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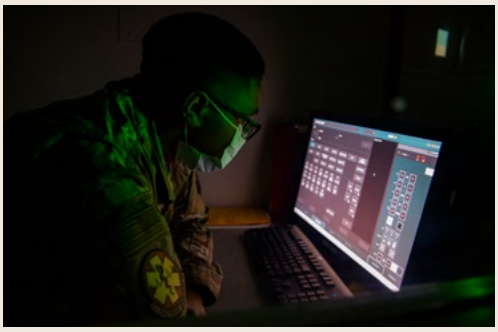

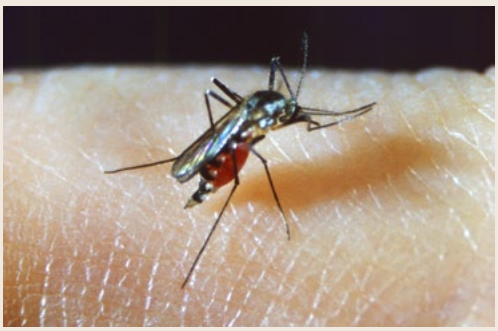

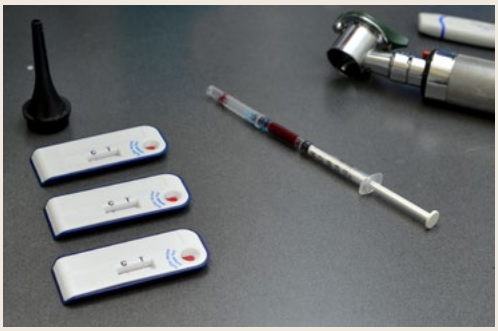

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Incidence of Colorectal Cancer Among Active Component Service Members, 2010–2022

Sithembile L. Mabila, PhD, MSc; Alexis A. McQuistan, MPH; Jessica H. Murray, MPH

Colorectal cancer, which is more predominant among men than women, has been shown to be associated with environmental and occupational risk factors experienced by military members. The Defense Medical Surveillance System (DMSS) was used to determine the crude and age-adjusted incidence rates of colorectal cancer among active component service members from all military services from January 1, 2010 to December 31, 2022. Results from this analysis show higher crude incidence rates of colorectal cancer among those who are older and male. The overall age-adjusted incidence rate throughout the surveillance period ranged from 3.56 (95% CI: 2.54-4.58) to 7.92 (95% CI: 5.98-9.86) cases per 100,000 person-years. Age-adjusted colorectal cancer rates were similar for males and females (4.46 and 4.33 cases per 100,000 person-years, respectively) and rates were relatively similar by service as well as race and ethnicity. This finding could be attributed to the small number of cases in this study due to better screening practices in the Military Health System (MHS).

What are the new findings?

Although non-Hispanic Black service members have historically had the highest incidence of colorectal cancer within the U.S. military, this study observed similar rates of colorectal cancer for all races and ethnicities after adjusting for age.

What is the impact on readiness and force health protection?

Incident rates of colorectal cancer within the U.S. military increase monotonically with age, with service members over the age of 45 with the highest incidence, re-enforcing the need to promote wellness screening among military populations. The importance of the DHA guideline changes that decreased colorectal screenings to age 45 years is significant.

Colorectal cancer is the third-most common cancer in incidence and mortality in the U.S.[1] Even though incidence of other digestive cancers such as liver and pancreatic cancers increased during the past 20 years,[2] colorectal cancer incidence in the U.S. decreased during the same period among adults aged 50 years and older.[3] This decrease in colorectal cancer is partly due to increased screening, leading to early detection and treatment of precancerous lesions.[4]

Colorectal cancer can be caused by exposure to risk factors such as tobacco use, alcohol use, diet, body composition, and physical inactivity.[5-9] There is also evidence showing an association between colorectal cancer and environmental and occupational risk factors.[10-13] Active component service members (ACSM) tend to be generally healthier than the U.S. general population, but they also tend to have a higher prevalence of smoking and alcohol use, and are more likely to be exposed to occupational risk factors including radiation, particulate matter, and solvents linked to colorectal cancer.[11-13]

Overall, rates of colorectal cancer in U.S. military service members are lower compared to age-adjusted rates within the general U.S. population.[14-15] In a study assessing incidence of numerous cancers from 2005 to 2014, the rate of colorectal cancer among ACSM was 4.5 cases per 100,000 person-years (p-yrs), with higher rates among men and African Americans.[16] Another study of colorectal cancer specifically identified 1,108 incident cases of colorectal cancer among ACSM from 1997 to 2016, with a higher incident rate among men (4.4 per 100,000 p-yrs) as well as non-Hispanic Black service members (5.3 per 100,000 p-yrs).[17] This study aims to build on prior analyses of incident colorectal cases among ACSM[17] and describe the incidence rate of colorectal cancer among active component U.S. military service members between 2010 and 2022.

Methods

The results presented in this study include ACSM from all military services from January 1, 2010 through December 31, 2022. Data were obtained from the Defense Medical Surveillance System (DMSS). Demographic data on age, military service, race and ethnicity, rank, and occupation at the time of colorectal cancer diagnosis were included. Ambulatory and inpatient administrative health records from both direct and purchased care were used to determine colorectal cancer diagnoses.

Case definition

International Classification of Diseases, 9th/10th revision (ICD-9/ICD-10) diagnostic codes, along with V-codes and Z-codes indicating a qualifying treatment (radiotherapy, chemotherapy, or immunotherapy), were used to define incident cases of colon and rectum cancer **(Table 1)**.[18] Cases of appendiceal malignancies were excluded, as they are histologically different from colorectal cancer.[18] An incident case of colorectal cancer was defined as either 1 hospitalization with a qualifying ICD-9 or ICD-10 diagnosis code in the first diagnostic position, or in the second diagnostic position if a V/Z-code indicating radiotherapy, chemotherapy, or immunotherapy treatment was in the first diagnostic position; or 3 or more ambulatory encounters within a 90-day period with a qualifying ICD-9/10 diagnostic code in the first or second diagnostic position.[18]

The date of the first case-defining hospitalization or ambulatory medical encounter was used as the incident date. Service members were counted once per lifetime. Person-time contributions for each service member were determined from January 1, 2010 to December 31, 2022. Service members and their person-time contributions were removed from the study population if a case-defining encounter was recorded prior to the start of the surveillance period on January 1, 2010. Person-time was censored when a service member left the active component or military service, and at the time of the incident diagnosis for a colorectal cancer case, whichever occurred first.

Statistical analysis

Crude and age-adjusted incident rates were calculated as incident colorectal cancer diagnoses per 100,000 p-yrs with 95% confidence intervals (CIs). The standard population used for the age-adjustment was the Military Health System (MHS) ACSM population in DMSS from 2010 to 2022, and age groups were utilized for adjusting colorectal incident rates. This age adjustment gave more weight to the younger age groups that constitute a majority of the ACSM population, leading to more stable incident rates. Incident rate ratios and 95% CI were calculated to compare colorectal cancer rates by all demographic variables included in the study. All analyses were conducted using SAS (version 9.4) with a significance level set at $p<0.05$.

Results

During the 13-year surveillance period 741 incident cases of colorectal cancer among ACSM were recorded, corresponding to an overall crude incident rate of 4.44 (95% CI: 4.12-4.76) cases per 100,000 p-yrs **(Table 2)**. The average age among colorectal cancer cases during the surveillance period was 39.9 years (STD=7.9, range 20-59). The distributions of incident colorectal cancer cases by select demographic characteristics are detailed in **Table 2**.

Crude incidence rates were higher among men and increased with age, ranging from 0.41 (95% CI: 0.24-0.57) per 100,000 p-yrs among those ages 20-24 to 54.51 (95% CI: 42.64-66.38) per 100,000 p-yrs among those older than 50-54 years **(Table 2)**. Only a few cases were recorded in the 55 and older age group (n=14), with some years—2013, 2015, 2019, 2021, 2022—reporting 0 cases in the oldest age group **(data not shown)**.

The overall age-adjusted incidence rate throughout the surveillance period ranged from 3.56 (95% CI: 2.54-4.58) to 7.92 (95% CI: 5.98-9.86) cases per 100,000 p-yrs **(Figure 1)**. The age-adjusted incidence rate peaked in 2017, at 7.92 (95% CI: 5.98-9.86) cases per 100,000 p-yrs, and then fluctuated for the rest of the surveillance period **(Figure 1)**. Age-adjusted colorectal rates were similar for men and women (4.46 [95% CI: 4.11-4.80] and 4.33 [95% CI: 3.49-5.17] cases per 100,000 p-yrs, respectively), and rates were relatively similar by service **(Table 2)**.

Age-adjusted rates were also similar for all races and ethnicities, ranging from 4.34 (95% CI: 3.56-5.12) cases per 100,000 p-yrs among non-Hispanic Blacks to 4.63 (95% CI: 3.65-5.62) cases per 100,000 p-yrs among Hispanics **(Table 2)**. The incident rate ratio was also relatively similar for all races and ethnicities, with no statistical significance when compared to non-Hispanic Whites **(Table 2)**.

Service members in the pilot/air crew occupation category had the highest age-adjusted colorectal incident rate (6.03 [95% CI: 4.31-7.74]), followed by those in motor transportation (5.20 [95% CI: 2.50-7.90]) **(Table 2)**. There was no significant difference, however, in the incident rate ratio for all occupation groups when compared to the reference group (infantry/artillery/armor/combat) **(Table 2)**.

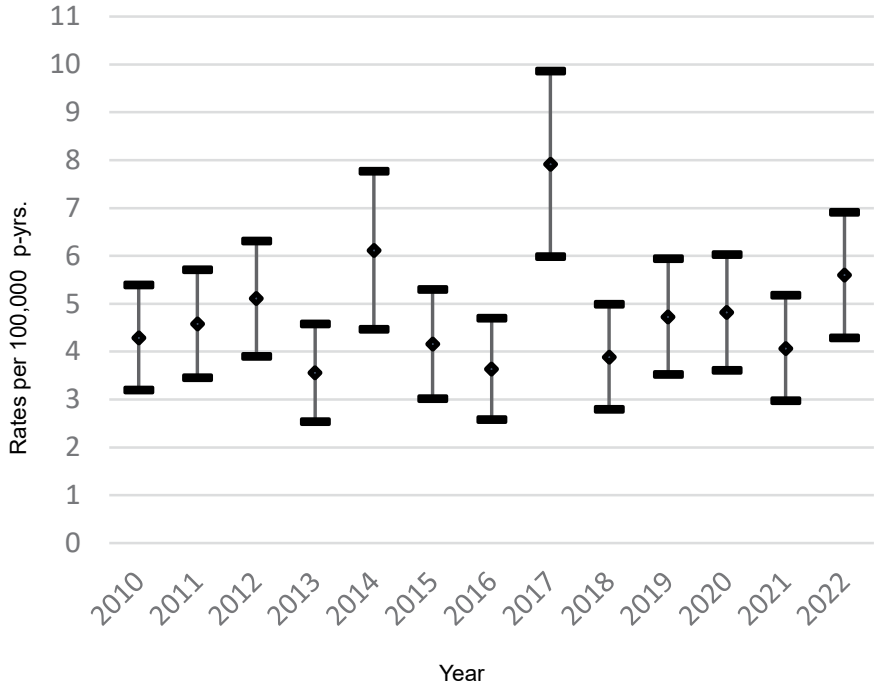
TABLE 1. ICD-9/ICD-10 Diagnostic Codes Used for Colorectal Cancer Case Classification

Colorectal diagnoses	ICD-9	ICD-10
Malignant neoplasm of colon (excluding malignant neoplasm of appendix)	153, 153.0-153.4, 153.6-153.9	C18.0, C18.2-C18.9
Malignant neoplasm of intestinal tract, part unspecified	159	C26.0
Malignant neoplasm of the rectosigmoid junction	154	C19
Malignant neoplasm of rectum	145.1	C20
Colorectal treatment (radiotherapy, chemotherapy, or immunotherapy)	V580, V581*	Z510*, Z511*

Abbreviations: ICD-9/ICD-10, International Classification of Diseases, 9th/10th Revisions.

