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# MISMR

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## *Infectious Disease Issue*

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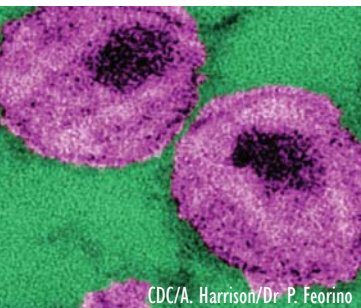
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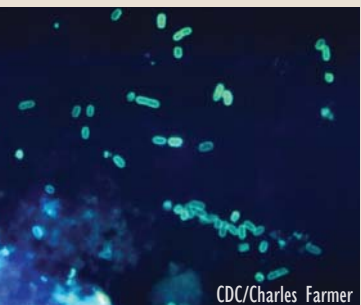
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CDC/A. Harrison/Dr. P. Feorino



CDC/Charles Farmer



CDC/James Gathany

# 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 2008-June 2013

(Corrected version: posted 13 September 2013)

This report contains an update through June 2013 on the results of screening for HIV infection among civilian applicants for military service and among members of the active and reserve components of the Armed Forces. Among civilian applicants, annual rates of prevalence of HIV infection showed a continuing downward trend. Rates among black, non-Hispanic applicants were higher than other racial/ethnic groups but have declined sharply since 2008. Among service members, annual rates have varied by service and component, with higher rates in the Army and Navy and lower rates in the Marine Corps and Air Force. Members of the Army and Air Force Reserves have had consistently higher rates than members of their respective active components. For both civilian applicants and service members, rates among men are notably higher than among women. The possible roles of unprotected sex and pre-deployment behaviors and the associated challenges to prevention of HIV infection are discussed.

Since the discovery of the human immunodeficiency virus (HIV) in the early 1980s, its spread has had a major impact on the health of populations and on health care systems all over the world. Recent global estimates are that the virus has been responsible for over 25 million deaths globally in the last 30 years and that nearly 2.7 million people are newly infected with HIV each year. In the U.S. the number of new HIV infections is estimated to be approximately 50,000 annually.<sup>1</sup> The most recent figures from the U.S. Centers for Disease Control and Prevention estimate in 2010 that there were close to 1.1 million persons over the age of 13 living with HIV in the United States.<sup>2</sup> Scientific advances such as availability of anti-retroviral medicines, aggressive preventive strategies, destigmatization of HIV/AIDS, and targeted behavioral change interventions have gone a long way in reducing the number of new cases of, and deaths due to, HIV infection.

In order to provide appropriate medical evaluations, treatment, and counseling, to prevent unwitting HIV transmission, and to protect the battlefield blood supply, 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.

Members of the active and reserve components of the U.S. Armed Forces are routinely and periodically screened to detect newly acquired HIV infections. 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.

The U.S. military has conducted routine screening for HIV infection among civilian applicants for U.S. military service since October 1985. All members of the active and reserve components of the U.S. Armed Forces have been periodically

screened since 1986. In 2004, the Department of Defense set a standard testing interval of two years for all service members.

Before 2009, all of the aforementioned screening programs used techniques that detected only HIV-1 type infections. Starting in 2009, all programs adopted laboratory methods which allowed the detection of antibodies to both major HIV types, i.e., HIV-1 and HIV-2. Although HIV-2 infection is rare in the United States itself, and no instances of HIV-2 infection have thus far been detected in civilian applicants or service members since 2009, HIV-2 virus is much more prevalent in other parts of the world where service members may be required to serve. To provide for the change in laboratory methods in the past and for the prospect of future detections of HIV-2 infection in the Services' screening programs, this report will hereafter refer to the target of the screening programs as simply "HIV" without specifying either of the types.

This *MSMR* report is the annual summary of the prevalences and trends of HIV antibody seropositivity among civilian applicants for military service who have been screened since 1 January 2008. Also summarized is the incidence of HIV antibody seropositivity among active and reserve component members of the U.S. Armed Forces in the same reporting period. Summaries of HIV antibody seropositivity among civilian applicants and military members screened since 1990 are available at <http://www.afhsc.mil/reports>.

## METHODS

Prevalence of HIV seropositivity among the civilian applicants for U.S. military service, and active and reserve component service members was assessed by

matching specimen numbers and serologic test results to the personal identifiers of the individuals who provided 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 the summary testing data used in this report.

An incident case of HIV antibody seropositivity was defined as two positive results from serologic testing of two different specimens from the same individual, or one positive result from serologic testing of the most recent specimen provided by an individual.

Annual prevalences of HIV seropositivity among civilian applicants for service 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

During the 18-month period from January 2012 to June 2013, there were 540,914 tests for antibodies to HIV performed among 519,723 civilian applicants for U.S. military service (Table 1). Of the applicants tested during this period, 101 were found to have antibodies to HIV (seroprevalence: 0.19 per 1,000 persons tested).

From 2008 to 2012, annual rates declined 53 percent from 2008 (0.49 per

1,000 persons tested) to 2012 (0.23 per 1,000 persons tested) (Table 1). The seroprevalence was higher in males than females in every year of the surveillance period (Table 1; Figure 1). The seroprevalence rate among males decreased by 52 percent from 2008 to 2012; among female applicants, annual seroprevalences declined 65 percent.

As in every year in the surveillance period, in 2012 the seroprevalence of HIV was higher among black, non-Hispanic applicants (0.88 per 1,000 persons tested) compared to Hispanic/other applicants (0.12 per 1,000 persons tested) or white, non-Hispanic applicants (0.08 per 1,000 persons tested) (Table 2; Figure 2). In black, non-Hispanic applicants, HIV seroprevalence decreased 49 percent from 2008 (1.79 per 1,000 persons tested) to 2010 (0.91 per 1,000 persons tested) then remained stable from 2010 through 2012.

**TABLE 1.** Diagnoses of HIV infections by gender, civilian applicants for U.S. military service, January 2008-June 2013

Year	Total HIV tests	Total persons tested	Males tested	Females 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
2008	297,503	<b>289,932</b>	234,975	54,957	<b>142</b>	131	11	<b>0.49</b>	0.56	0.20
2009	319,058	<b>302,299</b>	244,141	58,158	<b>112</b>	103	9	<b>0.37</b>	0.42	0.15
2010	294,949	<b>281,520</b>	226,966	54,554	<b>60</b>	56	4	<b>0.21</b>	0.25	0.07
2011	273,626	<b>266,065</b>	215,652	50,413	<b>68</b>	62	6	<b>0.26</b>	0.29	0.12
2012	314,454	<b>305,773</b>	248,230	57,543	<b>71</b>	67	4	<b>0.23</b>	0.27	0.07
2013 <sup>a</sup>	226,460	<b>213,950</b>	173,502	40,448	<b>30</b>	27	3	<b>0.14</b>	0.16	0.07
<b>Total</b>	1,726,050	<b>1,659,539</b>	1,343,466	316,073	<b>483</b>	446	37	<b>0.29</b>	0.33	0.12

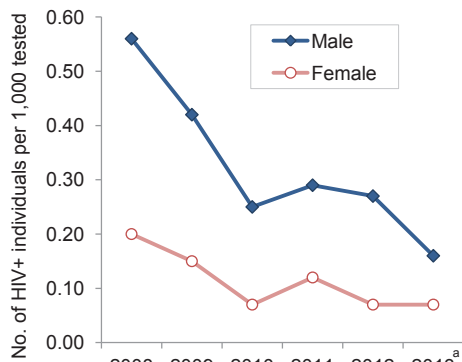
<sup>a</sup>Through 30 June 2013

**TABLE 2.** Diagnoses of HIV infections by race/ethnicity, civilian applicants for U.S. military service, January 2008-June 2013

Year	Total HIV tests	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
2008	297,503	<b>289,932</b>	194,654	49,048	46,230	<b>142</b>	40	88	14	<b>0.49</b>	0.21	1.79	0.30
2009	319,058	<b>302,309</b>	202,264	50,113	49,932	<b>112</b>	35	66	11	<b>0.37</b>	0.17	1.32	0.22
2010	294,949	<b>281,521</b>	188,074	48,580	44,867	<b>60</b>	12	44	4	<b>0.21</b>	0.06	0.91	0.09
2011	273,626	<b>266,067</b>	182,213	46,506	37,348	<b>68</b>	22	39	7	<b>0.26</b>	0.12	0.84	0.19
2012	314,454	<b>306,755</b>	202,830	54,851	49,074	<b>71</b>	17	48	6	<b>0.23</b>	0.08	0.88	0.12
2013 <sup>a</sup>	226,460	<b>213,952</b>	142,143	42,372	29,437	<b>30</b>	6	24	0	<b>0.14</b>	0.04	0.57	0.00
<b>Total</b>	1,726,050	<b>1,660,536</b>	1,112,178	291,470	256,888	<b>483</b>	132	309	42	<b>0.29</b>	0.12	1.06	0.16

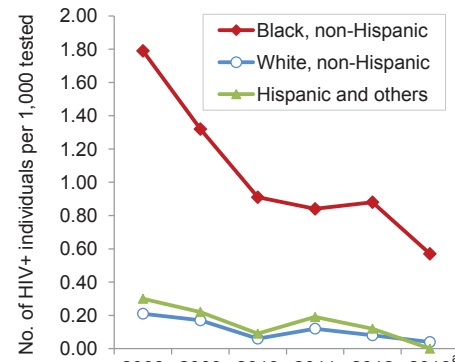
<sup>a</sup>Through 30 June 2013

**FIGURE 1.** Diagnoses of HIV infections by gender, civilian applicants for U.S. military service, January 2008-June 2013



<sup>a</sup>Through 30 June 2013

**FIGURE 2.** Diagnoses of HIV infections by race/ethnicity, civilian applicants for U.S. military service, January 2008-June 2013



<sup>a</sup>Through 30 June 2013

**U.S. Army**

*Active component:* During the 18-month period from January 2012 to June 2013, 777,119 tests for antibodies to HIV were conducted among 651,691 soldiers in the active component of the U.S. Army (Table 3). During the period, antibodies were detected in 164 soldiers (0.25 per 1,000 persons tested).

The rate of incident HIV diagnoses increased 22 percent from 2008 (0.22 per 1,000 persons tested) to 2012 (0.27 per 1,000 persons tested) (Table 3). In 2012,

**TABLE 3.** New diagnoses of HIV infections, by gender, active component, U.S. Army, January 2008-June 2013

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 2013
2008	511,529	<b>420,132</b>	361,253	58,879	<b>94</b>	93	1	<b>0.22</b>	0.26	0.02	<b>43</b>
2009	559,196	<b>431,714</b>	374,528	57,186	<b>89</b>	86	3	<b>0.21</b>	0.23	0.05	<b>38</b>
2010	589,933	<b>451,534</b>	390,216	61,318	<b>92</b>	89	3	<b>0.20</b>	0.23	0.05	<b>52</b>
2011	538,939	<b>431,342</b>	371,979	59,363	<b>108</b>	106	2	<b>0.25</b>	0.28	0.03	<b>64</b>
2012	519,037	<b>416,715</b>	359,452	57,263	<b>111</b>	108	3	<b>0.27</b>	0.30	0.05	<b>93</b>
2013 <sup>a</sup>	258,082	<b>234,976</b>	202,503	32,473	<b>53</b>	51	2	<b>0.23</b>	0.25	0.06	<b>53</b>
Total	2,976,716	<b>2,386,413</b>	2,059,931	326,482	<b>547</b>	533	14	<b>0.23</b>	0.26	0.04	<b>343</b>

<sup>a</sup>Through 30 June 2012

**TABLE 4.** New diagnoses of HIV infections, by gender, U.S. Army National Guard, January 2008-June 2013

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 2013
2008	234,754	<b>209,564</b>	180,402	29,162	<b>51</b>	49	2	<b>0.24</b>	0.27	0.07	<b>11</b>
2009	245,527	<b>204,799</b>	177,032	27,767	<b>55</b>	53	2	<b>0.27</b>	0.30	0.07	<b>17</b>
2010	240,470	<b>197,663</b>	170,188	27,475	<b>36</b>	35	1	<b>0.18</b>	0.21	0.04	<b>19</b>
2011	224,408	<b>187,247</b>	160,546	26,701	<b>43</b>	41	2	<b>0.23</b>	0.26	0.07	<b>19</b>
2012	192,298	<b>163,277</b>	137,898	25,379	<b>52</b>	52	0	<b>0.32</b>	0.38	0.00	<b>35</b>
2013 <sup>a</sup>	90,267	<b>83,399</b>	69,879	13,520	<b>27</b>	27	0	<b>0.32</b>	0.39	0.00	<b>27</b>
Total	1,227,724	<b>1,045,949</b>	895,945	150,004	<b>264</b>	257	7	<b>0.25</b>	0.29	0.05	<b>128</b>

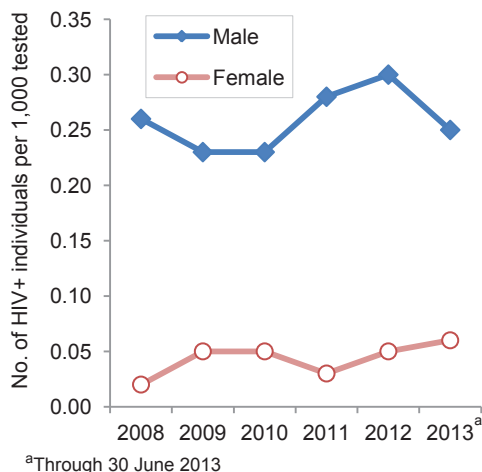
<sup>a</sup>Through 30 June 2012

**TABLE 5.** New diagnoses of HIV infections, by gender, U.S. Army Reserve, January 2008-June 2013

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 2013
2008	109,153	<b>97,434</b>	74,519	22,915	<b>43</b>	38	5	<b>0.44</b>	0.51	0.22	<b>19</b>
2009	113,156	<b>95,632</b>	74,184	21,448	<b>36</b>	34	2	<b>0.38</b>	0.46	0.09	<b>16</b>
2010	113,103	<b>93,579</b>	73,035	20,544	<b>35</b>	35	0	<b>0.37</b>	0.48	0.00	<b>27</b>
2011	106,760	<b>88,713</b>	68,935	19,778	<b>36</b>	34	2	<b>0.41</b>	0.49	0.10	<b>30</b>
2012	86,104	<b>73,651</b>	57,102	16,549	<b>41</b>	40	1	<b>0.56</b>	0.70	0.06	<b>37</b>
2013 <sup>a</sup>	41,260	<b>37,144</b>	28,589	8,555	<b>22</b>	20	2	<b>0.59</b>	0.70	0.23	<b>22</b>
Total	569,536	<b>486,153</b>	376,364	109,789	<b>213</b>	201	12	<b>0.44</b>	0.53	0.11	<b>151</b>

<sup>a</sup>Through 30 June 2013

**FIGURE 3.** New diagnoses of HIV infections, by gender, active component, U.S. Army, January 2008-June 2013



there were 111 incident diagnoses of HIV infections among active component soldiers – an average of one new HIV infected soldier per 4,676 screening tests. Increases in the numbers and prevalences of incident diagnoses of HIV seropositivity were attributable to male soldiers as rates among females were low and stable from 2008 to 2013 (a range of 1 to 3 new infections detected per year) (Figure 3).

Of the 547 active component soldiers diagnosed with HIV infection since 2008, 343 (63%) were still in the service in 2013 (Table 3).

**Army National Guard:** During the 18-month period from January 2012 to June 2013, 282,565 tests for antibodies to HIV were conducted among 246,676 members of the U.S. Army National Guard. Antibodies to HIV were detected in 79 soldiers (0.32 per 1,000 persons tested) (Table 4).

The annual prevalence of seropositivity was 0.32 per 1,000 soldiers tested in 2012, which was higher than in any previous year during the surveillance period and an increase of 33 percent from the rate in 2008 (0.24 per 1,000 persons tested) (Table 4). On average, one new HIV infected National Guard soldier was detected per 3,698 screening tests in 2012.

Of the 264 National Guard soldiers who tested positive for HIV from 2008 through 30 June 2013, 128 (48%) were still in the service in 2013 (Table 4).

**Army Reserve:** The annual prevalence of HIV seropositivity in the U.S. Army

Reserve was highest in 2012 (0.56 per 1,000) compared to any of the prior 22 years in the surveillance period. Male Army reservists accounted for almost all of the increase, contributing 40 new HIV positive diagnoses compared to only one female diagnosis in 2012 (Table 5). In contrast to their male counterparts, female Army reservists have averaged only two new HIV infection diagnoses per year since 2008; male reservists have averaged 36 new HIV infection diagnoses per year in the years 2008 to 2012.

