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Depression and Suicidality During the Postpartum Period After First Time Deliveries, Active Component Service Women and Dependent Spouses, U.S. Armed Forces, 2007-2012

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Although suicide is a leading cause of death among new mothers during the postpartum period, there has been limited research on self-harm in the postpartum period and associated risk factors. One potential risk factor for suicidality (completed suicides, suicide attempts, and suicide ideation including thoughts of self harm) during the postpartum period is postpartum depression (PPD). In this study of women who gave birth for the first time between 1 January 2007 and 31 December 2011, 5,267 (9.9% of all who delivered) active component service women and 10,301 (8.2%) dependent spouses received incident PPD diagnoses during the one year postpartum period; 213 (0.4%) service women and 221 (0.2%) dependent spouses were diagnosed with incident suicidality. After adjusting for the effects of other covariates, service women with PPD had 42.2 times the odds of being diagnosed with suicidality in the postpartum period compared to service women without PPD; dependent spouses with PPD had 14.5 times the odds compared to those without PPD. The findings of this report suggest that a history of mental disorders was common among service women and dependent spouses with PPD in the postpartum period, and, in turn, PPD was a strong predictor for suicidality in the postpartum period. These results emphasize the importance of PPD screening during the postpartum period. They also suggest that additional focused screening for suicidal behavior among those already diagnosed with PPD may be warranted.

Suicide deaths and attempts occur at a lower rate during pregnancy and the postpartum period than in the general population of women.[1] Nevertheless, it has been estimated that there are approximately 3.5 to 11 postpartum suicides per 100,000 pregnancies.[2] Prior studies have demonstrated that suicidal ideation is more common than suicide attempts or deaths from suicide during pregnancy and the postpartum period; suicidal ideation is estimated to affect between 5 to 14 percent of women.[2]

Overall, suicidality (completed suicides, suicide attempts, and suicidal ideation including thoughts of self harm) occurs at a higher rate during the perinatal period among women with a history of mental disorders.[2] It has been documented that postpartum depression (PPD) can adversely affect the mother-child relationship, child development, marital relationship, and mental health of the woman's partner,[3] but it is unclear if suicidality has similar effects on child development.

PPD is a potential risk factor for suicidality during the postpartum period. According to the American Psychiatric Association: Diagnostic and Statistical Manual of Mental Disorders (DSM-IV), PPD is a type of major depression disorder occurring within the first four weeks after delivery.[4] However, in clinical practice, it is accepted that a depression disorder occurring within 12 months of delivery is considered PPD. Some signs of PPD include disturbances in sleep, energy level, appetite, weight and libido.[3] However, signs and symptoms that are reported or observed by family members may be interpreted as the usual impact of taking care of a newborn infant, making the diagnosis of PPD difficult or delayed. Some studies suggest that PPD is the most common complication of childbearing.[5] The Centers for Disease Control and Prevention (CDC) reports that 8 to 19 percent of postpartum women report frequent PPD symptoms.[6] However, most studies were based on self-reported symptoms, whereas a true diagnosis of PPD is based on a physician evaluation of the patient's entire medical history after an initial positive screen for PPD.

Compared to the civilian population, active component service women and dependent spouses of active component service men may experience unique stressors as part of the military environment.[7] For active component women, these stressors may include working longer into their pregnancy and working longer hours during pregnancy.[7] In addition, they may have to deploy as early as six months after giving birth. Dependent spouses may not have the support of their active component spouses if the spouse is deployed during part or all of the pregnancy, delivery, or postpartum period. Previous research has reported that rates of PPD symptoms (based on screening results) among active component women range from 11 to 20 percent;[7-9] estimates of rates in the civilian population range from 8 to 15 percent.[10,11] Similarly, suicidal ideation rates in the postpartum period have been found to be higher in active component women (15.4%) than those in the civilian population (5.3%).[8,12] Additionally, Danielson et al. reported that first time mothers who deployed within six months after giving birth had a 37 percent higher incidence of mental health disorders than those who deployed much later after delivery.[13]

Previous studies of PPD and suicidal ideation and attempts during the postpartum period among service women focused primarily on screening results among small populations. This report summarizes counts, percentages, and trends of incident

PPD and suicidality diagnoses during the postpartum period among active component service women and dependent spouses over a six-year surveillance period.

METHODS

The surveillance period was 1 January 2007 to 31 December 2012. The surveillance population included two cohorts; active component service women of all Services, and dependent spouses of active component service members of all Services who gave birth for the first time between 1 January 2007 and 31 December 2011. Females within each cohort were followed for a one year postpartum period. First-time births and diagnoses of incident PPD and suicidality were derived from records routinely maintained in the Defense Medical Surveillance System (DMSS). DMSS records document both ambulatory encounters and hospitalizations of active component members of the U.S. Armed Forces and their dependents, if eligible and enrolled in a TRICARE health plan option, in fixed military and civilian (if reimbursed through the Military Health System) treatment facilities. Diagnoses were indicated by specific codes from the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM). Completed suicide data for active component service women were derived from records provided by the Armed Forces Medical Examiner System (AFMES) and routinely maintained by the DMSS. The AFMES does not have records for causes of death among dependent spouses so data on completed suicides among dependents were not available for this analysis.

For summary purposes, mental disorder-specific diagnoses indicative of single major depressive disorder (ICD-9-CM: 296.20-296.26), recurring major depressive disorder (ICD-9-CM: 296.30-296.36), unspecified episodic mood disorder (ICD-9-CM: 296.9), depressive disorder not elsewhere classified (ICD-9-CM: 311), or mental disease postpartum complication (ICD-9-CM: 648.44) qualified a woman as a case of PPD. Each incident diagnosis of PPD was defined by: a hospitalization with an indicator diagnosis in the first or second diagnostic position; two outpatient visits within 180 days documented with indicator diagnoses (from the same mental disorder or mental health problem-specific category [V-coded behavioral health disorders])[14] in the first or second diagnostic positions; or a single outpatient visit in a psychiatric or mental health care specialty setting (defined by Medical Expense and Performance Reporting System [MEPRS] code: BF) with an indicator diagnosis in the first or second diagnostic position.

For surveillance purposes, completed suicide was ascertained from AFMES casualty records for service members who died by suicide. Suicide attempt (SA) was ascertained from records of hospitalizations and ambulatory visits with external cause of injury codes (E-codes) indicative of self-inflicted injury or poisoning (ICD-9-CM: E950-E958). Each incident diagnosis of SA was defined by one hospitalization or one ambulatory visit with an indicator diagnosis in any diagnostic position. For each affected female, only the first self-inflicted injury-specific encounter was used for analyses regardless of the number of such encounters during the surveillance period. Suicidal ideation (SI) was ascertained from records of hospitalizations and ambulatory encounters with the ICD-9-CM code indicative of suicidal ideation (ICD-9-CM: V62.84). An incident diagnosis of SI was defined by one hospitalization with the code V62.84 in the first or second diagnostic position, or two ambulatory visits within 180 days with the code in the first or second diagnostic position, or one ambulatory visit in a psychiatric or mental health care specialty setting (MEPRS code: BF) with the indicator diagnostic code in the first or second diagnostic position. Suicidality was defined as any incident case of completed suicide, SA, or SI.

For the PPD-defined outcome, a descriptive analysis was conducted for both cohorts in relation to each demographic and military characteristic of interest. For the suicidality-defined outcome, the relative odds in relation to each demographic and military characteristic of interest were estimated by a logistic regression model that included a covariate for each characteristic. Since the incidence of suicidality was low (<1%) in this cohort, the odds ratios (OR) were used to estimate the relative risk estimates. The independent effects of factors were considered nominally statistically significant if 95 percent confidence intervals around estimates of adjusted odds ratios excluded 1.0.

RESULTS

During the six-year surveillance period, 5,267 or 9.9 percent of active component service women who gave birth for the first time were diagnosed with postpartum depression (PPD) during the 12 months post delivery (postpartum) period **(Table 1)**. Among dependent spouses of active component service members, 10,301 or 8.2 percent were diagnosed with PPD **(Table 1)**. For each year in the surveillance period, service women had a higher percentage of PPD, ranging from 9.2 to 10.5 percent with a slightly increasing trend, compared to the percentage for dependent spouses, which remained steady **(Figure 1)**. The mean time intervals from delivery to PPD diagnoses were 122 days (50th %ile: 96 days) for service women and 95.6 days (50th %ile: 54 days) for dependent spouses **(data not shown)**.

FIGURE 1. Percentage of incident postpartum depression diagnoses within 12 months of first time delivery by delivery year, active component females and dependent spouses, U.S. Armed Forces, 2007-2011

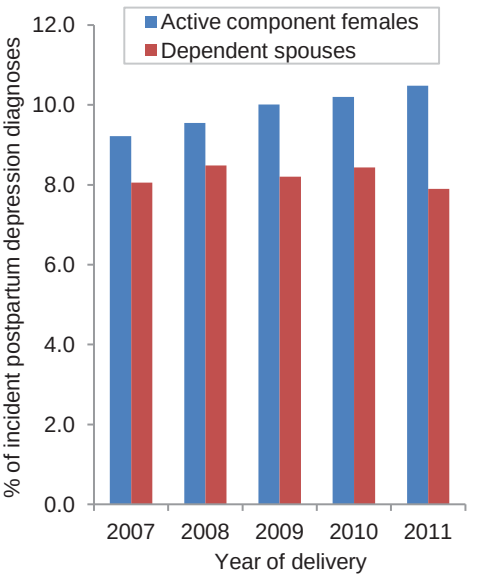


TABLE 1. Incident diagnoses of postpartum depression within 12 months following first time delivery, active component females and dependent spouses, U.S. Armed Forces, 2007-2012

	Active component females		Dependent spouses	
	No. with PPD (%)	% who delivered	No. with PPD (%)	% who delivered
Total	5,267 (100)	9.9	10,301 (100)	8.2
Service[a]				
Army	2,355 (44.7)	12.0	5,890 (57.2)	9.5
Navy	1,291 (24.5)	9.6	1,758 (17.0)	6.9
Air Force	1,046 (19.8)	7.3	1,502 (14.6)	7.8
Marine Corps	472 (9.0)	10.3	1,068 (10.4)	6.0
Coast Guard	103 (2.0)	8.7	83 (0.8)	7.2
Race/ethnicity				
White, non-Hispanic	2,889 (54.9)	11.2	7,077 (68.7)	9.6
Black, non-Hispanic	1,105 (21.0)	8.4	527 (5.1)	5.2
Hispanic	708 (13.4)	9.5	651 (6.3)	6.0
Asian/Pacific Islander/Other	452 (8.6)	8.4	1,615 (15.7)	6.4
Unknown	113 (2.1)	7.5	431 (4.2)	8.3
Age				
18-20	609 (11.6)	11.9	878 (8.5)	7.7
21-24	2,421 (46.0)	10.5	3,610 (35.1)	8.6
25-30	1,624 (30.8)	9.1	3,977 (38.6)	8.1
31-40	587 (11.1)	8.4	1,774 (17.2)	8.0
>40	26 (0.5)	8.5	62 (0.6)	8.1
Grade[a]				
E01-E04	3,893 (73.9)	11.6	5,292 (51.4)	9.1
E05-E09	1,045 (19.8)	7.9	4,025 (39.0)	8.1
O01-O04	317 (6.0)	5.2	850 (8.3)	5.4
O05-O10	3 (0.1)	2.4	52 (0.5)	6.9
W01-W05	9 (0.2)	7.4	82 (0.8)	7.3
Marital Status				
Married	3,455 (65.6)	9.7	9,564 (92.8)	8.2
Single	1,486 (28.2)	10.0	665 (6.5)	8.4
Other	326 (6.2)	11.9	72 (0.7)	8.8
Returned from deployment less than 365 days before delivery[a]				
No	4,957 (94.1)	9.9	9,312 (90.4)	8.1
Yes	310 (5.9)	9.8	989 (9.6)	9.0
Delivery outcome				
Livebirth	4,762 (90.4)	9.5	9,266 (90.0)	7.8
Stillbirth	51 (1.0)	15.6	64 (0.6)	13.3
Unknown	454 (8.6)	16.4	971 (9.4)	16.3
Suicidality				
None	5,088 (96.6)	9.6	10,163 (98.7)	8.1
Suicide ideation	113 (2.1)	85.6	31 (0.3)	75.6
Suicide attempt	66 (1.3)	82.5	107 (1.0)	59.4
Completed suicide	0	0.0	n/a	n/a
Deployed within 365 days after delivery[a]				
No	5,073 (96.3)	10.1	8,111 (78.7)	8.2
Yes	194 (3.7)	6.1	2,190 (21.3)	8.2
History of any mental disorder diagnosis[b]				
No	2,332 (44.3)	5.8	7,261 (70.5)	6.3
Yes	2,935 (55.7)	22.7	3,040 (29.5)	28.2
History of any mental health problem (V-code)[c]				
No	5,228 (99.3)	10.3	10,107 (98.1)	8.3
Yes	39 (0.7)	1.4	194 (1.9)	6.1

[a]For the dependent spouses, these covariates applied to the active component spouses
[b]At least one reported mental disorder diagnosis
[c]At least one reported mental health problem diagnosis

In general, incidence of PPD in the postpartum period among service women was higher in the Army (12.0%) and lower in the Air Force (7.3%) than in any of the other Services **(Table 1)**. Coast Guard PPD incidence peaked among service women who delivered in 2008, decreased for those who delivered from 2009 to 2010, but increased sharply among those who delivered in 2011 **(Figure 2a)**; a similar pattern was seen among Coast Guard dependent spouses with a PPD diagnosis **(Figure 2b)**. Overall incidence of PPD in the postpartum period among dependent spouses was higher in women who had active component spouses in the Army (9.5%) and lower in the Marine Corps (6.0%) than in any of the other Services **(Table 1, Figure 2b)**.

The overall incidence of PPD was higher among younger than older aged service women; the incidence was approximately 40 percent higher among the youngest (18-20 years, 11.9%) compared to the oldest (>40, 8.5%) aged service women **(Table 1)**. All age groups showed an increasing trend, except for women aged older than 40 **(Figure 3a)**. In contrast, the incidence of PPD was lower among the youngest (18-20 years, 7.7%) than any other age group of dependent spouses **(Table 1)**. All other age groups had steady and similar trends, except for women aged older than 40. Dependent women older than 40 had an increasing trend over the entire surveillance period and for delivery years 2010 and later had the highest incidence rates of PPD compared to all other age groups **(Figure 3b)**.

Overall, the incidence of PPD was slightly higher in single compared to married service women **(Table 1)**. Incident suicidality diagnoses were more common among service women than dependent spouses **(Table 1)**. During the surveillance period, there were no completed suicides among service women during their postpartum periods.

Among all women who gave birth for the first time during the six-year surveillance period, 213 (0.40%) of service women and 221 (0.18%) of dependent spouses were diagnosed with suicidality during their postpartum periods **(Table 2)**. For the logistic regression analysis, the unadjusted results of each dependent variable showed

FIGURE 2a. Percentage of incident postpartum depression diagnoses within 12 months of first time delivery, by service and year of delivery, active component females, U.S. Armed Forces, 2007-2011

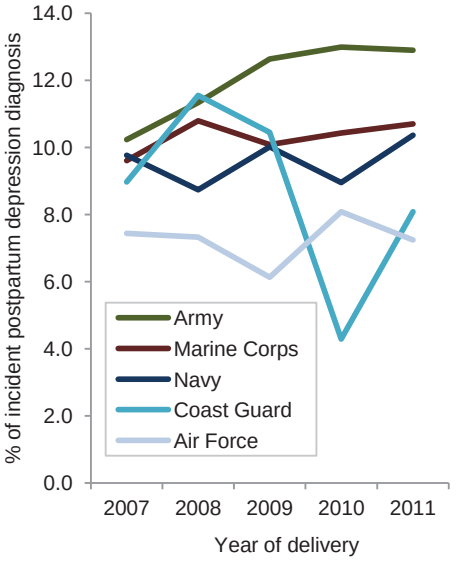
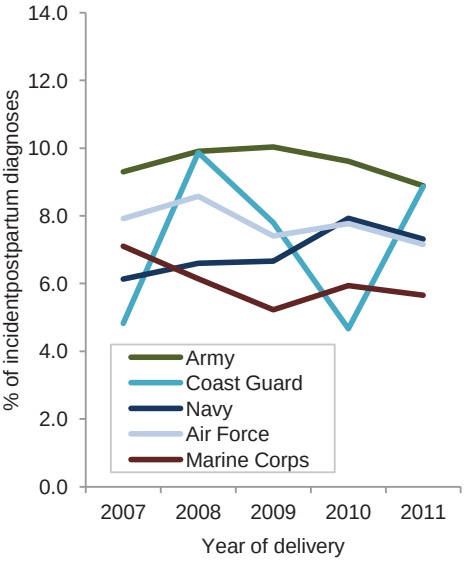


FIGURE 2b. Percentage of incident postpartum depression diagnoses within 12 months of first time delivery, by service[a] and year of delivery, active component dependent spouses, U.S. Armed Forces, 2007-2011



[a]Refers to the service of the active component spouse.

that Marine Corps, black, non-Hispanic race/ethnicity, youngest age group (18-20 years), delivery outcome (stillbirth/unknown), PPD during the postpartum period, and history of any mental disorder diagnosis were significant independent predictors of suicidality within both cohorts.

For the multivariate analyses, the odds ratio was adjusted for service, race/ethnicity, age, delivery outcome, and history of mental disorder. Service women with PPD had a higher odds for suicidality compared to service women without PPD (OR=42.2, 95% CI=28.8, 61.9). Risk factors predicting suicidality for service women included service (Coast Guard), age (18-20 years), PPD during the postpartum period, and history of mental disorder diagnosis. Dependent spouses with PPD also had a higher odds for suicidality compared to dependent spouses without PPD (OR=14.5, 95% CI=10.8, 19.4). Risk factors predicting suicidality for dependent spouses included race/ethnicity (black, non-Hispanic), age (18-20 years), delivery outcome (stillbirth/unknown), PPD during the postpartum period, and history of any mental disorder diagnosis.

EDITORIAL COMMENT

This report documents the counts, percentages, and trends of PPD among women in the active component and dependent spouses who gave birth for the first time (per administrative medical records of the Military Health System) during the postpartum period. In addition to PPD, the report also focused on other factors predicting suicidality during the postpartum period for both cohorts. Overall, the percentages of incident PPD diagnoses among service women and dependent spouses were within the range reported by the CDC for the general civilian population.[6] In general, the incidence of PPD was consistently higher among service women than dependent spouses; of note, during the period, annual percentages of PPD slowly increased among service women but not among dependent spouses.

