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Update

Sexually Transmitted Infections Among Active Component Service Members, U.S. Armed Forces, 2014–2022

This report summarizes incidence rates and trends of sexually transmitted infections (STIs) from 2014 to 2022 among active component service members of the U.S. Armed Forces. The data compiled for this report are derived from medical surveillance of chlamydia, gonorrhea, and syphilis as nationally notifiable diseases. Case data for 2 additional STIs, human papilloma virus (HPV) and genital herpes simplex virus (HSV), are also presented. Since 2019 case rates for all STIs have declined, excluding syphilis, which declined briefly but rose among male and female service members by approximately 40% between 2020 and 2022. Overall age- and gender-adjusted case rates for chlamydia, gonorrhea, and syphilis remain somewhat higher within the U.S. Armed Forces than among the general U.S. population, which may be due to factors including mandatory screening, more complete reporting, incomplete adjustment for age distribution, and inequitable comparisons between the active duty military and entire U.S. population. While case rates among female service members for chlamydia, gonorrhea, HPV, and HSV are significantly higher, syphilis rates display a male preponderance for all except the youngest age group. Social restrictions during the COVID-19 pandemic may have contributed to declines in true case rates and screening coverage.

What are the new findings?

STI rates have declined since 2019, except for syphilis, which has increased for 2 consecutive years. These trends may be partially influenced by changes in screening coverage or behavior associated with the COVID-19 pandemic. Future analyses of screening rates are warranted to assess a true decline in incidence and examine the recent increase in syphilis reports.

What is the impact on readiness and force health protection?

To assist service leader and medical corps planning and assessment of STI prevention and control measures for operational readiness, this report provides an updated epidemiologic profile of the most commonly reported STIs. STIs can adversely affect service member ability and availability for duty performance and result in serious medical sequelae if untreated. Continued behavioral and educational interventions are needed to mitigate STI risk among military service members.

In 2021, sexually transmitted infections (STIs) represented 1 of the highest healthcare burdens attributable to infectious diseases (other than COVID-19) among active component service members of the U.S. Armed Forces.[1] The National Academies of Sciences, Engineering and Medicine recently convened a committee to provide recommendations for STI prevention and control in the U.S., concluding that military recruits and active duty service members required focused consideration.[2] While multiple and interrelated factors influence STI risk within military populations,[3] the strongest risk factors are age and sex. The military population is young (mean age 26) and predominantly male (85%), so its rates are not directly comparable to the general U.S. population unless adjusted for these demographics. Previous reports have found higher incidence rates of all STIs in specific ethnic/racial groups, which may represent a true difference, or may be an artifact of the categories used for those analyses.

The Centers for Disease Control and Prevention (CDC) publishes annual summaries of national surveillance data for notifiable diseases covered by federally-funded control programs, including *Chlamydia trachomatis* (chlamydia), *Neisseria gonorrhoeae* (gonorrhea), and *Treponema pallidum* (syphilis). Preliminary data from the National Notifiable Diseases Surveillance System indicate that these 3 STIs continued to increase into the second year of the COVID-19 pandemic, underscoring the importance of continued prevention and control programs.[4] Although these 3 relatively common bacterial STIs are curable with antibiotics, there is continued concern about the threat of multidrug resistance.[5–7]

Common viral STIs in the U.S. also include infections caused by human papillomavirus (HPV) and genital herpes simplex virus (HSV). Studies assessing the National Health and Nutrition Examination Survey (NHANES) provide prevalence estimates for adolescents and young adults ages 15-24, estimating 1.3 million prevalent HSV-2 infections and 9.0 million infected with at least 1 disease-associated HPV type in 2018.[8] Neither HPV nor HSV viral infections are curable with antibiotics; however, suppression of recurrent herpes is attainable using antiviral medication, and a vaccine prevents infection from 4 of the most common HPV serotypes as well as 5 cancerous types.[9]

This report presents an epidemiologic profile for STIs among active component service members from 2014 to 2022, updating previous *MSMR* articles.[10,11] Data are presented for 5 common STIs: chlamydia, gonorrhea, syphilis, HPV, and HSV. This year marks the first where rates are expressed per 100,000 to match CDC reports; thus, any comparisons to prior *MSMR* reports using rates per 10,000 should account for this methodologic change.

Methods

The surveillance population for this report comprises all active component service members of the U.S. Army, Navy, Air Force, or Marine Corps who served at any time during the surveillance period of January 1, 2014 to December 31, 2022. STI diagnoses were ascertained from medical administrative data and reports of notifiable medical events routinely provided to the Armed Forces Health Surveillance Division (AFHSD) and maintained in the Defense Medical Surveillance System (DMSS) for health surveillance. STI cases were also derived from positive laboratory test results recorded in the Health Level 7 (HL7) chemistry and microbiology databases maintained by the Epi-Data Center at Defense Centers for Public Health-Portsmouth (DCPH-P).

Each service member's number of days in active service was determined and then aggregated to a total for all service members in each calendar year. The resultant annual totals were expressed as person-years (p-yrs) of service and used as the denominators for calculating annual incidence rates. Person-time not considered time at risk for each STI (i.e., the 30 days following each incident chlamydia or gonorrhea infection and all person-time following the first diagnosis, medical event report, or positive laboratory test of HSV, HPV, or syphilis) was excluded.

An incident case of chlamydia was defined by either 1) a case-defining diagnosis **(Table 1)** in the first or second diagnostic position in a record of an outpatient or in-theater medical encounter, 2) a confirmed notifiable disease report, or 3) a positive laboratory test (of any specimen source or test type). An incident case of gonorrhea was similarly defined by 1) a case-defining diagnosis in the first or second diagnostic position of an inpatient, outpatient, or in-theater encounter record, 2) a confirmed notifiable disease report, or 3) a positive laboratory test (any specimen source or test type). For both chlamydia and gonorrhea, an individual could be counted as having a subsequent case only if more than 30 days occurred between the dates recorded for each case-defining diagnosis.

TABLE 1. ICD-9/ICD-10 Diagnostic Codes Used to Label STI Cases in Case Records

STI	ICD-9[a]	ICD-10[a]
HPV	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 HSV	054.1*	A60.*
Gonorrhea	098.*	A54.*
Syphilis	091.*, 092.*, 093.*–096.*, 097.0, 097.1, 097.9	A51.* (excluding A51.31), A52.*, A53.0, A53.9

Abbreviations: ICD, International Classification of Diseases; STI, sexually transmitted infection; HPV, Human papillomavirus; HSV, herpes simplex virus.
[a]An asterisk (*) indicates that any subsequent digit/character is included.

An incident case of syphilis was defined by either 1) a qualifying ICD-9 or ICD-10 code in the first, second, or third diagnostic position of a hospitalization record, 2) at least 2 outpatient or in-theater encounters within 30 days with a qualifying ICD-9 or ICD-10 code in the first or second position, 3) a confirmed notifiable disease report for any type of syphilis, or 4) a record of a positive polymerase chain reaction or treponemal laboratory test. Stages of syphilis (primary, secondary, late, latent) could not be distinguished because HL7 laboratory data do not allow for stage differentiation, and because a high degree of misclassification is associated with ICD diagnosis code usage for stage determination.[12,13] An individual could be considered an incident case of syphilis only once during the surveillance period; those with evidence of prior syphilis infection were excluded.

Incident cases of HSV were identified by either 1) a requisite International Classification of Diseases, 9th or 10th Revision (ICD-9 or ICD-10, respectively) code in either the first or second diagnostic positions of an outpatient or in-theater encounter record or 2) a positive laboratory test from a genital specimen source. Antibody tests were excluded because they do not allow distinction between genital and oral infections. Incident cases of HPV were similarly identified by either 1) the presence of the requisite ICD-9 or ICD-10 codes in either the first or second diagnostic positions of an outpatient or in-theater encounter record or 2) a positive laboratory test from any specimen source or test type. Outpatient encounters for HPV with evidence of HPV immunization within 7 days before or after the encounter date were excluded, as were outpatient encounters with a procedural or Current Procedural Terminology (CPT) code indicating HPV vaccination, as such encounters were potentially related to vaccination administration. An individual could be counted as an incident case of HSV or HPV only once during the surveillance period. Individuals with HSV or HPV infection diagnoses before the surveillance period were excluded.

Incidence rates were calculated as incident cases of a given STI per 100,000 p-yrs of active component service, with percent changes in incidence calculated by unrounded rates.