* All subsequent digits/characters included.

FIGURE 1. Age-adjusted Annual Incidence Rates of Colorectal Cancer Among Active Component Service Members Aged 20-59, U.S Armed Forces, 2010–2022



Abbreviation: P-yrs, person-years.

Discussion

This analysis shows a higher crude incidence rate of colorectal cancer among those 50 to 54 years of age; a previous study of the active component military population, from 1997 to 2016, found similar results.[17] Age-adjusted colorectal cancer incident rates did not show any temporal trends during the study period, except for an increase in 2017. The prior study of colorectal cancer among ACSM from 1997 to 2016 also observed no temporal trends after adjusting for age.[17] The lack of temporal trends in the military population diverges from general U.S. population data, which from 2011 to 2019 have shown a 1% annual decrease.[19] This difference between the 2 populations could be due to the limited number of cases among ACSM, in turn leading to few cases among the younger (20-29 years) and older (55+ years) age groups.

The high incidence of colorectal cancer among service members in the pilot/aircrew occupation correlates with prior surveillance reports.[17] While this occupation accounts for the highest rate of colorectal cancer, a recent study of military pilots showed evidence that aircrew colorectal cancers were statistically lower in the military population when compared to the general U.S. population, by 44%.[20,21] Lower rates among ACSM may be attributed to universal health care and improved access to screenings for early pre-cancerous detection and treatment.

Older, White males have historically demonstrated greater use of colorectal cancer screenings within the MHS.[22] This study did not observe, after adjusting for age, any significant colorectal cancer rate differences between races and ethnicities **(Table 2)** that could indicate racial differences in health care access and screening. Recent Defense Health Agency (DHA) guideline changes that lowered the recommended age for colorectal screenings to age 45, combined with promotion of non-invasive colorectal cancer screenings and universal health care for all ACSM, may be contributing factors to the uniform incident rate among races and ethnicities.[22,23] Continued surveillance of colorectal cancer among ACSM is necessary for understanding the true burden of colorectal cancer within the MHS.

One of this study's primary limitations is that it did not use the DOD's cancer registry system, Oncolog, formerly known as the ACTUR. Oncolog includes cancer data reported by military hospitals and clinics for all DOD beneficiaries. Because this study relies solely on medical encounter data and does not incorporate Oncolog case reports, it may not include all colorectal cancer cases. Further studies should include both Oncolog and medical encounter data. Efforts are currently underway to determine true estimates of cancer diagnoses and treatment outside the MHS through the incorporation of data shared from state cancer registries.[24]

This study did not adjust for modifiable risk factors shown to increase risk of colorectal cancer such as obesity, physical inactivity, smoking, alcohol consumption, or environmental exposures.[5-10] The active component military population tends to be engaged in more physical activity, is required to pass routine physical fitness examinations, and must maintain a healthy body weight, and thereby is less likely to be overweight or obese compared to the general U.S. population.[21] These protective factors can be accredited to overall lower colorectal incidence rates within the U.S. military. Exposure to environmental toxins attributed to increased risk of colorectal cancer may be greater in this group, however, especially during deployment. Including deployment location and length of deployment in further analyses is important.

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Disclaimer
The views expressed in this article are those of the authors and do not necessarily reflect the official policy of the Department of Defense nor the U.S. Government.

TABLE 2. Crude and Age-adjusted Incidence Rates of Colorectal Cancer Among Active Component Service Members, U.S. Armed Forces, 2010–2022

	No.	Crude rate[a] (95%CI)		Age-adjusted rate[a] (95%CI)		IRR (95%CI)	
Total	741	4.44	(4.12 - 4.76)				
Sex							
Male	638	4.53	(4.18 - 4.88)	4.46	(4.11 - 4.80)	Ref	
Female	103	3.95	(3.18 - 4.71)	4.33	(3.49 - 5.17)	1.03	(0.83 - 1.27)
Race and ethnicity							
Non-Hispanic White	447	4.62	(4.19 - 5.04)	4.44	(4.03 - 4.85)	Ref	
Non-Hispanic Black	120	4.56	(3.74 - 5.37)	4.34	(3.56 - 5.12)	1.04	(0.85 - 1.27)
Hispanic	89	3.68	(2.91 - 4.44)	4.63	(3.65 - 5.62)	0.93	(0.74 - 1.17)
Other/unknown	85	4.36	(3.43 - 5.29)	4.43	(3.48 - 5.37)	1.00	(0.79 - 1.26)
Service							
Army	291	4.79	(4.24 - 5.34)	4.35	(3.85 - 4.85)	Ref	
Navy	170	4.25	(3.62 - 4.89)	4.17	(3.54 - 4.80)	1.00	(0.82 - 1.2)
Air Force	202	5.04	(4.35 - 5.74)	5.01	(4.31 - 5.71)	0.83	(0.70 - 1.00)
Marine Coprs	48	2.26	(1.62 - 2.90)	3.64	(2.57 - 4.71)	1.11	(0.82 - 1.52)
Coast Guard	30	6.18	(3.97 - 8.39)	4.34	(2.77 - 5.91)	0.77	(0.53 - 1.12)
Rank							
Junior Enlisted (E1-E4)	57	4.62	(4.19 - 5.04)	2.55	(1.28 - 3.81)	Ref	
Senior Enlisted (E5 - E9)	409	4.56	(3.74 - 5.37)	4.83	(4.31 - 5.35)	0.82	(0.58 - 1.16)
Officer (O1-O3 [W1-W3])	77	3.68	(2.91 - 4.44)	3.94	(2.97 - 4.91)	0.89	(0.6 - 1.33)
Officer (O4-O10, [W4-W5])	198	4.36	(3.43 - 5.29)	3.64	(0.00 - 12.07)	0.95	(0.65 - 1.39)
Military occupation							
Combat-specific[b]	85	3.70	(2.91 - 4.48)	4.47	(3.50 - 5.43)	Ref	
Motor transport	17	3.18	(1.67 - 4.69)	5.20	(2.50 - 7.90)	0.94	(0.56 - 1.58)
Pilot/air crew	54	8.48	(6.22 - 10.74)	6.03	(4.31 - 7.74)	0.77	(0.55 - 1.09)
Repair/engineering	176	3.53	(3.01 - 4.05)	4.29	(3.63 - 4.95)	1.02	(0.79 - 1.33)
Communications/ intelligence	180	4.92	(4.20 - 5.64)	4.79	(4.08 - 5.50)	0.93	(0.72 - 1.21)
Health care	84	5.73	(4.50 - 6.95)	4.09	(3.19 - 4.99)	1.12	(0.83 - 1.52)
Other/unknown	145	4.68	(3.91 - 5.44)	4.28	(3.57 - 4.99)	1.05	(0.80 - 1.37)

Abbreviation: No., number; IRR, incidence rate ratio.

[a] Rate per 100,000 person-years.

[b] Includes Infantry, artillery, armor, and combat occupations.

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Force Protection Risks in AFRICOM, INDOPACOM and SOUTHCOM Due to Rapid Diagnostic Test Failures for *Falciparum* Malaria, 2016–2022

Brian A. Vesely, PhD and Qin Cheng, PhD

Malaria, caused by various species of the *Plasmodium* parasite, remains a significant health threat in most U.S. military regions—AFRICOM, CENTCOM, INDOPACOM, and SOUTHCOM—and although less prevalent, also poses periodic risks to military personnel in NORTHCOM through imported cases. Early diagnosis is crucial for effective malaria chemotherapy, and rapid diagnostic tests (RDTs) have proven valuable in resource-poor settings and operational environments. The BinaxNow Malaria RDT is currently the sole U.S. Food and Drug Administration (FDA)-approved test for use on U.S. military personnel. This simple RDT targets *Plasmodium falciparum*, the deadliest malaria species, by detecting the histidine-rich protein 2 (HRP2), as well as pan-*Plasmodium* species by detecting aldolase. The emergence of mutant *P. falciparum* parasites lacking *pfhrp2/pfhrp3* genes and thus not expressing HRP2/HRP3 proteins poses a significant challenge in many malaria-endemic areas. This genetic variation has led to false-negative results in all HRP2-detecting RDTs including BinaxNow, undermining its utility. Current U.S. military force health protection (FHP) measures for preventing malaria, including chemoprophylaxis, permethrin-treated uniforms, and DEET application to exposed skin, are effective, but breakthrough infections still occur. The use of portable and user-friendly malaria diagnostics is necessary in remote locations that lack microscopy or nucleic acid-based diagnostic capabilities. The alarmingly high prevalence of mutant *pfhrp2/3*-deleted parasites poses a threat to malaria diagnosis in all Combatant Commands where point-of-care testing is vital. This review emphasizes the importance of ongoing monitoring to determine the frequency and distribution of mutant parasites. Urgent attention is needed to develop alternative RDTs that can effectively detect malaria infections caused by these mutant strains.

What are the new findings?

These findings confirm that mutant *pfhrp2/3*-deleted parasites are highly prevalent in SOUTHCOM and parts of AFRICOM, rendering HRP2-based RDTs such as BinaxNow an unsuitable diagnostic tool for malaria in many of the SOUTHCOM and AFRICOM countries surveyed: Peru (14.3-62% between 2011-2018), Eritrea (62% in 2016 and 9.4% in 2020), Nigeria (13.3%), Sudan (11.2%), South Sudan (17.7%), and Uganda (3.3%). In INDOPACOM countries surveyed, no prevalence greater than 5% *pfhrp2* deletions were observed. It is critical to continue surveillance on the frequency and distribution of these mutant parasites and develop alternative RDTs.

What is the impact on readiness and force health protection?

WHO recommends that countries switch to non-HRP2-based RDTs when prevalence of *pfhrp2/3* deletions that cause false-negative RDT results exceed 5%. Current prevalence of mutant *pfhrp2/3*-deleted parasites causing false-negative RDT results has exceeded this threshold in most parts of SOUTHCOM and several areas of AFRICOM. If alternative diagnostic tests are not utilized in areas affected, life-saving malaria treatment for U.S. military personnel could be delayed. Continuous mapping of the frequency and distribution of mutant parasites directly informs FHP protection policy decisions for alternative diagnostic tool utilization.

Malaria remains a major health problem worldwide. In 2021 the global burden of malaria was estimated at 247 million cases, an increase of 2 million cases from 2020.[1] In 2021, 20 malaria cases were reported among U.S. military personnel,[2] and this low number of reported cases, despite the massive global burden of malaria, is either an indication that current U.S. Department of Defense (DOD) countermeasures (e.g., insecticide-treated uniforms, chemoprophylaxis drugs) are currently effective despite increasing mosquito resistance to permethrin and *Plasmodium* drug resistance, or because few U.S. military personnel are currently in areas of high malaria transmission.

Malaria is caused by the *Plasmodium apicomplexan* protozoa parasite, a diverse genus of multiple hosts transmitted by a number of *Anopheles* genus mosquitoes. The *Plasmodium* species that commonly cause human malaria disease are *Plasmodium falciparum*, *P vivax*, *P. ovale*, *P. cynomolgi*, and *P. knowlesi*. While each of these parasites can cause incapacitation unless appropriately treated, *P. falciparum* is rapidly fatal if not diagnosed and treated properly. Additionally, *P vivax*, *P. ovale*, and *P. cynomolgi* have a dormant phase in the liver called hypnozoites that can relapse weeks to months later, causing debilitation and affecting readiness until properly cleared with the 8-aminoquinoline class of drugs.

While microscopy is the gold standard for detecting *Plasmodium* parasites, it requires equipment and a competent microscopist not always available in austere environments. U.S. military operations

often require movements far from fixed facilities with competent microscopists that can accurately diagnose malaria, and the weight of the diagnostic kit and its reliance on power and reagents is a significant consideration, which makes lightweight, easy-to-use RDTs more attractive than light microscopes. The World Health Organization (WHO) recommends rapid diagnostic tests (RDTs) as a diagnostic tool when quality microscopy is not available.[3] Despite many brands of malaria RDTs (89 meeting WHO procurement criteria and 11 WHO pre-qualified) that are commercially available, BinaxNOW Malaria RDT is the only RDT approved by the U.S. Food and Drug Administration (FDA) for use in the U.S. and by U.S. military personnel, since 2007.