The report also documents that service women in the Army, aged 18-20 years, and with any prior mental disorder-related diagnoses were more likely than their counterparts to have PPD diagnoses after first deliveries; dependent spouses of Army service members and those with any prior mental disorder-related diagnoses were also at relatively high risk of PPD diagnoses after first deliveries. For dependent spouses, the incidence of PPD among age groups was similar with an increase in women older than 40 since 2009. This may be due

FIGURE 3a. Percentage of incident postpartum depression diagnoses within 12 months of first time delivery, by age group and year of delivery, active component females, U.S. Armed Forces, 2007-2011

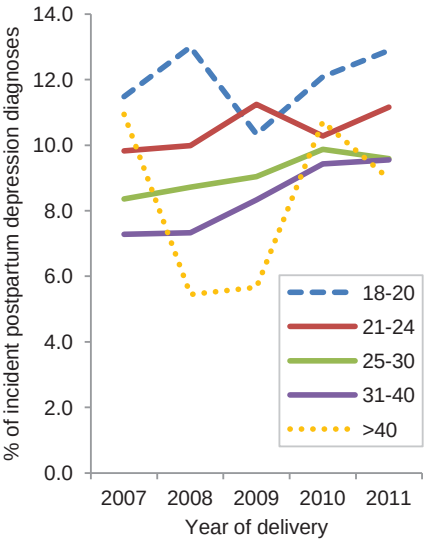


FIGURE 3b. Percentage of incident postpartum depression diagnoses within 12 months of first time delivery, by age group and year of delivery, active component dependent spouses, U.S. Armed Forces, 2007-2011

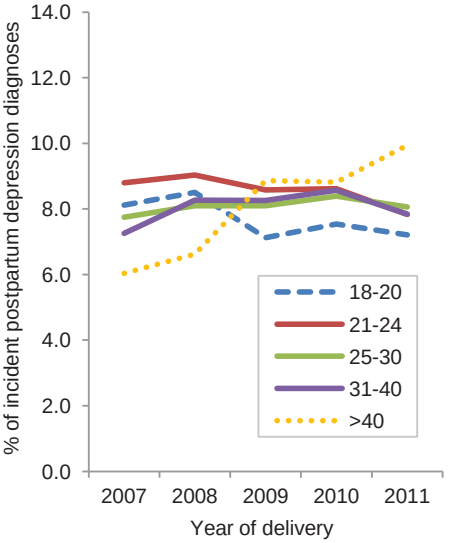


TABLE 2. Diagnosis of suicidality[a] within 12 months following first time delivery, active component females and dependent spouses, U.S. Armed Forces, 2007-2012

	Active component females					Dependent spouses				
	Total	No.	%	Unadjusted OR (95% CI)	Adjusted OR (95% CI)	Total	No.	%	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
Total	53,264	213	0.40	.	.	125,450	221	0.18	.	.
Service										
Army	19,582	105	0.54	3.2 (2.1, 5.0)	2.0 (1.3, 3.1)	61,765	150	0.24	2.8 (1.7, 4.6)	2.5 (1.5, 4.1)
Navy	13,510	50	0.37	2.2 (1.4, 3.6)	1.6 (1.0, 2.7)	25,382	33	0.13	1.5 (0.8, 2.7)	1.6 (0.9, 2.9)
Air Force	14,414	24	0.17	ref	ref	19,332	17	0.09	ref	ref
Marine Corps	4,571	28	0.61	3.7 (2.1, 6.4)	2.3 (1.3, 4.1)	17,811	21	0.12	1.3 (0.9, 2.1)	1.4 (0.7, 2.7)
Coast Guard	1,187	6	0.51	3.0 (0.7, 7.5)	2.9 (1.2, 7.3)	1,160	0	0.00	0.0	0.0
Race/ethnicity										
White, non-Hispanic	25,842	98	0.38	ref	ref	73,857	125	0.17	ref	ref
Black, non-Hispanic	13,095	59	0.45	1.2 (0.9, 1.6)	1.5 (1.1, 2.2)	10,070	23	0.23	1.4 (0.9, 2.1)	2.0 (1.2, 3.1)
Other	14,327	56	0.39	1.0 (0.7, 1.4)	1.2 (0.9, 1.7)	41,523	73	0.18	1.0 (0.8, 1.4)	1.4 (1.1, 1.9)
Age										
18-20	5,122	53	1.03	8.4 (4.2, 17.1)	6.9 (3.3, 14.1)	11,365	39	0.34	7.6 (3.9, 15.7)	10.3 (5.1, 20.8)
21-24	23,086	94	0.41	3.3 (1.7, 6.5)	2.8 (1.4, 5.6)	42,112	100	0.24	5.4 (2.8, 10.4)	6.2 (3.2, 11.9)
25-30	17,797	57	0.32	2.6 (1.3, 5.2)	2.5 (1.2, 5.0)	49,155	72	0.15	3.4 (1.7, 6.5)	3.6 (1.9, 7.0)
>31	7,259	9	0.12	ref	ref	22,818	10	0.04	ref	ref
Delivery outcome										
Livebirth	50,175	194	0.39	ref	ref	119,004	197	0.17	ref	ref
Stillbirth/unknown	3,089	19	0.62	1.6 (1.0, 2.6)	1.1 (0.7, 1.8)	6,446	24	0.37	2.3 (1.5, 3.5)	1.7 (1.1, 2.6)
Postpartum depression										
No	47,997	34	0.07	ref	ref	115,149	83	0.07	ref	ref
Yes	5,267	179	3.40	49.6 (34.3, 71.7)	42.2 (28.8, 61.9)	10,301	138	1.34	18.8 (14.3, 24.7)	14.5 (10.8, 19.4)
Any mental disorder diagnosis[b]										
No	40,313	98	0.24	ref	ref	114,670	147	0.13	ref	ref
Yes	12,951	115	0.89	3.7 (2.8, 4.8)	1.4 (1.0, 1.9)	10,780	74	0.69	5.4 (4.1, 7.1)	2.6 (1.9, 3.5)

OR=Odds Ratio
[a]Suicidality includes suicide ideation, suicide attempt, and completed suicide
[b]At least one recorded mental disorder diagnosis

to dependent spouses having children for the first time at a later age and experiencing unique, age-associated stressors. In contrast, service women may experience unique stressors associated with serving in the military, such as long duty hours and a fast-paced duty environment. Additionally, dependent spouses may share the burden of raising children with their husbands, whereas service women may often be single parents without social support during and after pregnancy.

The percentages of incident PPD diagnoses among service women who returned from a deployment within 365 days prior to delivery and those who did not were similar, and the incidence of PPD among those who deployed within 365 days after delivery was lower than among those who did not deploy. A history of recent deployment or the prospect of future deployment seemed to have no effect on the likelihood that a service woman would experience postpartum depression; this finding may

be due in part to a "healthy worker" effect since service women who deploy are often physically and mentally healthier than those who do not deploy.

Time to diagnosis of PPD was different among the cohorts. Compared to dependent spouses, service women were diagnosed with PPD at later times during their postpartum periods. The finding suggests that some service women may delay seeking care due to lack of knowledge regarding available services and/or concerns that seeking care for a mental disorder may adversely impact their military careers.

In the multivariate analysis, PPD diagnosis during the postpartum period was the strongest independent predictor of suicidality (i.e., with control of the effects of service, race/ethnicity, age, delivery outcome, and history of mental disorder diagnoses). Among service women, young age (18-20 years), service in the Coast Guard, and prior mental disorder diagnoses were other significant predictors of suicidality; among dependent spouses, young age (18-20 years), history of a mental disorder diagnosis, black, non-Hispanic race/ethnicity, and stillbirth/unknown delivery outcome were significant predictors of suicidality.

The limitations of these analyses should be considered when interpreting the results. Findings observed after first time deliveries may not apply after subsequent deliveries. The endpoints of analyses were ICD-9-CM diagnostic codes that are indicators of the conditions of interest for this report. However, some of the ICD-9-CM indicator diagnoses used here, particularly those not recorded as primary (first-listed) diagnoses may not represent confirmed diagnoses or currently symptomatic disease. Also, the diagnostic codes used as endpoints of analyses do not specify the clinical severity of the conditions of interest. The ICD-9-CM codes used to define a disease outcome may present issues. Since the diagnostic code for suicide ideation was only added to the ICD-9-CM in October 2005 and was not routinely used prior to 2007, the surveillance period was restricted to after January 2007. This approach assumed that every provider during the surveillance period was familiar with the usage of this specific code; if this assumption was incorrect, the result may be an underestimation of cases. Another limitation was assessment of effects prior to and after deployments. Relying on administrative data to capture specific stressors associated with deployments may not be reliable. This report also relied on ICD-9-CM codes entered into the subjects' medical records to determine if this was the first pregnancy for those in whom the analysis assessed incident PPD and suicidality. Service women and dependent spouses may have had children prior to accession and enrollment in the Military Health System; to the extent that subjects were misclassified as first-time mothers, this report would have failed to account for instances in which PPD, other mental disorders, and suicidality may have been associated with previous pregnancies not captured by the Military Health System.

In summary, the findings of this report suggest that a history of mental disorders was common among service women and dependent spouses with PPD, and, in turn, PPD was a strong predictor for suicidality in the postpartum period. These associations were most commonly found in younger age groups, but other predictors for suicidality included black, non-Hispanic race/ethnicity, Coast Guard service, and stillbirth/unknown delivery outcome.

The findings of this report emphasize the importance of PPD screening during the postpartum period. Mothers typically have only one postpartum visit, approximately six weeks after delivery, and may not be seen again until their annual well-woman check-ups. Additional screening assessments of mothers, around the same time as their infant well-baby visits, may be indicated. Since service women were diagnosed at a later time with PPD than dependent spouses, this may also suggest directing screening efforts for PPD to start immediately after delivery.

In addition to screening for PPD, screening for suicidality may also require a different approach. Postpartum women, when asked about suicidality outside the context of depression, admitted to suicidal behavior or suicide ideation at a much higher rate compared to when they were asked about suicidality in the context of depressed feelings.[2] This suggests that additional focused screening of suicidal behavior among those already diagnosed with PPD may be warranted.

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Female Infertility, Active Component Service Women, U.S. Armed Forces, 2000-2012

Infertility is the inability to become pregnant after one year of regular, unprotected sexual intercourse. Among active component service women, 16,807 received a diagnosis of female infertility during the 13-year surveillance period. The incidence rate of infertility diagnoses increased during the period, mainly due to increasing rates of infertility of unspecified origin. Infertility of tubal origin and anovulation were the most common specified types of infertility. Incidence rates of infertility were highest among women in their thirties; however, rates increased the most in women in their forties. Black, non-Hispanic women had the highest rates of infertility overall and of infertility of tubal and uterine origin. The higher rates among women in their thirties and forties may reflect high and increasing rates of clinical care seeking for infertility among women who elect to delay pregnancy until older ages and an increase in treatment options for women who have been unable to become pregnant.

Clinical infertility is the failure of a woman of childbearing age to become pregnant after one year of regular, unprotected sexual intercourse. There are other definitions that consider the age of the woman and the duration of the period of unprotected intercourse. The reasons for infertility can involve one or both partners, but, in some cases no cause can be identified. The most common causes of female infertility are ovulation disorders, uterine or cervical abnormalities, fallopian tube damage or blockage, endometriosis, and primary ovarian insufficiency (i.e., early menopause). Ovulation disorders, such as polycystic ovary syndrome, prevent the ovaries from releasing eggs (i.e., anovulation).[1,2,3]

Tubal infertility from blocked or swollen fallopian tubes can be caused by previous sexually transmitted infections, pelvic inflammatory disease (PID), and history of a ruptured appendix or abdominal surgery.[3-6] Uterine or cervical abnormalities include structural abnormalities or the growth of benign tumors called fibroids, which can interfere with the passage and implantation of the fertilized egg within the uterus.[3,7] Endometriosis occurs when endometrial tissue implants and grows outside of the uterus affecting the function of the female genital organs.[8]

Advancing age is the most common factor associated with infertility due to a decrease in ovarian function and in the number and quality of eggs released. In the United States many women are delaying pregnancies to their thirties and forties; approximately 20 percent of women in the U.S. now have their first child after age 35.[3,9] This factor has led to age as a growing cause of infertility in the U.S. There are also several lifestyle and environmental factors that can contribute to infertility. Stress, tobacco and alcohol use, being overweight or underweight, and strenuous, intense exercise are modifiable risk factors associated with infertility.[3]

Nearly 15 percent of active component U.S. military members are women, of whom about 90 percent are of child-bearing age. Service women are at risk for infertility based on the risk factors described previously. Tobacco use, alcohol abuse, and PID are relatively frequent diagnoses among service women, and each condition affects fertility.[10-12] Furthermore, increasing numbers and durations of wartime deployments have been associated with increasing rates of menstrual disorders and infertility.[13]

Women in active military service may receive diagnostic services to identify physical causes of and some treatments for infertility (e.g., hormonal therapy, corrective surgery, antibiotics).[14] However, the U.S. Military Health System does not provide non-coital reproductive therapies (e.g., artificial insemination, in vitro fertilization) except for service members who lost their natural reproductive abilities due to illnesses or injuries related to active service.

This report estimates frequencies, rates, temporal trends, types of infertility, and demographic and military characteristics of infertility among active component service women in the U.S. Armed Forces.

METHODS

The surveillance population consisted of service women who served in the active component of the Army, Navy, Air Force, Marine Corps, or Coast Guard at any time from January 2000 through December 2012. For this analysis, an incident case of infertility was defined as an individual who had two outpatient health care encounters with infertility-related diagnoses (per ICD-9 codes) listed in the first or second diagnostic positions of the records of those encounters **(Table 1)**. If infertility-related diagnostic codes reported on relevant records were non-specific codes (ICD-9 codes: 628, 628.8, 628.9), more specific infertility-related diagnostic codes (i.e., any of the remaining case-defining codes) were searched in records of later encounters of subject service members.

For analysis purposes, individuals were considered incident cases of infertility only once during the surveillance period. All data used for analyses were abstracted from records routinely maintained in the Defense Medical Surveillance System (DMSS) for health surveillance purposes.

TABLE 1. ICD-9-CM codes for female infertility and pregnancy

ICD-9-CM codes	Description
Infertility codes	
628	Female infertility
628.0	Infertility associated with anovulation
628.1	Infertility of pituitary-hypothalamic origin
628.2	Infertility of tubal origin (block, occlusion, stenosis of fallopian tubes)
628.3	Infertility of uterine origin (congenital anomaly of uterus, nonimplantation)
628.4	Infertility of cervical or vaginal origin (anomaly or cervical mucus congenital structural anomaly, dysmucorrhea)
628.8	Infertility of other specified origin
628.9	Infertility of unspecified origin
Pregnancy-related codes	
V27.0-V27.9	Outcome of delivery
650.xx	Normal delivery
640-679 where the 5th digit is 1, 2, or 4 (excluding 644.0, 644.1, 677.xx)	Pregnancy complications

Service women were counted as incident cases of infertility if they were hospitalized during the surveillance period and an infertility case-defining ICD-9 diagnostic code was reported in the primary diagnostic position of the hospitalization record. To enable assessments of health care burdens associated with infertility, ambulatory visits and hospitalizations for infertility were analyzed separately. To assess occurrences of pregnancy in women after diagnoses of infertility, records of all medical encounters within two years after incident infertility diagnoses were searched to identify those that included pregnancy-specific diagnostic (ICD-9-CM) codes **(Table 1)**.

RESULTS

During the 13-year surveillance period, 16,807 active component service women were diagnosed with infertility. The overall incidence rate of infertility among active component service members was 62.4 per 10,000 person-years (p-yrs) **(Table 2).**

Incidence rates of infertility diagnoses (all types) increased by 15 percent from 2005 to 2011 (mainly due to increasing rates of infertility of unspecified origin) but then decreased by 15 percent in 2012; as such, the rates in 2005 and 2012 were similar **(Figure 1a)**. Infertility of tubal origin and infertility due to anovulation were the most common specified types of infertility (incidence rates: 6.8 and 6.6 per 10,000 p-yrs, respectively). The incidence rate of diagnoses of unspecified infertility exceeded the rates of diagnoses of each of the five specific types of infertility considered here; rates of diagnoses of each of the specified types of infertility declined during the surveillance period **(Figure 1b, Table 2)**.

Among service women overall, rates of infertility diagnoses were highest among women in their thirties and lowest among the youngest (<20 years) and oldest (45+ years) **(Table 2, Figure 2)**. During the surveillance period, incidence rates more than doubled among service women aged 45-49, and nearly doubled among those aged 40-44 and younger than 20 years. Among the remaining age groups, incidence rates increased (31.2%) among women aged 35-39, but generally increased from 2005 to 2010 and then decreased among the others.

Infertility due to anovulation was the most frequently diagnosed specific type of infertility among the youngest (≤29) and oldest (45+) aged service women, while infertility of tubal origin was the most frequently diagnosed specific type among 30 to 44 year olds **(Figure 3a)**.

The overall rate of infertility diagnoses (all types) was highest among black, non-Hispanic women and lowest among white, non-Hispanic women (IRR: 1.32 black,

FIGURE 1a. Annual incidence rates of female infertility, overall and unspecified origin, active component service women, U.S. Armed Forces, 2000-2012

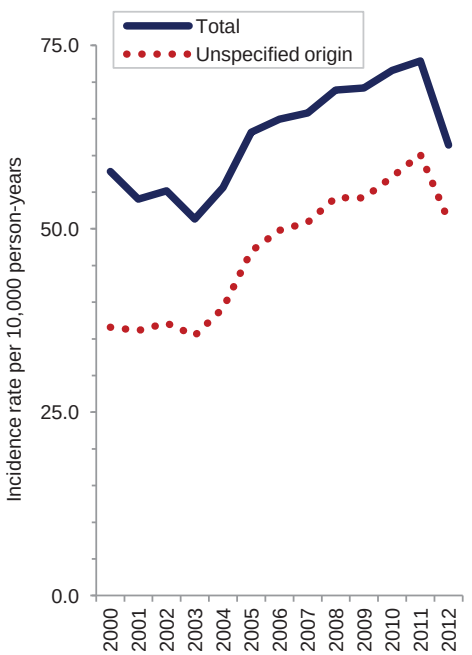
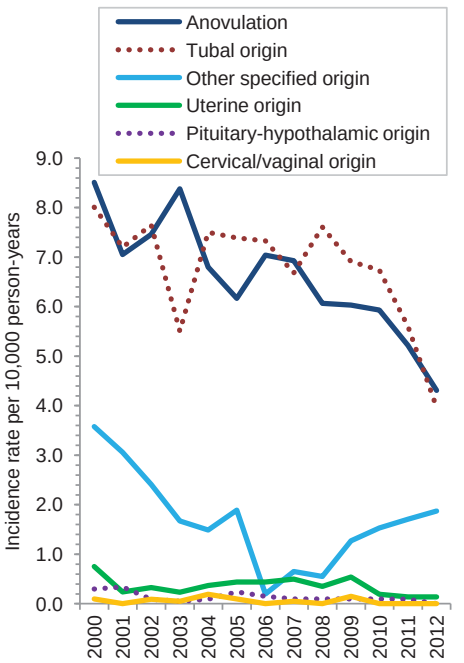


FIGURE 1b. Annual incidence rates of female infertility of specified type, active component service women, U.S. Armed Forces, 2000-2012



non-Hispanic vs. white, non-Hispanic) **(Table 2)**. However, over the period, rates of diagnoses relatively increased the most among Asian/Pacific Islanders (32.4%). Compared to other racial/ethnic groups, black, non-Hispanic women had the highest rates of diagnoses of infertility of tubal origin and uterine origin **(Figure 3b)**. Asian/Pacific Islanders had the highest rates of diagnoses of infertility due to anovulation, pituitary-hypothalamic origin, and cervical/vaginal origin.