Results

Between 2014 and 2022, the number of incident chlamydia infections among active component service members exceeded the other 4 STIs combined, and was 4.4 times the total number of genital HPV infections—the next most frequently identified STI during this period **(Table 2)**. In 2022, 34% of syphilis cases, 71% of

TABLE 2. Incident Counts and Incidence Rates of STIs, Active Component, U.S. Armed Forces, 2014–2022

	Chlamydia		Gonorrhea		Syphilis		Genital HSV		Genital HPV	
	No.	Rate[a]	No.	Rate[a]	No.	Rate[a]	No.	Rate[a]	No.	Rate[a]
Total	234,915	1,996.6	38,565	327.3	6,444	54.8	26,367	227.1	53,331	469.0
Sex										
Male	147,862	1,502.7	30,508	309.7	5,639	57.3	14,185	145.5	18,702	193.5
Female	87,053	4,520.2	8,057	417.0	805	41.7	12,182	655.0	34,629	2,030.7
Age group, y										
<20	32,239	3,850.6	4,019	478.8	669	79.7	1,940	231.3	756	90.1
20–24	137,216	3,664.2	20,623	549.3	2,481	66.1	11,154	299.1	19,331	520.4
25–29	45,229	1,647.0	8,591	312.5	1,656	60.4	6,803	250.8	14,119	531.0
30–34	13,522	715.4	3,335	176.4	891	47.2	3,486	188.3	11,325	638.9
35–39	4,786	348.7	1,325	96.5	412	30.1	1,812	135.8	4,840	380.8
40+	1,923	163.7	672	57.2	335	28.6	1,172	102.4	2,960	265.9
Racial/ethnic group										
Non-Hispanic White	90,119	1,357.4	10,223	153.8	2,083	31.4	11,625	177.0	25,356	394.0
Non-Hispanic Black	77,326	4,073.6	19,805	1,040.8	2,276	120.0	7,925	427.8	11,847	652.4
Hispanic	44,345	2,363.4	5,349	284.6	1,354	72.2	4,385	236.5	9,347	515.3
Asian/Pacific Islander	7,522	1,569.4	992	206.7	278	58.0	625	131.3	2,127	456.3
Other/unknown	15,603	1,787.9	2,196	251.3	453	51.9	1,807	209.8	4,654	555.1
Education level										
High school or less	203,657	2,723.0	32,488	433.6	4,733	63.3	18,728	252.6	32,223	439.9
Some college	14,735	1,013.7	2,768	190.3	695	47.9	3,220	227.6	7,699	568.7
Bachelor's or advanced degree	14,190	548.6	2,934	113.4	928	35.9	4,039	159.1	12,148	495.3
Other/unknown	2,333	947.1	375	152.1	88	35.7	380	155.8	1,261	527.5
Marital status										
Single, never married	164,872	3,262.5	26,121	515.7	4,106	81.2	14,121	281.1	25,999	523.5
Married	56,063	910.5	10,200	165.5	1,952	31.7	9,613	158.7	21,318	360.9
Other/unknown	13,980	2,520.7	2,244	403.9	386	69.7	2,633	495.6	6,014	1,208.8
Service										
Army	97,914	2,285.7	19,079	444.7	2,386	55.7	11,278	267.0	18,740	451.5
Navy	56,335	1,906.0	9,343	315.7	2,383	80.7	6,351	217.7	15,419	540.7
Air Force	45,836	1,592.1	5,661	196.4	1,073	37.3	5,851	206.4	14,256	518.9
Marine Corps	34,830	2,114.4	4,482	271.7	602	36.5	2,887	176.5	4,916	303.3
Rank/grade										
Junior enlisted (E1–E4)	176,015	3,479.5	27,080	534.0	4,058	80.1	14,338	284.4	24,690	492.3
Senior enlisted (E5–E9)	49,431	1,070.0	9,712	210.1	1,883	40.8	9,101	201.5	19,712	452.2
Junior officer (O1–O3)	8,103	694.2	1,360	116.5	326	27.9	2,070	179.3	6,473	574.6
Senior officer (O4–O10)	803	106.7	288	38.3	134	17.8	614	83.3	1,964	276.0
Warrant officer (W01–W05)	563	335.3	125	74.4	43	25.7	244	149.9	492	312.8
Military occupation										
Combat-specific[b]	27,481	1,681.8	4,783	292.4	563	34.4	2,713	167.3	3,951	246.1
Motor transport	11,134	3,209.9	2,121	610.2	371	106.9	973	283.4	2,012	594.1
Pilot/air crew	2,346	545.9	302	70.2	77	17.9	516	121.6	1,193	288.0
Repair/engineering	66,646	1,914.9	10,563	303.1	1,537	44.2	6,972	202.6	12,973	382.9
Communications/intelligence	58,039	2,291.8	10,590	417.5	1,492	59.0	7,223	290.9	15,043	625.0
Health care	17,726	1,722.3	2,859	277.5	575	55.9	2,886	285.8	8,011	827.1
Other	51,543	2,228.4	7,347	317.1	1,829	79.1	5,084	222.2	10,148	451.3

[a]Incidence rate per 100,000 person-years.
[b]Infantry/artillery/combat engineering/armor.
Abbreviations: STIs, sexually transmitted infections; HSV, herpes simplex virus; HPV, human papillomavirus; No., number.

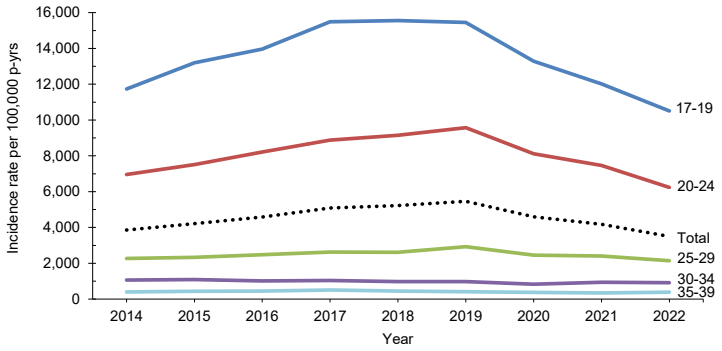
gonorrhea cases, and 87% of chlamydia cases that were qualified by laboratory or medical encounter data had a corresponding reportable medical event (RME). Table 2 provides the crude, unadjusted STI rates by other sociodemographic variables including service, age, education, marital status, rank/grade, and occupation. Patterns of incidence rates over time for each specific STI are described in subsequent subsections.

Chlamydia

Annual chlamydia rates among all active component members increased 53.2% between 2014 and 2019, with rates among both women and men peaking in 2019 (5,461.1 per 100,000 p-yrs and 1,883.4 per 100,000 p-yrs, respectively) **(Figure 1a; Figure 1b)**. From 2019 to 2022, chlamydia rates for both male and female service members declined by 35.0%. The younger age categories constituted a majority of this decline. Among women, non-Hispanic Black service members younger than age 25 demonstrated the largest absolute rate change, declining from a peak of 15,402.9 per 100,000 p-yrs in 2019 to 9,951.5 per 100,000 p-yrs in 2022 **(Figure 2a)**. The relative change in chlamydia rates among female service members younger than age 25 was comparable among racial/ethnic categories, declining approximately 33-37% between 2019 and 2022. This trend was also comparable among male service members under 25 years of age, whose rates declined by approximately 35-40% in each racial/ethnic category during the same period **(Figure 2b)**.

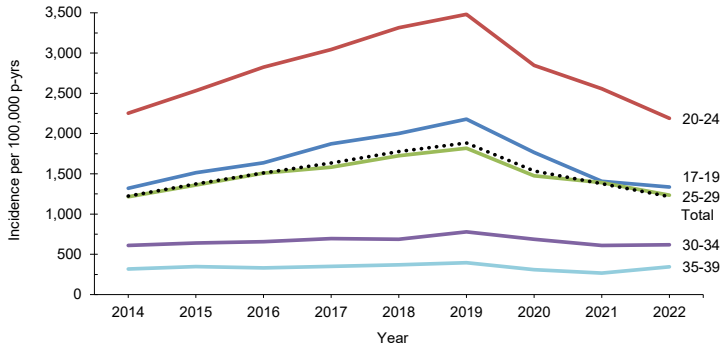
Note: Figures 2a and 2b are expressed on a logarithmic scale.

FIGURE 1a. Incidence Rates of *Chlamydia trachomatis* Infection Among Women by Age Group, Active Component, U.S. Armed Forces, 2014–2022



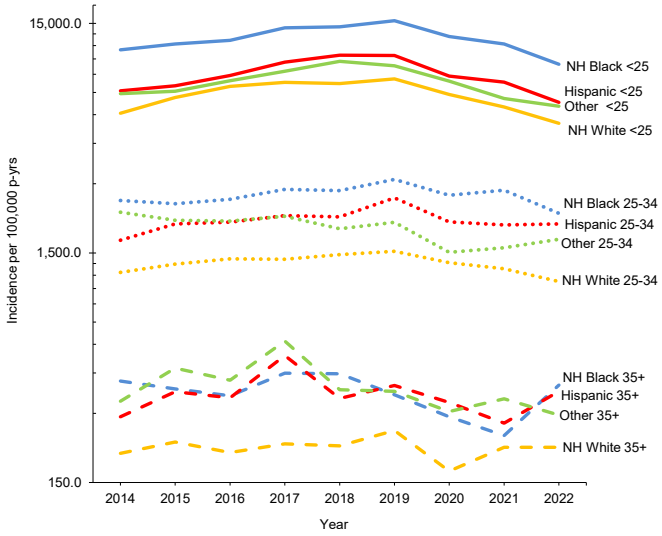
Abbreviation: P-yrs, person-years.

FIGURE 1b. Incidence Rates of *Chlamydia trachomatis* Infection Among Men by Age Group, Active Component, U.S. Armed Forces, 2014–2022



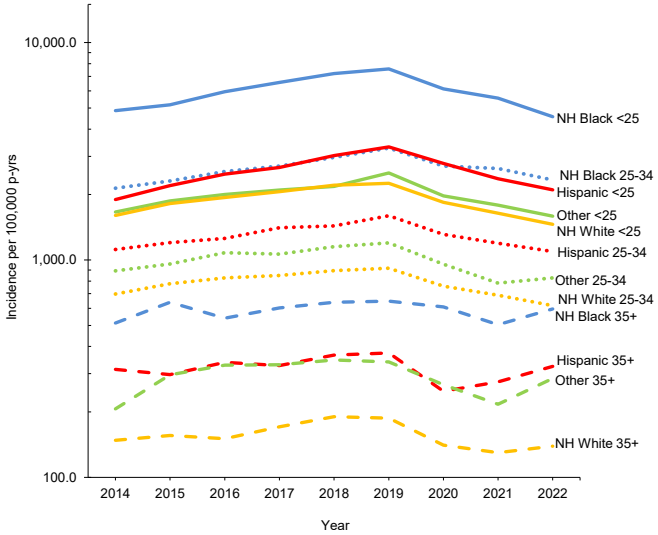
Abbreviation: P-yrs, person-years.