In 2012, there was one new HIV infected Army Reserve soldier detected per 2,100 screening tests. Of the 213 Army Reservists diagnosed with HIV infections since 2008, 151 (71%) were still in the service in 2013 (Table 5).

### U.S. Navy

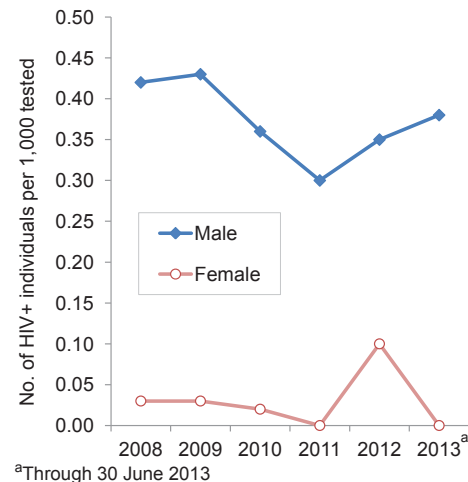
**Active component:** During the 18-month period from January 2012 to June 2013, 406,858 tests for antibodies to HIV were conducted among 360,214 U.S. Navy active component service members. During this period, the number of sailors who tested positive for HIV was 111 (0.31 per 1,000 tested) (Table 6).

In 2012, there were 72 incident diagnoses of HIV infections among active component sailors. Overall prevalence of seropositivity was 0.31 per 1,000 persons tested. Rates among females in the active component of the U.S. Navy remained low from 2008 to 2012; there were four incident diagnoses (0.10 per 1,000 persons tested) for HIV in 2012, and none in the first half of 2013 (Figure 4, Table 6). Among male U.S. Navy active component service members, there were 68 new positive HIV diagnoses in 2012 (0.35 per 1,000 persons tested) and 39 new cases in the first half of 2013 (0.38 per 1,000 persons tested). On average in 2012, one new HIV infected sailor was detected per 3,798 screening tests.

Of the 409 active component sailors who tested positive for HIV since 2008, 256 (63%) remained in service in 2013.

**Navy Reserve:** There were 73,089 tests for antibodies to HIV infection conducted among 63,996 sailors in the U.S. Navy Reserve during the 18-month period between January 1, 2012 and the first half of 2013 (Table 7). During this period,

**FIGURE 4.** New diagnoses of HIV infections by gender, active component, U.S. Navy, January 2008-June 2013



antibodies to HIV were detected in 23 sailors (0.36 per 1,000 persons tested).

There were 13 incident diagnoses (0.31 per 1,000) of HIV among U.S. Navy reservists in 2012, all of them occurring in males (Table 7). On average in 2012 there was one new HIV infected Navy reservist per 3,709 screening tests. There were no incident diagnoses of HIV among female U.S. Navy reservists from 2008 through the first half of 2013.

Of the 77 reserve component sailors diagnosed with HIV infections since 2008, there were 57 (74%) still in the service as of the first half of 2013 (Table 7).

### U.S. Marine Corps

**Active component:** During the 18-month period from January 2012 to June 2013, 292,702 tests for antibodies to HIV were conducted among 250,796 members of the active component of the U.S. Marine Corps (Table 8). Antibodies to HIV were detected in 32 Marines (0.13 per 1,000 persons tested) during this period.

In 2012, there were 23 incident diagnoses of HIV infection among active component Marines (Table 8). On average, one of every 8,786 screening tests performed in 2012 for new HIV infection among active component U.S. Marine Corps members was positive. Overall seropositivity in 2012 was 0.14 per 1,000 persons tested.

All the new HIV infection diagnoses in the active component of the U.S.

**TABLE 6.** New diagnoses of HIV infections, active component, U.S. Navy, January 2008-June 2013

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 2013
2008	287,094	<b>242,767</b>	204,076	38,691	<b>86</b>	85	1	<b>0.35</b>	0.42	0.03	<b>39</b>
2009	266,105	<b>227,516</b>	189,782	37,734	<b>82</b>	81	1	<b>0.36</b>	0.43	0.03	<b>33</b>
2010	283,052	<b>240,012</b>	199,582	40,430	<b>72</b>	71	1	<b>0.30</b>	0.36	0.02	<b>46</b>
2011	271,444	<b>232,625</b>	192,226	40,399	<b>58</b>	58	0	<b>0.25</b>	0.30	0.00	<b>38</b>
2012	273,481	<b>234,252</b>	192,640	41,612	<b>72</b>	68	4	<b>0.31</b>	0.35	0.10	<b>61</b>
2013 <sup>a</sup>	133,377	<b>125,962</b>	102,447	23,515	<b>39</b>	39	0	<b>0.31</b>	0.38	0.00	<b>39</b>
Total	1,514,553	<b>1,303,134</b>	1,080,753	222,381	<b>409</b>	402	7	<b>0.31</b>	0.37	0.03	<b>256</b>

<sup>a</sup>Through 30 June 2013**TABLE 7.** New diagnoses of HIV infections, by gender, Navy Reserve, U.S. Navy, January 2008-June 2013

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 2013
2008	54,685	<b>46,966</b>	38,113	8,853	<b>12</b>	12	0	<b>0.26</b>	0.31	0.00	<b>3</b>
2009	52,061	<b>43,675</b>	35,467	8,208	<b>10</b>	10	0	<b>0.23</b>	0.28	0.00	<b>7</b>
2010	54,310	<b>45,453</b>	36,902	8,551	<b>18</b>	18	0	<b>0.40</b>	0.49	0.00	<b>14</b>
2011	50,448	<b>42,850</b>	34,662	8,188	<b>14</b>	14	0	<b>0.33</b>	0.40	0.00	<b>11</b>
2012	48,215	<b>41,338</b>	33,316	8,022	<b>13</b>	13	0	<b>0.31</b>	0.39	0.00	<b>12</b>
2013 <sup>a</sup>	24,874	<b>22,658</b>	18,093	4,565	<b>10</b>	10	0	<b>0.44</b>	0.55	0.00	<b>10</b>
Total	284,593	<b>242,940</b>	196,553	46,387	<b>77</b>	77	0	<b>0.32</b>	0.39	0.00	<b>57</b>

<sup>a</sup>Through 30 June 2012**TABLE 8.** New diagnoses of HIV infections, by gender, active component, U.S. Marine Corps, January 2008-June 2013

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 2013
2008	188,723	<b>151,492</b>	141,787	9,705	<b>18</b>	18	0	<b>0.12</b>	0.13	0.00	<b>6</b>
2009	188,858	<b>151,736</b>	141,673	10,063	<b>23</b>	23	0	<b>0.15</b>	0.16	0.00	<b>7</b>
2010	187,692	<b>153,379</b>	142,634	10,745	<b>19</b>	19	0	<b>0.12</b>	0.13	0.00	<b>7</b>
2011	206,245	<b>172,277</b>	160,238	12,039	<b>26</b>	25	1	<b>0.15</b>	0.16	0.08	<b>8</b>
2012	202,083	<b>166,051</b>	154,096	11,955	<b>23</b>	23	0	<b>0.14</b>	0.15	0.00	<b>20</b>
2013 <sup>a</sup>	90,619	<b>84,745</b>	78,266	6,479	<b>9</b>	9	0	<b>0.11</b>	0.11	0.00	<b>9</b>
Total	1,064,220	<b>879,680</b>	818,694	60,986	<b>118</b>	117	1	<b>0.13</b>	0.14	0.02	<b>57</b>

<sup>a</sup>Through 30 June 2012**TABLE 9.** New diagnoses of HIV infections, by gender, U.S. Marine Corps Reserve, January 2008-June 2013

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 2013
2008	29,526	<b>25,984</b>	24,886	1,098	<b>7</b>	7	0	<b>0.27</b>	0.28	0.00	<b>1</b>
2009	29,120	<b>24,950</b>	23,933	1,017	<b>5</b>	5	0	<b>0.20</b>	0.21	0.00	<b>4</b>
2010	28,937	<b>25,341</b>	24,239	1,102	<b>6</b>	6	0	<b>0.24</b>	0.25	0.00	<b>2</b>
2011	32,883	<b>28,028</b>	26,890	1,138	<b>4</b>	4	0	<b>0.14</b>	0.15	0.00	<b>2</b>
2012	30,276	<b>25,837</b>	24,805	1,032	<b>4</b>	4	0	<b>0.15</b>	0.16	0.00	<b>2</b>
2013 <sup>a</sup>	14,200	<b>13,463</b>	12,871	592	<b>2</b>	2	0	<b>0.15</b>	0.16	0.00	<b>2</b>
Total	164,942	<b>143,603</b>	137,624	5,979	<b>28</b>	28	0	<b>0.16</b>	0.17	0.00	<b>13</b>

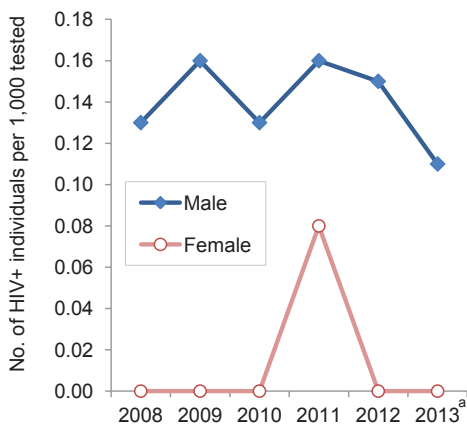
<sup>a</sup>Through 30 June 2012

Marine Corps in 2012 were among male service members (**Figure 5, Table 8**). In contrast to the 117 new HIV infections among active component male service members in the Marine Corps since 2008, there was only one incident diagnosis of HIV among active component female U.S. Marine Corps service members. Of the 118 active component Marines diagnosed with HIV infections, there were 57 (48%) still in service by the end of the first half of 2013.

*U.S. Marine Corps Reserve:* There were 44,476 tests for antibodies to HIV infection conducted among 39,300 individuals in the U.S. Marine Corps Reserve during the 18-month period between January 2012 and June 2013 (**Table 9**). During this period, six Marine Corps reservists (0.15 per 1,000) tested positive for antibodies to HIV.

Of the 28 Marine Corps Reservists diagnosed with HIV infection since 2008, 13 (46%) were still in service in 2013 (**Table 9**). All 28 incident cases were among males.

**FIGURE 5.** New diagnoses of HIV infections, by gender, active component, U.S. Marine Corps, January 2008-June 2013



<sup>a</sup>Through 30 June 2013

### U.S. Coast Guard

*Active component:* From January 2012 to June 2013, 35,992 tests for HIV antibodies were conducted among 34,370 active component members of the U.S. Coast Guard (**data not shown**). During 2012 there was one incident diagnosis of new HIV infection among active component U.S. Coast Guard members; there were five

incident diagnoses for HIV infection in the first half of 2013. On average, one new HIV infected guardsman was detected per 22,973 screening tests in 2012.

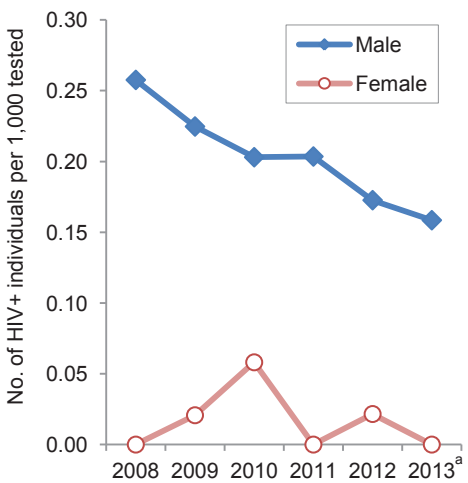
Of the 21 active component Coast Guard members diagnosed with HIV infections since 2008, 14 (67%) were still in service in 2013. Only two female Coast Guard members were diagnosed with HIV seropositivity during the period; both were diagnosed in 2010 (**data not shown**).

*Coast Guard Reserve:* From January 2012 to June 2013, 6,464 tests for HIV antibodies were conducted among 6,176 reserve component members of the U.S. Coast Guard (**data not shown**). There was one incident diagnosis of HIV seropositivity among U.S. Coast Guard reservists from 2008 through the first half of 2013. There were no HIV positive Coast Guard reservists serving as of June 2013 (**data not shown**).

### Air Force

*Active component:* In the 18-month period from January 2012 to June 2013, 382,687 tests for HIV antibodies were conducted among 363,033 active component members of the U.S. Air Force (**Table 10**). Fifty airmen tested seropositive for HIV antibodies during this period. Of these 50 airmen, antibodies to HIV were detected in

**FIGURE 6.** New diagnoses of HIV infections, by gender, active component, U.S. Air Force, January 2008-June 2013



<sup>a</sup>Through 30 June 2013

one (0.01 per 1,000 persons tested) female, and 49 (0.17 per 1,000 persons tested) males.

From 2008 through 2013, the seroprevalence rate in males decreased 31 percent (**Table 10, Figure 6**). The seroprevalence rate among female airmen remained low and stable during the past five years.

In 2012, 34 active airmen tested positive for HIV antibodies (0.14 per 1,000 persons tested) (**Table 10**). On average, one new HIV infection was detected per 7,373 screened tests.

*Air National Guard:* From January 2012 to June 2013, 67,539 tests for antibodies to HIV were conducted among 64,170 members of the Air National Guard (**Table 11**). A total of seven airmen were detected with antibodies to HIV – six in 2012, and one in the first half of 2013. Seroprevalence during this 18-month period was 0.11 per 1,000 persons tested.

In the period from 2008 to June 2013, there were 16 incident diagnoses of HIV seropositivity in the U.S. Air National Guard (**Table 11**). All diagnoses were in male airmen – there no new incident diagnosis in female Air National Guard members during the period.

*Air Force Reserve:* From January 2012 through June 2013, 42,902 tests for antibodies to HIV were conducted among 41,564 members of the Air Force Reserve (**Table 12**). Fifteen incident diagnoses were detected in this 18-month period; seroprevalence was 0.36 per 1,000 persons tested. From January 2008 through June 2013, there were 40 new diagnoses of HIV; all were in male reservists.

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

### EDITORIAL COMMENT

It has been almost 30 years since the U.S. military began routine screening of service members for antibodies to HIV. In the early years, screening detected both long-standing (prevalent) and recently acquired (incident) infections. Since 1990, however, routine screening has been presumed to have been detecting, almost exclusively,

**TABLE 10.** New diagnoses of HIV infections, by gender, active component, U.S. Air Force, January 2008-June 2013

Year	Total HIV tests	Total persons tested	Males tested	Females tested	Total new HIV (+)	New HIV (+), males	New HIV (+), females	Overall rate per 1,000 tested	Male rate per 1,000 tested	Female rate per 1,000 tested
2008	268,263	<b>237,393</b>	190,215	47,178	<b>49</b>	49	0	<b>0.21</b>	0.26	0.00
2009	290,056	<b>244,077</b>	195,826	48,251	<b>45</b>	44	1	<b>0.18</b>	0.22	0.02
2010	282,446	<b>263,451</b>	211,830	51,621	<b>46</b>	43	3	<b>0.17</b>	0.20	0.06
2011	257,586	<b>219,328</b>	176,902	42,426	<b>36</b>	36	0	<b>0.16</b>	0.20	0.00
2012	250,687	<b>237,451</b>	191,140	46,311	<b>34</b>	33	1	<b>0.14</b>	0.17	0.02
2013 <sup>a</sup>	132,000	<b>125,582</b>	100,945	24,637	<b>16</b>	16	0	<b>0.13</b>	0.16	0.00
Total	1,481,038	<b>1,327,282</b>	1,066,858	260,424	<b>226</b>	221	5	<b>0.17</b>	0.21	0.02

<sup>a</sup>Through 30 June 2013**TABLE 11.** New diagnoses of HIV infections, by gender, Air National Guard, U.S. Air Force, January 2008-June 2013

Year	Total HIV tests	Total persons tested	Males tested	Females tested	Total new HIV (+)	New HIV (+), males	New HIV (+), females	Overall rate per 1,000 tested	Male rate per 1,000 tested	Female rate per 1,000 tested
2008	25,976	<b>23,004</b>	19,020	3,984	<b>2</b>	2	0	<b>0.09</b>	0.11	0.00
2009	31,577	<b>27,083</b>	22,684	4,399	<b>4</b>	4	0	<b>0.15</b>	0.18	0.00
2010	24,294	<b>22,612</b>	18,837	3,775	<b>0</b>	0	0	<b>0.00</b>	0.00	0.00
2011	43,231	<b>37,972</b>	31,540	6,432	<b>3</b>	3	0	<b>0.08</b>	0.10	0.00
2012	47,687	<b>45,197</b>	37,668	7,529	<b>6</b>	6	0	<b>0.13</b>	0.16	0.00
2013 <sup>a</sup>	19,852	<b>18,973</b>	15,768	3,205	<b>1</b>	1	0	<b>0.05</b>	0.06	0.00
Total	192,617	<b>174,841</b>	145,517	29,324	<b>16</b>	16	0	<b>0.09</b>	0.11	0.00

<sup>a</sup>Through 30 June 2013**TABLE 12.** New diagnoses of HIV infections, by gender, Air Force Reserve, U.S. Air Force, January 2008-June 2013

Year	Total HIV tests	Total persons tested	Males tested	Females tested	Total new HIV (+)	New HIV (+), males	New HIV (+), females	Overall rate per 1,000 tested	Male rate per 1,000 tested	Female rate per 1,000 tested
2008	26,487	<b>24,054</b>	18,581	5,473	<b>5</b>	5	0	<b>0.21</b>	0.27	0.00
2009	27,720	<b>24,882</b>	19,364	5,518	<b>6</b>	6	0	<b>0.24</b>	0.31	0.00
2010	25,101	<b>23,938</b>	18,584	5,354	<b>9</b>	9	0	<b>0.38</b>	0.48	0.00
2011	27,329	<b>24,998</b>	19,570	5,428	<b>5</b>	5	0	<b>0.20</b>	0.26	0.00
2012	29,444	<b>28,461</b>	21,957	6,504	<b>10</b>	10	0	<b>0.35</b>	0.46	0.00
2013 <sup>a</sup>	13,458	<b>13,103</b>	10,095	3,008	<b>5</b>	5	0	<b>0.38</b>	0.50	0.00
Total	149,539	<b>139,436</b>	108,151	31,285	<b>40</b>	40	0	<b>0.29</b>	0.37	0.00

<sup>a</sup>Through 30 June 2013

recently acquired HIV infections in active and reserve component service members. All service members have been screened as civilian applicants for military service since 1985 and routinely every two years since 2004. In addition, pre- and post-deployment (90 days) screening has been a standard requirement for over a decade.

