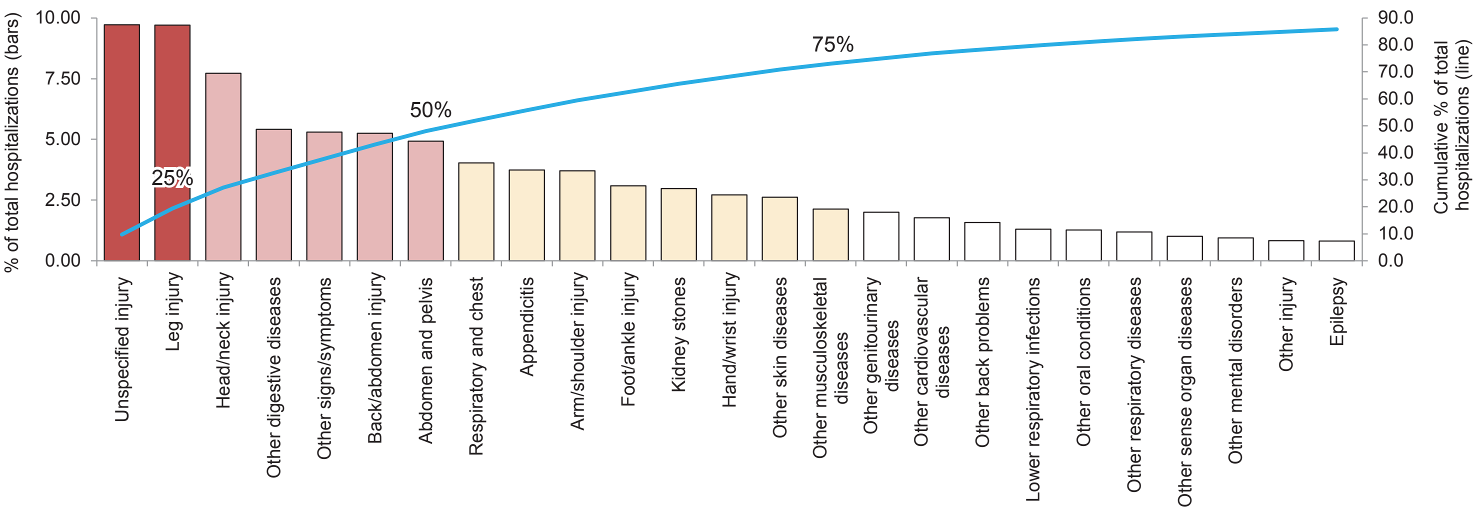
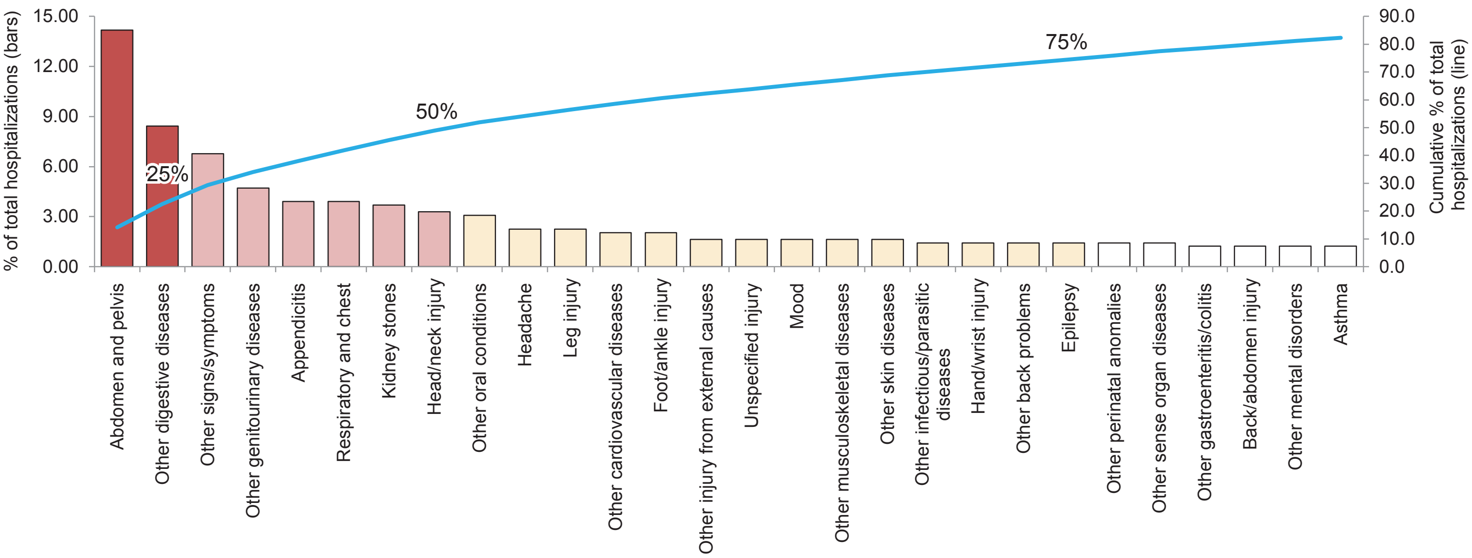