FIGURE 2a. Incidence Rates of *Chlamydia trachomatis* Infection Among Women by Age and Racial/Ethnic Group, Active Component, U.S. Armed Forces, 2014–2022



Abbreviations: P-yrs, person-years; NH, non-Hispanic.
Note: Rates are shown on a log scale.

FIGURE 2b. Incidence Rates of *Chlamydia trachomatis* Infection Among Men by Age and Racial/Ethnic Group, Active Component, U.S. Armed Forces, 2014–2022



Abbreviations: P-yrs, person-years; NH, non-Hispanic.
Note: Rates are shown on a log scale.

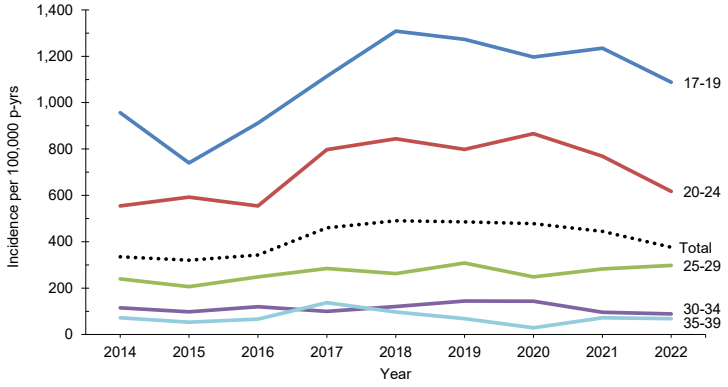
Gonorrhea

Between 2014 and 2022, the crude annual incidence rate of gonorrhea increased 28.7%; however, after peaking in 2019 (370.2 per 100,000 p-yrs), the rate declined to 324.7 per 100,000 p-yrs in 2022. During the last 5 years of the surveillance period (2018 to 2022), more substantial declines were observed among women (490.5 to 376.5 per 100,000 p-yrs) than men (346.2 to 313.7 per 100,000 p-yrs) **(Figure 3a; Figure 3b)**. These recent trends in declining female gonorrhea incidence were primarily driven by rates among service members under age 25. While male gonorrhea rates declined for those 20-24 years of age during the last 5 years, the rates among men under age 20 and ages 25-29 remained relatively stable. Gonorrhea rates remained highest among non-Hispanic Black service members throughout the surveillance period, peaking at 1,229.3 per 100,000 p-yrs in 2020 and declining to 984.9 per 100,000 p-yrs in 2022 **(data not shown)**.

Syphilis

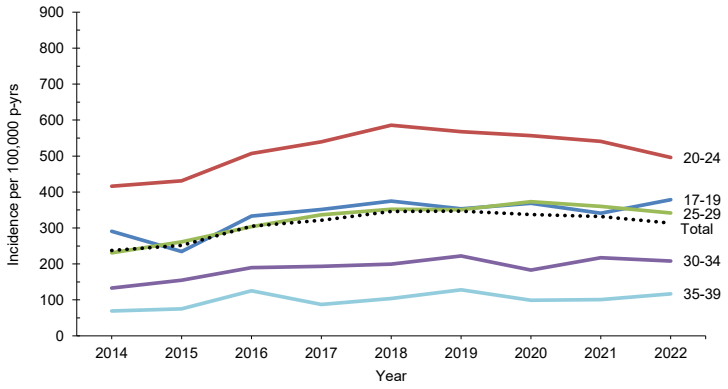
The crude incidence rate for total cases of syphilis in 2022 (73.5 per 100,000 p-yrs) almost doubled the rate observed in 2014 (40.7 per 100,000 p-yrs). After a period of brief decline starting in 2019, rates increased by nearly 40% from 2020 to 2022. During this 3-year period, the 61.1% increase in female syphilis rates (37.8 to 60.9 per 100,000 p-yrs) exceeded the 35.8% increase among men (56.1 to 76.2 per 100,000 p-yrs) **(Figure 4a; Figure 4b)**. Overall incidence rates of syphilis generally decreased with advancing age among both sexes; this pattern was consistent among all racial/ethnic groups. Non-Hispanic Black service members consistently accounted for the highest rates of syphilis throughout the surveillance period, with women under 25 years of age (122.6 per 100,000 p-yrs), men under age 25 (254.4 per 100,000 p-yrs), and men ages 25-34 (201.7 per 100,000 p-yrs) substantiating the largest rates stratified by age and biological sex within this racial/ethnic group in 2022 **(data not shown)**.

FIGURE 3a. Incidence Rates of Gonorrhea Infection Among Women by Age Group, Active Component, U.S. Armed Forces, 2014–2022



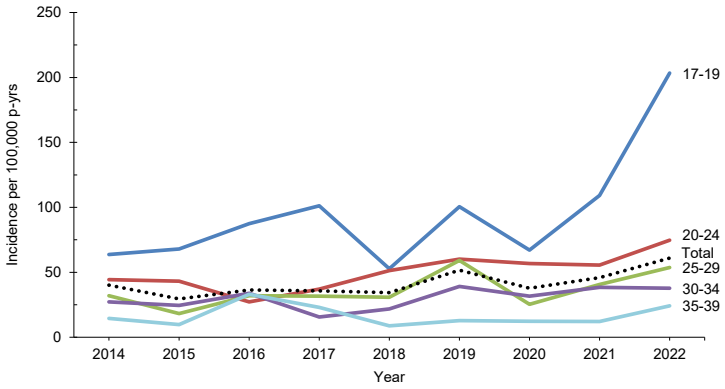
Abbreviation: P-yrs, person-years

FIGURE 3b. Incidence Rates of Gonorrhea Infection Among Men by Age Group, Active Component, U.S. Armed Forces, 2014–2022



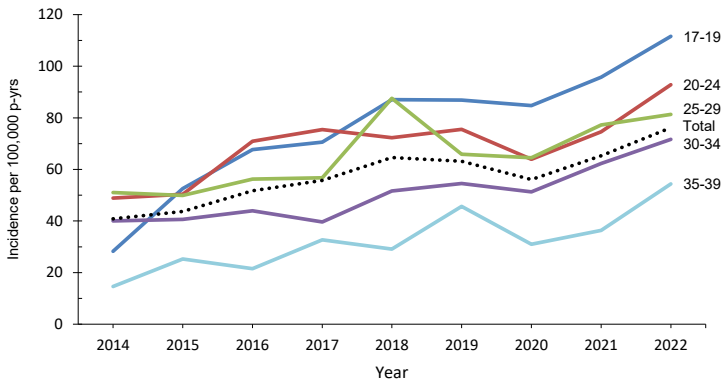
Abbreviation: P-yrs, person-years

FIGURE 4a. Incidence Rates of Syphilis Infection Among Women by Age Group, Active Component, U.S. Armed Forces, 2014–2022



Abbreviation: P-yrs, person-years

FIGURE 4b. Incidence Rates of Syphilis Infection Among Men by Age Group, Active Component, U.S. Armed Forces, 2014–2022



Abbreviation: P-yrs, person-years

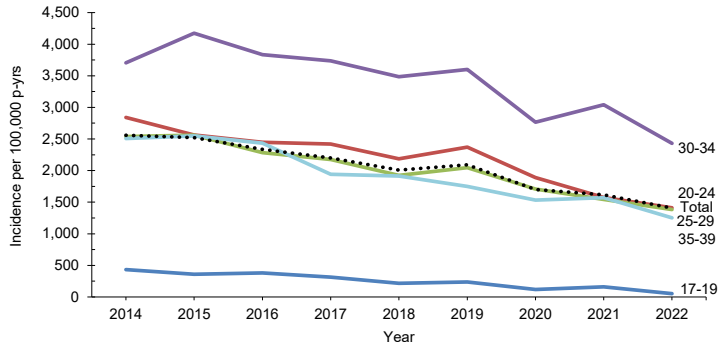
Genital HPV

The crude annual incidence rates of genital HPV infections decreased 47.3% among all active component service members from the start of the surveillance period until the end, with the most marked absolute decrease among women. Incidence rates of genital HPV infections among female service members decreased from a high of 2,559.0 cases per 100,000 p-yrs in 2014 to a low of 1,406.6 cases per 100,000 p-yrs in 2022 (45.0%) **(Figure 5a)**. While this crude decline was observed for all age groups, the rate of genital HPV among females 30-34 years old increased at 3 points annually during the surveillance period. The rate of genital HPV among males remained substantially lower than among women throughout the surveillance period, also demonstrating a major decline from 307.3 HPV cases per 100,000 p-yrs 2014 to 122.1 cases per 100,000 p-yrs in 2022 (60.3%). Beginning in 2020, genital HPV rates in men older than age 34 increased **(Figure 5b).**

Genital HSV

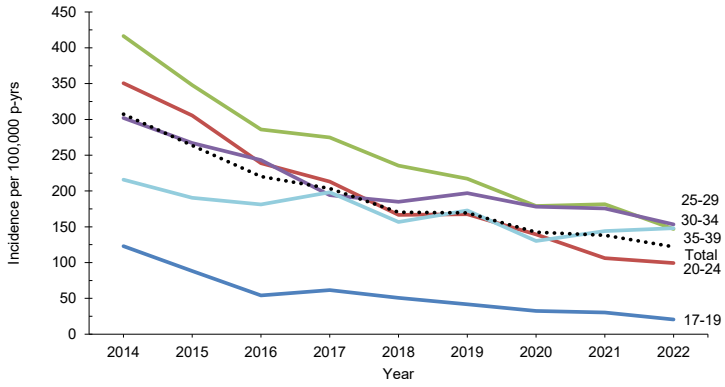
Crude annual incidence rates of genital HSV infections decreased from 237.9 to 158.2 per 100,000 p-yrs over the course of the surveillance period (33.5%). Rates among female service members ranged from a high of 782.8 per 100,000 p-yrs in 2016 to a low of 434.0 per 100,000 p-yrs in 2022. During the last 5 years of the surveillance period, genital HSV rates among female service members declined by approximately 40% for all age groups except women ages 35-49, who had a more stable rate reduction of 22.3% **(Figure 6a)**. Rates for male service members were also highest in 2016 (181.8 per 100,000 p-yrs) and lowest in 2022 (101.5 per 100,000 p-yrs). Men ages 20-24 demonstrated the largest HSV rate decline, of 38.6%, from 2018 to 2022 **(Figure 6b)**. Over the surveillance period, the incidence rates of genital HSV infections decreased among service members in all age and racial/ethnic groups **(data not shown).**