This year's update on HIV seroprevalence among civilian applicants for U.S. military service reveals a continuing downward trend in the prevalence of HIV seropositivity since 2008. The annual prevalences in 2010 and 2012 are the lowest since the U.S.

Armed Forces began testing civilian recruits for HIV. This decline is not interpreted as an indication of HIV incidence or prevalence in the general U.S. population. Male applicants continue to have a higher seroprevalence than their female counterparts. Civilian applicants who test HIV positive are precluded from accession into the military.

Among U.S. military service members, trends show that, after a few years of declines in all U.S. military services, incident cases have recently shown a slight rise. The only services spared this trend are the Marine Corps active and reserve

components, the Air Force active component, and Coast Guard active and reserve components. Across all services, increases in HIV infection rates are attributable to male service members.

High-risk sexual behavior among some military service members remains an important target of efforts through education and prevention programs to reduce the incidence of new HIV infections. The highest-risk sexual behavior for transmission of HIV is engaging in unprotected sex (i.e., without condoms) with an infected person. Other behaviors that compound the



risks include engaging in unprotected sex with more than one sexual partner or with a partner who has other, concurrent sexual partner(s). Binge drinking has also been associated with unsafe sexual practices. The probability of transmission by blood transfusion is very low.

Recent surveys of members of the armed services continue to reveal that the safe-sex messaging, particularly on the importance of condom use, is unheeded in some quarters. For example, the 2011 Department of Defense Health Related Behaviors Survey of Active Duty Military Personnel noted the following: one quarter (25.0%) of all married and unmarried personnel who reported having a new sexual partner in the past 12 months reported “never” using condoms with a new sexual partner. Across all services, the self-reported prevalence of sexually transmitted infections (STIs) in the previous year was 1.4 percent, and the lifetime rate was 10.8 percent. In a 2008 report based on a survey of 131 Army women in support of a randomized study, 70 percent of respondents indicated that they did not use condoms regularly.<sup>3</sup>

Recent studies indicate that there is a correlation between pre-deployment behaviors and acquisition of new HIV infection. In a study which aimed to characterize contemporary HIV infection among Navy and Marine Corps service members, Brett-Major et al. screened stored sera from 410 sailors and 86 Marines who were found to meet the criteria for an initial positive HIV test during their surveillance period.<sup>4</sup> Nearly half of the patients had deployed including to the wars in Iraq or Afghanistan. In each group (Navy and Marines), nearly half were infected by the age of 25; blacks were over-represented, as were those in specific occupational specialties. Interestingly, clustering of HIV infection risk occurred around the time of deployment.

Walter Reed Army Institute of Research's U.S. Military HIV Research Program reported on an Army-initiated investigation based on observations of a possible increase in HIV incidence among soldiers deployed to combat.<sup>5</sup> Stored predeployment serum samples were tested for HIV RNA. A key finding was that there may be an association between mobilization of soldiers for deployment and HIV infection

acquisition; according to their data, acute infections occur in close proximity to deployment. In all cases, HIV transmission was deemed to be via unprotected sexual contact with opposite and same-sex partners. Among the 48 HIV-positive cases they reviewed, most were determined to have been infected in the U.S. or Germany prior to deployment (n=20, 42%) or during rest and relaxation leave (n=13, 27%). Cases were older, of higher rank, and were more frequently black and unmarried.

There is also evidence that at least in non-deployed settings the use of the internet to solicit sex partners (mostly same-sex) contributes in some measure to acquisition of HIV infection.<sup>6</sup> One study of new HIV infections found that 88 percent of the new cases were men who have sex with men and who reported meeting anonymous sexual partners through internet sex-seeking sites.

Several recent studies have been directed at understanding the vulnerability of female service members to STIs including HIV while in trainee status and/or during deployment.<sup>3,7,8</sup> Although those studies point to behaviors that increase the risk of exposure for female service members to infection, the data in this report do not bear out those concerns. In fact, with respect to HIV infection, among female service members, the incidence of new HIV infections has remained low for at least the last ten years across all services.

In the U.S. Armed Forces, male service members contribute (in some services, exclusively) the majority of new incident cases of HIV infection. The data in this report indicate that, despite a few years of either gradual declines or stabilization in rates of acquisition of new cases among male service members, during the years 2010 to 2012 in the active and reserve components of the Army and Navy, there has been an increase in the numbers and rates of newly diagnosed HIV infections.

Experts have pointed out that the military presents challenging conditions to consider when addressing HIV education and prevention strategies. To begin with, the U.S. Armed Forces contain a large number of high risk age group individuals, i.e., those under the age of 25. A major challenge is presented by the complex ecology in theater – multiple social communities and a high

risk environment which fosters risky behaviors in some service members.<sup>9</sup> The stigma associated with STIs including HIV remains a major challenge in stemming their spread, particularly as pertains to self-examination of high risk sexual behavior. Policies that reduce sexual interactions among service members are already in place, but are difficult to enforce. In addition, the fact that new HIV infection in the U.S. general population and military alike predominates in younger adults suggests that the increasingly accepted notion that HIV is just another treatable STI continues to hold sway with those most at risk. Efforts toward education and prevention can be enhanced to address disparities in racial and ethnic groups, and these same efforts should continue even in deployed conditions.

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# Septicemia Diagnosed During Hospitalizations, Active Component Service Members, U.S. Armed Forces, 2000-2012

During the period 2000 through 2012, the records of 3,360 hospitalized active component service members contained a diagnosis of septicemia. Most of these cases were identified via diagnoses recorded in the first and second diagnostic positions and the numbers and rates of such cases increased dramatically during the period. Rates were higher among women than men and in the oldest and youngest age groups. The most frequent co-occurring diagnoses were pneumonia and infections of the skin and subcutaneous tissue. For the majority of cases of septicemia, no specific etiologic agent was indicated by ICD-9 codes in the record. The most commonly specified agents were *Staphylococcus aureus*, *Escherichia coli*, and *Streptococcus pneumoniae*. Most service members were returned to duty after discharge. The overall mortality associated with hospitalized septicemia cases was 4 percent, but was 5.1 percent for septicemia attributed to gram negative bacteria. Possible reasons why the mortality rate in service members was lower than the rates associated with septicemia in the general population are discussed.

Septicemia is an acute illness that occurs when pathogenic organisms invade the bloodstream and cause systemic inflammation. The pathogenic organisms usually originate from infections occurring in specific locations in the body such as the lungs (pneumonia), the urinary tract (urinary tract infections [UTIs]), the skin, or at surgical sites (wounds, devices, implants, grafts).

Individuals diagnosed with septicemia are usually hospitalized because the infection must be treated with aggressive drug therapy (e.g., antibiotics) in order to prevent progression into life threatening complications. Septicemia is considered severe when there is evidence of hypoperfusion (circulatory failure) and dysfunction of at least one organ system; this state is termed "severe sepsis."<sup>1,2,3</sup> Septic shock is severe sepsis accompanied by hypotension (low blood pressure) despite fluid resuscitation. As septicemia progresses in severity (severe sepsis, septic shock) mortality increases

(severe sepsis mortality rate: 25-30%; septic shock mortality rate: 40-70%).<sup>3</sup>

Septicemia may complicate conditions that are relatively frequently associated with military service; such conditions include combat<sup>4,5</sup> and non-combat trauma<sup>6,7</sup> (e.g., fractures, amputations, penetrating wounds, burns) and bacterial infections (e.g., pneumonia, UTIs, cellulitis/abscesses). In 2012, among active component service members, there were 328 hospitalizations for which the diagnosis of septicemia was designated by the clinician as the primary reason for the hospitalization (i.e., primary [first-listed] diagnostic position on the hospitalization record).<sup>8</sup>

This report summarizes the counts, rates, and trends of septicemia hospitalizations from 2000 through 2012, describes the demographic and military characteristics of the service members affected by septicemia, and estimates the health care burden of this condition (in terms of the number of individuals affected and hospital bed days).

The report also summarizes the organisms associated with septicemia, co-occurring conditions, and the final dispositions of the hospitalized patients (including deaths).

Septicemia is a term often used interchangeably with sepsis, septic shock, and bacteremia and there is much debate and confusion regarding the definitions and uses of these terms.<sup>1,2,9,10</sup> This report also describes the frequency and use of ICD-9 codes for sepsis, septic shock, and bacteremia among U.S. service members.

## METHODS

The surveillance period was January 2000 through December 2012. The surveillance population included active component service members of the Army, Navy, Air Force, Marine Corps, and Coast Guard. A case of septicemia was defined as a hospitalization with an ICD-9 diagnostic code specific for septicemia in any diagnostic position of the standardized hospitalization record (**Table 1**). An individual was considered an incident case of septicemia once every 14 days. If the septicemia hospitalization lasted for more than 14 days, the individual was counted only once as an incident case. Most of the analysis focused on cases where the diagnosis of septicemia was recorded in the primary or secondary diagnostic position, as an indicator of the primary purpose of hospitalization.

Analyses of experiences related to sepsis/septic shock and bacteremia used the same incidence rules as for septicemia (**Table 1**). Some ICD-9 codes in the sepsis/septic shock category were not available until October 2003, so the analysis of this category was limited to the period 2004 to 2012.

Deaths while serving on active duty were ascertained from records produced by service-specific casualty offices and maintained by the Armed Forces Medical Examiner System (AFMES). These

**TABLE 1.** ICD-9-CM codes for septicemia, sepsis/septic shock, and bacteremia

ICD-9-CM codes for septicemia	
038	Septicemia
Staphylococcal septicemia	
038.1	Staphylococcal septicemia
038.10	Staphylococcal septicemia, unspecified
038.11	<i>S. aureus</i> septicemia (2000-2008) then methicillin susceptible <i>S. aureus</i> (MSSA) after Oct 1, 2008
038.12	Methicillin resistant <i>S. aureus</i> septicemia (MRSA) (after Oct 1, 2008)
038.19	Other staphylococcal septicemia
Gram-negative septicemia	
038.4	Gram-negative septicemia
038.40	Unspecified gram-negative septicemia
038.41	<i>H. influenzae</i> septicemia
038.42	<i>E. coli</i> septicemia
038.43	<i>Pseudomonas</i> septicemia
038.44	<i>Serratia</i> septicemia
038.49	Other gram-negative septicemia
Other septicemia	
038.0	Streptococcal septicemia
038.2	Pneumococcal septicemia ( <i>S. pneumoniae</i> septicemia)
038.3	Septicemia due to anaerobes/bacteroides
003.1	<i>Salmonella</i> septicemia
022.3	Anthrax septicemia
036.2	Meningococemia
020.2	Septicemic plague
Unspecified septicemia	
038.8	Other specified septicemias
038.9	Unspecified septicemia (not elsewhere classified)
ICD-9-CM codes for sepsis/septic shock	
785.52	Septic shock (listed under symptoms involving the cardiovascular system) (code not available before October 2003)
995.91	Systemic inflammatory response syndrome [SIRS] due to infectious process without acute organ dysfunction (before December 2003). <b>Sepsis</b> (SIRS due to an infectious process without acute organ dysfunction) (after December 2003)
995.92	Severe sepsis (SIRS with acute organ dysfunction, multiple organ dysfunction)
ICD-9-CM code for bacteremia	
790.7	Bacteremia (listed under nonspecific findings on examination of blood)

as incident cases of septicemia based on diagnoses recorded in any diagnostic position (**data not shown**). Forty-two percent (n=1,395) were identified as incident cases of septicemia based on diagnoses recorded in the primary diagnostic position (**Table 2, Figure 1**). Annual incidence rates of primary diagnosed septicemia increased 33 percent from 2000 to 2004 and then 579 percent from 2004 to 2012. From 2000 to 2012, 1,033 service members were diagnosed with septicemia in the secondary diagnostic position. Incidence rates of secondary diagnosed septicemia increased 345 percent from 2000 to 2011, and then decreased 24 percent from 2011 to 2012. Septicemia rates reported in diagnostic positions three through eight (n=932) increased 56 percent from 2000 to 2012 (**Figure 1**). The remainder of this analysis will exclude septicemia cases diagnosed in the 3rd through 8th diagnostic positions.

**Demographics**

Of hospitalizations for which septicemia was reported in the primary or secondary positions, the overall incidence rate was higher among females than males (Incidence rate ratio [IRR]: 1.4) (**Table 2**). The annual rates were similar among females and males from 2000 to 2005; however, after 2005 the rates in females increased 430 percent and the rates in males increased 227 percent (**Figure 2**).

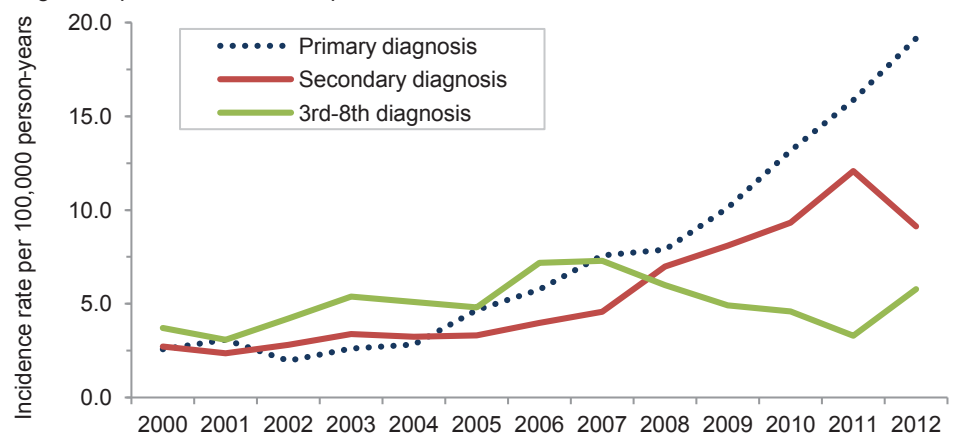
records are routinely provided to the Armed Forces Health Surveillance Center for integration into the Defense Medical Surveillance System. AFMES-assigned underlying cause of death (UCOD) codes were used to determine causes of deaths.