The distribution of infertility diagnoses in relation to age differed among racial/ethnic groups **(Figure 4)**. In each of the three youngest age groups (<30 years), black, non-Hispanic women had the highest rates of infertility while in each of the three age groups for women 35 to 49 years old, Asian/Pacific Islanders had the highest rates of infertility.

Incidence rates of infertility diagnoses were highest among service women in the Army and lowest in the Marine Corps **(Table 2)**. Senior officers, women in healthcare professions, and married women had higher crude incidence rates of diagnoses than their respective counterparts.

TABLE 2. Incident counts and incidence rates of infertility by infertility type and demographic and military characteristics, active component service women, U.S. Armed Forces, 2000-2012

	No.	Rate	% total/IRR	% difference 2000-2012
Total	16,807	62.4		6.2
Type of infertility			% total	
Tubal origin[a]	1,823	6.8	10.8	-50.4
Anovulation	1,780	6.6	10.6	-49.4
Uterine origin[b]	96	0.4	0.6	-81.3
Pituitary-hypothalamic origin	36	0.1	0.2	-100.0
Cervical/vaginal origin[c]	15	0.1	0.1	-100.0
Other specified origin	454	1.7	2.7	-47.8
Unspecified origin	12,603	46.8	75.0	39.7
Age			IRR	
<20	245	10.6	Ref	88.9
20-24	4,337	45.5	4.28	-8.5
25-29	5,101	81.5	7.66	-11.4
30-34	3,861	104.6	9.83	-14.3
35-39	2,494	90.3	8.48	31.2
40-44	698	44.8	4.21	92.8
45-49	68	11.4	1.07	118.4
50+	3	1.3	0.12	0.0
Race/ethnicity			IRR	
White, non-Hispanic	7,486	56.2	Ref	0.2
Black, non-Hispanic	5,605	74.2	1.32	16.2
Hispanic	1,816	61.7	1.10	0.5
Asian/Pacific Islander	785	66.8	1.19	32.4
Other/unknown	1,115	57.3	1.02	-1.7
Service			IRR	
Army	7,172	75.8	1.96	11.5
Navy	3,594	53.7	1.39	41.3
Air Force	5,195	60.0	1.55	-15.2
Marine Corps	585	38.7	Ref	-6.0
Coast Guard	261	42.7	1.10	86.4
Rank			IRR	
Junior enlisted	6,685	52.3	Ref	7.0
Senior enlisted	6,551	68.9	1.32	3.8
Junior officer	2,371	74.9	1.43	-0.9
Senior officer	1,200	81.6	1.56	-2.9
Occupation			IRR	
Combat-specific	247	61.9	1.19	-15.2
Armor/motor transport	525	58.1	1.11	69.5
Repair/engineer	2,312	53.2	1.02	18.5
Comm/intel	6,392	63.3	1.21	10.5
Health care	4,175	81.1	1.56	-2.2
Other	3,156	52.2	Ref	-2.8
Marital status			IRR	
Married	13,233	109.4	5.54	2.7
Unmarried	2,471	19.8	Ref	1.4
Other	1,088	47.6	2.41	6.4

[a]Block, occlusion, or stenosis of the fallopian tubes.
[b]Structural abnormality of the uterus or nonimplantation (includes fibroids).
[c]Anomalies in the structure or cervical mucus, dysmucorrhea.

Burden of infertility

During the surveillance period, annual numbers of medical encounters during which infertility was reported as primary (first-listed) diagnoses increased 300 percent, but annual numbers of individuals affected increased only 4 percent **(Figure 5)**. The ratio of medical encounters per individual affected increased from 2.7 in 2000 to 10.4 in 2012. During the period, there were 109 incident hospitalizations for infertility; 39 percent (n=43) of all infertility-related hospitalizations were due to infertility of tubal origin **(data not shown)**.

Pregnancy after infertility diagnosis

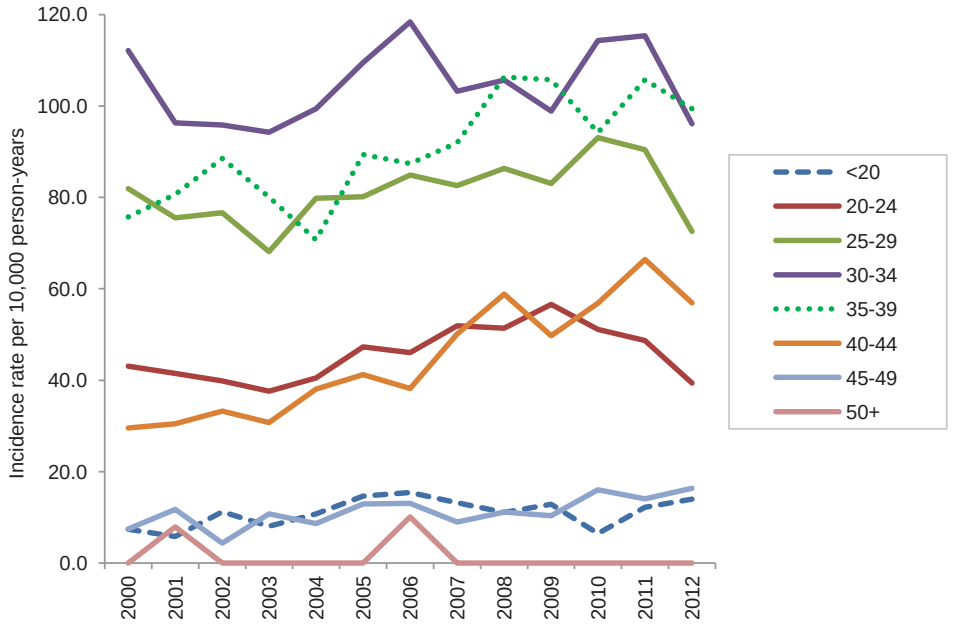
Of all service women who were diagnosed with infertility during the period (n=16,807), 493 (2.9%) and 1,055 (6.3%) had pregnancy-related medical encounters during the first or second years, respectively, after their incident infertility diagnoses **(data not shown)**.

EDITORIAL COMMENT

Incident diagnoses of infertility among women serving in the active component of the U.S. military steadily increased from 2003 through 2011 and then declined in 2012. The overall trend closely reflected and was primarily influenced by the trend in diagnoses of unspecified infertility.

Throughout the period, the highest rates of diagnoses of infertility were among

FIGURE 2. Annual incidence rates of female infertility by age, active component service women, U.S. Armed Forces, 2000-2012



women from 25 to 39 years old; and the largest absolute and relative increases in rates of diagnoses were among women 40 to 44 years old. The findings may reflect relatively high and increasing rates of clinical care seeking for infertility among service women who elect to delay pregnancy until older ages. Increasing rates of infertility diagnoses may also reflect increases in treatment options for women who have been unable to become pregnant. Studies in civilian settings document that women are attempting first and subsequent births at older ages[3,9,15] and that, because of new infertility treatment options and diagnostic tools, more women are pursuing infertility treatments.[9]

In this report, the two most frequent specified infertility diagnoses were infertility due to tubal origin and anovulation; these conditions were distributed differently in relation to age and race/ethnicity. Infertility due to anovulation was relatively frequently diagnosed among women in their teens and twenties, while diagnoses of infertility due to tubal origin were relatively frequent among women in their thirties. The different distributions of diagnoses in relation to age likely reflect the different pathophysiologic mechanisms associated with various types of infertility.

Among younger women (<30 years old), rates of infertility diagnoses were higher among black, non-Hispanic than any other racial/ethnic group members; among women older than 35 years, diagnosis rates were higher among Asian/Pacific Islanders than any other racial-ethnic group members. Pelvic inflammatory disease (PID) is a risk factor for tubal infertility.[3-6] Among women in the U.S. military, PID rates are relatively high, and the proportion of PID cases who are diagnosed with infertility has sharply increased among black, non-Hispanic members.[12]

FIGURE 3a. Incidence rates of female infertility by infertility type and age, active component service women, U.S. Armed Forces, 2000-2012

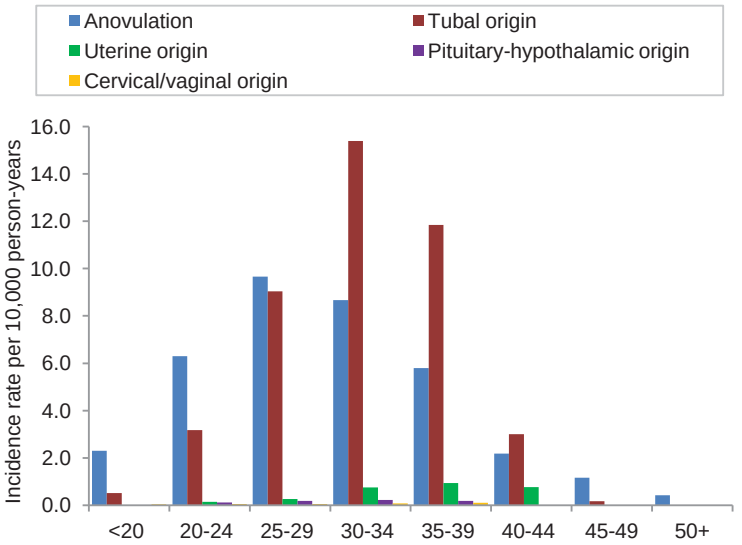


FIGURE 3b. Incidence rates of female infertility by infertility type and race/ethnicity, active component service women, U.S. Armed Forces, 2000-2012

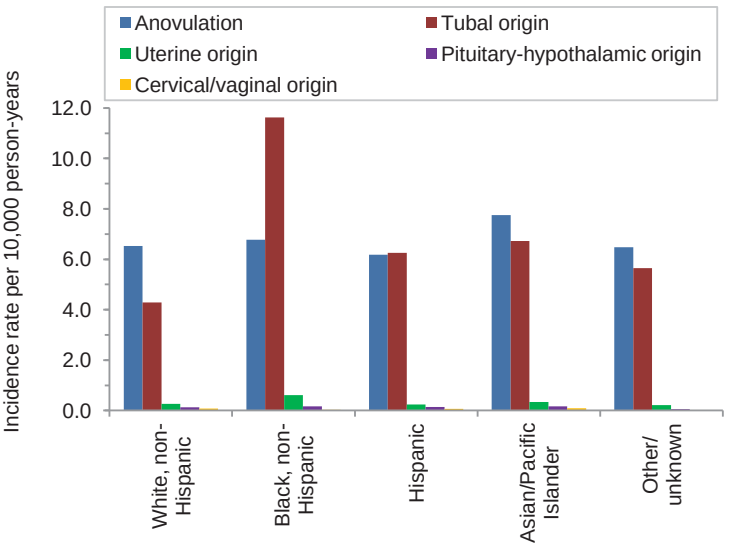


FIGURE 4. Annual incidence rates of female infertility by race/ethnicity and age, active component service women, U.S. Armed Forces, 2000-2012

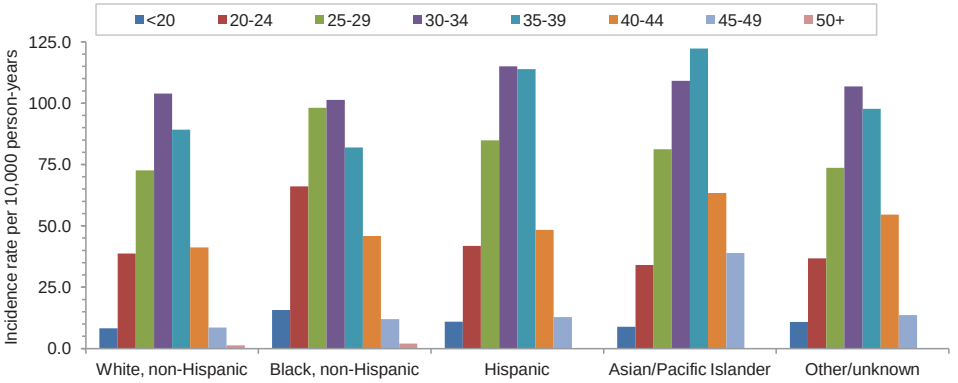
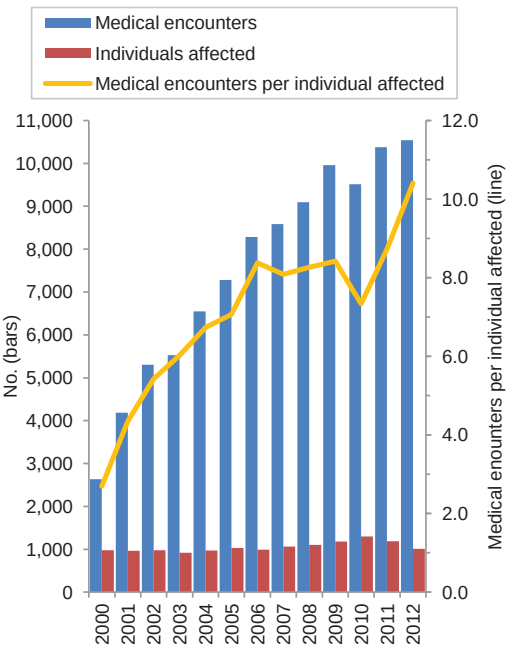


FIGURE 5. Medical encounters[a] for infertility and number of individuals affected,[b] active component service women, U.S. Armed Forces, 2000-2012



[a]Total hospitalizations and ambulatory visits for the condition (with no more than one encounter per individual per day per condition).
[b]Individuals with at least one hospitalization or ambulatory visit for the condition.

Black, non-Hispanic service women are also relatively frequently affected by uterine fibroids and uterine fibroids are a cause of infertility of uterine origin.[16] It is unclear why infertility affected relatively older women of Asian/Pacific Islander race/ethnicity or why rates of infertility diagnoses among them increased during the period.

The health care burden to the U.S. Military Health System associated with evaluation and treatment of infertility increased dramatically during the period; the increased burden was primarily due to increasing numbers of medical encounters per affected individual. The finding likely reflects increases in popular knowledge regarding, as well as advances in the quality and availability of testing and treatments for, infertility in recent years.

In this analysis, approximately nine percent of women who were diagnosed with infertility had pregnancy-related medical encounters within two years of their incident infertility diagnoses. The proportion undoubtedly underestimates the actual proportion of cases that eventually became pregnant because most service members who leave military service are no longer eligible for care through the Military Health System. Also, some infertility cases may have become pregnant more than two years after their infertility diagnoses.

The results presented here must be considered in light of several limitations. For example, to the extent that some affected women did not seek care for infertility or sought care outside of the Military Health System, the counts and rates reported here underestimate the actual counts and rates of female infertility in the U.S. Armed Forces. Furthermore, this report did not account for infertility associated with recurrent pregnancy loss (ICD-9-CM: 629.81, 646.3), which is defined by three consecutive pregnancy losses prior to 20 weeks of gestation.[17] Because recurrent pregnancy loss could be considered a type of infertility, some individuals with recurrent pregnancy loss may have received diagnoses of "unspecified infertility" and would have been included as cases in this analysis.

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Brief Report

Polycystic Ovary Syndrome, Active Component Service Women, U.S. Armed Forces, 2000-2012

Polycystic ovary syndrome (PCOS) is an endocrine disorder named for the appearance of the ovaries – enlarged and with numerous, small cysts – in most individuals with the syndrome.[1] PCOS is characterized by signs and symptoms that vary by individual and can present in different ways to a clinician. The hallmark criteria for this diagnosis are chronic anovulation (i.e., mature eggs are not released from the ovaries) and an excess in male hormones (i.e., androgens). In adolescence, the most common manifestation of PCOS is infrequent or prolonged menstrual periods, but the patient may also experience overweight/obesity, excessive hair growth (hirsutism), and/or acne.[1,2] In women of child bearing years, infertility and unexplained weight gain are the most common reasons for seeking medical evaluation. Older women with undiagnosed or untreated PCOS may develop metabolic abnormalities such type 2 diabetes or cardiovascular conditions such as heart disease and/or hypertension.[3,4]

Treatment of PCOS is directed at management of the signs and symptoms that are of most concern to the individual (e.g., infertility, excessive hair growth, acne, weight gain). Early detection and treatment can also prevent some of the long term, serious complications of PCOS.

This report describes the counts, rates, and trends of diagnoses of PCOS among active component service women. Co-occurring conditions were also identified during the period before and after PCOS diagnoses.

METHODS

The surveillance population was active component service women of the Army, Navy, Air Force, Marine Corps, and Coast Guard. The surveillance period was 2000 to 2012. Cases of PCOS were identified from the records routinely maintained in the Defense Medical Surveillance System (DMSS). An incident case of PCOS was defined as two outpatient medical encounters with a PCOS ICD-9-CM code (256.4) listed in the primary or secondary diagnostic position or one inpatient medical encounter with the PCOS ICD-9-CM listed in the primary diagnostic position. An individual was considered a case once during the surveillance period.

Co-occurring conditions – i.e., conditions identified as commonly associated with PCOS as described previously – were identified by searching medical records from the year prior to, and the year after, the incident diagnosis of PCOS. In order to be counted as a co-occurring condition in the year prior, the diagnosis had to be in the primary diagnostic position. In order to be counted as a co-occurring condition in the year after, the diagnosis had to be in the primary diagnostic position or in the secondary position when the primary diagnosis was PCOS. If an individual had the co-occurring condition before the PCOS diagnosis, the same condition was not counted in the period after the incident encounter for PCOS.

RESULTS

During the 13-year surveillance period 356 individuals were identified as cases of PCOS among active component service women **(Table 1)**. The overall incidence rate of PCOS was 1.3 per 10,000 person-years (p-yrs). The annual incidence rates increased from 2000 to 2006 and then remained relatively stable for the final six years of the surveillance period **(Figure 1)**.