FIGURE 5a. Incidence Rates of Genital HPV Infection Among Women by Age Group, Active Component, U.S. Armed Forces, 2014–2022



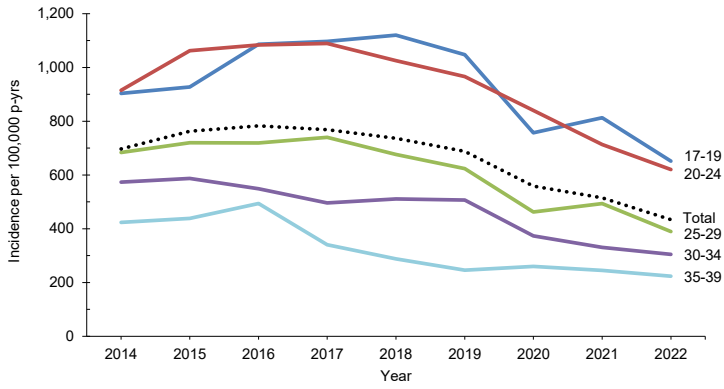
Abbreviations: HPV, human papillomavirus; p-yrs, person-years.

FIGURE 5b. Incidence Rates of Genital HPV Infection Among Men by Age Group, Active Component, U.S. Armed Forces, 2014–2022



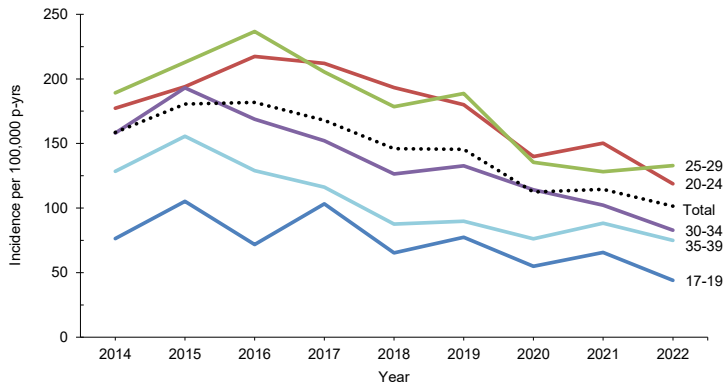
Abbreviations: HPV, human papillomavirus; p-yrs, person-years.

FIGURE 6a. Incidence Rates of HSV Infection Among Women by Age Group, Active Component, U.S. Armed Forces, 2014–2022



Abbreviation: HSV, herpes simplex virus; p-yrs, person-years.

FIGURE 6b. Incidence Rates of HSV Infection Among Men by Age Group, Active Component, U.S. Armed Forces, 2014–2022



Abbreviation: HSV, herpes simplex virus; p-yrs, person-years.

Discussion

This surveillance report documents a continued period of decline since 2019 for all STI case rates, with the exception of syphilis. After a brief decline in 2019, the incidence rate of syphilis among male and female active component service members increased by approximately 40% between 2020 and 2022. As noted by CDC national surveillance reports, the COVID-19 pandemic likely contributed to changes in STI screening coverage; thus, incidence rates during this time should be interpreted with caution.[14] Future analyses of STI screening practices for active component service members may help elucidate true incidence rate declines, particularly for STIs more commonly associated with asymptomatic infection.

While age- and gender-adjusted STI rates among active duty service members remain elevated when compared to U.S. rates, this comparison is subject to unmeasured sociodemographic differences and case surveillance methodologies unique to each population. The U.S. military represents a 'healthy worker' population with no-cost access to complete preventive and primary care, for maintenance of a medically ready force.[15] The electronic health records generated by the Military Health System (MHS) also enable more complete disease burden capture for notifiable disease reporting. The data source descriptions for chlamydia, gonorrhea, and syphilis in this report are provided to clarify the percentage of cases identified by sources supplemental to medical event reports.

Chlamydia rates were marked by a pronounced decline from 2019 to 2022, substantiated by distributed rates of decline by biological sex and all racial/ethnic groups among service members 25 years of age or younger. An assessment of screening rates may clarify whether this constituted a true decline in incidence, as chlamydia rates in the general population continued to increase during this period.[4] Compared to most recently published 2021 national statistics, the chlamydia case rate for service members 20-24 years of age remains elevated in relation to the general population for both male (2,556.2 service members vs. 1,680.0 civilians per 100,000) and female (7,466.4 service members vs. 3,797.8 civilians per 100,000) rates among the same age group.[16] These rate comparisons should, however, be interpreted with an understanding of the unique surveillance methods for each population, as well as their differences in screening access and use. Laboratory and medical encounter data from service members in 2022 supplemented chlamydia case rates by 13%; these cases had no medical event reports and would not have been identified without supplemental electronic health record data.

While the national gonorrhea rate for civilians has continued to increase since its historic low in 2009, gonorrhea case rates among both male and female service members of the youngest age groups have reduced, with male service members ages 25-29 demonstrating a relatively stable rate of decline. Recently published national statistics for 2021 demonstrate relatively equivalent gonorrhea case rates for female service members and female civilian populations ages 20-24 (768.9 service members vs. 873.2 civilians per 100,000), while gonorrhea case rates among male service members 20-24 years of age were lower (540.5 service members vs. 844.2 civilians per 100,000) during the same year.[17] These rate comparisons should be interpreted in concert with aforementioned case detection and surveillance methods, as 29% of the gonorrhea cases among service members in this report were identified from supplemental laboratory or medical encounter data.

Routine surveillance reports do not assess anatomic sites from gonorrhea case reports or laboratory records, which could provide more comprehensive understanding of extragenital infections in high-risk populations. National guidelines recommend screening for gonorrhea, including pharyngeal or rectal testing, at least annually for MSM and HIV-positive patients. Extragenital gonorrhea screening may be considered for females on the basis of reported sexual behaviors and exposure.[18] Despite these recommendations, extragenital screening for high-risk civilian and military populations is underused.[19,20] A recent assessment of extragenital STI screening by primary care physicians for HIV-positive airmen found that approximately one-third of patients had undetected STIs, the majority due to extragenital infections of the rectum and pharynx.[20]

A male-to-female syphilis rate ratio greater than 1 persisted throughout the surveillance period; meanwhile a recent relative increase in syphilis rates among female service members, particularly within the youngest age group, could indicate either improved accession screening or a true increase in rates among women. This finding is reflected in national surveillance reports: Although civilian rates of primary and secondary syphilis are lower among women, female incidence rates more than doubled from 2016 to 2020.[21] This evidence reinforces U.S. Preventive Services Task Force recommendations on early screening for syphilis infection in all pregnant women, particularly for female military service members, who are largely within child-bearing years.[22]

No data on sexual risk behaviors were available, but prior surveys of military personnel have indicated increased behaviors of possible concern. The 2018 Department of Defense Health-Related Behaviors Survey (HRBS) documented that 19.3% of active component respondents reported 2 or more sexual partners within the past year, and 34.9% reported sex with a new partner without condom use in the past year; these percentages are almost double those from the 2011 survey.[23]

This report has several limitations that should be considered when interpreting its results. First, STI diagnoses could be incorrectly coded. For example, STI-specific "rule out" diagnoses or vaccinations (e.g., HPV vaccination) may be reported with STI-specific diagnostic codes, which would result in overestimation of STI incidence. Cases of syphilis, genital HSV, and genital HPV infections based solely upon laboratory test results are considered "suspect" because laboratory test results cannot distinguish between active and chronic infections. Because incident cases of those STIs were identified based upon a first qualifying encounter or laboratory result, it is likely most cases were acute and not chronic.

STI cases coded in the medical record using symptom codes (e.g., urethritis) rather than STI-specific codes may not

be captured. In addition, the counts of STI diagnoses reported here may underestimate actual diagnoses because some affected service members may have been diagnosed and treated by non-reimbursed, non-military care providers (e.g., county health departments or family planning centers) or in deployed settings (e.g., overseas training exercises, combat operations, or aboard ships). Laboratory tests provided through purchased care or from a shipboard facility, battalion aid station, or in-theater facility were not captured by the current analysis. Finally, medical data from July 2017 to October 2019 at sites using the new MHS electronic health record, MHS GENESIS, are not available in the DMSS—these sites include Naval Hospital Oak Harbor, Naval Hospital Bremerton, Air Force Medical Services Fairchild, and Madigan Army Medical Center. Medical encounter data for individuals seeking care at any of those facilities between July 2017 and October 2019 could not be included in the current analysis.

For some STIs, detection of prevalent infection may occur long after an initial infection. Changes in incidence rates may reflect, at least in part, temporal changes in case detection, including shifts to more aggressive screening. The lack of standard service and installation practices for STI screening, testing, treatment, and reporting complicate interpretations of the differences between services, military and demographic subgroups, as well as locations. Establishing STI screening, testing, treatment, and reporting standards throughout the services, and ensuring adherence, would likely improve detection and characterization of STI-related health threats. Continued behavioral risk-reduction interventions are still required to counter STIs among military service members.