**RESULTS**

**Septicemia**

During the 13-year surveillance period 3,360 hospitalized active component service members were identified

**FIGURE 1.** Incidence rates (per 100,000 person-years) of septicemia hospitalizations by diagnostic position, active component, U.S. Armed Forces, 2000-2012



**TABLE 2.** Incident counts and incidence rates of septicemia diagnosed in the primary and secondary diagnostic position, active component, U.S. Armed Forces, 2000-2012

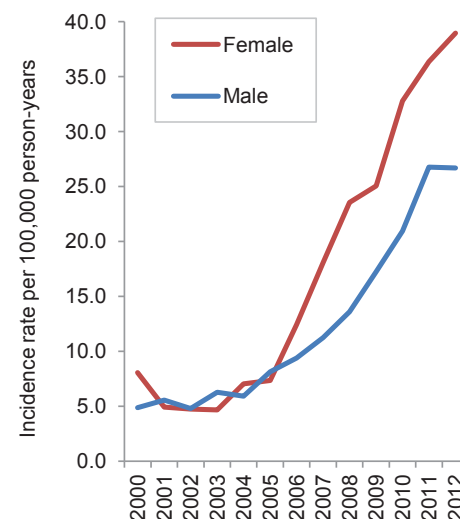
	No.	Rate per 100,000 person-years	Incidence rate ratio (IRR)
Total	2,428	13.2	.
Primary diagnosis	1,395	7.5	.
Secondary diagnosis	1,033	5.6	.
<b>Sex</b>			
Male	1,968	12.5	Ref
Female	460	17.2	1.4
<b>Race/ethnicity</b>			
White, non-Hispanic	1,552	13.5	1.1
Black, non-Hispanic	392	12.3	Ref
Hispanic	238	12.6	1.0
Asian/Pacific Islander	100	13.9	1.1
Other/Unknown	146	13.3	1.1
<b>Age</b>			
<20	326	20.0	1.8
20-24	741	12.0	1.1
25-29	455	11.6	1.1
30-34	290	10.8	Ref
35-39	252	11.1	1.0
40-45	209	17.7	1.6
45+	155	28.8	2.7
<b>Service</b>			
Army	875	13.3	1.3
Navy	476	10.6	1.0
Air Force	465	10.4	Ref
Marine Corps	535	22.6	2.2
Coast Guard	77	15.1	1.4
<b>Military status</b>			
Recruit	101	42.8	3.3
Active duty (non-recruit)	2,327	12.8	Ref
<b>Rank</b>			
Junior enlisted	1,276	16.0	2.0
Senior enlisted	835	11.3	1.4
Junior officer	151	8.1	Ref
Senior officer	166	14.0	1.7
<b>Occupation</b>			
Combat-specific	370	16.0	1.6
Armor/motor transport	111	13.9	1.4
Repair/engineering	557	10.2	Ref
Comm/intel	481	11.5	1.1
Healthcare	219	14.5	1.4
Other	690	16.5	1.6

Among racial/ethnic groups, Asian/Pacific Islanders, white, non-Hispanics, and other/unknown had the highest overall incidence rates (Table 2). In relation to age, overall incidence rates were highest in the oldest (45+) and youngest (<20) groups (IRR: 2.7 and 1.8, respectively). Among

the Services, the highest overall rate was reported in the Marine Corps (IRR: 2.2).

The overall incidence rate of septicemia was higher among recruits than non-recruits (IRR: 3.3) (Table 2). Among officers, overall incidence rates were higher among those more senior than

**FIGURE 2.** Incidence rates of septicemia diagnosed in the primary and secondary diagnostic position by gender, active component, U.S. Armed Forces, 2000-2012



junior; however, among enlisted members, overall rates were higher among those in lower than higher grades. Finally, overall incidence rates were relatively high among those in combat-specific and “other” military occupations.

#### Primary and secondary diagnoses associated with septicemia cases

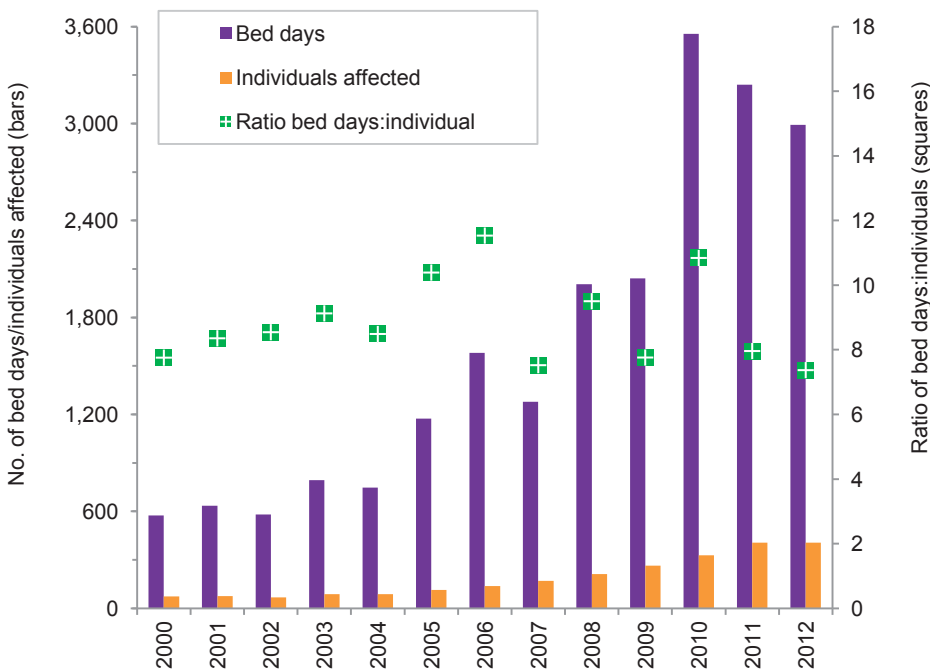
Of 1,395 hospitalization records that had primary diagnoses of septicemia, most (n=1,351, 96.8%) also had secondary diagnoses (Table 3). Of hospitalizations with septicemia-specific primary diagnoses, the most frequent secondary diagnoses were pneumonia (27.2%), sepsis/septic shock (14.1%), skin/subcutaneous tissue infections (7.2%) and pyelonephritis (5.9%). These four categories accounted for more than one-half of all secondary diagnoses during hospitalizations with primary diagnoses of septicemia.

Of 1,033 hospitalization records with septicemia-specific diagnoses in the secondary diagnostic positions, the most frequent primary diagnoses were complications of surgical/medical care (18.3%), pneumonias (17.8%), skin/subcutaneous tissue infections (9.2%), and injuries (e.g., fractures, burns, amputations) (8.0%)

**TABLE 3.** The most common primary and secondary diagnoses associated with hospitalizations for septicemia reported in the primary and secondary diagnostic position, active component, U.S. Armed Forces, 2000-2012

Diagnosis	Secondary diagnoses associated with a primary diagnosis of septicemia (n=1,351)			Primary diagnoses associated with a secondary diagnosis of septicemia (n=1,033)		
	No.	% total	Rank	No.	% total	Rank
Pneumonias	368	27.2	1	184	17.8	2
Sepsis/septic shock	191	14.1	2	4	0.4	11/12
Skin/subcutaneous tissue infections	97	7.2	3	95	9.2	3
Pyelonephritis	80	5.9	4	24	2.3	9
Respiratory failure/insufficiency	59	4.4	5	14	1.4	10
Acute renal failure	58	4.3	6	3	0.3	13
Infectious organism	58	4.3	7	32	3.1	8
Urinary tract infections/prostatitis	43	3.2	8	4	0.4	11/12
Neoplasms	29	2.1	9	44	4.3	5
Complication of surgical/medical care	25	1.9	10	189	18.3	1
Appendicitis	19	1.4	11	33	3.2	6/7
Injuries (e.g., fractures, burns, amputations)	5	0.4	12	83	8.0	4
Complications of pregnancy/childbirth/ puerperium	2	0.1	13	33	3.2	6/7

**FIGURE 3.** Number of bed days and individuals affected among septicemia diagnosed in the primary and secondary diagnostic position, active component, U.S. Armed Forces, 2000-2012



(Table 3). These four categories accounted for more than one-half of all primary diagnoses during hospitalizations with secondary diagnoses of septicemia.

### Bed days and individuals affected

From 2000 to 2012, the number of bed days during septicemia-related (i.e., primary/secondary diagnosis) hospitalizations increased by 421 percent, and the number of individuals affected increased by 449 percent (Figure 3). The average number of bed days per affected individual overall was nine days; however, annual averages ranged from 7 (in 2012) to 12 (in 2006) days per affected individual.

### Septicemia by infectious organism

Nearly two-thirds (62.0%; n=1,506) of all diagnoses of septicemia recorded in the primary or secondary diagnostic position did not have a specified organism identified by an organism-specific ICD-9 diagnostic code (Table 4). The overall incidence rate of septicemia with unspecified infectious causes was 8.2 per 100,000 person-years [p-yrs]; however, this rate increased by 875 percent from 2000 (2.2 per 100,000 p-yrs) to 2012 (21.1 per 100,000 p-yrs) (Table 4, Figure 4).

*Staphylococcus* species (n=344; rate: 1.9 per 100,000 p-yrs) were the most commonly identified organisms associated with septicemia cases (Table 4). Of note, since the introduction of ICD-9 codes to distinguish between methicillin-susceptible *Staphylococcus aureus* (MSSA) and methicillin-resistant *Staphylococcus aureus* (MRSA) septicemia, there were 48 cases of MSSA septicemia (rate: 0.8 per 100,000 p-yrs) and 40 cases of MRSA (rate: 0.6 per 100,000 p-yrs).

Gram-negative organisms were reported in 283 septicemia hospitalizations (rate: 1.5 per 100,000 p-yrs) (Table 4). The most common gram-negative organism reported was *Escherichia coli* (n=137; rate: 0.7 per 100,000 p-yrs). *E. coli* accounted for the largest relative increase in organism-specific septicemia

**TABLE 4.** Septicemia hospitalizations diagnosed in the primary and secondary diagnostic position by organism type, active component, U.S. Armed Forces, 2000-2012

	No.	Rate per 100,000 person-years	% rate difference 2000-2012
<b>Staphylococcal organisms</b>	<b>344</b>	<b>1.9</b>	<b>89</b>
<i>S. aureus</i> septicemia (2000-2008) then methicillin susceptible <i>S. aureus</i> (MSSA) after Oct 1, 2008	210	1.1 (MSSA=0.8 <sup>a</sup> )	12
Methicillin resistant <i>S. aureus</i> septicemia (MRSA) (after Oct 1, 2008)	40	0.6 <sup>a</sup>	73
Other staphylococcal septicemia	64	0.3	127
Unspecified staphylococcal septicemia	30	0.2	289
<b>Gram-negative organisms</b>	<b>283</b>	<b>1.5</b>	<b>267</b>
<i>E. coli</i> septicemia	137	0.7	386
<i>Pseudomonas</i> septicemia	22	0.1	28
<i>Serratia</i> septicemia	8	0.0	0
<i>H. influenzae</i> septicemia	6	0.0	-3
Other gram-negative organism	78	0.4	386
Unspecified gram-negative organism	32	0.2	30
<b>Other organisms</b>	<b>295</b>	<b>1.6</b>	<b>105</b>
Streptococcal septicemia	130	0.7	308
Pneumococcal septicemia ( <i>Streptococcus pneumoniae</i> septicemia)	107	0.6	119
Septicemia due to anaerobes/bacteroides	34	0.2	240
Meningococemia	18	0.1	-100
<i>Salmonella</i> septicemia	6	0.0	7
<b>Unspecified organism (total)</b>	<b>1,506</b>	<b>8.2</b>	<b>875</b>
Other specified septicemias	79	0.4	1,163
Unspecified septicemia (NOS)	1,427	7.7	865

<sup>a</sup>Counts and rate calculations include data from 2009-2012

cases during the period (% increase: 386%).

Streptococcal septicemia was reported in 130 hospitalizations (rate: 0.7 per 100,000 p-yrs), and pneumococcal septicemia (i.e., *Streptococcus pneumoniae* septicemia which has a separate ICD-9 code from streptococcal septicemia) was reported in 107 hospitalizations (rate: 0.6 per 100,000 p-yrs) (Table 4).

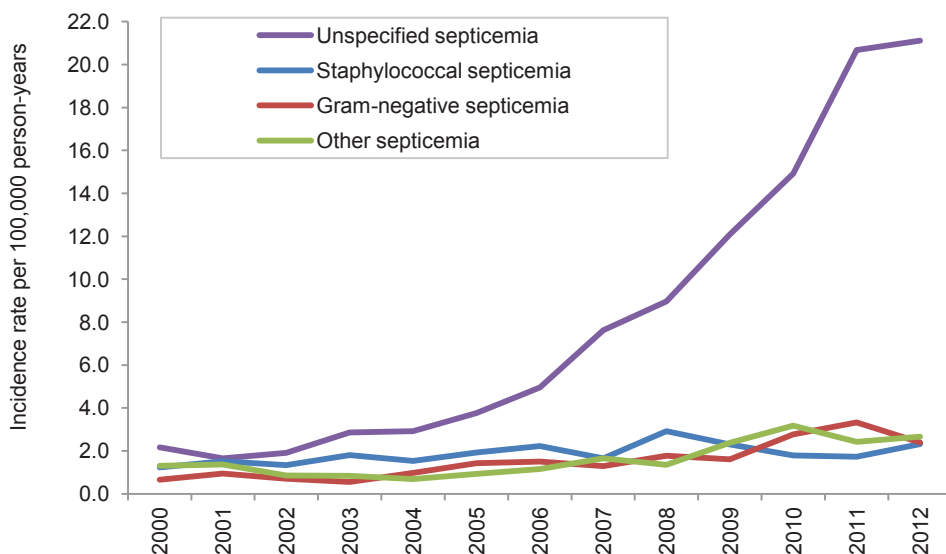
#### Septicemia hospitalization dispositions

Of the 2,428 hospitalizations for which septicemia was reported in the primary or secondary diagnostic position, 1,182 (55.1%) had dispositions of the affected service members recorded on the subject records (data not shown). Of service members with known dispositions after hospitalizations with septicemia, most (88.3%) returned to duty; 6.8 percent were transferred or discharged to another medical facility; 3.3 percent died; and 1.6 percent had “other” dispositions (e.g., discharged home, separated from service).

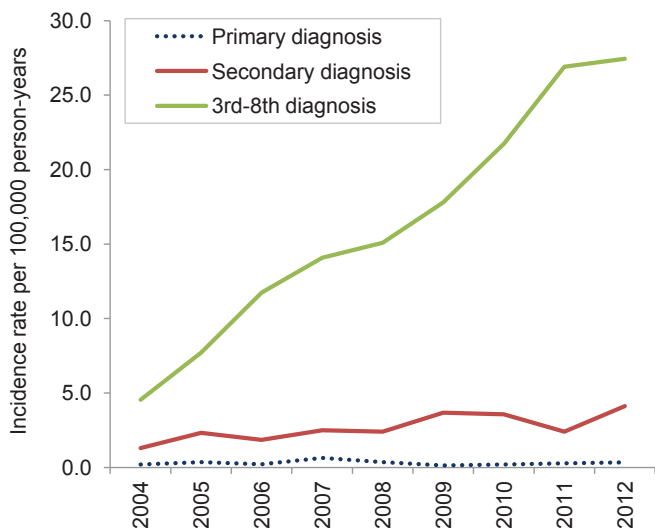
Hospitalizations for septicemia due to “other” organisms were associated with the greatest proportion of return to duty dispositions (91.9%) and the lowest proportion of transfers/discharges to other facilities (4.4%) (data not shown). Hospitalizations for septicemia due to gram-negative organisms were associated with the lowest proportion of return to duty dispositions (82.8%) and the greatest proportion of transfers/discharges to other facilities (9.6%) and of deaths (5.1%). Relatively fewer deaths (2.6 percent) were associated with hospitalizations for septicemia due to staphylococci than any other reported category of organisms.