BinaxNOW detects 2 *Plasmodium*-specific proteins: histidine-rich protein 2 (HRP2), specifically diagnosing *P. falciparum*, and aldolase, a pan-*Plasmodium* protein generically detecting all *Plasmodium* species. According to the WHO round 1 (2008) product testing of BinaxNOW, the detection rate for *P. falciparum* is 91.14% and *P. vivax* is 10% at 200/uL; for *P. falciparum* it is 100% and *P. vivax* 85% at 2000/uL.[4] Performance characteristics of diagnostic tests can vary depending on several factors, including the expertise of the operator, the quality of the test kit, and the population tested.

A serious threat to the utility of HRP2-based RDTs including BinaxNow has developed with the emergence of mutant *P. falciparum* parasites with deleted genes that encode HRP2 or a cross-reactive HRP3 which reduces or eliminates HRP2/3 protein expression, the targets of *P. falciparum* detection in BinaxNOW Malaria RDTs. These mutant parasites cause false-negative results. *Pfhrp2/3*-deleted *P. falciparum* parasites were first reported from patient samples collected between 2003 and 2007 in Peru,[5] and have now been confirmed in 40 of 47 countries surveyed.[1] The overall pooled prevalence of *pfhrp2/3*-deleted parasites is highest in South America, followed by Africa, then Asia[6]; countries from South America and the Horn of Africa are among the worst-affected by *pfhrp2/3*-deleted mutant parasites.

In 2019, WHO issued a "Response Plan to *pfhrp2* Gene Deletions" outlining major strategies that include defining the frequency and distribution of mutant parasites, changing to non-HRP2-based RDTs when prevalence of *pfhrp2/3* deletions that cause false-negative RDT results exceeds 5%, and developing new RDTs.[7] Over the past 7 years, our team has collaborated with the WHO, national ministries of Health (MoHs), and partner institutions to map and characterize *pfhrp2/3*-deleted parasites in several countries. These surveys provided critical data not only for national MoH diagnosis policy guidance, but also provided evidence of the extent of *pfhrp2/3* deletions within U.S. Africa Command (AFRICOM), U.S. Indo-Pacific Command (INDOPACOM), and U.S. Southern Command (SOUTHCOM), to directly support Force Health Protection (FHP) policy decisions. Herein we summarize major survey findings and their implications.

Methods

This is a review article collating and summarizing our survey findings published over the past 7 years, and their implications for public health and FHP. Field surveys conducted by our collaborating teams are described in the Results; the laboratory methods used for determining *pfhrp2/3* deletions are previously reported[11]; presence of parasite DNA was confirmed by PCR amplification of the 18s rRNA gene, msp1 and msp2 single copy genes. Presence or absence of deletions was confirmed by amplification of exon1 and exon2 of *pfhrp2* and *pfhrp3* using gene-specific PCR[11]; the work flow is summarized as a flow chart **(Figure)**.

Results

AFRICOM AOR

Eritrea

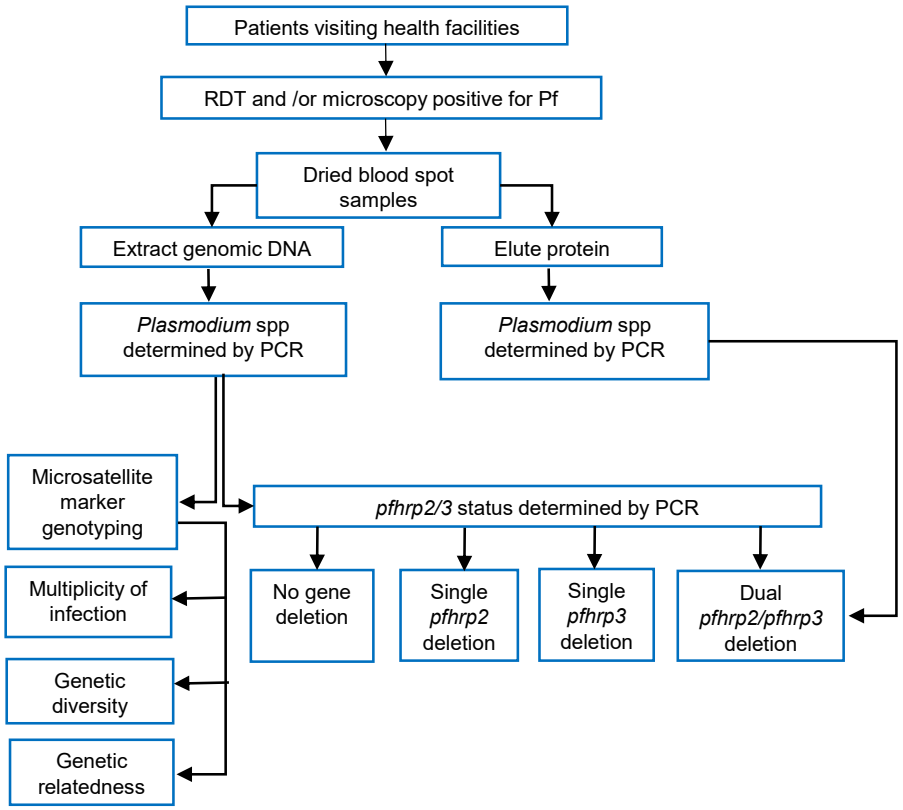
Eritrea's seasonal malaria transmission is low. Eritrea's MoH introduced a HRP2-based combination RDT in 2006, but received complaints of false-negative RDT results in 2015. Initial investigations into possible causes of RDT failures led to suspicions about the presence of *pfhrp2/3*-deleted parasites. In 2016, the country's MoH collected patient samples (n=50) from 2 hospitals in the Northern Red Sea Zone, where false-negative RDT results had been reported, to search for *pfhrp2/3*-deleted parasites. Laboratory analysis of these samples identified that 62% of patients were infected with *pfhrp2/3*-double-deleted parasites, and a further 20% with *pfhrp3*-deleted parasites. All double-*pfhrp2/3*-deleted parasites produced negative RDT results.[8] Genetic relatedness analysis suggested that *pfhrp2/3*-deleted parasites in Eritrea likely emerged *de novo*.

A follow-up survey in 2019 assessed the trend of *pfhrp2/3*-deleted parasites in Eritrea 2.5 years after the country's MoH switched from HRP2-based RDTs. This was the first survey in the world to assess the epidemiology and evolution of mutant *pfhrp2*-deleted parasites following RDT switch. The survey collected *P. falciparum* samples from malaria patients at 9 health facilities in 3 zones (n=715). Our analysis revealed an overall prevalence of mutant parasites lacking *pfhrp2*, *pfhrp3*, and both *pfhrp2/3* genes of 9.4%, 41.7% and 7.6%, respectively. The prevalence of mutant parasites was variable both within and between different zones.[9] We also showed that the genetic diversity of mutant parasites significantly increased. While the prevalence of *pfhrp2/3* deletions at all 9 survey sites was lower than in 2016 at a different location, the overall prevalence of gene deletions in 2020 still exceeded the WHO threshold for RDT switch.

Nigeria, Sudan and South Sudan

Because field surveys in many African countries are challenging, we analyzed imported *P. falciparum* cases (n=210, collected 2010-2018) to determine if *pfhrp2/3*-deleted parasites were present. We detected gene deletions in patients from 12 of 25 countries: *pfhrp2*-deletions in those from Nigeria (13.3%, n=30), Sudan (11.2%, n=39), and South Sudan (17.7%, n=17), and low levels of parasites with *pfhrp3*-deletion from Sudan (3.6%) and South Sudan (5.9%). No parasites with double *pfhrp2/3* deletions were detected.[9] Microsatellite

FIGURE. Work Flow to Determine *pfhrp2/3* Deletions



Abbreviations: *pfhrp 2/3, Plasmodium falciparum* histidine-rich proteins 2 and 3: RDT, rapid diagnostic test; *pfhrp, Plasmodium falciparum*; DNA, deoxyribonucleic acid; spp, *species pluralis* or "multiple species"; PCR, polymerase chain reaction.

typing of parasites from Nigeria, Sudan, and South Sudan revealed low relatedness among gene-deleted parasites, indicating independent emergencies.

Uganda

Uganda has one of highest malaria burdens in Africa. In collaboration with the country's MoH, we analyzed 300 *P. falciparum* isolates collected from cross-sectional malaria surveys in symptomatic individuals from 48 districts of Uganda's Eastern and Western regions. The prevalence of parasites with *pfhrp2*, *pfhrp3*, and dual *pfhrp2/3* deletions was 3.3%, 3.0%, and 3.3%, respectively.[11] The proportion of *pfhrp2/3* deletions was higher in the Eastern (14.7%) compared to the Western region (3.1%). This is the first large-scale survey reporting the presence of *pfhrp2/3*-deleted parasites in Uganda. These mutant parasites contributed to 12.3% of false-negative RDT results, along with low parasite density and non-*P. falciparum* infections.[12] Genetic analyses showed a high rate of multiplicity of infections consistent with high transmission intensity in survey areas, and that gene-deleted parasites likely evolved *de novo* from the local parasite population.[13]

SOUTHCOM AOR

Peru has low malaria transmission, and despite the fact RDT is not a diagnostic mainstay for malaria in Peru, it was the first country to report *pfhrp2/3*-deleted parasites. In collaboration with Naval Medical Research Unit-6, we characterized the presence of *pfhrp2* and *pfhrp3* genes on *P. falciparum* samples (n=325) collected in Iquitos and surrounding communities between 2011 and 2018, as part of an ongoing project, Malaria Disease in Peru, to understand the prevalence trend of *pfhrp2/3*-deleted parasites and evolution over an 8-year period. Overall, double-*pfhrp2* and -*pfhrp3* deletions were detected in 67% of patient samples. We observed a concordance (Cohen's Kappa=0.842) between *pfhrp2* gene deletion and negligible HRP2 protein levels. Prevalence of gene deletion varied by study site, but the overall prevalence increased between 2011 (14.3%) and 2016 (88.4%), stabilizing around 65% in 2018.[14] This prevalence increase was associated with rapid expansion of a single new parasite haplotype with double-*pfhrp2/3* deletions. Our study showed the increase of *pfhrp2/3* deletions in the absence of RDT pressure resulted from a clonal replacement of circulating lines with gene-deleted parasites in the Peruvian Amazon basin, suggesting that low immunity in the community to the new strain is likely the major factor in the rapid spread of *pfhrp2/3* deletion. Interestingly, participants infected with double-*pfhrp2/3*-deleted parasites had a significantly lower parasitemia than those without gene deletions, which may cause less disease.

INDOPACOM AOR

Pfhrp2-deleted parasites have been reported in India,[15] the China-Myanmar border,[16] and Indonesia,[17] with variable prevalence of 0-25%, 4% and 4%, respectively. To date, there are no published survey reports of *pfhrp2*-deleted mutant parasites from other countries in this region.

Discussion

The rise of *pfhrp2/3*-deleted parasites is of significant concern for FHP, with current U.S. military personnel reliance on BinaxNOW malaria RDTs as the point-of-care test in austere environments. Deployed small teams of military personnel are most at risk of developing malaria and are simultaneously most reliant on RDTs. The gold standard for malaria diagnosis is by trained microscopist via blood smear. Lack of trained microscopists, however, has led many countries to become reliant upon malaria RDTs for diagnosis. In semi-fixed facilities with sufficient power and specialized equipment, nucleic acid-based methods are available for *Plasmodium* diagnosis that circumvents the HRP deletion issue.

For deployed forces, this diagnostic capability such as a Biofire, Genexpert, or Loop Mediated Isothermal Amplification (LAMP) testing can be utilized at a Role 2 field hospital.

