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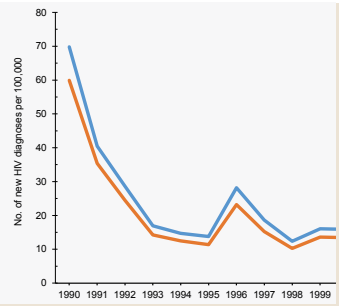
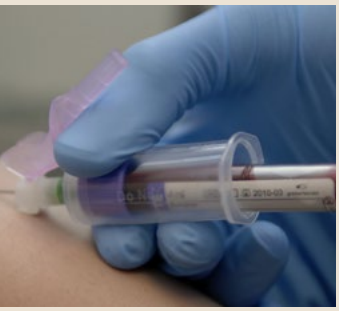
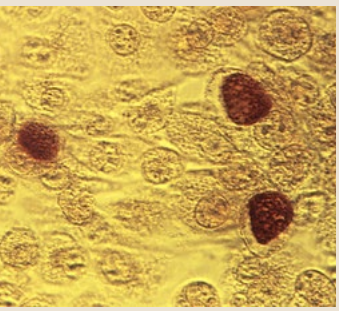
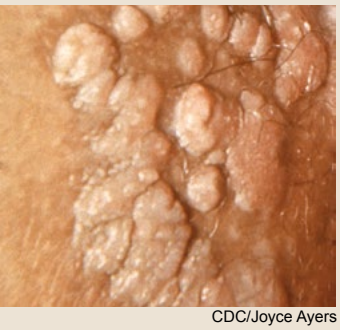






CDC/Dr. E. Arum; Dr. N. Jacobs



CDC/Joyce Ayers

Review of the U.S. Military's Human Immunodeficiency Virus Program: a Legacy of Progress and a Future of Promise

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The impact of human immunodeficiency virus (HIV) infection in the U.S. has changed dramatically over the past 30 years. With the advent of remarkably effective and well-tolerated antiretroviral therapy (ART), HIV infection is now more frequently a chronic disease rather than a terminal illness, meaning that most Americans infected with HIV and on effective ART can now anticipate a life span similar to HIV-uninfected persons. But the U.S. epidemic continues: each year approximately 40,000 new cases of HIV infection are diagnosed.[1] Although it appears that the rate of infection has decreased overall from 2010 through 2015,[2] the rate of infections among men who have sex with men (MSM) has not declined.[3] In fact, among the young (aged 25–34 years), sexually active MSM population, rates of infection are slowly rising.[2] It is also concerning that, of the 1.2 million people currently living with HIV in the U.S., approximately 150,000 are unaware of their infection.[1] An estimated 91.5% of HIV transmissions in 2009 were attributed to spread from the undiagnosed HIV-infected population and from those who were diagnosed but not receiving care.[4]

HIV in the Department of Defense

HIV infection remains a threat to the Department of Defense because sexually active service members and their beneficiaries are stationed throughout the U.S. and around the globe, including in areas with high rates of HIV transmission. Fortunately, the incidence and prevalence of HIV in the Department of Defense remain much lower than in the U.S. civilian population, mainly due to mandatory screening for infection at accession and biennially for all U.S. military service members. From 2010 through 2016, there were an average of 350 new HIV infections diagnosed in service members each year, with incidence rates of HIV infection remaining stable at approximately 21 new HIV diagnoses per 100,000 individuals tested and 25 new HIV diagnoses per 100,000 persons **(Figure)**. Despite these relatively low rates, there is an appreciable impact on military mission and troop readiness because of the incurable nature of the infection, the need for lifelong therapy, the high cost of treatment, and the limitations to duty assignments for HIV-infected service members.

National strategies

In the most recently published National HIV/Acquired Immunodeficiency Syndrome (AIDS) Strategy, the Office of National AIDS Policy focused on four major strategic goals to control the HIV epidemic: 1) reduce new HIV infections, 2) increase access to care and improve health outcomes for people living with HIV, 3) reduce HIV-related health disparities and health inequalities, and 4) achieve a more coordinated national response to the HIV epidemic.[5] Two main methods to accomplish these goals are: 1) identification and early treatment of HIV infection to prevent transmission, and 2) ensuring uninhibited access to HIV prevention services, including HIV pre-exposure prophylaxis (PrEP). As part of a coordinated national response, the Department of Defense has joined efforts to ensure frequent screening for HIV infection, retention in HIV care for all service members and beneficiaries, and improved access to HIV prevention services. Demand for the latter is clearly recognized because an increasing number of high-risk individuals are accessing the Military Health System (MHS) for HIV prevention services since the repeal of "Don't Ask, Don't Tell" (DADT) in 2011 (unpublished data, Armed Forces Health Surveillance Branch). In addition, many more beneficiaries are, for the first time, seeking care within the MHS for their HIV infections. The Department of Defense also has made efforts to improve laboratory diagnostics—specifically for acute HIV infection (AHI)—and to conduct further research on a vaccine and curative therapeutics.

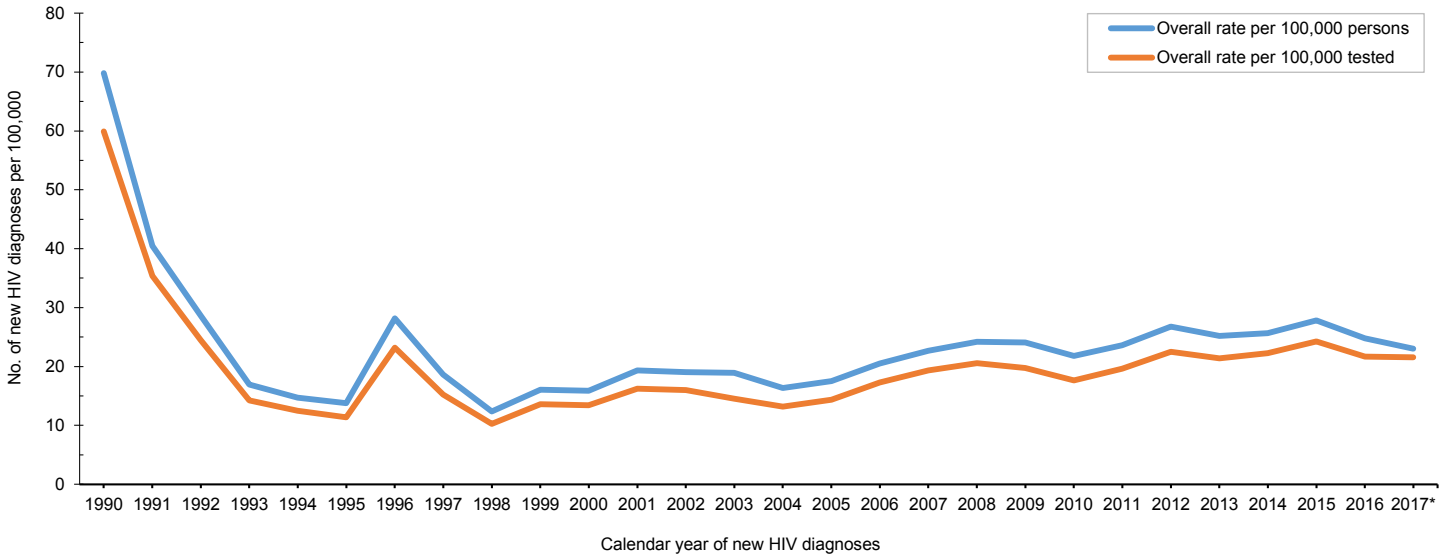
Identification of HIV infection

Detection and diagnosis of HIV infection are key first steps to HIV care and prevention. All U.S. military personnel are mandated to undergo biennial HIV screening.[6] In 1986, the U.S. military instituted HIV surveillance policies to ensure the safety of combat blood supply during urgent blood collections within combat casualty resuscitation settings. Currently, military personnel must screen negative for HIV infection within 120 days prior to deployment to U.S. Central Command areas of operation, including Iraq and Afghanistan, where an estimated 1.64 million military personnel have deployed for combat operations since 2001.[7,8]

HIV infection has been identified among service members in the U.S. military with standard U.S. diagnostic algorithms in use since 1989. Immunoassay (IA) initial screen-reactive specimens were tested in duplicate using the same assay and then by one of the following serologic supplemental confirmatory tests: HIV-1 Western Blot, Multispot HIV-1/HIV-2 Rapid Test, or the Geenius™ HIV 1/2 Supplemental Assay (Bio-Rad Laboratories, Redmond, WA).

The capability to detect and diagnose HIV infection at a single time point (i.e., from a single sample) is critical for a highly mobile population such as the U.S. military with unique operational requirements. This approach is based on detection of markers of HIV infection post HIV transmission. The

FIGURE. Rates of new human immunodeficiency virus (HIV) diagnoses among service members, active and reserve components, U.S. Armed Forces, 1990–2017



Source: Defense Medical Surveillance System (DMSS). Data provided by Armed Forces Health Surveillance Branch.

[a]Through 30 June 2017

first detectable laboratory marker of HIV infection is HIV ribonucleic acid (RNA) followed by an early HIV antigen, p24 (HIV-1), then anti-HIV immunoglobulin (Ig) M antibody, followed by anti-HIV IgG antibody. The standard fourth-generation IA plus supplemental confirmatory test (Western Blot, Multispot, or Geenius) HIV diagnostic algorithm is limited in its detection sensitivity. Current fourth-generation IAs detect HIV infection as early as 5–7 days post HIV infection, while the aforementioned supplemental confirmatory tests are second-generation tests that detect HIV infection at approximately 20–35 days post infection, and thus fail to confirm the initial screening test results for AHI cases.[9]

On 1 December 2009, the U.S. Army HIV Diagnostic Reference Laboratory, Rockville, MD, implemented an enhanced screening algorithm to address the limitations of the aforementioned standard serologic HIV algorithm by incorporating a highly sensitive qualitative HIV-1 RNA diagnostic assay in conjunction with a third-generation serologic screening test. The enhanced algorithm permitted HIV detection within 14–18 days post infection.[10] The first fourth-generation antigen/antibody combo serologic detection methods incorporating early HIV viral protein, p24 antigen, in conjunction with anti-HIV IgM and IgG antibodies were licensed in the U.S. in 2012. HIV-1 RNA nucleic acid testing (NAT) of third- or fourth-generation HIV IA antibody–negative specimens has been employed to identify AHI cases.[9,11] In 2014, the U.S. Army transitioned from a third-generation to a fourth-generation IA in the enhanced HIV algorithm. This transition, in conjunction with the previously introduced qualitative HIV-1 RNA NAT, permitted HIV infection detection and confirmation as early as 5–7 days post HIV infection.

As the world's largest repeatedly tested low-prevalence population, the U.S. military's HIV testing mission informs U.S. civilian HIV diagnostic recommendations. For example, enhancement of the U.S. Army HIV algorithm in 2009 informed the Centers for Disease Control and Prevention's (CDC's) updated HIV case surveillance definitions in 2014. The CDC update introduced a case definition for HIV-2 infection and included recommendations for HIV diagnosis and HIV result reporting. Current U.S. Army efforts in HIV infection detection encompass development of screening, confirmation, and monitoring algorithms for HIV infection status in the era of HIV treatment as prevention (TasP), HIV PrEP, and HIV post-exposure prophylaxis (PEP). Each HIV prevention strategy—TasP, PrEP, and/or PEP—poses unique challenges to generation of laboratory evidence for determination of HIV infection status classification. TasP initiated at early stages of HIV infection when HIV-1 viral load is highest reduces the potential for HIV transmission acquisition through rapid suppression of detectable HIV-1 RNA. However, TasP also may prevent or delay development of antibodies to HIV proteins leading to negative or indeterminate serologic results, or in some instances, loss of previously developed anti-HIV antibody response to infection. Initiation of PEP to prevent acquisition of HIV infection after occupational/non-occupational exposure to HIV and/or PrEP to prevent HIV acquisition in high-risk populations may also inhibit the emergence and detection of viral markers of HIV infection. Such inhibition of markers of infection may thus confound the diagnostic accuracy of currently available U.S. Food and Drug Administration (FDA)–approved antigen/antibody screening and serologic and nucleic acid confirmatory tests. Methodologies employing total nucleic acid detection, inclusive of total HIV RNA and deoxyribonucleic acid (DNA), may be required to discriminate infection status in cases without detectable HIV-1 RNA, and with

indeterminate or negative supplemental confirmatory test results. Currently, however, there are no FDA-approved total nucleic acid assays for confirmation of HIV infection; thus, highly sophisticated laboratory developed tests are required.

HIV treatment

After diagnosis of HIV infection, persons proceed along the HIV care continuum with linkage to care and initiation of ART. Contemporary ART regimens are potent and highly efficacious, with first-line therapeutics demonstrating 90% efficacy in clinical trials in treatment-naïve patients.[12,13] These regimens are well tolerated, with less than 4% of subjects discontinuing ART due to adverse effects in the same clinical trials.[12,13] The availability of several once-daily, single-tablet regimens has led to improved convenience and medication adherence. These characteristics of modern ART regimens have made the goal of durable viral load suppression achievable for nearly all HIV-infected patients.

Over the past decade, the pendulum has shifted back in favor of early, aggressive treatment of all patients after HIV diagnosis. Early treatment has, in part, contributed to a reduction in AIDS diagnoses and deaths among the U.S. population with HIV infection.[2] This test-and-treat disease control strategy also can reduce secondary transmission, with one study demonstrating a 93% reduction in HIV transmission to the sexual contacts of those on effective ART.[14]

HIV prevention

Prevention of sexually acquired HIV infection classically involves behavioral interventions that aim to lower the number of sex partners and alter risk-taking behavior as well as biomedical interventions that aim to reduce the efficiency of transmission.[15] HIV prevention efforts have been bolstered by the recent availability of HIV PrEP, a biomedical intervention consisting of daily oral use of tenofovir disoproxil fumarate/emtricitabine (TDF/FTC; brand name Truvada®). TDF/FTC is FDA approved to reduce sexual acquisition of HIV infection in combination with safer sexual practices in high-risk individuals.[16] PrEP is a new tool for prevention with efficacy exceeding 90% in adherent individuals.[17,18] There are many challenges and issues for optimal PrEP delivery in the military population, including uptake by those most at risk, significant budget implications, military-unique considerations associated with initiation and maintenance of PrEP among patients subject to worldwide assignability and deployability, specific occupational considerations, and access to appropriate specialty care and diagnostic and clinical monitoring laboratory services. To date, no Department of Defense–level policy about PrEP has been issued, and only Navy aviation has amended its aeromedical waiver guide to allow PrEP use among pilots and air crew.[19] A Defense Health Agency (DHA) Interim Procedural Memorandum is currently in development as an initial step to address these issues and challenges.