Sixty-two service members hospitalized with septicemia died within 30 days of their hospital discharges; of these, 37 died on the day they were discharged (of note, the deaths were not reported on the subject hospitalization records) (data not shown). The overall proportion of service members who were hospitalized with septicemia and died within 30 days of their hospital discharges was 4.0 percent. After hospitalizations for septicemia, the

**FIGURE 4.** Septicemia hospitalizations diagnosed in the primary and secondary diagnostic position by organism type, active component, U.S. Armed Forces, 2000-2012

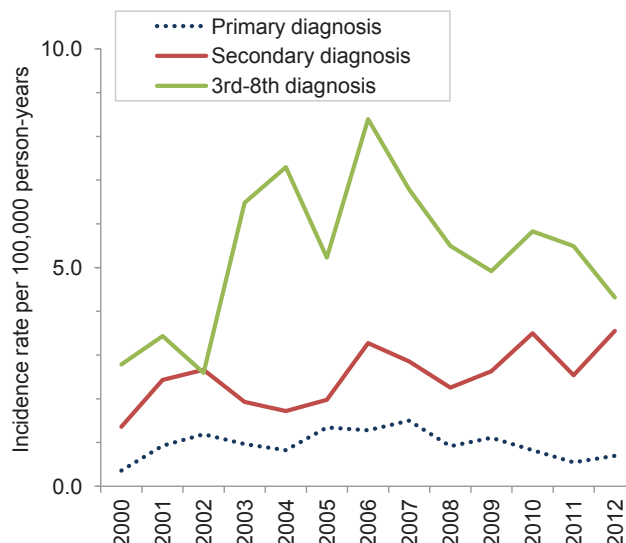


**FIGURE 5.** Hospitalizations for sepsis/septic shock,<sup>a</sup> active component, U.S. Armed Forces, 2004-2012



<sup>a</sup>ICD-9-CM codes for sepsis and septic shock were not available until October 2003

**FIGURE 6.** Hospitalizations for bacteremia, active component, U.S. Armed Forces, 2004-2012



highest and lowest proportions of deaths within 30 days were associated with cases due to gram-negative (5.4%) and staphylococcal (2.4 %) organisms, respectively.

Of all 107 total deaths reported within 30 days, the most common cause of death (per records of the Armed Forces Medical Examiner System) was malignant neoplasm (n=54; 50%) (**data not shown**). Eight deaths were attributed to bacterial infections (four meningococcal infections, three bacterial pneumonia, one unspecified); eight deaths were combat-related injuries; seven deaths were accidental injuries; five deaths were from septicemia; and four deaths were from viral infections (including HIV).

### Sepsis/septic shock

From 2004 to 2012 the majority of sepsis/septic shock diagnoses (84.6%; n=2,496) were reported in the 3rd through 8th diagnostic positions of the associated hospitalizations records (**data not shown**). Sepsis/septic shock was reported as primary (first-listed) diagnoses on records of 39 hospitalizations (1.6%) and secondary diagnoses on records of 346 hospitalizations (13.9%). The rate of sepsis/septic

shock diagnoses reported in 3rd through 8th positions of standardized hospitalization records was five times higher in 2012 (27.4 per 100,000 p-yrs) than 2004 (4.5 per 100,000 p-yrs) (**Figure 5**).

### Bacteremia

From 2000 to 2012, bacteremia was reported as the primary (first-listed) diagnosis on records of 178 hospitalizations (10.9%) and as the second diagnosis on the records of 467 hospitalizations (28.6%) (**Figure 6**). During the period overall, however, a majority (60.5%; n=987) of bacteremia diagnoses were reported in the 3rd through 8th diagnostic positions of the associated hospitalization records. Of the 178 hospitalizations with bacteremia in the primary diagnostic position, 99 (55.6%) had secondary diagnoses indicative of infections (e.g., *streptococcus* infection, cellulitis, UTI) (**data not shown**).

– and particularly those reportedly due to “unspecified” organisms – increased dramatically. The increase was most evident in septicemia reported as the primary reason for hospitalization and to a lesser degree as the secondary reason for hospitalization. Septicemia diagnosed in a later diagnostic position (i.e., 3rd-8th) remained relatively stable throughout the period.

This trend correlates with increases in reported cases of septicemia in the U.S. general population.<sup>9,11</sup> In the general population, septicemia is relatively common among the very young and the elderly, the immunocompromised, critically ill patients, and the poor.<sup>9,11</sup> However, because active military members are generally young adults who have met physical and health standards for service and have ready access to health care, the demographic characteristics of service members affected with, and risk factors for septicemia among them, differ from those in the U.S. general population. For example, in the U.S. military, incidence rates of septicemia were relatively high among the oldest and youngest members and among recruits and other junior enlisted members. Recruits have relatively high rates

### EDITORIAL COMMENT

During the 13-year surveillance period, hospitalizations of U.S. service members with septicemia

of injuries, respiratory infections (e.g., pneumonia), and skin infections (e.g., cellulitis), all of which are risk factors for septicemia.<sup>7,12,13</sup>

It is not clear why the incidence rate of septicemia was higher among females than males or why rates among females increased so markedly during the period. Because studies of septicemia in civilian populations usually include individuals outside the military age range, it is difficult to compare the role of gender in such studies to the findings of this analysis of a military population.

This report documents that infectious diseases (i.e., pneumonias, skin infections, UTIs) and sequelae of other conditions (i.e., complications of surgical/medical care, injuries, childbirth) that are relatively common among military members were the most frequently reported co-occurring diagnoses with septicemia. The finding suggests that earlier detection and more effective treatment of such relatively common conditions among military members may decrease the incidence of septicemia among them.

The proportion of service members hospitalized with septicemia who died within 30 days (4.0%) was much lower than the mortality percentage associated with septicemia reported in the general population (15%-30%).<sup>2,9,11</sup> The mortality rate is presumably lower among military members because of the aforementioned unique characteristics of the military population (i.e., youth, health status, and access to care). Also, septicemia-associated

mortality in the general population is highest in the very young (less than 1 year of age) and the elderly.<sup>9,11</sup> These age groups are not represented in the active military population.

A limitation of this study is the confusing overlap in meaning among terms related to septicemia. Guidelines for the coding of septicemia, sepsis, systemic inflammatory response syndrome (SIRS), and bacteremia are complex and have changed during the surveillance period.<sup>1,10</sup> Based on this analysis it is evident that sepsis/septic shock codes are most often reported in the 3rd-8th diagnostic positions or may co-occur as a secondary diagnosis when septicemia is the primary diagnosis. Likewise, bacteremia ICD-9 codes also are most likely reported in 3rd-8th diagnostic positions; however, some cases are reported in the primary and secondary position. Given these results, this analysis relied upon the clinicians' and coders' interpretations of these terms. As result, other studies designed to estimate rates and trends of septicemia may have different findings based on which ICD-9 codes were used in case definitions.

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# Active Surveillance for Asymptomatic Colonization with Multidrug-Resistant Gram-Negative Bacilli Among Injured Service Members – A Three Year Evaluation

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In response to the high rates of colonization and infection by multidrug-resistant gram-negative bacilli (MDR GNB), many military treatment facilities (MTFs) have implemented additional infection control practices, such as active surveillance cultures for asymptomatic colonization. Results of surveillance cultures (June 2009 – May 2012) collected from patients at Landstuhl Regional Medical Center (Landstuhl RMC), Germany, and three U.S. MTFs were analyzed to evaluate trends in MDR GNB colonization over time and across facilities. At Landstuhl RMC, 6.6 percent of patients were colonized on admission with MDR GNB compared to 12.4 percent of patients admitted to the participating U.S. MTFs. *Escherichia coli* was the predominant organism, representing 82.4 percent of MDR isolates at Landstuhl RMC and 67.1 to 83.3 percent at U.S. MTFs. Other common MDR GNB included *Acinetobacter calcoaceticus-baumannii* complex and *Klebsiella pneumoniae*. Although *Pseudomonas aeruginosa* was often isolated from the surveillance cultures, it was never multidrug-resistant. Annual rates of MDR GNB colonization were not significantly different over the three-year period. Ongoing research includes assessment of predictive factors for MDR GNB colonization and the relationship between colonization and infection.

Numerous reports have described infection and colonization with multidrug-resistant gram-negative bacilli (MDR GNB) among wounded and hospitalized military service members during the conflicts in Afghanistan and Iraq.<sup>1-7</sup> The spread of some resistant organisms, such as *Acinetobacter calcoaceticus-baumannii* (ACB) complex, is thought to be primarily healthcare-associated. Studies of healthy service members in the United States have not demonstrated significant colonization with MDR GNB prior to deployment.<sup>8-10</sup> Additionally, MDR GNB have not been reported to be common in the soil in deployed locations,<sup>11</sup> and war wounds have not been found to be colonized with MDR GNB at the time of injury.<sup>12</sup> Potential sources for MDR GNB

introduction include acquired resistance of endogenous flora due to antibiotic pressure or acquisition of resistant strains from the healthcare system.

The increase in infections associated with MDR GNB at U.S. military treatment facilities (MTFs) led to the implementation of several infection control practices, including active surveillance cultures to detect asymptomatic colonization and preemptive contact isolation of patients while awaiting surveillance culture results. In 2003, three U.S. MTFs (Brooke Army Medical Center [Brooke AMC], National Naval Medical Center, and Walter Reed Army Medical Center [Walter Reed AMC]) began performing surveillance cultures for ACB at the time of hospital admission; however, data were not routinely collected

from all care areas, and colonization with other MDR GNB was not evaluated. In 2005, Landstuhl Regional Medical Center (Landstuhl RMC) in Germany initiated screening in order to gather ACB colonization data from patients arriving directly from combat zones. Analysis of surveillance culture data collected from 2005 through 2009 demonstrated a decrease in ACB colonization from seven percent to one percent at Landstuhl RMC and from 21 percent to 4 percent at the U.S. MTFs.<sup>13</sup>

In an effort to further understand MDR GNB colonization, a prospective longitudinal study at Walter Reed AMC conducted in 2008 entailed collection of surveillance cultures at the time of admission and during hospitalization from six different anatomic sites of both injured service members and non-deployed subjects.<sup>6</sup> Evaluation of the cultures determined that the groin was the most sensitive anatomic site for the detection of MDR GNB colonization. The prevalence of MDR GNB colonization at admission was 23 percent and eight percent among deployed and non-deployed beneficiaries, respectively, and included not only ACB, but also high rates of multidrug-resistant (MDR) *Escherichia coli* and *Klebsiella pneumoniae*. Based on this study and others, Walter Reed AMC, National Naval Medical Center, Brooke AMC, and Landstuhl RMC aligned their surveillance culture programs in 2009 and began routinely swabbing the groins of new admissions to evaluate for colonization with any MDR GNB.<sup>6</sup>

This report presents surveillance data on MDR GNB colonization from June 2009 through May 2012 on injured service members admitted to Landstuhl RMC and the three U.S. MTFs after their surveillance culture programs were aligned.

For this report, groin surveillance cultures performed on service members injured in Iraq or Afghanistan within three days of admission to Landstuhl RMC or the U.S. MTFs were analyzed.<sup>13</sup> The analysis included only the first swab collected from each patient at admission. Results from the surveillance cultures were captured at all four MTFs as part of a prospective study on infectious complications following deployment-related injuries (The Department of Defense-Department of Veterans Affairs, Trauma Infectious Disease Outcomes Study [TIDOS]).<sup>14</sup> Clinical information and microbiology results from deployed subjects admitted to Landstuhl RMC, Walter Reed AMC, National Naval Medical Center (Walter Reed National Military Medical Center after September 2011), or Brooke AMC (San Antonio Military Medical Center after September 2011) were collected through TIDOS as part of an infectious disease module of the Department of Defense Trauma Registry.

Gram-negative bacilli were defined as multidrug-resistant if they were determined to be resistant to three or more of the following antibiotic classes, aminoglycosides,  $\beta$ -lactams, carbapenems, and fluoroquinolones, or if they produced extended spectrum  $\beta$ -lactamases, or if they produced *K. pneumoniae* carbapenemases.<sup>15</sup> Antimicrobial susceptibility tests were performed for all bacterial strains using automated systems (BD Phoenix [BD Biosciences, Sparks, MD] or Vitek 2 [bioMérieux Inc., Hazelwood, MO]) in addition to testing with disc diffusion and E-test methods as recommended by the Clinical and Laboratory Standards Institute and per routine at each hospital.<sup>16</sup>

McNemar's test, which evaluates paired proportions, was used to compare the proportion of subjects colonized between Landstuhl RMC and the U.S. MTFs. Trend comparisons used the GENMOD procedure with binomial distribution in SAS® version 9.3. P-values less than 0.05 were considered statistically significant.

Study population

The study population consisted predominantly of male (98%) service members from the Army (63%) and the Marine Corps (29%) with a median age of 24 years. The majority of patients were medically evacuated to Landstuhl RMC due to injuries sustained through explosions (65%) or gunshots (20%) (data not shown).

Of the 3,882 military personnel admitted to Landstuhl RMC, 48 percent (n=1,859) were transferred to one of the

participating U.S. MTFs (Figures 1a,b,c). Examination of monthly admissions combined for the three years indicated a seasonal pattern of admissions at Landstuhl RMC and the subsequent U.S. MTFs with the highest number of subjects admitted during the summer and early autumn months and the lowest number during the winter (Figures 2a,b).

Proportion with MDR GNB

Within three days of admission, 89.0 percent of patients at Landstuhl RMC and 93.8 percent of patients at the U.S. MTFs

FIGURE 1a. Landstuhl Regional Medical Center (LMRC) admissions and active surveillance cultures for asymptomatic colonization, June 2009-May 2012

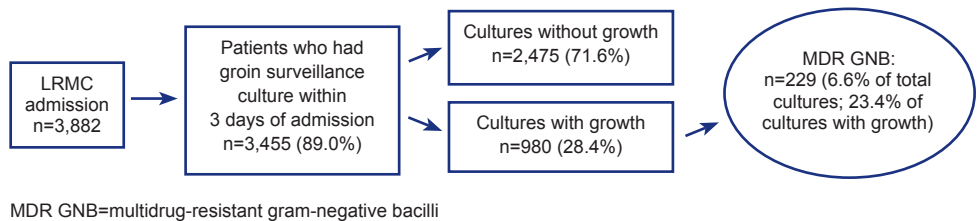


FIGURE 1b. Landstuhl Regional Medical Center (LMRC) admissions and active surveillance cultures for asymptomatic colonization, restricted to the population of patients who transferred to a U.S. Military Treatment Facility (MTF), June 2009-May 2012

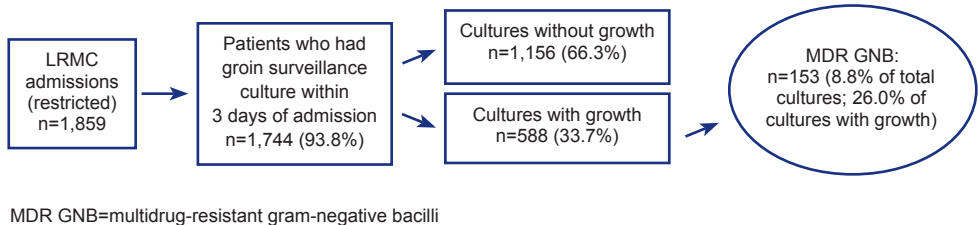
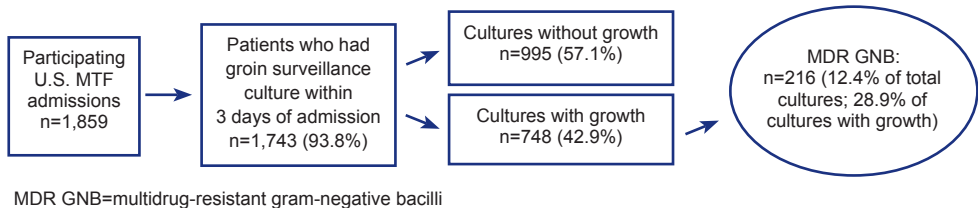
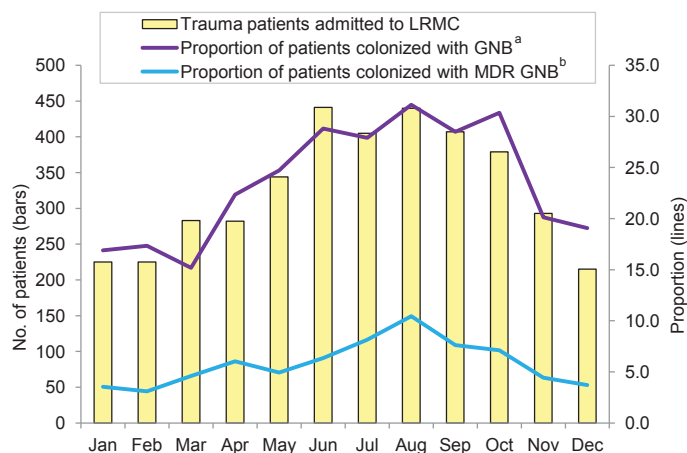


FIGURE 1c. U.S. Military Treatment Facility (MTF) admissions and active surveillance cultures for asymptomatic colonization, June 2009-May 2012

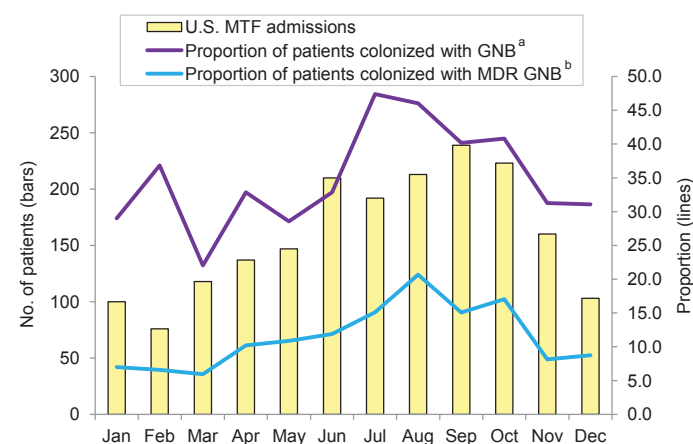


**FIGURE 2a.** Multidrug-resistant (MDR) gram-negative bacilli (GNB) colonization at Landstuhl Regional Medical Center (LRMC) by month of admission, June 2009-May 2012



<sup>a</sup>p<0.0001 for test of trend over time  
<sup>b</sup>p<0.0001 for test of trend over time

**FIGURE 2b.** Multidrug-resistant (MDR) gram-negative bacilli (GNB) colonization at U.S. Military Treatment Facilities (MTFs) by month of admission, June 2009-May 2012



<sup>a</sup>p=0.0042 for test of trend over time  
<sup>b</sup>p<0.0001 for test of trend over time

admitted from a deployment location had surveillance cultures performed (Figures 1a,b,c). Only approximately one-fourth of the surveillance cultures from Landstuhl RMC grew bacteria (Figure 1a). Of the total patients cultured (n=3,455), 6.6 percent grew MDR GNB at Landstuhl RMC. Limiting the analysis of Landstuhl RMC patients with surveillance cultures to those who ultimately transferred to one of the participating U.S. MTFs (n=1,744), 8.8 percent were

colonized at Landstuhl RMC with MDR GNB (Figure 1b). After admission to an U.S. MTF (n=1,743), the percentage of surveillance cultures that grew MDR GNB significantly increased to 12.4 percent (p<0.0001) when compared to the same population at Landstuhl RMC (Figure 1c).