P. falciparum is biodiverse among strains, so stratifying risk based on location is complex and requires active surveillance. These data presented summarize data collected from collaborating countries since 2016. There are inherent biases when focusing on a subset of all data collected on a topic, but our data concur with other published work on HRP2/3 deletions. Our DOD Global Emerging Infections Surveillance-supported findings contributed to the global effort of mapping the frequency of gene-deleted parasites causing false-negative RDT results and inform diagnostic policies of related stakeholders. Our 2016 survey in Eritrea was the first study demonstrating a high prevalence of gene-deleted parasites causing a high rate of RDT failures in Africa, and based on these survey findings, Eritrea switched to non-HRP2-based RDTs in 2016. The results from a 2019 follow-up survey suggest that HRP2-based RDT use is likely the main factor behind the high prevalence of gene-deleted parasites. Switching to non-HRP2-based RDT was partially effective in reducing gene-deleted parasite prevalence in Eritrea. HRP2-based RDTs remain unsuitable for malaria diagnosis in Eritrea at this time, however.

We detected significant proportions of mutant parasites in travelers returning from Nigeria, Sudan, and South Sudan, where surveys are difficult to conduct. The proportions of parasites with gene deletions in those returning travelers signify a risk of false-negative HRP2 RDT results. In many of these countries our findings provided the first report of mutant parasites, which warrants surveillance to determine whether the prevalence of gene-deleted parasites justifies switching malaria RDTs in Nigeria, Sudan, and South Sudan.

Our detection of gene-deleted parasites in Eastern and Western Uganda led to a nationwide survey to establish the prevalence and distribution of these mutant parasites. Field collection is complete and genetic analysis of samples is underway. We are also conducting surveillance of *pfhrp2/3*-deleted parasites in Cambodia and Papua New Guinea (PNG) in collaborations with the Armed Forces Research Institute of Medical Sciences and the PNG Defence Force.

Our microsatellite genotyping and genetic relatedness analyses revealed that *pfhrp2/3*-deleted parasites likely evolved *de novo* from local parasite populations. This finding suggests that a control rather than containment strategy may be a more effective intervention. These mutant parasites are prevalent in most malaria-endemic areas surveyed, with the ability to develop *de novo*, making false-negative malaria diagnosis a concern for all COCOMS.

Forshey et al. provide a framework for continued assessment of the *pfhrp2/3* deletion problem and a framework for U.S. DOD to acquire alternative RDTs that meet DOD requirements including FDA clearance.[18] Currently, there are limited alternative RDTs available for the detection of parasites lacking HRP2. The WHO product testing round 8 evaluated 34 brands of RDTs against *pfhrp2/3*-deleted parasites and revealed that only 2 RDTs targeting Pan-pLDH met WHO procurement criteria, while RDTs specifically targeting Pf-pLDH performed poorly against gene-deleted parasites.[19] While the 2 Pan-pLDH RDTs can be used to detect gene-deleted parasites in areas where *P. falciparum* is dominant, they are not WHO pre-qualified, nor FDA approved. For areas where discriminating *P. falciparum* from *P. vivax* and other *Plasmodium* species is necessary, combination RDTs detecting Pf-pLDH/Pv-pLDH and Pf-pLDH/pan-pLDH are required; a new Pf-pLDH RDT has shown promising performance against gene-deleted parasites,[20] and some are in the WHO pre-qualification pipeline.

With the U.S. military operational framework evolving from counterinsurgency to large scale combat operations, doctrine is shifting to a need for prolonged casuality care that would benefit from a next-generation malaria RDT. For FHP in the short- and medium terms, FHP officers and pre-deployment planners should be made aware of the problem of *pfhrp2/3*-deleted parasites and given the most up-to-date aggregate surveillance data for their areas of responsibility. Long-term investment should be made in point-of-care testing with alternative targets that can discriminate different *Plasmodium* species and detect mutant parasites lacking HRP2.

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Update

Completeness and Timeliness of Reporting Notifiable Medical Events, U.S. Military Active Component and Other DOD Beneficiaries, 2018–2022

Complete and timely reporting of notifiable medical conditions among the Department of Defense (DOD) beneficiary population is important for the control of communicable and preventable diseases and injuries. The Defense Medical Surveillance System was used to identify all hospital and ambulatory care encounters during 2018-2022 for which a notifiable medical condition was indicated among active component service members as well as all other DOD beneficiaries. Incident cases with diagnoses of DOD-notifiable medical conditions were matched with reportable medical events entered through the Disease Reporting System internet (DRSi). During the study period, 61.2% of notifiable hospitalized cases and 65.5% of notifiable ambulatory care cases at a military hospital or clinic among active component service members were reported. Among other beneficiaries treated at a military hospital or clinic, only 15.2% of notifiable hospitalized cases and 22.1% of notifiable ambulatory care cases were reported to DRSi. Reporting percentages were much lower for care at outsourced facilities, regardless of the population. The timeliness of reporting for active component service members fluctuated annually, but in both 2018 and 2022, 64.2% of notifiable cases at a military hospital were reported within 1 week. For ambulatory care cases, timeliness of reporting decreased over time, with 50.1% reported within 1 week in 2018 and 43.3% in 2022.

What are the new findings?

A total of 1,306 hospitalized and 100,163 ambulatory incident cases for notifiable medical conditions among active component service members occurred from January 2018 to December 2022. Reporting of these events though the DRSi (Disease Reporting System Internet) increased since the last report in 2015, but timeliness decreased. Data on other beneficiaries and outsourced care facilities were added to the analysis for this report.

What is the impact on readiness and force health protection?

Improvements to reporting and timeliness of active component service member notifiable medical conditions is needed to effectively track and mitigate communicable diseases and preventable injuries. Although reporting currently is not required for all non-service member beneficiaries, they present another source of communicable diseases that could affect disease among service members, making them a potential population for report consideration.

U.S. military Services are required, by Department of Defense (DOD) Directive 6490.02E, to report notifiable medical conditions among all DOD personnel and dependents, residing either in garrison or overseas with their military sponsor, during a possible exposure or public health event.[1] Centralized reporting of preventable and communicable medical conditions is an important tool for facilitating rapid dissemination of information on the occurrence of medical events that could pose a public health threat. Centralized reporting also serves as a mechanism for recording more extensive information about a medical event in hospitalization and ambulatory care administrative data. The guidelines and specific case definitions for all medical conditions required by DOD for reporting are described in *Armed Forces Reportable Medical Events: Guidelines and Case Definitions*.[2] Currently, all Services report notifiable medical conditions through a single electronic system, the Disease Reporting System Internet (DRSi), accessible at all military hospitals and clinics.[3]

The usefulness of these reportable medical events (RMEs) is highly dependent on the completeness and timeliness of their submission. For optimally-informed determinations by military leadership and public health officers about the locations and extents of possible outbreaks, all cases of notifiable medical conditions need to be reported, with all required information, as soon as possible. During the COVID-19 pandemic, DRSi became a key data source for tracking confirmed cases of COVID-19.[4] Reports on preventable notifiable medical conditions such as heat and cold injuries are produced frequently to assist the evaluation and potential modification of prevention strategies. The Armed Forces Health Surveillance Division of the Defense Health Agency publishes communicable disease RMEs in each issue of the *MSMR*.

The most recent analysis of the completeness and timeliness of RMEs, published in the *MSMR* in November 2015,

only reported on active component service members (ACSM).[5] The 2008-2014 analysis found that 47.6% of notifiable hospitalized cases and 57.2% of notifiable ambulatory cases were reported as RMEs to DRSi. Since the 2015 report on 2008-2014 data, medical encounters are now coded with ICD-10 diagnostic codes, which provide better specificity than ICD, 9th revision diagnostic codes (ICD-9) and improve identification of health conditions.[6] Three revisions to DOD reporting guidelines since 2015 aligned laboratory and clinical criteria with standardized case definitions published by the Nationally Notifiable Disease Surveillance System, which added or removed RMEs.[7] This report estimates RME completeness and timeliness from 2018 to 2022 among ACSM and all other DOD beneficiaries.

Methods

The Defense Medical Surveillance System (DMSS) contains administrative records for all medical encounters of DOD beneficiaries who were hospitalized or received ambulatory care at military hospitals and clinics, or for civilian purchased care at an outsourced care facility (OCF). Records of health care encounters from both sources of care were included in this analysis, but analyzed separately. Hospitalizations and ambulatory encounters for all DOD beneficiaries between January 1, 2018 and December 31, 2022 were searched for diagnoses of notifiable medical conditions in the primary diagnostic position using the 10th revision of International Classification of Diseases (ICD-10) diagnostic codes listed in **Table 1**.

Potentially notifiable cases were identified by the required numbers and types of encounters delineated in **Table 1** for specified conditions. For example, a potential case of amebiasis would require an ICD-10 code of A06.x in the primary diagnostic position in the record of a hospitalization, or 2 ambulatory encounters within 2 weeks. Incident cases of the various conditions for individuals were then identified by applying the incidence rule listed for each condition. For example, an individual who met the criteria for a potentially notifiable case of amebiasis in February 2019 but was previously diagnosed with amebiasis in December 2018 (within 120 days of the February 2019 diagnosis) would not be counted as a newly incident case in 2019 **(Table 1)**.

The DMSS also contains RME records entered in DRSi for all DOD beneficiaries. RMEs from event dates January 1, 2018 through December 31, 2022 were identified from DMSS for DOD beneficiaries with an incident notifiable medical condition hospitalization or ambulatory encounter. By notifiable medical condition, RMEs were matched to incident hospitalization or ambulatory encounters. If more than 1 RME for the specific condition was found, the RME with an event date closest to the encounter event date was selected. The total number of incident notifiable medical conditions and the percentage with a corresponding RME were calculated by population (ACSM or other beneficiaries), source of care (military hospital/clinic or OCF), RME category, and year. The "other beneficiary" category included service members in the reserve or guard components, retirees, and dependents. Reporting timeliness was estimated by calculating the number of weeks between the incident case's medical encounter or hospitalization date and the RME entry date in DRSi. Among the incident notifiable medical cases matched to an RME, the percentages that were reported within 1 week, 2 weeks, and 4 weeks were calculated. All data were analyzed using SAS Enterprise Guide v8.3 Update 3 (SAS Institute, Cary, NC).

Results

Active Component Service Members

During the study period, 61.2% of incident notifiable hospitalized medical cases among ACSM seen at a military hospital were reported as RMEs, ranging from a low in 2020 (56.0%) to a high in 2022 (71.1%). Reporting percentages for hospitalized cases at OCFs were much lower than at military hospitals, with an overall reporting of 18.1% and a range of 7.9% (2020) to 24.4% (2019) **(Table 2)**. **Table 2** also shows the percentage of incident notifiable ambulatory medical cases reported as RMEs. Over the study period, 65.5% of incident notifiable ambulatory medical cases at military clinics among ACSM were reported as RMEs, substantially higher than the percent of ambulatory medical cases reported from OCFs (11.9%).

The total numbers of incident cases for each type of notifiable medical condition among active ACSM at military hospitals and clinics are shown in **Table 3**. For hospitalized conditions, the largest numbers of incident cases were for heat illness (368 cases), influenza-associated hospitalizations (128 cases), and malaria (65 cases). Of those, 67.7% of heat illness cases, 40.6% of influenza-associated hospitalization cases, and 87.7% of malaria cases were reported as RMEs. The most frequent incident ambulatory conditions were chlamydia (43,673 cases, 91.3% reported), novel and variant influenza (16,083 cases, 0.03% reported), and heat illness (6,915 cases, 48.2% reported).

Table 4 presents the notifiable medical conditions at OCFs among ACSM. Although much lower in magnitude, hospitalizations at OCFs had similar trends in condition frequency compared to military hospitals and clinics. The most frequently hospitalized medical conditions at OCFs were influenza-associated (58 cases, 10.3% reported), heat illness (57 cases, 17.5% reported), malaria (23 cases, 34.8% reported), and campylobacter infection (23 cases, 13.0% reported). Among ambulatory conditions reported at OCFs, novel and variant influenza (9,170 cases, 0.01% reported), chlamydia (3,396 cases, 34.9% reported), and heat illness (1,603 cases, 10.2% reported) were the most frequent.