MSM in the military

The Department of Defense Directive 1304.26, Qualification Standards for Enlistment, Appointment, and Induction, Change 1, dated 4 March 1994, discouraged public disclosure of same-sex relations.[20] Before the DADT Repeal Act of 2010, there were limited data suggesting that MSM in the military were at significantly increased risk for HIV infection, but it was unknown whether MSM in the military were at similar or increased risk, compared to civilian MSM.[21-24] The DADT policy significantly limited public health efforts to engage those most at risk for HIV infection because of the restrictions on healthcare providers and patients regarding soliciting or disclosing risk behaviors for which targeted prevention and screening services, care, and treatment were indicated.

Impact of repeal of DADT

Since repeal of DADT, standardized collection of sexual risk behavior data has occurred across the Services. The U.S. Army Public Health Center, the Air Force HIV Medical Evaluation Unit, and the Navy and Marine Corps Public Health Center have all initiated surveillance programs to collect and analyze the data needed to comprehensively characterize incident HIV infections among service members and other beneficiaries of the MHS. These programs included implementation of standardized case report forms containing specific questions on sexual behavior.

These data demonstrate that military MSM are at significantly increased risk for HIV infection,[25-27] which is consistent with the U.S. civilian data. Hakre et al reported that the contemporary HIV epidemic in the U.S. Army mirrors the U.S. civilian HIV epidemic in that military men who have male–male sexual contact and are of black/African American race/ethnicity comprise the majority of active duty soldiers who acquire HIV in the U.S. Army. Among 307 HIV-infected male Air Force members who were evaluated for sexually transmitted infections (STIs), Patterson et al reported that 81.4% indicated having sex with men.[28] Clearly, MSM comprise the population most at risk for HIV infection in the military.[21,22,24-26,28-30]

Prevention programs ascertaining the needs of and targeting uniformed MSM and other military personnel at high risk of HIV infection have become possible since DADT repeal. A recent analysis of nationally representative survey data indicate approximately 4% of former military personnel aged 18–44 years self-reported having had sex with other men.[31] Adopting and adapting HIV prevention and risk reduction best practices from the civilian community for use in the U.S. military has been a focus since repeal of DADT. These programs include expansion of HIV PrEP services and a series of initiatives through the HIV/Bloodborne Pathogen Threat Reduction Program being piloted at the San Antonio Military Medical Center. These pilot programs include expansion of screening services for those populations most at risk for HIV to expand the availability of STI and HIV screening services and to reduce barriers to accessing these services in the MHS. They include on-demand, self-collection of specimens for extragenital STI screening and HIV testing. These services are intended to maximize opportunities for the increased testing recommended by the CDC for the most at-risk populations. For example, the CDC recommends that MSM be tested for HIV at least

annually[32]; this exceeds the current biennial HIV force screening policy in the Department of Defense.[6] Testing of self-collected specimens, performed by a Department of Defense central reference clinical laboratory at the Walter Reed Army Institute of Research (WRAIR), is provided as a means to increase testing frequency. Processing self-collected specimens in a centralized laboratory facility also addresses the problem of many medical treatment facilities (MTFs) not having the capability to perform STI testing of clinical samples collected from extragenital sites. Other pilot initiatives include a nascent program to perform outreach and engagement of the most at-risk populations.

Department of Defense–specific policies on HIV

Department of Defense Instruction 6485.01, HIV in Military Service Members, was last issued in 2013 and directs all services to adhere to overall policy guidance that mandates periodic HIV testing every 2 years for all service members.[6] Other provisions for management of HIV-infected service members are decided at the service level. In more recent years, the Department of Defense and individual services have implemented significant changes in their HIV policies. In September 2016, the DHA Tri-Service Specialty Care Advisory Board chartered the DHA HIV Tri-Service Working Group (DHA HIV TSWG).[33] The goals of the DHA HIV TSWG are as follows: 1) to ensure high clinical standards for HIV prevention and treatment, 2) to align clinical care policies and procedures across the military services, and 3) to harmonize administrative processes and procedures related to care of active duty service members with HIV infection. The DHA HIV TSWG has a voting member from each service as well as a DHA representative. The group meets quarterly and is currently focused on standardizing HIV clinical care practices across the Services; standardizing waiver policy and procedures for permanent change of station, mobility, and special duty assignments; developing improved educational programs for HIV prevention; and serving as a resource for other committees, groups, or individual practitioners on HIV-related issues. The DHA HIV TSWG also engages other federal and state agencies, organizations, committees, and communities of practice to support active duty HIV care.

One key policy and practice change for the Department of the Navy resulted from the revision of Secretary of the Navy Instruction (SECNAVINST) 5300.30E in August 2012.[34] For the first time in the Department of Navy, sailors and Marines infected with HIV could be evaluated on a case-by-case basis for medical suitability for selected overseas and operational assignments, including shipboard duty on large deck platforms and aircraft carriers. The prior policy of denying *any* deployment had a detrimental impact on the careers and advancement opportunities for service members living with HIV, particularly among enlisted ranks lacking sea duty rotations. As treatment and management of HIV infections continue to evolve toward easier (one pill once daily) regimens, deployment limitations are less absolute, although the availability of medical services, including access to pharmaceuticals, must still be considered for each assignment and each individual member. The eligible command types are duty stations within a 2-hour driving radius of six naval hospitals (Rota, Spain; Naples and Sigonella, Italy; Yokosuka and Okinawa, Japan; Guam) as well as Naval Health Clinic Hawaii and Tripler Army Medical Center. Since implementation of SECNAVINST 5300.30E policy changes, approximately 170 medical suitability screenings have been conducted and 55 sailors have been assigned to various overseas and/or operational assignments without any adverse events. The U.S. Marine Corps Headquarters is also working to afford similar overseas assignments to HIV-infected Marines, but no combatant, remote, or hostile duty locations are allowed. Only those individuals who are medically stable (e.g., reconstituted immune system, virologically suppressed, no opportunistic infections) with a professional attitude toward their medical care are considered, and all assignments are voluntary. For service members assigned overseas or shipboard, their periodic HIV evaluations are conducted by non-infectious diseases physicians due to the lack of this specialty care at Navy MTFs outside the continental U.S. (OCONUS). The interval may be extended from every 6 months to annual visits (i.e., to coincide with a 9-month deployment) as non-urgent medical travel is not authorized. Thus far, this new policy has boosted morale for Department of Navy active duty service members living with HIV and demonstrates a career enhancing advancement for those still able to perform duties of their office, grade, rank and/or rating.

In the Air Force, OCONUS assignments are permitted with waivers according to Air Force Instruction 44-178.[35] The Air Force does not limit or designate specific locations, and as of this writing there are 13 HIV-infected members serving overseas. Air Force members with HIV infection can also deploy with waivers to support missions outside areas of combat. The Air Force still maintains one central HIV treatment center in San Antonio, TX, and HIV-infected members return there for annual evaluations while receiving interim care locally.

The Army has yet to revise "foreign service tour" (FST) limitations as per Army Regulation 600-110 (last updated in 2014), but has considered possible modifications for FSTs and changes to restrictions on special duty trainings.[36] Restrictions on flight status for aviators in all Services remain because of the challenges associated with identifying and monitoring the impact of potential HIV-associated neurocognitive disorders (HAND). Results of an ongoing Infectious Disease Clinical Research Program–sponsored study of HAND are expected to inform aviation and undersea policies. Pending the study findings, the Navy will consider HIV waiver requests on a case-by-case basis for all aviation members except pilots.[19]

Ongoing HIV studies in the Department of Defense

The U.S. Military HIV Natural History Study (NHS) is a continuous enrollment cohort study of HIV-infected active duty service members and beneficiaries. Started in 1986, the study has been in continuous operation for more than 30 years, collecting demographic, clinical, laboratory, pharmacy, questionnaire, and medical outcomes data, as well as storing plasma, serum, and

peripheral blood mononuclear cells at research study visits, which occur approximately every 6 months. The NHS has enrolled more than 6,100 HIV-infected volunteers and is notable for a high proportion of dated seroconverters (nearly 90%) with a negative HIV test preceding the first positive test. The population is racially and ethnically diverse (39% Caucasian, 44% African American, 10% Hispanic, 7% Other) and has excellent follow-up and data availability through the single-payer MHS, open access to healthcare and medications, and low illicit drug use due to the military drug screening program. Since its inception, the NHS has made considerable contributions to the published literature informing military clinical practice and policy by shedding light on the clinical course, outcomes, and pathogenesis of HIV-related complications. These contributions include early descriptions of the novel and highly predictive Walter Reed staging system,[37] one of the first reports of female-to-male transmission,[38] the evaluation of drug resistance testing (genotypic and phenotypic) and its clinical use in various patient populations,[39] and genetic studies, including identification of human leucocyte antigen types among African Americans associated with viral load set point (the level of viremia in untreated HIV).[40,41] With the success of antiretroviral therapy, the NHS has evolved its focus toward long-term health and function of infected service members, focusing on non-AIDS comorbidities that are more common among HIV-infected individuals (e.g., cardiovascular disease, cancer, kidney and liver disease). The cohort also serves as a foundation for studies seeking to understand the effects of long-term antiretroviral therapy on the HIV reservoir and in the study of novel therapeutic approaches to HIV cure, including therapeutic vaccination.

An effective HIV vaccine is needed to end the pandemic, protect deployed U.S. and allied service members, and stabilize countries impacted by HIV. In 2009, the U.S. Military HIV Research Program (MHRP), part of the WRAIR, announced results of an Army-sponsored clinical trial in Thailand that demonstrated for the first time a modest ability to protect against HIV infection, reducing the number of new infections by 31.2%. A new efficacy study using a similar vaccine regimen, called HVTN 702, began in November 2016 in South Africa and is being led by the National Institute of Allergy and Infectious Diseases (NIAID). The MHRP recently participated in a Phase II study that will result in an efficacy trial that will begin in 2018 to evaluate a next-generation adenovirus serotype 26 (Ad26)/protein vaccine candidate aimed at global protection from HIV infection. The MHRP has also developed a next-generation Modified Vaccinia Ankara (MVA) vaccine in collaboration with the Laboratory of Viral Diseases at NIAID, which has been tested in Africa and Sweden in combination with two investigational DNA vaccines. The MHRP plans to use this product in HIV remission studies in combination with the Ad26 vaccine candidate. WRAIR researchers are also developing and testing novel strategies, including new adjuvants and improved protein constructs aimed at HIV subtype B, which is the most common subtype of HIV infection circulating in the Americas, West and Central Europe, Australia, South America, and Thailand. To better understand how the immune system responds during the critical moments of early infection, the MHRP launched innovative studies of high-risk volunteers and HIV voluntary counseling and testing clinic attendees in Thailand and East Africa. By focusing on the earliest stages of infection, scientists hope to understand what is needed to create an effective HIV vaccine and possibly inform future investigations into a functional cure. In 2016, the MHRP launched functional cure studies within these cohorts. These small studies are evaluating strategies aimed at inducing HIV remission (controlling virus without the need for long-term antiretroviral treatment). Examples of the interventions are administering HIV vaccines or antibody against HIV. In addition, MHRP researchers are exploring immune responses during this early phase of infection, along with genetic changes in the virus.

Conclusions

Despite the tremendous advances observed in treatment, clinical outcomes, and life expectancy of those with HIV infection over the past three decades, many challenges remain in the military population. For HIV-infected military members, the Services are working to expand the currently limited scope of duties and to provide opportunities to serve overseas. The modification of military policies and procedures in support of HIV-infected members can be attributed to the many scientific and clinical advances made by the military research community. HIV prevention is now a major focus as incidence has yet to decline among those at highest risk of acquiring HIV. Delivery of screening and prevention services to the most at-risk populations is now possible since the repeal of DADT, but success is contingent on cultural change and enhanced implementation of novel prevention strategies, including HIV PrEP. As the landscape of HIV changes in the U.S., the military continues to adapt to improve HIV prevention programs and to provide the most comprehensive and state-of-the-art care to HIV-infected service members.

Disclaimer: The views expressed are those of the authors and should not be construed to represent the positions of the U.S. Army, U.S. Navy, U.S. Air Force, the Department of Defense, the Uniformed Services University of the Health Sciences, or the Henry M. Jackson Foundation for the Advancement of Military Medicine.