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Update

Malaria Among Members of the U.S. Armed Forces, 2013–2022

Malaria infection remains a potential health threat to U.S. service members located in or near endemic areas due to duty assignment, participation in contingency operations, or personal travel. In 2022, a total of 30 active and reserve component service members were diagnosed with or reported to have malaria, a 42.9% increase from the 21 cases identified in 2021. Over half of the malaria cases in 2022 were caused by *Plasmodium falciparum* (53.3%; n=16) and one-sixth (16.7%; n=5) were attributed to *P vivax*. The remaining 9 cases were associated with other or unspecified types of malaria. Malaria cases were diagnosed or reported from 19 different medical facilities—15 in the U.S. and 1 each from Germany, Africa, South Korea, and Japan. Of the 28 cases with a known location of diagnosis, 9 (32.1%) were reported from or diagnosed outside the U.S.

What are the new findings?

Total malaria cases have decreased since 2016, likely due to the reduction in forces deployed to Afghanistan, a known malaria risk area. The reduction in case counts over the last 3 years of the period may be due in part, to COVID-19-related travel restrictions, curtailing travel to malaria risk areas.

What is the impact on readiness and force health protection?

Malaria infection causes acute incapacitation. *P falciparum* malaria poses a high risk of serious sequelae including death. Unprotected forces can experience extraordinarily high attack rates in highly endemic areas, potentially causing mission failure. Malaria poses a risk for service members deployed to endemic regions as well as those traveling to such areas for personal reasons. The finding that *P falciparum* malaria was diagnosed in more than half of cases in 2022 underscores the need for continued emphasis on effective preventive measures against this most dangerous malaria strain.

Since 1999, the *MSMR* has published regular updates on malaria incidence among U.S. service members.[1-3] This year's update employs methods similar to previous analyses describing the epidemiologic patterns of malaria incidence among service members in the active and reserve components of the U.S. Armed Forces. The *MSMR*'s focus on malaria reflects both historical lessons about this mosquito-borne disease and its continuing threat to military operations and service members' health.

Malaria is a febrile parasitic disease transmitted through the bite of an infected female *Anopheles* mosquito. The parasite *P falciparum* is responsible for the deadliest form of malaria and is most prevalent in Africa.[4] *P vivax* is the most widely distributed parasite species, with relatively high infection prevalence in the Western Pacific, Southeast Asia, and Eastern Mediterranean regions and less densely populated areas of the Americas.[4]

P vivax and *P falciparum* have distinct epidemiologies. A major difference is *P vivax*'s ability to cause relapses weeks or months following primary infection due to its activation of hypnozoites, dormant liver-stage parasites.[5] This infection reservoir allows *P vivax*'s survival during mosquito-free cold seasons, expanding its geographic range far into temperate zones such as the Korean peninsula.[6] Relapse can be prevented with presumptive antirelapse therapy (PART), but the risk must be recognized, with appropriate therapy (primaquine or tafenoquine) prescribed and regimen successfully completed after departing the malaria-endemic area.[7,8]

In 2021, approximately 95% of global malaria cases and related deaths were in sub-Saharan Africa, where 4 countries accounted for more than half (52%) of this mortality: Nigeria (31%), Democratic Republic of the Congo (13%), the Niger (4%), and the United Republic of Tanzania (4%).[4] Most of these cases and deaths were due to mosquito-transmitted *P falciparum* among children under age 5.[4] In 2021, 2% of global estimated malaria cases were caused by *P vivax*.[4] While heightened malaria-control efforts have reduced the incidence of *P falciparum* malaria in many areas, the proportion of *P vivax* malaria cases has increased in some regions where both parasites are present.[9,10]

Methods

The surveillance period for this report was January 1, 2013 through December 31, 2022. The surveillance population included Army, Navy, Air Force, and Marine Corps active and reserve component members of the U.S. Armed Forces. The records of the Defense Medical Surveillance System (DMSS) were searched for qualifying evidence of malaria diagnoses from reportable medical events (RMEs), hospitalizations or outpatient encounters (in military and non-military facilities), and laboratory results generated at military facilities. The case definition criteria included 1) an RME record of confirmed malaria, 2) a hospitalization record with a primary diagnosis of malaria, 3) a hospitalization record with a nonprimary diagnosis of malaria due to a specific *Plasmodium* species, 4) a hospitalization record with a nonprimary

diagnosis of malaria and diagnosis of anemia, thrombocytopenia and related conditions, or malaria complicating pregnancy in any diagnostic position, 5) a hospitalization record with a nonprimary diagnosis of malaria plus diagnoses of signs or symptoms consistent with malaria in each diagnostic position antecedent to malaria,[11] or 6) a positive malaria antigen test plus an outpatient record with a diagnosis of malaria in any diagnostic position within 30 days of the specimen collection date. The relevant International Classification of Diseases, 9th and 10th Revision (ICD-9 and ICD-10, respectively) codes used to identify cases are shown in **Table 1**.

The analysis restricted each service member to 1 episode of malaria per 365-day period. When multiple records documented a single episode, the date of the earliest record was considered the date of clinical onset. Records within 30 days of the clinical onset date were reviewed for evidence of a *Plasmodium* species.

Presumed location of malaria acquisition was estimated using a hierarchical algorithm: 1) cases diagnosed in a malaria-endemic country were considered acquired there, 2) RMEs listing exposures to malaria-endemic locations were considered acquired in those locations, 3) RMEs not listing exposures to malaria-endemic locations but reported from installations in such locations were considered acquired there, 4) cases diagnosed among service members during or within 30 days of deployment or assignment to a malaria-endemic country were considered acquired in that country, and 5) cases diagnosed among service members deployed or assigned to a malaria-endemic country within 2 years before diagnosis were considered acquired in those respective countries. All remaining cases were considered acquired in unknown locations.

TABLE 1. ICD-9/ICD-10 Diagnostic Codes Used in Defining Malaria Cases from Records of Inpatient Encounters (Hospitalizations)

	ICD-9	ICD-10
Malaria (*Plasmodium* species)		
P falciparum	84.0	B50
P vivax	84.1	B51
P malariae	84.2	B52
P ovale	84.3	B53.0
Unspecified	84.4, 84.5, 84.6, 84.8, 84.9	B53.1, B53.8, B54
Anemia	280–285	D50–D53, D55–D64
Thrombocytopenia	287	D69
Malaria complicating pregnancy	647.4	O98.6
Signs, symptoms, or other abnormalities consistent with malaria	276.2, 518.82, 584.9, 723.1, 724.2, 780.0, 780.01, 780.02, 780.03, 780.09, 780.1, 780.3, 780.31, 780.32, 780.33, 780.39, 780.6, 780.60, 780.61, 780.64, 780.65, 780.7, 780.71, 780.72, 780.79, 780.97, 782.4, 784.0, 786.05, 786.09, 786.2, 786.52, 786.59, 787.0, 787.01, 787.02, 787.03, 787.04, 789.2, 790.4	E87.2, J80, M54.2, M54.5, N17.9, R05, R06.0, R06.89, R07.1, R07.81, R07.82, R07.89, R11, R11.0, R11.1, R11.2, R16.1, R17, R40, R41.0, R41.82, R44, R50, R51, G44.1, R53, R56, R68.0, R68.83, R74.0

Abbeviations: ICD-9, International Classification of Diseases, 9th Revision; ICD-10, International Classification of Diseases, 10th Revision.

Results

In 2022, a total of 30 U.S. service members were diagnosed with or reported to have malaria **(Table 2)**, resulting in a rate of 1.4 per 100,000 persons **(data not shown)**. The 2022 total is a 42.9% increase from the 21 cases ascertained in 2021 **(Figure 1)**. Twenty-two of the 30 cases (73.3%) in 2022 were identified from inpatient data and reported as RMEs; the remaining 8 cases were identified from inpatient data and did not have associated RMEs. In 2022, no cases were identified from laboratory data in combination with an outpatient record of malaria.

As in previous years, in 2022 the majority of U.S. military members diagnosed with malaria were men (96.7%), members of the active component (90.0%), and in the Army (66.7%). In 2022, non-Hispanic Black service members and those under age 30 accounted for the most cases of malaria (56.7% and 53.3%, respectively) **(Table 2)**.

Over half of the malaria cases in 2022 were caused by *P falciparum* (53.3%; n=16). Of the 14 cases not attributed to *P falciparum*, 5 (16.7%) were identified as due to *P vivax* and 9 were labeled as associated with other/unspecified types of malaria (30.0%) **(Figure 1)**. This result reflects historical data over a 10-year surveillance period, where malaria cases caused by *P falciparum* have accounted for the largest number of cases (n=170; 43.1%), followed by other/unspecified species (n=116; 29.4%), *P vivax* (n=93; 23.6%), and other *Plasmodium* species (n=15; 3.8%). The annual percentages of cases attributed to *P vivax* showed the greatest variability during the period, ranging from 9.5% in 2021 to 53.6% in 2020.

During the 2013 to 2022 surveillance period, malaria cases attributed to Africa accounted for the greatest number of cases (n=149; 37.8%), followed by other/unspecified locations (n=96; 24.4%), Korea (n=67; 17.0%), Afghanistan (n=80; 9.6%), and South/Central America (n=2; 0.5%) **(Figure 2)**. The annual percentages of cases associated with Africa had the greatest variability during the 10-year surveillance period, ranging from 17.9% in 2020 to 57.1% in 2021. From 2021 to 2022, the number of cases associated with Korea demonstrated the greatest increase, from 3 to 9; these 9 cases are the most from Korea since 2018. Since 2013, only 2 years (2014, with 13 cases; and 2016, with 11 cases) recorded higher totals **(Figure 2)**. Malaria cases were diagnosed or reported in 2022 at 19 different medical facilities in the U.S., Germany, Africa, South Korea, and Japan **(Table 3)**.