The timeliness of reporting of incident notifiable medical conditions among ACSM varied by care type and facility **(Table 5)**. Between 2018 and 2022, timeliness of notifiable conditions for military hospitalizations reported within 1 week to DRSi ranged from 48.5% to 64.2%; this range increased to 91.8% and 98.9% when evaluating timeliness within 1 month. Regardless of facility type, ambulatory care reporting timeliness to DRSi within 1 week decreased over time, declining from 40.5% in 2018 to 35.1% in 2022 at military clinics

TABLE 1. Reportable Medical Events and Associated ICD-10 Codes, Incidence Rules, and Required Numbers and Types of Encounters to Identify Notifiable Medical Cases

Reportable Medical Event	ICD-10 diagnosis code	Incidence rule	No. and type of encounter
Amebiasis	A06.x	Once per 120 days	1 inpt, 2 outpt within 14 days
Anthrax	A22.x	Once per 120 days	1 inpt
Arboviral disease	A83.x	Once per lifetime	1 inpt
Botulism	A05.1, A48.5x	Once per 120 days	1 inpt
Brucellosis	A23.x	Once per 120 days	1 inpt, 2 outpt within 14 days
Campylobacter infection	A04.5	Once every 180 days	1 inpt, 1 outpt
Chikungunya virus disease	A92.0	Once per lifetime	1 inpt
Chlamydia trachomatis, genital infections	A55.x, A56.x, A74.x, P23.1	Once per 120 days	1 inpt, 1 outpt
Cholera	A00.x	Once per lifetime	1 inpt
Coccidioidomycosis	B38.x	Once per lifetime	1 inpt, 2 outpt within 14 days
Cold weather injuries[a]	T33.x, T34.x, T68, T68.XXXA, T69.0x	Once per "cold weather" year[c]	1 inpt, 1 outpt
COVID hospitalization and death[b]	U07.1	Once per respiratory year[c]	1 inpt
Cryptosporidiosis	A07.2	Once per 120 days	1 inpt, 2 outpt within 14 days
Cyclosporiasis	A07.4	Once per 120 days	1 inpt, 2 outpt within 14 days
Dengue fever	A90.x, A91.x	Once per calendar year	1 inpt, 2 outpt within 60 days
Diphtheria	A36.x, Z22.2	Once per lifetime	1 inpt
E. coli, Shiga toxin-producing	A04.3, B96.2x	Once every 180 days	1 inpt, 1 outpt
Ehrlichiosis/anaplasmonthsis	A77.4x	Once per lifetime	1 inpt, 2 outpt within 14 days
Filariasis	B73.x, B74.x	Once per lifetime	1 inpt, 2 outpt within 14 days
Giardiasis	A07.1	Once per 120 days	1 inpt, 2 outpt within 14 days
Gonorrhea	A54.x, O98.2x	Once per 120 days	1 inpt, 1 outpt
Haemophilus influenzae, invasive disease	A41.3, B96.3, G00.0, J14	Once per calendar year	1 inpt, 2 outpt within 14 days
Hantavirus disease	A98.5, B33.4	Once per lifetime	1 inpt
Heat illness[a]	T67.0, T67.0XXA, T67.3, T67.3XXA, T67.4, T67.4XXA, T67.5, T67.5XXA	Once per calendar year	1 inpt, 1 outpt
Hemorrhagic fever	A96.x, A98.x, A99	Once per 120 days	1 inpt
Hepatitis A	B15.x	Once per lifetime	1 inpt, 2 outpt within 14 days
Hepatitis B, acute and chronic	B16.x, B17.0, B18.0, B18.1, B19.1x, Z22.51	Once per lifetime	1 inpt, 2 outpt within 90 days
Hepatitis C	B17.1x, B18.2, B19.2x, Z22.52	Once per lifetime	1 inpt, 2 outpt within 90 days
Influenza-associated hospitalization	J09-J11	Once per respiratory year[†]	1 inpt
Legionellosis	A48.1, A48.2	Once per lifetime	1 inpt, 1 outpt
Leishmaniasis	B55.x	Once per lifetime	1 inpt
Leprosy	A30.x	Once per lifetime	1 inpt, 2 outpt within 14 days
Leptospirosis	A27.x	Once per lifetime	1 inpt, 2 outpt within 14 days
Listeriosis	A32.x	Once per 120 days	1 inpt, 2 outpt within 14 days
Lyme disease	A69.2x	Once per calendar year	1 inpt, 2 outpt within 14 days
Malaria	B50.x-B54, P37.3, P37.4	Once per calendar year	1 inpt
Measles	B05.x	Once per lifetime	1 inpt
Meningococcal disease	A39.x	Once per calendar year	1 inpt
Mumps	B26.x	Once per lifetime	1 inpt
Norovirus	A08.0, A08.1, A08.11	Once per 120 days	1 inpt
Novel and variant influenza	J11.x	Once per respiratory year[†]	1 inpt, 1 outpt
Pertussis	A37.x	Once per lifetime	1 inpt, 2 outpt within 14 days
Plague	A20.x,	Once per lifetime	1 inpt
Poliomyelitis	A80.x	Once per lifetime	1 inpt
Post-exposure prophylaxis (PEP) against rabies	Z29.14	Once per lifetime	1 inpt, 1 outpt
Q fever	A78	Once per lifetime	1 inpt, 2 outpt within 14 days
Rabies	A82.0x	Once per lifetime	1 inpt
Relapsing fever	A68.x	Once per calendar year	1 inpt, 2 outpt within 14 days
Rift Valley fever	A92.4	Once per lifetime	1 inpt
Rubella	B06.x, P35.0	Once per lifetime	1 inpt, 2 outpt within 14 days
Salmonellosis	A02.x	Once every 180 days	1 inpt, 1 outpt
Schistosomiasis	B65.x	Once per lifetime	1 inpt, 2 outpt within 14 days
Severe acute respiratory syndrome (SARS)	B97.21, J12.81	Once per 120 days	1 inpt, 2 outpt within 14 days
Shigellosis	A03.x	Once every 180 days	1 inpt, 1 outpt
Smallpox	B03	Once per lifetime	1 inpt
Spotted fever rickettsiosis	A77, A77.0	Once per lifetime	1 inpt, 2 outpt within 14 days
Streptococcus, group A, invasive[b]	A40.0, B95.0, J15.4	Once per calendar year	1 inpt
Syphilis	A50.x, A51.x, A52.x, A53.x, O98.1x	Once per calendar year	1 inpt, 1 outpt
Tetanus	A33-A35	Once per lifetime	1 inpt
Toxic shock syndrome	A48.3	Once per lifetime	1 inpt
Trichinellosis	B75	Once per lifetime	1 inpt, 2 outpt within 14 days
Trypanosomiasis	B56.x, B57.x	Once per lifetime	1 inpt, 2 outpt within 14 days
Tuberculosis, pulmonary	A15.x,, O98.1x	Once per lifetime	1 inpt
Tularemia	A21.x	Once per lifetime	1 inpt, 2 outpt within 14 days
Typhoid fever	A01.x, Z22.0	Once every 180 days	1 inpt, 1 outpt
Typhus fever	A75.x	Once per lifetime	1 inpt, 1 outpt
Varicella	B01.x	Once per lifetime	1 inpt, 1 outpt
Yellow fever	A95.x	Once per lifetime	1 inpt
Zika virus	A92.5	Once per lifetime	1 inpt

Abbreviations: ICD-10, International Classification of Diseases, 10th edition; No., number; inpt, inpatient; outpt, outpatient.

[a]Only reportable for active component service members.

[b]Only reportable since October 2022.

[c]Respiratory year and cold weather year defined as July 1 to June 30.

TABLE 2. Frequency of Incident Notifiable Medical Cases Among Active Component U.S. Service Members, with Number and Percentage Reported by Care Type and Source, 2018–2022

Hospitalizations						
	Military hospital			Outsourced care facility		
Year	No. of cases	No. reported	% reported	No. of cases	No. reported	% reported
2018	316	187	59.2	75	12	16.0
2019	273	170	62.3	78	19	24.4
2020	166	93	56.0	38	3	7.9
2021	106	66	62.3	41	6	14.6
2022	114	81	71.1	99	20	20.2
Total	975	597	61.2	331	60	18.1
Ambulatory care						
	Military clinic			Outsourced care facility		
Year	No. of cases	No. reported	% reported	No. of cases	No. reported	% reported
2018	18,844	11,117	59.0	4,044	330	8.2
2019	19,805	12,785	64.6	3,970	404	10.2
2020	16,945	10,922	64.5	3,891	420	10.8
2021	13,450	10,424	77.5	2,045	448	21.9
2022	13,859	9,081	65.5	3,310	455	13.7
Total	82,903	54,329	65.5	17,260	2,057	11.9

Abbreviation: No., number.

and 26.4% to 17.6% for OCFs. OCF hospitalizations was the only group to improve in reporting timeliness over the study period, with reporting within 1 week rising from 25.0% in 2018 to 40.0% in 2022.

Other Beneficiaries

During the surveillance period, only 15.2% of incident notifiable hospitalized medical cases among other beneficiaries seen at military hospitals were submitted as RMEs **(Table 6)**. Reporting increased from 8.8% in 2018 to 25.5% in 2021 but dropped to 18.0% in 2022. Reporting for hospitalizations at OCFs were significantly lower than at MTFs, with an overall reporting of 0.9% and range of 0.5% (2022) to 2.0% (2021) **(Table 6)**. **Table 6** also provides the percentage of incident notifiable ambulatory care medical conditions submitted as RMEs. During the study period, the military clinic reporting percentage for ambulatory conditions among other beneficiaries was higher than for hospitalized conditions (22.1% vs. 15.2%). Reporting of ambulatory conditions at OCFs was very low (0.5%).

The total numbers of incident cases for each type of notifiable medical condition among other beneficiaries at military hospitals or clinics are shown in **Table 7**. For hospitalized conditions during 2018-2022, the largest numbers of incident cases were influenza-associated (928 cases), novel and variant influenza (400 cases), and COVID hospitalization and death (only reportable in 2022; 169 cases). Of those cases, 11.7% of influenza-associated hospitalizations, 0.0% of novel and variant influenza cases, and 16.6% of COVID hospitalizations and death were submitted as RMEs. The most frequent incident ambulatory conditions were novel and variant influenza (42,184 cases, 0.05% reported), chlamydia (13,397 cases, 79.7% reported), and gonorrhea (2,437 cases, 69.8% reported).

Table 8 lists the notifiable medical conditions among other beneficiaries treated at an OCF. The most frequent hospitalized medical conditions were 5,061 influenza-associated cases (0.45% reported), 3,785 cases of COVID hospitalizations and death (only reportable in 2022; 0.3% reported), and 698 cases of salmonellosis, of which 3.0% were submitted as RMEs. Among ambulatory care conditions, the most frequent were novel and variant influenza (238,111 cases, <0.01% reported), chlamydia (17,890 cases, 5.0% reported), and gonorrhea (6,788 cases, 2.6% reported).

The timeliness of reporting incident hospitalized notifiable medical conditions among other beneficiaries fluctuated annually, but increased overall from 2018 to 2022 for both military hospitals and OCFs **(Table 9)**. Between 2018 and 2022, hospitalization reporting within 1 week rose from 60.0% to 64.1% for military care and from 48.1% to 65.6% for OCF care. Regardless of facility type, reporting timeliness for ambulatory care within 1 week decreased, from 42.9% in 2018 to 37.5% in 2022 for military care and from 16.4% to 8.2% for OCFs.