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REFERENCES

1. Centers for Disease Control and Prevention. HIV/AIDS Basic Statistics. 2017; https://www.cdc.gov/hiv/basics/statistics.html. Accessed on 10 August 2017.
2. Centers for Disease Control and Prevention. HIV Surveillance Report, 2015. Vol 27. Atlanta, GA: Division of HIV/AIDS Prevention, National Center for HIV/AIDS, Viral Hepatitis, STD, and TB Prevention, Centers for Disease Control and Prevention (CDC), U.S. Department of Health and Human Services; 2016.
3. Centers for Disease Control and Prevention. New HIV infections drop 18 percent in six years [press release]. 14 February 2017. https://www.cdc.gov/nchhstp/newsroom/2017/croi-hiv-incidence-press-release.html.
4. Skarbinski J, Rosenberg E, Paz-Bailey G, et al. Human immunodeficiency virus transmission at each step of the care continuum in the United States. *JAMA Intern Med*. 2015;175(4):588–596.
5. White House Office of National AIDS Policy. National HIV/AIDS Strategy for the United States: Updated to 2020–2016 Progress Report. December 2016; https://www.whitehouse.gov/sites/whitehouse.gov/files/images/nhas-2016-progress-report.pdf. Accessed on 10 August 2017.
6. Department of Defense. Department of Defense Instruction 6485.01: Human Immunodeficiency Virus (HIV) in Military Service Members. 2013.
7. Department of Defense, 2017. USCCPZM. Modification thirteen to USCENTCOM individual protection and individual/unit deployment policy. 2017.
8. Tanielian T, Jaycox LH, eds. Invisible wounds of war: psychological and cognitive injuries, their consequences, and services to assist recovery. RAND Center for Military Health Policy Research; 2008.
9. Branson BM. The Future of HIV testing. *J Acquir Immune Defic Syndr*. 2010;55(Suppl 2):S102–S105.
10. Hakre S, Paris RM, Brian JE, et al. Enhanced U.S. Army HIV diagnostic algorithm used to diagnose acute HIV infection in a deployed soldier. *Mil Med*. 2012;177(5):609–613.
11. Pilcher CD, Fiscus SA, Nguyen TQ, et al. Detection of acute infections during HIV testing in North Carolina. *New Engl J Med*. 2005;352(18):1873–1883.
12. Clotet B, Feinberg J, van Lunzen J, et al. Once-daily dolutegravir versus darunavir plus ritonavir in antiretroviral-naive adults with HIV-1 infection (FLAMINGO): 48 week results from the randomised open-label phase 3b study. *Lancet*. 2014;383(9936):2222–2231.
13. Sax PE, DeJesus E, Mills A, et al. Co-formulated elvitegravir, cobicistat, emtricitabine, and tenofovir versus co-formulated efavirenz, emtricitabine, and tenofovir for initial treatment of HIV-1 infection: a randomised, double-blind, phase 3 trial, analysis of results after 48 weeks. *Lancet*. 2012;379(9835):2439–2448.
14. Cohen MS, Chen YQ, McCauley M, et al. Antiretroviral Therapy for the Prevention of HIV-1 Transmission. *N Engl J Med*. 2016;375(9):830–839.
15. Cohen MS, Kaleebu P, Coates T. Prevention of the sexual transmission of HIV-1: preparing for success. *J Int AIDS Soc*. 2008;11:4.
16. Gilead Sciences I. Truvada Package Insert. 2004; https://www.gilead.com/~/media/Files/pdfs/medicines/hiv/truvada/truvada_pi.pdf. Accessed on 16 August 2017.
17. Grant RM, Lama JR, Anderson PL, et al. Preexposure chemoprophylaxis for HIV prevention in men who have sex with men. *N Engl J Med*. 2010;363(27):2587–2599.
18. Baeten JM, Donnell D, Ndase P, et al. Antiretroviral prophylaxis for HIV prevention in heterosexual men and women. *N Engl J Med*. 2012;367(5):399–410.
19. Navy Dot. U.S. Navy Aeromedical Reference and Waiver Guide–Miscellaneous Conditions, Section 17.4 Human Immunodeficiency Virus (HIV) Infection. March 2016.
20. Department of Defense. Qualification Standards for Enlistment, Appointment, and Induction. No. 1304.261993.
21. Brodine SK, Shaffer RA, Starkey MJ, et al. Drug resistance patterns, genetic subtypes, clinical features, and risk factors in military personnel with HIV-1 seroconversion. *Ann Intern Med*. 1999;131(7):502–506.
22. Brodine SK, Starkey MJ, Shaffer RA, et al. Diverse HIV-1 subtypes and clinical, laboratory and behavioral factors in a recently infected US military cohort. *AIDS*. 2003;17(17):2521–2527.
23. Levin LI, Peterman TA, Renzullo PO, et al. HIV-1 seroconversion and risk behaviors among young men in the U.S. Army. The Seroconversion Risk Factor Study Group. *Am J Public Health*. 1995;85(11):1500–1506.
24. Renzullo PO, McNeil JG, Levin LI, Bunin JR, Brundage JF. Risk factors for prevalent human immunodeficiency virus (HIV) infection in active duty Army men who initially report no identified risk: a case-control study. *J Acquir Immune Defic Syndr*. 1990;3(3):266–271.
25. Hakre S, Armstrong AW, O'Connell RJ, Michael NL, Scott PT, Brett-Major DM. A pilot online survey assessing risk factors for HIV acquisition in the Navy and Marine Corps, 2005–2010. *J Acquir Immune Defic Syndr*. 2012;61(2):125–130.
26. Hakre S, Scoville SL, Pacha LA, et al. Brief report: sexual risk behaviors of HIV seroconverters in the U.S. Army, 2012–2014. *J Acquir Immune Defic Syndr*. 2015;70(4):456–461.
27. Navy and Marine Corps Public Health Center. Assessment of Risk Behaviors and Sex-Seeking Practices Among Male Active Duty Sailors and Marines Infected with HIV, 2010–2016. 2017. http://www.med.navy.mil/sites/nmcphc/health-promotion/reproductive-sexual-health/Pages/sexual-health-indicators.aspx. Accessed on 8 August 2017.
28. Patterson SB, Rivera D, Sunil TS, Okulicz JF. Evaluation of extragenital screening for gonorrhea and chlamydia in HIV-infected active duty Air Force members. *MSMR*. 2014;21(11):7–9.
29. Hakre S, Casimier R, Danboise B, et al. Enhanced sexually transmitted infection screening for *Mycoplasma genitalium* in human immunodeficiency virus-infected U.S. Air Force personnel. *Clin Infect Dis*. 2017;(in press).
30. Pacha LA, Hakre S, Myles O, et al. Centralized HIV program oversight: an investigation of a case series of new HIV infections among U.S. Army soldiers, 2012 to 2013. *Medicine (Baltimore)*. 2015;94(46):e2093.
31. Hoover KW, Tao KL, Peters PJ. Nationally representative prevalence estimates of gay, bisexual, and other men who have sex with men who have served in the U.S. military. *PLoS One*. 2017;12(8):e0182222.
32. Workowski KA, Bolan GA; Centers for Disease Control and Prevention. Sexually transmitted diseases treatment guidelines, 2015. *MMWR Recomm Rep*. 2015;64(RR-03):1–137.
33. Defense Health Agency. Tri-Service Human Immunodeficiency Virus Working Group Charter. 2016.
34. Office of the Secretary of the Navy. SECNAV Instruction 5300.30E. Management of Human Immunodeficiency Virus, Hepatitis B Virus and Hepatitis C Virus Infection in the Navy and Marine Corps. Washington, DC. 13 August 2012.
35. Secretary of the Air Force. Air Force Instruction 44-178. Human Immunodeficiency Virus Program. 4 March 2014. http://static.e-publishing.af.mil/production/1/af_sg/publication/afi44-178/afi44-178.pdf.
36. Secretary of the Army. Army Regulation 600-110. Identification,Surveillance, and Administration of Personnel Infected with Human Immunodeficiency Virus. Washington, DC. 22 April 2014. https://www.army.mil/e2/downloads/rv7/r2/policydocs/r600_110.pdf.
37. Redfield RR, Wright DC, Tramont EC. The Walter Reed staging classification for HTLV-III/LAV infection. *N Engl J Med*. 1986;314(2):131–132.
38. Redfield RR, Markham PD, Salahuddin SZ, et al. Frequent transmission of HTLV-III among spouses of patients with AIDS-related complex and AIDS. *JAMA*. 1985;253(11):1571–1573.
39. Wegner SA, Wallace MR, Aronson NE, et al. Long-term efficacy of routine access to antiretroviral-resistance testing in HIV type 1-infected patients: results of the clinical efficacy of resistance testing trial. *Clin Infect Dis*. 2004;38(5):723–730.
40. Pelak K, Goldstein DB, Walley NM, et al. Host determinants of HIV-1 control in African Americans. *J Infect Dis*. 2010;201(8):1141–1149.
41. McLaren PJ, Coulonges C, Bartha I, et al. Polymorphisms of large effect explain the majority of the host genetic contribution to variation of HIV-1 virus load. *Proc Natl Acad Sci U S A*. 2015;112(47):14658–14663.

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 2012–June 2017

This report contains an update through June 2017 of the results of routine screening for antibodies to the human immunodeficiency virus among civilian applicants for military service and among members of the active and reserve components of the U.S. Armed Forces. During the surveillance period, annual seroprevalences among civilian applicants for military service peaked in 2015 (0.33 per 1,000 tested) and then decreased slightly in 2016. Seroprevalences among Marine Corps reservists, Navy active component service members, and Navy reservists also peaked in 2015. Overall (1 January 2012 through 30 June 2017) seroprevalences were highest for Army reservists, Army National Guard members, Navy reservists, and Navy active component members. Among active and reserve component service members, seroprevalences continue to be higher among males than females.

Since acquired immune deficiency syndrome (AIDS) was first recognized as a distinct clinical entity in 1981,[1] its spread has had major impacts on the health of populations and on healthcare systems worldwide. The human immunodeficiency virus type 1 (HIV-1) was identified as the cause of AIDS in 1983. For more than 30 years, the U.S. military has conducted routine screening for antibodies to HIV-1 to enable adequate and timely medical evaluations, treatment, and counseling; to prevent unwitting transmission; and to protect the battlefield blood supply.[2,3]

As part of the U.S. military's total-force HIV screening program, civilian applicants for military service are screened for antibodies to HIV during pre-accession medical examinations. Infection with HIV is medically disqualifying for entry into U.S. military service. Since 1986, all members of the active and reserve components of the U.S. Armed Forces have been periodically screened to detect newly acquired HIV infections. In 2004, the Department of Defense set a standard testing interval of 2 years for all service members.[4,5] All military personnel are periodically screened for HIV infection (at a minimum every 2 years, or on deployment, return from deployment, or after having received a diagnosis of various other conditions such as sexually transmitted infection).[5] Service members who are infected with HIV receive clinical assessments, treatments, and counseling; they may remain in service as long as they are capable of performing their military duties.[2,3]

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

This report summarizes numbers, prevalences, and trends of newly identified HIV antibody positivity among civilian applicants for military service and members of the active and reserve components of the U.S. Armed Forces from 1 January 2012 through 30 June 2017. Summaries of results of routine screening for antibodies to HIV among civilian applicants and active and reserve component members of the U.S. military since 1990 are available at www.health.mil/MSMRArchives.

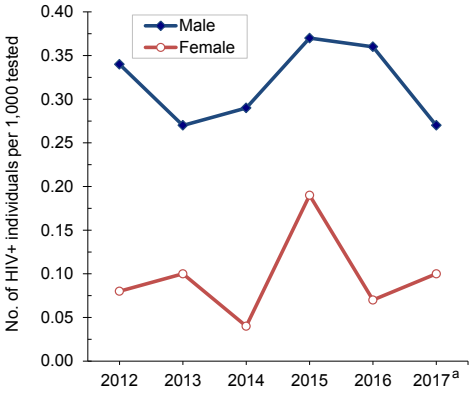
METHODS

The surveillance period was 1 January 2012 through 30 June 2017. The surveillance population included all civilian applicants for U.S. military service and all individuals who were screened for antibodies to HIV while serving in the active or reserve component of the Army, Navy, Air Force, or Marine Corps during the surveillance period.

All individuals who were tested and all first-time detections of antibodies to HIV through U.S. military medical testing programs were ascertained by matching specimen numbers and serologic test results to the personal identifiers of providers of the specimens. All results were accessed from records routinely maintained in the Defense Medical Surveillance System (DMSS).

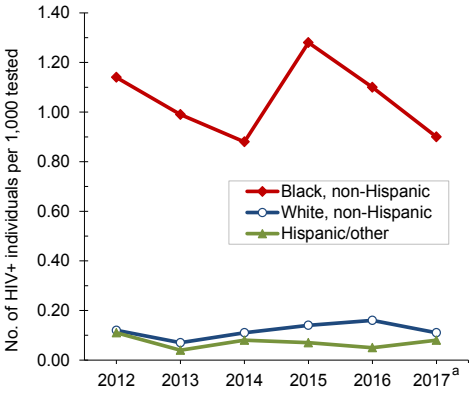
An incident case of HIV antibody seropositivity was defined as two positive results from serologic testing of two different specimens from the same individual, or one positive result from serologic testing of

FIGURE 1. Diagnoses of human immunodeficiency virus (HIV) infections, by sex, civilian applicants for U.S. military service, January 2012–June 2017



[a]Through 30 June 2017

FIGURE 2. Diagnoses of human immunodeficiency virus (HIV) infections, by race/ethnicity, civilian applicants for U.S. military service, January 2012–June 2017



[a]Through 30 June 2017

the most recent specimen provided by an individual.

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

RESULTS

Civilian applicants

From January 2016 through June 2017, a total of 464,838 civilian applicants for U.S. military service were tested for antibodies to HIV, and 128 applicants were identified as HIV antibody positive (seroprevalence: 0.28 per 1,000 applicants tested) **(Table 1)**. During the surveillance period, annual seroprevalences among applicants for service peaked in 2015 (0.33 per 1,000 tested) and then decreased slightly in 2016 (0.30 per 1,000 tested) **(Table 1)**.