TABLE 2. Malaria Cases by *Plasmodium* Species and Selected Demographic Characteristics, Active and Reserve Components, U.S. Armed Forces, 2022

	P vivax	*P falciparum*	Other/ Unspecified	Total	% Total	DOD AD Reference Population[a] (October 2022)	
						n	%
Total	5	16	9	30	100.0	1,289,815	100.0
Sex							
Male	5	15	9	29	96.7	1,063,645	82.5
Female	0	1	0	1	3.3	226,169	17.5
Age group, y							
<20	0	0	1	1	3.3	84,152	6.5
20–24	1	2	6	9	30.0	406,128	31.5
25–29	2	4	0	6	20.0	302,512	23.5
30–34	0	1	1	2	6.7	210,619	16.3
35–39	2	4	1	7	23.3	159,193	12.3
40–44	0	3	0	3	10.0	81,768	6.3
45–49	0	1	0	1	3.3	34,456	2.6
50+	0	1	0	1	3.3	10,987	0.9
Racial/ethnic group							
Non-Hispanic White	2	3	2	7	23.3	886,197	68.7
Non-Hispanic Black	1	11	5	17	56.7	224,875	17.4
Other/unknown	2	2	2	6	20.0	178,743	13.9
Component							
Active	5	15	7	27	90.0	1,289,815	56.5
Reserve/Guard	0	1	2	3	10.0	991,699	43.5
Service							
Army	5	9	6	20	66.7	458,715	35.6
Navy	0	2	1	3	10.0	338,088	26.2
Air Force	0	4	1	5	16.7	319,586	24.8
Marine Corps	0	1	1	2	6.7	173,423	13.4

Abbreviations: DOD, Department of Defense; AD, active duty.
[a]Data from Defense Manpower Data Center (DMDC) population tables for active duty service members (October 2022). Accessed March 10, 2023. https://dwp.dmdc.osd.mil/dwp/app/dod-data-reports/data-requests

Most cases acquired in Africa were caused by *P falciparum* (80.0%;12/15), and more than two-fifths (44.4%; 4/9) of the cases considered as acquired in Korea were caused by *P vivax* **(Figure 3).** Of the 15 malaria infections in 2022 considered to be acquired in Africa, 4 were linked to Nigeria; 4 were associated with unknown African locations; 3 were linked to Niger; and 1 each were linked to Chad, Cameroon, Djibuti, and Uganda **(data not shown).** Examination of 22 malaria case records reported as RMEs revealed that 12 of the exposures were classified as deployment-related while 10 were categorized as nonduty-related, of which 9 were considered acquired in Africa. Non-Hispanic Black service members accounted for 8 of those nonduty cases; leisure travel to African countries was documented in the RME records of 4 of these service members.

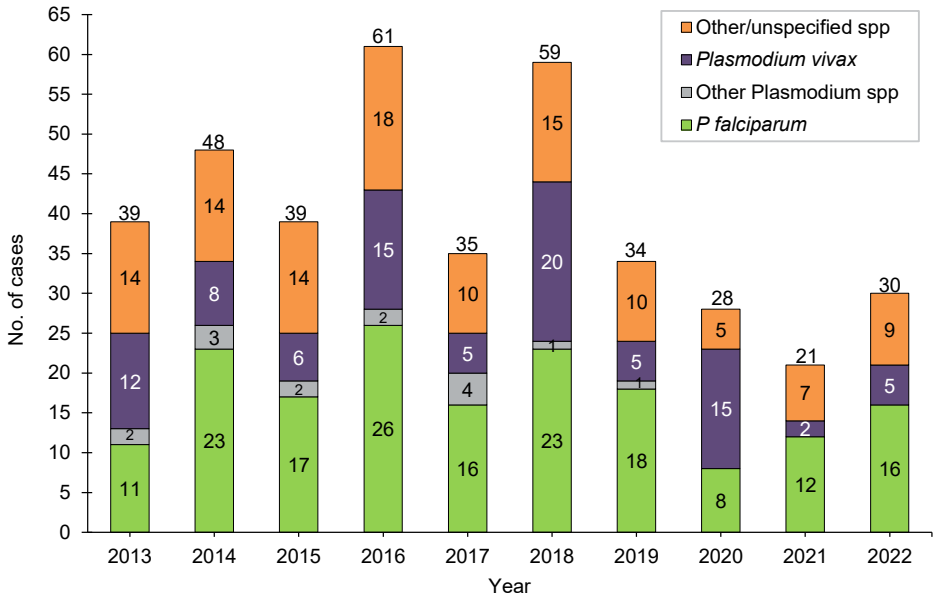
From 2013 to 2022, most non-*P vivax* malaria cases (70.2%) were diagnosed or reported during the 6 months from the middle of spring through the middle of autumn (May-October) in the Northern Hemisphere **(Figure 4)**. This result is comparable to 2022, when 72.0% (n=23) of non-*P vivax* malaria cases among U.S. service members were diagnosed from May through October **(data not shown)**. During the 10-year surveillance period, the proportions of non-*P vivax* malaria cases diagnosed or reported from May to October varied by region of acquisition: Korea (87.1%; 27/31); Afghanistan (86.8%; 33/38); Africa (68.3%; 97/142); and South/Central America (100.0%; 1/1) **(data not shown).**

Discussion

In 2022 *P falciparum* was responsible for more than half of U.S. service member malaria cases, underscoring the need for continued emphasis on prevention of this disease, given its potential severity and risk of death. Adherence to malaria prevention protocols is critical for military personnel when entering malaria-endemic areas. Personal protective measures against malaria include bed nets, topical insect repellent, permethrin-treated uniforms, along with chemoprophylaxis regimen compliance. Current Department of Defense guidance on medications for malaria prophylaxis summarizes the roles of chloroquine, atovaquone-proguanil, doxycycline, mefloquine, primaquine, and tafenoquine.[12]

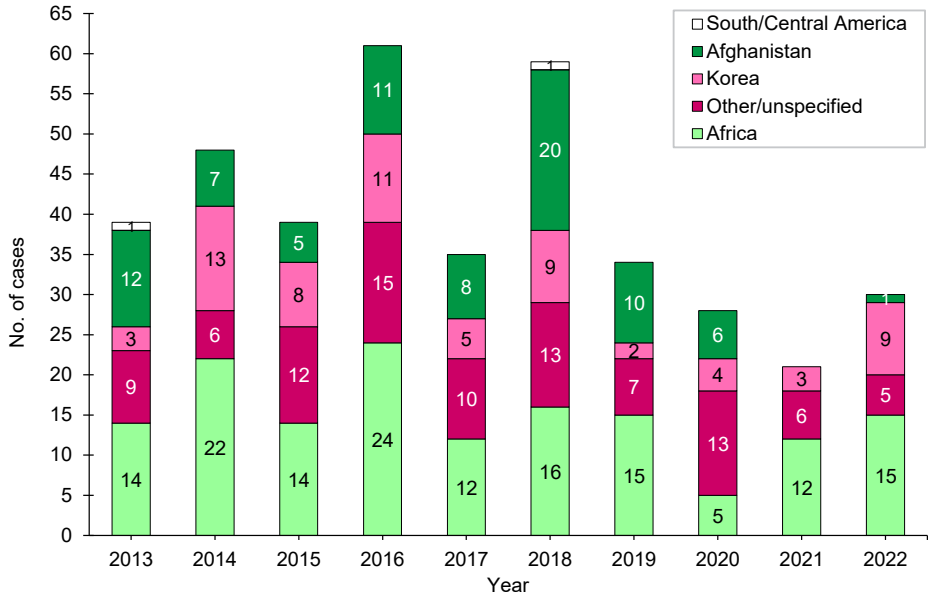
Malaria remains a potential health threat to U.S. military personnel in endemic areas as a consequence of long-term duty assignments, shorter-term contingency operations, as well as personal travel. The low case counts and rate of malaria reported during the surveillance period are primarily due to the limited number of service members at risk, as most duty locations in malaria-endemic countries are far removed from areas of malaria transmission. Complacency and inattention to the serious threat of malaria, however, can have disastrous consequences during deployment to malaria-endemic regions. Just 2 decades ago, in 2003, 225 U.S. Marines were sent to augment U.S. embassy security in Liberia,[13] and that mission's failure of appropriate countermeasures led to 80 suspected cases of *P falciparum* malaria, with an estimated attack rate of 36%. Those malaria cases necessitated 44 medical evacuations and resulted in 5 complicated cases requiring ICU admission, ventilator, and vasopressor support.[13]

FIGURE 1. Numbers of Malaria Cases by Species and Calendar Year of Diagnosis or Report, Active and Reserve Components, U.S. Armed Forces, 2013–2022



Abbreviation: No., number; spp, species.

FIGURE 2. Numbers of Malaria Cases by Location of Acquisition, Active and Reserve Components, U.S. Armed Forces, 2013–2022



Abbreviation: No., number

In addition to deployment exposures, malaria poses a significant medical concern for service members on leave traveling to malaria-endemic regions[14,15]; of particular concern is foreign-born personnel who travel on personal leave to their countries of origin. A prior study demonstrated that malaria rates among military members born in 7 western Africa countries were 44 times greater than those born in the U.S.[14] Leisure travel to specific African countries as reported on RME records may account, at least in part, for the disproportionately high malaria rates observed among non-Hispanic Black service members in this report. Among those service members visiting their birth countries in malaria-endemic regions, susceptibility due to loss of partial immunity from previous continuous exposure poses a substantial risk for infection and morbidity.[16]

The observations about diagnosis seasonality for non-*P vivax* malaria are compatible with the presumption that risk of acquiring malaria in a temperate climatic zone of the Northern Hemisphere is greatest from May through October. Given the typical incubation periods of malaria infection (approximately 9-14 days for *P falciparum*, 12-18 days for *P vivax* and *P ovale*, and 18-40 days for *P malariae*)[17] and the seasonal disappearance of biting mosquitoes during the winter, most malaria acquired in Korea and Afghanistan would be expected to cause initial symptoms during the warmer months. If primary prophylaxis is taken during the exposure period, however, initial symptoms may be suppressed. Studies of *P vivax* malaria in Korea have found that duration between primary infection and relapse among different *P vivax* strains ranges between 8 days and 8-13 months.[18] Up to 40–50% of infected individuals do not manifest symptoms until 6-11 months after infection.[19] Transmission of malaria in tropical regions such as sub-Saharan Africa occurs year-round but is location-specific.[20]

Much of the decline in cases early in the surveillance period is attributable to the decreases in military personnel in Afghanistan. The lower case counts in the last 3 years of the period may be due, at least in part, to COVID-19-related travel restrictions to, from, or through many malaria-endemic areas.