Discussion

The results of this analysis indicate that in recent years just over 60% of ACSM with incident hospitalized notifiable medical conditions identified at a military hospital were reported as RMEs through the DRSi reporting system. Case reporting of notifiable medical conditions identified from ambulatory encounters at military clinics was slightly higher (65.5%) than cases

TABLE 3. Frequency of Incident Notifiable Medical Cases at Military Hospitals and Clinics Among Active Component U.S. Service Members, with Number and Percentage Reported by Condition and Care Type, 2018–2022

	Hospitalizations			Ambulatory care		
Reportable Medical Event	No. of cases	No. reported	% reported	No. of cases	No. reported	% reported
All reportable events	975	597	61.2	82,903	54,329	65.5
Amebiasis	1	0	0.0	9	2	22.2
Anthrax	0	0	*	NR	NR	NR
Arboviral disease	2	1	50.0	NR	NR	NR
Botulism	1	1	100.0	NR	NR	NR
Brucellosis	0	0	*	1	1	100.0
Campylobacter infection	38	27	71.1	196	154	78.6
Chikungunya virus disease	0	0	*	NR	NR	NR
Chlamydia trachomatis, genital infections	31	27	87.1	43,673	39,862	91.3
Cholera	0	0	*	NR	NR	NR
Coccidioidomycosis	11	8	72.7	46	25	54.3
Cold weather injuries	29	15	51.7	1,476	429	29.1
COVID hospitalization and death[a]	14	12	85.7	NR	NR	NR
Cryptosporidiosis	1	1	100.0	5	3	60.0
Cyclosporiasis	1	1	100.0	4	3	75.0
Dengue fever	4	1	25.0	4	3	75.0
Diphtheria	0	0	*	NR	NR	NR
E. coli, Shiga toxin-producing	1	1	100.0	20	13	65.0
Ehrlichiosis/anaplasmonthsis	0	0	*	3	1	33.3
Filariasis	0	0	*	0	0	*
Giardiasis	1	1	100.0	16	14	87.5
Gonorrhea	27	18	66.7	6,791	5,674	83.6
Haemophilus influenzae, invasive disease	2	0	0.0	6	1	16.7
Hantavirus disease	2	2	100.0	NR	NR	NR
Heat illness	368	249	67.7	6,915	3,334	48.2
Hemorrhagic fever	1	0	0.0	NR	NR	NR
Hepatitis A	1	0	0.0	6	0	0.0
Hepatitis B, acute and chronic	2	0	0.0	324	145	44.8
Hepatitis C	0	0	*	120	52	43.3
Influenza-associated hospitalization	128	52	40.6	NR	NR	NR
Legionellosis	3	2	66.7	4	0	0.0
Leishmaniasis	6	4	66.7	0	0	*
Leprosy	0	0	*	6	3	50.0
Leptospirosis	16	4	25.0	10	1	10.0
Listeriosis	1	1	100.0	1	0	0.0
Lyme disease	10	3	30.0	114	40	35.1
Malaria	65	57	87.7	NR	NR	NR
Measles	0	0	*	NR	NR	NR
Meningococcal disease	4	4	100.0	NR	NR	NR
Mumps	4	2	50.0	NR	NR	NR
Norovirus	49	38	77.6	NR	NR	NR
Novel and variant influenza	38	0	0.0	16,083	6	0.0
Pertussis	0	0	*	8	5	62.5
Plague	0	0	*	NR	NR	NR
Poliomyelitis	0	0	*	NR	NR	NR
Post-exposure prophylaxis (PEP) against rabies	0	0	*	363	172	47.4
Q fever	0	0	*	7	6	85.7
Rabies	0	0	*	NR	NR	NR
Relapsing fever	1	0	0.0	14	0	0.0
Rift Valley fever	0	0	*	NR	NR	NR
Rubella	0	0	*	0	0	*
Salmonellosis	26	16	61.5	145	78	53.8
Schistosomiasis	0	0	*	5	0	0.0
Severe acute respiratory syndrome (SARS)	2	0	0.0	474	0	0.0
Shigellosis	8	5	62.5	28	19	67.9
Smallpox	1	0	0.0	NR	NR	NR
Spotted fever rickettsiosis	0	0	*	6	2	33.3
Streptococcus, group A, invasive[a]	0	0	*	NR	NR	NR
Syphilis	31	26	83.9	5,796	4,261	73.5
Tetanus	1	0	0.0	NR	NR	NR
Toxic shock syndrome	4	0	0.0	NR	NR	NR
Trichinellosis	0	0	*	0	0	*
Trypanosomiasis	0	0	*	6	3	50.0
Tuberculosis, pulmonary	28	16	57.1	NR	NR	NR
Tularemia	0	0	*	1	0	0.0
Typhoid fever	1	0	0.0	7	0	0.0
Typhus fever	3	1	33.3	6	3	50.0
Varicella	7	1	14.3	204	14	6.9
Yellow fever	0	0	*	NR	NR	NR
Zika virus	0	0	*	NR	NR	NR

Abbreviatons: RME, reportable medical event; No., number; NR, not reportable.

[a]Only reportable since October 2022.

*No cases to report.

TABLE 4. Frequency of Incident Notifiable Medical Cases at Outsourced Care Facilities Among Active Component U.S. Service Members, with Number and Percentage Reported by Condition and Care Type, 2018–2022

	Hospitalizations			Ambulatory care		
Reportable Medical Event	No. of cases	No. reported	% reported	No. of cases	No. reported	% reported
All reportable events	331	60	18.1	17,260	2,057	11.9
Amebiasis	5	0	0.0	7	0	0.0
Anthrax	0	0	*	NR	NR	NR
Arboviral disease	1	0	0.0	NR	NR	NR
Botulism	0	0	*	NR	NR	NR
Brucellosis	0	0	*	0	0	*
Campylobacter infection	23	3	13.0	71	22	31.0
Chikungunya virus disease	0	0	*	NR	NR	NR
Chlamydia trachomatis, genital infections	7	3	42.9	3,396	1,184	34.9
Cholera	1	0	0.0	NR	NR	NR
Coccidioidomycosis	11	6	54.5	43	20	46.5
Cold weather injuries	8	3	37.5	409	67	16.4
COVID hospitalization and death[a]	5	4	80.0	NR	NR	NR
Cryptosporidiosis	3	0	0.0	2	1	50.0
Cyclosporiasis	0	0	*	0	0	*
Dengue fever	11	1	9.1	10	2	20.0
Diphtheria	0	0	*	NR	NR	NR
E. coli, Shiga toxin-producing	0	0	*	4	1	25.0
Ehrlichiosis/anaplasmonthsis	3	0	0.0	2	0	0.0
Filariasis	0	0	*	2	0	0.0
Giardiasis	3	0	0.0	8	4	50.0
Gonorrhea	9	2	22.2	1,226	230	18.8
Haemophilus influenzae, invasive disease	9	0	0.0	2	0	0.0
Hantavirus disease	2	2	100.0	NR	NR	NR
Heat illness	57	10	17.5	1,603	164	10.2
Hemorrhagic fever	0	0	*	NR	NR	NR
Hepatitis A	4	2	50.0	6	0	0.0
Hepatitis B, acute and chronic	0	0	*	101	37	36.6
Hepatitis C	0	0	*	42	11	26.2
Influenza-associated hospitalization	58	6	10.3	NR	NR	NR
Legionellosis	1	1	100.0	8	2	25.0
Leishmaniasis	0	0	*	0	0	*
Leprosy	0	0	*	0	0	*
Leptospirosis	1	0	0.0	9	0	0.0
Listeriosis	1	0	0.0	0	0	*
Lyme disease	9	1	11.1	86	5	5.8
Malaria	23	8	34.8	NR	NR	NR
Measles	0	0	*	NR	NR	NR
Meningococcal disease	2	0	0.0	NR	NR	NR
Mumps	0	0	*	NR	NR	NR
Norovirus	13	2	15.4	NR	NR	NR
Novel and variant influenza	10	0	0.0	9,170	1	0.0
Pertussis	0	0	*	2	0	0.0
Plague	0	0	*	NR	NR	NR
Poliomyelitis	1	0	0.0	NR	NR	NR
Post-exposure prophylaxis (PEP) against rabies	0	0	*	247	45	18.2
Q fever	0	0	*	0	0	*
Rabies	0	0	*	NR	NR	NR
Relapsing fever	1	0	0.0	8	0	0.0
Rift Valley fever	0	0	*	NR	NR	NR
Rubella	0	0	*	0	0	*
Salmonellosis	17	3	17.6	61	7	11.5
Schistosomiasis	1	0	0.0	4	0	0.0
Severe acute respiratory syndrome (SARS)	3	0	0.0	23	0	0.0
Shigellosis	7	0	0.0	9	0	0.0
Smallpox	0	0	*	NR	NR	NR
Spotted fever rickettsiosis	1	0	0.0	7	1	14.3
Streptococcus, group A, invasive[a]	2	0	0.0	NR	NR	NR
Syphilis	6	1	16.7	606	253	41.7
Tetanus	1	0	0.0	NR	NR	NR
Toxic shock syndrome	1	0	0.0	NR	NR	NR
Trichinellosis	0	0	*	0	0	*
Trypanosomiasis	0	0	*	4	0	0.0
Tuberculosis, pulmonary	8	2	25.0	NR	NR	NR
Tularemia	0	0	*	4	0	0.0
Typhoid fever	1	0	0.0	8	0	0.0
Typhus fever	0	0	*	3	0	0.0
Varicella	1	0	0.0	67	0	0.0
Yellow fever	0	0	*	NR	NR	NR
Zika virus	0	0	*	NR	NR	NR

Abbreviatons: RME, reportable medical event; No., number; NR, not reportable.

[a]Only reportable since October 2022.

*No cases to report.

identified from hospitalization records. To compare these results to the 2015 analysis published in the *MSMR*,[5] active component case reporting from both military hospitals and clinics as well as OCFs were combined, resulting in reporting estimates of 50.3% and 56.3% for hospitalized and ambulatory cases, respectively. These findings show an increase in reporting from the 2015 analysis, which found that 46.7% of hospitalized cases and 55.2% of ambulatory cases were reported in 2014.[5]

This first analysis of RME reporting among other DOD beneficiaries reveals a significantly lower number of incident notifiable medical cases reported among other beneficiaries compared to ACSM. Approximately one-fifth of cases among other beneficiaries from military clinics and hospitals were reported to DRSi, and only a negligible proportion from OCFs were reported. Because DOD Directive 6490.02E specifies health surveillance activities for dependents residing in garrison or overseas

TABLE 5. Timeliness of Reporting of Incident Notifiable Medical Cases Among Active Component U.S. Service Members, by Care Type and Source, 2018–2022

	Hospitalizations							
	Military hospital				Outsourced care facility			
Year	Total reported cases	% reported within 1 week	% reported within 2 weeks	% reported within 1 month	Total reported cases	% reported within 1 week	% reported within 2 weeks	% reported within 1 month
2018	187	64.2	81.8	93.6	12	25.0	50.0	100.0
2019	170	70.6	78.8	91.8	19	36.8	57.9	94.7
2020	93	61.3	72.0	98.9	3	33.3	33.3	100.0
2021	66	48.5	57.6	93.9	6	33.3	50.0	100.0
2022	81	64.2	74.1	93.8	20	40.0	45.0	100.0
	Ambulatory care							
	Military clinic				Outsourced care facility			
Year	Total reported cases	% reported within 1 week	% reported within 2 weeks	% reported within 1 month	Total reported cases	% reported within 1 week	% reported within 2 weeks	% reported within 1 month
2018	11,117	40.5	50.1	85.6	330	26.4	35.5	95.8
2019	12,785	37.7	46.6	84.7	404	20.5	28.5	96.0
2020	10,922	34.7	43.4	86.9	420	18.6	25.7	96.9
2021	10,424	35.9	44.7	87.1	448	15.2	24.8	97.5
2022	9,081	35.1	43.3	89.3	455	17.6	23.5	97.4

TABLE 6. Frequency of Incident Notifiable Medical Cases Among Other Beneficiaries, with Number and Percentage Reported by Care Type and Source, 2018–2022

	Hospitalizations					
	Military hospital			Outsourced care facility		
Year	No. of cases	No. reported	% reported	No. of cases	No. reported	% reported
2018	683	60	8.8	3,137	27	0.9
2019	592	99	16.7	2,441	38	1.6
2020	431	74	17.2	1,578	16	1.0
2021	153	39	25.5	857	17	2.0
2022	355	64	18.0	6,021	29	0.5
Total	2,214	336	15.2	14,034	127	0.9
	Ambulatory care					
	Military clinic			Outsourced care facility		
Year	No. of cases	No. reported	% reported	No. of cases	No. reported	% reported
2018	19,607	3,251	16.6	93,094	262	0.3
2019	17,533	3,555	20.3	76,876	348	0.5
2020	13,761	2,877	20.9	60,036	305	0.5
2021	4,667	2,557	54.8	15,329	330	2.2
2022	9,028	2,023	22.4	43,805	319	0.7
Total	64,596	14,263	22.1	289,140	1,564	0.5

Abbreviation: No., number.