The incidence rates of PCOS were highest in service women aged 30 to 34 and lowest in the youngest and oldest age groups **(Table 1)**. Incidence rates were similar among all race/ethnicities except for Asian/Pacific Islanders, whose rate was half that of other racial/ethnic groups. Compared to their counterparts, rates of PCOS were highest among service women in the Coast Guard and lowest in the Marine Corps. Rates were similar among all ranks except for senior officers, who had the lowest rate. Incidence rates did not vary much by occupation. The incidence rate of PCOS among married women was notably higher than those for unmarried women and those categorized as other.

TABLE 1. Incident counts and incidence rates of polycystic ovary syndrome, active component service women, U.S. Armed Forces, 2000-2012

	No.	Rate[a]
Total	356	1.3
Age[b]		
>20	29	0.7
20-24	85	1.1
25-29	117	1.9
30-34	80	2.2
35-39	35	1.3
40-44	10	0.6
Race/ethnicity		
White, non-Hispanic	185	1.4
Black, non-Hispanic	93	1.2
Hispanic	41	1.4
Asian/Pacific Islander	7	0.6
Other	30	1.5
Service		
Army	131	1.4
Navy	78	1.2
Air Force	118	1.4
Marine Corps	10	0.7
Coast Guard	19	3.1
Rank		
Junior enlisted	144	1.1
Senior enlisted	156	1.6
Junior officers	47	1.5
Senior officers	9	0.6
Occupation		
Combat-specific	5	1.3
Armor/motor transport	13	1.4
Repair/engineering	45	1.0
Comm/intel	146	1.5
Health care	75	1.5
Other	72	1.2
Marital status		
Married	212	1.8
Unmarried	115	0.9
Other	29	1.2

[a]Incidence rate per 10,000 person-years
[b]There were no cases identified in service women aged 45 and older.

FIGURE 1. Annual incidence rates of polycystic ovary syndrome, active component service women, U.S. Armed Forces, 2000-2012

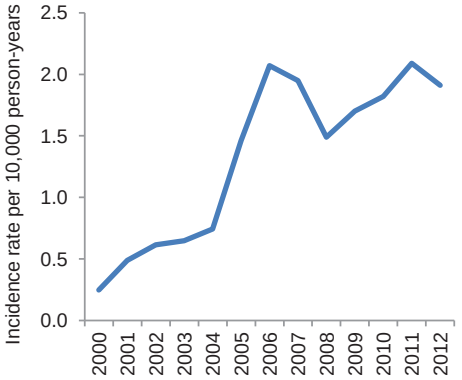


TABLE 2. Co-occurring conditions identified pre/post incident diagnosis of polycystic ovary syndrome (PCOS), active component service women, U.S. Armed Forces, 2000-2012

		1 year prior to incident PCOS[a]		1 year after to incident PCOS[b]		Total 1 year before and after	
Co-occurring condition	ICD-9-CM code	No.	% total	No.	% total	No.	% total
Menstruation irregularities (oligomenorrhea, dysmenorrhea, abnormal bleeding)	626.0, 626.1, 626.4, 626.8, 626.9, 625.3	17	4.8	60	16.9	77	21.6
Infertility (female)	628.x	12	3.4	47	13.2	59	16.6
Obesity	278.00, 278.01, v85.3x, v85.4x	4	1.1	24	6.7	28	7.9
Essential hypertension	401.x	4	1.1	8	2.2	12	3.4
Hirsutism (excessive hair growth)	704.1	3	0.8	19	5.3	22	6.2
Acne	706.0, 706.1	2	0.6	4	1.1	6	1.7
Dyslipidemia	272.xx	1	0.3	2	0.6	3	0.8
Diabetes mellitus	250.00-250.99	0	0.0	1	0.3	1	0.3

[a]Diagnosis in the primary diagnostic position of the medical encounter
[b]Includes incident date; diagnosis in the primary diagnostic position or in the secondary diagnostic position when the primary diagnostic position is PCOS.

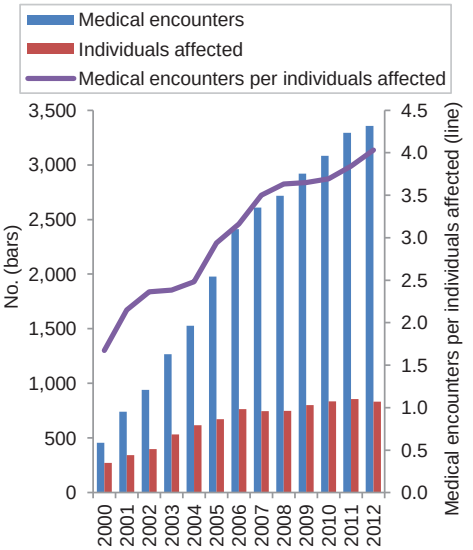
Among co-occurring conditions the most common was menstrual irregularities which were diagnosed in 4.8 percent of cases within the one year before diagnoses of PCOS and in 16.9 percent of PCOS cases in the one year afterwards **(Table 2)**. Infertility was the second most common co-occurring diagnosis, recorded in 3.4 percent and 13.2 percent before and after the incident diagnoses of PCOS. Among other co-occurring diagnoses of interest, obesity was documented in 7.9 percent of PCOS cases within one year before or after; hirsutism in 6.2 percent; essential hypertension in 3.4 percent; acne in 1.7 percent; dyslipedemia in 0.8 percent; and diabetes mellitus in 0.3 percent.

From 2000 to 2012, the annual number of medical encounters for PCOS increased by 635 percent and the number of individuals affected increased by 205 percent **(Figure 2)**. In 2000 the average number of medical encounters for PCOS per affected individual was 1.7. This ratio increased throughout the period to a high of 4.0 medical encounters per individual in 2012.

EDITORIAL COMMENT

PCOS is not common among active component service women. During the surveillance period the annual rates remained relatively low, despite the increase from 2000 to 2006. Since 2006, the average annual number of active component service women diagnosed with PCOS was 38. Of all co-occurring conditions analyzed, menstrual irregularities and infertility were the most common conditions identified both prior to and after the incident diagnoses of PCOS. Given the age distribution of the U.S. Armed Forces (90% of child bearing age), it is not surprising that these conditions were the most common among the PCOS cases identified.

FIGURE 2. Medical encounters[a] for polycystic ovary syndrome and number of individuals affected,[b] active component service women, U.S. Armed Forces, 2000-2012



[a]Total hospitalizations and ambulatory visits for the condition (with no more than one encounter per individual per day per condition).
[b]Individuals with at least one hospitalization or ambulatory visit for the condition.

Despite the small number of cases, the annual numbers of medical encounters for PCOS and the ratios of medical encounters to affected individuals increased dramatically during the period. These trends may have occurred as a consequence of improvements in technology and medical knowledge applied to the diagnosis and treatment of PCOS and infertility.

Because of the nature of PCOS, some women may not seek care for their symptoms or their symptoms may not be recognized by clinicians as related to PCOS. Therefore, the counts and rates reported in this analysis may be underestimates of the true burden of PCOS among active component service members.

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Pelvic Inflammatory Disease Among Female Recruit Trainees, Active Component, U.S. Armed Forces, 2002-2012

Patricia Rohrbeck, DrPH, MPH, CPH (Maj, USAF)

Pelvic inflammatory disease (PID) is a bacterial infection causing an inflammatory reaction in the upper genital tract. It can be treated with antibiotics, but since it is often asymptomatic, women often delay seeking health care, which may result in long-term sequelae such as infertility. Among 161,501 female recruits who began basic training between January 2002 and December 2011, 1,750 (1.1%) met the surveillance case definition for PID during the 12 months following completion of their basic military training. The overall incidence rate (11.2 per 1,000 person-years) showed a stable trend during the surveillance period, with the exception of a decline for females accessed in 2011. The unadjusted rates were higher among women who were not screened for chlamydia during basic training. Compared to their respective counterparts, rates were higher in service women aged 17-20, of black, non-Hispanic race/ethnicity, married, in the Army, and who had a chlamydia diagnosis after basic training. The lowest rates were among women 25 years and older, other race/ethnicity, and in the Coast Guard. The findings in this report may warrant further evaluation of the long-term impact of chlamydia screening programs for recruit trainees on PID and PID-related sequelae among service women.

Pelvic inflammatory disease (PID) is a female specific inflammatory process, which affects the uterus, fallopian tubes, and other reproductive organs.[1] The inflammation is the result of a bacterial infection commonly caused by *Chlamydia trachomatis*, *Neisseria gonorrhoeae*, enteric organisms, or anaerobic organisms.[1] When the bacteria ascend from the cervix through the uterus to the upper genital tract, which includes the endometrium, uterine wall, uterine serosa and broad ligaments, fallopian tubes, ovary, and pelvic peritoneum, the resulting inflammation is referred to as PID.[1,2]

Symptoms vary and can range from mild to severe.[1,2] Since PID comprises a spectrum of inflammatory disorders, there is no definitive diagnostic test available; laparoscopy can be used, but is often not readily available.[3] The clinical diagnosis of PID is based on symptoms and physical findings associated with the disease, even though many episodes go unnoticed because cases are often asymptomatic or not recognized by the health care provider.[3]

The main etiologic agent for PID is chlamydia, and when compared to PID due to *Neisseria gonorrhoeae* infection, chlamydial infections are associated with lower rates of clinical symptoms.[2] Mild to moderate symptoms of PID often result in women delaying care, and the length of time from onset of symptoms to seeking care is highest among women with chlamydia infection.[4] Since chlamydia induces an inflammatory reaction resulting in permanent scarring of the fallopian tubes, higher rates of infertility are associated with PID due to chlamydia.[2] Cohorts of women who delayed seeking care overall showed higher rates of infertility, as well as recurrent PID, and chronic pelvic pain.[4] Standard treatment for PID consists of oral antibiotics; however, any damage which has already occurred to the reproductive organs due to delayed care cannot be reversed.[5]

Since antibiotics are readily available to treat PID, mortality outcomes are rare among otherwise healthy women.[2,5] Most cases of PID are managed in outpatient settings, and hospitalizations are only recommended if the woman is severely ill, pregnant, does not respond to or cannot take antibiotic treatment, or needs to be monitored due to potential complications.[5] Even though it has been difficult to accurately estimate rates of PID among civilians because it is a non-reportable disease and is often misdiagnosed or asymptomatic, hospitalizations and initial visits to physicians' offices by women aged 15 to 44 years have declined since 1998.[6]

Racial disparities have been noted among PID cases in ambulatory and hospitalized settings, suggesting that black women have two to three times higher disease rates than white women.[6] Within the active duty U.S. military population, incidence rates of PID remained stable between 2002 and 2011 at approximately 11.2 per 1,000 person-years, with high-risk subgroups among the 17-24 year olds, and females in the Army and of black, non-Hispanic race/ethnicity.[7]

Due to tissue inflammation, PID often results in tubal scarring which can lead to major sequelae such as infertility and ectopic pregnancy.[2] These sequelae often occur long after the initial PID diagnosis; additionally, risk for sequelae increases with reoccurrence of PID encounters.[2] As a result, prevention efforts for PID sequelae have focused on preventing the major cause of PID – chlamydia infection. Compared to the civilian population, U.S. service women are at higher risk for sexually transmitted infections (STIs).[6,8] Within the U.S. military, rates of STIs are highest among recruit trainees.[8] As a result, the Services began implementing recruit trainee chlamydia screening programs, except for the

Army. Recruit trainee chlamydia screening was implemented by the Navy and Marine Corps prior to 2000, by the Coast Guard in 2004, and by the Air Force in 2005; the Army screens females upon arrival at their first duty location if aged 25 or younger. Bloom et al. compared PID rates among female Navy and Army recruits and observed that crude incident PID rate was 61 percent higher among Army recruits.[9] The authors suggest that the increased risk for PID may in part be attributed to Army recruits experiencing higher recurrence rates for chlamydia as a result of not being screened at entry-level military service.[9] Due to increased risk for STI, particularly chlamydia infection, female recruit trainees may consequently be at higher risk for PID during their first 12 months on active duty after their basic training period if not screened immediately upon entry.

The objective of this report is to estimate the incidence of pelvic inflammatory disease (related to chlamydia infection) and unspecified pelvic inflammatory disease (hereafter referred to as PID) diagnosed during medical encounters of former recruit trainees during their initial 12 months on active duty following completion of basic training.

METHODS

The surveillance population was active component females, aged 17 to 42, in all services, who entered basic military training between January 2002 and December 2011. Coast Guard data prior to 2007 were incomplete and thus excluded from the report. Additionally, each female had to have successfully completed her training requirements and to have remained on active duty for at least 12 months after basic training. The surveillance period for PID for this population consisted of the 12 months following completion of basic training. Incident diagnoses of PID were identified from ICD-9-CM diagnostic codes recorded during hospitalizations and ambulatory medical encounters **(Table 1)**.

The *MSMR* PID case definition was applied for this analysis.[7] An incident case of PID was defined as an individual with a case-defining acute or chronic PID diagnostic code during a medical encounter (hospitalization or ambulatory visit) with: 1) a primary (first-listed) diagnosis of PID during a single medical encounter; 2) a secondary (not first-listed) diagnosis of PID during a single medical encounter plus diagnoses with signs or symptoms consistent with PID in each diagnostic position antecedent to PID; or 3) a PID diagnosis in any diagnostic position during two medical encounters that occurred between one and 60 days apart.

Diagnoses of chlamydia infection during the 12-month surveillance period and prior to incident PID diagnoses were identified from confirmed Reportable Medical Events (RMEs). Recruit trainees were categorized as having been screened for chlamydia based upon their respective services' screening polices at the time of entry into basic training. Each recruit trainee was assigned a code of "yes" or "no" based upon this categorization. Female service members in the Navy and Marines were screened during the entire surveillance period. Since the Army does not have a Recruit Chlamydia Screening Policy, all females in the Army in this surveillance population were categorized as not screened. Recruits who started basic military training with the Coast Guard on or after 1 April 2004, and recruits in the Air Force who started their training on or after 1 December 2005 were screened and categorized accordingly.

TABLE 1. Diagnostic codes (ICD-9-CM) considered indicative of acute pelvic inflammatory disease

Acute gonococcal infections of the upper genitourinary tract	098.10, 098.16, 098.17
Gonococcal peritonitis	98.86
Chlamydia trachomatis infection of peritoneum	099.56
Acute or unspecified inflammatory disease of pelvic organs and tissues (salpingitis and oophoritis, peritonitis, pelvic cellulitis)	614.0, 614.2, 614.3, 614.5, 614.8, 614.9
Acute or unspecified inflammatory diseases of uterus	615.0, 615.9
Chronic pelvic inflammatory disease	098.30, 098.36, 098.37, 098.39, 614.1, 314.7, 615.1

RESULTS

Between January 2002 and December 2011, 223,642 females entered basic training on active duty, all services. Of the recruit population, 200,508 (89.7%) completed their training, but 39,007 (19.5%) did not remain on active duty for at least 12 months following basic training and were eliminated from the study. The surveillance population consisted of 161,501 female service members, and 1,750 (1.1%) met the surveillance case definition for PID; of the total number of cases, 1,719 (98.2%) were

FIGURE 1. Incidence rates of pelvic inflammatory disease during 12 months following basic training, active component females, U.S. Armed Forces, 2002-2012

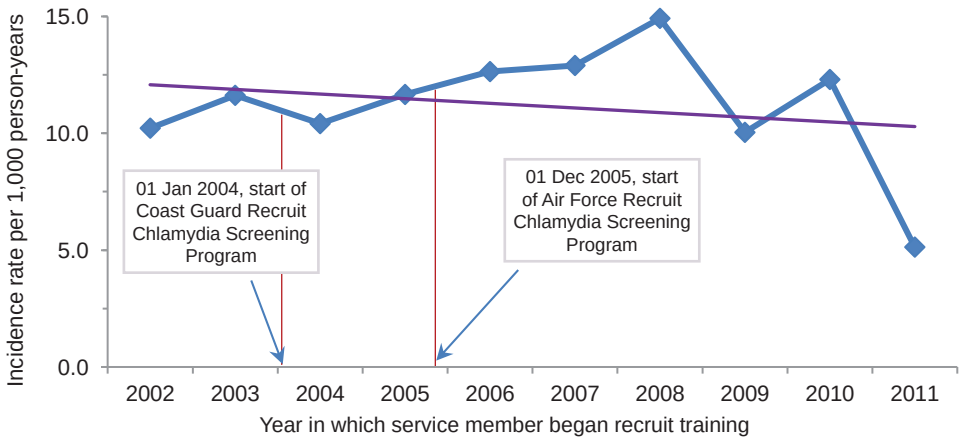


TABLE 2. Incidence rates (per 1,000 person-years) of acute/unspecified pelvic inflammatory disease during 12 months following basic training, active component females, U.S. Armed Forces, 2002-2012

	No.	Incidence rate (unadjusted)	Incidence rate ratio
Total	1,750	11.2	.
Service			
Army	879	14.8	1.7
Navy	374	8.7	1.0
Air Force	333	8.6	Ref
Marine Corps	157	11.8	1.4
Coast Guard	7	4.4	0.5
Age			
17-20	1,233	11.5	1.3
21-24	380	11.1	1.2
25+	137	9.1	Ref
Race/ethnicity			
Black, non-Hispanic	585	16.3	1.6
White, non-Hispanic	786	9.9	Ref
Hispanic	229	10.4	1.1
Other	150	7.8	0.8
Education			
High school or less	1,643	11.4	1.3
College degree	107	8.7	Ref
Marital status			
Married/other	301	14.3	1.3
Single	1,449	10.7	Ref
Chlamydia screening during basic training			
Yes	719	9.2	Ref
No	1,031	13.3	1.4
Chlamydia Reportable Medical Event (RME) during 12 months following basic training			
Yes	222	25.4	2.4
No	1,528	10.4	Ref

classified as acute PID and 31 (1.8%) were classified as chronic PID **(data not shown)**. Overall incidence rates remained stable with slight fluctuations over the surveillance period (range: 10.2 per 1,000 person-years [p-yrs] to 14.9 per 1,000 p-yrs), with the exception of a decline for females accessed in 2011 (5.1 per 1,000 p-yrs) **(Figure 1)**. Of the 1,750 cases, 50.2 percent were in the Army; 44.9 percent were white, non-Hispanic; and 70.5 percent were aged 17-20. For 93.9 percent, the highest level of educational achievement was less than a college degree, and 82.8 percent were single **(Table 2)**.

During the 12-month surveillance period following basic training, the overall incidence rate of PID was 11.2 per 1,000 p-yrs **(Table 2)**. Compared to their respective counterparts, unadjusted rates were higher among women who were not screened for chlamydia during basic training, aged 17-20 years, black, non-Hispanic race/ethnicity, married/other (including divorced and widowed), in the Army, and who had a chlamydia infection after basic training **(Table 2)**. The lowest rates were among women 25 years and older, of other race/ethnicity (included Asian/Pacific Islander, American Indian/Alaskan Native, other, unknown), and in the Coast Guard **(Table 2)**.