FIGURE 4b. Percentage and cumulative percentage distribution of burden "conditions" that accounted for the most hospitalizations among deployed female service members, U.S. Armed Forces, 2008–2014



digestive, genitourinary, skin, and infectious/parasitic diseases in the burden described in this report, when compared to burden analyses for non-deployed settings. Furthermore, the treatment of these conditions may not have necessitated medical evacuations of affected service members out of theater (i.e., out of TMDS capture); in turn, encounters associated with follow-up care may have been repeatedly recorded in TMDS among deployed service members. In addition, some emergency medical care provided to stabilize combat-injured service members before evacuation may not be routinely captured in TMDS.

Encounters for certain conditions are not expected to occur often in deployment settings. For example, the presence of some conditions (e.g., diabetes, pregnancy, congenital anomalies) may make the affected service members ineligible for deployment. As a result of this selection process, deployed service members are generally healthier than their non-deployed counterparts and, specifically, less likely to require medical care for conditions that preclude deployment. The overall result of such predeployment medical screening is diminished healthcare burdens (as documented in TMDS) related to certain disease categories.

Interpretation of the data in this report should be done with consideration of some limitations. Not all medical encounters in theaters of operation are captured in TMDS. Some care is rendered by medical personnel at small, remote, or austere forward locations where electronic documentation of diagnoses and treatment is not feasible. As a result, the data described in this report likely underestimate the total burden of health care actually provided in the areas of operation examined. Another limitation derives from the potential for misclassification of diagnoses due to errors in the coding of diagnoses entered into the electronic health record. Although the aggregated distributions of illness and injury found in this study are compatible with expectations derived from other examinations of morbidity in military populations (both deployed and non-deployed), instances of incorrect diagnostic codes (e.g., coding a spinal cord injury using an ICD-9 code that denotes the injury was suffered as "birth trauma" rather than using a code indicating injury in an adult) warrant care in the interpretation of some findings. Although such coding errors are not common, their presence serves as a reminder of the extent to which this study depends on the capture of accurate information in the sometimes austere deployment environment in which healthcare encounters occur.

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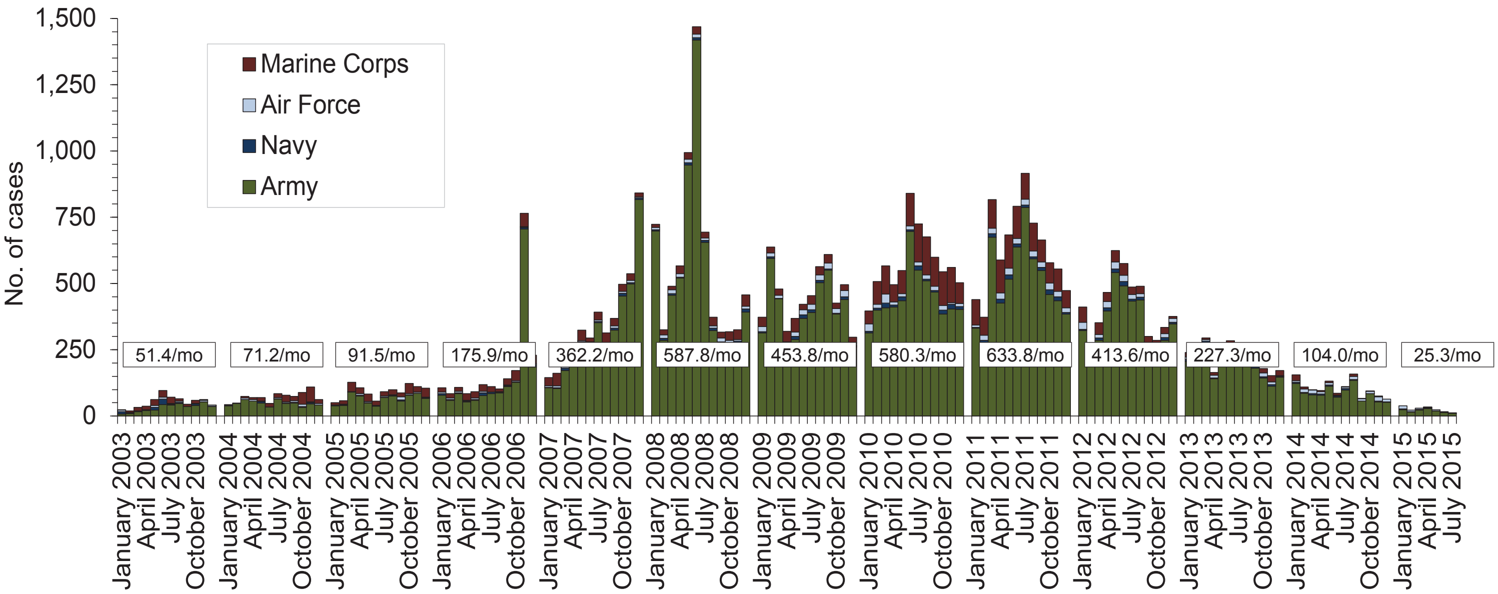
Deployment-Related Conditions of Special Surveillance Interest, U.S. Armed Forces, by Month and Service, January 2003–July 2015 (data as of 18 August 2015)