TABLE 7. Frequency of Incident Notifiable Medical Cases at Military Hospitals and Clinics Among Other Beneficiaries, with Number and Percentage Reported by Condition and Care Type, 2018–2022

	Hospitalizations			Ambulatory care		
Reportable Medical Event	No. of cases	No. reported	% reported	No. of cases	No. reported	% reported
All reportable events	2,214	336	15.2	64,596	14,263	22.1
Amebiasis	1	0	0.0	8	0	0.0
Anthrax	0	0	*	NR	NR	NR
Arboviral disease	2	0	0.0	NR	NR	NR
Botulism	4	1	25.0	NR	NR	NR
Brucellosis	2	0	0.0	2	0	0.0
Campylobacter infection	80	25	31.3	324	125	38.6
Chikungunya virus disease	0	0	*	NR	NR	NR
Chlamydia trachomatis, genital infections	25	20	80.0	13,397	10,684	79.7
Cholera	1	0	0.0	NR	NR	NR
Coccidioidomycosis	11	3	27.3	64	12	18.8
Cold weather injuries	NR	NR	NR	NR	NR	NR
COVID hospitalization and death[a]	169	28	16.6	NR	NR	NR
Cryptosporidiosis	2	2	100.0	8	3	37.5
Cyclosporiasis	1	0	0.0	5	2	40.0
Dengue fever	4	2	50.0	5	0	0.0
Diphtheria	1	1	100.0	NR	NR	NR
E. coli, Shiga toxin-producing	3	0	0.0	41	10	24.4
Ehrlichiosis/anaplasmonthsis	3	0	0.0	5	0	0.0
Filariasis	0	0	*	2	0	0.0
Giardiasis	5	1	20.0	12	5	41.7
Gonorrhea	16	9	56.3	2,437	1,702	69.8
Haemophilus influenzae, invasive disease	20	1	5.0	20	3	15.0
Hantavirus disease	0	0	*	NR	NR	NR
Heat illness	NR	NR	NR	NR	NR	NR
Hemorrhagic fever	0	0	*	NR	NR	NR
Hepatitis A	12	2	16.7	7	0	0.0
Hepatitis B, acute and chronic	18	6	33.3	636	103	16.2
Hepatitis C	8	0	0.0	338	29	8.6
Influenza-associated hospitalization	928	109	11.7	NR	NR	NR
Legionellosis	32	2	6.3	42	1	2.4
Leishmaniasis	0	0	*	0	0	*
Leprosy	0	0	*	2	0	0.0
Leptospirosis	3	0	0.0	13	0	0.0
Listeriosis	4	0	0.0	4	0	0.0
Lyme disease	9	4	44.4	157	21	13.4
Malaria	41	22	53.7	NR	NR	NR
Measles	6	0	0.0	NR	NR	NR
Meningococcal disease	4	2	50.0	NR	NR	NR
Mumps	5	0	0.0	NR	NR	NR
Norovirus	84	22	26.2	NR	NR	NR
Novel and variant influenza	400	0	0.0	42,182	21	0.0
Pertussis	4	0	0.0	16	5	31.3
Plague	0	0	*	NR	NR	NR
Poliomyelitis	1	0	0.0	NR	NR	NR
Post-exposure prophylaxis (PEP) against rabies	0	0	*	618	200	32.4
Q fever	1	0	0.0	4	1	25.0
Rabies	0	0	*	NR	NR	NR
Relapsing fever	4	0	0.0	44	0	0.0
Rift Valley fever	0	0	*	NR	NR	NR
Rubella	0	0	*	0	0	*
Salmonellosis	107	41	38.3	414	198	47.8
Schistosomiasis	0	0	*	5	0	0.0
Severe acute respiratory syndrome (SARS)	28	0	0.0	400	0	0.0
Shigellosis	5	2	40.0	49	20	40.8
Smallpox	0	0	*	NR	NR	NR
Spotted fever rickettsiosis	3	0	0.0	27	4	14.8
Streptococcus, group A, invasive[a]	8	0	0.0	NR	NR	NR
Syphilis	48	13	27.1	2,366	1,033	43.7
Tetanus	1	0	0.0	NR	NR	NR
Toxic shock syndrome	16	1	6.3	NR	NR	NR
Trichinellosis	0	0	*	0	0	*
Trypanosomiasis	0	0	*	3	0	0.0
Tuberculosis, pulmonary	47	10	21.3	NR	NR	NR
Tularemia	2	1	50.0	0	0	*
Typhoid fever	5	0	0.0	20	0	0.0
Typhus fever	11	1	9.1	16	2	12.5
Varicella	19	5	26.3	903	79	8.7
Yellow fever	0	0	*	NR	NR	NR
Zika virus	0	0	*	NR	NR	NR

Abbreviatons: RME, reportable medical event; No., number; NR, not reportable.

[a]Only reportable since October 2022.

*No cases to report.

TABLE 8. Frequency of Incident Notifiable Medical Cases at Outsourced Care Facilities Among Other Beneficiaries, with Number and Percentage Reported by Condition and Care Type, 2018–2022

	Hospitalizations			Ambulatory care		
Reportable Medical Event	No. of cases	No. reported	% reported	No. of cases	No. reported	% reported
All reportable events	14,034	127	0.9	289,140	1,564	0.5
Amebiasis	30	0	0.0	58	0	0.0
Anthrax	2	0	0.0	NR	NR	NR
Arboviral disease	62	3	4.8	NR	NR	NR
Botulism	30	6	20.0	NR	NR	NR
Brucellosis	5	0	0.0	13	0	0.0
Campylobacter infection	430	5	1.2	1,408	9	0.6
Chikungunya virus disease	0	0	*	NR	NR	NR
Chlamydia trachomatis, genital infections	35	2	5.7	17,890	902	5.0
Cholera	245	0	0.0	NR	NR	NR
Coccidioidomycosis	96	1	1.0	751	24	3.2
Cold weather injuries	0	0	*	NR	NR	NR
COVID hospitalization and death[a]	3,785	11	0.3	NR	NR	NR
Cryptosporidiosis	44	2	4.5	95	4	4.2
Cyclosporiasis	3	0	0.0	15	0	0.0
Dengue fever	121	0	0.0	83	0	0.0
Diphtheria	0	0	*	NR	NR	NR
E. coli, Shiga toxin-producing	17	0	0.0	116	2	1.7
Ehrlichiosis/anaplasmonthsis	95	1	1.1	108	0	0.0
Filariasis	1	0	0.0	6	0	0.0
Giardiasis	31	0	0.0	84	1	1.2
Gonorrhea	37	0	0.0	6,788	177	2.6
Haemophilus influenzae, invasive disease	545	3	0.6	290	0	0.0
Hantavirus disease	2	0	0.0	NR	NR	NR
Heat illness	0	0	*	NR	NR	NR
Hemorrhagic fever	2	0	0.0	NR	NR	NR
Hepatitis A	91	4	4.4	123	0	0.0
Hepatitis B, acute and chronic	48	0	0.0	2,085	54	2.6
Hepatitis C	35	0	0.0	3,087	18	0.6
Influenza-associated hospitalization	5,061	23	0.5	NR	NR	NR
Legionellosis	123	1	0.8	356	0	0.0
Leishmaniasis	1	0	0.0	0	0	*
Leprosy	0	0	*	18	0	0.0
Leptospirosis	11	0	0.0	56	1	1.8
Listeriosis	27	0	0.0	40	0	0.0
Lyme disease	140	3	2.1	1,804	10	0.6
Malaria	60	10	16.7	NR	NR	NR
Measles	7	2	28.6	NR	NR	NR
Meningococcal disease	15	0	0.0	NR	NR	NR
Mumps	10	0	0.0	NR	NR	NR
Norovirus	678	14	2.1	NR	NR	NR
Novel and variant influenza	572	0	0.0	238,111	4	0.0
Pertussis	32	2	6.3	87	0	0.0
Plague	0	0	*	NR	NR	NR
Poliomyelitis	4	0	0.0	NR	NR	NR
Post-exposure prophylaxis (PEP) against rabies	0	0	*	1,942	59	3.0
Q fever	1	0	0.0	32	0	0.0
Rabies	1	0	0.0	NR	NR	NR
Relapsing fever	10	0	0.0	375	0	0.0
Rift Valley fever	1	0	0.0	NR	NR	NR
Rubella	1	0	0.0	7	0	0.0
Salmonellosis	698	21	3.0	1,954	43	2.2
Schistosomiasis	1	0	0.0	24	0	0.0
Severe acute respiratory syndrome (SARS)	217	0	0.0	1,386	0	0.0
Shigellosis	49	0	0.0	204	4	2.0
Smallpox	0	0	*	NR	NR	NR
Spotted fever rickettsiosis	36	0	0.0	163	3	1.8
Streptococcus, group A, invasive[a]	101	0	0.0	NR	NR	NR
Syphilis	94	10	10.6	6,223	236	3.8
Tetanus	3	0	0.0	NR	NR	NR
Toxic shock syndrome	61	0	0.0	NR	NR	NR
Trichinellosis	2	0	0.0	1	0	0.0
Trypanosomiasis	0	0	*	25	0	0.0
Tuberculosis, pulmonary	118	3	2.5	NR	NR	NR
Tularemia	9	0	0.0	10	0	0.0
Typhoid fever	15	0	0.0	249	1	0.4
Typhus fever	20	0	0.0	73	1	1.4
Varicella	63	0	0.0	3,000	11	0.4
Yellow fever	0	0	*	NR	NR	NR
Zika virus	0	0	*	NR	NR	NR

Abbreviatons: RME, reportable medical event; No., number; NR, not reportable.

[a]Only reportable since October 2022

*No cases to report

TABLE 9. Timeliness of Reporting of Incident Notifiable Medical Cases Among Other Beneficiaries, by Care Type and Source, 2018–2022

Hospitalizations								
	Military hospital				Outsourced care facility			
Year	Total reported cases	% reported within 1 week	% reported within 2 weeks	% reported within 1 month	Total reported cases	% reported within 1 week	% reported within 2 weeks	% reported within 1 month
2018	60	60.0	71.7	95.0	27	48.1	63.0	92.6
2019	99	74.7	83.8	92.9	38	55.3	76.3	97.4
2020	74	68.9	78.4	93.2	16	56.3	68.8	100.0
2021	39	61.5	71.8	100.0	17	47.1	47.1	94.1
2022	64	64.1	73.4	98.4	29	55.2	65.5	96.6
Ambulatory care								
	Military clinic				Outsourced care facility			
Year	Total reported cases	% reported within 1 week	% reported within 2 weeks	% reported within 1 month	Total reported cases	% reported within 1 week	% reported within 2 weeks	% reported within 1 month
2018	3,251	42.9	52.5	85.1	262	16.4	22.1	96.2
2019	3,555	44.5	53.1	85.6	348	13.8	17.8	97.7
2020	2,877	40.0	49.4	87.1	305	12.5	15.1	98.7
2021	2,557	41.9	50.8	87.6	330	8.8	10.6	99.1
2022	2,023	37.5	46.6	89.0	319	8.2	13.5	98.7

with their military sponsor during a possible exposure or public health event, the low proportion of incident notifiable medical cases reported among other beneficiaries was expected.[1] In addition, because personnel resources for public health reporting may be limited at certain facilities, active component service member case reporting will take precedence over conditions from other beneficiaries, especially considering the greater number of hospitalizations among the other beneficiary population. Despite the fact there is no requirement for reporting of notifiable medical events for all dependents, this analysis was conducted to demonstrate the utility of RME reports for the larger MHS beneficiary population.