When the rates in each service branch were stratified by age, the Army had the highest rates of PID in each age group **(Figure 2)**. Women in the Marines had the second highest rates for the younger age groups (18-20, 21-24), but had a similar low rate to Navy women aged 25 and older **(Figure 2)**. Overall, PID rates were lower in each service for women aged 25 and older, with the exception of the Coast Guard which had the lowest rate among service women aged 18-20 and the highest rate among service women aged 21-24 **(Figure 2)**. Females in the Air Force had the lowest rate among all services in the 25 and older age group **(Figure 2)**.

Overall, when the rates were stratified by service, the Army had the highest incidence rate, which was 2.4 times higher than the rate of the Coast Guard **(Table 2)**. During the surveillance period, the rates fluctuated among services without indicating a trend **(Figure 3)**.

About 87.3 percent of PID cases (n=1,528) had no confirmed reportable medical event diagnosis of chlamydia infection prior to their initial PID diagnosis **(Table 2)**.

EDITORIAL COMMENT

This report documents a stable trend in PID incidence among service women who began military service between 2002 and 2011 during their initial 12 months on active duty after basic military training with the exception of a decline among those accessed in 2011. The overall incidence rate

FIGURE 2. Incidence rates of pelvic inflammatory disease during 12 months following basic training by service and age group, active component females, U.S. Armed Forces, 2002-2012

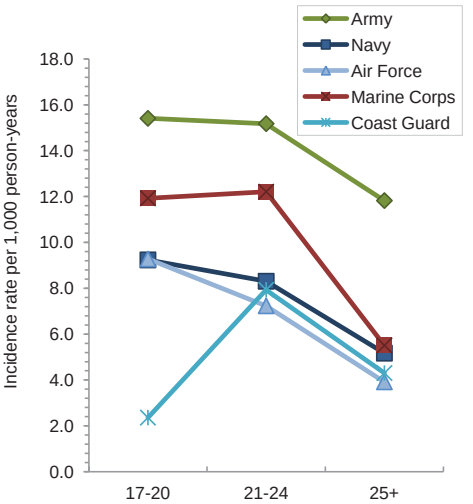
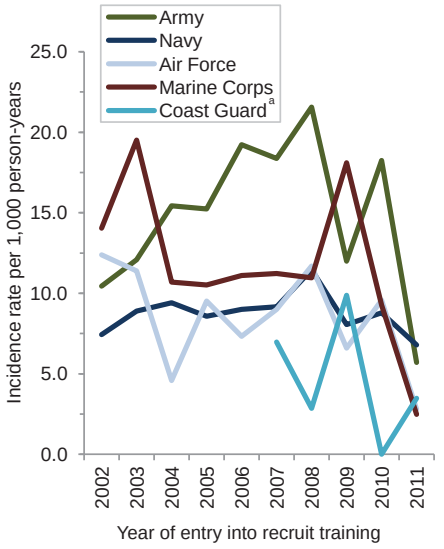


FIGURE 3. Annual incidence rates of pelvic inflammatory disease during 12 months following basic training by service, active component females, U.S. Armed Forces, 2002-2012



[a]Coast Guard data was not available until 2007

of PID during the surveillance period was higher among known high-risk sub-populations (women aged 17-20 years, black, non-Hispanic, and in the Army). Overall and demographic-specific rates were higher compared to those previously reported in military populations.[7,9]

Rates of PID were higher in the Army than the other Services. As previously stated, service women in the Army are not routinely screened for chlamydia until they arrive at their first duty assignment, which may cause women with asymptomatic chlamydia to wait 12 months to receive chlamydia screening. At the same time, the Army incidence rate of PID was only 25.4 percent higher than the rate among Marines, who undergo screening for chlamydia during recruit training. This observation suggests that high-risk behavior may persist after screening and education, or that episodes of PID prior to military service may have made some of these women more susceptible to recurrences of PID. Medical history prior to military service was not available, so it is unknown how many women may have had PID prior to military service.

One risk factor for PID in studies of civilian populations was single marital status. In this study, the incidence rate among those categorized as married/other was 33.6 percent higher than the rate of single service women. Bloom et al. found the same trend in their study but were unable to explain these findings.[9] Married women with one sexual partner are considered at low risk for acquiring sexually transmitted infections and PID, but Lee et al. found that if this group has intercourse six or more times per week, they had a higher risk for PID (RR: 3.2, 95% CI: 1.4-7.2) compared to similar women having intercourse less than once per week.[10] This suggests further investigation of sexual behaviors among service women to determine possible explanations for why married/other women are at higher risk for PID than single service women.

These results should be interpreted in consideration of several limitations. Women of black, non-Hispanic race (who had a higher rate of PID) comprised a larger proportion of women in the Army (27.3%) than in the other services (5.7-20.7%) **(data not shown)**. As a result, variation in racial/ethnic composition may account for some of the difference in PID rates among the Services. Nevertheless, Bloom et al. reported higher rates of PID among women in the Army than the Navy, even after adjustment for race/ethnicity.[9] PID rate discrepancies among the service branches may also be affected by differences in case management.

Even before the official start date of the chlamydia screening program in some Services, screening had begun. As a result, some recruit trainees who were categorized as unscreened actually had been screened, and the chlamydia positive ones were likely treated for their infection. Early screening and treatment may have lowered the risk of subsequent PID and may have consequently lowered the overall rate of PID in all unscreened recruit trainees. This may have reduced the difference in PID incidence rates between those women and those identified as screened.

Additionally, this study focused on a disease that can be difficult to diagnose and may remain asymptomatic for long periods. Reporting bias or non-healthcare seeking behavior among service women may have been responsible for an underestimate of PID cases and the incidence rates and risk ratios. Even though all Services, except for the Army, had begun chlamydia screening in basic training for females by 2006, overall rates for PID during the surveillance period remained stable with the exception of a decline for females accessed in 2011. This overall stable trend was previously documented for active component service women, even though at a lower rate.[7] The findings in this report may warrant further evaluation of the long-term impact of chlamydia screening programs for recruit trainees on PID and PID-related sequelae among service women.

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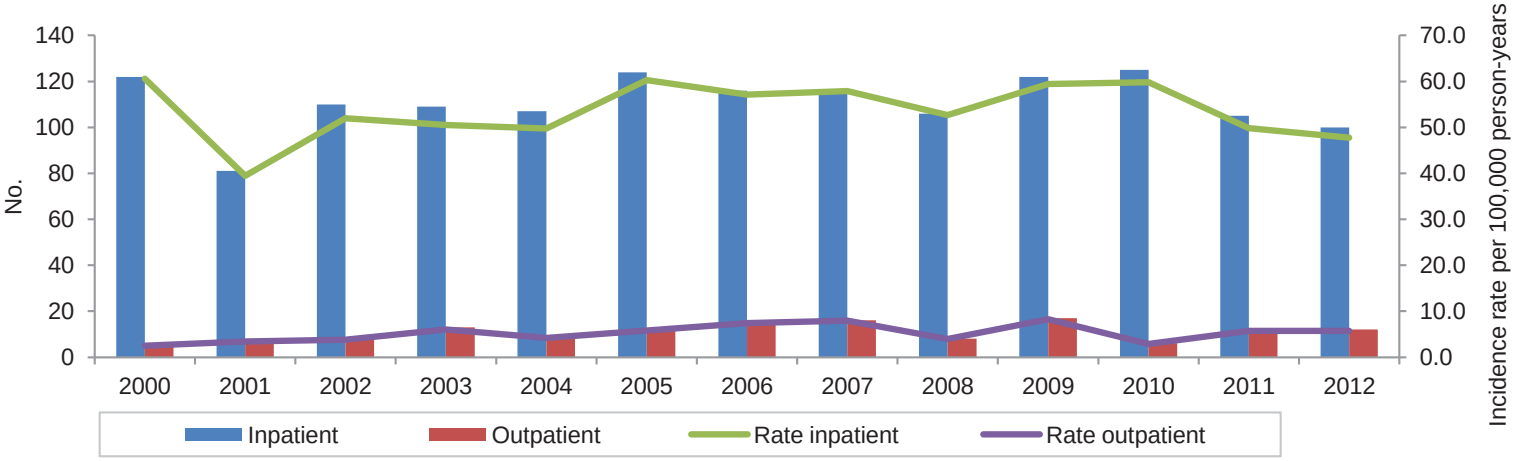
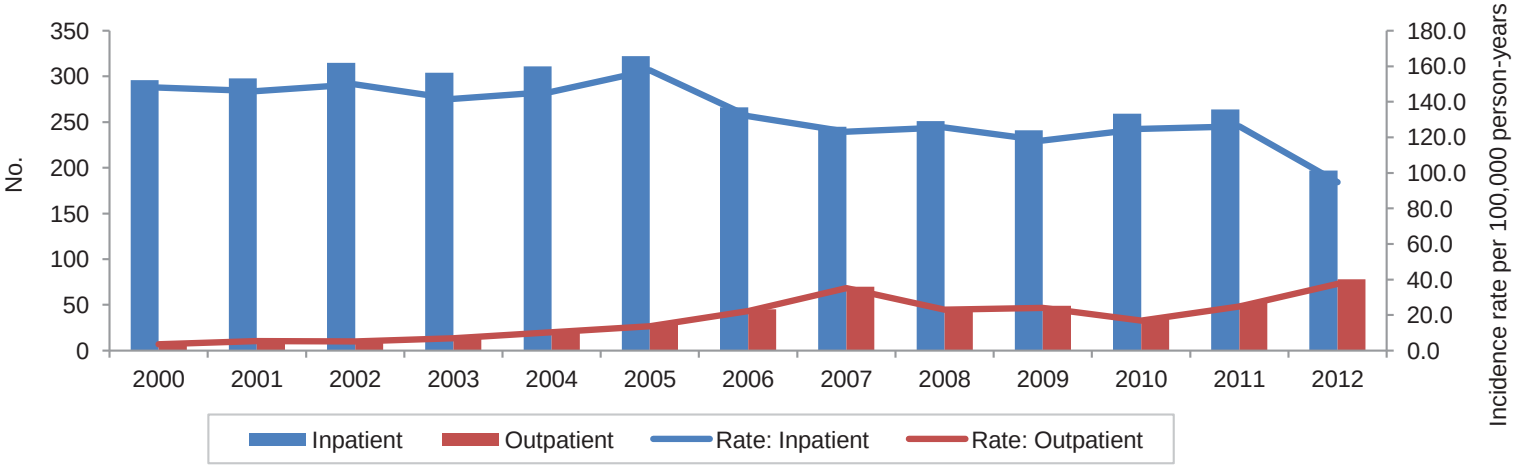
Surveillance Snapshot: Myomectomies and Hysterectomies Performed for Uterine Fibroids at Military Health Facilities, Active Component Service Women, U.S. Armed Forces, 2000-2012

FIGURE 1. Incident counts and incidence rates of myomectomies[a] performed at military health facilities for women with diagnoses of uterine fibroids, active component, U.S. Armed Forces, 2000-2012



[a]An individual could have one myomectomy per year.

FIGURE 2. Incident counts and incidence rates of hysterectomies performed at military health facilities for women with diagnoses of uterine fibroids, active component, U.S. Armed Forces, 2000-2012



Among active component service women diagnosed with uterine fibroids, a total of 1,583 myomectomies were performed in military treatment facilities (MTFs) during the surveillance period of 1 January 2000 through 31 December 2012 (overall rate: 58.8 per 100,000 person years [p-yrs]) **(Figure 1).** The annual numbers and rates of myomectomies decreased slightly in 2011 and 2012, (rates: 55.6 and 53.5 per 100,000 p-yrs ,respectively) but the numbers and rates were relatively stable during the surveillance period. Inpatient myomectomies (n=1,443; rate: 53.6 per 100,000 p-yrs) greatly outnumbered outpatient procedures (n=140; rate: 5.2 per 100,000 p-yrs) during the surveillance period.

A total of 4,038 service women diagnosed with fibroids underwent hysterectomies performed at MTFs during the surveillance period (rate: 150.9 per 100,000 p-yrs) **(Figure 2).** During the period, the annual rates of hysterectomies performed as inpatient procedures showed a stable, then declining trend. After peaking in 2005 (rate: 157.7 per 100,000 p-yrs), the rate of inpatient hysterectomies declined to 94.7 per 100,000 p-yrs in 2012. By contrast, hysterectomies performed as outpatient procedures increased during the surveillance period. In 2000, the rate for outpatient hysterectomies was 3.5 per 100,000 p-yrs. By 2012 the rate for outpatient hysterectomies was 37.5 per 100,000 p-yrs.

Menorrhagia, Active Component Service Women, U.S. Armed Forces, 1998-2012

Kerri A. Dorsey, MPH

Menorrhagia (excessive menstrual bleeding) is relatively common among women of reproductive age and may be caused by a wide range of different conditions. Menorrhagia symptoms can interfere with work and quality of life and may result in iron deficiency anemia due to chronic blood loss. This analysis of active component service women of the U.S. Armed Forces found that, during the surveillance period of 1998 through 2012, the crude incidence rate of menorrhagia was 6.2 cases per 1,000 person years. Annual incidence rates rose steadily throughout the period. Compared to their respective counterparts, rates were highest in women who were aged 40 to 49 or were of black, non-Hispanic ethnicity. Among women with menorrhagia whose records documented co-occurring conditions, the most common such conditions were uterine disorders (e.g., fibroids) and ovarian cysts. Less than one percent of cases had underlying bleeding disorders documented. Of women hospitalized with the diagnosis of menorrhagia, 79 percent underwent hysterectomy during their hospitalizations. Limitations of the analysis and possible future studies are discussed.

Menorrhagia, also known as heavy menstrual bleeding or abnormal ovulatory bleeding, is common among women of reproductive age. The CDC estimates that menorrhagia affects about one in five American women each year;[1] furthermore, in a nationwide sample of U.S. women, 13 percent self-reported menorrhagia.[2]

The clinical criteria for menorrhagia usually specify that excessive bleeding (greater than 80 milliliters per period, perhaps with large blood clots) occurs during menstrual periods that last seven days or longer over several consecutive, monthly cycles. Such periods may interfere with daily activities.[3] Possible etiologies (causes) of menorrhagia include endocrine (hormonal) disorders (e.g., polycystic ovary syndrome), structural abnormalities of the uterus (e.g., polyps, fibroids, or cancer), infectious agents (i.e., those causing endometritis), disorders of blood clotting (e.g., von Willebrand Disease), systemic illness (e.g., liver or kidney disease), intrauterine devices, and medications.[3,4]

Untreated menorrhagia is a known cause of iron deficiency anemia (IDA) because of chronic blood loss. Disorders of menstruation and other abnormal bleeding diagnoses were identified in 15 percent of incident IDA cases among active duty service women.[5] In a civilian study of women with physician-diagnosed menorrhagia, 58 percent of the women with menorrhagia reported a past history of anemia and four percent had received a blood transfusion.[6] Symptoms caused by menorrhagia can interfere with work and the quality of life of the individual. Among premenopausal women, menorrhagia is the reason for approximately 12 to 20 percent of all gynecological medical encounters.[7,8] Healthcare costs and all-cause total work loss were significantly higher in women with idiopathic menorrhagia compared to a matched cohort of women without menorrhagia.[9] Of women with idiopathic menorrhagia almost 85 percent underwent surgical treatment (e.g., endometrial ablation or hysterectomy).[9]

Approximately 14 percent of active duty service members are women[10] and a majority of these women are of reproductive age (15-44 years) (Source: Defense Medical Epidemiology Database [DMED]). As more women enter the military it is important to describe and understand the gynecological issues that may affect them and their readiness to serve. Managing a normal menstrual period where access to bathroom facilities is limited, such as during training, shipboard, or in an operational theater, can be difficult. Women have reported an increase in menstrual-related symptoms when access to rest room facilities was limited.[11] Navy women reported an increase in heavy menstrual bleeding after they began serving onboard a ship.[12] According to a recent publication, women service members who deployed for nine months or longer were more likely to receive a diagnosis of disorders of menstruation (which include menorrhagia) than women who were deployed for shorter periods.[13]

This report describes the demographic distribution, frequency, rates, trends and comorbid conditions of menorrhagia among active component women from 1998 to 2012.

METHODS

The surveillance period was from January 1, 1998 through December 31, 2012. The surveillance population consisted of all service women who served in the active component of the U.S. Armed Forces at any time during the surveillance period. Records of inpatient hospitalizations and outpatient encounters for menorrhagia as well as demographic characteristics of the study population were obtained from the Defense Medical Surveillance System

TABLE 1. ICD-9-CM codes for menorrhagia and co-occurring conditions

Description	ICD-9-CM codes
Menorrhagia	
Excess menstruation	626.2
Puberty menorrhagia	626.3
Premenopausal menorrhagia	627.0
Co-occurring conditions	
Uterine leiomyoma, polyps, or disorders of uterus	218.0-218.9, 621.0-621.2, 622.7-622.9
Ovarian cyst	620.x
Adenomyosis, endometriosis	617.0, 617.1, 617.9
Infections of female genital organs (e.g., gonorrhea, chlamydia, cervicitis)	098.10 ,098.16 ,098.17, 098.86, 099.56, 099.41, 099.53, 616.0, 112.1, 131, 131.0, 131.00, 131.01, 131.9
Endocrine disorders (e.g., disorders of thyroid, ovaries, pituitary)	242.x-244.x, 253.1, 256.1, 256.4, 256.8, 256.9, 246.x
Dysplasia, hyperplasia	621.3x, 622.1x
Neoplasms of female genital organs	180.x-183.x, 219.x, 220, 221.x, 233.1-233.3x, 239.5
Pelvic inflammatory disease	614.x, 615.0, 615.9
Coagulation disorders/other hemorrhagic conditions	286.0-286.9, 286.5x, 287.1-287.9, 387.3x, 287.4x
Systemic illnesses	571.4x, 571.5, 571.8, 571.9, 585.x

TABLE 2. Incident counts and incidence rates of menorrhagia, active component service women, U.S. Armed Forces, 1998-2012

	No.	Rate
Total	18,631	6.2
Age		
17-19	859	2.6
20-29	5,477	3.1
30-39	7,126	10.1
40-49	4,998	23.1
50-55	169	9.2
>55	2	0.7
Race/ethnicity		
White, non-Hispanic	7,891	5.2
Black, non-Hispanic	7,586	8.9
Hispanic	1,574	4.9
Asian/Pacific Islander	511	4.0
Other	1,069	4.9
Rank		
Junior enlisted	8,448	4.2
Senior enlisted	6,753	13.4
Junior officer	1,721	4.9
Senior officer	1,707	10.4
Service		
Navy	3,570	4.8
Army	8,097	7.6
Marine Corps	608	3.6
Air Force	5,849	6.0
Coast Guard	507	7.6
Occupation		
Combat-specific	243	5.4
Armor/motor transport	521	5.0
Pilot/aircrew	135	2.9
Repair/engineer	2,446	5.1
Comm/intel	7,946	7.0
Health care	4,165	7.2
Other	3,175	5.0

[a]Incidence rate per 1,000 person-years

(DMSS) database which contains electronic medical records for all active component service members. The Theater Medical Data Store (TMDS), which maintains records for medical encounters of service members that occurred during operational deployments, and medical air transport (medical evacuation) data were evaluated independently for unique menorrhagia encounters. The earliest TMDS records are from 2005; therefore, encounters occurring between 2005 and 2012 were captured. Medical air transport data was evaluated from 2002 to 2012. Case definition and incidence rules were not applied to the cases identified from in-theater treatment and medical transport data, and such cases were not included in the overall analysis.