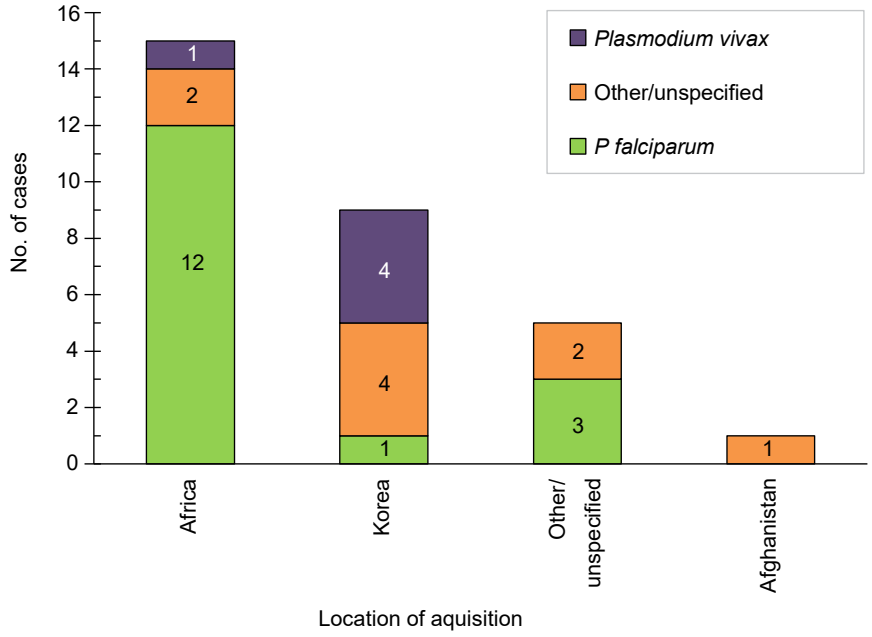
There are limitations to this report that should be considered when interpreting its findings. Ascertainment of malaria cases, especially among reserve components as well as non-deployment-related exposures, is likely incomplete, leading to rate underestimation. Some cases treated at deployed or non-U.S. military medical facilities may not have been reported or otherwise ascertained at the time of analysis. It should be noted that medical data from July 2017 through October 2019 at sites using the Military Health System's new electronic health record, MHS GENESIS, are not available in the DMSS—these sites include Naval Hospital Oak Harbor, Naval Hospital Bremerton, Air Force Medical Services Fairchild,

and Madigan Army Medical Center. Medical encounter data for individuals seeking care at any of those facilities from July 2017 through 2019 were not included in the current analysis.

Diagnoses of malaria documented only in outpatient settings without confirmatory testing and not reported as notifiable events were not included in this report. The geographic location where malaria was acquired was estimated from reported information. Some cases had reported exposures in multiple malaria-endemic regions or areas, and others had no relevant exposure or information. Personal travel to or deployment in malaria-endemic countries was not accounted for unless specified in notifiable event reports. Limited information on species type in RME records highlights the need for more attention to complete documentation of reportable conditions.

Acknowledgements: The authors thank the Navy Marine Corps Public Health Center, Portsmouth, VA, for providing laboratory data for this analysis.

FIGURE 3. Numbers of Malaria Cases by Species Type and Location of Acquisition, Active and Reserve Components, U.S. Armed Forces, 2022



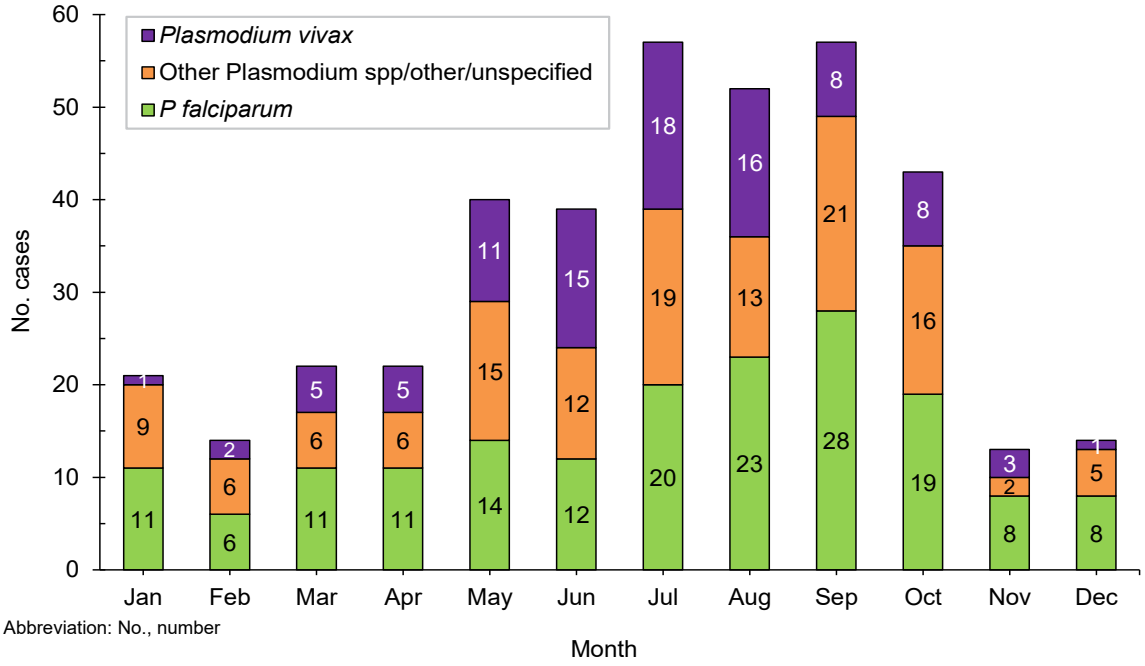
Abbreviation: No., number

TABLE 3. Number of Malaria Cases by Geographic Location of Diagnosis or Report and Presumed Location of Acquisition, Active and Reserve Components, U.S. Armed Forces, 2022

Location Where Diagnosed or Reported	Korea	Afghanistan	Africa	South/ Central America	Other/ unknown location	Total	
	No.	No.	No.	No.	No.	No.	%
William Beaumont AMC, Fort Bliss, TX	5	0	0	0	0	5	16.7
Lanstuhl Regional Medical Center, Germany	0	0	3	0	1	4	13.3
Evans Carson ACH, Fort Carson, CO	0	1	1	0	0	2	6.7
Grafenwoehr AHC, Germany	1	0	1	0	0	2	6.7
673rd Medical Group, Joint Base Elmendorf-Richardson, AK	0	0	1	0	0	1	3.3
412th Medical Group, Edwards AFB, CA	0	0	1	0	0	1	3.3
Tripler AMC, HI	0	0	1	0	0	1	3.3
Bayne-Jones ACH, Fort Polk, LA	0	0	1	0	0	1	3.3
Walter Reed National Military Medical Center, MD	0	0	1	0	0	1	3.3
Womack AMC, Fort Bragg, NC	0	0	1	0	0	1	3.3
Darnall AMC, Fort Hood, TX	0	0	1	0	0	1	3.3
Kenner AHC, VA	0	0	0	0	1	1	3.3
NMC Portsmouth, VA	0	0	1	0	0	1	3.3
Madigan AMC, Joint Base Lewis-McChord, WA	1	0	0	0	0	1	3.3
BMC Marine Corps Air Station Kaneohe Bay, HI	1	0	0	0	0	1	3.3
Brian D. Allgood ACH, Pyeongtaek, South Korea	1	0	0	0	0	1	3.3
NH Okinawa, Japan	0	0	1	0	0	1	3.3
7th Special Forces Group, Eglin AFB. FL	0	0	0	0	1	1	3.3
Expeditionary Medical Facility, Djibouti	0	0	1	0	0	1	3.3
Remote location (East), U.S.	0	0	0	0	1	1	3.3
Location not reported	0	0	0	0	1	1	3.3
Total	9	1	15	0	5	30	100.0

Abbreviations: No., number; AMC, Army Medical Center; ACH, Army Community Hospital; AFB, Air Force Base; NMC, Navy Medical Center; NH, Naval Hospital.