The timeliness of reporting for ACSM fluctuated over the 5-year surveillance period. Notifiable case reporting within 1 week from military hospitals and clinics ebbed from 2020 to 2021. This report does not speculate on factors influencing slower RME reporting, which are likely multifactorial and may include the COVID-19 pandemic. Throughout the surveillance period, however, the timeliness of reporting for hospitalized active component cases within 1 month remained above 90%. For active component cases identified from military clinic ambulatory care, timeliness of reporting within 1 month increased, approaching 90% (89.3%) by 2022.

Interpretation of these findings should be with caution due to methodological limitations. First, use of administrative data from health records to identify cases warranting RME submission likely overestimates the number of true cases of the conditions of interest, which is especially true for preliminary outpatient diagnoses, which do not meet RME criteria. Laboratory test results that are inconclusive or pending negative do not meet RME criteria. Conversely, common diagnoses such as heat and cold injuries are based on clinical findings at a single ambulatory encounter and do not require laboratory confirmation, and these diagnoses produced RME submissions for only one-third of cold injury and half of heat injury outpatient cases identified.

The data available for this analysis do not permit any insight into subsequent exclusion of preliminary diagnoses of such conditions when considering RME submission. Because many reportable conditions that may be of critical importance for rapid public health response are so infrequently encountered, clinical suspicion may result in diagnosis documentation prior to confirmation. It would not be surprising that many, if not most, such tentative diagnoses would fail to meet RME criteria.

Outsourced care providers are not required to report to the DOD, nor do they have access to DRSi, so reporting of outsourced care encounters for notifiable medical conditions relies on the referring military hospital or clinic to follow up and report, or for public health reporting personnel to identify these cases in the medical record. These additional steps for reporting likely contributed to the low OCF reporting numbers and present a missed opportunity.

This analysis does not include RMEs without a matching incident hospitalization or clinic encounter, and therefore timeliness of non-matching RMEs could not be assessed, nor are the total RMEs in this analysis the complete number of RMEs for the surveillance period.

One of the most frequently diagnosed conditions during ambulatory care, regardless of population or source of care, was novel and variant influenza. Although ambulatory seasonal influenza is not a reportable condition, novel and variant influenza is reportable. Given that influenza surveillance data for the U.S. during the study period do not indicate expansive circulation of novel or variant influenza strains, it is likely encounters for seasonal influenza were miscoded,[8,9]

which is further supported by the finding that only a few of these encounters were reported.

Complete and timely reporting of notifiable medical conditions is an important factor for public health prevention and control of communicable disease and injuries. These findings indicate that improvements are needed for complete and timely reporting among ACSM. Although reporting is not currently required for non-DOD personnel, the large number of notifiable medical conditions in this population present a potential transmission risk to service members, and consideration should be given to tracking notifiable medical conditions in this population as well. Revisions to RME guideline training and corresponding enhancements among public health personnel to increase accuracy of coding for medical encounters could produce needed improvements in RME reporting and timeliness.

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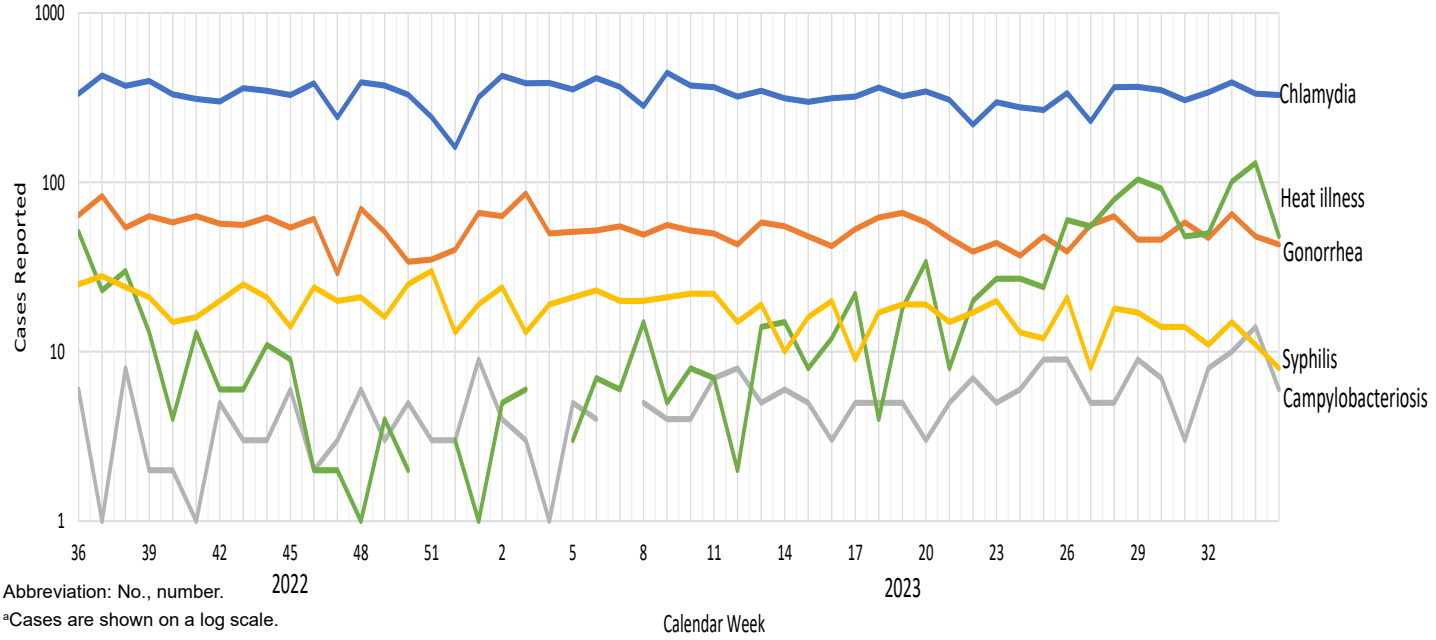
Reportable Medical Events, Military Health System Facilities, Week 35, Ending September 2, 2023

Matthew W. R. Allman, MPH; Anthony R. Marquez, MPH; Katherine S. Kotas, MPH

TOP 5 REPORTABLE MEDICAL EVENTS BY CALENDAR WEEK, ACTIVE COMPONENT (SEPTEMBER 4, 2022–SEPTEMBER 2, 2023)



Abbreviation: No., number.
[a]Cases are shown on a log scale.
Note: There were 0 heat illness cases in week 51 of 2022 and week 4 of 2023.
0 cases of campylobacteriosis were reported in week 7 of 2023.

Reportable Medical Events (RMEs) are documented in the Disease Reporting System internet (DRSi) by health care providers and public health officials throughout the Military Health System (MHS) to monitor, control, and prevent the occurrence and spread of diseases of public health interest or readiness importance. These reports are reviewed by each service's public health surveillance hub. The DRSi collects reports on over 70 different RMEs, including infectious and non-infectious conditions, outbreak reports, STI risk surveys, and tuberculosis contact investigation reports. A complete list of RMEs is available in the *2022 Armed Forces Reportable Medical Events Guidelines and Case Definitions*.[1] Data reported in these tables are considered provisional and do not represent conclusive evidence until case reports are fully validated.

Total active component cases reported per week are displayed for the top 5 RMEs for the previous year. Each month, the graph is updated with the 5 most frequently occurring RMEs, to present the most recent month's (August 2023) 5 most frequent RMEs, which may differ from previous months. COVID-19 is excluded from these graphs due to changes in reporting and case definition updates in 2023.

For questions about this report, please contact the Disease Epidemiology Branch at the Defense Centers for Public Health–Aberdeen, email: dha.apg.pub-health-a.mbx.disease-epidemiologyprogram13@health.mil.

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TABLE. Reportable Medical Events, Military Health System Facilities, Week Ending September 2, 2023 (Week 35)[a]

Reportable Medical Event[b]	Active component[c]					MHS beneficiaries[d]
	July	August	YTD 2023	YTD 2022	Total, 2022	August
	no.	no.	no.	no.	no.	no.
Amebiasis	1	1	12	7	13	1
Arboviral diseases, neuroinvasive and non-neuroinvasive	0	2	2	1	1	0
Brucellosis	0	0	0	2	2	0
COVID-19-associated hospitalization and death[e]	6	1	74	0	7	53
Campylobacteriosis	27	41	199	165	229	21
Chikungunya virus disease	0	1	1	1	1	0
Chlamydia trachomatis	1,391	1,595	11,723	13,667	19,432	258
Cholera	2	0	4	1	2	0
Coccidioidomycosis	2	2	17	9	15	1
Cold weather injuries[f]	3	2	100	112	151	0
Cryptosporidiosis	8	5	53	27	46	3
Cyclosporiasis	9	0	14	9	10	1
Dengue virus infection	0	2	4	1	1	1
E. coli, Shiga toxin-producing	10	7	47	52	67	4
Ehrlichiosis/anaplasmosis	28	1	29	2	3	1
Giardiasis	4	7	52	51	71	6
Gonorrhea	219	244	1,832	2,356	3,305	29
Haemophilus influenzae, invasive	1	0	1	1	1	0
Hantavirus disease	0	0	1	0	1	0
Heat illness[f]	348	361	1,062	1,018	1,213	1
Hepatitis A	1	0	5	11	16	1
Hepatitis B	5	7	96	86	119	7
Hepatitis C	3	4	36	36	57	3
Influenza-associated hospitalization[g]	0	1	6	116	148	3
Lead poisoning, pediatric[h]	0	0	0	0	0	8
Legionellosis	0	0	3	2	4	1
Leishmaniasis	0	0	1	1	1	0
Leprosy	0	2	2	0	0	0
Leptospirosis	0	1	3	1	1	0
Lyme disease	9	4	49	46	65	10
Malaria	4	2	15	17	26	2
Meningococcal disease	0	0	2	1	2	0
Mpox	0	0	0	65	93	0
Norovirus	24	17	330	165	221	25
Pertussis	1	0	4	7	10	3
Post-exposure prophylaxis against rabies	68	42	391	361	514	45
Q fever	1	0	2	2	3	0
Rubella	0	0	2	2	3	0
Salmonellosis	11	12	64	89	122	28
Schistosomiasis	0	0	0	1	1	0
Severe Acute Respiratory Syndrome (SARS)	0	0	0	1	1	0
Shigellosis	7	10	48	20	33	4
Spotted fever rickettsiosis	4	4	29	48	70	0
Syphilis (all)	59	57	582	677	1,047	7
Toxic shock syndrome	0	0	1	0	0	0
Trypanosomiasis	0	0	1	1	1	0
Tuberculosis	1	2	6	6	11	1
Tularemia	0	0	1	0	0	1
Typhoid fever	0	0	1	0	0	0
Typhus fever	0	0	2	1	1	2
Varicella	3	0	8	12	16	5
Total case counts	2,260	2,437	16,917	19,257	27,157	536

Abbreviations: RME, reportable medical event; MHS, Military Health System; YTD, year to date; no., number; FMP, family member prefix.

[a] RMEs reported through the DRSi as of September 30, 2023 are included in this report. RMEs were classified by date of diagnosis, or where unavailable, date of onset. Monthly comparisons are displayed for the period of July 1, 2023-July 31, 2023 and August 1, 2023-August 31, 2023. YTD comparison is displayed for the period of January 1, 2023-August 31, 2023 for MHS facilities. Previous year counts are provided as the following: previous year YTD–January 1, 2022-August 31, 2022; total 2022–January 1, 2022-December 31, 2022.

[b] RME categories with 0 reported cases among active component service members and MHS beneficiaries for the time periods covered were not included in this report.

[c] Services included in this report include Army, Navy, Air Force, Marine Corps, Coast Guard, and Space Force, including personnel classified as FMP 20 with duty status of Active Duty, Recruit, or Cadet in DRSi.

[d] Beneficiaries included the following: individuals classified as FMP 20 with duty status of Retired and individuals with all other FMPs except 98 and 99. Civilians, contractors, and foreign nationals were excluded from these counts.

[e] Only cases reported after case definition update on May 4, 2023. Includes only cases resulting in hospitalization or death.

[f] Only reportable for active component service members.

[g] Influenza-associated hospitalization is reportable only for individuals aged 65 years or younger.

[h] Pediatric lead poisoning is reportable only for children aged 6 years or younger.

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