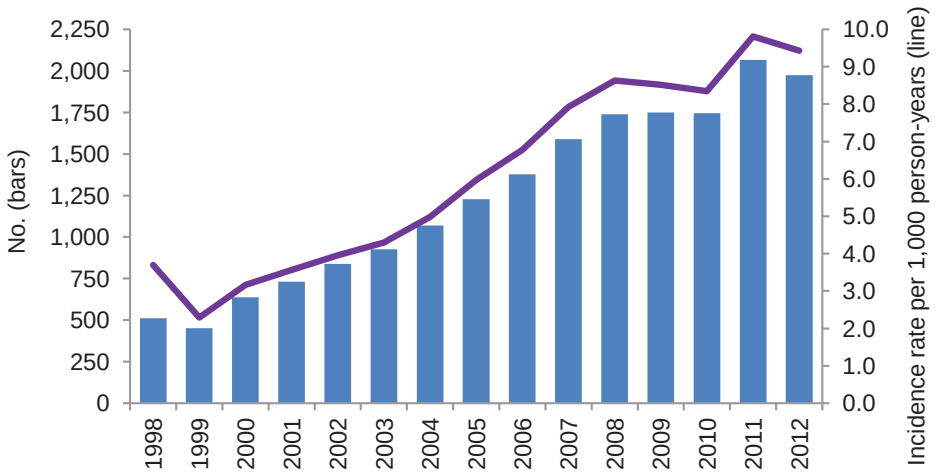
A woman was considered a case of menorrhagia if she had a record of a hospitalization with an ICD-9-CM code for menorrhagia in the primary diagnostic position or records of two outpatient encounters with a defining ICD-9-CM code in any diagnostic position within a 180 day period **(Table 1)**. An individual who met the case definition for an incident case could be counted again as an incident case if more than 365 days had passed without any health care encounters for menorrhagia.

Denominators for rates were calculated by summing the person-time for all female active component service members who served during the surveillance period. For each menorrhagia case identified, the record of the incident encounter was searched to identify co-occurring diagnoses of those conditions and common symptoms often associated with menorrhagia. The records for inpatient cases of menorrhagia were analyzed to determine the most common procedures that were performed during the same hospitalizations.

RESULTS

During the 15 year surveillance period, 16,150 different active component service women (2.4% of all women who served during the period) were identified as incident cases of menorrhagia on at least one occasion. Among these women there were 18,631 incident cases of menorrhagia diagnosed (crude rate of 6.2 per 1,000 person-years [p-yrs]) **(Table 2)**. Annual incidence rates more than doubled during the 15-year surveillance period from 3.7 per 1,000 p-yrs in 1998 (n=511) to 9.4 per 1,000 p-yrs in 2012 (n=1,975) **(Figure 1)**. Inpatient hospitalizations accounted for 13 percent (n= 2,440) of these cases and 16,191 were outpatient cases **(data not shown)**. In addition to the cases diagnosed in fixed medical facilities, during the period of 2005 to 2012 TMDS records documented 2,595 medical encounters for menorrhagia during deployment to an operational theater. An additional 48 women were evacuated from theater, between 2002 and 2012 due to menorrhagia **(data not shown)**.

FIGURE 1. Annual incident counts and incidence rates of menorrhagia, active component service women, U.S. Armed Forces, 1998-2012



Service women aged 40 to 49 years had twice the overall rate of menorrhagia as service women in their thirties (23.1 per 1,000 p-yrs and 10.1 per 1,000 p-yrs, respectively) and over seven times the rate among service women in their twenties (3.1 per 1,000 p-yrs) **(Table 2)**. During the surveillance period, annual incidence rates of menorrhagia increased in every age group except those aged 55 or more **(Figure 2)**. The largest increase was among women in their forties (1998 rate: 15.0 per 1,000 p-yrs; 2012 rate: 33.2 per 1,000 p-yrs).

Black, non-Hispanic women had the highest total rates of menorrhagia (overall rate: 8.9 per 1,000 p-yrs) compared to all other racial/ethnic categories **(Table 2, Figure 3)**. Stratifying the data by age group and race/ethnicity, overall incidence rates for black, non-Hispanic women were the highest in every age group except for women 50 to 55 years, for whom Hispanic service women had the highest rates. **(Figure 4)**.

Service women in the Army and Coast Guard had the highest overall rates of menorrhagia among the services **(Table 2)**. The annual incidence rates of menorrhagia in each of the Services generally increased during the surveillance period **(Figure 5)**.

Service women in health care had the highest overall incidence rate among the occupational groups (7.19 per 1,000 p-yrs) during the surveillance period **(Table 2)**. Annual incidence rates increased for all of the occupational groups during the period **(data not shown)**.

A majority (73.9%) of menorrhagia cases did not have a co-occurring condition recorded during the incident encounters. Nevertheless, 15.4 percent of all the cases of menorrhagia had a co-occurring diagnosis of uterine leiomyoma/polyps or disorders of the uterus documented in the record of the incident encounter **(Table 3)**. The other most common co-occurring diagnoses were ovarian cysts (3.4% of cases), adenomyosis/endometriosis (2.5%), and infections of the female genital organs (2.0%). Each of the remaining conditions of interest was found in less than two percent of the records of incident encounters of menorrhagia. The records of approximately 18 percent of the women with menorrhagia documented the presence of associated symptoms such as dysmenorrhea (painful periods), and 8 percent reflected diagnoses of anemia, including iron deficiency anemia and post hemorrhagic anemia **(data not shown)**.

Of the 2,440 women who were hospitalized for menorrhagia, the records for those hospitalizations documented the performance of a hysterectomy in 79.4 percent of the cases (n=1,918) **(Table 4)**. Additional procedures associated with these hospitalizations included removal of one or more ovaries and/or fallopian tubes (22.7% [n=549]), cystoscopy (20.5%), and operation involving the vagina/cul-de-sac (13.0%).

FIGURE 2. Annual incidence rates of menorrhagia by age, active component service women, U.S. Armed Forces, 1998-2012

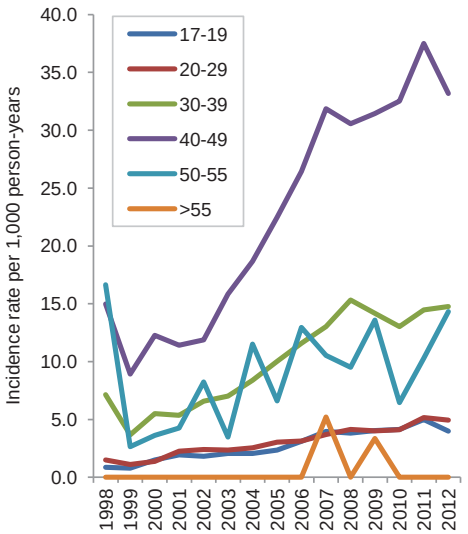


FIGURE 3. Annual incidence rates of menorrhagia by race/ethnicity, active component service women, U.S. Armed Forces, 1998-2012

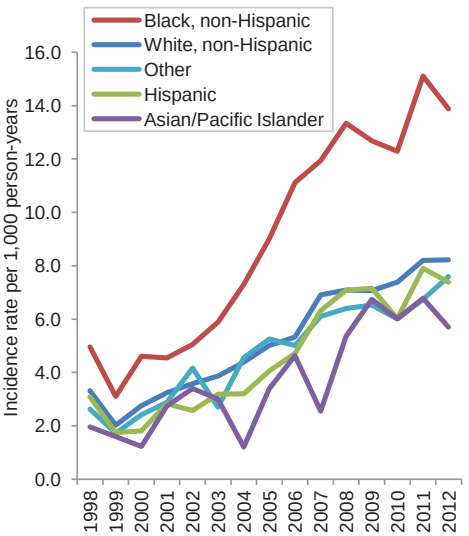


FIGURE 4. Incidence rates of menorrhagia by age and race/ethnicity, active component service women, U.S. Armed Forces, 1998-2012

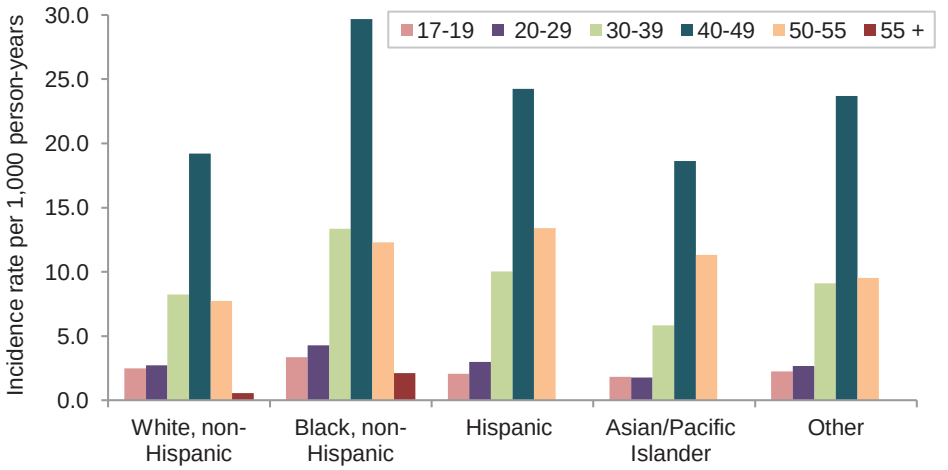
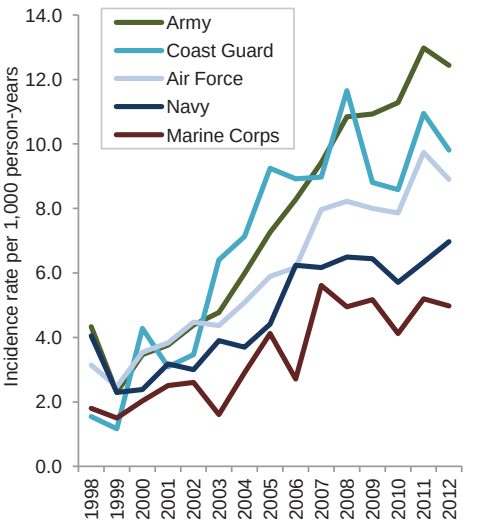


FIGURE 5. Annual incidence rates of menorrhagia by service, active component service women, U.S. Armed Forces, 1998-2012



EDITORIAL COMMENT

This report summarizes incident cases of menorrhagia over a 15 year period (1998-2012) among active component service women. Menorrhagia is a common condition that may be due to any one of a variety of disorders. The overall crude incidence rate of menorrhagia was 6.2 per 1,000 p-yrs. Annual incidence rates increased 150 percent between the start and the end of the surveillance period.

The known association between advancing age and the incidence of diagnoses of menorrhagia was demonstrated in this report. Women in their forties had the highest overall incidence rate and had the largest increase in annual incidence rates during the surveillance period. With the exception of women aged 55 and older, the annual rates of incident menorrhagia diagnoses for women in all age groups increased during the surveillance period. Black, non-Hispanic women in their forties had the highest rate of menorrhagia when the cases were stratified by race/ethnicity and age. One possible reason for the higher rates of menorrhagia in black, non-Hispanic women compared to other, similarly aged women could be the higher prevalence of fibroids – a known risk factor for menorrhagia – in black, non-Hispanic women in the Armed Forces.[14] Among all service women with menorrhagia in the study population, uterine fibroids were the most commonly associated co-occurring condition.

While the Army and Air Force had the highest numbers of menorrhagia diagnoses, Coast Guard women had the highest overall incidence rate. One possible explanation for the high rate in Coast Guard women could be an association with the incidence of fibroids. In a 2011 report, Coast Guard women had the second highest rate of fibroids among all of the services.[14]

In the civilian population, up to 20 percent of women with menorrhagia have an underlying bleeding disorder;[15] however, in this study of active component service women bleeding disorders were recorded in less than one percent. Because this analysis was restricted to co-occurring conditions documented during the incident encounter, the counts and percentages reported likely underestimate the true occurrence of these conditions. Bleeding disorders, in particular, may not be routinely investigated during the incident encounter, but may possibly be diagnosed in subsequent encounters.[16] On the other hand, applicants for military service are screened for many pre-existing conditions including some that could potentially lead to menorrhagia.

TABLE 3. Counts and percentages of co-occurring conditions[a] among menorrhagia cases, active component service women, U.S. Armed Forces, 1998-2012

Description	No.	% total
Uterine leiomyoma, polyps, or disorders of uterus	2,862	15.4
Ovarian cyst	631	3.4
Adenomyosis, endometriosis	468	2.5
Infections of the female genital organs (e.g., gonorrhea, chlamydia, cervicitis)	364	2.0
Endocrine disorders (e.g., disorders of thyroid, ovaries, pituitary)	221	1.2
Dysplasia, hyperplasia	135	0.7
Neoplasms of female genital organs	110	0.6
Pelvic inflammatory disease	39	0.2
Bleeding disorder (i.e., coagulation disorders/ other hemorrhagic conditions)	38	0.2
Systemic illnesses	3	0.0

[a]A case could have more than one co-occurring condition.

TABLE 4. Top ten procedures associated with inpatient cases of menorrhagia, active component service women, U.S. Armed Forces, 1998-2012

Description	No.	% total
Hysterectomy (vaginal or abdominal)	1,918	79.4
Removal of ovaries and/or fallopian tubes (i.e., oophorectomy, salpingo-oophorectomy, and salpingectomy)	549	22.7
Cystoscopy	496	20.5
Operations of the vagina and cul-de-sac	313	13.0
Other operations on abdominal region	210	8.7
Diagnostic procedures including biopsy	140	5.8
Other operations on urinary tract	135	5.6
Excision or destruction of lesion or tissue of uterus	99	4.1
Dilation and curettage of uterus	88	3.6
Other operations on ovary	88	3.6

[a]Patients may have had one or more procedures while admitted so percentages may total over 100 percent.

A medical history of a bleeding (coagulation) disorder, of menorrhagia unresponsive to treatment, or of some of the other known causes of menorrhagia during the 12 months prior to enlistment precludes induction into the Armed Forces.[17] As a result, the prevalence of bleeding disorders among active component women may be significantly lower than among women in the general population.

Hysterectomies were the most common procedures recorded among inpatient cases of menorrhagia in service women; this finding is consistent with published reports for civilians with menorrhagia. Hysterectomy is a definitive treatment for menorrhagia; however, it is often reserved for women who have completed childbearing. Alternatively, endometrial ablation is available for women who do not want to undergo major surgery; among service women with menorrhagia this procedure was performed in 4.1 percent of inpatient cases.

A limitation of this report is that the analysis for co-occurring conditions was limited by the study design which restricted the search for other diagnoses to the records of the initial encounters for menorrhagia. The records of only 26.1 percent of the menorrhagia cases contained additional co-occurring diagnoses that were potential etiologies for menorrhagia. It is plausible that specific causes of menorrhagia might have been identified in records of encounters that took place before or after the case-defining medical encounters for menorrhagia. Such an approach is planned for a follow-up study to clarify the possible etiologies of the majority of cases identified in this study. Another limitation of this study is that, for outpatient encounters, codes that indicate procedures performed (Current Procedural Terminology [CPT] codes) were not evaluated; therefore, menorrhagia treatments that may not require hospitalization were not captured.

An additional limitation of this report is the inclusion of all female active component service members in the calculation of person time in the denominator used in the estimation of menorrhagia incidence rates. The inclusion of all female service members would include person time for service women who had undergone hysterectomy and who were, therefore, not at risk for menorrhagia; this would result in the overestimation of person time and subsequently, underestimation of the incidence rate of menorrhagia.

Future studies are planned to assess the aforementioned limitations as well as to further examine the overall impact (burden) of menorrhagia on the readiness of the force and on health care utilization.

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Incident Diagnoses of Breast Cancer, Active Component Service Women, U.S. Armed Forces, 2000-2012

In the United States, with the exception of skin cancer, breast cancer accounts for the greatest number of incident cancer diagnoses in women and is the second most frequent cause of female cancer-related deaths. Compared to the general U.S. population, female military members have been estimated to have higher breast cancer rates. Between 2000 and 2012, 1,092 female active component members were diagnosed with breast cancer; 244 (22.3%) of these cases were ductal carcinoma in situ (DCIS). The overall crude incidence rate of breast cancer was 40.6 per 100,000 person-years (p-yrs); the lowest annual incidence rate was 28.6 per 100,000 p-yrs in 2006, and the highest annual incidence rate was 53.6 per 100,000 p-yrs in 2001. Over the surveillance period, the crude incidence rate of DCIS cases was 9.1 per 100,000 p-yrs; for other (invasive) breast cancer diagnoses the rate was 31.5 per 100,000. Potential differences in breast cancer risk factors between military and civilian women are discussed.

With the exception of skin cancer, breast cancer accounts for the greatest number of incident cancer diagnoses in women in the United States and is the second most frequent cause of female cancer-related deaths. In 2012, there were an estimated 226,870 new cases of breast cancer in U.S. women; breast cancer incidence rates have remained relatively stable since 2005 while the breast cancer death rate has declined during the same period.[1,2]

A 2009 study by Zhu and colleagues comparing incidence rates of six cancers (lung, colorectal, prostate, breast, testicular, and cervical cancers) in active military and civilian populations estimated that female military members had higher rates of breast cancers than their civilian counterparts.[3] In that study, cancer incidence among military members was determined using the Department of Defense Automated Central Tumor Registry (ACTUR); cancer incidence among U.S. civilians was estimated using data from the SEER (Surveillance, Epidemiology, and End Results) study of the National Cancer Institute (NCI).

The *MSMR* has previously reported on incidence rates of breast cancer in military women. As in the general U.S. population, with the exception of skin cancer, breast cancer is the most frequent cancer diagnosis among service women and, although rates have fluctuated slightly over the past 12 years, breast cancer incidence rates have remained relatively stable.[4] This report provides new estimates of breast cancer rates and expands upon previous analysis by providing incidence rates of ductal carcinoma in situ (DCIS).