Throughout the period, seroprevalences were much higher among males than

TABLE 1. Diagnoses of human immunodeficiency virus (HIV) infections, by sex, civilian applicants for U.S. military service, January 2012–June 2017[a]

Year	Total HIV tests	Total persons tested	Males tested	Females tested	Total HIV(+)	HIV(+) male	HIV(+) female	Overall rate per 1,000 tested	Male rate per 1,000 tested	Female rate per 1,000 tested
2012	**268,265**	**260,861**	210,355	50,506	**75**	71	4	**0.29**	0.34	0.08
2013	**275,537**	**267,283**	215,005	52,278	**62**	57	5	**0.23**	0.27	0.10
2014	**240,440**	**234,770**	186,965	47,805	**57**	55	2	**0.24**	0.29	0.04
2015	**255,027**	**248,234**	196,723	51,511	**83**	73	10	**0.33**	0.37	0.19
2016	**278,839**	**272,427**	216,390	56,037	**82**	78	4	**0.30**	0.36	0.07
2017[a]	**195,372**	**192,411**	153,270	39,141	**46**	42	4	**0.24**	0.27	0.10
Total	**1,513,480**	**1,475,986**	1,178,708	297,278	**405**	376	29	**0.27**	0.32	0.10

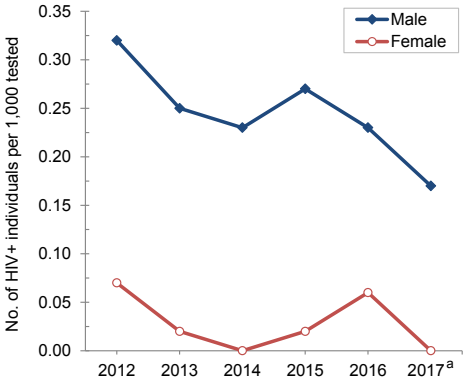
[a]Through 30 June 2017

TABLE 2. Diagnoses of human immunodeficiency virus (HIV) infections, by race/ethnicity, civilian applicants for U.S. military service, January 2012–June 2017[a]

Year	Total persons tested	Non-Hispanic white tested	Non-Hispanic black tested	Hispanic/ others tested	Total HIV(+)	Non-Hispanic white HIV(+)	Non-Hispanic black HIV(+)	Hispanic/ others HIV(+)	Overall rate per 1,000 tested	Non-Hispanic white rate per 1,000 tested	Non-Hispanic black rate per 1,000 tested	Hispanic/ others rate per 1,000 tested
2012	**260,862**	165,034	42,840	52,988	**75**	20	49	6	**0.29**	0.12	1.14	0.11
2013	**267,283**	162,084	48,685	56,514	**62**	12	48	2	**0.23**	0.07	0.99	0.04
2014	**234,770**	141,154	43,106	50,510	**57**	15	38	4	**0.24**	0.11	0.88	0.08
2015	**248,234**	146,646	45,274	56,314	**83**	21	58	4	**0.33**	0.14	1.28	0.07
2016	**272,427**	164,418	47,110	60,899	**82**	27	52	3	**0.30**	0.16	1.10	0.05
2017[a]	**192,413**	123,769	32,380	36,264	**46**	14	29	3	**0.24**	0.11	0.90	0.08
Total	**1,475,989**	903,105	259,395	313,489	**405**	109	274	22	**0.27**	0.12	1.06	0.07

[a]Through 30 June 2017

FIGURE 3. New diagnoses of human immunodeficiency virus (HIV) infections, by sex, active component, U.S. Army, January 2012–June 2017



[a]Through 30 June 2017

females and among non-Hispanic blacks than other race/ethnicity groups **(Tables 1 and 2; Figures 1 and 2)**. Of note, during 2016–2017, seroprevalences decreased by 25.0% among male applicants, increased by 42.9% among female applicants, and decreased by 18.2% among black, non-Hispanic applicants. During 2016, on average, one civilian applicant for service was detected with antibodies to HIV per 3,400 screening tests **(Table 1)**.

U.S. Army

Active component: From January 2016 through June 2017, a total of 543,025 soldiers in the active component of the U.S. Army were tested for antibodies to HIV, and 101 soldiers were identified as HIV antibody positive (seroprevalence: 0.19 per 1,000 soldiers tested) **(Table 3)**. Full-year seroprevalences fluctuated between 0.29 per 1,000 tested in 2012 and 0.20 per 1,000 tested in 2014 (31.0% decrease) **(Table 3)**. Annual seroprevalences for male active component Army members greatly exceed those of females **(Figure 3)**. During 2016, on average, one new HIV infection was detected among active component Army soldiers per 5,879 screening tests **(Table 3)**. Of the 460 active component soldiers diagnosed with HIV infections since 2012, a

TABLE 3. New diagnoses of human immunodeficiency virus (HIV) infections, by sex, active component, U.S. Army, January 2012–June 2017[a]

Year	Total HIV tests	Total persons tested	Males tested	Females tested	Total new HIV(+)	New HIV(+) male	New HIV(+) female	Overall rate per 1,000 tested	Male rate per 1,000 tested	Female rate per 1,000 tested	HIV(+) still in military service in 2017
2012	519,104	416,744	359,473	57,271	119	115	4	0.29	0.32	0.07	39
2013	508,965	405,824	349,389	56,435	87	86	1	0.21	0.25	0.02	32
2014	447,730	361,941	309,979	51,962	71	71	0	0.20	0.23	0.00	38
2015	426,462	349,811	298,195	51,616	82	81	1	0.23	0.27	0.02	56
2016	423,261	345,950	294,251	51,699	72	69	3	0.21	0.23	0.06	61
2017[a]	217,282	197,075	165,922	31,153	29	29	0	0.15	0.17	0.00	29
Total	2,542,804	2,077,345	1,777,209	300,136	460	451	9	0.22	0.25	0.03	255

[a]Through 30 June 2017

TABLE 4. New diagnoses of human immunodeficiency virus (HIV) infections, by sex, U.S. Army National Guard, January 2012–June 2017[a]

Year	Total HIV tests	Total persons tested	Males tested	Females tested	Total new HIV(+)	New HIV(+) male	New HIV(+) female	Overall rate per 1,000 tested	Male rate per 1,000 tested	Female rate per 1,000 tested	HIV(+) still in military service in 2017
2012	192,376	163,331	137,938	25,393	52	52	0	0.32	0.38	0.00	9
2013	173,618	147,729	122,223	25,506	52	51	1	0.35	0.42	0.04	18
2014	265,934	239,346	199,819	39,527	93	92	1	0.39	0.46	0.03	46
2015	205,549	181,785	151,135	30,650	68	66	2	0.37	0.44	0.07	38
2016	230,438	207,561	172,208	35,353	80	78	2	0.39	0.45	0.06	65
2017[a]	120,175	114,357	95,036	19,321	45	43	2	0.39	0.45	0.10	44
Total	1,188,090	1,054,109	878,359	175,750	390	382	8	0.37	0.43	0.05	220

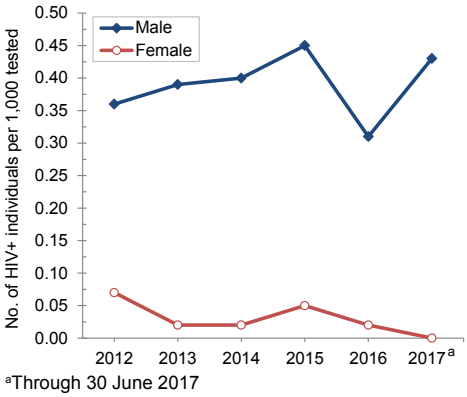
[a]Through 30 June 2017

TABLE 5. New diagnoses of human immunodeficiency virus (HIV) infections, by sex, U.S. Army Reserve, January 2012–June 2017[a]

Year	Total HIV tests	Total persons tested	Males tested	Females tested	Total new HIV(+)	New HIV(+) male	New HIV(+) female	Overall rate per 1,000 tested	Male rate per 1,000 tested	Female rate per 1,000 tested	HIV(+) still in military service in 2017
2012	86,125	73,662	57,112	16,550	43	42	1	0.58	0.74	0.06	15
2013	127,374	113,176	87,343	25,833	54	50	4	0.48	0.57	0.15	26
2014	120,291	107,303	81,909	25,394	46	43	3	0.43	0.52	0.12	25
2015	121,897	110,161	84,774	25,387	42	42	0	0.38	0.50	0.00	33
2016	120,510	109,467	83,470	25,997	44	44	0	0.40	0.53	0.00	40
2017[a]	54,206	51,226	39,086	12,140	17	16	1	0.33	0.41	0.08	17
Total	630,403	564,995	433,694	131,301	246	237	9	0.44	0.55	0.07	156

[a]Through 30 June 2017

FIGURE 4. New diagnoses of human immunodeficiency virus (HIV) infections, by sex, active component, U.S. Navy, January 2012–June 2017

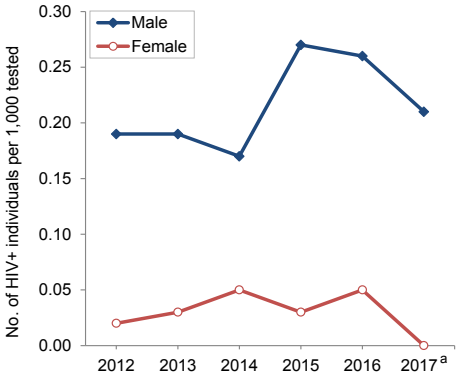


[a]Through 30 June 2017

FIGURE 5. New diagnoses of human immunodeficiency virus (HIV) infections, by sex, active component, U.S. Marine Corps, January 2012–June 2017

[a]Through 30 June 2017

FIGURE 6. New diagnoses of human immunodeficiency virus (HIV) infections, by sex, active component, U.S. Air Force, January 2012–June 2017



[a]Through 30 June 2017

total of 255 (55.4%) were still in military service in 2017.

Army National Guard: From January 2016 through June 2017, a total of 321,918 members of the U.S. Army National Guard were tested for antibodies to HIV, and 125 soldiers were identified as HIV antibody positive (seroprevalence: 0.39 per 1,000 soldiers tested) **(Table 4)**. Among Army National Guard soldiers, annual seroprevalences increased each year, from 2012 through 2014 (seroprevalences: 0.32 and 0.39 per 1,000 soldiers tested, respectively), decreased somewhat in 2015 and then increased slightly in 2016. On average, during 2016, one new HIV infection was detected among Army National Guard soldiers per 2,880 screening tests **(Table 4)**. Of the 390 National Guard soldiers who tested positive for HIV since 2012, a total of 220 (56.4%) were still in military service in 2017.

Army Reserve: From January 2016 through June 2017, a total of 160,693 members of the U.S. Army Reserve were tested for antibodies to HIV, and 61 soldiers were identified as HIV antibody positive (seroprevalence: 0.38 per 1,000 soldiers tested) **(Table 5)**. Among Army reservists, the seroprevalence in 2012 (0.58 per 1,000 tested) was higher than in any other year of routine HIV antibody screening of Army reservists since 1991 **(data not shown)**. However, the seroprevalence among Army reservists tested from January 2016 through June 2017 was 34.5% lower than in 2012 **(Table 5)**. During 2016, on average, one new HIV infection was detected among Army reservists per 2,488 screening tests **(Table 5)**. Of the 246 Army reservists diagnosed with HIV infections since 2012, a total of 156 (63.4%) were still in military service in 2017.

U.S. Navy

Active component: From January 2016 through June 2017, a total of 338,628 active component members of the U.S. Navy were tested for antibodies to HIV, and 97 sailors were identified as HIV antibody positive (seroprevalence: 0.29 per 1,000 sailors tested) **(Table 6)**. Among tested male active component sailors, the annual HIV antibody seroprevalence increased each year between 2012 and 2015, declined 31.1% in 2016 and then increased 38.7% in 2017 **(Figure 4)**. During 2016, on average, one new HIV infection was detected among active component sailors per 3,941 screening tests **(Table 6)**. Of the 391 active component sailors who tested positive for HIV since 2012, a total of 255 (65.2%) were still in military service in 2017.

Navy Reserve: From January 2016 through June 2017, a total of 56,341 members of the U.S. Navy Reserve were tested for antibodies to HIV, and 10 sailors were identified as HIV antibody positive (seroprevalence: 0.18 per 1,000 sailors tested) **(Table 7)**. The HIV antibody seroprevalence among Navy reservists in 2015 was two times that in 2016 (seroprevalences: 0.46 and 0.22 per 1,000 sailors tested, respectively). The seroprevalence in 2017 (through June) was lower than in any full year of routine HIV antibody screening of Navy reservists since 1998 **(data not shown)**. Of note, no antibodies to HIV were detected among female Navy reservists during 2012–2017 **(Table 7)**. On average, during 2016, one new HIV infection was detected among Navy reservists per 5,162 screening tests **(Table 7)**. Of the 68 reserve component sailors diagnosed with HIV infections since 2012, a total of 47 (69.1%) were still in military service in 2017.

U.S. Marine Corps

Active component: From January 2016 through June 2017, a total of 216,315 members of the active component of the U.S. Marine Corps were tested for antibodies to HIV, and 27 Marines were identified as HIV antibody positive (seroprevalence: 0.12 per 1,000 Marines tested) **(Table 8)**. From January 2012 through June 2017, prevalences of antibodies to HIV remained relatively low and stable among routinely tested Marines **(Figure 5)**. During 2016, on average, one new HIV infection was detected among active component Marines per 9,854 screening tests **(Table 8)**. Of the 117 active component Marines diagnosed with HIV infections since 2012, a total of 60 (51.3%) were still in military service in 2017.

Marine Corps Reserve: From January 2016 through June 2017, a total of 38,650 members of the U.S. Marine Corps Reserve were tested for antibodies to HIV, and 11 Marines were identified as HIV antibody

TABLE 6. New diagnoses of human immunodeficiency virus (HIV) infections, by sex, active component, U.S. Navy, January 2012–June 2017[a]

Year	Total HIV tests	Total persons tested	Males tested	Females tested	Total new HIV(+)	New HIV(+) male	New HIV(+) female	Overall rate per 1,000 tested	Male rate per 1,000 tested	Female rate per 1,000 tested	HIV(+) still in military service in 2017
2012	273,841	234,272	192,654	41,618	72	69	3	0.31	0.36	0.07	29
2013	248,137	217,548	177,268	40,280	70	69	1	0.32	0.39	0.02	38
2014	250,386	222,117	180,803	41,314	73	72	1	0.33	0.40	0.02	44
2015	241,711	214,218	172,621	41,597	79	77	2	0.37	0.45	0.05	54
2016	239,410	212,818	171,549	41,269	54	53	1	0.25	0.31	0.02	47
2017[a]	134,686	125,810	100,290	25,520	43	43	0	0.34	0.43	0.00	43
Total	1,388,171	1,226,783	995,185	231,598	391	383	8	0.32	0.38	0.03	255

[a]Through 30 June 2017

TABLE 7. New diagnoses of human immunodeficiency virus (HIV) infections, by sex, U.S. Navy Reserve, January 2012–June 2017[a]

Year	Total HIV tests	Total persons tested	Males tested	Females tested	Total new HIV(+)	New HIV(+) male	New HIV(+) female	Overall rate per 1,000 tested	Male rate per 1,000 tested	Female rate per 1,000 tested	HIV(+) still in military service in 2017
2012	48,242	41,339	33,316	8,023	13	13	0	0.31	0.39	0.00	7
2013	45,173	38,551	30,703	7,848	12	12	0	0.31	0.39	0.00	4
2014	42,807	37,608	29,912	7,696	17	17	0	0.45	0.57	0.00	13
2015	39,028	34,625	27,328	7,297	16	16	0	0.46	0.59	0.00	14
2016	41,292	35,680	27,942	7,738	8	8	0	0.22	0.29	0.00	7
2017[a]	22,891	20,661	16,229	4,432	2	2	0	0.10	0.12	0.00	2
Total	239,433	208,464	165,430	43,034	68	68	0	0.33	0.41	0.00	47

[a]Through 30 June 2017

TABLE 8. New diagnoses of human immunodeficiency virus (HIV) infections, by sex, active component, U.S. Marine Corps, January 2012–June 2017[a]