Similar to the pattern of admissions, the highest proportion of patients colonized with MDR GNB at Landstuhl RMC occurred in August (10%), while the lowest

proportion colonized was in February (3%) (Figure 2a). The proportion of patients at the U.S. MTFs colonized with MDR GNB followed the same pattern with the highest proportion of colonization occurring in August (21%) and the lowest in March (6%) (Figure 2b).

Restricting the study population to a subset of military personnel injured in combat demonstrated an increased percentage of medical evacuees at Landstuhl

**TABLE 1.** Most common colonizing bacteria isolated from gram-negative bacilli active surveillance cultures, 1 June 2009-31 May, 2012

Organism	Overall (% of total)	LRMC (% of total)	NNMC <sup>a</sup> (% of total)	WRAMC <sup>b</sup> (% of total)	BAMC (% of total)	WRNMMC <sup>c</sup> (% of total)
<i>Escherichia coli</i>	1,039 (50.3)	606 (51.3)	144 (49.7)	147 (52.1)	128 (49.8)	14 (25.9)
<i>Klebsiella pneumoniae</i>	179 (8.7)	88 (7.4)	26 (9.0)	30 (10.6)	30 (11.7)	5 (9.3)
<i>Enterobacter aerogenes</i>	153 (7.4)	96 (8.1)	18 (6.2)	18 (6.4)	17 (6.6)	4 (7.4)
<i>Acinetobacter calcoaceticus baumannii</i>	143 (6.9)	84 (7.1)	23 (7.9)	20 (7.1)	16 (6.2)	0 (0.0)
<i>Pseudomonas aeruginosa</i>	130 (6.3)	45 (3.8)	37 (12.8)	19 (6.7)	18 (7.0)	11 (20.4)
<i>Enterobacter cloacae</i>	116 (5.6)	80 (6.8)	10 (3.4)	9 (3.2)	13 (5.1)	4 (7.4)
<i>Citrobacter spp.</i>	83 (4.0)	57 (4.8)	6 (2.1)	9 (3.2)	8 (3.1)	3 (5.6)
<i>Pseudomonas spp. (non-aeruginosa)</i>	47 (2.3)	33 (2.8)	2 (0.7)	6 (2.1)	4 (1.6)	2 (3.7)
<i>Proteus mirabilis</i>	41 (2.0)	20 (1.7)	5 (1.7)	6 (2.1)	7 (2.7)	3 (5.6)
<i>Serratia marcescens</i>	35 (1.7)	15 (1.3)	7 (2.4)	8 (2.8)	3 (1.2)	2 (3.7)
Total <sup>d</sup>	2,065	1,182	290	282	257	54

LRMC=Landstuhl Regional Medical Center; NNMC=National Naval Medical Center; BAMC=Brooke Army Medical Center; WRAMC=Walter Reed Army Medical Center; WRNMMC=Walter Reed National Military Medical Center

<sup>a</sup>NNMC was combined with WRAMC to form WRNMMC in September 2011; therefore, NNMC is limited to data from June 2009 through August 2011.

<sup>b</sup>WRAMC was combined with NNMC to form WRNMMC in September 2011; therefore, WRAMC is limited to data from June 2009 through August 2011.

<sup>c</sup>WRNMMC was established September 2011; therefore, WRNMMC is limited to data from September 2011 through May 2012.

<sup>d</sup>Total for each column includes bacterial isolates not incorporated as part of the top ten overall colonizing bacteria, therefore, the sum of the isolates listed for each column equals less than the total.

RMC who received surveillance cultures upon admission (95%), of which nine percent grew MDR GNB. At U.S. MTFs, 89 percent of those injured during combat had surveillance cultures performed and 16 percent of those subjects were colonized with MDR GNB. At both Landstuhl RMC and the U.S. MTFs, the percentage of MDR GNB colonization among combat wounded was statistically greater compared to the non-combat group ( $p < 0.0001$ ) (data not shown).

The most prevalent colonizing organisms identified at Landstuhl RMS and the U.S. MTFs were *E. coli*, *K. pneumoniae*, and *Enterobacter aerogenes* (Table 1). *E. coli* was not only the most common colonizing organism, but also the most frequent MDR GNB recovered (total of 387 isolates) accounting for 82.4 percent of MDR GNB at Landstuhl RMC and 67.1 to 83.3 percent at the U.S. MTFs. The next most frequent MDR GNB cultured included: *ACB*, *K. pneumoniae*, and *Enterobacter cloacae*. Pathogen distribution was similar among the U.S. MTFs, although at Brooke AMC the percentage of MDR *E. coli* was lower and the percentages of MDR *ACB* and *K.*

*pneumoniae* were higher compared to the other sites (data not shown).

### Antibiotic Resistance of MDR GNB

*E. coli* and *K. pneumoniae* isolates were primarily MDR due to extended spectrum  $\beta$ -lactamase production, whereas *ACB* isolates much more frequently demonstrated resistance to multiple antimicrobial classes (Table 2). Of the extended spectrum  $\beta$ -lactamase-producing *E. coli*, 47 percent were also resistant to fluoroquinolones and 11 percent were resistant to aminoglycosides (data not shown). Of the extended spectrum  $\beta$ -lactamase-producing *K. pneumoniae*, approximately one-third were resistant to fluoroquinolones and aminoglycosides (data not shown). Most *Pseudomonas aeruginosa* and *E. aerogenes* isolates were susceptible to all antibiotic classes.

### Annual Trends

Overall, the percentages of patients colonized with MDR GNB at Landstuhl RMC among the population who received surveillance cultures and transferred to

the U.S. MTFs ( $n=1,744$ ) were 7.0 percent, 10.6 percent, and 8.5 percent during the first (June 2009 – May 2010), second (June 2010 – May 2011), and third (June 2011 – May 2012) years, respectively (Figure 3a). The percentages at the U.S. MTFs were 11.5 percent, 14.9 percent, and 12.9 percent, respectively (Figure 3b). Although the rates of MDR GNB colonization were generally highest in the second year of the study and declined during the third, the differences were not statistically significant at either Landstuhl RMC or the U.S. MTFs.

### EDITORIAL COMMENT

This report summarizes three-years (June 2009 – May 2012) of results from active surveillance culturing for MDR GNB of deployed U.S. service members who were hospitalized at Landstuhl RMC and several U.S. MTFs. A higher overall percentage of MDR GNB was observed at U.S. MTFs compared to Landstuhl RMC. *E. coli* was the most frequently cultured MDR GNB recovered at both Landstuhl RMC and U.S. MTFs, followed by *ACB*, *K. pneumoniae*,

**TABLE 2.** Antibiotic resistance among common colonizing gram-negative bacilli, active surveillance cultures, 1 June 2009-31 May, 2012

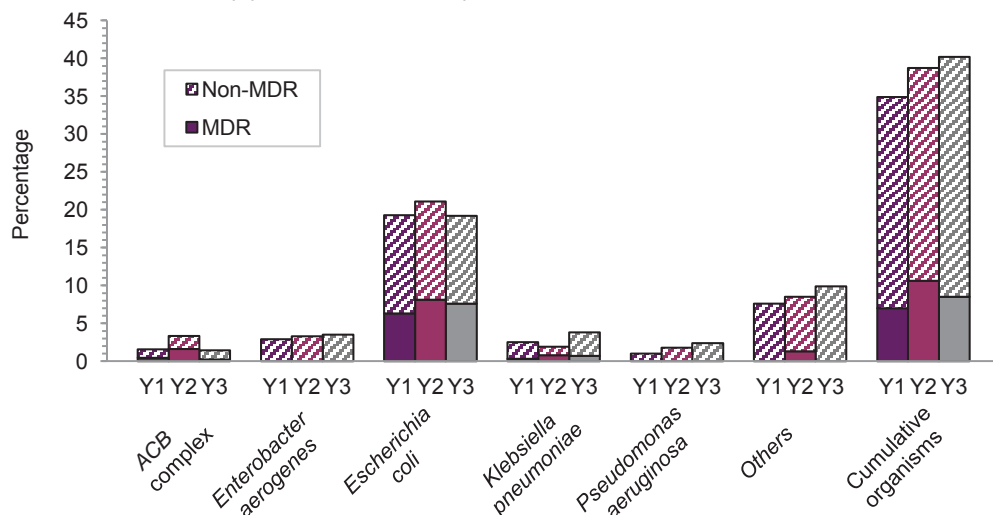
Organism	Total no. of isolates <sup>a</sup>	MDR isolates (% total)	ESBL producers (% MDR isolates)	Aminoglycosides (% resistant <sup>b</sup> )	$\beta$ -lactams (% resistant <sup>b</sup> )	Carbapenems (% resistant <sup>b</sup> )	Fluoroquinolones (% resistant <sup>b</sup> )
<i>Escherichia coli</i>	1,039	387 (37.2)	385 (99.5)	69 (6.6)	391 (37.6)	3 (0.3)	348 (33.5)
<i>Klebsiella pneumoniae</i>	179	40 (22.3)	40 (100)	13 (7.3)	40 (22.3)	0 (0.0)	23 (12.8)
<i>Enterobacter aerogenes</i>	153	0 (0.0)	0 (0.0)	0 (0.0)	2 (1.3)	0 (0.0)	0 (0.0)
<i>Acinetobacter calcoaceticus baumannii</i>	143	64 (44.8)	0 (0.0)	48 (33.6)	52 (36.4)	63 (44.1)	70 (49.0)
<i>Pseudomonas aeruginosa</i>	130	0 (0.0)	0 (0.0)	0 (0.0)	3 (2.3)	1 (0.8)	11 (8.5)
<i>Enterobacter cloacae</i>	116	4 (3.4)	4 (100)	2 (1.7)	12 (10.3)	1 (0.9)	8 (6.9)
<i>Citrobacter spp.</i>	83	1 (1.2)	1 (100)	2 (2.4)	2 (2.4)	0 (0.0)	8 (9.6)
<i>Pseudomonas spp. (non-aeruginosa)</i>	47	0 (0.0)	0 (0.0)	0 (0.0)	1 (2.1)	0 (0.0)	2 (4.3)
<i>Proteus mirabilis</i>	41	2 (4.9)	2 (100)	0 (0.0)	3 (7.3)	0 (0.0)	3 (7.3)
<i>Serratia marcescens</i>	35	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (2.9)

ESBL=extended spectrum  $\beta$ -lactamase; MDR=multidrug-resistant

<sup>a</sup>Total number of isolates refers to both resistant isolates (shown here) and non-resistant isolates. In addition, an isolate may be resistant to more than one antimicrobial agent and will be counted under each applicable column.

<sup>b</sup>The percentage reflects the proportion of organisms resistant to that antibiotic class divided by the total number of isolates of that organism.

**FIGURE 3a.** Percentage of surveillance cultures with colonizing isolates at Landstuhl Regional Medical Center (LRMC) among patients transferred to U.S. military treatment facilities (MTFs)<sup>a</sup> by year, June 2009-May 2012

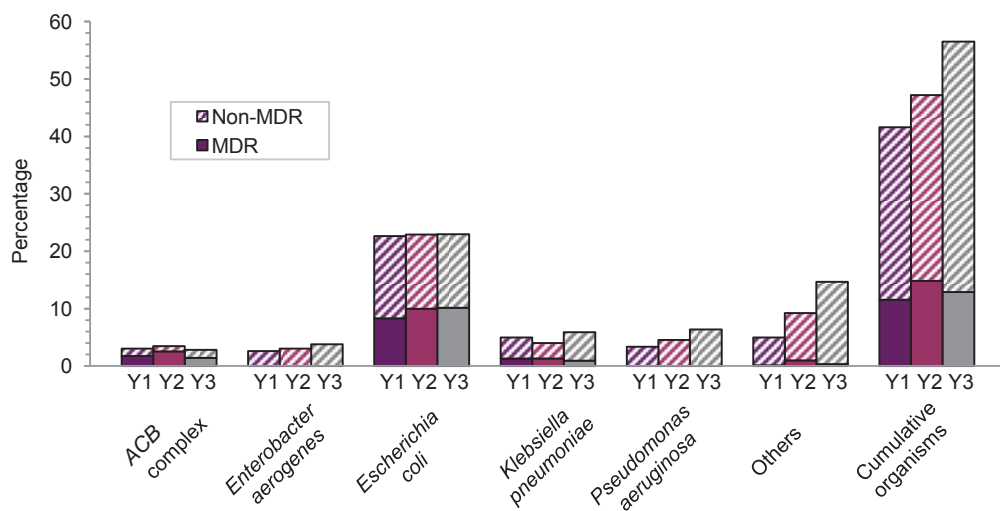


ACB=*Acinetobacter calcoaceticus baumannii*; MDR=multidrug resistant

<sup>a</sup>The proportion is the number of LRMC patients with a particular organism among the total patients admitted to LRMC in that year that were transferred to a U.S. MTF.

Y1=June 2009-May 2010; Y2=June 2010-May 2011; Y3=June 2011-May 2012

**FIGURE 3b.** Percentage of surveillance cultures with colonizing isolates at U.S. military treatment facilities (MTFs)<sup>a,b</sup> by year, June 2009-May 2012



ACB=*Acinetobacter calcoaceticus baumannii*; MDR=multidrug resistant

<sup>a</sup>U.S. MTF data were combined for yearly analysis

<sup>b</sup>The proportion is the number of U.S. MTF patients having a particular organism among the total patients admitted to the U.S. MTFs in that year.

Y1=June 2009-May 2010; Y2=June 2010-May 2011; Y3=June 2011-May 2012

and *E. cloacae*. In addition, *P. aeruginosa* and *E. aerogenes* commonly grew from active surveillance cultures; however, the isolates were almost always susceptible to multiple classes of antibiotics.