METHODS

The surveillance period was 1 January 2000 to 31 December 2012. The surveillance population included all women who served in the active component of the U.S. Armed Forces at any time during the surveillance period. All data used to determine incident cancer cases were derived from records routinely maintained in the Defense Medical Surveillance System (DMSS).

The following ICD-9-CM codes were used to define cases of breast cancer or DCIS: 174.0-174.9 (malignant neoplasm of the female breast); 233.0 (carcinoma in situ of breast). For surveillance purposes, an incident case of breast cancer was defined as one inpatient encounter with a diagnosis of interest in the first diagnostic position (or in the second diagnostic position if the first code was a V-code indicating radiotherapy, chemotherapy, or immunotherapy treatment [ICD-9-CM: V58.0-V58.12]); or three or more outpatient encounters within a 90-day period with the defining diagnosis in the first or second diagnostic position.

Incident dates of breast cancer diagnoses were the dates of the first medical encounters that included case-defining diagnoses. Individuals could be counted as a breast cancer case only once during the surveillance period (even if cases had had a recurrence of, or subsequent diagnoses of breast cancer after initially becoming an incident case). Female military members with case-defining breast cancer diagnoses prior to the start of the surveillance period were excluded from the analysis because they were not considered to be at risk of incident (first-ever) breast cancer diagnoses during the period.

RESULTS

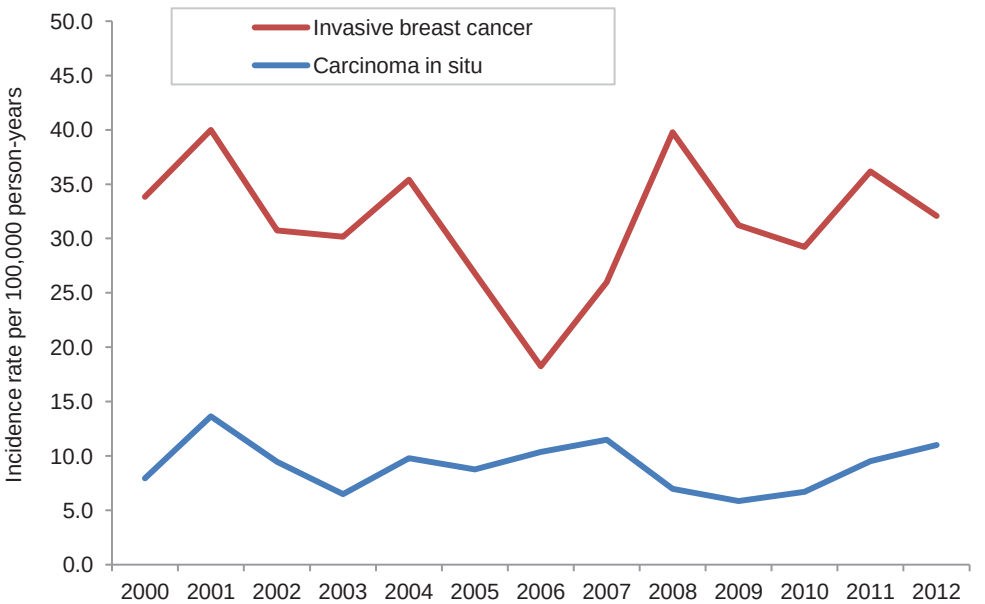
During the 13-year surveillance period, 1,092 female active component members were diagnosed with breast cancer; 244 (22.3%) of these cases were DCIS **(Table 1)**. The overall crude incidence rate of breast cancer was 40.6 per 100,000 person-years (p-yrs); the lowest annual incidence rate was 28.6 per 100,000 p-yrs in 2006, and the highest annual incidence rate was 53.6 per 100,000 p-yrs in 2001. Over the surveillance period, the crude incidence rate of DCIS cases was 9.1 per 100,000 p-yrs; for other (invasive) breast cancer diagnoses the rate was 31.5 per 100,000 p-yrs. While crude incidence rates of invasive breast cancer fluctuated during the period, the crude incidence rate in the final year of the surveillance period was slightly lower than the rate in the first year of the surveillance period (2012: 32.1 cases per 100,000 p-yrs; 2000: 33.8 cases per 100,000 p-yrs) **(Figure 1)**. In contrast, crude incidence rates of DCIS fluctuated less dramatically during

TABLE 1. Incident counts and incidence rates of breast cancer overall and by type, active component service women, U.S. Armed Forces, 2000-2012

	Total			Ductal carcinoma in situ (DCIS)			Invasive breast cancer		
	No.	Rate[a]	IRR	No.	Rate[a]	IRR	No.	Rate[a]	IRR
Total	1,092	40.6	.	244	9.1	.	848	31.5	.
Service									
Army	399	42.2	2.2	85	9.0	3.4	314	33.2	2.0
Navy	242	36.2	1.9	50	7.5	2.8	192	28.7	1.7
Air Force	399	46.1	2.4	101	11.7	4.4	298	34.4	2.1
Marine Corps	29	19.2	Ref	4	2.6	Ref	25	16.6	Ref
Coast Guard	23	37.7	2.0	4	6.6	2.5	19	31.1	1.9
Race/ethnicity									
White, non-Hispanic	541	40.7	1.8	122	9.2	2.2	419	31.5	1.7
Black, non-Hispanic	369	49.0	2.2	81	10.7	2.6	288	38.2	2.1
Hispanic	65	22.1	Ref	12	4.1	Ref	53	18.0	Ref
Other	117	37.5	1.7	29	9.3	2.3	88	28.2	1.6
Age									
<20	0	0.0	.	0	0.0	.	0	0.0	.
20-24	29	3.0	Ref	3	0.3	Ref	26	2.7	Ref
25-29	65	10.9	1.0	10	1.7	5.4	55	9.2	3.4
30-34	142	39.9	3.7	21	5.9	19.1	121	34.0	12.7
35-39	237	88.6	8.2	44	16.5	53.2	193	72.2	26.9
40+	619	294.5	27.1	166	79.0	255.4	453	215.6	80.4
Rank									
Junior enlisted	9	0.7	Ref	77	6.0	Ref	68	5.3	Ref
Senior enlisted	128	13.5	1.0	592	62.4	10.4	464	48.9	8.1
Junior officers	26	8.2	0.6	127	40.2	6.7	101	32.0	5.3
Senior officers	81	55.7	4.1	296	203.6	33.8	215	147.9	24.6
Military occupation									
Combat-specific	55	31.4	1.1	8	4.6	0.8	47	26.8	4.9
Health care	302	58.9	2.1	65	12.7	2.3	237	46.2	8.4
Admin/supply	472	44.6	1.6	119	11.2	2.0	353	33.4	6.1
Other	263	27.9	Ref	52	5.5	Ref	211	22.4	Ref

IRR=Incidence rate ratio
[a]Incidence rate per 100,000 person-years
[b]Treatment= medical encounters related to breast cancer 1 year from the incident date of diagnosis of breast cancer.

FIGURE 1. Annual incidence rates of breast cancer by type, active component service women, U.S. Armed Forces, 2000-2012



the period, but incidence rates were higher in 2012 than in the first year of the surveillance period (2012: 11.0 cases per 100,000 p-yrs; 2000: 8.0 cases per 100,000 p-yrs).

The strongest demographic correlate of increased risk of a breast cancer diagnosis was older age **(Table 1)**. For example, the highest rates of diagnoses were among those older than 40 years. Incident cases of DCIS were relatively uncommon in female military members under 40 years of age; crude incidence rates were sharply higher in those 40 years of age or older compared to those 35-39 years of age (79.0 per 100, 000 p-yrs and 16.5 per 100,000 p-yrs, respectively). Similar age-related increases in crude incidence rates were observed for invasive breast cancer.

Crude incidence rates of both DCIS and invasive breast cancer were lower among members of the Marine Corps than the other Services **(Table 1)**. Military members in health care occupations were much more likely than members of other occupation groups to be an incident breast cancer case (IRR: 2.1).

Black, non-Hispanic women had higher overall crude incidence rates of breast cancer (rate: 49.0 per 100,000 p-yrs) than women in any other race-ethnicity category **(Table 1)**. This finding was true for both cases of DCIS and invasive breast cancer.

EDITORIAL COMMENT

Over the past thirteen years, crude incidence rates of both invasive breast cancer and DCIS have fluctuated somewhat, but no clear increasing or decreasing trend in incidence rates has emerged.

For this analysis, we included cases of diagnoses of ductal carcinoma in situ (DCIS) in the calculation of counts and rates of breast cancer incidence; previous estimates of breast cancer incidence in the U.S. military published in the *MSMR* have not included DCIS diagnoses.

While DCIS is less common than invasive breast cancer, the widespread adoption of breast cancer screening (i.e., mammography) has led to marked increases in DCIS diagnoses as most cases of DCIS are diagnosed via screening mammography.[5] In 2012, Bleyer and Welch reported on the effect of screening mammography on

breast cancer incidence and demonstrated that increases in the use of screening mammography resulted in significant increases in incidence of early stage breast cancer and concluded that breast cancer screening results in substantial overdiagnosis.[6] Concern over nomenclature was recently voiced by an NCI working group who suggested that premalignant conditions such as DCIS no longer be called cancer.[7] This concern prompted us to report on these two conditions separately in this report.

In the U.S. civilian population, the average annual breast cancer rate is highest in white, non-Hispanic women, followed by black, non-Hispanic (African American) women;[2] in contrast, this analysis of active component military women found that black, non-Hispanic women had the highest crude incidence rates of breast cancer (both invasive and DCIS). One factor that may contribute to this difference is the prevalence of screening mammography by race/ethnicity among female military members. A recent study by Enewold et al. demonstrated that black, non-Hispanic service women were slightly more likely to have screening mammography than their white, non-Hispanic counterparts. (OR: 1.09; 95% CI: 1.01-1.18).[8]

There are limitations to these analyses that should be considered when interpreting the results. For example, for this surveillance report, breast cancer cases were ascertained from ICD-9-CM coded diagnoses reported on standardized records of hospitalizations and outpatient medical encounters. As such, breast cancer diagnoses were not independently confirmed by reviews of pathology reports or of records in cancer registries (as was done to ascertain cases for some previous studies in military populations). As a result, some cancer-specific diagnoses considered case-defining for this report may reflect erroneous or miscoded diagnoses (e.g., some rule out or suspected cases may have been reported with cancer-specific codes). Because of the potential lack of specificity of cancer diagnoses on administrative medical encounter records, cancer cases reported herein may overestimate the actual numbers of cancers definitively diagnosed among active component military members during the surveillance period. On the other hand, while ACTUR (the DoD tumor registry) and SEER (a U.S. population-based cancer registry managed by the National Cancer Institute) are considered gold standards for cancer case identification in the United States, the numbers of cases that are reported to those registries likely underestimate the total of all breast cancers that affect the populations of interest. Interpretations of the findings of various population-based breast cancer studies should consider the likely completeness and accuracy of case ascertainment.

Active military populations differ from the U.S. civilian population in many ways. Several risk factors that differ in the populations could affect the incidence of breast cancer. For example, Zhu and colleagues postulated that the higher breast cancer rates they observed in female military members might be due, in part, to exposure to more breast cancer risk factors (e.g., chemical exposures, long term use of oral contraceptives, and night time shift work).[3] In addition, because women in the military are subject to relatively intensive medical screening, cancers may be detected earlier in their clinical courses in active military than in civilian populations. If so, rates of cancer diagnoses may be higher among active military members than similarly aged civilians (because cases are detected earlier); however, the detection and treatment of cancers at earlier stages may decrease cancer-related mortality among military members compared to civilians.

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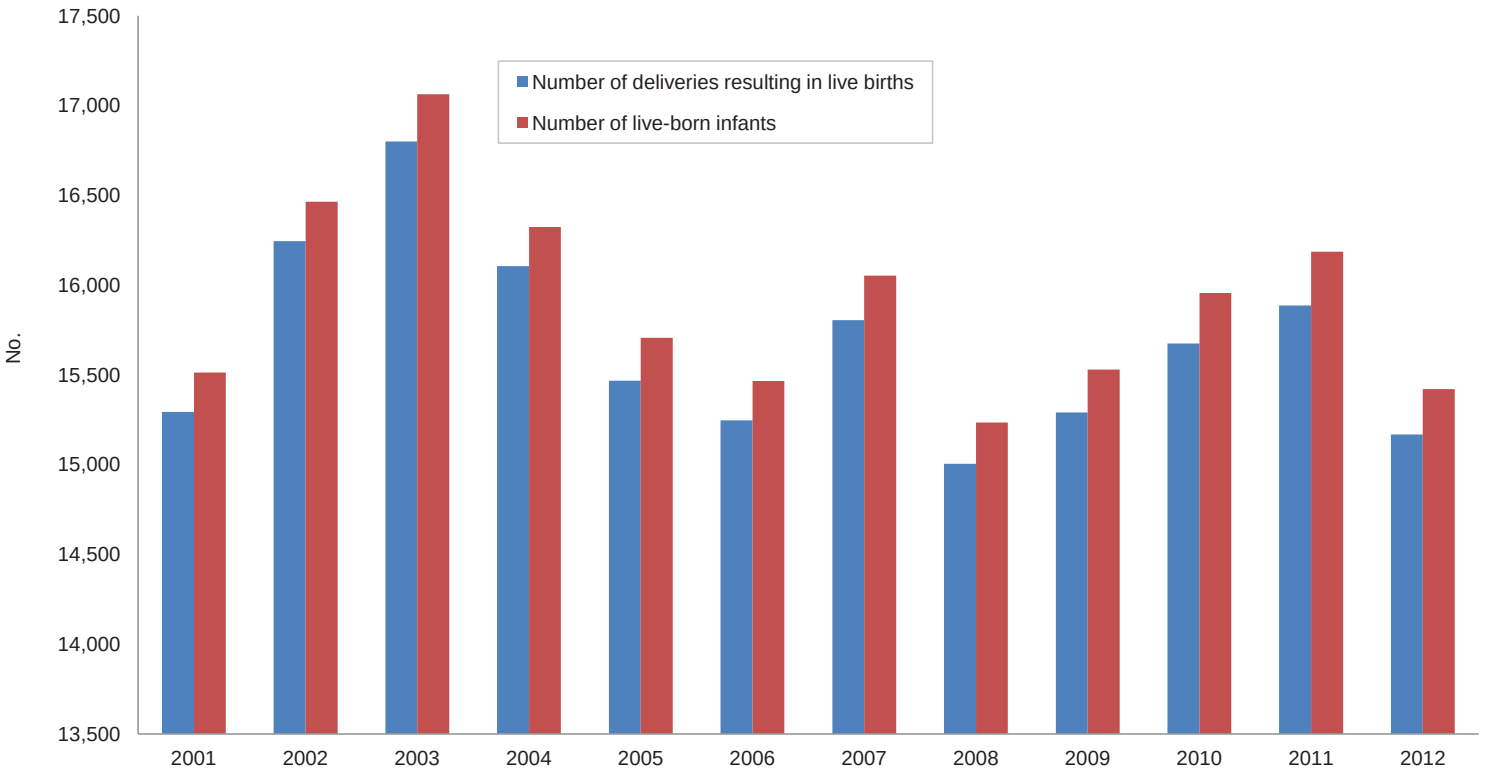
Correction: The following is a correction to the article "Update: routine screening for antibodies to human immunodeficiency virus, civilian applicants for U.S. military service and U.S. Armed Forces, active and reserve components, January 2008-June 2013" which appeared in the August 2013 issue (Vol. 20, No. 8) of the *MSMR*. The totals provided for Tables 1 and 2 in the print edition are inclusive of all 23.5 years of surveillance, and not the 5.5 year surveillance period reported in the article. Although the figures presented for the individual years 2008 through June 30, 2013 are accurate, the totals are incorrect. The online version of the article has been updated with corrected tables and can be found at: http://afhsc.mil/viewMSMR?file=2013/v20_n08.pdf#Page=02.

Surveillance Snapshot: Births, Active Component Service Women, U.S. Armed Forces, 2001-2012

FIGURE 1. Number of deliveries resulting in live births and live-born infants, active component service women, U.S. Armed Forces, 2001-2012



A previous *MSMR* report about active component women documented the numbers and rates of deliveries resulting in live births.[1] Because some pregnancies involve carrying more than one fetus to term (multiple gestation pregnancies), the numbers of deliveries among active component women are slightly lower than the numbers of live births. This snapshot summarizes the difference between those two numbers for active component women of reproductive age during the surveillance period 2001 through 2012.

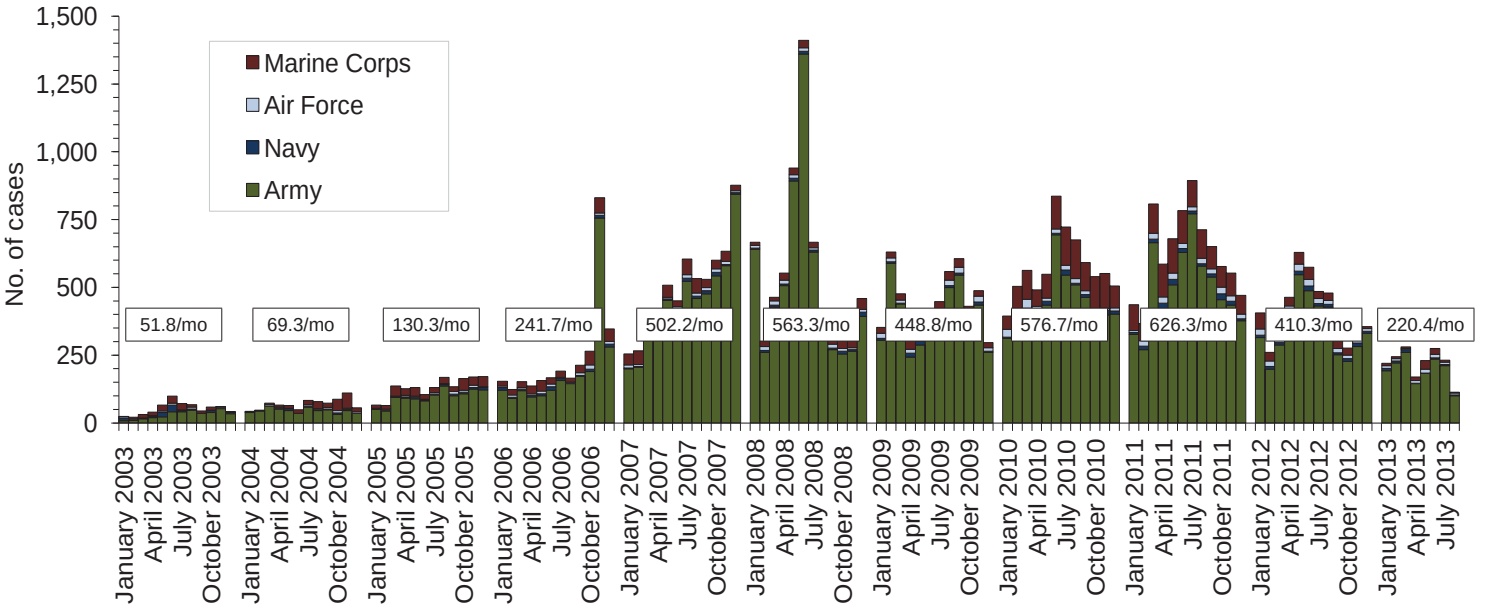
Data from the Defense Medical Surveillance System were analyzed to identify deliveries of live-born infants to active component female U.S. military service members (ages 17-49) from 2001 to 2012. For surveillance purposes, a delivery was defined as an inpatient medical encounter for which the medical record included diagnostic codes corresponding to outcomes of delivery (ICD-9-CM: V27.x) or other pregnancy-related codes (ICD-9-CM: 640.xx-679.xx).[2] For each patient the earliest such encounter was assigned as the first delivery date for that woman, and a 280 day incidence rule was applied for subsequent deliveries. Because each delivery encounter can have up to eight ICD-9 codes, an algorithm[3] was devised to identify a priority diagnosis for each encounter, and that diagnosis was used to estimate the number of live-born infants **(Figure 1)**. Encounters for deliveries resulting only in still births (V27.1, V27.4, V27.7) were excluded. Each multiple gestation pregnancy that was coded with "some surviving" infants (number not specified) was assigned one live birth. Otherwise, the number of live-born infants corresponded to the number specified by the code.