Year	Total HIV tests	Total persons tested	Males tested	Females tested	Total new HIV(+)	New HIV(+) male	New HIV(+) female	Overall rate per 1,000 tested	Male rate per 1,000 tested	Female rate per 1,000 tested	HIV(+) still in military service in 2017
2012	202,314	166,051	154,098	11,953	25	25	0	0.15	0.16	0.00	5
2013	180,549	151,897	140,326	11,571	22	21	1	0.14	0.15	0.09	7
2014	173,351	146,849	135,132	11,717	22	22	0	0.15	0.16	0.00	10
2015	162,065	140,440	129,484	10,956	21	21	0	0.15	0.16	0.00	13
2016	157,659	138,112	126,691	11,421	16	15	1	0.12	0.12	0.09	14
2017[a]	85,490	78,203	71,321	6,882	11	11	0	0.14	0.15	0.00	11
Total	961,428	821,552	757,052	64,500	117	115	2	0.14	0.15	0.03	60

[a]Through 30 June 2017

TABLE 9. New diagnoses of human immunodeficiency virus (HIV) infections, by sex, U.S. Marine Corps Reserve, January 2012–June 2017[a]

Year	Total HIV tests	Total persons tested	Males tested	Females tested	Total new HIV(+)	New HIV(+) male	New HIV(+) female	Overall rate per 1,000 tested	Male rate per 1,000 tested	Female rate per 1,000 tested	HIV(+) still in military service in 2017
2012	30,323	25,838	24,806	1,032	4	4	0	0.15	0.16	0.00	0
2013	27,669	24,171	23,181	990	4	4	0	0.17	0.17	0.00	0
2014	27,337	24,389	23,454	935	7	7	0	0.29	0.30	0.00	4
2015	26,809	24,018	23,141	877	11	10	1	0.46	0.43	1.14	5
2016	26,283	23,140	22,299	841	6	6	0	0.26	0.27	0.00	4
2017[a]	16,436	15,510	14,976	534	5	5	0	0.32	0.33	0.00	5
Total	154,857	137,066	131,857	5,209	37	36	1	0.27	0.27	0.19	18

[a]Through 30 June 2017

TABLE 10. New diagnoses of human immunodeficiency virus (HIV) infections, by sex, active component, U.S. Air Force, January 2012–June 2017[a]

Year	Total HIV tests	Total persons tested	Males tested	Females tested	Total new HIV(+)	New HIV(+) male	New HIV(+) female	Overall rate per 1,000 tested	Male rate per 1,000 tested	Female rate per 1,000 tested	HIV(+) still in military service in 2017
2012	264,126	213,960	172,685	41,275	34	33	1	0.16	0.19	0.02	14
2013	255,720	208,558	168,678	39,880	33	32	1	0.16	0.19	0.03	18
2014	243,141	201,184	162,510	38,674	29	27	2	0.14	0.17	0.05	16
2015	231,752	192,811	155,489	37,322	43	42	1	0.22	0.27	0.03	34
2016	239,254	193,941	155,849	38,092	42	40	2	0.22	0.26	0.05	37
2017[a]	131,628	116,777	93,482	23,295	20	20	0	0.17	0.21	0.00	20
Total	1,365,621	1,127,231	908,693	218,538	201	194	7	0.18	0.21	0.03	139

[a]Through 30 June 2017

TABLE 11. New diagnoses of human immunodeficiency virus (HIV) infections, by sex, U.S. Air National Guard, January 2012–June 2017[a]

Year	Total HIV tests	Total persons tested	Males tested	Females tested	Total new HIV(+)	New HIV(+) male	New HIV(+) female	Overall rate per 1,000 tested	Male rate per 1,000 tested	Female rate per 1,000 tested	HIV(+) still in military service in 2017
2012	44,238	60,280	49,296	10,984	9	9	0	0.15	0.18	0.00	2
2013	39,923	53,947	43,777	10,170	4	4	0	0.07	0.09	0.00	1
2014	41,242	57,548	46,489	11,059	2	2	0	0.03	0.04	0.00	1
2015	36,579	53,483	43,098	10,385	6	6	0	0.11	0.14	0.00	5
2016	40,948	60,470	48,560	11,910	6	6	0	0.10	0.12	0.00	5
2017[a]	21,678	33,152	26,516	6,636	2	2	0	0.06	0.08	0.00	2
Total	224,608	318,880	257,736	61,144	29	29	0	0.09	0.11	0.00	16

[a]Through 30 June 2017

TABLE 12. New diagnoses of human immunodeficiency virus (HIV) infections, by sex, U.S. Air Force Reserve, January 2012–June 2017[a]

Year	Total HIV tests	Total persons tested	Males tested	Females tested	Total new HIV(+)	New HIV(+) male	New HIV(+) female	Overall rate per 1,000 tested	Male rate per 1,000 tested	Female rate per 1,000 tested	HIV(+) still in military service in 2017
2012	44,238	38,986	29,272	9,714	13	13	0	0.33	0.44	0.00	3
2013	39,923	35,234	26,381	8,853	14	14	0	0.40	0.53	0.00	3
2014	41,242	36,717	27,446	9,271	8	8	0	0.22	0.29	0.00	5
2015	36,579	32,681	24,266	8,415	3	2	1	0.09	0.08	0.12	3
2016	40,948	36,227	26,654	9,573	10	10	0	0.28	0.38	0.00	10
2017[a]	21,678	20,335	15,023	5,312	4	4	0	0.20	0.27	0.00	4
Total	224,608	200,180	149,042	51,138	52	51	1	0.26	0.34	0.02	28

[a]Through 30 June 2017

positive (seroprevalence: 0.28 per 1,000 Marines tested) **(Table 9)**. During the surveillance period, annual seroprevalences among Marine Corps reservists peaked in 2015 (0.46 per 1,000 tested), decreased in 2016 (0.26 per 1,000 tested), and then increased in 2017 (0.32 per 1,000 tested). Of note, only one female Marine Corps reservist was detected with antibodies to HIV during routine screening in 2015; none were detected during 1990–2014 or during 2016–2017 (through June) **(data not shown)**. During 2016, on average, one new HIV infection was detected among Marine Corps reservists per 4,381 screening tests **(Table 9)**. Of the 37 Marine Corps reservists diagnosed with HIV infection since 2012, a total of 18 (48.7%) were still in military service in 2017.

U.S. Air Force

Active component: From January 2016 through June 2017, a total of 310,718 active component members of the U.S. Air Force were tested for antibodies to HIV, and 62 airmen were diagnosed with HIV infections (seroprevalence: 0.20 per 1,000 airmen tested) **(Table 10)**. From 2012 through June 2017, annual seroprevalences ranged from

0.14 per 1,000 tested to 0.22 per 1,000 tested. HIV antibody seroprevalence rose among tested males after 2014 and remained relatively low and stable among females **(Figure 6)**. During 2016, on average, one new HIV infection was detected among active Air Force members per 5,697 screening tests **(Table 10)**. Of the 201 active component airmen diagnosed with HIV infections since 2012, 139 (69.2%) were still in military service in 2017.

Air National Guard: From January 2016 through June 2017, a total of 93,622 members of the Air National Guard were tested for antibodies to HIV, and eight airmen were diagnosed with HIV infections (seroprevalence: 0.09 per 1,000 airmen tested) **(Table 11)**. Since 2010, no female Air National Guard member has been detected with antibodies to HIV during routine testing **(data not shown)**. During 2016, on average, one new HIV infection was detected among Air National Guard members per 6,825 screening tests **(Table 11)**. Of the 29 Air National Guard members diagnosed with HIV infections since 2012, a total of 16 (55.2%) were still in military service in 2017.

Air Force Reserve: From January 2016 through June 2017, a total of 56,562 members of the Air Force Reserve were tested for antibodies to HIV, and 14 airmen were diagnosed with HIV infections (seroprevalence: 0.25 per 1,000 airmen tested) **(Table 12)**. During 2016, on average, one new HIV infection was detected among Air Force reservists per 4,095 screening tests **(Table 12)**. Of the 52 reserve component airmen diagnosed with HIV infections since 2012, a total of 28 (53.8%) were still in military service in 2017.

EDITORIAL COMMENT

For more than 30 years, the U.S. military has conducted routine screening for antibodies to HIV among all civilian applicants for service and all active and reserve component members of the services.[2-5] For more than two decades, results of U.S. military HIV antibody testing programs have been summarized in the *MSMR*.[6]

This report documents that, since 2012, prevalences of HIV seropositivity among civilian applicants for military service have fluctuated between 0.23 and 0.33 per 1,000 applicants tested. During this period, full-year seroprevalences among civilian applicants peaked in 2015 and then decreased slightly in 2016. It is important to note that, because applicants for military service are not randomly selected from the general population of U.S. young adults, seroprevalences among applicants are not directly indicative of HIV prevalences, infection rates, or trends in the general U.S. population. As such, relatively low prevalences of HIV among civilian applicants for military service do not necessarily indicate low prevalences or incidence rates of HIV among young adults in the U.S. in general.

This report also documents that full-year seroprevalences among the active components of all of the services were relatively stable during the 6-year period. As was observed for civilian applicants, annual seroprevalences among Marine Corps reservists, Navy active component service members, and Navy reservists peaked in 2015. Seroprevalences among the Army Reserve showed a consistent decrease from 2012 to 2017 and the Navy Reserve exhibited a pronounced decrease in seroprevalences since 2015. Overall (January 2012 through June 2017) seroprevalences were highest for Army reservists, Army National Guard members, Navy reservists, and Navy active component members. Among active and reserve component service members, seroprevalences continue to be higher among males than females. Again, however, such results should be interpreted with consideration of the limitations of the surveillance data summarized herein. For example, because of the frequency of screening in the military (as an applicant, routinely every 2 years, and before and after overseas deployments), routine screening now detects relatively recently acquired HIV infections (i.e., infections acquired since the most recent negative test of each affected individual). As such, annual HIV-antibody seroprevalences during routine screening of military populations are reflective of, but are not direct unbiased estimates of, incidence rates and trends of acquisitions of HIV infections among military members.

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

REFERENCES

1. Centers for Disease Control and Prevention. Kaposi's sarcoma and pneumocystis pneumonia among homosexual men—New York City and California. *MMWR*. 1981;30(25):305–308.
2. Tramont EC, Burke DS. AIDS/HIV in the U.S. military. *Vaccine*. 1993;11(5):529–533.
3. Brown AE, Brundage JF, Tomlinson JP, Burke DS. The U.S. Army HIV testing program: the first decade. *Mil Med*. 1996;161(2):117–122.
4. Office of the Assistant Secretary of Defense, Health Affairs Policy Memorandum—Human Immunodeficiency Virus Interval Testing, dated 29 March 2004.
5. U.S. Department of Defense, Instruction No. 6485.01; October 2006.
6. Army Medical Surveillance Activity. Supplement: HIV-1 in the Army. *MSMR*. 1995;1(3):12–15.

Sexually Transmitted Infections, Active Component, U.S. Armed Forces, 2007–2016

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This report summarizes incidence rates of the five most commonly diagnosed sexually transmitted infections (STIs) among active component service members of the U.S. Armed Forces during 2007–2016. Chlamydia diagnoses were the most common, followed in decreasing order of frequency by diagnoses associated with genital human papillomavirus (HPV), gonorrhea, herpes simplex virus (HSV), and syphilis. Compared to men, women had higher rates of all STIs except for syphilis. In general, compared to their respective counterparts, younger service members, non-Hispanic blacks, soldiers, and enlisted members had higher incidence rates of STIs. Rates of STIs among men were stable throughout the surveillance period except for rates of syphilis, which increased. Among women, the incidence rates for HSV, syphilis, and chlamydia were stable, but the rates of HPV and gonorrhea decreased considerably. Similarities to, and differences from, the last *MSMR* update on STIs are discussed.

Sexually transmitted infections (STIs) continue to be of high importance to the U.S. Armed Forces because of their relatively high incidence, adverse impact on service members' availability and ability to perform their duties, and potential for serious medical sequelae if untreated.[1] Two of the most common bacterial STIs are *Chlamydia trachomatis* (chlamydia) and *Neisseria gonorhoeae* (gonorrhea). Between 2000 and 2012, there were almost 200,000 incident infections of chlamydia and 42,000 incident infections of gonorrhea in the active component, with no apparent decrease in incidence rates during the surveillance period.[1]

Another bacterial STI of relative importance is syphilis, which is caused by the bacterium *Treponema pallidum*. Rates of primary and secondary syphilis in the U.S. increased 67% from 4.5 cases per 100,000 persons in 2011 to 7.5 cases per 100,000 persons in 2015.[2] In the active component of the U.S. Armed Forces, crude incidence rates of syphilis (any type) increased by more than 50% between January 2010 and August 2015, from 30.9 to 47.4 cases per 100,000 person-years (p-yrs).[3] Fortunately, these three relatively common bacterial STIs are curable with antibiotics.[4] However, the threat of multidrug-resistant gonorrhea has emerged in recent years.[5]

Common viral STIs in the U.S. include human papillomavirus (HPV) and genital herpes simplex virus (HSV). Human papillomaviruses are DNA viruses that infect basal epithelial (skin or mucosal) cells. HPV genotypes 6 and 11 are responsible for 90% of all genital warts infections.[6] HSV can cause genital or oral herpes infections, which usually manifest with the appearance of one or more vesicles that can break and leave painful ulcers. Most genital herpes infections are caused by type 2 (HSV-2); however, type 1 (HSV-1), which is most often associated with oral herpes infection, is estimated to be responsible for 50% of new genital herpes infections.[7] Neither HPV nor HSV viral infections are curable with antibiotics; however, suppression of recurrent herpes manifestations is attainable using antiviral medication, and there is a vaccine to prevent infection with four of the most common HPV serotypes. The overall incidence rates of HPV and HSV in the active component during 2000–2012 were 175.5 and 22.4 cases per 10,000 p-yrs, respectively.[1]

This article summarizes incident cases and incidence rates of five of the most common STIs among active component military members during 2007–2016.