Colonization with MDR GNB has been reported in prior studies in relation to

deployed personnel. An evaluation of colonization among service members admitted to Walter Reed AMC from Landstuhl RMC in 2008 found that 23 percent were colonized with MDR organisms at Walter Reed AMC admission.<sup>6</sup> In another analysis, 21 percent of subjects admitted to Walter Reed

AMC, National Naval Medical Center, or Brooke AMC in 2005 were colonized with MDR ACB; however, the colonization rate decreased to four percent in 2009. A comparable decrease was reported at Landstuhl RMC with seven percent of subjects colonized with MDR ACB at admission in 2005 and one percent in 2009. The overall MDR organism colonization rate in 2009 was three percent at admission to Landstuhl RMC and 13 percent at the U.S. MTFs. In addition, extended spectrum  $\beta$ -lactamase-producing *E. coli* represented the most prevalent colonizing organism.<sup>13</sup>

Similar to the previous analyses, the report herein demonstrates that rates of MDR GNB colonization are higher at the U.S. MTFs (12.4%) than at Landstuhl RMC (8.8% of subjects that transfer to a participating U.S. MTF). The reasons for this remain unclear, but may be related to nosocomial acquisition through the evacuation chain, longer time available for bacterial growth, different culturing techniques, or greater administration of antibiotics. Another similarity to the prior studies is that the percentage of patients colonized with MDR ACB has decreased since the early 2000s. Moreover, the three-year data reported here indicate that the mechanism responsible for the majority of drug resistance seen in colonizing isolates is extended spectrum  $\beta$ -lactamase production. Future studies should investigate risk factors for extended spectrum  $\beta$ -lactamase production in this patient population.

A key finding of this study is that service members who sustained combat-related injuries had significantly higher rates of MDR GNB colonization (9% and 16% at Landstuhl RMC and U.S. MTFs, respectively) than the overall population admitted to Landstuhl RMC and, subsequently, to one of the three U.S. MTFs. Although MDR GNB colonization in those with combat-related trauma is higher than in the overall population, deployed subjects without combat injuries who transit through the same evacuation chain continue to have significant rates of MDR GNB colonization that warrant similar infection control practices.

The findings of this study should be interpreted with consideration that the surveillance culture data were collected from U.S. MTFs involved in the TIDOS project. The patients at these participating U.S. MTFs (approximately 50% of subjects transferred from Landstuhl RMC) tended to be more severely injured than those transferred to other U.S. MTFs; therefore, it is uncertain if the surveillance culture results are generalizable to all injured service members transferred from Landstuhl RMC.

Prevention and control of MDR organism transmission has become a national priority. The emergence of MDR GNB limits the use of specific antimicrobial agents, lengthens the time of convalescence, and may lead to increases in morbidity and mortality. The Healthcare Infection Control Practices Advisory Committee (HICPAC) has published guidelines on how to manage these organisms in health-care settings.<sup>17</sup> The HICPAC guidelines recommend using a combination of techniques to control MDR GNB including surveillance cultures to detect asymptomatic colonization and preemptive contact precautions until culture results return. This report demonstrates sustained levels of MDR GNB colonization at Landstuhl RMC and select U.S. MTFs over the past three years, which warrants the continuation of surveillance cultures and contact precautions. Future studies should focus on the relationship between MDR GNB colonization and infection, the effectiveness of surveillance cultures plus contact isolation for decreasing nosocomial transmission of MDR GNB, and risk factors for the propagation of extended spectrum  $\beta$ -lactamases in the deployed population.

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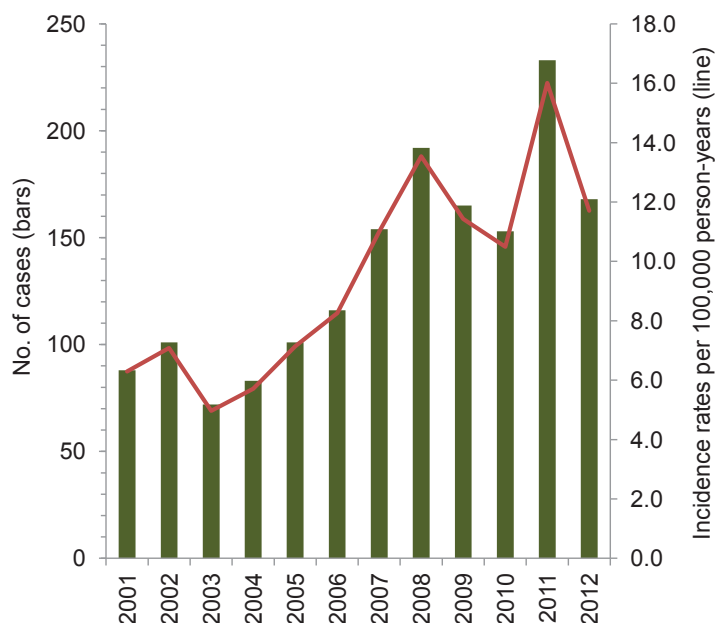
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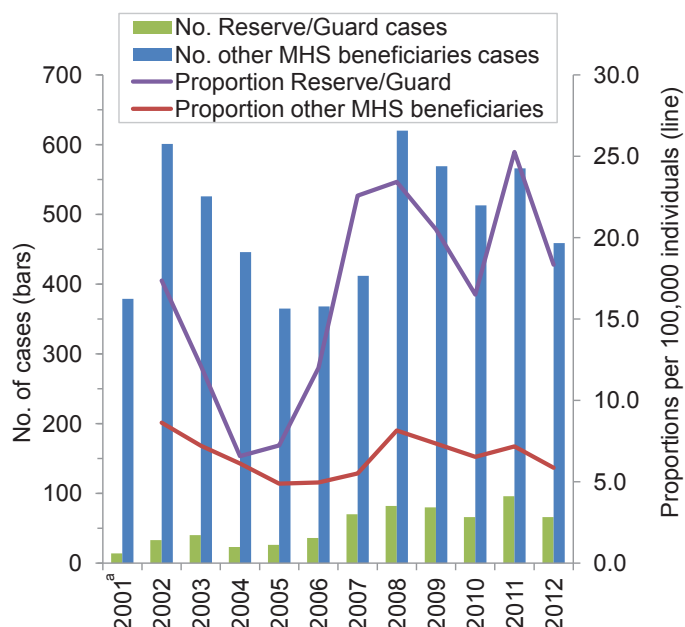
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# Surveillance Snapshot: Lyme Disease among Beneficiaries of the Military Health System, 2001-2012

**FIGURE 1.** Incident counts and incidence rates of Lyme disease, active component, U.S. Armed Forces, 2001-2012



**FIGURE 2.** Incident counts and proportions<sup>a</sup> of Lyme disease in the Reserve/Guard and all other MHS beneficiaries,<sup>b</sup> 2001-2012



<sup>a</sup>Denominator data was derived from eligible beneficiaries of the MHS extrapolated from the yearly Report to Congress: Evaluation of TRICARE Program. This data was not available in 2001.

<sup>b</sup>MHS=Military Health System; other MHS beneficiaries= family members of active and guard/reserve component service members, and retirees and their eligible family members.

Among U.S. military service members of the active component, annual incidence rates of Lyme disease rose during the years 2001-2008, but appear to have stabilized since 2008. The peak incidence rate in the surveillance period 2001-2012 was in 2011 (n=233), when there were 16 cases of Lyme disease per 100,000 person-years (**Figure 1**).

Among service members of the reserve component (Reserve and Guard), the numbers and proportions of cases have, as was true for the active component, been higher in the last five years than was true in the earlier part of the surveillance period. Similarly, the peak incidence was in 2011 (n=96) when the proportion of reserve component service members with Lyme disease was 25 cases per 100,000 individuals (**Figure 2**).

Among other MHS beneficiaries, incident cases and proportions of Lyme disease have been relatively stable from 2008 through 2012. The number of cases (n=365) and the proportion of cases in other MHS beneficiaries (4.89 cases per 100,000 individuals) in 2005 were the lowest of the 13-year surveillance period. The denominators used to calculate the proportion of MHS beneficiaries with Lyme disease per 100,000 individuals were extrapolated from the yearly Report to Congress: Evaluation of the TRICARE Program.<sup>1</sup> Other MHS beneficiaries are identified as the family members of active and guard/reserve component service members, and retirees and their eligible family members (**Figure 2**).

1. TRICARE Management Activity. Report to Congress: Evaluation of the TRICARE Program. Found at: [http://tricare.mil/tma/congressionalinformation/report\\_cong\\_archive.aspx](http://tricare.mil/tma/congressionalinformation/report_cong_archive.aspx). Accessed on: 04 September 2013.

## Letter to the Editor

**T**o the Editor: As former Preventive Medicine officers assigned to joint regional headquarters at Bagram Air Base, we read with interest the recent analysis of medical evacuations from Afghanistan.<sup>1</sup> This analysis of U.S. Transportation Command (TRANSCOM) data identified 103 medical evacuations for pregnancy-related conditions among female U.S. military service members through the end of 2012.

Our experiences tell us that TRANSCOM data provide a misleading estimate of the incidence of uncomplicated pregnancy in Afghanistan. Many uncomplicated pregnancies will be safely redeployed administratively, not necessarily as a medical evacuation, and will not be reflected in TRANSCOM data.<sup>2</sup> Of 103 pregnancy-related evacuations from Afghanistan in the June analysis, only 38 (36.9%) were assigned diagnosis of “normal pregnancy.”<sup>1</sup>

To better estimate the rate of pregnancy, we evaluated clinic records from the women’s health clinic at the tertiary referral hospital at Bagram Air Base, between mid-January and mid-September, 2007 as public health surveillance. Among 3,298 female U.S. military personnel deployed to areas supported by the clinic during the period, 487 (14.8%) were evaluated at the clinic one or more times. Overall, 49 pregnancies were identified, comprising nearly 1.5 percent of deployed females.<sup>3</sup>

In a crude analysis, assuming average deployment lengths of eight months during the analysis period, we calculate rates of pregnancy of 22.3 per 1,000 person-years, or over 12 times the rates implied by TRANSCOM data alone. Assuming deployed person-time data from the June *MSMR* analysis, the true number of pregnancies in Afghanistan through December 2012 would be therefore closer to 1,296. Subtracting those 103 medically evacuated, the 1,193 (92%) inferred from our analysis and presumed to be administratively redeployed are consistent with an earlier analysis, which also found 92 percent of pregnancies identified during deployment were administratively redeployed.<sup>2</sup>

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LTC Jennifer Caci, MS, USA

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**I**n reply: The letter from Dr. Nevin and LTC Caci describes a method to estimate the number of incident pregnancy diagnoses in a population of service women during their deployments in Afghanistan. The authors contrast their estimate with the number of medical evacuations for pregnancy from Afghanistan during Operation Enduring Freedom (as reported in the summary of medical evacuations in the June 2013 *MSMR*).<sup>1</sup> Not surprisingly, the number of pregnancies estimated by Nevin and Caci markedly exceeded the number of pregnancy-related evacuations documented in the report.

As discussed in the subject *MSMR* report, most medical care for service members in Afghanistan is provided by deployed military medical personnel in theater; however, some injuries and illnesses require medical management elsewhere. Medical evacuations are generally used for service members who have serious conditions, whose treatment is not available in theater, whose recovery is likely to be prolonged, who require medical care en route to their destination, or who are not able to travel on their own because of mobility limitations. Service members who are medically evacuated represent, in general, only a small fraction of all incident cases of illnesses and injuries that occur in theater.

In regard to pregnancy specifically, service women whose pregnancies are diagnosed in theater are required to redeploy. As pointed out by Nevin and Caci and by Albright et al., most pregnant deployed women are administratively transported out of theater by routine passenger aircraft, and such travel is not reflected in TRANSCOM medical evacuation records.<sup>2</sup>

Although not described in the *MSMR* medical evacuation report, a majority (63%) of the women with pregnancy-related medical evacuations had documented complications of their pregnancies (e.g., miscarriage, ectopic pregnancy, hemorrhage) – conditions that may necessitate medical evacuation – on records of their subsequent medical care. As discussed in the *MSMR* report, “most causes of medical evacuations were estimated from primary (first-listed) diagnoses that were recorded during hospitalizations or initial outpatient encounters after evacuation. In some cases, clinical evaluations in fixed medical treatment facilities after medical evacuations may have ruled out serious conditions that were clinically suspected in the theater. For this analysis, the causes of such evacuations reflect diagnoses that were determined after evaluations outside of the theater rather than diagnoses – perhaps of severe disease – that were clinically suspected in the theater. To the extent that this occurred, the causes of some medical evacuations may seem surprisingly minor.”<sup>1</sup> Against that backdrop, it seems likely that most, if not all, of the pregnant women whose post-evacuation diagnoses were “normal pregnancy” were transported through the medical evacuation process because of suspected complications of pregnancy.

In summary, the sharp differences between Nevin and Caci’s estimates of cases and rates of pregnancies overall and the numbers and rates of pregnancy-related medical evacuations (as reported in the *MSMR*) highlight the important point that, for most conditions (diseases, injuries, pregnancies), it is inappropriate to use numbers of medical evacuations for specific conditions to estimate total cases or incidence rates of the conditions in deployed populations overall.

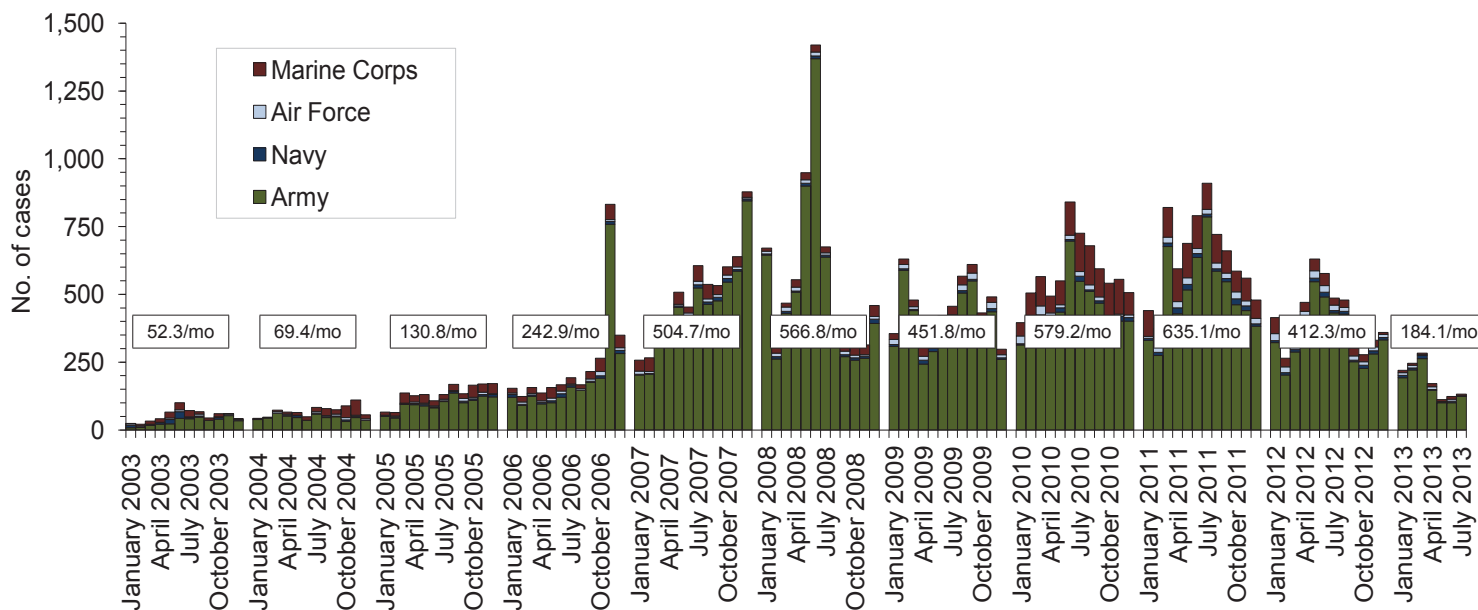
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# Deployment-Related Conditions of Special Surveillance Interest, U.S. Armed Forces, by Month and Service, January 2003-July 2013 (data as of 16 August 2013)