This analysis identified 187,988 deliveries resulting in 190,913 live births during the surveillance period. From those deliveries, an estimated 8,333 live infants were born from 5,408 multiple gestation pregnancies meeting the inclusion criteria.

1. Armed Forces Health Surveillance Center. Births, active component, U.S. Armed Forces, 2001-2010. *MSMR*. 2011 Dec; 18(12):16-17.
2. To be included in the analysis, ICD-9-CM codes ranging from 640-679 were required to have a fifth digit of a 1 or 2, with the following exceptions: 644.0, 644.1, and 677 were excluded, 650 did not require a fifth digit, and 651 only needed a fifth digit of 1 (a fifth digit of 2 is not an option for that ICD-9-CM code).
3. The ICD-9-CM codes V27.x were preferentially selected over 650 and 651.xx, which were preferentially selected over the remaining codes.

Deployment-Related Conditions of Special Surveillance Interest, U.S. Armed Forces, by Month and Service, January 2003-August 2013 (data as of 19 September 2013)

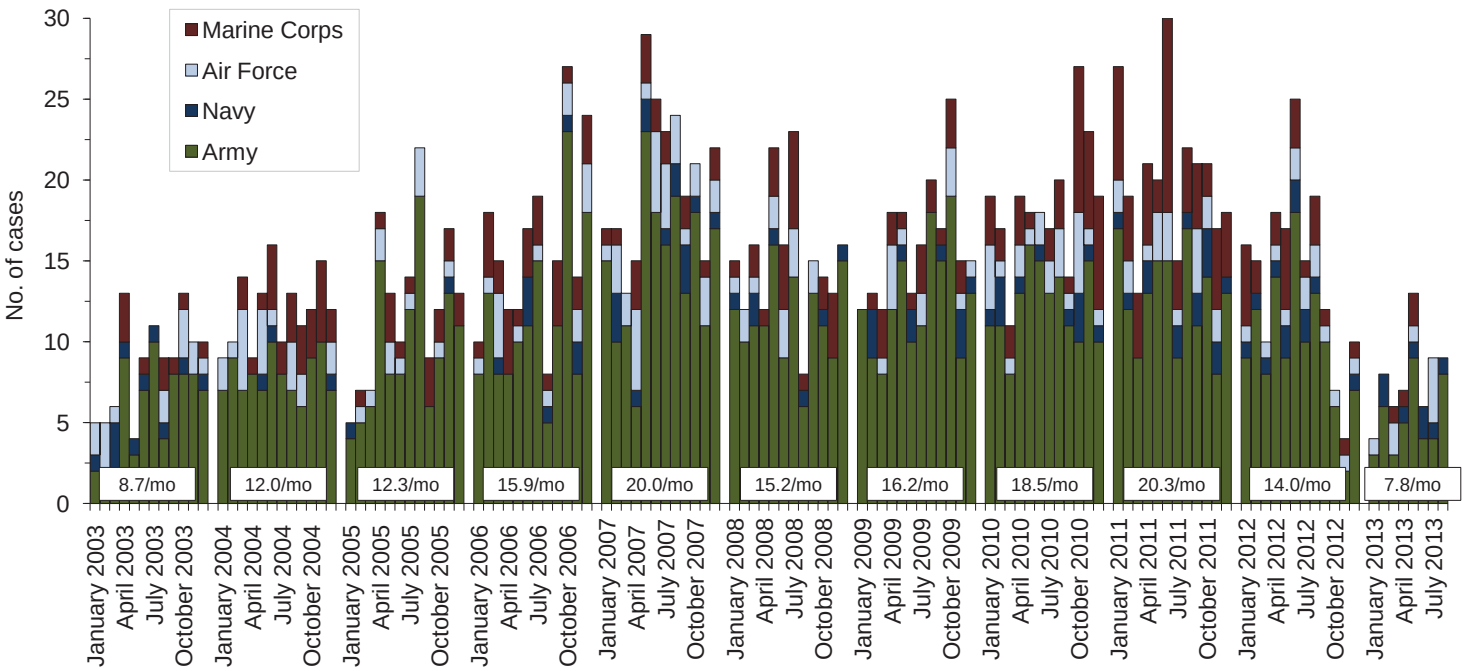
Traumatic brain injury (ICD-9: 310.2, 800-801, 803-804, 850-854, 907.0, 950.1-950.3, 959.01, V15.5_1-9, V15.5_A-F, V15.52_0-9, V15.52_A-F, V15.59_1-9, V15.59_A-F)[a]



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.

[a]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 4,218 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)[b]

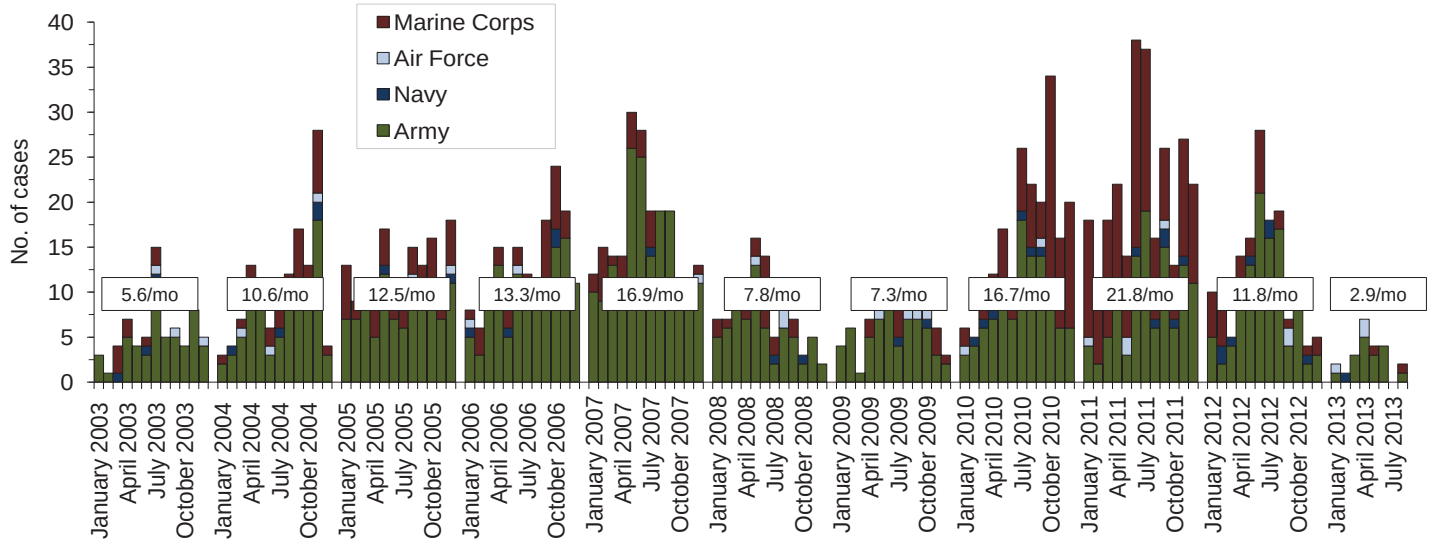


Reference: Isenbarger DW, Atwood JE, Scott PT, et al. Venous thromboembolism among United States soldiers deployed to Southwest Asia. *Thromb Res*. 2006;117(4):379-83.

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

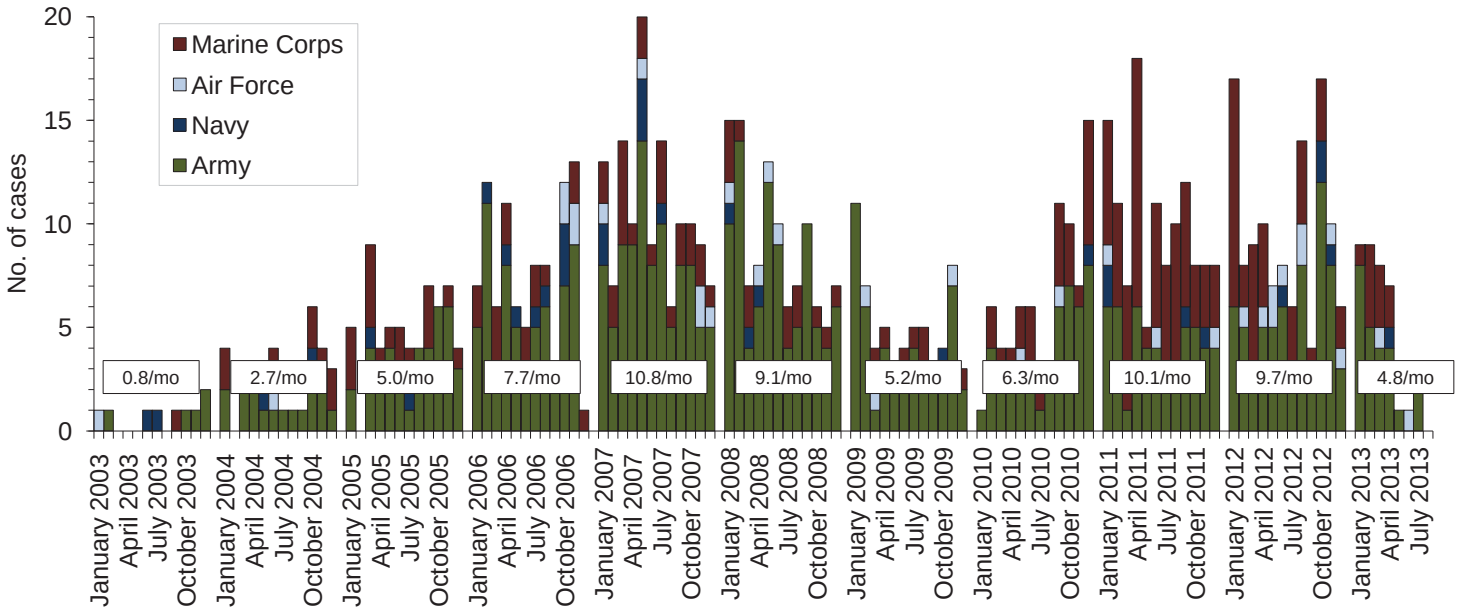
Deployment-related conditions of special surveillance interest, U.S. Armed Forces, by month and service, January 2003-August 2013 (data as of 19 September 2013)

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)[a]



Reference: Army Medical Surveillance Activity. Deployment-related condition of special surveillance interest: amputations. Amputations of lower and upper extremities, U.S. Armed Forces, 1990-2004. *MSMR*. Jan 2005;11(1):2-6.
[a]Indicator diagnosis (one per individual) during a hospitalization while deployed to/within 365 days of returning from OEF/OIF/OND.

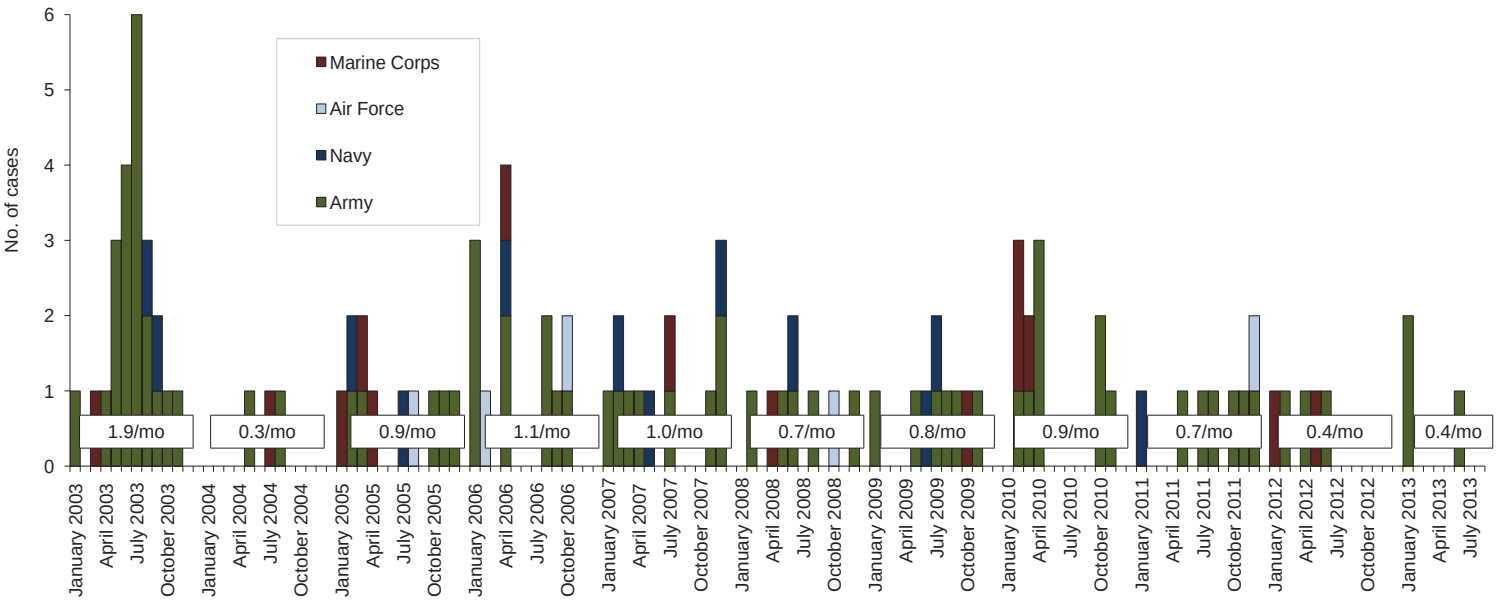
Heterotopic ossification (ICD-9: 728.12, 728.13, 728.19)[b]



Reference: Army Medical Surveillance Activity. Heterotopic ossification, active components, U.S. Armed Forces, 2002-2007. *MSMR*. Aug 2007; 14(5):7-9.
[b]One diagnosis during a hospitalization or two or more ambulatory visits at least 7 days apart (one case per individual) while deployed to/within 365 days of returning from OEF/OIF/OND.

Deployment-Related Conditions of Special Surveillance Interest, U.S. Armed Forces, by Month and Service, January 2003-August 2013 (data as of 19 September 2013)

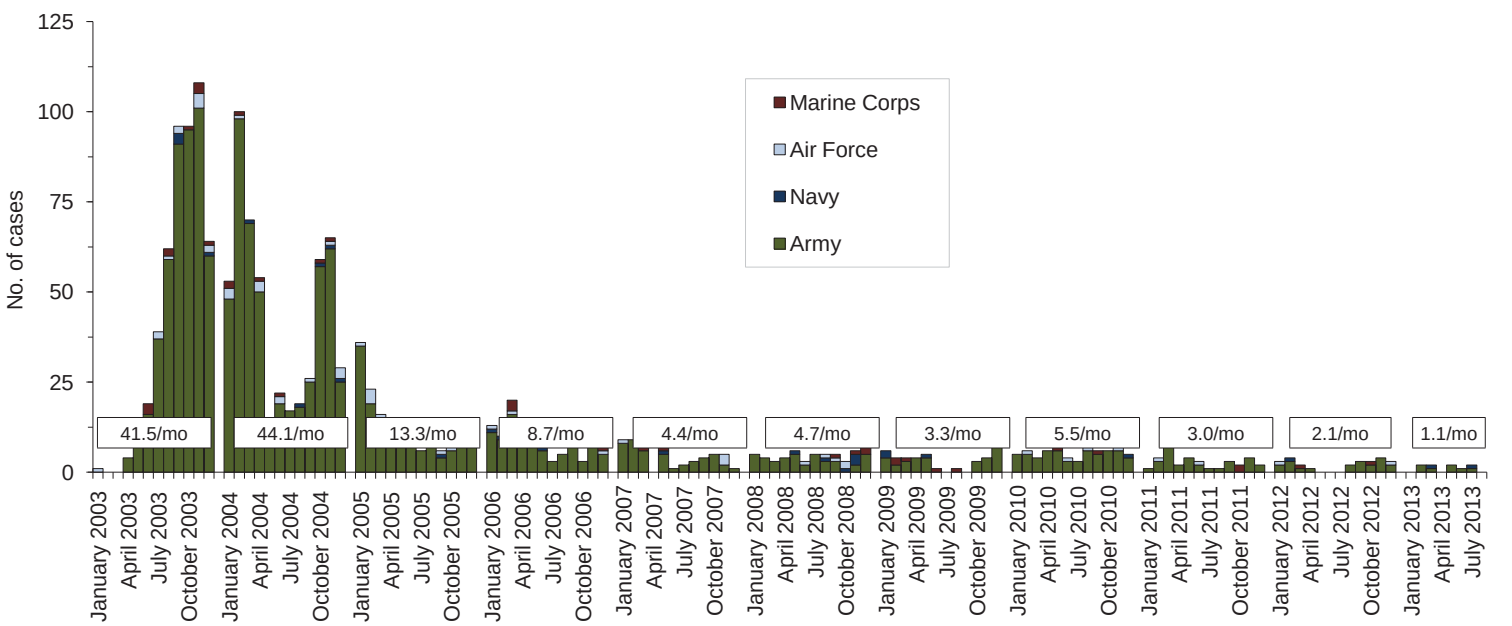
Severe acute pneumonia (ICD-9: 518.81, 518.82, 480-487, 786.09)[a]



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.

[a]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)[b]



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

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

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