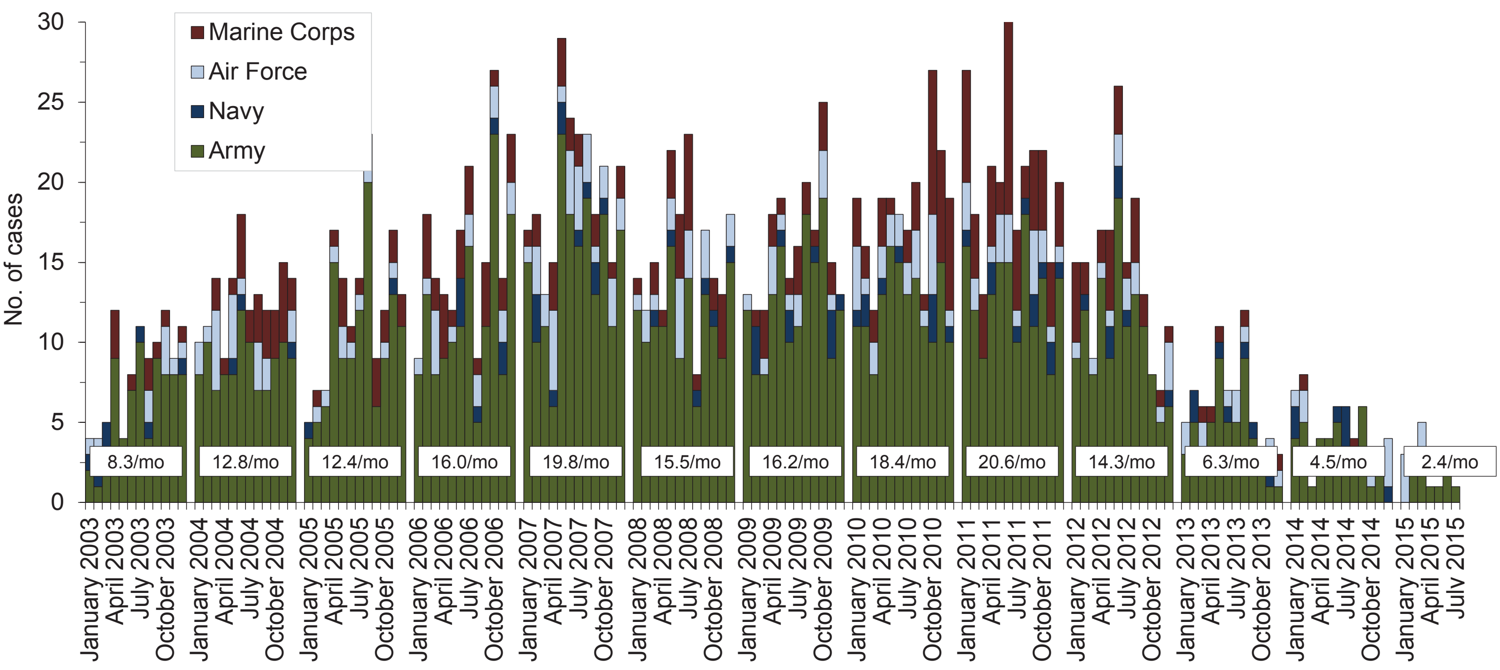
Traumatic brain injury (TBI) (ICD-9: 310.2, 800–801, 803-804, 850–854, 907.0, 950.1–950.3, 959.01, V15.5_1–9, V15.5_A–F, V15.52_0–9, V15.52_A–F, V15.59_1–9, V15.59_A–F)[a]



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 4,613 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.

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