FIGURE 4. Cumulative Malaria Cases by Species Type and Month of Clinical Presentation or Diagnosis, Active and Reserve components, U.S. Armed Forces, 2013–2022



Abbreviation: No., number

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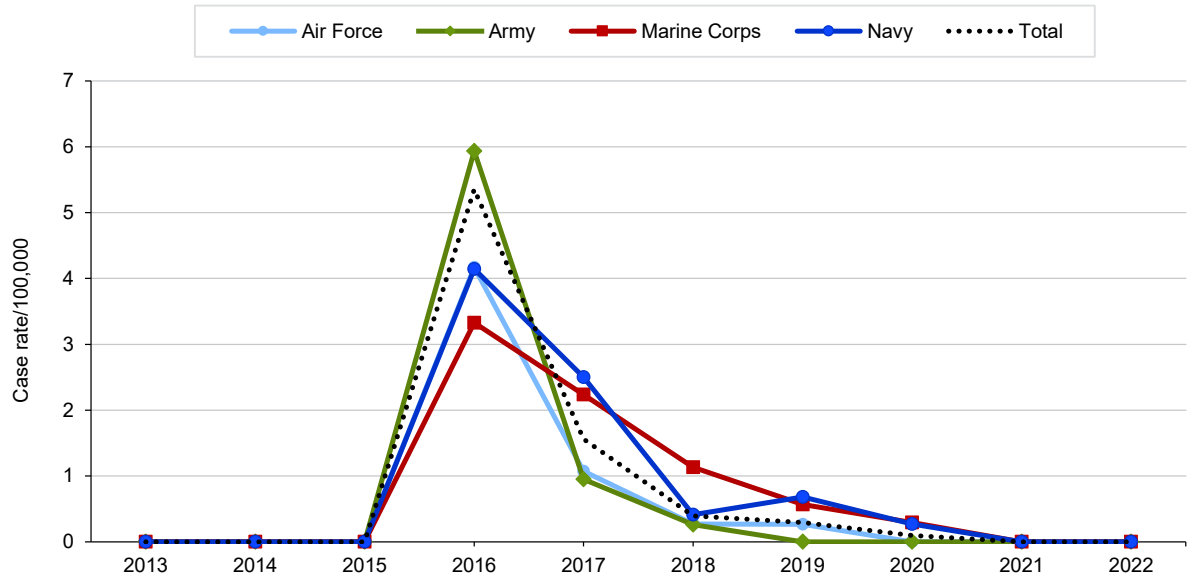
Surveillance Snapshot

Zika Virus Among Department of Defense Service Members and Beneficiaries, 2013–2022

Kati Touchstone, MPH; Kenji Matsumoto, MSc, MPH; Nicholas Seliga, MPH

FIGURE. Zika Case Rates[a] by Year and Service, DOD Service Members and Beneficiaries, 2013–2022



[a]Zika cases were identified from the Disease Reporting System-internet (DRSi) and HL7-formatted laboratory records generated in the Composite Healthcare System (CHCS). These data sources primarily capture MHS beneficiaries enrolled in TRICARE Prime; thus, case rate denominators were calculated using DMDC population tables. The denominator (per service) was the sum of active duty service members, the number of married active duty service members, and the number of children of active duty members.

Zika virus is an arboviral infection transmitted primarily through *Aedes* mosquitoes in tropical and subtropical regions. Although most infections are asymptomatic or mild, Zika virus infection during pregnancy can lead to infant complications and congenital abnormalities.[1] In the U.S., the Centers for Disease Control and Prevention (CDC) reported 5,559 travel-associated and 231 locally-acquired Zika virus cases from 2015 to 2021.[2] The majority of these cases (n=5,168) were identified in 2016, which translates to a peak of 1.6 confirmed or probable noncongenital Zika virus cases per 100,000 persons in the U.S.[3,4]

From January 1, 2013 through December 31, 2022, 212 Zika virus cases were detected among Department of Defense (DOD) service members and beneficiaries. Zika virus's presentation in the Western Hemisphere in early 2015[5] led to peak rates (n=143) for all services in 2016, which declined substantially thereafter, until no cases were identified among DOD beneficiaries from 2021 to 2022.

Zika virus cases described in this Snapshot reflect documentation from the Disease Reporting System-internet (DRSi) and laboratory records generated from the Composite Healthcare System (CHCS). The DRSi Zika virus reporting option was not available until July 2017,[6] and until then a medical event report from DRSi included those entered as "Any other unusual condition not listed" that contained case report notes indicating a positive Zika case. Cases indicated by laboratory records include culture identification, antigen detection, nucleic acid detection, and plaque reduction neutralization test (PRNT) detection. Immunoglobulin M (IgM)-positive cases were included in the absence of PRNT testing.

The rates depicted in this figure were estimated from the number of service members and dependents most likely enrolled in TRICARE Prime, as DRSi reports and CHCS laboratory records primarily reflect individuals with direct care at a military clinic or hospital. These population estimates do not clearly delineate risk for services more likely to deploy, travel, or live in assigned unit areas with endemic risk.

Surveillance Snapshot, continued

Author Affiliations: Defense Centers for Public Health—Portsmouth (Mr. Seliga, Ms. Touchstone, Mr. Matsumoto); Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. (Mr. Matsumoto)

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Notice to Readers

Vector-borne Disease Branch Detects *Borrelia miyamotoi* in Human Tick Submission

The Defense Centers Public Health–Aberdeen (DCPH-A) Vector-Borne Disease (VBD) Branch has confirmed the presence of *Borrelia miyamotoi*, an emerging tick-borne pathogen that causes hard tick relapsing fever (HTRF). This pathogen was detected for the first time at DCPH-A, following implementation of a new molecular test to detect and differentiate between the related agents of Lyme disease and HTRF. The pathogen was found in a human-biting tick submitted in January 2023 to the Military Tick Identification/Infection Confirmation Kit (MilTICK) Program.

MilTICK offers free testing and identification services for ticks removed from Department of Defense (DOD) beneficiaries, including service members from all branches, civilians, contractors, retirees, and dependents. Any tick found biting an eligible person can be submitted to MilTICK by health care providers through tick kits available at DOD health care facilities, or by individuals through a simple mail-in process. Approximately 3,000 human-biting ticks are tested each year, with each tick species identified, assessed for duration of attachment, and tested for the relevant suite of human pathogens. Results are returned via email to the point of contact provided on the MilTICK form and are used to assess the risk of tick-borne disease to military personnel. Recent tick surveillance data can be accessed through the MilTICK CAC-enabled data dashboard at https://carepoint.health.mil/sites/ENTO/miltick.

For additional information, or to request tick kits or services, contact the VBD Branch:
Phone: (410) 436-5421 or (410) 436-5425
Email: usarmy.apg.medcom-aphc.mbx.tickcom@health.mil
Website: https://phc.amedd.army.mil/topics/envirohealth/epm/Pages/HumanTickTestKitProgram.aspx

Letter to the Editor

Military Health System Exceeded Healthy People 2020 Goal for Rotavirus Vaccination

David R. Sayers, MD, MTM&H (Lt Col, MC, USAF); Sarah M. Reynolds, MD (Lt Col, MC, USAF)

We read with great interest the Brief Report in the November 2022 issue of the *MSMR* about pediatric vaccination rates by Romano et al.[1] The immunization schedule recommended by the Advisory Committee on Immunization Practices of the Centers for Disease Control and Prevention (CDC) provides guidance on protecting infants and children from preventable infectious diseases, and well-established national metrics allow assessment of Military Health System (MHS) performance.

While the authors make some comparisons to national vaccination data, CDC's Healthy People 2020 goals also provide a benchmark to compare MHS vaccination rates. The Healthy People initiative is the federal government's prevention agenda, developed and published by the CDC, for building a healthier nation that includes goals to attain longer lives free of preventable disease.[2] It is updated every 10 years.

For rotavirus vaccine, the Healthy People 2020 goal was 80% of children receiving 2 or more doses of vaccine by ages 19-35 months (can receive vaccine up to 8 months of age). The data presented by Romano et al. not only show that *completion* of rotavirus vaccine series well exceeded this metric by 2016 (92.4%), but that *compliance* with the rotavirus vaccine series was also above 80%. In comparison, at the Healthy People 2020 final review, only 73.5% of children in the U.S. had completed 2 or more doses of rotavirus vaccine. The data presented by Romano et al. also demonstrate better vaccination rates for polio and DTaP compared to the Healthy People 2020 final review.[3]

This is an important perspective, as medical care for pediatric dependents of military service members involves extra variables that add complexity to vaccine series completion (e.g. frequent moves, parent deployments). Nevertheless, high vaccination rates for pediatric dependents of military service members occurred, with 82.5% of children receiving care in military clinics, despite 61.1% of children experiencing a change in well-child care location and 16.8% of mothers deploying within 24 months postpartum.[1]

We concur with Romano et al. to suggest continued efforts for improving pediatric vaccination rates and the removal of barriers delaying vaccination within the MHS. We encourage the authors and other researchers to consider quantifying their data in relation to well-established national metrics to demonstrate MHS successes, as in this case, as well as identifying areas in need of improvement.

Disclaimer: The contents described in this publication are those of the authors and do not necessarily reflect official policy of the Department of the Air Force or Walter Reed National Military Medical Center.

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In Reply:

We thank Drs. Sayers and Reynolds for their interest in our brief report, *Pediatric Vaccine Completion and Compliance Among Infants Born to Female Active Duty Service Members, 2006-2016*.

We agree with Drs. Sayers and Reynolds that the MHS performed well in relation to the U.S. population. We included comparisons to national estimates throughout the study period to facilitate this assessment, but elected not to include Healthy People 2020-realized estimates for comparative benchmarking because the study period did not fully correlate with the dates for this national framework. We agree, however, that there is added value in contextualizing our measures with Healthy People 2020 targets. Although MHS vaccination coverage did not achieve the Healthy People 90% target for diphtheria, tetanus, and acellular pertussis (DTaP), MHS coverage surpassed the 90% and 80% targets for inactivated polio virus (IPV) and rotavirus vaccines, respectively. In our ongoing work on pediatric immunizations, where we extend the study period to include the COVID-19 era and assess the complete pediatric immunization series, we will integrate discussion of Healthy People 2020 and 2030 targets.

Celeste J. Romano, MS; Anna T. Bukowinski, MPH; Clinton Hall, PhD; Monica Burrell, MPH; Gia R. Gumbs, MPH; Ava Marie S. Conlin, DO, MPH; Nanda Ramchandar, MD, MPH

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