METHODS

The surveillance period was the 10-year interval from 1 January 2007 through 31 December 2016. The surveillance population consisted of all active component service members who served at any time during the period. Diagnoses of STIs were derived from medical administrative data and reports of notifiable medical events routinely provided to the Armed Forces Health Surveillance Branch (AFHSB) and maintained in the Defense Medical Surveillance System (DMSS) for surveillance purposes. For each service member, the number of days in active military service was ascertained and then aggregated into a total for all service members in each calendar year. The resultant annual totals were expressed as p-yrs of service and used as the denominators for the calculation of annual incidence rates. Person-time that was not considered to be time at risk for each STI was excluded (i.e., the 30 days following each incident chlamydia and gonorrhea infection; 365 days following incident primary, secondary, latent, and unspecified syphilis infection; and all person-time following the first diagnosis of HSV, HPV, or late syphilis, for each of the respective STIs).

Cases of each STI that occurred during periods of deployment to a U.S. Central Command (CENTCOM) theater of operations were evaluated separately. These

diagnoses were derived from records of medical encounters of deployed service members that were documented in the Theater Medical Data Store (TMDS).

For surveillance purposes, an incident case of chlamydia was defined by case-defining diagnostic codes **(Table 1)** in either the first or second diagnostic position of a record of an outpatient encounter or a notifiable disease report for chlamydia. An incident case of gonorrhea was defined by case-defining diagnostic codes in either the first or second diagnostic position of a record of an inpatient or outpatient encounter or a notifiable disease report for gonorrhea. For both chlamydia and gonorrhea, an individual could be counted as having a second (or subsequent) case only if there were more than 30 days between the dates of encounters in which the diagnosis was recorded.

Incident cases of HSV and HPV were identified by the presence of the requisite ICD-9 or ICD-10 codes in either the first or second diagnostic positions of a record of an outpatient encounter. Encounters for HPV with evidence of an immunization for HPV within 7 days before or after were excluded, as well as encounters with a procedural or CPT code indicating HPV vaccination, as these encounters were potentially related to the vaccination administration. An individual could be an incident case of HSV or HPV only once during the surveillance period. Individuals who had diagnoses of HSV or HPV infection prior to the surveillance period were excluded from the analysis.

An incident case of syphilis was defined by the presence of the requisite ICD-9 or ICD-10 code in the first, second, or third diagnostic positions of a hospitalization; the first or second position of an outpatient encounter; or, by a notifiable disease report. For primary or secondary, latent, and unspecified syphilis, an individual could be counted as having a second (or subsequent) case only if there were more than 365 days between the dates of the encounters in which the diagnosis was recorded. For late syphilis, an individual could be diagnosed as an incident case only once during the surveillance period. Individuals with late syphilis diagnoses prior to the surveillance period were excluded. Once an individual was diagnosed with late syphilis, he or she was not eligible to be subsequently counted for any other syphilis type. However, an individual could be counted multiple times for primary or secondary, latent, or unspecified syphilis.

TABLE 1. ICD-9 and ICD-10 diagnostic codes used to identify cases of sexually transmitted infection (STI) in electronic healthcare records, active component, U.S. Armed Forces, 2007–2016

Name of STI	ICD-9 codes	ICD-10 codes
Human papillomavirus	078.11, 079.4, 795.05, 795.09, 795.15, 795.19, 796.75, 796.79	A63.0, R85.81, R85.82, R87.81, R87.810, R87.811, R87.82, R87.820, R87.821, B97.7
Chlamydia	099.41, 099.5*	A56.**
Genital herpes simplex virus	054.1*	A60.**
Gonorrhea	098.**	A54.**
Syphilis, all types	All of those below	
Primary/secondary syphylis	091.*	A51.** (excluding A51.5 and A51.31)
Latent syphilis	092.*	A51.5, A53.0
Late syphilis	093.*–096.*, 097.0	A52.*
Unspecified syphilis	097.9	A53.9

*Any digit/character

RESULTS

During the surveillance period, the number of incident diagnoses of chlamydia infection in active component service members was greater than that for any other single STI and nearly 2.5 times the total number of diagnoses of genital HPV infections, the next most frequently diagnosed STI **(Table 2).** Excluding syphilis, the incidence rates for each STI were markedly higher among women than men. For chlamydia and gonorrhea, incidence rates were highest among those younger than 20 years and those aged 20–24 years and declined with increasing age. However, rates of syphilis, HSV, and genital HPV were highest among those aged 20–24 years and those aged 25–29 years. Rates of all STIs were highest among non-Hispanic black service members. For most of the STIs, rates tended to be highest among members of the Army. The exceptions were that syphilis incidence was higher in the Navy and genital HPV was slightly higher in the Air Force. For all STIs, rates tended to be higher among enlisted service members, and among those with lower levels of educational achievement. Married service members had the lowest incidence rates for all five STIs. Rates of chlamydia, gonorrhea, and syphilis were highest among those in the motor transport occupational category. In contrast, HSV and genital HPV rates were highest among those in communications/intelligence and healthcare occupations **(Table 2)**. Results for each STI are described below.

Chlamydia trachomatis infections

During the surveillance period, rates of diagnosis of *C. trachomatis* infection among service women generally ranged between three to five times those among men. Annual rates among both men and women were relatively stable, but the rates among women showed greater fluctuation. Women's rates peaked in 2008 (448.1 per 10,000 p-yrs) and were relatively high again in 2016 (426.6 per 10,000 p-yrs) **(Figure 1).** Most of the variations in rates among women were attributable to fluctuations within the two youngest age groups **(Figure 2).**

HPV infections

The annual incidence rates of diagnoses of genital HPV decreased among all active component service members

TABLE 2. Incident counts and incidence rates of sexually transmitted infections, active component, U.S. Armed Forces, 2007–2016

	Chlamydia		Gonorrhea		Syphilis (all types)		HSV		Genital HPV	
	No.	Rate[a]	No.	Rate[a]	No.	Rate[a]	No.	Rate[a]	No.	Rate[a]
Total (2007–2016)	178,885	144.1	29,297	23.6	4,742	3.8	28,579	23.3	72,454	60.1
Service										
Army	85,080	187.1	16,865	37.0	2,008	4.3	12,576	28.0	29,499	66.7
Navy	35,108	116.8	5,521	18.4	1,498	5.0	6,412	21.6	15,479	53.0
Air Force	39,433	127.9	4,018	13.0	763	2.5	6,626	21.8	19,913	67.2
Marine Corps	19,264	108.2	2,893	16.2	473	2.6	2,965	16.8	7,563	43.2
Sex										
Male	106,924	101.4	22,122	21.0	4,154	3.9	16,574	15.8	38,569	37.2
Female	71,961	383.9	7,175	38.2	588	3.1	12,005	66.1	33,885	199.6
Age										
<20	24,329	291.3	3,104	37.1	274	3.3	1,863	22.3	3,686	44.1
20–24	101,160	258.0	15,433	39.3	1,706	4.3	11,071	28.3	31,558	81.8
25–29	36,433	123.9	6,653	22.6	1,295	4.3	7,726	26.6	20,511	72.6
30–34	11,130	58.0	2,496	13.0	664	3.4	3,875	20.6	9,191	50.3
35–39	4,029	27.7	1,026	7.1	417	2.9	2,349	16.5	4,430	31.7
40+	1,804	13.4	585	4.3	386	2.9	1,695	12.8	3,078	23.4
Race/ethnicity										
Non-Hispanic white	73,969	97.9	7,639	10.1	1,549	2.0	14,015	18.7	41,607	56.6
Non-Hispanic black	61,722	308.2	16,430	81.9	1,943	9.5	8,401	42.9	13,827	71.7
Hispanic	25,399	164.7	3,049	19.8	785	5.0	3,736	24.5	9,820	65.7
Asian/Pacific Islander	5,687	122.4	690	14.8	143	3.1	611	13.2	2,050	45.1
Other/unknown	12,108	141.6	1,489	17.4	322	3.7	1,816	21.5	5,150	62.1
Rank										
Junior enlisted (E1–E4)	134,808	251.0	20,963	39.0	2,545	4.7	14,716	27.5	39,710	75.0
Senior enlisted (E5–E9)	38,062	77.5	7,382	15.0	1,858	3.7	10,482	21.8	23,974	51.1
Junior officer (O1–O3)	4,998	43.0	701	6.0	172	1.5	2,138	18.6	6,452	57.2
Senior officer (O4–O10)	506	6.3	150	1.9	134	1.7	903	11.4	1,770	22.5
Warrant officer (WO1–WO5)	511	30.8	101	6.1	33	2.0	340	21.0	548	34.4
Education level										
High school or less	157,338	187.3	25,663	30.5	3,632	4.3	20,668	24.8	53,341	65.1
Some college	10,655	80.7	1,828	13.8	490	3.7	3,274	25.4	7,159	57.1
Bachelor's or advanced degree	8,403	34.9	1,392	5.8	549	2.3	4,102	17.3	10,469	44.9
Other/unknown	2,489	88.0	414	14.6	71	2.5	535	19.1	1,485	53.7
Marital status										
Single	114,257	229.9	18,082	36.3	2,816	5.6	13,546	27.4	35,687	73.3
Married	53,150	77.0	9,479	13.7	1,678	2.4	12,194	17.9	30,655	45.9
Other/unknown	11,478	211.0	1,736	31.9	248	4.5	2,839	54.0	6,112	121.4
Military occupation										
Infantry/artillery/combat engineer	19,171	111.0	3,580	20.7	422	2.4	2,826	16.5	7,493	44.1
Motor transport	7,666	214.4	1,565	43.7	244	6.7	946	26.7	2,453	70.1
Pilot/air crew	1,646	35.2	236	5.0	57	1.2	632	13.7	1,743	38.4
Repair/engineer	47,936	132.9	7,437	20.6	1,150	3.2	7,498	21.0	17,885	50.8
Communications/intelligence	47,328	172.3	8,500	30.9	1,390	5.0	8,167	30.3	20,138	76.5
Health care	13,375	120.4	1,945	17.5	455	4.1	3,046	27.9	8,325	78.5
Other	41,763	174.0	6,034	25.1	1,024	4.2	5,464	23.0	14,417	61.5

[a]Incidence rate per 10,000 person-years

HSV, herpes simplex virus; HPV, human papillomavirus

FIGURE 1. Incidence rates of *Chlamydia trachomatis* infections, by sex, active component, U.S. Armed Forces, 2007–2016

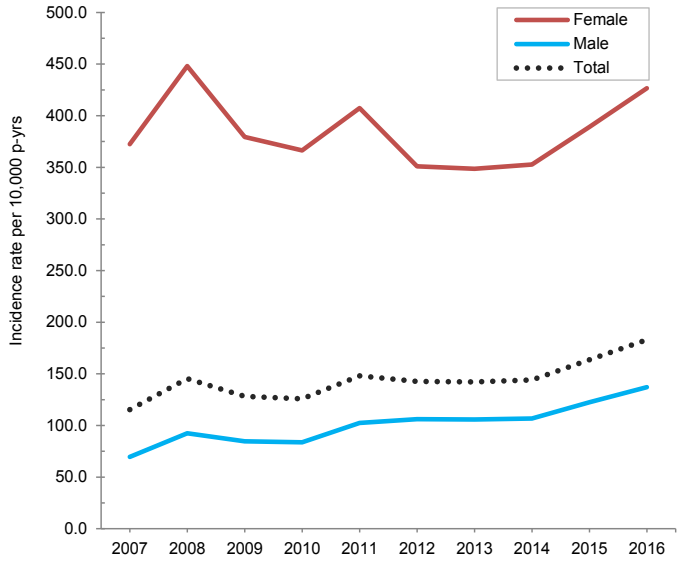


FIGURE 2. Incidence rates of *Chlamydia trachomatis* infections among females, by age group, active component, U.S. Armed Forces, 2007–2016

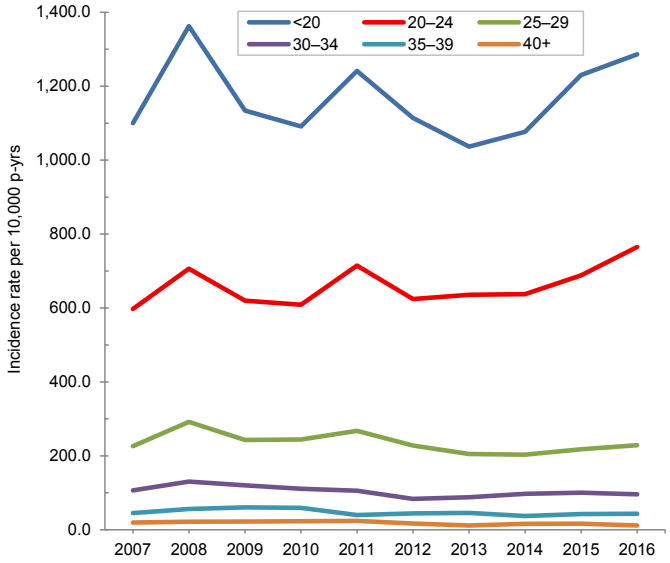


FIGURE 3. Incidence rates of human papillomavirus infections, by sex, active component, U.S. Armed Forces, 2007–2016

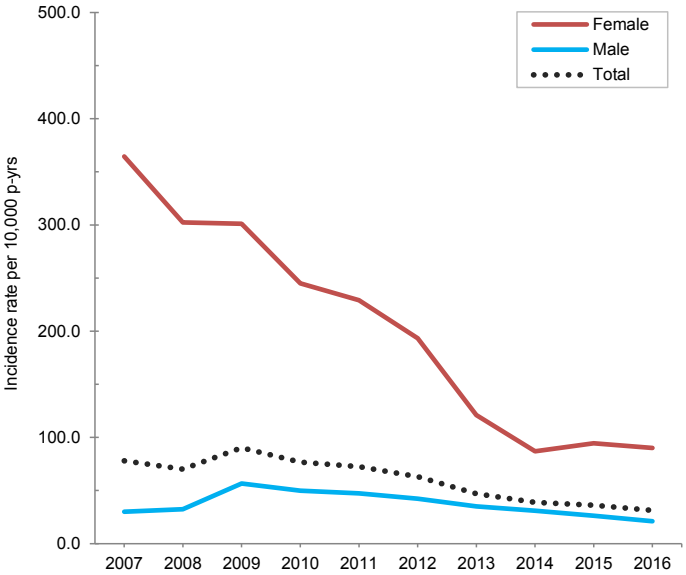
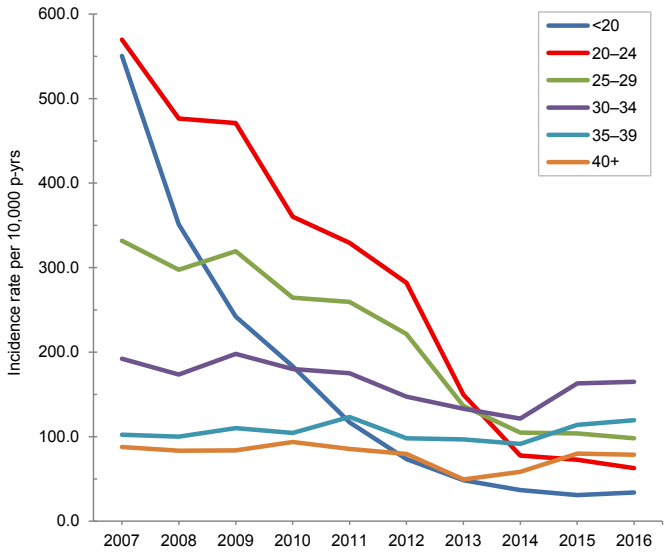