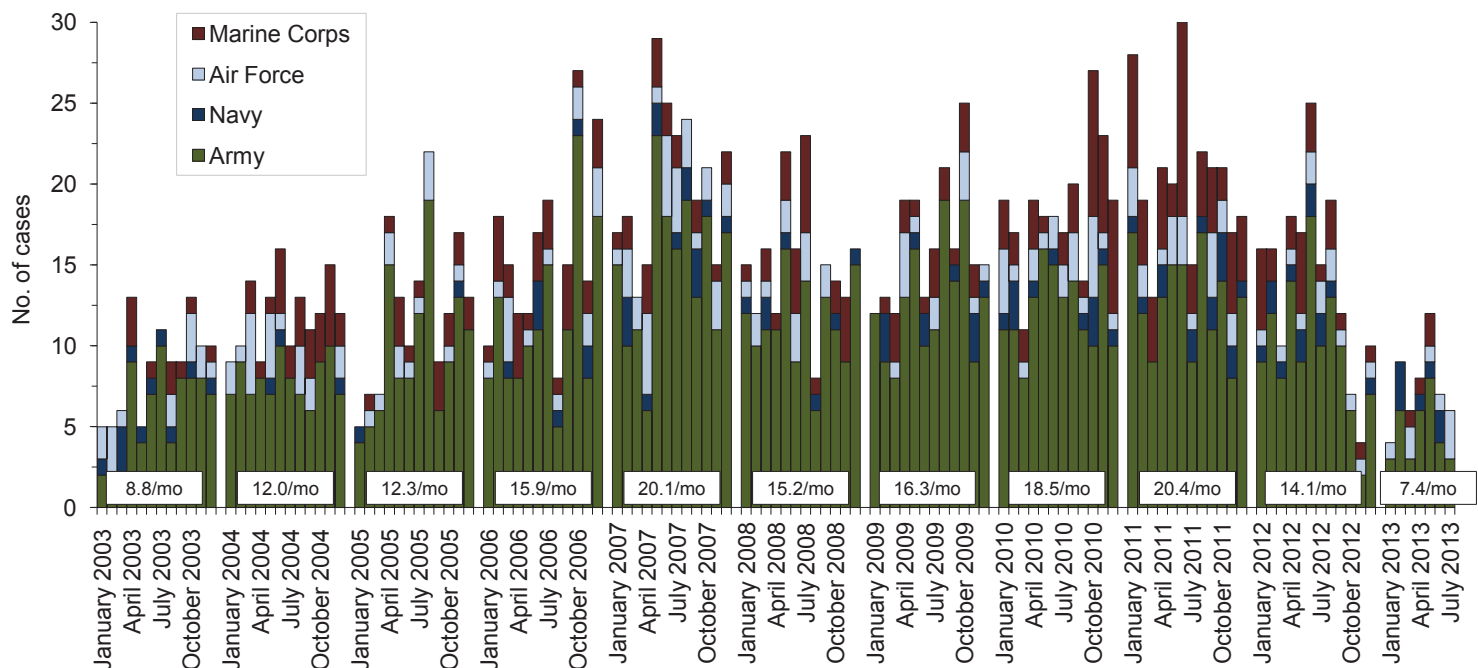
Traumatic brain injury (ICD-9: 310.2, 800-801, 803-804, 850-854, 907.0, 950.1-950.3, 959.01, V15.5\_1-9, V15.5\_A-F, V15.52\_0-9, V15.52\_A-F, V15.59\_1-9, V15.59\_A-F)<sup>a</sup>



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

<sup>a</sup>Indicator diagnosis (one per individual) during a hospitalization or ambulatory visit while deployed to/within 30 days of returning from OEF/OIF. (Includes in-theater medical encounters from the Theater Medical Data Store [TMDS] and excludes 4,193 deployers who had at least one TBI-related medical encounter any time prior to OEF/OIF).

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)<sup>b</sup>

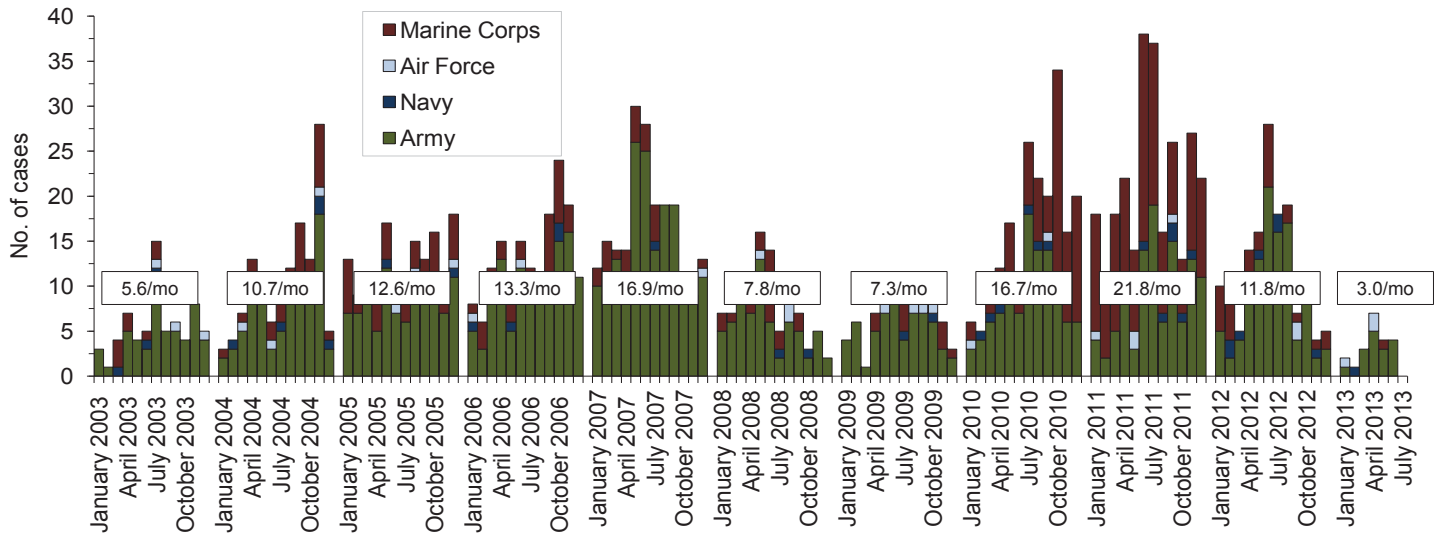


Reference: Isenbarger DW, Atwood JE, Scott PT, et al. Venous thromboembolism among United States soldiers deployed to Southwest Asia. *Thromb Res*. 2006;117(4):379-83.

<sup>b</sup>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 OEF/OIF.

# Deployment-related conditions of special surveillance interest, U.S. Armed Forces, by month and service, January 2003-July 2013 (data as of 16 August 2013)

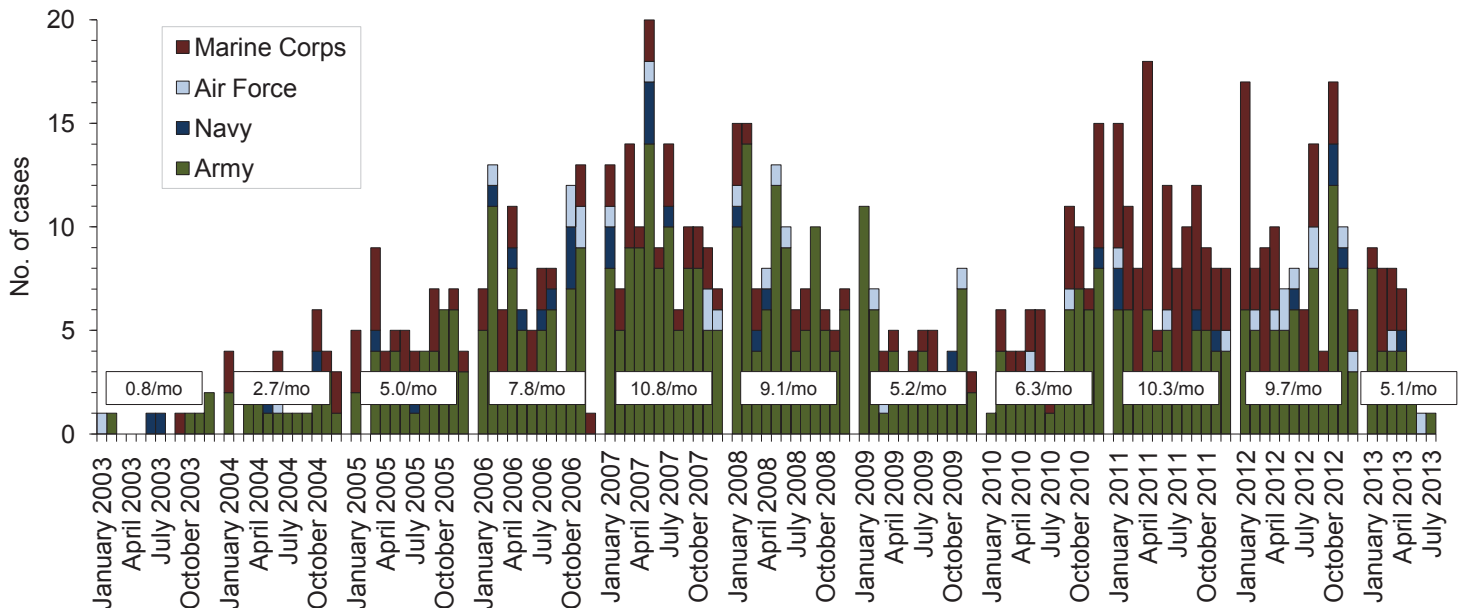
Amputations (ICD-9-CM: 887, 896, 897, V49.6 except V49.61-V49.62, V49.7 except V49.71-V49.72, PR 84.0-PR 84.1, except PR 84.01-PR 84.02 and PR 84.11)<sup>a</sup>



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*. Jan 2005;11(1):2-6.

<sup>a</sup>Indicator diagnosis (one per individual) during a hospitalization while deployed to/within 365 days of returning from OEF/OIF/OND.

Heterotopic ossification (ICD-9: 728.12, 728.13, 728.19)<sup>b</sup>

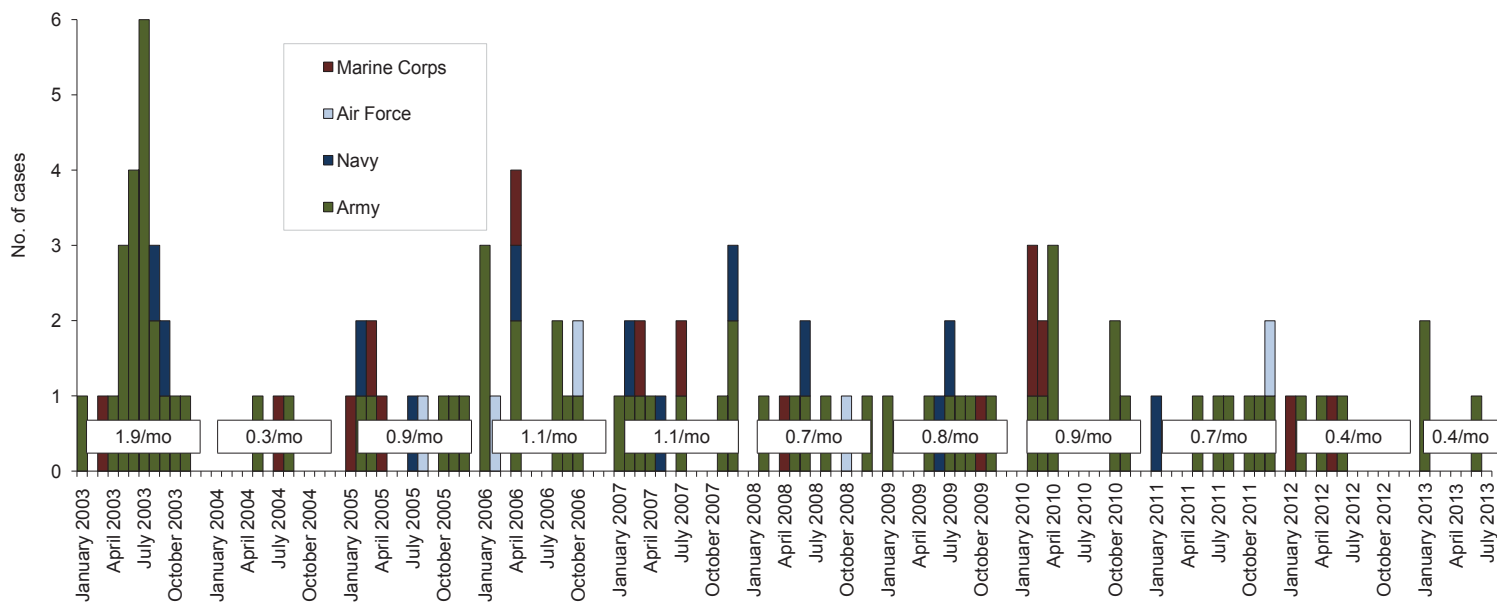


Reference: Army Medical Surveillance Activity. Heterotopic ossification, active components, U.S. Armed Forces, 2002-2007. *MSMR*. Aug 2007; 14(5):7-9.

<sup>b</sup>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 OEF/OIF/OND.

# Deployment-Related Conditions of Special Surveillance Interest, U.S. Armed Forces, by Month and Service, January 2003-July 2013 (data as of 16 August 2013)

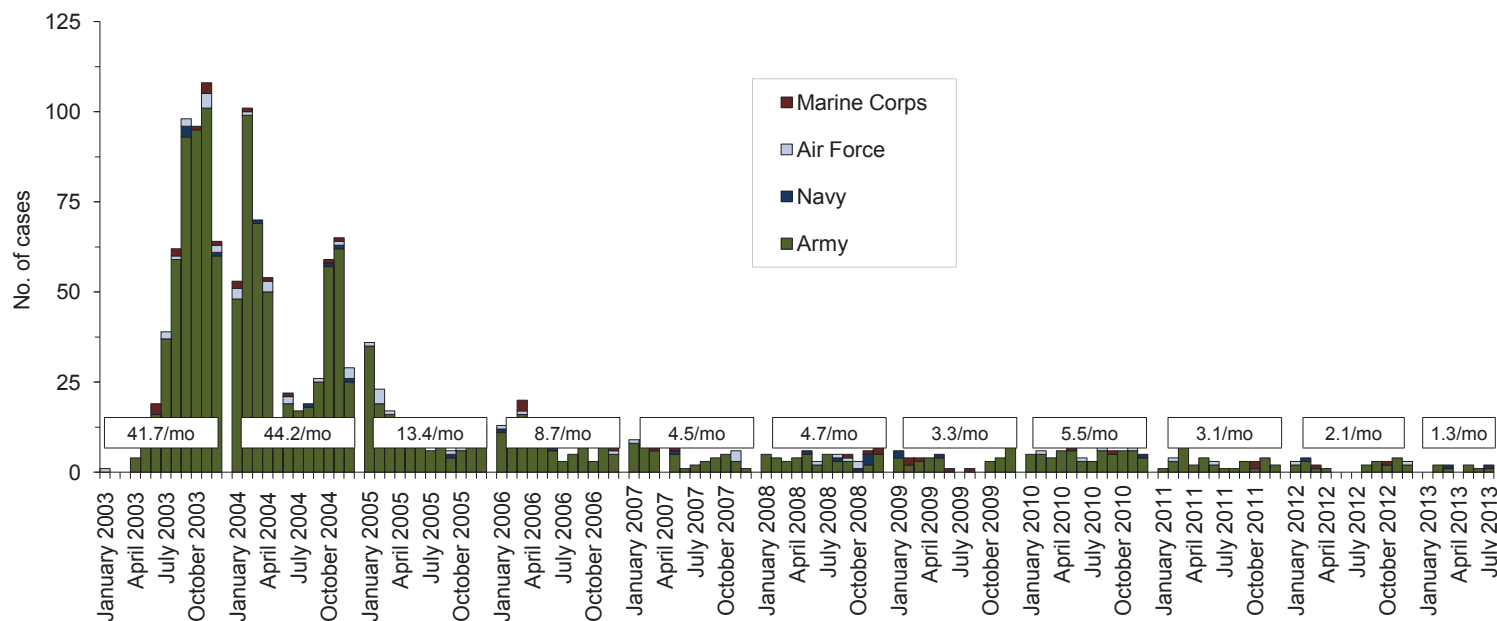
Severe acute pneumonia (ICD-9: 518.81, 518.82, 480-487, 786.09)<sup>a</sup>



Reference: Army Medical Surveillance Activity. Deployment-related condition of special surveillance interest: severe acute pneumonia. Hospitalizations for acute respiratory failure (ARF)/acute respiratory distress syndrome (ARDS) among participants in Operation Enduring Freedom/Operation Iraqi Freedom, active components, U.S. Armed Forces, January 2003-November 2004. MSMR. Nov/Dec 2004;10(6):6-7.

<sup>a</sup>Indicator diagnosis (one per individual) during a hospitalization while deployed to/within 30 days of returning from OEF/OIF/OND.

Leishmaniasis (ICD-9: 085.0 to 085.9)<sup>b</sup>



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

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

## Medical Surveillance Monthly Report (MSMR)

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