FIGURE 4. Incidence rates of human papillomavirus infections among females, by age group, active component, U.S. Armed Forces, 2007–2016



throughout the surveillance period, with the most dramatic decrease occurring among women **(Figure 3)**. The overall incidence of genital HPV reached 31.1 cases per 10,000 person-years (p-yrs) in 2016, the lowest rate of the entire surveillance period. Incidence rates among female service members declined by 75% during the surveillance period, from a high of 364.4 cases per 10,000 p-yrs in 2007 to a low of 90.0 cases per 10,000 p-yrs in 2016 **(Figure 3).** Rates among men steadily rose to a peak of 56.6 per 10,000 p-yrs in 2009 but then declined to a rate of 21.0 per 10,000 p-yrs in 2016. Most of the recent fall in women's rates was associated with dramatic declines in the rates for women in the youngest age groups **(Figure 4).**

Gonorrhea infections

During the surveillance period, annual incidence rates of gonorrhea decreased among female service members and were relatively stable among male service members, although there was a slight increase among males in 2016 **(Figure 5)**. The ratio of annual incidence rates for women compared to men was 2.5 in 2007 but dropped to 1.2 in

FIGURE 5. Incidence rates of gonorrhea infections, by sex, active component, U.S. Armed Forces, 2007–2016

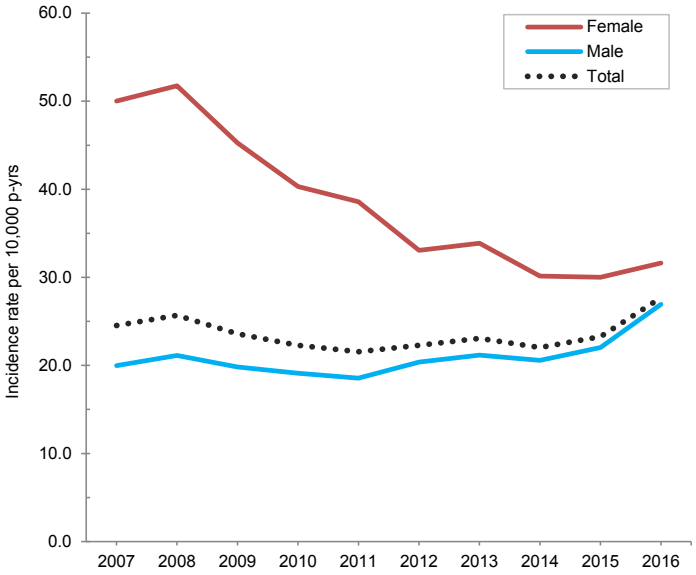


FIGURE 6. Incidence rates of gonorrhea infections among females, by age group, active component, U.S. Armed Forces, 2007–2016

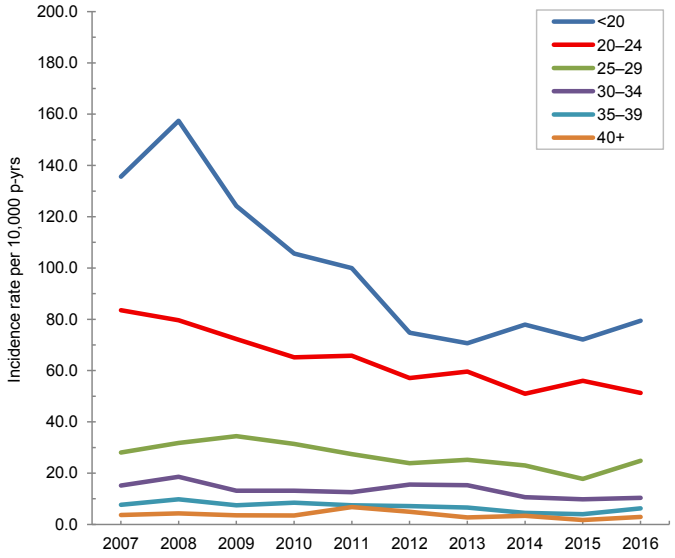


FIGURE 7. Incidence rates of genital herpes simplex virus infections, by sex, active component, U.S. Armed Forces, 2007–2016

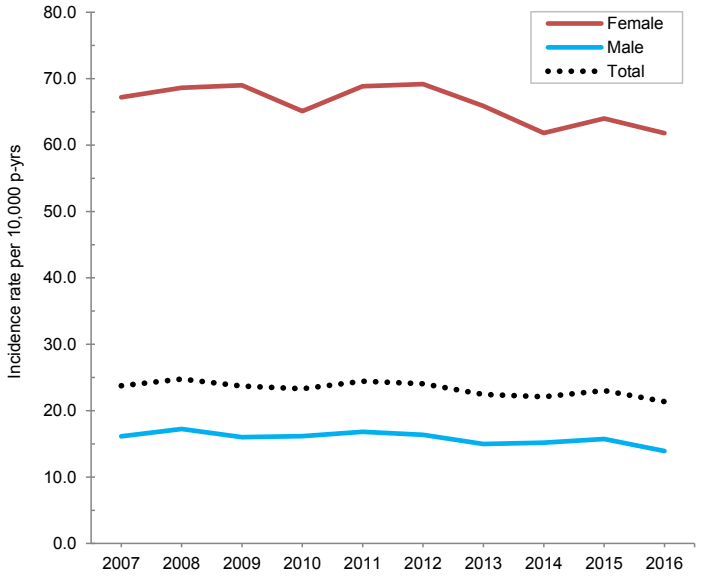
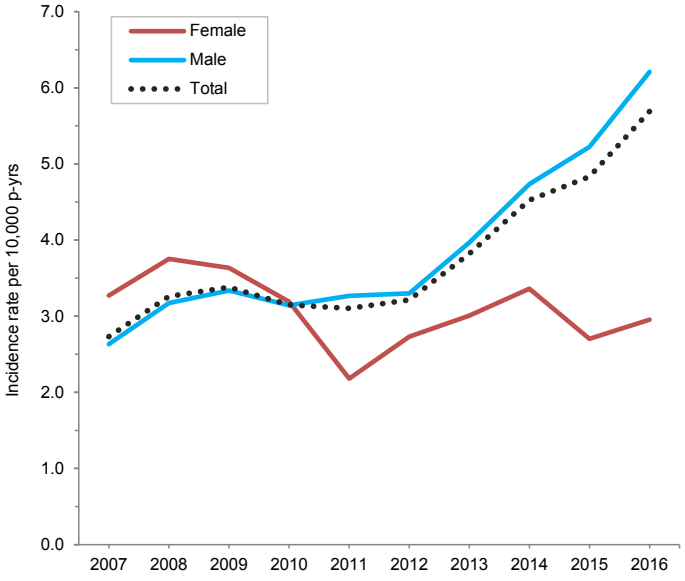


FIGURE 8. Incidence rates of syphilis (all types), by sex, active component, U.S. Armed Forces, 2007–2016



2016. Rates of gonorrhea among 17- to 19- and 20- to 24-year-old service women were high in the period 2007 to 2008 but declined to 79.4 and 51.3 per 10,000 p-yrs, respectively, in 2016 **(Figure 6).**

Genital herpes simplex infections

Incidence rates of genital herpes infections were relatively stable during the surveillance period. Rates among female service members ranged from a high of 69.2 per 10,000 p-yrs in 2012 to 61.8 per 10,000 p-yrs in 2016. Men's rates were highest in 2008 (17.2 per 10,000 p-yrs) and lowest in 2016 (13.9 per 10,000 p-yrs) **(Figure 7).** Among women, the highest rates were observed among those aged 17–19 years during 2007–2011 and 2016, and among those aged 20–24 years during 2012–2015 **(data not shown).** Among men, rates were consistently higher among those aged 25–29 years **(data not shown).** Incidence rates of diagnoses of genital herpes among service members with marital status of "other/unknown" were markedly higher than among those who were categorized as either "single" or "married" **(data not shown).**

Syphilis

The total incidence rate for syphilis in the last year of the surveillance period was more than double that of 2007 **(Figure 8).** After 2011, overall annual rates of syphilis increased steadily by 3%–19% per year. Annual incidence rates among women decreased to rates below those among men in 2010 and declined to their lowest point during the surveillance period in 2011 (2.18 per 10,000 p-yrs). The expanded analysis of syphilis incidence among the four different types found the following numbers of cases and total rates during the surveillance period: primary and secondary (1,918 cases, rate 1.53 per 10,000 p-yrs), latent (1,076 cases, rate 0.86 per 10,000 p-yrs), late (688 cases, rate 0.55 per 10,000 p-yrs), and unspecified syphilis (1,060 cases, rate 0.84 per 10,000 p-yrs **(Table 3).** Of all syphilis cases, 40.4% of diagnoses were for primary and secondary syphilis; 22.7% were latent; 22.4% were unspecified; and 14.5% were for late syphilis. Rates of primary and secondary syphilis were highest among those aged 20–24 and 25–29 years. Rates of late syphilis diagnoses were highest among those aged 40 years or older, and were lowest among those aged 20 years or younger **(Table 3).**

STIs during deployment

Between 2008 and 2016, among service members deployed to CENTCOM operations, there were more medical encounters associated with diagnoses of genital HPV than for all of the other STIs combined. There were 2,037 individuals with 2,887 encounters for genital HPV during a deployment to CENTCOM area of responsibility; 916 individuals with 1,108 encounters for HSV; 510 individuals with 540 encounters for chlamydia; 278 individuals with 318 encounters for gonorrhea; and 94 individuals with 134 encounters for syphilis **(Figure 9)**. Of those diagnosed with an STI in theater, many did not have corresponding inpatient or outpatient incident diagnoses or recorded reportable medical events at any other time during the surveillance period. Of the 2,037 individuals with genital HPV infection in theater, 1,242 (61%) did not have a corresponding diagnosis in a non-deployed outpatient encounter. Similarly, of the 916 individuals with an HSV infection in theater, 582 (63.5%) did not have a corresponding outpatient diagnosis when not deployed. For those with bacterial STIs diagnosed in theater, there were 220 (43%) individuals with chlamydia, 213 (77%) with gonorrhea, and 66 (70%) with syphilis who did not have corresponding inpatient, outpatient, or reportable event incident diagnoses at any other time during the 2007–2016 surveillance period **(data not shown)**.

EDITORIAL COMMENT

During most of the 10-year surveillance period the incidence rates of the five STIs examined were relatively stable among male service members, except for syphilis, for which rates increased. Among female service members, the incidence rates were stable for HSV, syphilis, and chlamydia, but the rates of infection with HPV and gonorrhea decreased considerably.

The higher incidence of most STIs among women as compared to men may be attributable to the implementation of the Services' screening programs for STIs among female service members as they enter active service and the subsequent annual screenings for women under age 26. Because asymptomatic infection with chlamydia, gonorrhea, and HPV is common among sexually active women, widespread screening may result in sustained high numbers of infections diagnosed among young women. For chlamydia and gonorrhea, the early detection and curative treatment of these infections would likely, over time, contribute to a decline in incidence rates of these diagnoses as the prevalence of untreated infection in the population of young service women was driven downward. This may be one reason for the declining gonorrhea incidence rates over time, but it is unclear why a similar trend was not observed for chlamydia. Trends may be affected by what is happening in the civilian population. From 2001 to 2015, chlamydia rates increased for men and women nationally, whereas gonorrhea rates from 2006 to 2015 remained stable overall with a slight decrease among women.[4]

In the February 2013 *MSMR*, the case definition for HPV included 078.1 ("viral warts"), which includes unspecified viral warts, condyloma acuminatum, plantar warts, and other specified viral warts. In the current analysis, only 078.11 ("condyloma acuminatum") was included to more conservatively capture genital warts caused by HPV infection, which resulted in a significant reduction in the number of cases, compared to the 2013 report. The downward trend of genital HPV incidence among women may be related to the introduction of the HPV vaccine for women and girls in 2006. Among civilian women aged 14–24 years, cervical-vaginal prevalence of HPV types 6, 11, 16, and 18 decreased by approximately 6% from the period 2003–2006 to 2009–2012 after introduction of the vaccine.[8] The HPV vaccine is currently not a mandatory vaccine for military service, but it is encouraged and offered to service members. An increasing number of service women who entered military service during the surveillance period may have been vaccinated for HPV prior to entering service.[9]

This report has several limitations that should be considered when interpreting the results. Analyses were based on administrative records of medical encounters. Such records do not specify the laboratory tests (or specific results) or clinical criteria that were used to confirm STI diagnoses. In addition, diagnoses of STIs may be incorrectly coded; for example, STI-specific "rule out" diagnoses or vaccinations (e.g., HPV vaccination) may be reported with STI-specific diagnostic codes. Conversely, "true" STI cases may not be captured if coded in the medical record using symptom codes (e.g., urethritis) rather than STI-specific codes; this practice could contribute to underestimation of STI cases. In addition, the counts of STI diagnoses reported here may underestimate the actual numbers of diagnoses to the extent that affected service members are diagnosed and treated through non-reimbursed, non-military care providers (e.g., county health departments, family planning centers) and particularly in deployed settings (e.g., overseas training exercises, combat operations, on-board ships).[10]

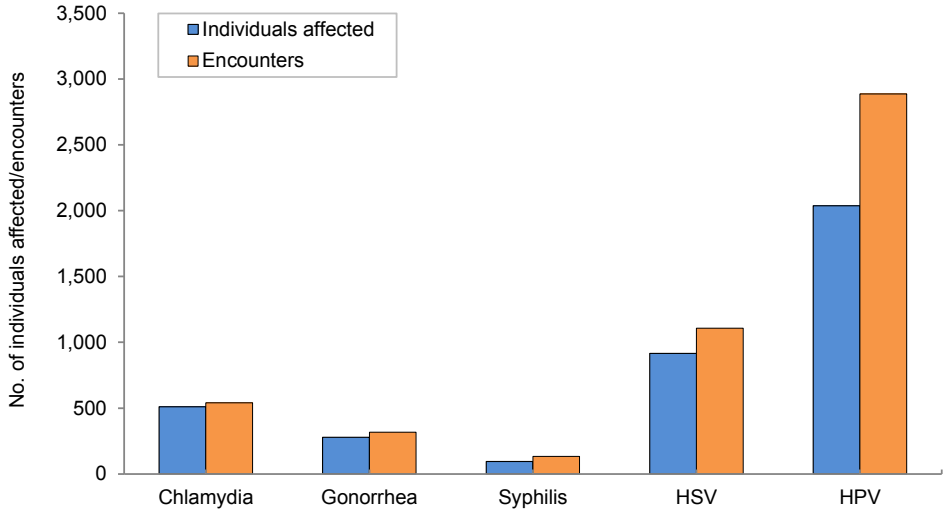
Incident cases of syphilis are particularly challenging to capture using administrative data. A previous analysis found

TABLE 3. Incidence counts and incidence rates of four types of syphilis, active component, U.S. Armed Forces, 2007–2016

	Primary and secondary syphilis		Latent syphilis		Late syphilis		Unspecified syphilis	
	No.	Rate[a]	No.	Rate[a]	No.	Rate[a]	No.	Rate[a]
Total	1,918	1.53	1,076	0.86	688	0.55	1,060	0.84
Service								
Army	700	1.51	464	1.00	343	0.74	501	1.08
Navy	616	2.04	409	1.35	183	0.60	290	0.96
Air Force	374	1.21	130	0.42	104	0.34	155	0.50
Marine Corps	228	1.27	73	0.41	58	0.32	114	0.64
Sex								
Male	1,734	1.63	901	0.85	594	0.56	925	0.87
Female	184	0.96	175	0.91	94	0.49	135	0.71
Age								
<20	113	1.34	72	0.86	23	0.27	66	0.78
20–24	730	1.83	409	1.03	204	0.51	363	0.91
25–29	531	1.78	275	0.92	184	0.62	305	1.02
30–34	274	1.42	153	0.79	93	0.48	144	0.74
35–39	145	0.99	78	0.53	86	0.59	108	0.74
40+	125	0.92	89	0.66	98	0.73	74	0.55
Race/ethnicity								
Non-Hispanic white	658	0.86	276	0.36	291	0.38	324	0.43
Non-Hispanic black	737	3.61	505	2.47	249	1.22	452	2.21
Hispanic	322	2.06	208	1.33	80	0.51	175	1.12
Asian/Pacific Islander	67	1.43	27	0.58	20	0.43	29	0.62
Other/unknown	134	1.55	60	0.70	48	0.56	80	0.93
Rank								
Junior enlisted (E1–E4)	1,060	1.95	608	1.12	296	0.54	581	1.07
Senior enlisted (E5–E9)	719	1.45	404	0.82	325	0.66	410	0.83
Junior officer (O1–O3)	79	0.68	28	0.24	30	0.26	35	0.30
Senior officer (O4–O10)	44	0.54	29	0.36	32	0.40	29	0.36
Warrant officer (WO1–WO5)	16	0.96	7	0.42	5	0.30	5	0.30
Education level								
High school or less	1,473	1.73	839	0.99	486	0.57	834	0.98
Some college	203	1.53	117	0.88	82	0.62	88	0.66
Bachelor's or advanced degree	209	0.86	106	0.44	113	0.47	121	0.50
Other/unknown	33	1.16	14	0.49	7	0.25	17	0.60
Marital status								
Single	1,228	2.44	673	1.34	322	0.64	593	1.18
Married	582	0.84	358	0.51	332	0.48	406	0.58
Other/unknown	108	1.95	45	0.81	34	0.61	61	1.10
Military occupation								
Infantry/artillery/combat engineer	155	0.89	74	0.42	80	0.46	113	0.65
Motor transport	96	2.64	69	1.90	40	1.10	39	1.07
Pilot/air crew	25	0.53	14	0.30	12	0.26	6	0.13
Repair/engineer	482	1.32	232	0.64	170	0.47	266	0.73
Communications/intelligence	575	2.07	297	1.07	207	0.74	311	1.12
Health care	187	1.67	104	0.93	63	0.56	101	0.90
Other	398	1.64	286	1.18	116	0.48	224	0.92

[a]Incidence rate per 10,000 person-years

FIGURE 9. Individuals affected by sexually transmitted infections (STIs), and encounters for STIs, during deployment to U.S. Central Command operations, active component, U.S. Armed Forces, 2008–2016



HSV, herpes simplex virus; HPV, human papillomavirus

that almost one-third of syphilis cases captured using DMSS data were not true incident cases. Provider misclassification was common due to false-positive screening tests, incorrect interpretation of laboratory results, and empiric diagnoses before laboratory results were available.[11] In a separate article in this *MSMR* issue, the potential misclassification of ICD-10 code A51.31 ("Condyloma latum") for syphilis and HPV cases is discussed.[12]

This analysis was based on incident diagnoses of STIs. For some STIs, the detection of prevalent infections may occur long after the subject infections were acquired. As a result, changes in incidence rates reflect, at least in part, temporal changes in case ascertainment (e.g., more aggressive screening). The lack of standard practices across the services and their installations regarding screening, testing, treatment, and reporting complicate interpretations of differences between services, military and demographic subgroups, and locations. Establishing screening, testing, treatment, and reporting standards across the services and ensuring adherence would likely improve efforts to detect, characterize, and counter STI-related health threats to military service members.

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REFERENCES

1. Armed Forces Health Surveillance Center. Sexually transmitted infections, active component, U.S. Armed Forces, 2000–2012. *MSMR*. 2013;20(2):5–10.
2. Centers for Disease Control and Prevention. 2015 Sexually Transmitted Disease Surveillance: Syphilis. https://www.cdc.gov/std/stats15/syphilis.htm. Accessed on 29 August 2017.
3. Clark LL, Hunt DJ. Incidence of syphilis, active component, U.S. Armed Forces, 1 January 2010 through 31 August 2015. *MSMR*. 2015;22(9):8–16.
4. Centers for Disease Control and Prevention. Sexually Transmitted Disease Surveillance 2015. Atlanta: U.S. Department of Health and Human Services; 2016. https://www.cdc.gov/std/stats. Accessed on 30 August 2017.
5. Allan-Blitz LT, Wang X, Klausner JD. Wild-type gyrase A genotype of *Neisseria gonorrhoeae* predicts in vitro susceptibility to ciprofloxacin: a systematic review of the literature and meta-analysis. *Sex Transm Dis*. 2017;44(5):261–265.
6. National Cancer Institute. HPV and Cancer. https://www.cancer.gov/about-cancer/causes-prevention/risk/infectious-agents/hpv-fact-sheet. Accessed on 30 August 2017.
7. Roberts CM, Pfister JR, Spear SJ. Increasing proportion of herpes simplex virus type 1 as a cause of genital herpes infection in college students. *Sex Transm Dis*. 2003;30(10):797–800.
8. Markowitz LE, Liu G, Hariri S, Steinau M, Dunne EF, Unger ER. Prevalence of HPV after introduction of the vaccination program in the United States. *Pediatrics*. 2016;137(3):e20151968.
9. Walker TY, Elam-Evans LD, Singleton JA, et al. National, regional, state, and selected local area vaccination coverage among adolescents aged 13–17 years—United States, 2016. *MMWR*. 2017;66(33):874–882.
10. Stahlman S, Garges EC, Ying S, Clark LL. Rates of *Chlamydia trachomatis* infections across the deployment cycle, active component, U.S. Armed Forces, 2008–2015. *MSMR*. 2017;24(1):12–18.
11. Garges E, Stahlman S, Jordan N, Clark LL. P3.69 Administrative medical encounter data and medical event reports for syphilis surveillance: a cautionary tale. [poster]. *Sex Transm Infect*. 2017;93:A118.
12. Armed Forces Health Surveillance Branch. Use of ICD-10 code A51.31 (Condyloma latum) for identifying cases of secondary syphilis. *MSMR*. 2017;24(9):23.

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Brief Report

Use of ICD-10 Code A51.31 (Condyloma Latum) for Identifying Cases of Secondary Syphilis

Shauna Stahlman, MPH, PhD

The article on pages 15–22 of this issue of the *MSMR* reported on the incidence rates of syphilis infections among active component service members. Initial examination of the incidence of primary and secondary syphilis revealed that, although annual incidence rates had risen steadily from 2007 (0.9 cases per 10,000 person-years [p-yrs]) to 2014 (2.0 cases per 10,000 p-yrs), the rates for 2015 and 2016 were dramatically higher (4.1 and 8.4 cases per 10,000 p-yrs, respectively). Exploration of the factors associated with these dramatic increases revealed that 47% and 66% of cases of primary and secondary syphilis in 2015 and 2016 were associated with the ICD-10 code (A51.31) for condyloma latum. Because the diagnosis of condyloma latum is unlikely to be associated with two-thirds of all cases of early syphilis, and because the ICD-10 coding system went into effect on 1 October 2015, the possibility that use of the new code might have introduced a systematic error in the counting of cases was examined.

During 2007–2014, when the ICD-9 coding system was in use, 7% of all diagnoses of primary and secondary syphilis were associated with the ICD-9 code 091.3 for "secondary syphilis of skin or mucous membranes," which includes condyloma latum. In contrast, in 2016, 66% of such diagnoses were associated with ICD-10 code A51.31 for condyloma latum. The dramatic increase after 2014 in the proportion of early syphilis cases associated with the diagnosis of condyloma latum suggested a complication to the ICD code–based system of counting incident cases.

One possible explanation considered was the miscoding or misdiagnosing of cases of condyloma acuminatum as condyloma latum. In the ICD-9 coding system, the description of code 078.11 explicitly referred to "condyloma acuminatum" and "genital warts." In ICD-10, the word "condyloma" does not appear in the description of the relevant code (A63.0). Instead, the code is simply identified as designating "Anogenital (venereal) warts." It was considered possible that the change in the nomenclature for the codes pertaining to condyloma acuminatum resulted in diagnoses of that condition being erroneously coded as condyloma latum.

FIGURE 1. Rates of primary and secondary syphilis with and without ICD-10 code A51.31 (Condyloma latum), active component, U.S. Armed Forces, 2007–2016

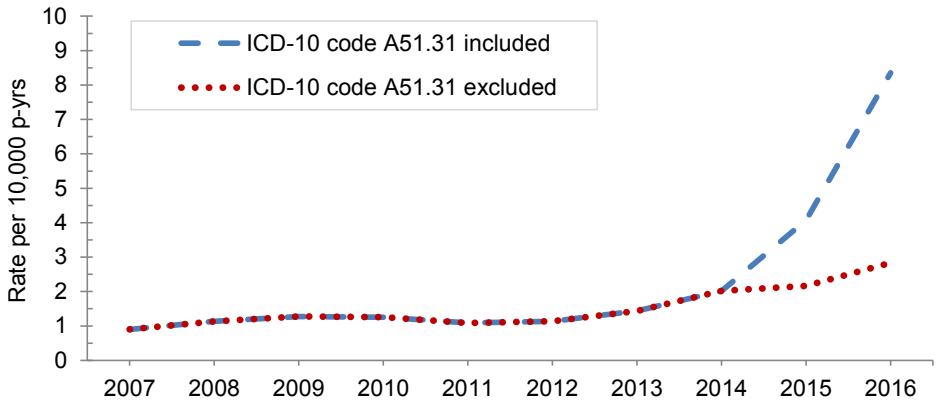

FIGURE 2. Rates of human papillomavirus with and without ICD-10 code A51.31 (Condyloma latum), active component, U.S. Armed Forces, 2007–2016

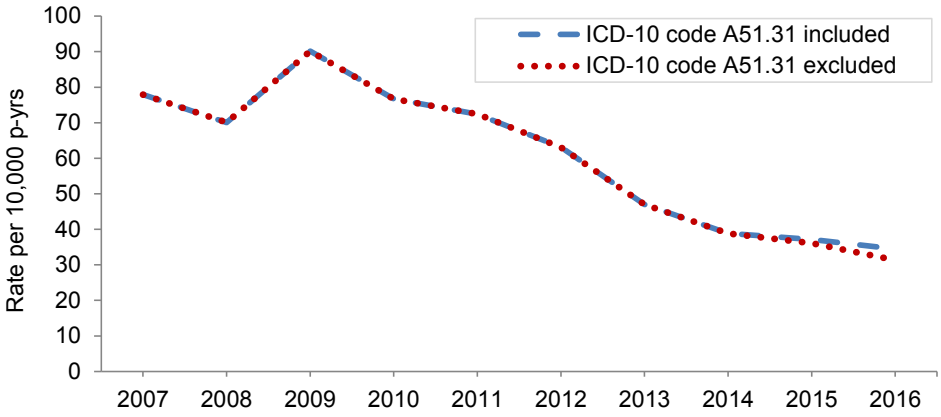

Figure 1 compares the annual incidence rates of primary and secondary syphilis during the surveillance period of 2007–2016. The blue dashed line indicates what the rates would have been if ICD-10 code A51.31 had been included in the case definition for primary and secondary syphilis. The red dotted line depicts the trend with the exclusion of A51.31, which represents the syphilis data published in the current *MSMR*. In particular, inclusion of ICD-10 code A51.31 would have resulted in almost twice as many cases in 2015 and almost three times as many cases in 2016.

Figure 2 shows how the annual incidence rates for genital HPV would have been affected during the surveillance period of 2007–2016. The blue dashed line indicates what the rates would have been if ICD-10 code A51.31 had been included in the case definition for genital HPV, on the premise that some cases of HPV-related genital warts (condyloma acuminatum) may have been misclassified as secondary syphilis sores (condyloma latum). The numbers of incident HPV cases would have increased by 3% in 2015 and 10% in 2016.

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